



touchMATRIX[®] Indicator 7788.5150 / 7788.5155

Frequency counter, tachometer and speed indicator with touchscreen and graphic display

Product features:

- Multifunction unit with operating modes for incremental encoders (tachometer, pulse counter, position indicator)
 - Operating modes as frequency display and / or position display (pulse counter)
 - Universal incremental inputs (HTL / TTL / RS422) for NPN / PNP / NAMUR encoders and sensors
 - Functions such as links (eg A+B, A-B, ...), scaling, filters, start-up delay, ...
- Bright and high-contrast display with event controlled color variations
- Emulation of a 7-segment display inclusively icons and units
- Intuitive and easy parameterization by plain text and touchscreen
- 5 / 24 V auxiliary output for encoder supply
- Input frequencies up to 1 MHz
- Linearization with 24 interpolation points
- 96 x 48 mm (3.78 x 1.89 inch) norm panel housing and IP65 protection

Available options:

- | | |
|---------------------|---|
| 7788.5150: | Basic unit with HTL inputs (A, B), 3 control inputs |
| 7788.5155: | Basic unit with HTL/RS422 inputs (A, /A, B, /B), 3 control inputs |
| • Option AC: | Power supply 115 ... 230 VAC |
| • Option AO: | 16 bit analog output, 4 control outputs, serial RS232 interface |
| • Option AR: | 16 bit analog output, 4 control outputs, serial RS485 interface |
| • Option CO: | 4 control outputs, serial RS232 interface |
| • Option CR: | 4 control outputs, serial RS485 interface |
| • Option RL: | 2 relay outputs |

Options can be combined

Version:	Description
7788.5150_01a_oi/mbo/Jan-21	First Version

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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 these manual. The unit must be installed, connected and put into operation by a qualified electrician.

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

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

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

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

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

1.2. Use according to the intended purpose

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

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

1.3. Installation

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

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

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

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

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

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

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

For placement, wiring, environmental conditions as well as shielding and earthing/grounding of the supply lines the general standards of industrial automation industry and the specific shielding instructions of the manufacturer are valid. Please find all respective hints and rules on <https://www.motrona.com/en/support> --> "[General EMC Rules for Wiring, Screening and Earthing]".

1.4. 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. Introduction

This series of display unit is suitable for HTL impulse signals and panel mounting. It is very versatile in use, due to the intuitive handling and the extensive range of functions and options.

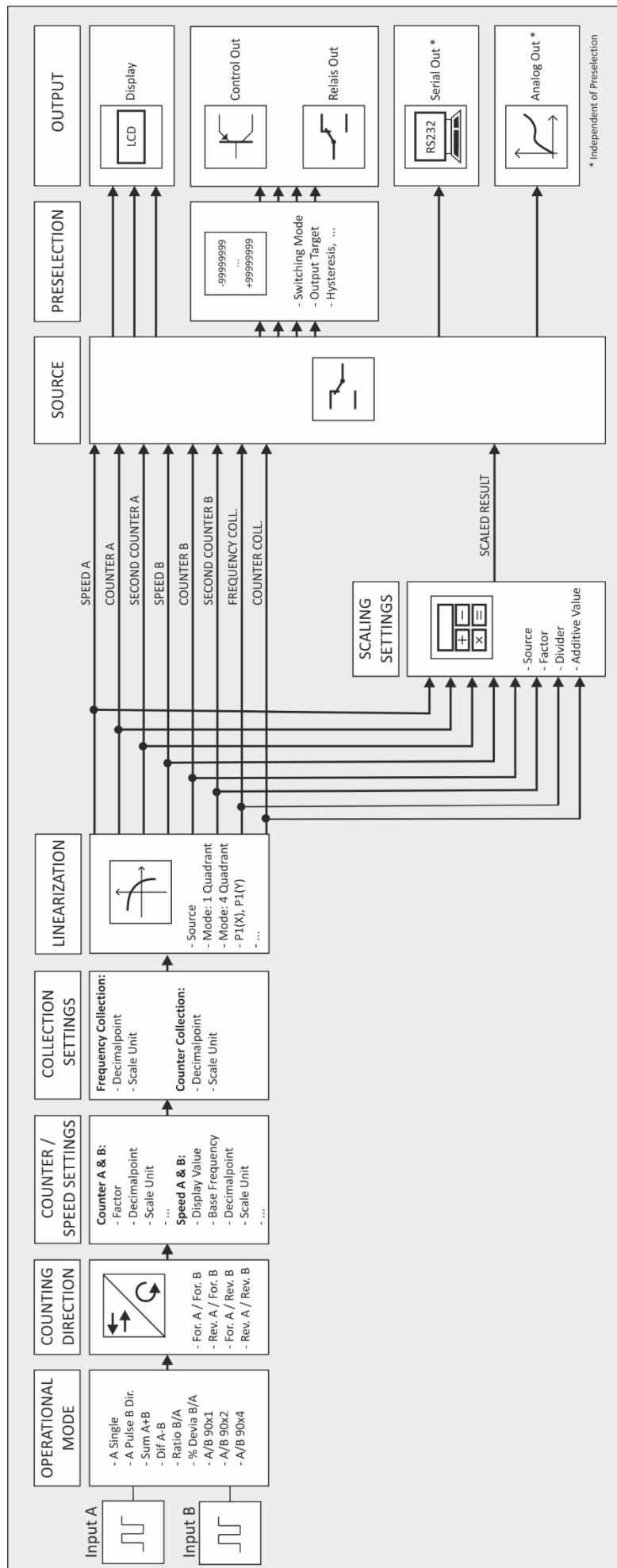
2.1. Operation mode

All functions can be configured in the parameter menu.

The device can be set to one of the following operation modes:

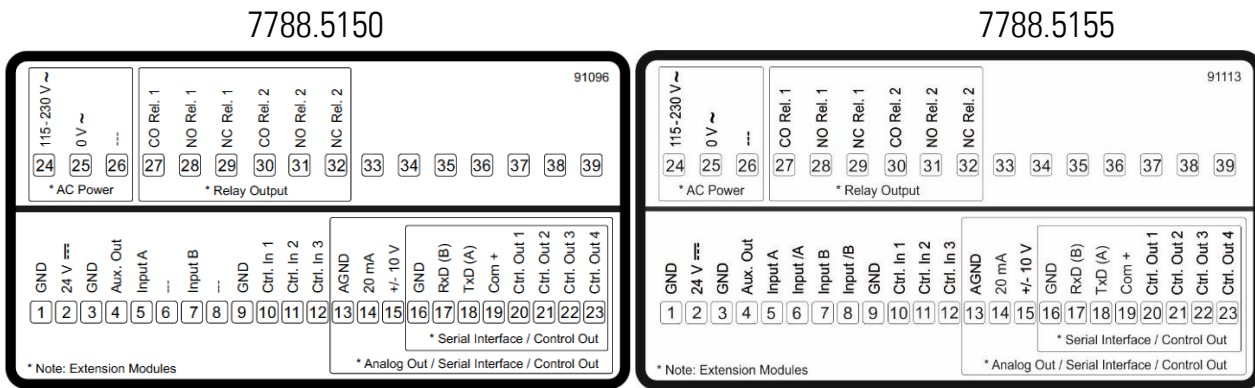
- Operation as frequency display for incremental input signals
 - Measurement of frequency / RMP indicator
 - Tachometers / speed indicator
 - Monitoring functions for speed and standstill
 - Possibility of linking (A+B, B/A, ...) of both channels (e.g., ratio or percentage deviation)
- Operation as position indicator / counter for incremental input signals
 - Pulse counter
 - Up- or down counter
 - Position indicator
 - Protractor
 - Quadrature counter
 - Batch counter / total counter
 - Possibility of linking (A+B, B/A, ...) of both channels (e.g., ratio or percentage deviation)
- Operation as speed- and position indicator for incremental input signals

2.2. Function diagram



3. Electrical Connections

The terminal screws should be tightened with a slotted screwdriver (blade width 2mm).



3.1. DC Power Supply

The unit accepts DC supply from 18 to 30 V at the terminals 1 and 2. The power consumption depends on the level of the supply voltage with aprox. 100 mA and the additional current required at the Auxiliary Voltage Output.

All GND terminals are internally interconnected.

3.2. Auxiliary Voltage Output

Terminal 3 and 4 provide an auxiliary output for supply of sensors and encoders. The output voltage depends on the power supply.

DC version	AC version
The encoder voltage is approx. 1 V lower than the power supply voltage at terminal 1 and 2 and should be loaded with max. 250 mA.	The encoder voltage is 24 VDC (± 15%) and should be loaded with max. 150 mA up to 45 degrees Celsius. At higher temperature the maximum output current is reduced to 80 mA.

At 7788.5155 devices, the auxiliary voltages output is switchable from 24 VDC to 5 VDC.

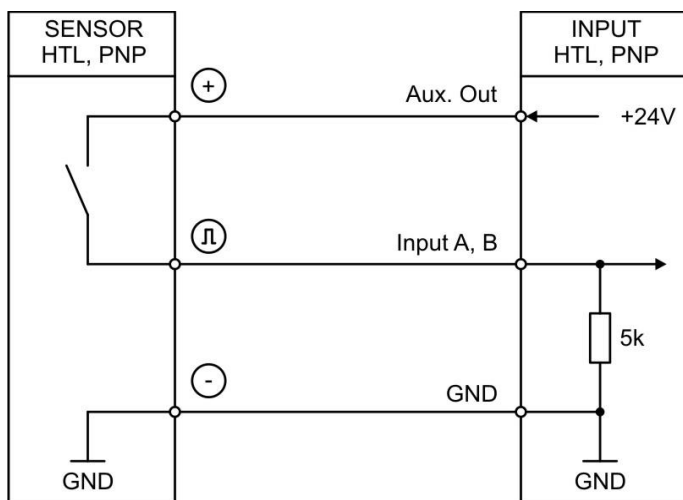
3.3. 7788.5150: Incremental Input A, B

The unit provides two inputs at terminal 5 and 7 for HTL signals.

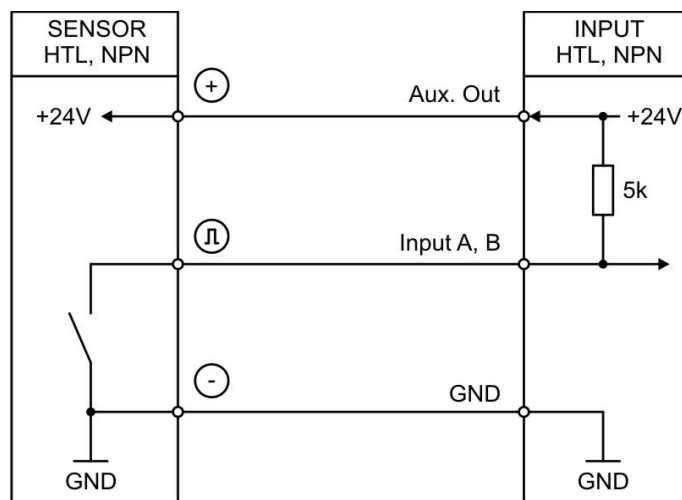
The characteristics of the incremental input (PNP, NPN, Namur or Tri-State) can be set in the GENERAL MENU.

Wiring of the incremental inputs:

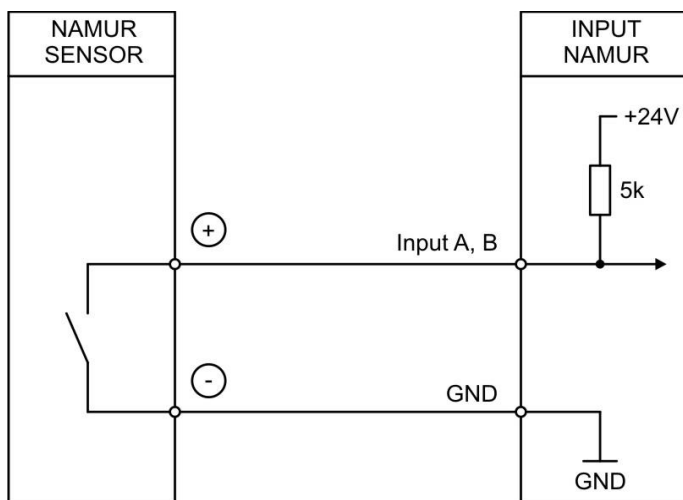
PNP



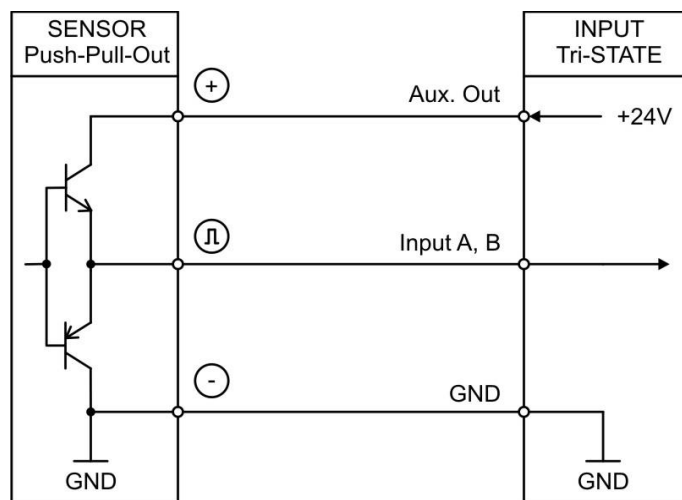
NPN



Namur



Tri-State



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

Notice for mechanical switching contacts:

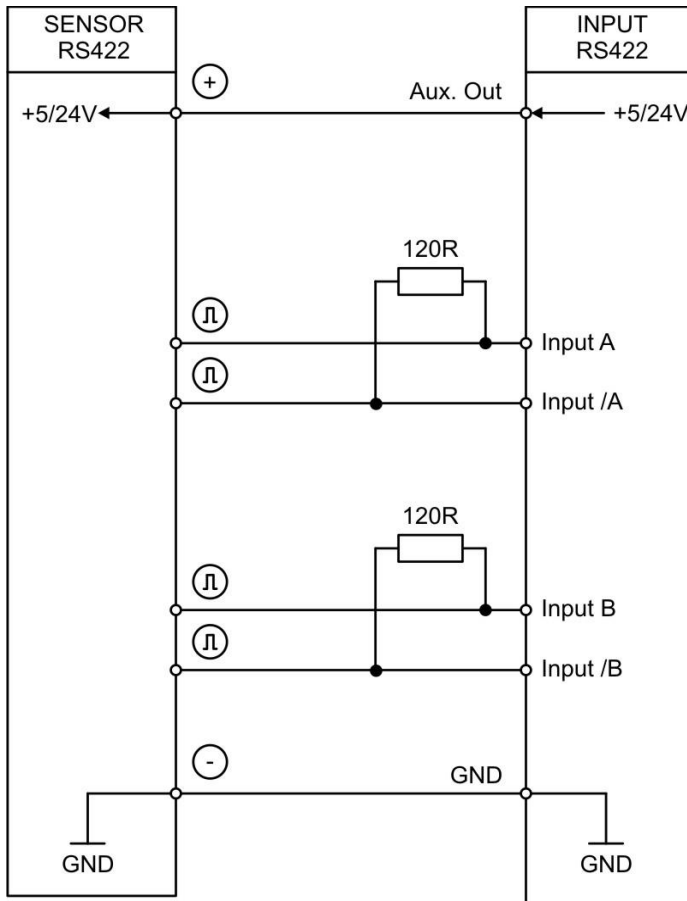
When exceptionally mechanical contacts are used, please connect an external capacitor between GND (-) and the corresponding input (+). A capacity of 10 μ F will reduce the input frequency to 20 Hz and miscounting due to contact bouncing will be eliminated.

3.4. 7788.5155: Incremental Input A, /A, B, /B

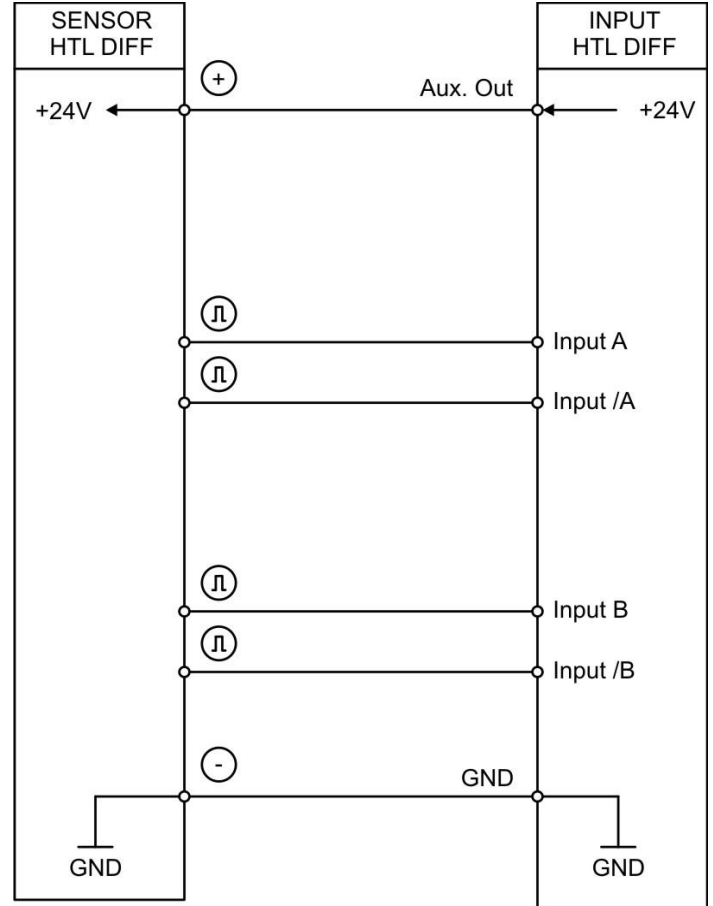
The unit provides two pulse inputs at terminal 5, 6, 7 and 8 for HTL/RS422 signals. The characteristics of the incremental input can be set in the GENERAL MENU.

Wiring of the incremental inputs:

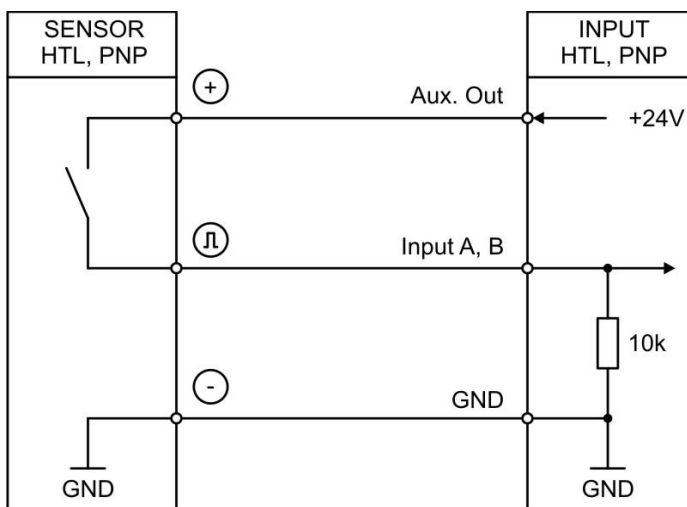
RS422



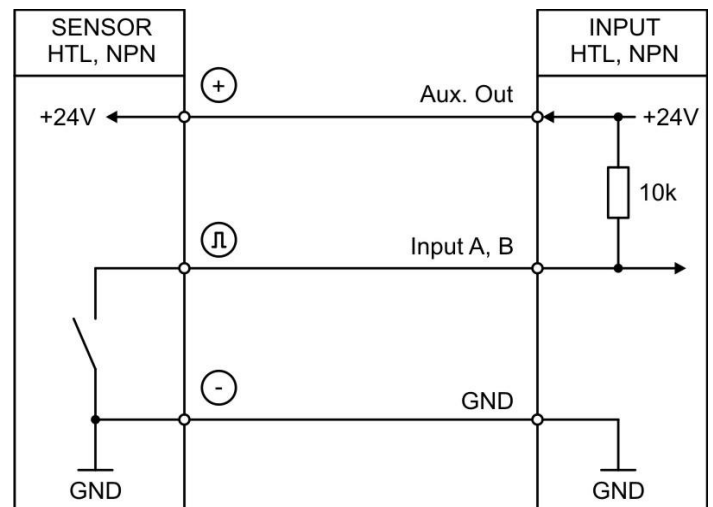
HTL DIFFERENTIAL



HTL PNP, single ended



HTL NPN, single ended



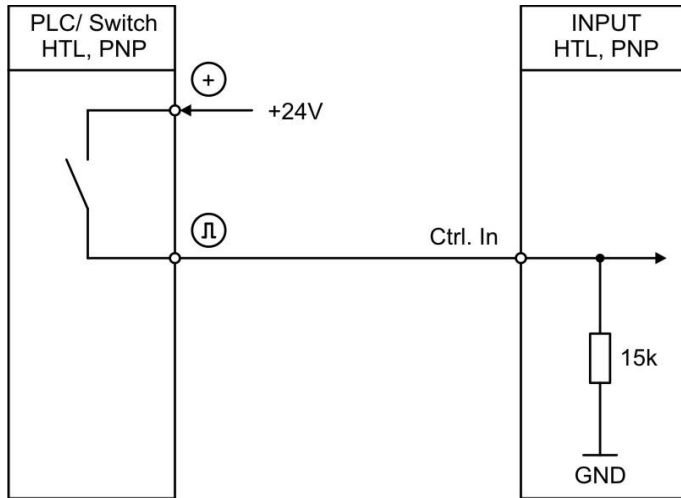
Unconnected PNP inputs are always "LOW" and unconnected NPN inputs are always "HIGH". All inputs are designed to receive impulses from electrical impulse sources.

3.5. Control Inputs

The three control inputs at terminal 10, 11 and 12 have HTL PNP characteristics.

In the COMMAND MENU the programmable functions for the control inputs can be assigned. Available functions are: reset the display value, display switching, locking the touch screen or release the lock function of the control or relay outputs.

Wiring of the control inputs:



Unconnected control inputs are always "LOW".

All inputs are designed to receive impulses from an electronic impulse source.

Notice for mechanical switching contacts:

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

3.6. Analog Output (Option AO/AR)

A 16 bit analog output is available at terminal 13 and 14 / 15

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 reference source 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 not allowed.

3.7. Serial interface (Option AO/AR/CO/CR)

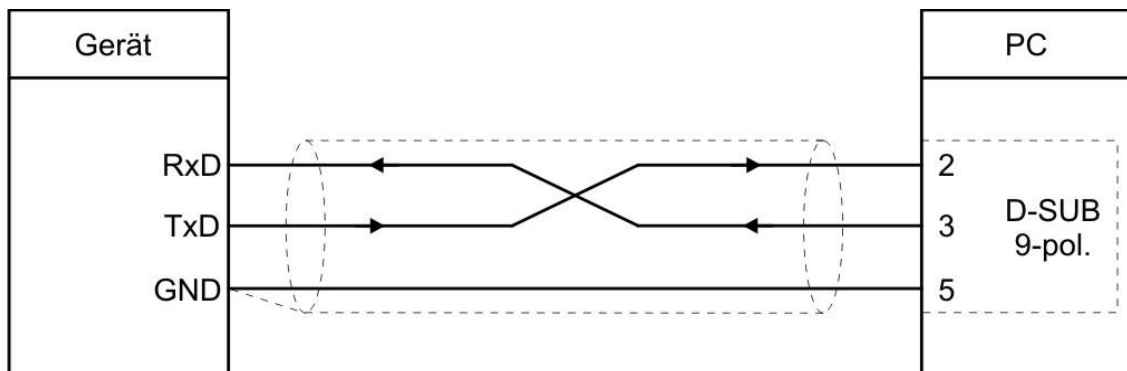
A serial interface (RS232 or RS485) is available at terminal 16, 17 und 18. This interface can be configured in the SERIAL MENU.

The serial interface RS232 or RS485 can be used:

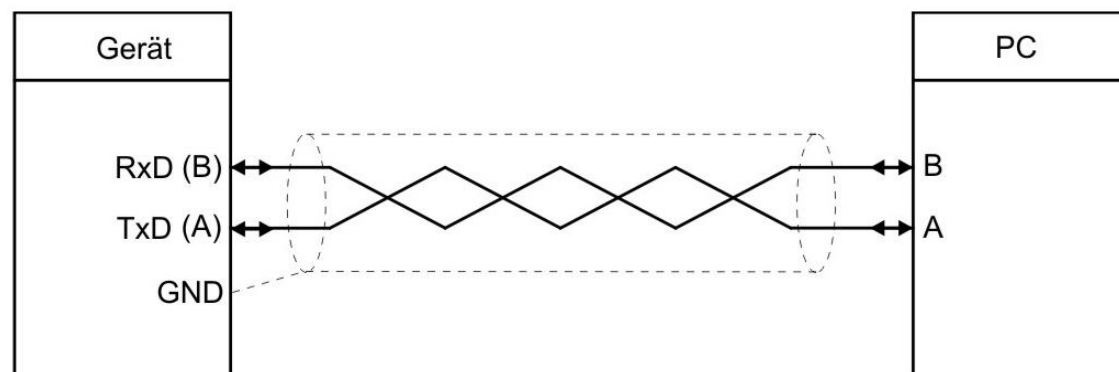
- for easy setup and commissioning of the units
- to modify settings and parameters during operation
- to read out internal states and actual measuring values by PC or PLC

The following drawing shows the connection to a PC by using a standard Sub-D-9 connector:

Connection of the RS232 interface:



Connection of the RS485 interface:



3.8. Control-Output (AO/AR/CO/CR)

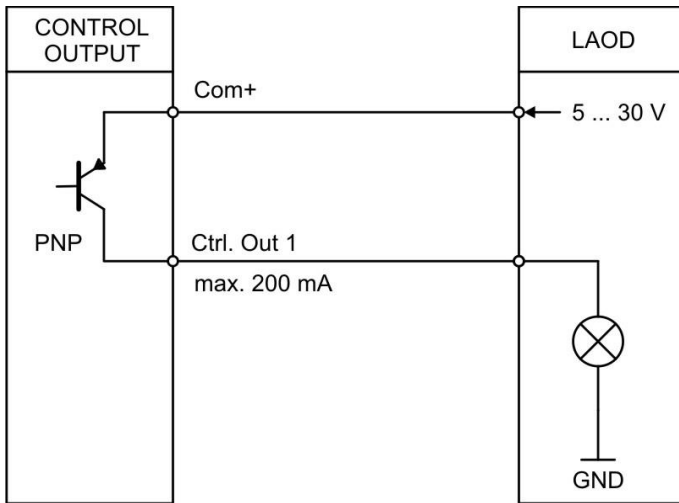
Four control outputs are available at terminal 20, 21, 22 and 23.

Switching conditions can be set in the PRESELECTION MENU. The output Ctrl. Out1 – 4 are fast PNP outputs with a switching capability of 5 – 30 Volt / 200 mA per channel. The switching states is displayed (display with unit and status bar) as C1 ... C4.

The switching voltage of the outputs must be applied to input terminal 19 (COM+).

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

Wiring of the control-outputs:



3.9. AC Power supply (Option AC)

The unit accepts AC supply from 115 to 230 V at the terminals 24 and 25. The power consumption depends on the level of the supply voltage with approx. 3VA and the additional current required at the auxiliary voltage output.

Devices with option AC can also be supplied with a DC voltage between 18 and 30 VDC at terminals 1 and 2.

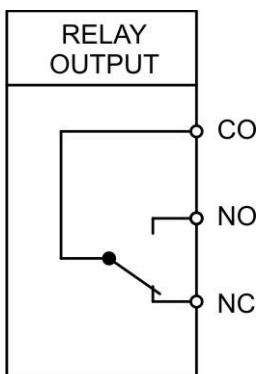
3.10. Relay-Output (Option RL)

Two relay outputs with potential-free changeover contacts are available at terminal 27, 28, 28, 30, 31, 32. Switching conditions can be set in the PRESELECTION MENU. The switching states are displayed (display with unit and status bar) as K1 and K4.

AC-switching capacity max. 250 VAC/ max. 3 A / 750 VA

DC-switching capacity max. 150 VAC/ max. 2 A / 50 W

Wiring of the relay outputs



4. Display and touch screen

4.1. Screen structure for parametrization

The parameter menus and the parameters are described in chapter 5.



Start setup procedure:

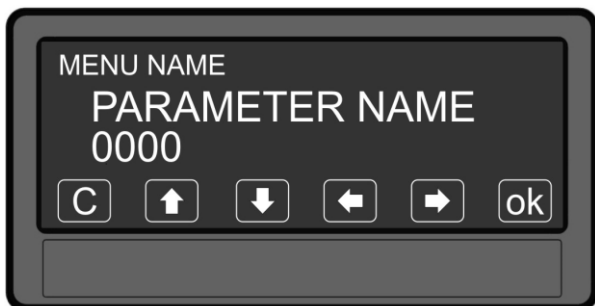
To edit the parameters, press the touchscreen for 3 seconds.



Menu selection:

Select the parameter menu via arrow buttons and confirm with "OK".

The menu selection can be terminated with „C“.



Parameter selection:

Select the parameter via arrow buttons and confirm with „OK“.

The parameter selection can be terminated with „C“.



Parameter editing:

Edit the parameter via arrow button up and down, shift cursor via left and right and save with „OK“.

The parameter editing can be terminated with „C“.

Parameter changes becomes active only after closing the menu selection.

4.2. Screen structure in operation

The following screens are available during operation. Depending on the device version and the selected operation mode, not all displays will be shown.



Display with unit and status bar

To switch to the next display, press the touch screen.

Control - or Relay status are only shown with option AO, AR, CO, CR or RL.



Large Display (4 digits)

To switch to the next display, press the top of the screen.

This is only possible with activated parameter „LARGE DISPLAY“.



Two-line display without units

To switch to the next display, press the top of the screen.



Two-line display with units

To switch to the next display, press the top of the screen.



Display with command keys

To switch to the next display, press the top of the screen.

Continuation „Screen structure in operation“:



Display for quick start for enter or display preselection values (PRESELECTION VALUES 1-4)

The desired command key ("Edit Presel." or "Show Presel.") can be set in the display menu via the parameter "QUICKSTART BUTTON".

To switch to the next display, press the top of the screen or the "skip" button.

This is only possible with option AO, AR, CO, CR or RL



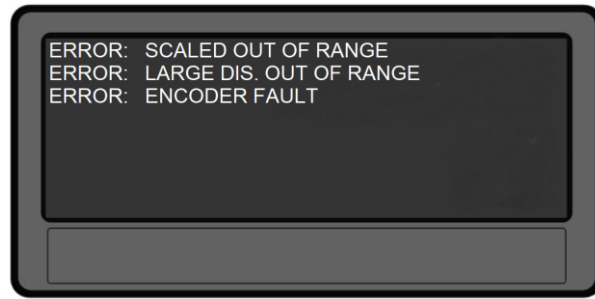
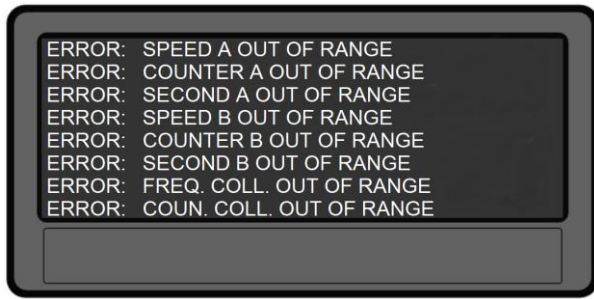
Display with minimum and maximum value

To switch to the next display, press the top of the screen or the "skip" button.

The minimum and maximum evaluation refers to the reference source set in the "SOURCE SINGLE" parameter.



4.3. Error messages



If a measurement result, which is shown on the display, is outside the displayable display range, an error screen is briefly displayed every two seconds. In this appears, which display value was exceeded or fallen below.



The error messages described are automatically reset as soon as the corresponding display value is within the representable range.

5. Parameter / Overview-Menu Structure

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. Depending on the device version and the selected operation mode, only the necessary menus / parameters are shown.

Menu / Parameter	Menu / Parameter
GENERAL MENU	COUNTER A SETTINGS
OPERATIONAL MODE	FACTOR
ENCODER PROPERTIES	SET VALUE
ENCODER SUPPLY	DECIMAL POINT
COUNTING DIRECTION	SCALE UNITS
LINEARIZATION MODE	SECOND MODE
PIN PRESELECTION	SECOND SET VALUE
PIN PARAMETER	SECOND DECIMAL POINT
BACK UP MEMORY	SECOND SCALE UNITS
FACTORY SETTINGS	COUNTER B SETTINGS
SPEED A SETTINGS	FACTOR
DISPLAY VALUE	SET VALUE
BASE FREQUENCY	DECIMAL POINT
DECIMAL POINT	SCALE UNITS
SAMPLING TIME	SECOND MODE
WAIT TIME	SECOND SET VALUE
STANDSTILL TIME	SECOND DECIMAL POINT
AVERAGE FILTER	SECOND SCALE UNITS
SCALE UNITS	COLLECTION SETTINGS
SPEED B SETTINGS	DECIMAL POINT FREQUENCY
DISPLAY VALUE	SCALE UNITS FREQUENCY
BASE FREQUENCY	DECIMAL POINT COUNTER
DECIMAL POINT	SCALE UNITS COUNTER
SAMPLING TIME	SCALING SETTINGS
WAIT TIME	SOURCE
STANDSTILL TIME	FACTOR
AVERAGE FILTER	DIVIDER
SCALE UNITS	ADDITIVE VALUE

Menu / Parameter
PRESELECTION VALUES
PRESELECTION 1 PRESELECTION 2 PRESELECTION 3 PRESELECTION 4
PRESELECTION 1 MENU
SOURCE 1 MODE 1 HYSTERESIS 1 PULSE TIME 1 OUTPUT TARGET 1 OUTPUT POLARITY 1 OUTPUT LOCK 1 START UP DELAY 1 EVENT COLOR 1
PRESELECTION 2 MENU
SOURCE 2 MODE 2 HYSTERESIS 2 PULSE TIME 2 OUTPUT TARGET 2 OUTPUT POLARITY 2 OUTPUT LOCK 2 START UP DELAY 2 EVENT COLOR 2
PRESELECTION 3 MENU
SOURCE 3 MODE 3 HYSTERESIS 3 PULSE TIME 3 OUTPUT TARGET 3 OUTPUT POLARITY 3 OUTPUT LOCK 3 START UP DELAY 3 EVENT COLOR 3
PRESELECTION 4 MENU
SOURCE 4 MODE 4 HYSTERESIS 4 PULSE TIME 4 OUTPUT TARGET 4 OUTPUT POLARITY 4 OUTPUT LOCK 4 START UP DELAY 4 EVENT COLOR 4

Menu / Parameter
SERIAL MENU
UNIT NUMBER SERIAL BAUD RATE SERIAL FORMAT SERIAL INIT SERIAL PROTOCOL SERIAL TIMER SERIAL VALUE MODBUS
ANALOG MENU
ANALOG SOURCE 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
DISPLAY MENU
START DISPLAY SOURCE SINGLE SOURCE DUAL TOP SOURCE DUAL TOWN LARGE DISPLAY COLOR BRIGHTNESS CONTRAST SCREEN SAVER UP-DATE-TIME FONT QUICKSTART BUTTON
LINEARISATION MENU
SOURCE P1(X) P1(Y) P2(X) P2(Y) ... P23(X) P23(Y) P24(X) P24(Y)

5.1. General Menu

OPERATIONAL MODE		
This parameter specifies the selected measuring function.		
0	A SINGLE	Input A is the pulse input. (single-channel measurement)
1	A PULSE B DIR	Input A is the pulse input. Input B determines the direction: for example, "LOW" = forward "HIGH" = backward
2	SUM A+B	Sum: counts impulses A + impulses B and frequency A + frequency B
3	DIF A-B	Difference: counts pulses A - pulses B and frequency A - frequency B
4	RATIO B/A	Ratio: Frequency and counter ratio of both channels (channel B / channel A). Note: Interpretation of the result with 4 decimal places in the format +/- x.xxxx
5	%-DEVIA B/A	Deviation: percentage deviation from channel B to channel A. Note: Interpretation of the result with 2 decimal places in the format +/- xxx.xx%
6	A/B 90 x1	Up / down counter for pulses with 2x90 ° offset (simple edge evaluation x1)
7	A/B 90 x2	Up / down counter for pulses with 2x90 ° offset (double edge evaluation x1)
8	A/B 90 x4	Up / down counter for pulses with 2x90 ° offset (fourfold edge evaluation x1)

ENCODER PROPERTIES (for 7788.5150)		
This parameter determines the characteristics of the pulse input for 7788.5150.		
0	PNP	PNP (switch to +)
1	NPN	NPN (switch to -)
2	NAMUR	Connect sensor (-) to GND and sensor (+) to input (A or B)
3	TRI-STATE	Tri-State for push-pull encoders/ sensors

ENCODER PROPERTIES (for 7788.5155)		
This parameter determines the characteristics of the pulse input for 7788.5155.		
0	RS422	RS422 standard
1	HTL DIFFERENTIAL	HTL differential
2	HTL PNP	HTL PNP single ended (switch to +)
3	HTL NPN	HTL NPN single ended (switch to -)

ENCODER SUPPLY (only for 7788.5155 available)		
This parameter defines the voltage of the auxiliary supply output (Aux-Out).		
0	24VDC SUPPLY	24 VDC encoder supply
1	5VDC SUPPLY	5 VDC encoder supply

COUNTING DIRECTION		
With this parameter the direction of rotation / direction of counting of the pulse inputs (input A and B) can be reversed.		
0	FOR. A / FOR. B	Direction of rotation / direction of counting <u>of both</u> pulse inputs (A and B) forward
1	REV. A / REV. B	Direction of rotation / direction of counting <u>of both</u> pulse inputs (A and B) reverse
2	FOR. A / REV. B	Direction of rotation / direction of counting input A forward and input B reverse
3	REV. A / FOR. B	Direction of rotation / direction of counting input A reverse and input B forward

Continuation "General Menu"

LINEARIZATION MODE		
This parameter defines the linearization function. See chapter 6.1.		
0	OFF	No linearization
1	1 QUADRANT	Linearization in the 1. quadrant
2	4 QUADRANT	Linearization in all 4 quadrants

PIN PRESELECTION		
This parameter defines the PIN-code to lock the quick start of the menu PRESELECTION VALUE for entering the preselection values. (Master PIN 6079).		
This Lock function is only useful in conjunction with active lock function in PIN PARAMETER.		
	0000	No lock
	...	
	9999	Access after entering PIN-Code 9999

PIN PARAMETER		
This parameter defines the PIN-code for lock function of all parameters (master PIN 6079).		
	0000	No lock
	...	
	9999	Parameterization of the unit after entering PIN-code 9999

BACK UP MEMORY		
0	NO	No back memory –up by power failure
1	YES	Backup memory by power failure, actual value will be saved

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

5.2. Speed A Settings

In this menu, the settings for a frequency measurement / tachometer on channel A are defined. Depending on the operating mode selected, only input A or input A and input B with 90 ° phase offset are active for forward / reverse direction detection.

DISPLAY VALUE		
Desired value, which should be displayed at the setting of BASE FREQUENCY.		
	1	Smallest value
	1000	Default value
	99999999	Highest value

BASE FREQUENCY (HZ)		
Reference frequency for the desired DISPLAY VALUE.		
	1	Smallest value
	100	Default value
	500000	Highest value

DECIMAL POINT		
This value defines the position of the decimal point.		
0	NO	No decimal point
1	0000000.0	Decimal point at the specified position
2	000000.00	Decimal point at the specified position
3	00000.000	Decimal point at the specified position
4	0000.0000	Decimal point at the specified position
5	000.00000	Decimal point at the specified position
6	00.000000	Decimal point at the specified position
7	0.0000000	Decimal point at the specified position

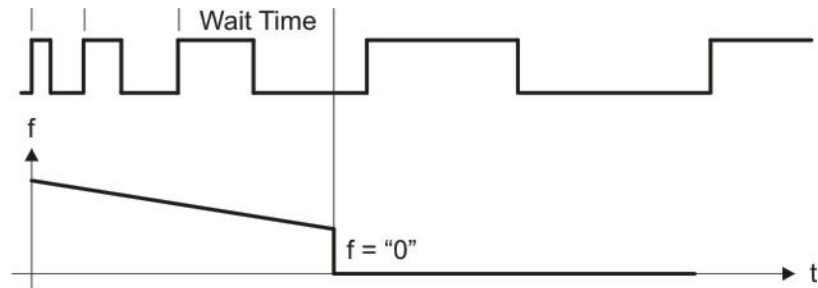
SAMPLING TIME (S)		
The configured value corresponds to the minimum measurement time. The Parameter is used as a filter in case of irregular frequencies. This parameter directly affects the response time of the unit.		
	0.005	Shortest Sampling time
	0.1	Default value
	9.999	Longest Sampling time

Continuation "Speed A Settings":

WAIT TIME (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
80.00	Frequency = 0 Hz, for frequencies below 0,01 Hz



STANDSTILL TIME (S)

This parameter defines the time setting for standstill definition. A time of xx.xx seconds after detection " frequency = 0 Hz " the unit signals "standstill" and reactivates the start-up-delays. Stand still detection can be set in PRESELECT MENU.

0.00	Shortest time
...	
99.99	Largest time

AVERAGE FILTER

Selectable average or filter function to avoid measuring fluctuations by unstable frequencies. At setting 1 to 4 a floating average calculation is performed. At settings 5 to 8, the device uses an exponential filter. 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
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

Continuation "Speed A Settings":

SCALE UNITS																																																																																																		
This parameter defines the required engineering unit. This parameter does not affect the calculation of the display value. The number of decimal places must be defined with the parameter DECIMAL POINT																																																																																																		
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28	H:M																																																																																																	
29	Edit Unit	<p>A customized unit with up to 16 digits can be edited using this parameter. Pressing the "OK" button opens the Edit Unit Menu.</p> <p>A unit can be created using the arrow keys. (by pressing and holding the arrow keys the characters scroll fast).</p> <p>The "OK" button saves the Edit Unit Menu. The "C" button closes the Edit Unit Menu.</p> <table border="1"> <tr> <td></td> <td>!</td> <td>"</td> <td>#</td> <td>\$</td> <td>%</td> <td>&</td> <td>'</td> <td>(</td> <td>)</td> <td>*</td> <td>+</td> <td>,</td> <td>-</td> <td>.</td> <td>/</td> </tr> <tr> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> <td>8</td> <td>9</td> <td>:</td> <td>;</td> <td><</td> <td>=</td> <td>></td> <td>?</td> </tr> <tr> <td>@</td> <td>A</td> <td>B</td> <td>C</td> <td>D</td> <td>E</td> <td>F</td> <td>G</td> <td>H</td> <td>I</td> <td>J</td> <td>K</td> <td>L</td> <td>M</td> <td>N</td> <td>O</td> </tr> <tr> <td>P</td> <td>Q</td> <td>R</td> <td>S</td> <td>T</td> <td>U</td> <td>V</td> <td>W</td> <td>X</td> <td>Y</td> <td>Z</td> <td>[</td> <td>\</td> <td>]</td> <td>^</td> <td>_</td> </tr> <tr> <td>`</td> <td>a</td> <td>b</td> <td>c</td> <td>d</td> <td>e</td> <td>f</td> <td>g</td> <td>h</td> <td>i</td> <td>j</td> <td>k</td> <td>l</td> <td>m</td> <td>n</td> <td>o</td> </tr> <tr> <td>p</td> <td>q</td> <td>r</td> <td>s</td> <td>t</td> <td>u</td> <td>v</td> <td>w</td> <td>x</td> <td>y</td> <td>z</td> <td>{</td> <td> </td> <td>}</td> <td>~</td> <td></td> </tr> </table>		!	"	#	\$	%	&	'	()	*	+	,	-	.	/	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	^	_	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	{		}	~	
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5.3. Speed B Settings

In this menu, the settings for a frequency measurement / tachometer on channel B are defined. This menu is only displayed if the corresponding OPERATIONAL MODE is selected in the GENERAL MENU. (e.g., "SUM A + B", "DIF A-B", "RATIO B / A", or "% DEVIA B / A")

DISPLAY VALUE		
Desired value, which should be displayed at the setting of BASE FREQUENCY.		
	1	Smallest value
	1000	Default value
	99999999	Highest value

BASE FREQUENCY (HZ)		
Reference frequency for the desired DISPLAY VALUE.		
	1	Smallest value
	100	Default value
	500000	Highest value

DECIMAL POINT		
This value defines the position of the decimal point.		
	0 NO	No decimal point
	1 0000000.0	Decimal point at the specified position
	2 000000.00	Decimal point at the specified position
	3 00000.000	Decimal point at the specified position
	4 0000.0000	Decimal point at the specified position
	5 000.00000	Decimal point at the specified position
	6 00.000000	Decimal point at the specified position
	7 0.0000000	Decimal point at the specified position

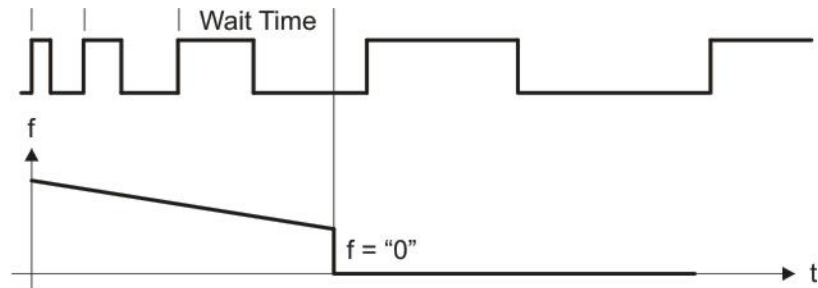
SAMPLING TIME (S)		
The configured value corresponds to the minimum measurement time. The Parameter is used as a filter in case of irregular frequencies. This parameter directly affects the response time of the unit.		
	0.005	Shortest Sampling time
	0.1	Default value
	9.999	Longest Sampling time

Continuation "Speed B Settings":

WAIT TIME (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 1" will be detected as frequency = 0 Hz.

0.01	Frequency = 0 Hz, for frequencies below 100 Hz
1.00	Default value
80.00	Frequency = 0 Hz, for frequencies below 0,01 Hz



STANDSTILL TIME (S)

This parameter defines the time setting for standstill definition. A time of xx.xx seconds after detection " frequency = 0 Hz " the unit signals "standstill" and reactivates the start-up-delays. Stand still detection can be set in PRESELECT MENU.

0.00	Shortest time
...	
99.99	Largest time

AVERAGE FILTER

Selectable average or filter function to avoid measuring fluctuations by unstable frequencies. At setting 1 to 4 a floating average calculation is performed. At settings 5 to 8, the device uses an exponential filter. 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
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

Continuation "Speed B Settings":

SCALE UNITS (display unit of measurement)

This parameter determines which unit is shown on the display. Setting the SCALE UNITS does not affect the display value. The decimal point is set in the parameter DECIMAL POINT.

A list of possible units can be found in "SPEED A SETTINGS - SCALE UNITS".

5.4. Counter A Settings

In this menu, the settings for the pulse counter (or position indicator) on channel A are defined.

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

SET VALUE		
In case of a set/reset command (via keys, Control-Inputs or PC-user interface), the counter of channel A is set to the value entered here.		
	-99999999	Smallest value
	0	Default value
	+99999999	Highest value

DECIMAL POINT		
This value defines the position of the decimal point.		
	0 NO	No decimal point
	1 0000000.0	Decimal point at the specified position
	2 000000.00	Decimal point at the specified position
	3 00000.000	Decimal point at the specified position
	4 0000.0000	Decimal point at the specified position
	5 000.00000	Decimal point at the specified position
	6 00.000000	Decimal point at the specified position
	7 0.0000000	Decimal point at the specified position

Continuation "Counter A Settings":

SCALE UNITS																																																																																																		
This parameter defines the required engineering unit. This parameter does not affect the calculation of the display value. The number of decimal places must be defined with the parameter DECIMAL POINT																																																																																																		
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Continuation "Counter A Settings":

SECOND MODE

Setting of the batch counter / total counter.

The function of batch counting according to a preset value is only possible in combination with the switch condition "automatic reset to zero" (RESULT <= PRES-> 0), "automatic reset to set value" (RESULT >= PRES->VALUE) or "set the counter value to the respective preselection value" (RESULT <=0-> SET).

When SECOND MODE is active, PRESELECTION serves as the present value (SOURCE 1-4) for the SECOND COUNTER A.

Example for the batch counter:

If the batch counter should increment 1 all 1000 pulses, the value e.g. PRESELECTION 1 has to be set to 1000, the related reference source SOURCE 1 to "COUNTER A", the corresponding switching condition MODE 1 to "RESULT >= PRES->0" and SECOND MODE to INCREMENT BATCH. Should an output be turned on after a batch amount of 33, e.g. PRESELECTION 2 has to be set to 33, the related reference source SOURCE 2 to "SECOND COUNTER A" and the switching condition of MODE 2 has to be set to display value greater than or equal (RESULT >= PRES).

Example for the total counter:

For the total counter, SECOND MODE must be set to "TOTAL COUNTER". The total counter counts here parallel to the main counter. e.g. If the total counter should automatically reset to 0, when 4000 is reached, the preset value e.g. PRESELECTION 3 must be set to "4000", the reference source SOURCE 3 must be set to "SECOND COUNTER A" and the corresponding switching condition MODE 3 must be set to "RESULT > = PRES-> 0"

0	OFF	No batch counter and no total counter
1	INCREMENT BATCH	increment batch counter
2	DECREMENT BATCH	decrement batch counter
3	USE INPUTS ONLY	increment / decrement batch counter only by external commands (see command menu)
4	TOTAL COUNTER	Total counter is activated

SECOND SET VALUE

With a "RESET / SET " command (command "SET SECOND A" via control input), the Second Counter A (batch counter / total counter) is set to this value.

(Parameter only visible with activated "SECOND MODE")

	-99999999	Smallest value
	0	Default value
	+99999999	Highest value

SECOND DECIMAL POINT

This value defines the position of the decimal point.

(Parameter only visible with activated "SECOND MODE")

0	NO	No decimal point
1	0000000.0	Decimal point at the specified position
2	000000.00	Decimal point at the specified position
3	00000.000	Decimal point at the specified position
4	0000.0000	Decimal point at the specified position
5	000.00000	Decimal point at the specified position
6	00.000000	Decimal point at the specified position
7	0.0000000	Decimal point at the specified position

Continuation "Counter A Settings":

SECOND SCALE UNITS (display unit of measurement)

This parameter determines which unit is shown on the display. Setting the SCALE UNITS does not affect the display value. The decimal point is set in the parameter SECOND DECIMAL POINT.

A list of possible units can be found in "COUNTER A SETTINGS - SCALE UNITS".

(Parameter only visible with activated "SECOND MODE")

5.5. Counter B Settings

In this menu, the settings for the pulse counter (or position indicator) on channel B are defined. This menu is only displayed when the appropriate OPERATIONAL MODE in the GENERAL MENU is selected (e.g., "SUM A + B", "DIF A-B", "RATIO B / A", or "% DEVIA B / A").

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

SET VALUE		
In case of a set/reset command (via keys, Control-Inputs or PC-user interface), the counter of channel A is set to the value entered here		
	-99999999	Smallest value
	0	Default value
	+99999999	Highest value

DECIMAL POINT		
This value defines the position of the decimal point.		
	0 NO	No decimal point
	1 000000.0	Decimal point at the specified position
	2 000000.00	Decimal point at the specified position
	3 00000.000	Decimal point at the specified position
	4 0000.0000	Decimal point at the specified position
	5 000.00000	Decimal point at the specified position
	6 00.000000	Decimal point at the specified position
	7 0.0000000	Decimal point at the specified position

SCALE UNITS (display unit of measurement)		
This parameter determines which unit is shown on the display. Setting the SCALE UNITS does not affect the display value. The decimal point is set in the parameter DECIMAL POINT.		
A list of possible units can be found in "COUNTER A SETTINGS - SCALE UNITS".		

Continuation "Counter B Settings":

SECOND MODE

Setting of the batch counter / total counter.

The function of batch counting according to a preset value is only possible in combination with the switch condition "automatic reset to zero" (RESULT <= PRES-> 0), "automatic reset to set value" (RESULT >= PRES-> VALUE) or "set the counter value to the respective preselection value" (RESULT <= 0-> SET).

When SECOND MODE is active, PRESELECTION serves as the present value (SOURCE 1-4) for the SECOND COUNTER B.

Example for the batch counter:

If the batch counter should increment 1 all 1000 pulses, the value e.g. PRESELECTION 1 has to be set to 1000, the related reference source SOURCE 1 to "COUNTER B", the corresponding switching condition MODE 1 to "RESULT >= PRES-> 0" and SECOND MODE to INCREMENT BATCH. Should an output be turned on after a batch amount of 33, e.g. PRESELECTION 2 has to be set to 33, the related reference source SOURCE 2 to "SECOND COUNTER B" and the switching condition of MODE 2 has to be set to display value greater than or equal (RESULT >= PRES).

Example for the total counter:

For the total counter, SECOND MODE must be set to "TOTAL COUNTER". The total counter counts here parallel to the main counter. e.g. If the total counter should automatically reset to 0, when 4000 is reached, the preset value e.g. PRESELECTION 3 must be set to "4000", the reference source SOURCE 3 must be set to "SECOND COUNTER B" and the corresponding switching condition MODE 3 must be set to "RESULT > = PRES-> 0"

0	OFF	No batch counter and no total counter
1	INCREMENT BATCH	increment batch counter
2	DECREMENT BATCH	decrement batch counter
3	USE INPUTS ONLY	increment / decrement batch counter only by external commands (see command menu)
4	TOTAL COUNTER	Total counter is activated

SECOND SET VALUE

With a "RESET / SET " command (command "SET SECOND B" via control input), the Second Counter B (batch counter / total counter) is set to this value.

(Parameter only visible with activated "SECOND MODE")

-99999999	Smallest value
0	Default value
+99999999	Highest value

SECOND DECIMAL POINT

This value defines the position of the decimal point.

(Parameter only visible with activated "SECOND MODE")

0	NO	No decimal point
1	0000000.0	Decimal point at the specified position
2	000000.00	Decimal point at the specified position
3	00000.000	Decimal point at the specified position
4	0000.0000	Decimal point at the specified position
5	000.00000	Decimal point at the specified position
6	00.000000	Decimal point at the specified position
7	0.0000000	Decimal point at the specified position

Continuation „Counter B Settings“:

SECOND SCALE UNITS (display unit of measurement)

This parameter determines which unit is shown on the display. Setting the SCALE UNITS does not affect the display value. The number of decimal places must be defined with the parameter SECOND DECIMAL POINT.

A list of possible units can be found in "COUNTER A SETTINGS - SCALE UNITS".

(Parameter only visible with activated "SECOND MODE")

5.6. Collection Settings

In this menu the decimal point as well as the corresponding unit for the linked results ("Frequency Collection" and "Counter Collection") can be set. This menu is only displayed if the corresponding OPERATIONAL MODE is selected in the GENERAL MENU. (e.g., "SUM A + B", "DIF A-B", "RATIO B / A", or "% DEVI A / B")

DECIMAL POINT FREQUENCY

This value defines the position of the decimal point

0	NO	No decimal point
1	0000000.0	Decimal point at the specified position
2	000000.00	Decimal point at the specified position
3	00000.000	Decimal point at the specified position
4	0000.0000	Decimal point at the specified position
5	000.00000	Decimal point at the specified position
6	00.000000	Decimal point at the specified position
7	0.0000000	Decimal point at the specified position

SCALE UNITS FREQUENCY (display unit of measurement)

This parameter determines which unit is shown on the display. Setting the SCALE UNITS does not affect the display value. The decimal point is set in the parameter DECIMAL POINT.

A list of possible units can be found in "SPEED A SETTINGS - SCALE UNITS".

DECIMAL POINT COUNTER

This value defines the position of the decimal point

0	NO	No decimal point
1	0000000.0	Decimal point at the specified position
2	000000.00	Decimal point at the specified position
3	00000.000	Decimal point at the specified position
4	0000.0000	Decimal point at the specified position
5	000.00000	Decimal point at the specified position
6	00.000000	Decimal point at the specified position
7	0.0000000	Decimal point at the specified position

SCALE UNITS COUNTER (display unit of measurement)

This parameter determines which unit is shown on the display. Setting the SCALE UNITS does not affect the display value. The decimal point is set in the parameter DECIMAL POINT.

A list of possible units can be found in "SPEED A SETTINGS - SCALE UNITS".

5.7. Scaling Settings

In this menu, additional scaling factors can be defined with which the desired process value is additionally calculated again. The correspondingly scaled result is stored in the "SCALED RESULT" and can be selected accordingly for further processing by means of an adjustable reference source. (eg via "Source" parameter for analogue output, switching output, display, ...)

SOURCE (reference source)		
This parameter defines the reference source, which is additionally calculated with the scaling factors		
0	SPEED A	Result of frequency measurement on channel A (or A / B 90)
1	COUNTER A	Result of the counter on channel A (or A / B 90)
2	SECOND COUNTER A	Result of the second counter (total counter / batch counter) on channel A (or A / B 90) (Only visible if "Second Mode -A" has been activated.)
3	SPEED B	Result of frequency measurement on channel B (Only visible if corresponding "Operational Mode" has been activated.)
4	COUNTER B	Result of the counter on channel B (Only visible if corresponding "Operational Mode" has been activated.)
5	SECOND COUNTER B	Result of the second counter (total counter / batch counter) on channel B (Only visible if "Second Mode -B" has been activated.)
6	FREQUENCY COLL.	Result of the linked frequency of channel A and B (A + B, A-B, B / A, ...) (Only visible if corresponding "Operational Mode" has been activated.)
7	COUNTER COLL.	Result of the linked counters of channel A and B (A + B, A-B, B / A, ...) (Only visible if corresponding "Operational Mode" has been activated.)

FACTOR		
This parameter defines the factor		
	-99999999	Smallest value
	1	Default value
	99999999	Highest value

DIVIDER		
This parameter defines the divisor.		
	-99999999	Smallest value
	1	Default value
	99999999	Highest value

ADDITIVE VALUE		
This parameter defines an additive constant.		
	-99999999	Smallest value
	0	Default value
	99999999	Highest value

5.8. Preselection Values

In this menu, the preselection values or switching points are set. The preselection values always refer to the SOURCE selected in the PRESELECTION MENU.

This feature is only available on devices with option CO, CR, AO, AR or RL.

PRESELECTION 1 Preselection / switching point 1		
	-99999999	Smallest value
	1000	Default value
	+99999999	Highest value

PRESELECTION 2 Preselection / switching point 2		
	-99999999	Smallest value
	2000	Default value
	+99999999	Highest value

PRESELECTION 3 Preselection / switching point 3		
	-99999999	Smallest value
	3000	Default value
	+99999999	Highest value

PRESELECTION 4 Preselection / switching point 4		
	-99999999	Smallest value
	4000	Default value
	+99999999	Highest value

5.9. Preselection 1 Menu

In this menu, the parameters of the reference source, the switching conditions and further definitions for preselection value / switching point 1 are defined.

This function is only available for devices with option CO, CR, AO, AR or RL.

SOURCE (reference source)		
This parameter defines the reference source, which is additionally calculated with the scaling factors		
0	SPEED A	Result of frequency measurement on channel A (or A / B 90)
1	COUNTER A	Result of the counter on channel A (or A / B 90)
2	SECOND COUNTER A	Result of the second counter (total counter / batch counter) on channel A (or A / B 90) (Only visible if "Second Mode -A" has been activated.)
3	SPEED B	Result of frequency measurement on channel B (Only visible if corresponding "Operational Mode" has been activated.)
4	COUNTER B	Result of the counter on channel B (Only visible if corresponding "Operational Mode" has been activated.)
5	SECOND COUNTER B	Result of the second counter (total counter / batch counter) on channel B (Only visible if "Second Mode -B" has been activated.)
6	FREQUENCY COLL.	Result of the linked frequency of channel A and B (A + B, A-B, B / A, ...) (Only visible if corresponding "Operational Mode" has been activated.)
7	COUNTER COLL.	Result of the linked counters of channel A and B (A + B, A-B, B / A, ...) (Only visible if corresponding "Operational Mode" has been activated.)
8	SCALED RESULT	Result of the additionally scaled process value

MODE 1		
Switching conditions for preselection 1. Output/ relay/ display switches under the following conditions:		
0	$ \text{RESULT} \geq \text{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 \geq PRESELECTION 1 \rightarrow ON, Display value $<$ PRESELECTION 1 – HYSTERESIS 1 \rightarrow OFF
1	$ \text{RESULT} \leq \text{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 \leq PRESELECTION 1 \rightarrow ON, Display value $>$ PRESELECTION 1 + HYSTERESIS 1 \rightarrow OFF
2	$ \text{RESULT} = \text{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 \rightarrow OFF, Display value $<$ PRESELECTION 1 - ½ HYSTERESIS 1 \rightarrow OFF
3	$\text{RESULT} \geq \text{PRES}$	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 \geq PRESELECTION 1 \rightarrow ON, Display value $<$ PRESELECTION 1 – HYSTERESIS 1 \rightarrow OFF
4	$\text{RESULT} \leq \text{PRES}$	Display value is less or equal PRESELECTION 1, e.g. underspeed (start-up suppression “START UP DELAY” is recommend) With HYSTERESIS 1 not equal 0 the following switching condition is applied: Display value \leq PRESELECTION 1 \rightarrow ON, Display value $>$ PRESELECTION 1 + HYSTERESIS 1 \rightarrow OFF
5	$\text{RESULT} = \text{PRES}$	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 \rightarrow OFF, Display value $<$ PRESELECTION 1 - ½ HYSTERESIS 1 \rightarrow OFF
6	$\text{RESULT} = 0$	Display value is zero (Standstill after STANDSTILL TIME(s)), e. g. standstill monitoring (only for reference source SPEED A and SPEED B).
7	$\text{RESULT} \geq \text{PRES} \rightarrow 0$	Auto reset to zero: (only for reference sources: COUNTER A, SECOND COUNTER A, COUNTER B and SECOND COUNTER B) Display value is greater or equal PRESELECTION 1, the display value is set to zero. If the BATCH MODE A or B is active, the corresponding batch counter increments or decrements when the display value is set to zero and when the corresponding reference source COUNTER A or COUNTER B was selected.
8	$\text{RESULT} \leq 0 \rightarrow \text{SET}$	Auto set to PRESELECTION 1: (only for reference sources: COUNTER A, SECOND COUNTER A, COUNTER B and SECOND COUNTER B) Display value is less or equal zero, the display value is set to PRESELECTION 1. If the BATCH MODE A or B is active, the corresponding batch counter increments or decrements when PRESELECTION 1 is set and when the corresponding reference source COUNTER A or COUNTER B was selected.
9	$\text{RES} \geq \text{PRES} - \text{TRAIL}$	Trailing PRESELECTION 1: Display value is greater or equal PRESELECTION 2 – PRESELECTION 1 \rightarrow ON, PRESELECTION 1 is the trailing value from PRESELECTION 2

Continuation „PRESELECTION 1 MENU“:

10	RESULT >= PRES->VALUE	Set the counter reading to "SET VALUE": (only for reference sources: COUNTER A, SECOND COUNTER A, COUNTER B and SECOND COUNTER B) Display value is greater or equal PRESELECTION 1, the counter reading is set to the corresponding "SET VALUE". If the BATCH MODE A or B is active, the corresponding batch counter increments or decrements when the counter reading is set to the corresponding "SET VALUE" and when the corresponding reference source COUNTER A or COUNTER B was selected.
11	ERROR SET	Error message for device errors

HYSTERESIS 1

This parameter defines the switching hysteresis of the switch-off point for preselection 1

	0	No switching hysteresis
	...	
	9999	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 or relay for the switching condition of preselection 1.

If more than one switching condition is assigned to one output / relay, 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	RELAY 1	Switching condition assigned to "Rel. 1"
6	RELAY 2	Switching condition assigned to "Rel. 2"

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.

This adjustment is only valid for the switching condition $|RESULT| \leq |PRES|$ or $RESULT \leq PRES$ and only for reference sources "SPEED A" and "SPEED B".

(Start Up Delay 3 and 4 have an automatic start up suppression).

	00.000	No start-up suppression
	...	
	60.000	Start-up suppression in seconds

EVENT COLOR 1

Event-depending change of the display color for the switching condition of preselection 1.

EVENT COLOR 1 has the lowest priority. EVENT COLOR 2 ... 4 are allowed to overwrite this color change.

0	NO CHANGE	No color change.
1	CHANGE TO RED	Color change to red
2	CHANGE TO GREEN	Color change to green
3	CHANGE TO YELLOW	Color change to yellow

5.10. Preselection 2 Menu

SOURCE 2

The reference source for PRESELECTION 2, see PRESELECTION 1 MENU.

MODE 2

Switching conditions for preselection 2. Output/ relay/ display switches under the following conditions:

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

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

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.
(Start Up Delay 3 and 4 have an automatic start up suppression).

EVENT COLOR 2

Event-dependending change of the display color for the switching condition of preselection 2.
See chapter PRESELECTION 1 MENU.

5.11. Preselection 3 Menu

SOURCE 3

The reference source for PRESELECTION 3, see PRESELECTION 1 MENU.

MODE 3

Switching conditions for preselection 3. Output/ relay/ display switches under the following conditions:

		See chapter PRESELECTION 1 MENU
9	RES \geq PRES-TRAIL	Trailing preselection 3: Display value is greater or equal to PRESELECTION 4 – PRESELECTION 3 → ON, PRESELECTION 3 is the trailing preselection from PRESELECTION 4.

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 or relay for the switching condition of preselection 3.

See chapter PRESELECTION 1 MENU.

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

Start-up suppression for the switching condition of preselection 3.

This adjustment is only valid for the switching condition $|\text{RESULT}| \leq |\text{PRES}|$ or $\text{RESULT} \leq \text{PRES}$ and only for reference sources "SPEED A" and "SPEED B".

0	OFF	No start-up suppression
1	AUTO	Automatic start up suppression, until the preselection value / switching point is exceeded for the first time.

EVENT COLOR 3

Event-depending change of the display color for the switching condition of preselection 3.

See chapter PRESELECTION 1 MENU.

5.12. Preselection 4 Menu

SOURCE 4

The reference source for PRESELECTION 4, see PRESELECTION 1 MENU.

MODE 4

Switching conditions for preselection 4. Output/ relay/ display switches under the following conditions:

		See chapter PRESELECTION 1 MENU
9	RES>=PRES-TRAIL	Trailing preselection 4: Display value is greater or equal to PRESELECTION 3 – PRESELECTION 4 → ON, PRESELECTION 4 is the trailing preselection from PRESELECTION 3.

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 3.

See chapter PRESELECTION 1 MENU.

OUTPUT TARGET 4

Assignment of an output or relay for the switching condition of preselection 4.

See chapter PRESELECTION 1 MENU.

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

Start-up suppression for the switching condition of preselection 4.

This adjustment is only valid for the switching condition $|\text{RESULT}| \leq |\text{PRES}|$ or $\text{RESULT} \leq \text{PRES}$ and mode SPPED and PROCESS TIME. (Start Up Delay 1 and 2 have a time-dependent start up suppression).

0	OFF	No start-up suppression
1	AUTO	Automatic start up suppression, until the preselection value / switching point is exceeded for the first time.

EVENT COLOR 4

Event-dependending change of the display color for the switching condition of preselection 4.

See chapter PRESELECTION 1 MENU.

5.13. Serial Menu

This menu defines the basic settings of serial interface.

This function is only available for devices with option CO, CR, AO or AR.

UNIT NUMMER

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
	...	
	99	Highest address

SERIAL BAUD RATE

This parameter defines the serial baud rate

	0	9600	9600 baud
	1	19200	19200 baud
	2	38400	38400 baud

SERIAL FORMAT

This parameter defines the bit data format.

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

SERIAL INIT

This parameter defines the baud rate for the initialization to the user interface OS6.0. With settings larger than 9600 the initialization time can be reduced.

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

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 Nr., +/-, data, LF, CR											
		1	1	+/-	X	X	X	X	X	X	X	LF	CR
	1	Transmission report = +/-, data, LF, CR											
		+/-	X	X	X	X	X	X	X	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	Register contents
	0	:0	Measurement_Result
	1	:1	Speed_Value
	2	:2	Time_Result
	3	:3	Counter
	4	:4	Velocity_Speed
	5	:5	Batch_Counter
	6	:6	Minimal_Value
	7	:7	Maximal_Value
	8	:8	Counter_Total
	9	:9	Time_Result_Total

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.

5.14. Analog Menu

This menu defines the basic settings of the analog output.

This function is only available for devices with option AO or AR.

ANALOG SOURCE		
This parameter defines the reference source for analog output		
0	SPEED A	Result of frequency measurement on channel A (or A / B 90)
1	COUNTER A	Result of the counter on channel A (or A / B 90)
2	SECOND COUNTER A	Result of the second counter (total counter / batch counter) on channel A (or A / B 90) (Only visible if "Second Mode -A" has been activated.)
3	SPEED B	Result of frequency measurement on channel B (Only visible if corresponding "Operational Mode" has been activated.)
4	COUNTER B	Result of the counter on channel B (Only visible if corresponding "Operational Mode" has been activated.)
5	SECOND COUNTER B	Result of the second counter (total counter / batch counter) on channel B (Only visible if "Second Mode -B" has been activated.)
	FREQUENCY COLL.	Result of the linked frequency of channel A and B (A + B, A-B, B / A, ...) (Only visible if corresponding "Operational Mode" has been activated.)
	COUNTER COLL	Result of the linked counters of channel A and B (A + B, A-B, B / A, ...) (Only visible if corresponding "Operational Mode" has been activated.)
	SCALED RESULT	Result of the additionally scaled process value

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...20M	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.		
	-99999999	Smallest start value
	0	Default value
	+99999999	Highest start 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.		
	-99999999	Smallest end value
	10000	Default Wert
	+99999999	Highest end value

Continuation „Analog Menu“:

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	Smallest gain
	100	Default value
	110	Highest gain

ANALOG OFFSET (%)		
This parameter sets the zero offset of the output.		
e.g. 0.20 result in an offset of 0.02 V or 0.04 mA at ANALOG START value		
	-99,99	Smallest zero offset
	0	Default value
	+99,00	Highest zero offset

5.15. Command Menu

INPUT 1 ACTION (function Input 1)			
This parameter defines the function of the input "Ctrl. In 1".			
0	NO	No function	
1	RESET/SET A+B	Reset / set the counter reading of channel A and. B to the value set in "SET VALUE".	(d) (s)
2	FREEZE	Freeze actual display value	(s)
3	KEY LOCK	disable touch screen	(s)
4	LOCK RELEASE	Loosen locking of all outputs / relay	(d)
5	RESET MIN/MAX	Reset of the min. / max. values	(d) (s)
6	SERIAL PRINT	Sending of serial data, see parameter SERIAL VALUE	(d)
7	TEACH PRESEL. 1	Current display value is stored as PRESELECTION 1 (reference source is the <u>one-line</u> display)	(d)
8	TEACH PRESEL. 2	Current display value is stored as PRESELECTION 2 (reference source is the <u>one-line</u> display)	(d)
9	TEACH PRESEL. 3	Current display value is stored as PRESELECTION 3 (reference source is the <u>one-line</u> display)	(d)
10	TEACH PRESEL. 4	Current display value is stored as PRESELECTION 4 (reference source is the <u>one-line</u> display)	(d)
11	SCROLL DISPLAY	Display switching (see display in operation mode)	(d)
12	CLEAR LOOP TIME	N.A.	
13	START PRESELECT	N.A.	
14	ACTIVATE	N.A.	
15	STORE DATA	N.A.	
16	TESTPROGRAM	N.A.	
17	SET RED COLOR	The display lights up red. The color can be changed by the event-dependent color switching in the PRESELECTION 1... 4	(d)
18	SET GREEN COLOR	The display lights up green. The color can be changed by the event-dependent color switching in the PRESELECTION 1... 4	(d)
19	SET YELLOW COLOR	The display lights up yellow The color can be changed by the event-dependent color switching in the PRESELECTION 1... 4	(d)
20	RESET/SET A	Reset /set the value of counter from channel A to the set value in "Counter A Settings – SET VALUE"	(d) (s)
21	RESET/SET B	Reset /set the value of counter from channel B to the set value in "Counter B Settings – SET VALUE"	(d) (s)
22	SET SECOND A	Reset / set of the batch counter / total counter from channel A to the set value in "Counter A Settings – SECOND SET VALUE"	(d) (s)
23	SET SECOND B	Reset / set of the batch counter / total counter from channel B to the set value in "Counter B Settings – SECOND SET VALUE"	(d) (s)
24	INC. BATCH A	Increase the batch counter of channel A	(d)
25	DEC. BATCH A	Decrease of the batch counter of channel A	(d)
26	INC. BATCH B	Increase the batch counter of channel B	(d)
27	DEC. BATCH B	Decrease of the batch counter of channel B	(d)
28	INC. BRIGHTNESS	Display brightness is increased	(d) (s)
29	DEC. BRIGHTNESS	Display brightness is reduced	(d) (s)

Continuation "Command Menu":

30	LOCK COUNTER A	Counter (channel A) is disabled and stops counting any further pulses as long as this command is present.	(s)
31	LOCK COUNTER B	Counter (channel B) is disabled and stops counting any further pulses as long as this command is present.	(s)

(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

Continuation "Command Menu":

INPUT 1 CONFIG

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

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

INPUT 2 ACTION

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

INPUT 2 CONFIG

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

INPUT 3 ACTION

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

INPUT 3 CONFIG

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

5.16. Display Menu

Parameter changes become active only after closing the menu selection.

START DISPLAY		
This parameter defines the start display after switching on device.		
0	STANDARD	Display with unit and status bar
1	LARGE	Large display (only the parameter „LARGE DISPLAY“ is active)
2	DOUBLE	Two-line display without units
3	DOUBLE WITH UNITS	Two-line display with units
4	COMMAND	Display with command keys
5	QUICKSTART	Display for quick start for enter / display preselection values (only for option CO/CR/AO/AR/RL)
6	MINIMUM/MAXIMUM	Display with minimum and maximum value

SOURCE SINGLE		
(Reference source for single-line display <u>and</u> large display)		
0	SPEED A	Result of frequency measurement on channel A (or A / B 90)
1	COUNTER A	Result of the counter on channel A (or A / B 90)
2	SECOND COUNTER A	Result of the second counter (total counter / batch counter) on channel A (or A / B 90) (Only visible if "Second Mode -A" has been activated.)
3	SPEED B	Result of frequency measurement on channel B (Only visible if corresponding "Operational Mode" has been activated.)
4	COUNTER B	Result of the counter on channel B (Only visible if corresponding "Operational Mode" has been activated.)
5	SECOND COUNTER B	Result of the second counter (total counter / batch counter) on channel B (or A / B 90) (Only visible if "Second Mode -B" has been activated.)
6	FREQUENCY COLL.	Result of the linked frequency of channel A and B (A+B, A-B, B/A, ...) (Only visible if corresponding "Operational Mode" has been activated.)
7	COUNTER COLL.	Result of the linked counter of channel A and B (A+B, A-B, B/A, ...) (Only visible if corresponding "Operational Mode" has been activated.)
8	SCALED RESULT	Result of the additionally scaled process value

Continuation "Display Menu":

SOURCE DUAL TOP		
(Reference source for two-line display, first line)		
0	SPEED A	Result of frequency measurement on channel A (or A / B 90)
1	COUNTER A	Result of the counter on channel A (or A / B 90)
2	SECOND COUNTER A	Result of the second counter (total counter / batch counter) on channel A (or A / B 90) (Only visible if "Second Mode -A" has been activated.)
3	SPEED B	Result of frequency measurement on channel B (Only visible if corresponding "Operational Mode" has been activated.)
4	COUNTER B	Result of the counter on channel B (Only visible if corresponding "Operational Mode" has been activated.)
5	SECOND COUNTER B	Result of the second counter (total counter / batch counter) on channel B (or A / B 90) (Only visible if "Second Mode -B" has been activated.)
6	FREQUENCY COLL.	Result of the linked frequency of channel A and B (A+B, A-B, B/A, ...) (Only visible if corresponding "Operational Mode" has been activated.)
7	COUNTER COLL.	Result of the linked counter of channel A and B (A+B, A-B, B/A, ...) (Only visible if corresponding "Operational Mode" has been activated.)
8	SCALED RESULT	Result of the additionally scaled process value

SOURCE DUAL DOWN		
(Reference source for two-line display, second line)		
0	SPEED A	Result of frequency measurement on channel A (or A / B 90)
1	COUNTER A	Result of the counter on channel A (or A / B 90)
2	SECOND COUNTER A	Result of the second counter (total counter / batch counter) on channel A (or A / B 90) (Only visible if "Second Mode -A" has been activated.)
3	SPEED B	Result of frequency measurement on channel B (Only visible if corresponding "Operational Mode" has been activated.)
4	COUNTER B	Result of the counter on channel B (Only visible if corresponding "Operational Mode" has been activated.)
5	SECOND COUNTER B	Result of the second counter (total counter / batch counter) on channel B (or A / B 90) (Only visible if "Second Mode -B" has been activated.)
6	FREQUENCY COLL.	Result of the linked frequency of channel A and B (A+B, A-B, B/A, ...) (Only visible if corresponding "Operational Mode" has been activated.)
7	COUNTER COLL.	Result of the linked counter of channel A and B (A+B, A-B, B/A, ...) (Only visible if corresponding "Operational Mode" has been activated.)
8	SCALED RESULT	Result of the additionally scaled process value

Continuation "Display Menu":

LARGE DISPLAY		
This parameter defines to switch on / off the large display. By splitting ratio the display value for the large display can be divided. (Reference source for the large display is the set process value in the "SOURCE SINGLE" parameter.)		
0	NO	Large display off
1	1:1	Large display with splitting ratio 1:1
2	1:10	Large display with splitting ratio 1:10
3	1:100	Large display with splitting ratio 1:100
4	1:1000	Large display with splitting ratio 1:1000
5	1:10000	Large display with splitting ratio 1:10000

COLOR		
This parameter defines the display color. Event-dependending change of the display color by a switching condition is possible (see PRESELECTION 1...4 MENU) Event-dependending changes are only available for devices with option CO, CR, AO, AR or RL.		
0	RED	Red display
1	GREEN	Green display
2	YELLOW	Yellow display

BRIGHTNESS (%)		
This parameter defines the brightness of the display in percent		
	10	Min. brightness
	90	Default value
	100	Max. brightness

CONTRAST		
This parameter defines the viewing angle.		
	0	Viewing angle from top
	1	Viewing angle from center
	2	Viewing angle from bottom

SCREEN SAVER (S)		
This parameter defines the time in seconds until the display is switched off, after the last touch action. A new touch action will activate the display again.		
	0	No switch off
	...	
	99.99	Longest time to switch off

UP-DATE-TIME (S)		
This parameter defines the update time in seconds of the display only.		
	0.005	Shortest update time
	0.1	Default value
	9.999	Longest update time

Continuation "Display Menu":

FONT		
This parameter defines the setting of the font style.		
	0	Standard
	1	Font 1

QUICKSTART BUTTON			
This parameter determines which command key should be displayed on the "Quick Start"-display. (Parameter only visible with option CO/CR/AO/AR/RL).			
	0	EDIT PRESEL.	Editing menu is opened after pressing the left command key and "Preselection Values" can be changed. Attention: Monitoring of the switching outputs, correction of the analogue output etc. are <u>deactivated</u> as long as the editing menu is open!
	1	SHOW PRESEL.	Set "Preselection Values" are displayed on the screen after pressing the left-hand button. The editing menu will <u>not</u> be opened. The monitoring of the switching outputs, the correction of the analog output etc. are still activated.

5.17. Linearization Menu

The linearization function is defined in this menu. This menu will only be showed, if the LINEARIZATION MODE in GENERAL MENU is selected.

Linearization description and examples are shown in the appendix.

SOURCE		
(Reference source for single-line display <u>and</u> large display)		
0	SPEED A	Result of frequency measurement on channel A (or A / B 90)
1	COUNTER A	Result of the counter on channel A (or A / B 90)
2	SECOND COUNTER A	Result of the second counter (total counter / batch counter) on channel A (or A / B 90) (Only visible if "Second Mode -A" has been activated.)
3	SPEED B	Result of frequency measurement on channel B (Only visible if corresponding "Operational Mode" has been activated.)
4	COUNTER B	Result of the counter on channel B (Only visible if corresponding "Operational Mode" has been activated.)
5	SECOND COUNTER B	Result of the second counter (total counter / batch counter) on channel B (or A / B 90) (Only visible if "Second Mode -B" has been activated.)
6	FREQUENCY COLL.	Result of the linked frequency of channel A and B (A+B, A-B, B/A, ...) (Only visible if corresponding "Operational Mode" has been activated.)
7	COUNTER COLL.	Result of the linked counter of channel A and B (A+B, A-B, B/A, ...) (Only visible if corresponding "Operational Mode" has been activated.)
8	SCALED RESULT	Result of the additionally scaled process value

P1(X) - P24(X)		
X-coordinate of the linearization point.		
This value representing the display value which the unit show in the display without linearization.		
	-99999999	Smallest X-coordinate
	0	Default value
	+99999999	Largest X-coordinate

P1(Y) - P24(Y)		
Y-coordinate of the linearization point		
This is the display value, which the unit should show in the display with linearization.		
E.g. P2(X) is replaced by P2(Y).		
	-99999999	Smallest Y-coordinate
	0	Default value
	+99999999	Largest Y-coordinate

6. Appendix

6.1. Data readout via serial interface

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 our homepage www.motrona.com and in the chapter "Modbus RTU Interface" in this manual.

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

EOT	AD1	AD2	C1	C2	ENQ
-----	-----	-----	----	----	-----

EOT = control character (Hex 04)

AD1 = unit address, High Byte

AD2 = unit address, Low Byte

C1 = register code, High Byte

C2 = register code, Low Byte

ENQ = control character (Hex 05)

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

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

After a correct request, the unit will respond:

STX	C1	C2	xxxxx	ETX	BCC
-----	----	----	-------	-----	-----

STX = control character (Hex 02)

C1 = register code, High Byte

C2 = register code, Low Byte

xxxxx = readout data

ETX = control character (Hex 03)

BCC = block check character

6.2. 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 7788.5150 / 7788.5155 "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

SERIAL FORMAT		
This parameter defines the bit data format.		
0	7-EVEN-1	Do not use with Modbus protocol
1	7-EVEN-2	
2	7-ODD-1	
3	7-ODD-2	
4	7-NONE-1	
5	7-NONE-2	
6	8-EVEN-1	8 data bits Parity even 1 stop bit
7	8-ODD-1	8 data bits Parity odd 1 stop bit
8	8-NONE-1	Do not use with Modbus protocol
9	8-NONE-2	8 data bits no Parity 2 stop bits

Continuation "Parameter setting":

SERIAL INIT

Not valid for Modbus communication

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. Modbus Communication

The following Modbus functions are available:

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 # 51 "PRESELECTION 1" by Holding Register 0x0066 and 0x0067 hex.

Continuation "Modbus Communication":

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)

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	Reset/Set Value of channel A and B
1	55	Freeze Display	Freeze actual display value
2	56	Touch Disable	Disable touch screen
3	57	Clear Lock	Loosen locking of all outputs / relay
4	58	Clear Min/Max	Reset of the min. / max. values
5	59	Serial Print (do not use with Modbus)	Sending of serial data
6	60	Teach Preset 1	Current display value (reference source here is the one-line display) is stored as PRESELECTION 1
7	61	Teach Preset 2	Current display value (reference source here is the one-line display) is stored as PRESELECTION 2
8	62	Teach Preset 3	Current display value (reference source here is the one-line display) is stored as PRESELECTION 3
9	63	Teach Preset 4	Current display value (reference source here is the one-line display) is stored as PRESELECTION 4
10	64	Scroll Display	Display switching (see display in operation mode)
11	65	Clear Loop Time	Release all latched switching conditions
12	66	Start Preselection	The preselection starts
13	67	Activate Data (not required with Modbus)	The data is activated.
14	68	Store to EEPROM	Store to EEPROM
15	69	Testprogram (do not use with Modbus)	Testprogram (do not use with Modbus)

6.2.3. Diagnostics

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

6.3. Parameter / serial codes

#	Menu	Name	Serial Code	Min	Max	Default
0	GENERAL MENU	OPERATIONAL MODE	00	0	0	8
1	GENERAL MENU	ENCODER PROPERTIES	01	0	0	3
2	GENERAL MENU	ENCODER SUPPLY	02	0	0	1
3	GENERAL MENU	COUNTING DIRECTION	03	0	0	3
4	GENERAL MENU	LINEARIZATION MODE	04	0	0	2
5	GENERAL MENU	PIN PRESELECTION	05	0	0	9999
6	GENERAL MENU	PIN PARAMETER	06	0	0	9999
7	GENERAL MENU	BACK UP MEMORY	07	1	0	1
8	GENERAL MENU	FACTORY SETTINGS	08	0	0	1
9	GENERAL MENU	___	09	0	0	0
10	SPEED A SETTINGS	DISPLAY VALUE	10	1000	1	99999999
11	SPEED A SETTINGS	BASE FREQUENCY (HZ)	11	100	1	500000
12	SPEED A SETTINGS	DECIMAL POINT	12	1	0	7
13	SPEED A SETTINGS	SAMPLING TIME (S)	13	100	5	9999
14	SPEED A SETTINGS	WAIT TIME (S)	14	100	1	8000
15	SPEED A SETTINGS	STANDSTILL TIME (S)	15	0	0	9999
16	SPEED A SETTINGS	AVERAGE FILTER	16	0	0	8
17	SPEED A SETTINGS	SCALE UNITS	17	0	0	29
18	SPEED A SETTINGS	___	18	0	0	0
19	SPEED A SETTINGS	___	19	0	0	0
20	SPEED A SETTINGS	___	20	0	0	0
21	SPEED B SETTINGS	DISPLAY VALUE	21	1000	1	99999999
22	SPEED B SETTINGS	BASE FREQUENCY (HZ)	22	100	1	500000
23	SPEED B SETTINGS	DECIMAL POINT	23	1	0	7
24	SPEED B SETTINGS	SAMPLING TIME (S)	24	100	5	9999
25	SPEED B SETTINGS	WAIT TIME (S)	25	100	1	8000
26	SPEED B SETTINGS	STANDSTILL TIME (S)	26	0	0	9999
27	SPEED B SETTINGS	AVERAGE FILTER	27	0	0	8
28	SPEED B SETTINGS	SCALE UNITS	28	0	0	29
29	SPEED B SETTINGS	___	29	0	0	0
30	SPEED B SETTINGS	___	30	0	0	0
31	SPEED B SETTINGS	___	31	0	0	0
32	COUNTER A SETTINGS	FACTOR	32	100000	1	9999999
33	COUNTER A SETTINGS	SET VALUE	33	0	-99999999	999999999
34	COUNTER A SETTINGS	DECIMALPOINT	34	0	0	7
35	COUNTER A SETTINGS	SCALE UNITS	35	12	0	29
36	COUNTER A SETTINGS	SECOND MODE	36	0	0	4
37	COUNTER A SETTINGS	SECOND SET VALUE	37	0	-99999999	99999999
38	COUNTER A SETTINGS	SECOND DEC.POINT	38	0	0	7
39	COUNTER A SETTINGS	SECOND SCALE UNITS	39	12	0	29
40	COUNTER A SETTINGS	___	40	0	0	0
41	COUNTER A SETTINGS	___	41	0	0	0

Continuation "Parameter list":

#	Menu	Name	Serial Code	Min	Max	Default
42	COUNTER B SETTINGS	FACTOR	42	100000	1	9999999
43	COUNTER B SETTINGS	SET VALUE	43	0	-99999999	999999999
44	COUNTER B SETTINGS	DECIMALPOINT	44	0	0	7
45	COUNTER B SETTINGS	SCALE UNITS	45	12	0	29
46	COUNTER B SETTINGS	SECOND MODE	46	0	0	4
47	COUNTER B SETTINGS	SECOND SET VALUE	47	0	-99999999	99999999
48	COUNTER B SETTINGS	SECOND DEC.POINT	48	0	0	7
49	COUNTER B SETTINGS	SECOND SCALE UNITS	A0	12	0	29
50	COUNTER B SETTINGS	___	A1	0	0	0
51	COUNTER B SETTINGS	___	A2	0	0	0
52	COLLECTION SETTINGS	DECIMALPOINT FREQ.	A3	0	0	7
53	COLLECTION SETTINGS	SCALE UNITS FREQ.	A4	0	0	29
54	COLLECTION SETTINGS	DECIMALPOINT COUN.	A5	0	0	7
55	COLLECTION SETTINGS	SCALE UNITS COUN.	A6	0	0	29
56	SCALING SETTINGS	SOURCE	A7	0	0	7
57	SCALING SETTINGS	FACTOR	A8	1	-99999999	99999999
58	SCALING SETTINGS	DIVIDER	A9	1	1	99999999
59	SCALING SETTINGS	ADDITIVE VALUE	B0	0	-99999999	99999999
60	PRESELECTION VALUES	PRESELECTION 1	B1	1000	-99999999	99999999
61	PRESELECTION VALUES	PRESELECTION 2	B2	2000	-99999999	99999999
62	PRESELECTION VALUES	PRESELECTION 3	B3	3000	-99999999	99999999
63	PRESELECTION VALUES	PRESELECTION 4	B4	4000	-99999999	99999999
64	PRESELECTION 1 MENU	SOURCE 1	B5	0	0	8
65	PRESELECTION 1 MENU	MODE 1	B6	0	0	11
66	PRESELECTION 1 MENU	HYSTERESIS 1	B7	0	0	99999
67	PRESELECTION 1 MENU	PULSE TIME 1 (S)	B8	0	0	60000
68	PRESELECTION 1 MENU	OUTPUT TARGET 1	B9	1	0	6
69	PRESELECTION 1 MENU	OUTPUT POLARITY 1	C0	0	0	1
70	PRESELECTION 1 MENU	OUTPUT LOCK 1	C1	0	0	1
71	PRESELECTION 1 MENU	START UP DELAY 1 (S)	C2	0	0	60000
72	PRESELECTION 1 MENU	EVENT COLOR 1	C3	0	0	3
73	PRESELECTION 1 MENU	___	C4	0	0	0
74	PRESELECTION 2 MENU	SOURCE 2	C5	0	0	8
75	PRESELECTION 2 MENU	MODE 2	C6	0	0	11
76	PRESELECTION 2 MENU	HYSTERESIS 2	C7	0	0	99999
77	PRESELECTION 2 MENU	PULSE TIME 2 (S)	C8	0	0	60000
78	PRESELECTION 2 MENU	OUTPUT TARGET 2	C9	2	0	6
79	PRESELECTION 2 MENU	OUTPUT POLARITY 2	D0	0	0	1
80	PRESELECTION 2 MENU	OUTPUT LOCK 2	D1	0	0	1
81	PRESELECTION 2 MENU	START UP DELAY 2 (S)	D2	0	0	60000
82	PRESELECTION 2 MENU	EVENT COLOR 2	D3	0	0	3
83	PRESELECTION 2 MENU	___	D4	0	0	0

Continuation "Parameter list":

#	Menu	Name	Serial Code	Min	Max	Default
84	PRESELECTION 3 MENU	SOURCE 3	D5	0	0	8
85	PRESELECTION 3 MENU	MODE 3	D6	0	0	11
86	PRESELECTION 3 MENU	HYSTERESIS 3	D7	0	0	99999
87	PRESELECTION 3 MENU	PULSE TIME 3 (S)	D8	0	0	60000
88	PRESELECTION 3 MENU	OUTPUT TARGET 3	D9	3	0	6
89	PRESELECTION 3 MENU	OUTPUT POLARITY 3	E0	0	0	1
90	PRESELECTION 3 MENU	OUTPUT LOCK 3	E1	0	0	1
91	PRESELECTION 3 MENU	START UP DELAY 3	E2	0	0	1
92	PRESELECTION 3 MENU	EVENT COLOR 3	E3	0	0	3
93	PRESELECTION 3 MENU	___	E4	0	0	0
94	PRESELECTION 4 MENU	SOURCE 4	E5	0	0	8
95	PRESELECTION 4 MENU	MODE 4	E6	0	0	11
96	PRESELECTION 4 MENU	HYSTERESIS 4	E7	0	0	99999
97	PRESELECTION 4 MENU	PULSE TIME 4 (S)	E8	0	0	60000
98	PRESELECTION 4 MENU	OUTPUT TARGET 4	E9	4	0	6
99	PRESELECTION 4 MENU	OUTPUT POLARITY 4	F0	0	0	1
100	PRESELECTION 4 MENU	OUTPUT LOCK 4	F1	0	0	1
101	PRESELECTION 4 MENU	START UP DELAY 4	F2	0	0	1
102	PRESELECTION 4 MENU	EVENT COLOR 4	F3	0	0	3
103	PRESELECTION 4 MENU	___	F4	0	0	0
104	SERIAL MENU	UNIT NUMBER	90	11	11	99
105	SERIAL MENU	SERIAL BAUD RATE	91	0	0	2
106	SERIAL MENU	SERIAL FORMAT	92	0	0	9
107	SERIAL MENU	SERIAL INIT	9~	0	0	1
108	SERIAL MENU	SERIAL PROTOCOL	F5	0	0	1
109	SERIAL MENU	SERIAL TIMER (S)	F6	0	0	60000
110	SERIAL MENU	SERIAL VALUE	F7	0	0	9
111	SERIAL MENU	MODBUS	F8	0	0	247
112	SERIAL MENU	___	F9	0	0	0
113	SERIAL MENU	___	G0	0	0	0
114	ANALOG MENU	ANALOG SOURCE	G1	0	0	8
115	ANALOG MENU	ANALOG FORMAT	G2	0	0	2
116	ANALOG MENU	ANALOG START	G3	0	-99999999	99999999
117	ANALOG MENU	ANALOG END	G4	10000	-99999999	99999999
118	ANALOG MENU	ANALOG GAIN %	G5	10000	0	11000
119	ANALOG MENU	ANALOG OFFSET %	G6	0	-9999	9999
120	ANALOG MENU	___	G7	0	0	0
121	COMMAND MENU	INPUT 1 ACTION	G8	0	0	31
122	COMMAND MENU	INPUT 1 CONFIG.	G9	2	0	3
123	COMMAND MENU	INPUT 2 ACTION	H0	0	0	31
124	COMMAND MENU	INPUT 2 CONFIG.	H1	2	0	3
125	COMMAND MENU	INPUT 3 ACTION	H2	0	0	31
126	COMMAND MENU	INPUT 3 CONFIG.	H3	2	0	3
127	COMMAND MENU	___	H4	0	0	0
128	COMMAND MENU	___	H5	0	0	0
129	COMMAND MENU	___	H6	0	0	0
130	COMMAND MENU	___	H7	0	0	0

Continuation "Parameter list":

#	Menue	Name	Serial Code	Min	Max	Default
131	DISPLAY MENU	START DISPLAY	H8	0	0	6
132	DISPLAY MENU	SOURCE SINGLE	H9	0	0	8
133	DISPLAY MENU	SOURCE DUAL TOP	I0	0	0	8
134	DISPLAY MENU	SOURCE DUAL DOWN	I1	1	0	8
135	DISPLAY MENU	LARGE DISPLAY	I2	0	0	5
136	DISPLAY MENU	COLOR	I3	0	0	2
137	DISPLAY MENU	BRIGHTNESS %	I4	90	10	100
138	DISPLAY MENU	CONTRAST	I5	1	0	2
139	DISPLAY MENU	SCREEN SAVER (S)	I6	0	0	9999
140	DISPLAY MENU	UP-DATE-TIME (S)	I7	100	5	9999
141	DISPLAY MENU	FONT	I8	0	0	1
142	DISPLAY MENU	QUICKSTART BUTTON	I9	0	0	1
143	LINEARIZATION MENU	SOURCE	J0	0	0	8
144	LINEARIZATION MENU	P1(X)	J1	0	-99999999	99999999
145	LINEARIZATION MENU	P1(Y)	J2	-99999999	99999999	0
146	LINEARIZATION MENU	P2(X)	J3	-99999999	99999999	0
147	LINEARIZATION MENU	P2(Y)	J4	-99999999	99999999	0
148	LINEARIZATION MENU	P3(X)	J5	-99999999	99999999	0
149	LINEARIZATION MENU	P3(Y)	J6	-99999999	99999999	0
150	LINEARIZATION MENU	P4(X)	J7	-99999999	99999999	0
151	LINEARIZATION MENU	P4(Y)	J8	-99999999	99999999	0
152	LINEARIZATION MENU	P5(X)	J9	-99999999	99999999	0
153	LINEARIZATION MENU	P5(Y)	K0	-99999999	99999999	0
154	LINEARIZATION MENU	P6(X)	K1	-99999999	99999999	0
155	LINEARIZATION MENU	P6(Y)	K2	-99999999	99999999	0
156	LINEARIZATION MENU	P7(X)	K3	-99999999	99999999	0
157	LINEARIZATION MENU	P7(Y)	K4	-99999999	99999999	0
158	LINEARIZATION MENU	P8(X)	K5	-99999999	99999999	0
159	LINEARIZATION MENU	P8(Y)	K6	-99999999	99999999	0
160	LINEARIZATION MENU	P9(X)	K7	-99999999	99999999	0
161	LINEARIZATION MENU	P9(Y)	K8	-99999999	99999999	0
162	LINEARIZATION MENU	P10(X)	K9	-99999999	99999999	0
163	LINEARIZATION MENU	P10(Y)	L0	-99999999	99999999	0
164	LINEARIZATION MENU	P11(X)	L1	-99999999	99999999	0
165	LINEARIZATION MENU	P11(Y)	L2	-99999999	99999999	0
166	LINEARIZATION MENU	P12(X)	L3	-99999999	99999999	0
167	LINEARIZATION MENU	P12(Y)	L4	-99999999	99999999	0
168	LINEARIZATION MENU	P13(X)	L5	-99999999	99999999	0
169	LINEARIZATION MENU	P13(Y)	L6	-99999999	99999999	0
170	LINEARIZATION MENU	P14(X)	L7	-99999999	99999999	0
171	LINEARIZATION MENU	P14(Y)	L8	-99999999	99999999	0
172	LINEARIZATION MENU	P15(X)	L9	-99999999	99999999	0
173	LINEARIZATION MENU	P15(Y)	M0	-99999999	99999999	0
174	LINEARIZATION MENU	P16(X)	M1	-99999999	99999999	0
175	LINEARIZATION MENU	P16(Y)	M2	-99999999	99999999	0
176	LINEARIZATION MENU	P17(X)	M3	-99999999	99999999	0

Continuation "Parameter list":

#	Menue	Name	Serial Code	Min	Max	Default
177	LINEARIZATION MENU	P17(Y)	M4	-99999999	99999999	0
178	LINEARIZATION MENU	P18(X)	M5	-99999999	99999999	0
179	LINEARIZATION MENU	P18(Y)	M6	-99999999	99999999	0
180	LINEARIZATION MENU	P19(X)	M7	-99999999	99999999	0
181	LINEARIZATION MENU	P19(Y)	M8	-99999999	99999999	0
182	LINEARIZATION MENU	P20(X)	M9	-99999999	99999999	0
183	LINEARIZATION MENU	P20(Y)	N0	-99999999	99999999	0
184	LINEARIZATION MENU	P21(X)	N1	-99999999	99999999	0
185	LINEARIZATION MENU	P21(Y)	N2	-99999999	99999999	0
187	LINEARIZATION MENU	P22(Y)	N4	-99999999	99999999	0
188	LINEARIZATION MENU	P23(X)	N5	-99999999	99999999	0
189	LINEARIZATION MENU	P23(Y)	N6	-99999999	99999999	0
190	LINEARIZATION MENU	P24(X)	N7	-99999999	99999999	0
191	LINEARIZATION MENU	P24(Y)	N8	-99999999	99999999	0

Serial codes of commands:

Serial code	Command
54	RESET/SET
55	FREEZE DISPLAY
56	TOUCH DISABLE
57	CLR LOCK
58	CLR MIN MAX
59	SERIAL PRINT
60	TEACH PRES 1
61	TEACH PRES 2
62	TEACH PRES 3
63	TEACH PRES 4
64	SCROLL_DISPLAY
65	CLEAR LOOP TIME
66	START PRESELCTION
67	ACTIVATE DATA
68	STORE EEPROM
69	TESTPROGRAMM

6.4. Linearization

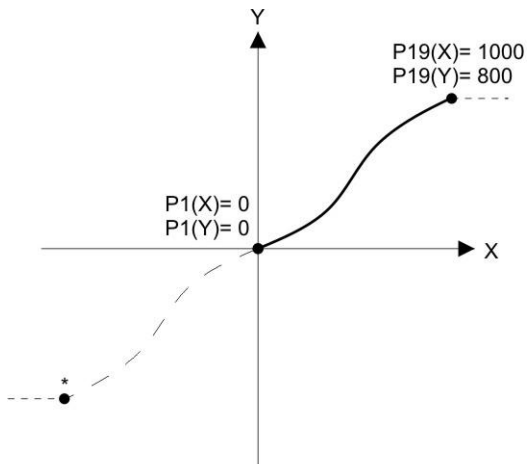
The linearization function of this unit allows converting a linear input signal into a non-linear developing (or vice versa). There are 24 programmable x/y coordinates available, which can be set in any desired distance over the full conversion range. Between two coordinates, the unit uses linear interpolation.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

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

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.

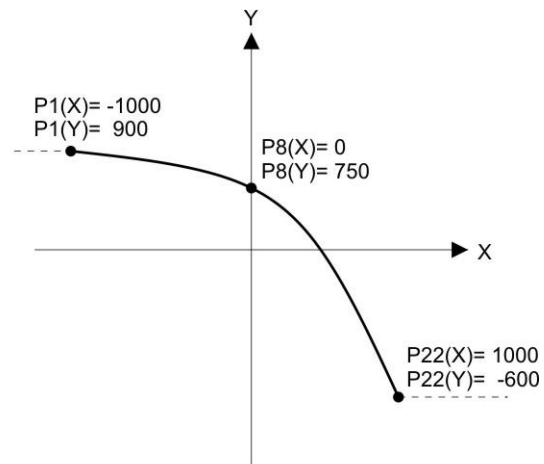
Now enter the attached values to parameter P1(Y) to P24(Y). These are the values that the unit will generate instead of the x- values, i.e. P5(Y) replaces P5(X) etc.

The X-Coordinates must use continuously increasing settings, i.e. P1(X) must have the lowest and P24(X) must have the highest setting. If the measured value is bigger than the last defined X-value, the corresponding Y-value is displayed.



Example: Linearization Mode: 1 Quadrant

* Linearization is point symmetric to 1. Quadrant



Example: Linearization Mode: 4 Quadrant

Mode: 1 Quadrant:

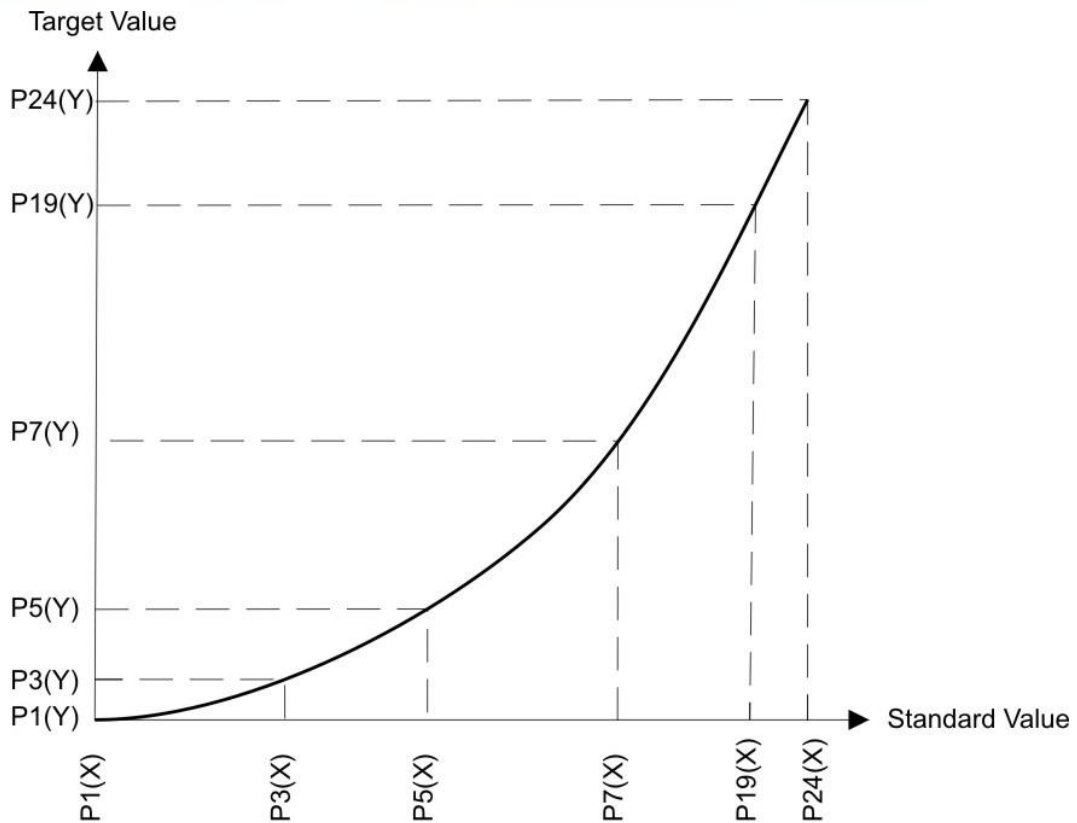
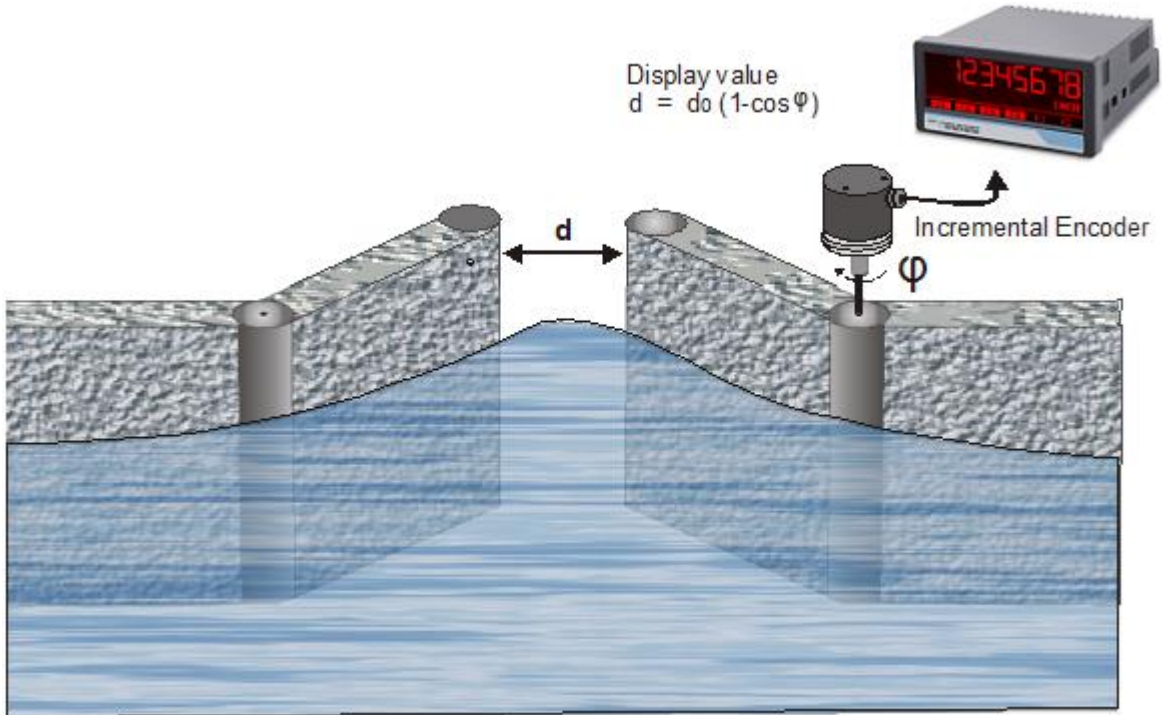
P1(X) must be set to zero. Linearization is only defined in the positive range and the negative range will be mirrored symmetric to central point.

Mode: 4 Quadrant:

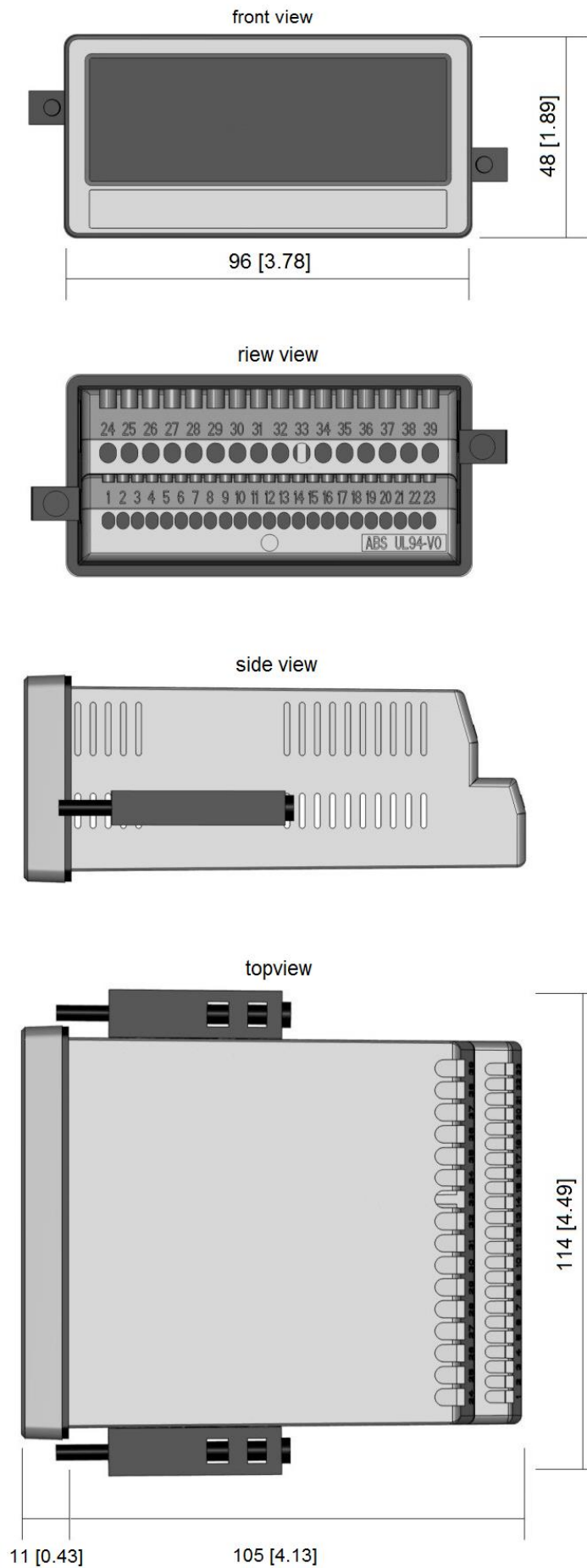
P1(X) can also be set to a negative value. If the measured value is smaller than P1(X), P1(Y) is displayed.

Application Example:

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



6.5. Dimensions



6.6. Technical specifications

Technical Specifications:		
Connections:	Connector type:	screw terminal, 1.5 mm ² / AWG 16
Power supply (DC):	Input voltage:	18 ... 30 VDC
	Protection circuit:	reverse polarity protection
	Consumption:	approx. 100 mA (unloaded)
	Fuse protection:	extern: T 0.5 A
Power supply (AC): (Option AC)	Input voltage:	115 ... 230 VAC (50 ... 60 Hz)
	Power consumption:	approx. 3 VA (unloaded)
	Fuse protection:	extern: T 0.1 A
Encoder supply:	DC version:	24 VDC (approx. 1 V lower than the power supply voltage), max. 250 mA
	AC version:	24 VDC (± 15%), (max. 150 mA until 45°C / 80 mA by more than 45°C)
Encoder supply: (7788.5155)	DC version:	24 VDC (approx. 1 V lower than the power supply voltage), max. 250 mA or 5 VDC (± 15%), max. 250 mA
	AC version:	24 VDC (± 15%) (max. 150 mA until 45°C / 80 mA by more than 45°C) or 5 VDC (± 15%), max. 250 mA
Incremental inputs:	Number of inputs:	2 (A, B)
	Configuration:	PNP, NPN, Namur or Tri-State
	Format:	HTL (Low 0 ... 3 V, High 9 ... 30 V)
	Frequency:	max. 250 kHz
	Load:	max. 6 mA / Ri > 5 kOhm / 470 pF
Incremental inputs: (7788.5155)	Number of inputs:	2 with inverted signal (A, /A, B, /B)
	Configuration:	RS422, HTL differential, HTL PNP or HTL NPN
	RS422:	max. 1 MHz (RS422 differential signal > 0,5 V)
	HTL differential:	max. 500 kHz (HTL differential signal > 2 V)
	HTL PNP / NPN:	max. 250 kHz (Low 0 ... 3 V, High 9 ... 30 V)
	Load:	max. 3 mA / Ri > 10 kOhm / 47 pF
Accuracy:	Measurement:	+/- 50 ppm, +/- 1 digit
Control inputs:	Number of inputs:	3
	Format:	HTL, PNP (Low 0 ... 3 V, High 9 ... 30 V)
	Frequency:	max. 10 kHz
	Load:	max. 2 mA / Ri > 15 kOhm / 470 pF
Analog output: (Option AO/AR)	Configuration:	current or voltage operation
	Voltage output:	-10...+10 V (max. 2 mA)
	Current output:	0/4 ... 20 mA (burden: max. 270 Ohm)
	Resolution:	16 Bit
	Accuracy:	± 0,1 %
	Reaction time:	< 150 ms
Control outputs: (Option AO/AR/CO/CR)	Number of outputs:	4
	Format / level:	5 ... 30 V (depend on COM+ voltage), PNPc
	Output current:	max. 200 mA
	Reaction time:	< 1 ms

Continuation „Technical specifications“:

Relay outputs: (Option RL)	Number of outputs: Configuration: AC-Switching capacity: DC-Switching capacity Reaction time:	2 potential free changeovers max. 250 VAC / 3 A / 750 VA max. 150 VDC / 2 A / 50 W < 20 ms
Serielle Schnittstelle: (Option AO/AR/CO/CR)	Format (Option AO/CO): Format (Option AR/CR) Baudrate:	RS232 RS485 9600, 19200 oder 38400 Baud
Display:	Type: Display range: Digit height Color: Operation:	Graphic LCD with backlight 8 digits plus sign (-99999999 ... 99999999) 13 mm height red / green / yellow (selectable) resistive touchscreen
Housing:	Material: Mounting: Dimensions (w x h x d): Cut out (w x h): Protection class: Weight:	ABS, UL 94 V-0 panel 96 x 48 x 116 mm / 3.78 x 1.89 x 4.56 inch 91 x 43 mm / 3.58 x 1.69 inch IP65 (front), IP20 (rear) approx. 200 g
Ambient temperature:	Operation: Storage:	-20°C ... +60°C / -4 ... 140°F -25°C ... +70°C / -13 ... 158°F
Conformity and standards:	EMC 2014/30/EU: LV 2014/35/EU: (Only for option AC and RL) RoHS (II) 2011/65/EU RoHS (III) 2015/863:	EN 61000-6-2, EN 61000-6-3, EN 61000-6-4, EN 61326-1 EN 61010-1 EN IEC 63000