Operating Manual

touchMATRIX Indicator DP350
Display with Start-Stop-Interface for transsonar measurement with absolute and magnetostrictive position encoders, with touchscreen and graphic display

Product features:

- For absolute and magnetostrictive position encoder with Start-Stop-Interface
- Bright and high-contrast display with event-dependent color variations
- Emulation of a 7-segment display inclusively icons and units
- Intuitive and easy parameterization by plain text and touchscreen
- 5 V / 24 V auxiliary output for encoder supply
- Linearization with 24 control points
- Numerous features, e. g. scaling, filter, zero offset and counting direction etc.
- 3.78 x 1.89 inch norm panel housing and IP65 protection

Available options:

DP350:   Basic unit with Start-Stop-Interface, 3 control inputs, 5V/24 VDC encoder supply

- 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

All options can be combined

Die deutsche Beschreibung ist verfügbar unter:

https://www.motrona.com/fileadmin/files/bedienungsanleitungen/Dp350_d.pdf

The English description is available at:

https://www.motrona.com/fileadmin/files/bedienungsanleitungen/Dp350_e.pdf

La description en français est disponible sur:

https://www.motrona.com/fileadmin/files/bedienungsanleitungen/Dp350_f.pdf

The operator software OS (freeware) is available at:

https://www.motrona.com/en/support/software.html
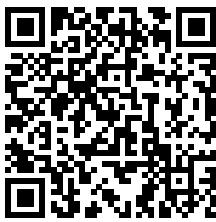
Version:	Description:
DP350_01b_oi/cf/Oct-18	First Version
DP350_01c_oi/cf/Okt-18	Small corrections, additional error message
DP350_02a_oi/tgo/Juli-19	Extension of large display, home screen and display format
DP350_02b_oi/mbo/Jan-22	Extension of chapter 1.4 "EMC Guidelines", various revisions

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1. Safety Instructions and Responsibility

1.1. General Safety Instructions

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

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

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

Liability exclusion: The manufacturer is not liable for personal injury and/or damage to property and for consequential damage, due to incorrect handling, installation and operation. Further claims, due to errors in the operation manual as well as misinterpretations are excluded from liability.
In addition the manufacturer reserves the right to modify the hardware, software or operation manual at any time and without prior notice. Therefore, there might be minor differences between the unit and the descriptions in operation manual.
The raiser respectively positioner is exclusively responsible for the safety of the system and equipment where the unit will be integrated.

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

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

1.2. Use according to the intended purpose

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

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

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

1.4. EMC Guidelines

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

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

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

1.5. Cleaning, Maintenance and Service Notes

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

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

2. Introduction

The display device is designed for panel mounting. It is universally applicable, with its intuitive operation, the extensive features and options.

2.1.   Operation mode

All functions are can be configured in the parameter menu.
The device can be set to one of the following operation modes:

- **DISTANCE** (Distance measurement)

  The scaling (setting of the display unit) is set with the parameter FACTOR and DIVIDER. When measuring the distance, the default setting (FACTOR = 1, DIVIDER = 1, ADDITIVE VALUE = 0 and DECIMAL POINT = 3) corresponds to a position display in the unit "mm" in the following display format: "**00000.000" mm**".

  For example, to display a position in "inch" with three decimal places as well, the parameter "FACTOR" must be set to 10 and the parameter "DIVIDER" to 254. The unit "inch", which is to be displayed in the display, is set in the parameter "SCALE UNITS".

- **ANGLE** (Angle Measurement)

  With the parameter "LENGHT PER REVOLUTION", the distance covered is set in 360 ° degrees (in millimeters) for this operating mode. The desired unit to be displayed for angle measurement is set in the parameter "SCALE UNITS".
  For angle measurement, you can choose between three different display formats:

  - DISPLAY FORMAT: „99999999":

  For this angle measurement, the default setting (FACTOR = 1, DIVIDER = 1, ADDITIVE VALUE = 0 and DECIMAL POINT = 3) corresponds to an angle display of "**0.000 ... 359.999 degrees**".
  If necessary, the display can be scaled again using "FACTOR" and "DIVIDER". (for example, hiding decimal places).

  - DISPLAY FORMAT: „999999:59":

  This display format corresponds to a display in the format "degrees : arc minutes". The default setting (FACTOR = 1, DIVIDER = 1 and ADDITIVE VALUE = 0) corresponds to an angle display of "**0.00** ... **359.59 degrees**" per revolution. The decimal point is automatically set in this display format. If necessary, the display can be scaled again using "FACTOR", "DIVIDER" and "ADDITIVE VALUE".

  DISPLAY FORMAT: „9999.59:59":

  This display format corresponds to a display in the format "degrees : arc minutes: arc seconds". The default setting (FACTOR = 1, DIVIDER = 1 and ADDITIVE VALUE = 0) corresponds to an angle display of "**0.00.00** ... **359.59.59 degrees**" per revolution. The decimal points are automatically set in this display format. If necessary, the display can be scaled again using "FACTOR", "DIVIDER" and "ADDITIVE VALUE".

2.2. Function diagram
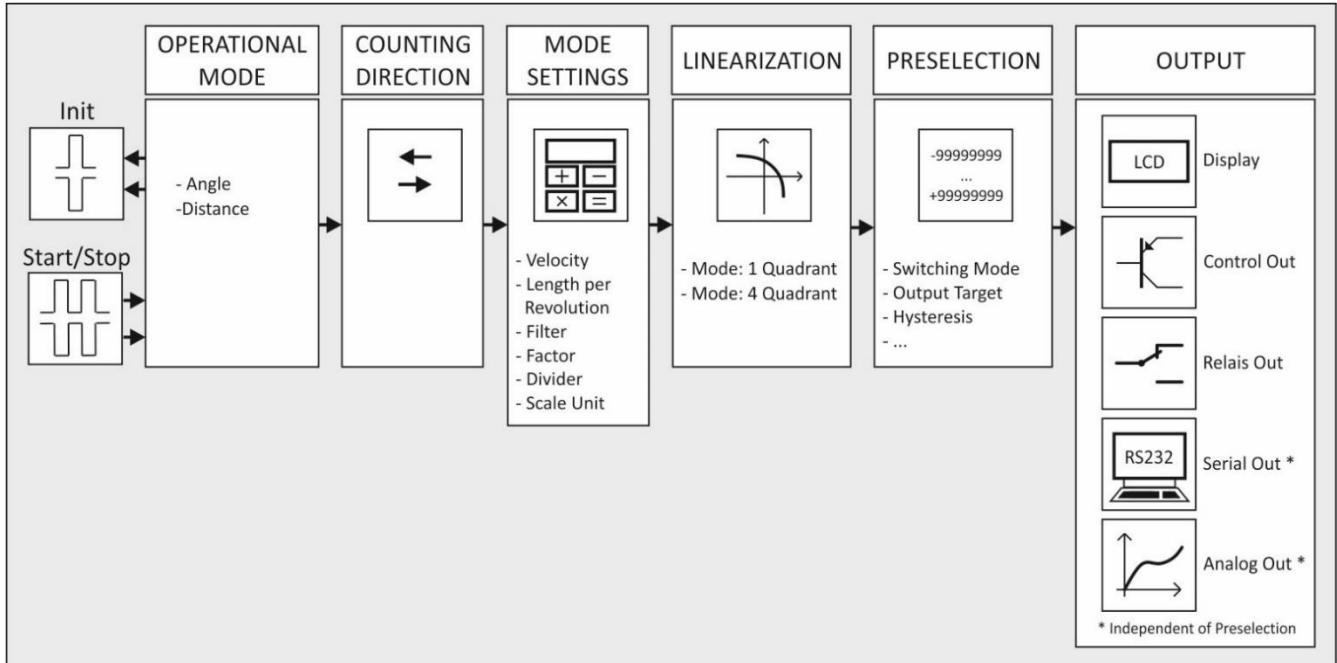
3. Electrical Connections

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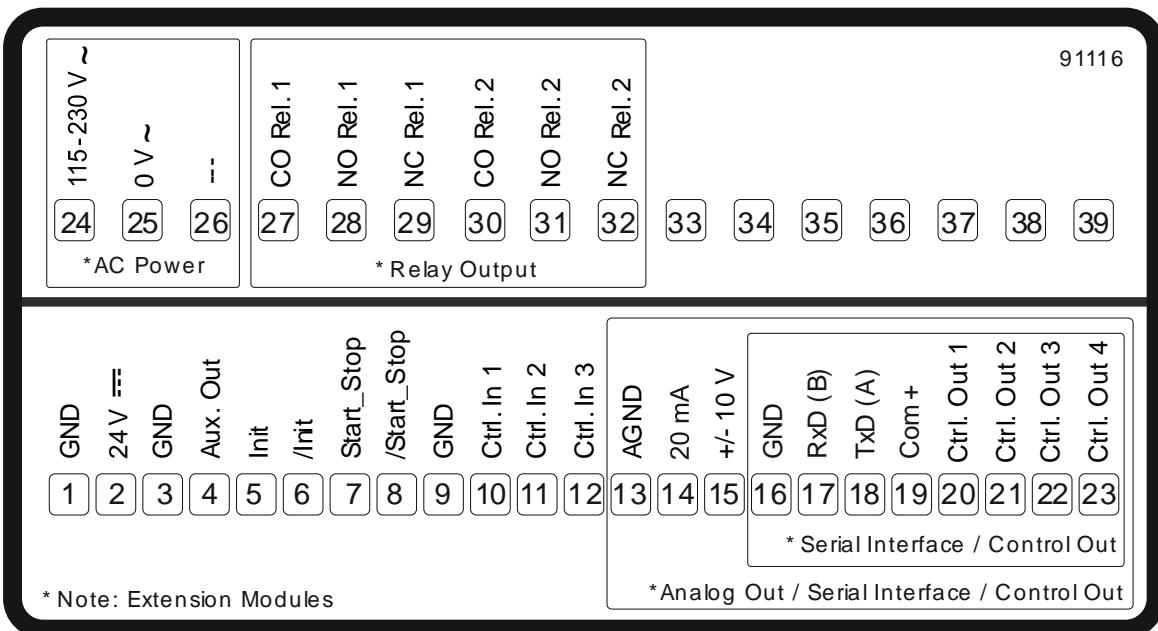
3.1. DC Power Supply

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 approx. 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.

The auxiliary voltages output is switchable from 24 VDC to 5 VDC.

3.3.   RS-485 inputs and outputs

At Terminal 5, 6, 7 and 8, the connection is available for the RS485 signals (Init + Start-Stop impulse).

Wiring for RS485 signals:
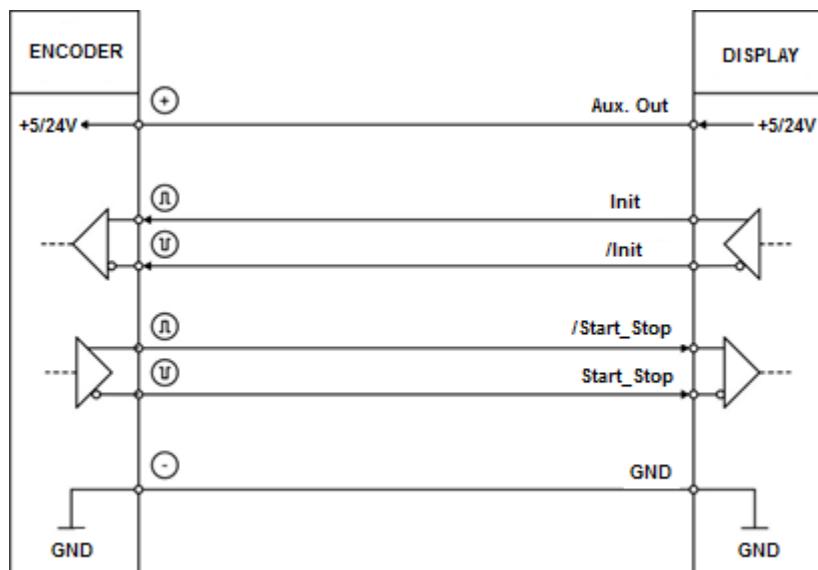
Continuation "RS-485 inputs and outputs":

DPI-Measurement mode:

On the Init line, the Init impulse is sent to position encoder at regular intervals, whose rising edge triggers a measurement.
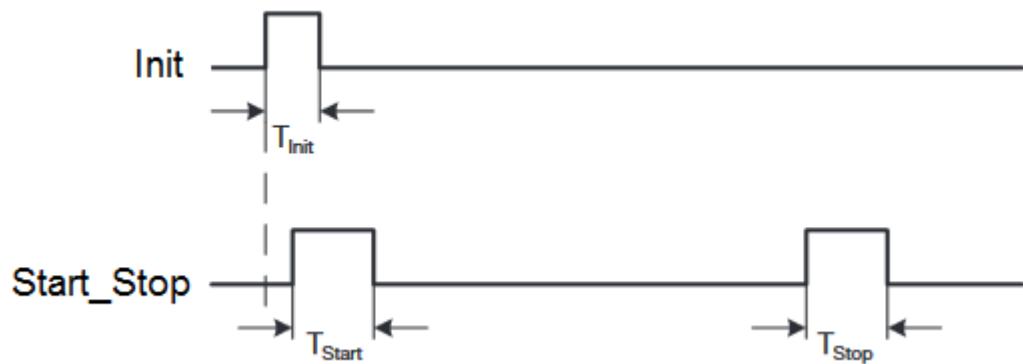
T_{Init}:   1…5 µs
T_{Start}:   3…5 µs
T_{Stop}:   3…5 µs

3.4.   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: display switching, locking the touch screen or release the lock function of the control or relay outputs.

Wiring of the control inputs:
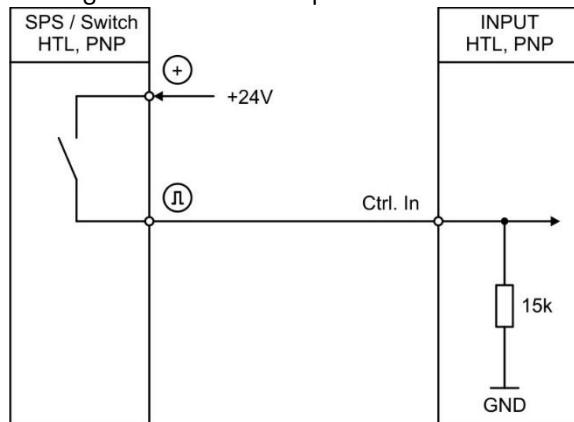
Unconnected PNP inputs are always "LOW.
All inputs are designed to receive impulses from electrical impulse sources.

Notice for mechanical switching contacts:

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

3.5.   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 measurement result and refers to the set absolute reference point or machine zero point, as well as AGND potential.
AGND and device GND are internally interconnected.

⚠	Important: A parallel operation with voltage and current output at the analog output is not allowed.

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

A serial interface (RS232 or RS485) is available at terminal 16, 17 and 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:

Wiring of the RS232 interface:
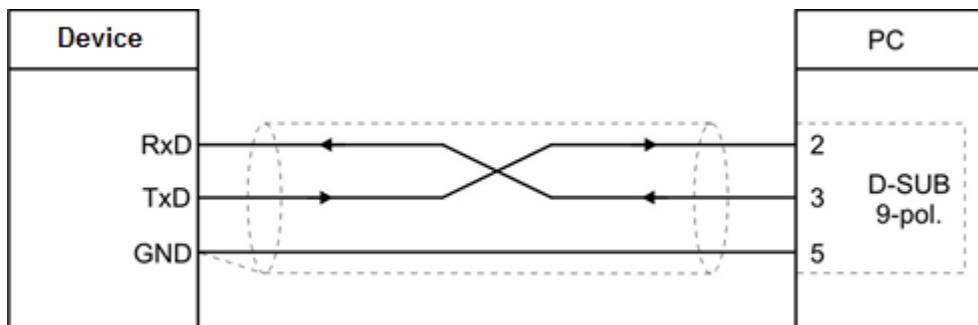
Wiring of the RS485 interface:
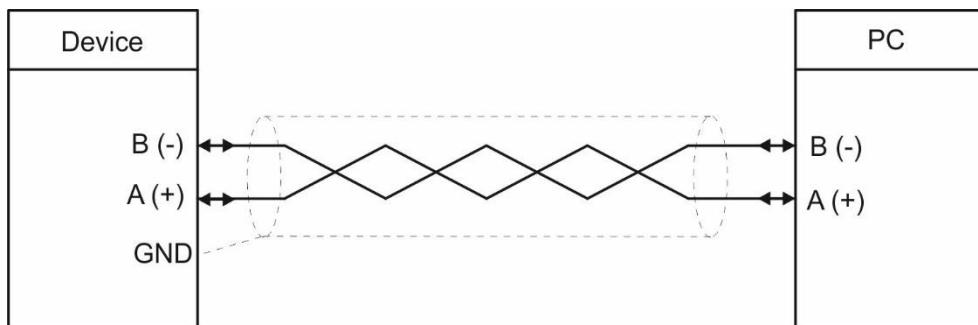
3.7. Control-Output (Option AO/AR/CO/CR)

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.

Continuation "**Control-Output (Option AO/AR/CO/CR)**":

Wiring of the control-outputs:
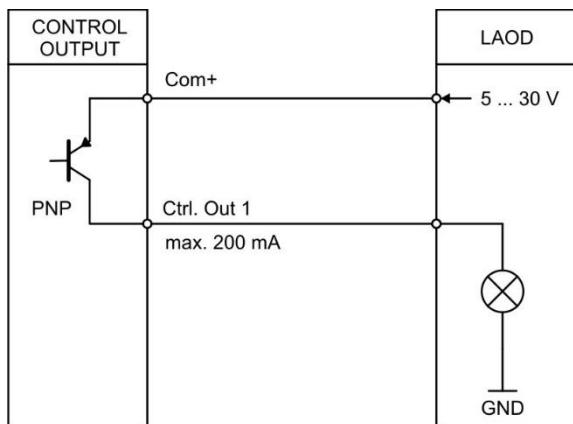
3.8. AC Power supply (Option AC)

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 via Terminals 1 and 2.

3.9. Relay-Output (Option RL)

Two relay outputs with potential-free changeover contacts are available at terminal 27, 28, 28, 30, 31 and 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
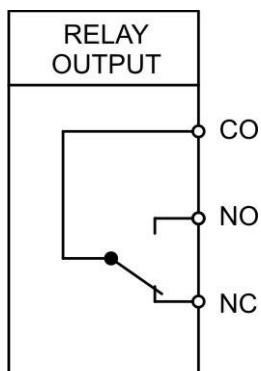
4. Display and touch screen

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".
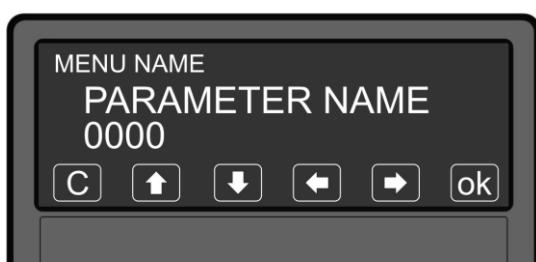
Parameter selection:

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

The parameter selection can be terminated with „C".
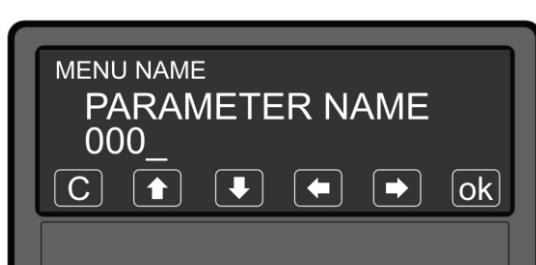
Parameter editing:

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 displays are available during operation. Depending on the device version and the selected operating mode, only certain representations are displayed.

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, CO, RL.

Large Display (4 digits)

To switsch to the next display, press the top of the screen.
This is possible with activated parameter "LARGE DISPLAY".

Display with command keys
To switch to the next display, press the top of the screen. Functions of the keyboard commands see "Command Menu". (Display can be deactivated by the "Skip Commands" parameter in the "Display Menu".)

Display for quick start for enter preselection values (PRESELECT VALUES)

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.

4.3.   Error Message
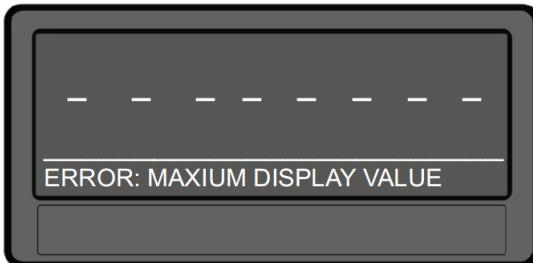
ERROR: MAXIMUM DISPLAY VALUE

Display value is greater than + 99 999 999
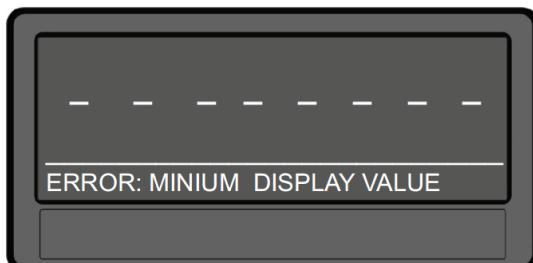
ERROR: MINIMUM DISPLAY VALUE

Display value is less than - 99 999 999
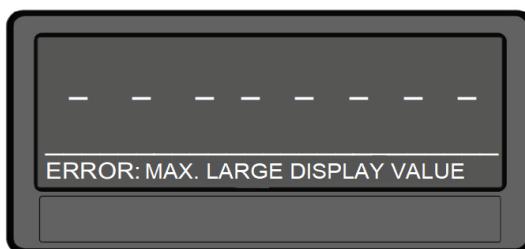
ERROR: MAX. LARGE DISPLAY VALUE

Display value of the large display is greater than + 9999

ERROR: MIN. LARGE DISPLAY VALUE

The display value of the large display is less than - 999
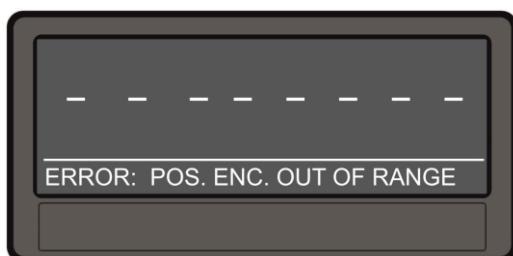
ERROR: POS. ENC. OUT OF RANGE

No position encoder or position encoder outside the limits
(No "Stop" pulse between two "lnit" pulses detected)
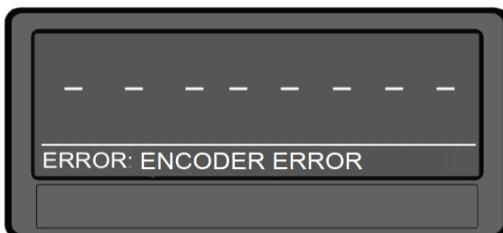
ERROR: ENCODER ERROR

Check sensor connections.
(No "Start" and "Stop" pulse between two "lnit" pulses detected)

Continuation "Error Message":

	The described error messages are <u>automatically</u> reset as soon as the corresponding display value is within the representable range or the error has been corrected. For the errors "POS. ENC. OUT OF RANGE "and" ENCODER ERROR ", the measurement result is set to" 0 ". With option AO or AR, the analogue output is controlled with 0 V or 0 mA and with option CO or CR and AO or AR the limit value monitoring takes place with the comparison value "0".

5. Parameter / Overview-Menu Structure

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

This section provides an overview of the menus and their parameters. The menu names are printed bold and the associated parameters are listed under the menu name. Depending on the device version and the selected operation mode, only the necessary menus / parameters are shown.

Menu / Parameter
GENERAL MENU
OPERATIONAL MODE
LENGHT PER REV. (MM)
DISPLAY FORMAT
FACTOR
DIVIDER
ADDITIVE VALUE
DECIMAL POINT
SCALE UNITS
AVERAGE FILTER
LINEARIZATION MODE
PIN PRESELECTION
PIN PARAMETER
FACTORY SETTINGS

Menu / Parameter
ENCODER PROPERTIES
SAMPLING TIME (MS)
VELOCITY (M/S)
OFFSET
DIRECTION
ENCODER SUPPLY

Menu / Parameter	Menu / Parameter
PRESELECTION VALUES	**SERIAL MENU**
PRESELECTION 1	UNIT NUMBER
PRESELECTION 2	SERIAL BAUD RATE
PRESELECTION 3	SERIAL FORMAT
PRESELECTION 4	SERIAL INIT
PRESELECTION 1 MENU	SERIAL PROTOCOL
MODE 1	SERIAL TIMER
HYSTERESIS 1	SERIAL VALUE
PULSE TIME 1	MODBUS
OUTPUT TARGET 1	**ANALOG MENU**
OUTPUT POLARITY 1	ANALOG FORMAT
OUTPUT LOCK 1	ANALOG START
START UP DELAY 1	ANALOG END
EVENT COLOR 1	ANALOG GAIN
PRESELECTION 2 MENU	ANALOG OFFSET
MODE 2	**COMMAND MENU**
HYSTERESIS 2	INPUT 1 ACTION
PULSE TIME 2	INPUT 1 CONFIG
OUTPUT TARGET 2	INPUT 2 ACTION
OUTPUT POLARITY 2	INPUT 2 CONFIG
OUTPUT LOCK 2	INPUT 3 ACTION
START UP DELAY 2	INPUT 3 CONFIG
EVENT COLOR 2	**DISPLAY MENU**
PRESELECTION 3 MENU	COLOR
MODE 3	BRIGHTNESS
HYSTERESIS 3	CONTRAST
PULSE TIME 3	SCREEN SAVER
OUTPUT TARGET 3	UP-DATE-TIME
OUTPUT POLARITY 3	FONT
OUTPUT LOCK 3	SKIPCOMMANDS
START UP DELAY 3	START DISPLAY
EVENT COLOR 3	LARGE DISPLAY
PRESELECTION 4 MENU	**LINEARISATION MENU**
MODE 4	P1(X)
HYSTERESIS 4	P1(Y)
PULSE TIME 4	P2(X)
OUTPUT TARGET 4	P2(Y)
OUTPUT POLARITY 4	…
OUTPUT LOCK 4	…
START UP DELAY 4	P23(X)
EVENT COLOR 4	P23(Y)
	P24(X)
	P24(Y)

5.1.   General Menu

OPERATIONAL MODE
This parameter determines which measurement function (mode) the device should run.

0	DISTANCE	Distance measurement
1	ANGLE	Angle measurement (display in degrees)

LENGHT PER REVOLUTION (in millimeters)
This parameter represents the reference value for the angle measurement. Here, the distance covered (perimeter) per 360 degrees (in "mm") must be set.
This parameter is only visible if "ANGLE" was selected as the operating mode.

	00000.100	Smallest value
	01000.000	Default value
	99999.999	Highest value

DISPLAY FORMAT
This parameter is used to select the desired display format for the "angle measurement". This parameter is only visible if "ANGLE" was selected as the operating mode.
The decimal point automatically adjusts to format 999999: 59 or 9999: 59: 59.
The display value depends on the scaling (FACTOR, DIVIDER and ADDITIVE VALUE).

0	99999999	Without format adjustment (0.000…359.999)
1	999999:59	Display in degrees: Arc minutes (0.00 ... 359.59)
2	9999:59:59	Display in degrees : Arc minutes: arc seconds (0.00.00…359.59.59)

FACTOR
This parameter defines the factor.

	-99999999	Smallest value
	1	Default value
	99999999	Highest value

DIVIDER
This parameter defines the divider.

	-99999999	Smallest value
	1	Default value
	99999999	Highest value

ADDITIVE VALUE
This parameter defines the additive constant.

	-99999999	Smallest value
	0	Default value
	99999999	Highest value

Continuation "**General Menu**":

	DECIMAL POINT	
This value defines the position of the decimal point. This is only a decimal point that can be graphically switched. This does not affect the two scaling factors FACTOR and DIVIDER.	
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 "**General Menu**":

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, the corresponding scaling must be defined with the parameters FACTOR and DIVIDER.

0	inch	
1	feet	
2	mm	Default
3	cm	
4	m	
5	Stueck	
6	pcs	
7	Grad	
8	degree	
9	Min:Sec	
10	G:M:S	
11	%	
12	mbar	
13	bar	
14	psi	
15	Pa	
16	kPa	
17	g	
18	kg	
19	t	
20	lb	
21	oz	
22	ml	
23	1	
24	cm3	
25	m3	
26	gal	
27	Edit Unit	A customized unit with up to 16 digits can be edited using this parameter. Pressing the "OK" button opens the Edit Unit Menu. A unit can be created using the arrow keys. (pressing and holding the arrow keys the characters scroll fast). The "OK" button saves the Edit Unit Menu. The "C" button closes the Edit Unit Menu.

	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
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	{	|	}	~	

Continuation "**General Menu**":

AVERAGE FILTER (filter for average value)		
The average value can be switched to avoid display fluctuations.		
	0	No average value
	1	Flowing mean value with 2 cycles
	2	Flowing average value with 4 cycles
	3	Flowing average value with 8 cycles
	4	Flowing mean value with 16 cycles

LINEARIZATION MODE		
This parameter defines the linearization function. See chapter 6.3. The linearization always refers to the <u>absolute</u> measured value.		
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

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

5.2. Encoder Properties

SAMPLING TIME (S)
Period duration between two init pulses (in milliseconds). Corresponds to the time after a new measurement is started and directly affects the reaction time of the device.

	00.200	Minimum measurement time
	04.000	Default value
	16.000	Maximum measurement time

VELOCITY (M/S)
Waveguide velocity of the encoder (in m/s).

	0001.00	Smallest value
	2800.00	Default value
	9999.99	Highest value

OFFSET
In the case of a "Reset/Set Value" command (via keyboard command, control input or PC user interface) the current position of the encoder is transferred to the parameter "Offset".

	-99999999	Smallest value
	0	Default value
	99999999	Highest value

DIRECTION
Definition of the direction of rotation forward / backward

0	FORWARD	Forward
1	REVERSE	Backwards

ENCODER SUPPLY
This parameter defines the output voltage of the auxiliary voltage output (Aux. Out).

0	24VDC SUPPLY	24 VDC Encoder supply
1	5VDC SUPPLY	5 VDC Encoder supply

5.3.   Preselection Values

This menu is used to set the preselection values or the switching points.
The preselection values / switching points are always referred to the display value.
(Position value relative to the reference zero point or machine zero that was stored in the parameter offset.)
This menu is only available for 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		
If the BATCH MODE is active, the batch counter is compared with the preselection value 4.		
	-99999999	Smallest value
	4000	Default value
	+99999999	Highest value

5.4. Preselection 1 Menu

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

MODE 1
Switching conditions for preselection 1. Output/ relay/ display switches under the following conditions:

0	|RESULT|>=|PRES|	Absolute value of the display value is greater or equal absolute value of PRESELECTION 1 With HYSTERESIS 1 not equal 0 the following switching condition is applied: Display value >= PRESELECTION 1 → ON, Display value < PRESELECTION 1 – HYSTERESIS 1 →OFF
1	|RESULT|<=|PRES|	Absolute value of the display value is less or equal absolute value of PRESELECTION 1 (start-up suppression (START UP DELAY) is advisable) With HYSTERESIS 1 not equal 0 the following switching condition is applied: Display value <= PRESELECTION 1 → ON, Display value > PRESELECTION 1 + HYSTERESIS 1 →OFF
2	|RESULT|=|PRES|	Absolute value of the display value is equal absolute value of PRESELECTION 1 A range (Preselection +/- ½ Hysteresis) can be defined and monitored in conjunction with the hysteresis. With HYSTERESIS 1 not equal 0 the following switching condition is applied: Display value > PRESELECTION 1 + ½ HYSTERESIS 1 → OFF, Display value < PRESELECTION 1 - ½ HYSTERESIS 1 → OFF
3	RESULT>=PRES	Display value is greater or equal PRESELECTION 1, e.g. overspeed With HYSTERESIS 1 not equal 0 the following switching condition is applied: Display value >= PRESELECTION 1 → ON, Display value < PRESELECTION 1 – HYSTERESIS 1 →OFF
4	RESULT<=PRES	Display value is less or equal PRESELECTION 1, e.g. underspeed (start-up suppression (START UP DELAY) is advisable) With HYSTERESIS 1 not equal 0 the following switching condition is applied: Display value <= PRESELECTION 1 → ON, Display value > PRESELECTION 1 + HYSTERESIS 1 →OFF
5	RESULT=PRES	Display value is equal PRESELECTION 1. A range (Preselection +/- ½ Hysteresis) can be defined and monitored in conjunction with the hysteresis. With HYSTERESIS 1 not equal 0 the following switching condition is applied: Display value > PRESELECTION 1 + ½ HYSTERESIS 1 → OFF, Display value < PRESELECTION 1 - ½ HYSTERESIS 1 → OFF
6	RES>=PRES-TRAIL	Trailing PRESELECTION 1: Display value is greater or equal PRESELECTION 2 – PRESELECTION 1 → ON, PRESELECTION 1 is the trailing value from PRESELECTION 2
7	ERROR SET	Error message for device errors

Continuation "**Preselection 1 Menu**":

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

	0	No switching hysteresis
	…	
	99999	Switching hysteresis of 99999

PULSE TIME 1 (S)
Duration of output pulse for the switching condition of preselection 1

	0,000	No output pulse (static signal)
	…	
	60,000	Pulse duration of 60 seconds

OUTPUT TARGET 1
Assignment of an output 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	Active „HIGH"
1	ACTIVE LOW	Active „LOW"

OUTPUT LOCK 1
Latch for the switching condition of preselection 1

0	NO	No latch for preselection
1	YES	Latch for preselection

Continuation "**Preselection 1 Menu**":

START UP DELAY 1 (S)		
Start-up suppression for the switching condition of preselection 1. Time to start the monitoring function. This adjustment is only valid for the switching condition |RESULT|<=|PRES| or RESULT<=PRES and mode SPPED and PROCESS TIME. (Start Up Delay 3 and 4 have an automatic start up suppression).		
	0.000	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

5.5. Preselection 2 Menu

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

			see chapter PRESELECTION 1 MENU
	6	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-depending change of the display color for the switching condition of preselection 2.
See chapter PRESELECTION 1 MENU.

5.6. Preselection 3 Menu

MODE 3

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

			See chapter PRESELECTION 1 MENU
	6	RES>=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.
Time to start the monitoring function.
This adjustment is only valid for the switching condition |RESULT|<=|PRES| or RESULT<=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 3

Event-depending change of the display color for the switching condition of preselection 3.
See chapter PRESELECTION 1 MENU.

5.7. Preselection 4 Menu

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

			See chapter PRESELECTION 1 MENU
	6	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 4.
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. See chapter PRESELECTION 3 MENU.
(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-depending change of the display color for the switching condition of preselection 4.
See chapter PRESELECTION 1 MENU.

5.8. Serial Menu

This menu defines the basic settings of serial interface.
This function is only available for devices with option CO or AO.

UNIT NUMBER		
This parameter defines serial device addresses. The addresses between 11 and 99 can be assigned to the devices. Addresses with zero are not allowed, there are used as broadcast addresses.		
	11	Smallest address
	…	
	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 No., +/-, data, LF, CR
			1	1	+/-	X	X	X	X	X	X	X	LF	CR	
	1	Transmission report = +/-, data, LF, CR
			+/-	X	X	X	X	X	X	X	LF	CR	

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

	Value	Description
	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	Definition
	0	:0	Measurement_Result (absolute or relative measurement result)
	1	:1	Analog_Out_Voltage (analog output modulation (in mV))
	2	:2	Analog_Out_Current (analog output modulation (in yA))
	3	:3	Analog_Out_Percent (Percentage analogue output modulation)
	4	:4	Measurement Absolute (absolute measurement result)
	5	:5	Measurement_Relative (relative measurement result)
	6	:6	Minimum_Value (minimum measurement result)
	7	:7	Maximum_Value (maximum measurement result)

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

	Value	Description
	0	Serial interface is using Lecom protocol (Motrona default protocol)
	1 … 247	Serial interface is using Modbus RTU protocol. The set value is the Modbus address of the device.

5.9.　Analog Menu

This menu defines the basic settings of the analog output. The analog output always refers to the <u>absolute</u> measurement result.

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

ANALOG FORMAT			
This parameter defines the output characteristics. In the output format (-10... + 10 V), the polarity of the analog output depends on the polarity of the display value. The analogue output is proportional to the display value.			
	0	-10…10V	-10 … +10 V
	1	0…20MA	0 … 20 mA
	2	4…20MA	4 … 20 mA

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

ANALOG GAIN (%)		
This parameter defines the zero offset of the analog output. The ANALOG GAIN is the maximum modulation of the analog output in % terms given up to (+/-) 10 V or 20 mA. E.g. 102,00 results in an offset of 10.2 V / 20.4 mA from reaching the ANALOG START value E.g. 95,00 results in an offset of 9.5 V / 18 mA from reaching the ANALOG END value		
	0,00	Smallest end value
	100,00	Default Wert
	110,00	Highest end value

ANALOG OFFSET (%)		
This parameter defines the zero offset of the analog output. E. g. 0.20 results in an offset of 0.02 V or 0.04 mA from reaching the ANALOG START value		
	-99,99	Smallest offset
	0	Default value
	+99,00	Highest offset

5.10. 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 VALUE	Power fail-safe stored transfer of the current position to the parameter "offset". (Includes command "STOP SET TO ZERO" to cancel any previous relative measurements) Example Application: non-volatile setting of the machine zero point.	(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	(d)
	8	TEACH PRESEL. 2	Current display value is stored as PRESELECTION 2	(d)
	9	TEACH PRESEL. 3	Current display value is stored as PRESELECTION 3	(d)
	10	TEACH PRESEL. 4	Current display value is stored as PRESELECTION 4	(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 DATA	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	SET TO REL. ZERO	Measurement is set to 0. The position of the switching points is not changed. After switched on or by the command STOP SET TO ZERO, the zero point stored in the offset parameter is valid again. Sample Application: Relative measurements	(d) (s)
	21	SET TO ABS. ZERO	Measurement is set to 0. The position of the switching points is accordingly moved. After switching on or by the command STOP SET TO ZERO, the machine zero point stored in the offset parameter is valid again. Example Application: setting a reference point	(d) (s)
	22	STOP SET TO ZERO	Any previous zero set (by commands: SET TO REL. ZERO or SET TO ABS. ZERO) is canceled. The machine zero point stored in the offset parameter is valid again. Example application: switch back to absolute measurement after a relative measurement	(d) (s)
	23	INC. BRIGHTNESS	Display brightness is increased	(d) (s)
	24	DEC. BRIGHTNESS	Display brightness is reduced	(d) (s)

Continuation "**Command Menu**":

(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

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.

5.11. Display Menu

COLOR

This parameter defines the display color.

Event-depending change of the display color by a switching condition is possible (see PRESELECTION 1…4 MENU)

Event-depending changes are only available for devices with option CO, AO 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 centre
	2	Viewing angle from bottom

SCREEN SAVER (S)

This parameter defines the time in seconds until the display is switched off.

	0	No switch off
	…	
	9999	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

FONT

This parameter defines the setting of the font style.

	0	Standard
	1	Font 1

SKIP COMMANDS

This parameter is used to share or skip the display of keyboard commands.

	SHOW COMMAND KEY	The display and execution of the commands is released
	SKIP COMMAND KEY	The display window for commands is skipped

Continuation "**Display Menu**":

START DISPLAY		
This parameter defines the start display after switching on the device.		
0	STANDARD	Single-line display with status bar
1	LARGE	Large display. (only with activated parameter "LARGE DISPLAY"!)
2	COMMAND	Display of keyboard commands (only with "SKIP COMMANDS".setting → "SHOW COMMAND KEY")
2	QUICKSTART	Display with quick start function. (Only with option AO, AR, CO, CR, RL)
3	MINIMUM/MAXIMUM	Display of the Actual / Minimum / Maximum value

LARGE DISPLAY		
This parameter is used to turn on or off the large display. Using the divider ratio, the display value can also be divided accordingly for the large display. (valid for all "99999999" number formats, but not for 999999: 59 or 9999: 59: 59!)		
0	NO	Large display is switched off
1	1:1	Large display with divider ratio 1:1
2	1:10	Large display with divider ratio 1:10
3	1:100	Large display with divider ratio 1:100
4	1:1000	Large display with divider ratio 1:1000
5	1:10000	Large display with divider ratio 1:10000

5.12.   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.

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

The free operator software OS is available at: https://www.motrona.com/en/support/software.html
All codes shown in the parameter SERIAL VALUE are available for serial readout by PC or PLC. For communication the monitors use the Drivecom Protocol according to ISO 1745. More details can be found in our separate description SERPRO (Drivecom) or Modbus_RTU (Modbus), see https://www.motrona.com/en/support/.

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

After a correct request, the unit will respond:

STX	C1	C2	xxxxx	ETX	BCC

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

6.2. Parameter / serial codes / unit variables

6.2.1. Parameter:

#	Menu	Name	Serial Code	Min	Max	Default
0	GENERAL MENU	OPERATIONAL MODE	0	0	2	0
1	GENERAL MENU	LENGHT PER REV. (MM)	1	100	99999999	1000000
2	GENERAL MENU	DISPLAY FORMAT	2	0	2	0
3	GENERAL MENU	FACTOR	3	-99999999	99999999	1
4	GENERAL MENU	DIVIDER	4	-99999999	99999999	1
5	GENERAL MENU	ADDITIVE VALUE	5	-99999999	99999999	0
6	GENERAL MENU	DECIMAL POINT	6	0	7	0
7	GENERAL MENU	SCALE UNITS	7	0	28	0
8	GENERAL MENU	AVERAGE FILTER	8	0	4	0
9	GENERAL MENU	LINIARIZATION MODE	9	0	2	0
10	GENERAL MENU	PIN PRESELECTION	10	0	9999	0
11	GENERAL MENU	PIN PARAMETER	11	0	9999	0
12	GENERAL MENU	FACTORY SETTINGS	12	0	1	0
13	GENERAL MENU	-	13	0	0	0
14	ENCODER PROPERTIES	SAMPLING TIME (MS)	14	200	16000	4000
15	ENCODER PROPERTIES	VELOCITY (M/S)	15	100	999999	280000
16	ENCODER PROPERTIES	OFFSET	16	-99999999	99999999	0
17	ENCODER PROPERTIES	DIRECTION	17	0	1	0
18	ENCODER PROPERTIES	ENCODER SUPPLY	18	0	1	1
19	ENCODER PROPERTIES	__	19	0	0	0
20	ENCODER PROPERTIES	__	20	0	0	0
21	ENCODER PROPERTIES	__	21	0	0	0
22	ENCODER PROPERTIES	__	22	0	0	0
23	ENCODER PROPERTIES	__	23	0	0	0
24	ENCODER PROPERTIES	__	24	0	0	0
25	PRESELECTION VALUES	PRESELECTION 1	A0	-99999999	99999999	1000
26	PRESELECTION VALUES	PRESELECTION 2	A1	-99999999	99999999	2000
27	PRESELECTION VALUES	PRESELECTION 3	A2	-99999999	99999999	3000
28	PRESELECTION VALUES	PRESELECTION 4	A3	-99999999	99999999	4000
29	PRESELECTION 1 MENU	MODE 1	A4	0	7	0
30	PRESELECTION 1 MENU	HYSTERESIS 1	A5	0	99999999	0
31	PRESELECTION 1 MENU	PULSE TIME 1 (S)	A6	0	60000	0
32	PRESELECTION 1 MENU	OUTPUT TARGET 1	A7	0	6	1
33	PRESELECTION 1 MENU	OUTPUT POLARITY 1	A8	0	1	0
34	PRESELECTION 1 MENU	OUTPUT LOCK 1	A9	0	1	0
35	PRESELECTION 1 MENU	START UP DELAY 1 (S)	B0	0	60000	0
36	PRESELECTION 1 MENU	EVENT COLOR 1	B1	0	3	0
37	PRESELECTION 1 MENU	-	B2	0	0	0
38	PRESELECTION 1 MENU	-	B3	0	0	0

Continuation "**Parameter / serial codes / unit variables**":

#	Menu	Name	Serial Code	Min	Max	Default
39	PRESELECTION 2 MENU	MODE 2	B4	0	7	0
40	PRESELECTION 2 MENU	HYSTERESIS 2	B5	0	99999999	0
41	PRESELECTION 2 MENU	PULSE TIME 2 (S)	B6	0	60000	0
42	PRESELECTION 2 MENU	OUTPUT TARGET 2	B7	0	6	2
43	PRESELECTION 2 MENU	OUTPUT POLARITY 2	B8	0	1	0
44	PRESELECTION 2 MENU	OUTPUT LOCK 2	B9	0	1	0
45	PRESELECTION 2 MENU	START UP DELAY 2 (S)	C0	0	60000	0
46	PRESELECTION 2 MENU	EVENT COLOR 2	C1	0	3	0
47	PRESELECTION 2 MENU	-	C2	0	0	0
48	PRESELECTION 2 MENU	-	C3	0	0	0
49	PRESELECTION 3 MENU	MODE 3	C4	0	7	0
50	PRESELECTION 3 MENU	HYSTERESIS 3	C5	0	99999999	0
51	PRESELECTION 3 MENU	PULSE TIME 3 (S)	C6	0	60000	0
52	PRESELECTION 3 MENU	OUTPUT TARGET 3	C7	0	6	3
53	PRESELECTION 3 MENU	OUTPUT POLARITY 3	C8	0	1	0
54	PRESELECTION 3 MENU	OUTPUT LOCK 3	C9	0	1	0
55	PRESELECTION 3 MENU	START UP DELAY 3	D0	0	1	0
56	PRESELECTION 3 MENU	EVENT COLOR 3	D1	0	3	0
57	PRESELECTION 3 MENU	-	D2	0	0	0
58	PRESELECTION 3 MENU	-	D3	0	0	0
59	PRESELECTION 4 MENU	MODE 4	D4	0	7	0
60	PRESELECTION 4 MENU	HYSTERESIS 4	D5	0	99999999	0
61	PRESELECTION 4 MENU	PULSE TIME 4 (S)	D6	0	60000	0
62	PRESELECTION 4 MENU	OUTPUT TARGET 4	D7	0	6	4
63	PRESELECTION 4 MENU	OUTPUT POLARITY 4	D8	0	1	0
64	PRESELECTION 4 MENU	OUTPUT LOCK 4	D9	0	1	0
65	PRESELECTION 4 MENU	START UP DELAY 4	E0	0	1	0
66	PRESELECTION 4 MENU	EVENT COLOR 4	E1	0	3	0
67	PRESELECTION 4 MENU	-	E2	0	0	0
68	PRESELECTION 4 MENU	-	E3	0	0	0
69	SERIAL MENU	UNIT NUMBER	90	11	99	11
70	SERIAL MENU	SERIAL BAUD RATE	91	0	2	0
71	SERIAL MENU	SERIAL FORMAT	92	0	9	0
72	SERIAL MENU	SERIAL INIT	9~	0	1	0
73	SERIAL MENU	SERIAL PROTOCOL	E4	0	1	0
74	SERIAL MENU	SERIAL TIMER (S)	E5	0	60000	0
75	SERIAL MENU	SERIAL VALUE	E6	0	7	0
76	SERIAL MENU	MODBUS	E7	0	0	247
77	SERIAL MENU	-	E8	0	0	0
78	ANALOG MENU	ANALOG FORMAT	E9	0	2	0
79	ANALOG MENU	ANALOG START	F0	-99999999	99999999	0
80	ANALOG MENU	ANALOG END	F1	-99999999	99999999	10000
81	ANALOG MENU	ANALOG GAIN %	F2	0	11000	10000
82	ANALOG MENU	ANALOG OFFSET %	F3	-9999	9999	0
83	ANALOG MENU	-	F4	0	0	0
84	ANALOG MENU	-	F5	0	0	0

Continuation "**Parameter / serial codes / unit variables**":

#	Menu	Name	Serial Code	Min	Max	Default
85	COMMAND MENU	INPUT 1 ACTION	F6	0	24	0
86	COMMAND MENU	INPUT 1 CONFIG.	F7	0	3	2
87	COMMAND MENU	INPUT 2 ACTION	F8	0	24	0
88	COMMAND MENU	INPUT 2 CONFIG.	F9	0	3	2
89	COMMAND MENU	INPUT 3 ACTION	G0	0	24	0
90	COMMAND MENU	INPUT 3 CONFIG.	G1	0	3	2
91	COMMAND MENU	-	G2	0	0	0
92	COMMAND MENU	-	G3	0	0	0
93	COMMAND MENU	-	G4	0	0	0
94	COMMAND MENU	-	G5	0	0	0
95	DISPLAY MENU	COLOR	G6	0	2	0
96	DISPLAY MENU	BRIGHTNESS %	G7	10	100	90
97	DISPLAY MENU	CONTRAST	G8	0	2	1
98	DISPLAY MENU	SCREEN SAVER (S)	G9	0	9999	0
99	DISPLAY MENU	UP-DATE-TIME (S)	H0	5	9999	100
100	DISPLAY MENU	FONT	H1	0	1	0
101	DISPLAY MENU	SKIP COMMANDS	H2	0	1	0
102	DISPLAY MENU	START DISPLAY	H3	0	4	0
103	DISPLAY MENU	LARGE DISPLAY	H4	0	5	0
104	LINEARIZATION MENU	P1(X)	H5	-99999999	99999999	0
105	LINEARIZATION MENU	P1(Y)	H6	-99999999	99999999	0
106	LINEARIZATION MENU	P2(X)	H7	-99999999	99999999	0
107	LINEARIZATION MENU	P2(Y)	H8	-99999999	99999999	0
108	LINEARIZATION MENU	P3(X)	H9	-99999999	99999999	0
109	LINEARIZATION MENU	P3(Y)	I0	-99999999	99999999	0
110	LINEARIZATION MENU	P4(X)	I1	-99999999	99999999	0
111	LINEARIZATION MENU	P4(Y)	I2	-99999999	99999999	0
112	LINEARIZATION MENU	P5(X)	I3	-99999999	99999999	0
113	LINEARIZATION MENU	P5(Y)	I4	-99999999	99999999	0
114	LINEARIZATION MENU	P6(X)	I5	-99999999	99999999	0
115	LINEARIZATION MENU	P6(Y)	I6	-99999999	99999999	0
116	LINEARIZATION MENU	P7(X)	I7	-99999999	99999999	0
117	LINEARIZATION MENU	P7(Y)	I8	-99999999	99999999	0
118	LINEARIZATION MENU	P8(X)	I9	-99999999	99999999	0
119	LINEARIZATION MENU	P8(Y)	J0	-99999999	99999999	0
120	LINEARIZATION MENU	P9(X)	J1	-99999999	99999999	0
121	LINEARIZATION MENU	P9(Y)	J2	-99999999	99999999	0
122	LINEARIZATION MENU	P10(X)	J3	-99999999	99999999	0
123	LINEARIZATION MENU	P10(Y)	J4	-99999999	99999999	0
124	LINEARIZATION MENU	P11(X)	J5	-99999999	99999999	0
125	LINEARIZATION MENU	P11(Y)	J6	-99999999	99999999	0
126	LINEARIZATION MENU	P12(X)	J7	-99999999	99999999	0
127	LINEARIZATION MENU	P12(Y)	J8	-99999999	99999999	0
128	LINEARIZATION MENU	P13(X)	J9	-99999999	99999999	0
129	LINEARIZATION MENU	P13(Y)	K0	-99999999	99999999	0
130	LINEARIZATION MENU	P14(X)	K1	-99999999	99999999	0
131	LINEARIZATION MENU	P14(Y)	K2	-99999999	99999999	0

Continuation "**Parameter / serial codes / unit variables**":

#	Menu	Name	Serial Code	Min	Max	Default
132	LINEARIZATION MENU	P15(X)	K3	-99999999	99999999	0
133	LINEARIZATION MENU	P15(Y)	K4	-99999999	99999999	0
134	LINEARIZATION MENU	P16(X)	K5	-99999999	99999999	0
135	LINEARIZATION MENU	P16(Y)	K6	-99999999	99999999	0
136	LINEARIZATION MENU	P17(X)	K7	-99999999	99999999	0
137	LINEARIZATION MENU	P17(Y)	K8	-99999999	99999999	0
138	LINEARIZATION MENU	P18(X)	K9	-99999999	99999999	0
139	LINEARIZATION MENU	P18(Y)	L0	-99999999	99999999	0
140	LINEARIZATION MENU	P19(X)	L1	-99999999	99999999	0
141	LINEARIZATION MENU	P19(Y)	L2	-99999999	99999999	0
142	LINEARIZATION MENU	P20(X)	L3	-99999999	99999999	0
143	LINEARIZATION MENU	P20(Y)	L4	-99999999	99999999	0
144	LINEARIZATION MENU	P21(X)	L5	-99999999	99999999	0
145	LINEARIZATION MENU	P21(Y)	L6	-99999999	99999999	0
146	LINEARIZATION MENU	P22(X)	L7	-99999999	99999999	0
147	LINEARIZATION MENU	P22(Y)	L8	-99999999	99999999	0
148	LINEARIZATION MENU	P23(X)	L9	-99999999	99999999	0
149	LINEARIZATION MENU	P23(Y)	M0	-99999999	99999999	0
150	LINEARIZATION MENU	P24(X)	M1	-99999999	99999999	0
151	LINEARIZATION MENU	P24(Y)	M2	-99999999	99999999	0

6.2.2. Serial codes of commands:

Serial Code	Command
54	RESET/SET VALUE
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 PRESELCETION
67	ACTIVATE DATA
68	STORE EEPROM
69	TESTPROGRAMM

6.2.3. Unit variables:

Serial Code	DP350
:0	Measurement_Result;
:1	Analog_Out_Voltage;
:2	Analog_Out_Current;
:3	Analog_Out_Percent;
:4	Measurement_Absolute;
:5	Measurement_Relative;
:6	Minimum_Value;
:7	Maximum_Value;
:8	Inc_Period_Time;
:9	Position_Value;
;0	0;
;1	Cmd_State_New;
;2	Error_Status;
;3	Absolute_Zero_Offset;
;4	Relative_Zero_Offset;
;5	LCD_Status;

6.3.   Linearization

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

5.
To specify an individual linearization curve, the parameter LINEARISAZATION MODE must be set to either 1 QUADRANT or 4 QUADRANT (see following diagram).

6.
The parameters P1(X) to P24(X) are used to specify the coordinates on the x-axis. These are the measuring values that the unit normally would generate according to the actual input signal.

7.
Now enter the attached values to parameter P1(Y) to P24(Y). These are the values that the unit will generate 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.
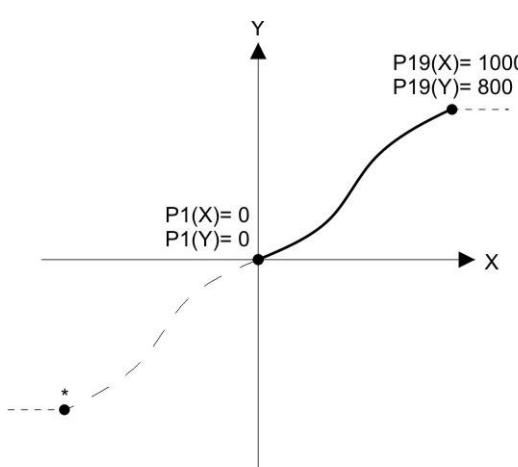
Example: Linearization Mode: 1 Quadrant
* Linearization is point symmetric to 1. Quadrant
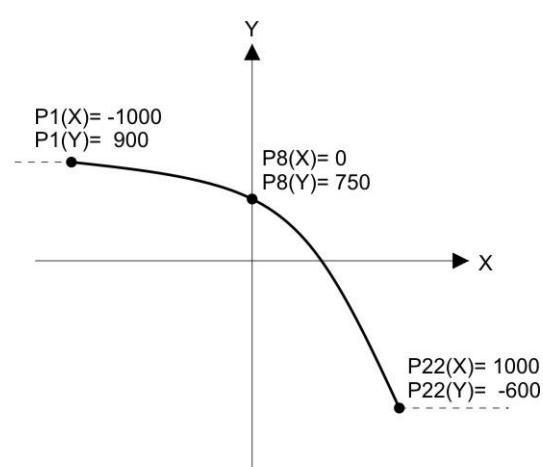
Example: Linearization Mode: 4 Quadrant

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.

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

Incremental Encoder

front view

48 [1.89]

96 [3.78]

riew view

24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

ABS UL94-V0

side view

topview

114 [4.49]

11 [0.43]

105 [4.13]
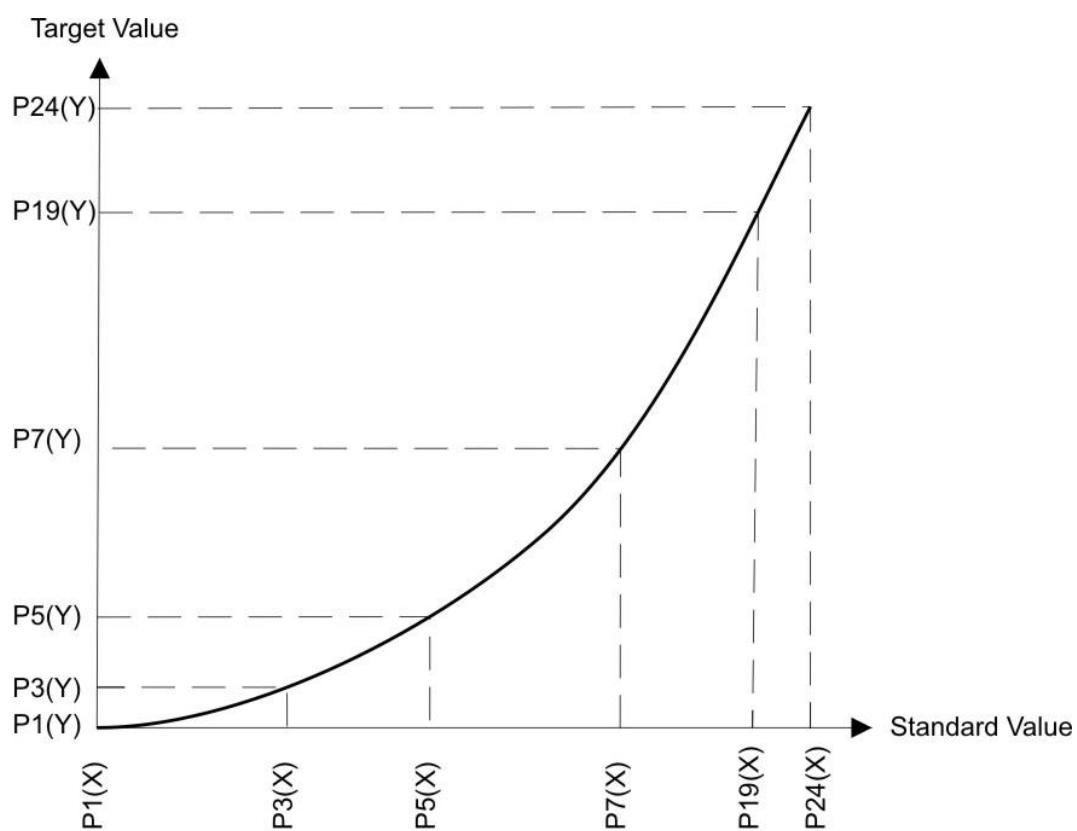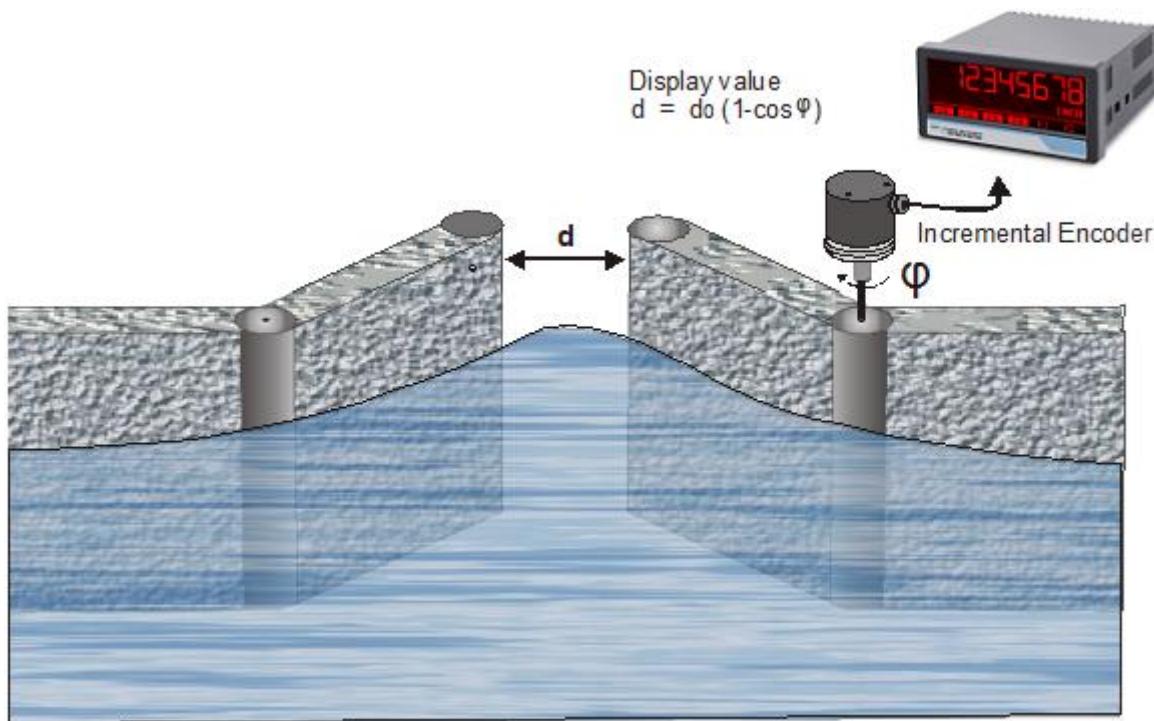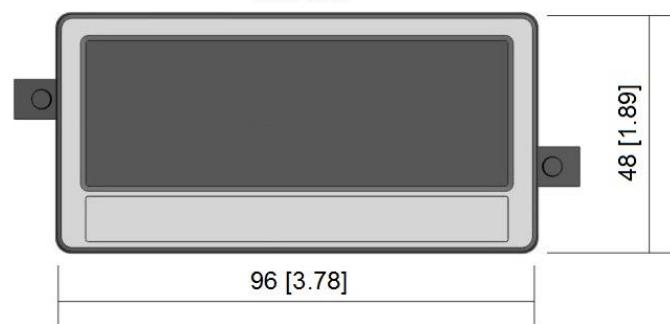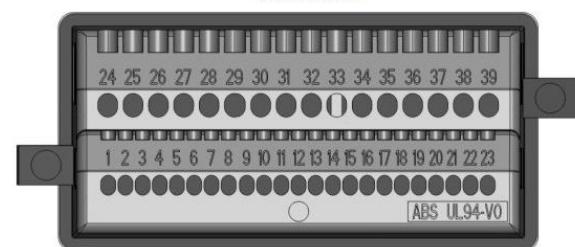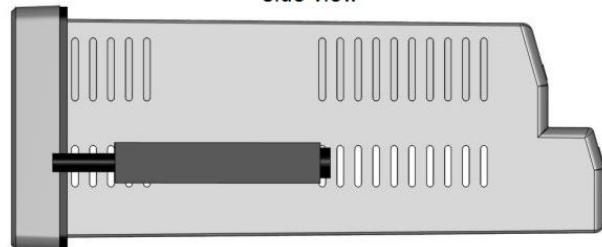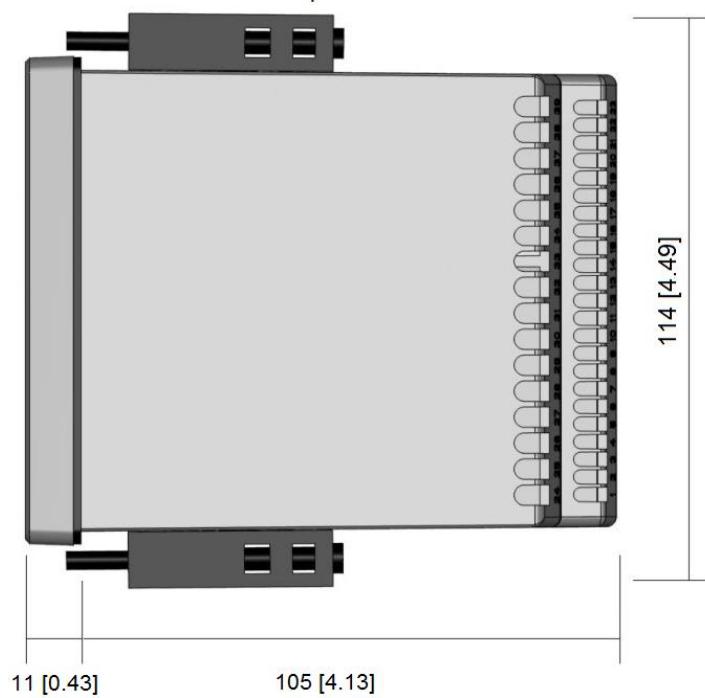
6.4.   Technical Specifications:

Technical Specifications:		
Connections:	Connector type:	screw terminal, 1.5 mm² / AWG 16
Power supply (DC):	Input voltage:	18 … 30 VDC
	Protection circuit:	reverse polarity protection
	Consumption:	approx. 100 mA (unloaded)
	Fuse protection:	extern: T 0.5 A
Power supply (AC): (Option AC)	Input voltage:	115…230 VAC ± 10%, 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 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)
P interface:	RS485 input:	1 (Start_Stop, /Start_Stop)
	RS485 output:	1 (Init, /Init)
	Pulse width init-pulse:	~2 µs
	Frequency init-pulse:	62,5 Hz - 5000 Hz (adjustable)
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 % 0°C … +45°C
		± 0,15 % -20°C … 0°C and +45°C … +60°C
	Reaction time:	< 150 ms
Control outputs: (Option AO/AR/CO/CR)	Number of outputs:	4
	Format / level:	5 … 30 V (depends on the Com+ voltage), PNP
	Output current:	Max. 200 mA
	Reaction time:	< 1 ms
Relay outputs: (Option RL)	Number of outputs:	2
	Configuration:	potential free changeovers
	AC-Switching capacity:	Max. 250 VAC / 3 A / 750 VA
	DC-Switching capacity:	Max. 150 VDC / 2 A / 50 W
	Reaction time:	< 20 ms

Continuation "**Technical Specifications**":

Serial interface: (Option AO/AR/CO/CR)	Format (Option A0/CO): Format (Option AR/CR) Baud rate:	RS232 RS485 9600, 19200 or 38400 baud
Display:	Type: Display range: Digit height Color: Operation:	LCD (backlight) 8 digits plus sign (-99999999 … 999999999) 13 mm height red / green / yellow (switchable) 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 cut out 96 x 48 x 116 mm / 3.78 x 1.89 x 4,56 inch 91 x 44 mm / 3.58 x 1.69 inch IP65 (front), IP20 (rear) approx. 200 g
Ambient temperature:	Operation: Storage:	-20 °C … +60 °C resp. -4 … 140 °F non-condensing -25 °C … +70 °C resp. -13 … 158 °F
Ambient conditions:	Altitude: Humidity: Pollution Degree:	max. 2000 m (6560 ft) above sea level max. 80% relative humidity up to 30°C 2
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 61326-1: 2013 for industrial location EN 55011: 2016 + A1: 2017 + A11: 2020 Class A EN 61010-1: 2010 + A1:2019 + AC: 2019-04 EN IEC 61010-2-201: 2018 EN IEC 63000: 2018