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Smart encoders & actuators

User's guide

LD220

- Touch-screen indicator for SSI encoders
- For 10 to 32 bit singleturn and multiturn encoders with SSI interface
- Operation as Master or Slave
- Analogue, serial, relay, and control outputs
- DC / AC power supply: 18÷30Vdc or 115÷230Vac

Suitable for the following models:
- LD220-P8-...
- LD220-PM-...

General Contents

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General contents

Subject index

Typographic and iconographic conventions

In this guide, to make it easier to understand and read the text the following typographic and iconographic conventions are used:

- parameters and objects both of the device and the interface are coloured in GREEN;
- alarms are coloured in RED;
- states are coloured in FUCSIA.

When scrolling through the text some icons can be found on the side of the page: they are expressly designed to highlight the parts of the text which are of great interest and significance for the user. Sometimes they are used to warn against dangers or potential sources of danger arising from the use of the device. You are advised to follow strictly the instructions given in this guide in order to guarantee the safety of the user and ensure the performance of the device. In this guide the following symbols are used:

	This icon, followed by the word WARNING, is meant to highlight the parts of the text where information of great significance for the user can be found: user must pay the greatest attention to them! Instructions must be followed strictly in order to guarantee the safety of the user and a correct use of the device. Failure to heed a warning or comply with instructions could lead to personal injury and/or damage to the unit or other equipment.
	This icon, followed by the word NOTE, is meant to highlight the parts of the text where important notes needful for a correct and reliable use of the device can be found. User must pay attention to them! Failure to comply with instructions could cause the equipment to be set wrongly: hence a faulty and improper working of the device could be the consequence.
	This icon is meant to highlight the parts of the text where suggestions useful for making it easier to set the device and optimize performance and reliability can be found. Sometimes this symbol is followed by the word EXAMPLE when instructions for setting parameters are accompanied by examples to clarify the explanation.

Preliminary information

This guide is designed to provide the most complete information the operator needs to correctly and safely install and operate the **LD220 touch-screen indicator** series.

LD220 touch-screen indicator is designed to interface SSI encoders.
It accepts signals from single- and multiturn encoders with SSI interface, resolution in the range 10 to 32 bits and clock frequency up to 1 MHz. Operation can be as either Master or Slave. The features include scaling, bit blanking, linearization over 24 interpolation points, choice of the engineering unit, sampling time setting, three HTL PNP control inputs (for example for resetting the display value), etc.
It features a touch screen and 7-segment graphic display with a complete set of plain text, symbols and units. The LED display is bright and provides high contrast readability and also allows the background light to turn red, green or yellow in the event of the set occurrences such as when the threshold limits are exceeded. The combination of plain text and touch screen functions make the parametrization very user-friendly and intuitive.

In the series the following models are available:
- **LD220-P8** touch-screen indicator standard version;
- **LD220-PM** provides additional 115-230Vac power supply;
- **LD220-...-AVI** provides additional 16-bit analogue output, four control outputs and RS-232/RS-485 serial interface;
- **LD220-...-DO** further offers four control outputs and RS-232/RS-485 serial interface;
- **LD220-...-RO** is equipped with two relay outputs.

All options (-PM-, -AVI-, -DO-, -RO) can be freely combined.

For technical specifications please refer to the product datasheet.

To make it easier to read the text, this guide can be divided into two main sections.

In the first section (from section 1 to section 4) general information concerning the safety, the mechanical installation and the electrical connection.

In the second section (from section 5 to section 8) both general and specific information is given on the operator menu and the setup procedure.

Operational modes

All functions can be configured in the parameter menu.
The device can be set to one of the following operation modes:
- MASTER, see the Mode parameter in the "6.3 SSI properties menu" section on page 41.
  - The unit provides the clock signal for the connected device.
  - Both clock terminal blocks "5 – CLK" and "6 - /CLK" are configured as outputs.

- SLAVE, see the **Mode** parameter in the "6.3 SSI properties menu" section on page 41.
  - An external device (i.e. the SSI Master) must provide the clock signal for the connected encoder / sensor.
  - Both clock terminal blocks "5 – CLK" and "6 - /CLK" are configured as inputs.

Functional diagram

MODE	COUNTING DIRECTION	SSI PROPERTIES	LINEARIZATION	PRESELECTION	OUTPUT

Clock

Data

- Master
- Slave

- Resolution
- High / low bit
- Format
- ...

- Mode: 1 Quadrant
- Mode: 4 Quadrant

-99999999
...
+99999999

- Switching Mode
- Output Target
- Hysteresis
- ...

LCD — Display

Control Out

Relays Out

Serial Out *

Analog Out *

* Independent of Preselection
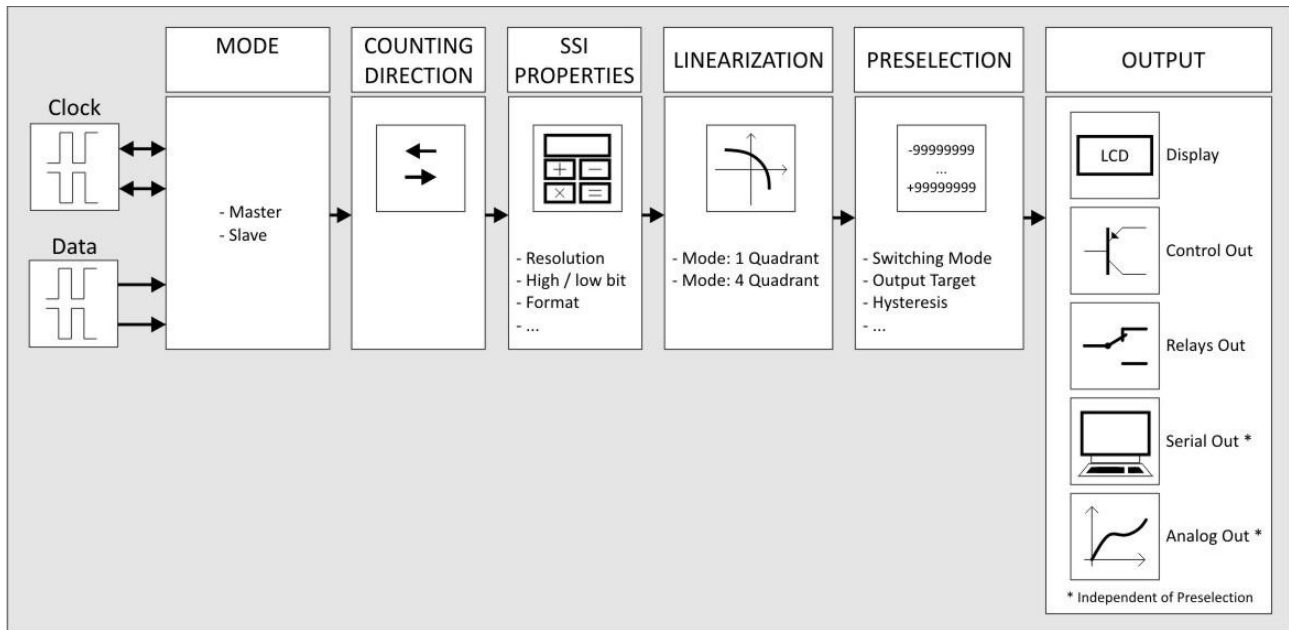
1 – Safety summary

1.1 Safety

- Always adhere to the professional safety and accident prevention regulations applicable to your country during device installation and operation;
- installation and maintenance operations have to be carried out by qualified personnel only, with power supply disconnected and stationary mechanical parts;
- device must be used only for the purpose appropriate to its design: use for purposes other than those for which it has been designed could result in serious personal and/or the environment damage;
- high current, voltage and moving mechanical parts can cause serious or fatal injury;
- warning ! Do not use in explosive or flammable areas;
- failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment;
- Lika Electronic assumes no liability for the customer's failure to comply with these requirements.

1.2 Electrical safety

- Turn OFF power supply before connecting the device;
- connect following to explanation in the "4 - Electrical connections" section on page 18;
- in compliance with 2014/30/EU norm on electromagnetic compatibility, following precautions must be taken:
  - before handling and installing the equipment, discharge electrical charge from your body and tools which may come in touch with the device;
  - power supply must be stabilized without noise; install EMC filters on device power supply if needed;
  - always use shielded cables (twisted pair cables whenever possible);
  - avoid cables runs longer than necessary;
  - avoid running the signal cable near high voltage power cables;
  - mount the device as far as possible from any capacitive or inductive noise source; shield the device from noise source if needed;
  - minimize noise by connecting the unit to ground (GND). Make sure that ground (GND) is not affected by noise. The connection point to ground can be situated both on the device side and on user's side. The best solution to minimize the interference must be carried out by the user.

1.3 Mechanical safety

- Install the device following strictly the information in the "3 - Mounting instructions" section;
- do not disassemble the unit;
- do not tool the unit;

- delicate electronic equipment: handle with care;
- do not subject the device to knocks or shocks;
- respect the environmental characteristics of the device.

2 – Identification

Device can be identified through the **order code** and the **serial number** printed on the label applied to its body. Information is listed in the delivery document too. Please always quote the order code and the serial number when reaching Lika Electronic for purchasing spare parts or needing assistance. For any information on the technical characteristics of the product, <u>refer to the technical catalogue</u>.

⚠	**Warning**: devices having order code ending with "/Sxxx" may have mechanical and electrical characteristics different from standard and be supplied with additional documentation for special connections (Technical info).

3 – Mounting instructions

WARNING

Installation and maintenance operations have to be carried out by qualified personnel only, with power supply disconnected and mechanical parts compulsorily in stop.

3.1 Overall dimensions

Mount the display into the provided cut-out (w x h approx. 91 x 43 mm, 3.58" x 1.69'') without panel clips.
Install panel clips on the display housing and screw until the unit is fixed.

Front view

48 mm / 1.89"

96 mm / 3.78"

Lateral view

Rear 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

Top view

114 mm / 4.49"

11 mm / 0.43"   105 mm / 4.13"
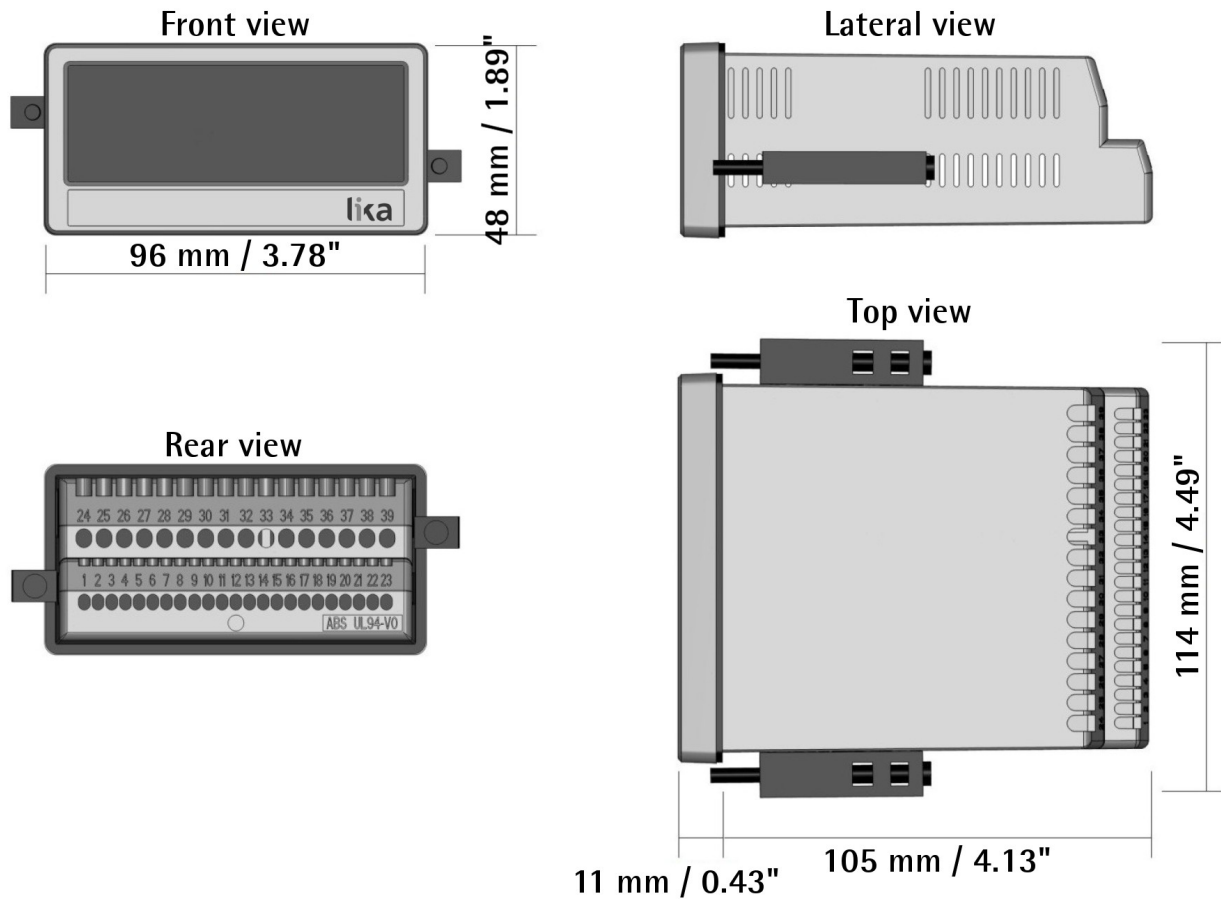
Panel cut out: 91 x 43 mm (3.58" x 1.69'')

3.2 Installation

The device is allowed to be installed and operated only within the permissible temperature range (-20°C +60°C / -4°F +140°F). Please ensure an adequate ventilation and avoid any direct contact between the device and gases / liquids.
Before installation or maintenance, the unit must be disconnected from all voltage sources. Furthermore it must be ensured that no danger can arise in the event of contact with the disconnected voltage sources.
Devices which are supplied by AC voltages must be connected only by means of switches or circuit breakers with low voltage circuit. The switch or circuit breaker must be installed 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 double or increased insulation.
All selected wires and insulations must comply with the provided voltage and temperature ranges. Furthermore 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 product datasheet.

Before starting the unit for the first time it must be ensured that all connections and wires are firmly plugged in and secured to the screw terminal blocks. All terminal blocks (including unused ones) must be fastened by turning the relevant screws clockwise up to the end position.

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

For placement, wiring, environmental conditions as well as shielding and earthing/grounding of the supply lines you must comply with the general standards stated for industrial automation industry and the specific shielding instructions provided by the manufacturer.

3.3 Cleaning, maintenance and service notes

To clean the unit please just use a slightly damp (not wet!), soft cloth. For the rear side no cleaning is necessary. For an unscheduled, individual cleaning of the rear side the maintenance technicians or installation operators are self-responsible.

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

4 – Electrical connections

WARNING

Power supply must be turned off before performing any electrical connection!

The terminal block screws must be tightened using a slotted screwdriver having a 2 mm wide blade.
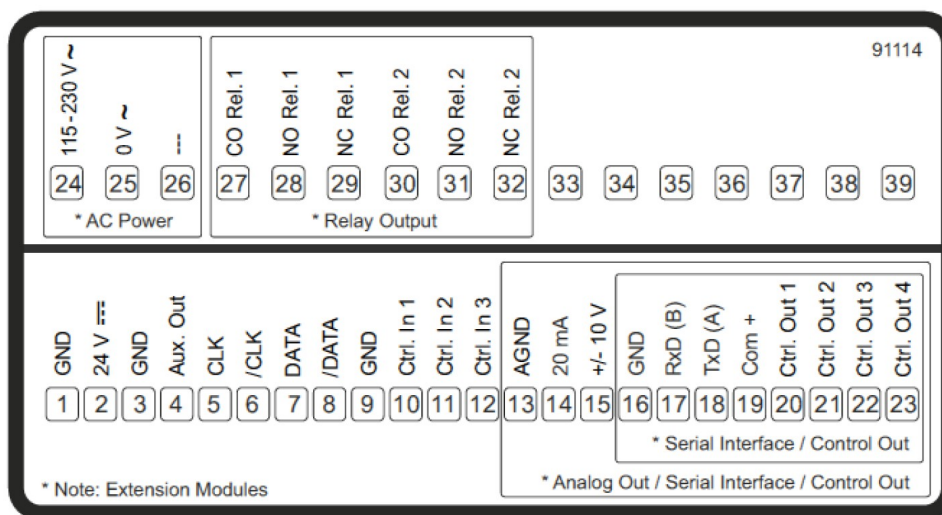
4.1 DC power supply

DC power supply technical specifications (–P8– order code)

Input voltage:	+18Vdc … +30Vdc
Protection circuit:	reverse polarity protection
Power consumption:	approx. 150 mA (unloaded)
Fuse protection:	external fuse T 0.5 A

The unit accepts DC supply from +18 to +30 V through terminal blocks 1 and 2. The power consumption depends on the level of the supply voltage (approx. 150 mA) and the additional current required by the Auxiliary Voltage output (3 – GND + 4 – Aux. Out, see the "4.3 Auxiliary voltage output" section on page 19).

All GND terminal blocks are internally connected.

NOTE

For AC power supply (–PM– order code) see the following section.

4.2 AC power supply (-PM- order code)

AC power supply technical specifications

Input voltage:	115Vac ... 230Vac (60/50Hz)
Power consumption:	approx. 5 VA (unloaded)
Fuse protection:	external fuse T 0.1 A

The unit with -PM- order code also accepts AC power supply from 115 V to 230 V through terminal blocks 24 and 25. The power consumption depends on the level of the supply voltage (approx. 5 VA) and the additional current required by the Auxiliary Voltage output (3 – GND + 4 – Aux. Out, see the "4.3 Auxiliary voltage output" section below).

Devices with -PM- order code can also be supplied with a DC voltage between +18 V and +30 V through terminals 1 and 2, see the previous "4.1 DC power supply" section.

4.3 Auxiliary voltage output

Auxiliary voltage output technical specifications

DC version:	+24Vdc (approx. 1 V lower than the power supply voltage), max. 250 mA or +5Vdc ($\pm$15%), max. 250 mA
AC version:	+24Vdc ($\pm$15%) (max. 150 mA up to +45°C/+113°F / 80 mA when more than +45°C/+113°F) or +5Vdc ($\pm$15%), max. 250 mA

Terminal blocks 3 and 4 provide an auxiliary output useful for supplying sensors and encoders.
The +24Vdc output voltage depends on the power supply, see the table above.
The unit allows the auxiliary voltage output to be set to either +24 Vdc or +5 Vdc. Refer to the **Encoder supply** parameter in the "6.3 SSI properties menu" section on page 41.

4.4 SSI inputs

SSI inputs technical specifications

Number of inputs (channels):	1 (Clock, /Clock, Data, /Data)
Configuration:	Master or Slave
Format:	Binary or Gray code
Frequency:	max. 1 MHz
Resolution:	10 ... 32 bits
Load:	max. 2 mA / Ri > 10 kOhm / 47 pF

The unit provides the connection for SSI signals through terminal blocks 5, 6, 7, and 8.
The characteristics of the SSI inputs can be set in the "6.3 SSI properties menu" section on page 41.

4.4.1 Wiring of Master operational mode

For more information refer to the Mode parameter on page 41.
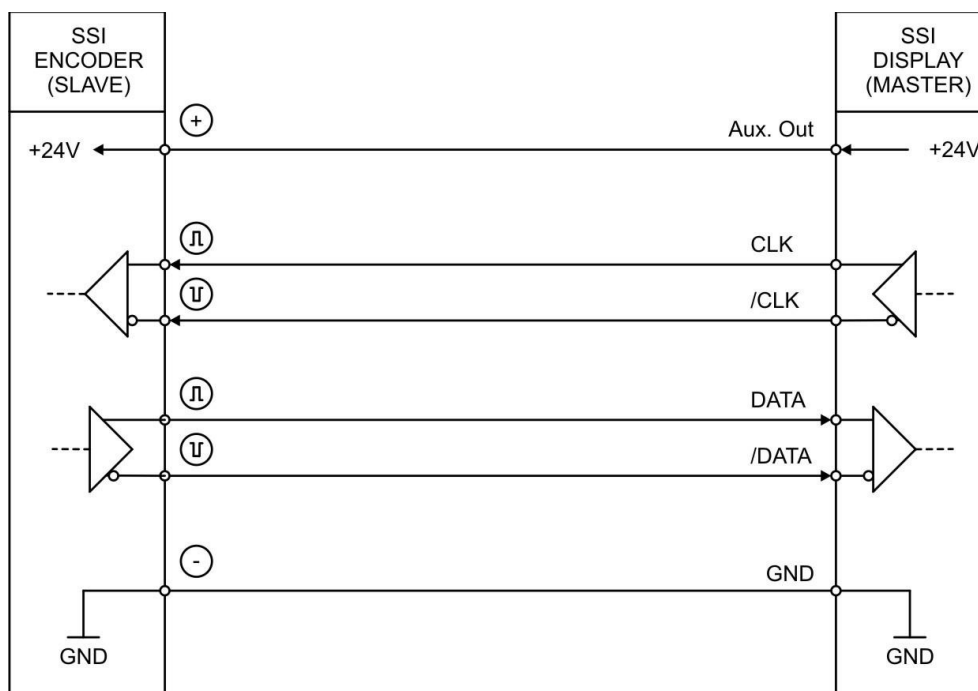
4.4.2 Wiring of Slave operational mode

For more information refer to the Mode parameter on page 41.
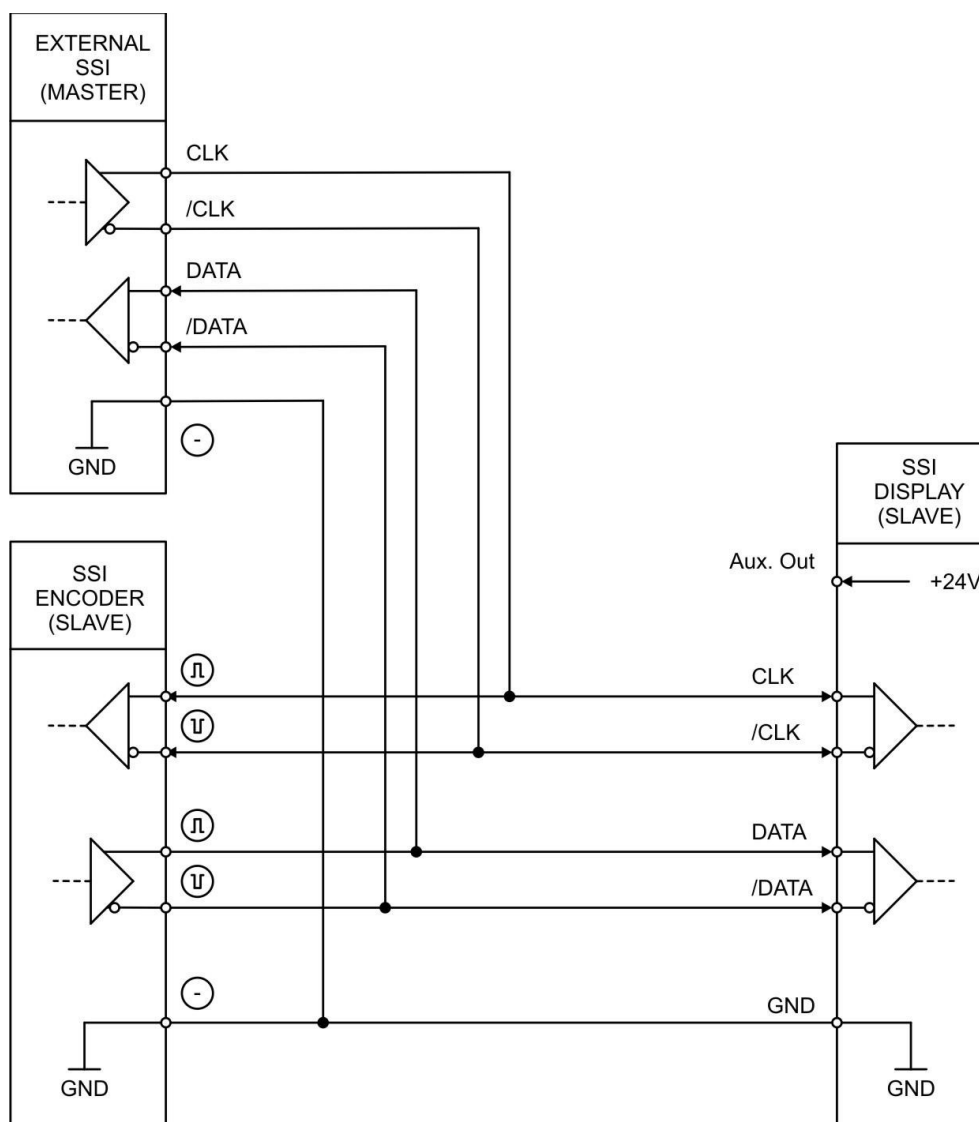
4.4.3 Monitoring CLOCK and DATA signals

LD220 display includes an open-circuit monitoring of the signals (only with termination, e.g. 120 Ohm). When the Slave operational mode is set (Mode = 1), CLK, /CLK, DATA and /DATA signals are monitored. When the Master operational mode is set (Mode = 0), only DATA and /DATA signals are monitored.
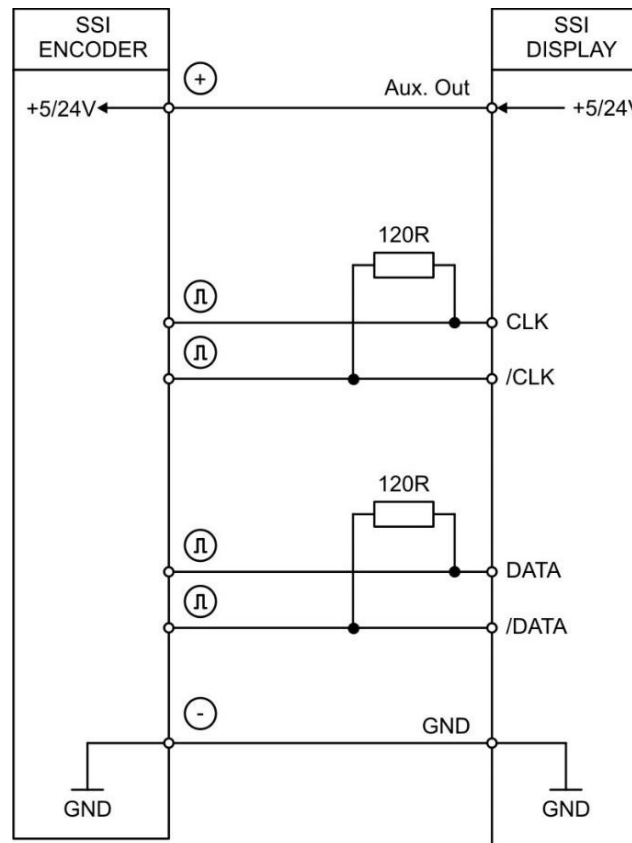
Detection of errors

/DATA	DATA	/CLK	CLK	Status
+	+	+	+	Stable data
+	+	+	-	Stable data (not guaranteed), no error detected
+	+	-	+	Stable data (not guaranteed), no error detected
+	+	-	-	Display value freezes, no error detected
+	-	+	+	Error
+	-	+	-	Error
+	-	-	+	Error
+	-	-	-	Error
-	+	+	+	Error
-	+	+	-	Error

-	+	-	+	Error
-	+	-	-	Error
-	-	+	+	Error
-	-	+	-	Error
-	-	-	+	Error
-	-	-	-	Error

If the power supply to the encoder (GND or +V) is broken, an error is detected (regardless of the CLK, /CLK, DATA, and /DATA signals).

4.5 Control inputs

Control inputs technical specifications

Number of inputs:	3
Format:	HTL, PNP (+10 V ... +30 V)
Frequency:	max. 10 kHz
Load:	max. 2 mA / Ri > 15 kOhm / 470 pF

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

In the **Command** menu (see the "6.13 Command menu" section on page 77) the operation of the control inputs can be set. Available functions are: reset the display value, display switching, locking the touch screen or release the lock function of the control or relay outputs.

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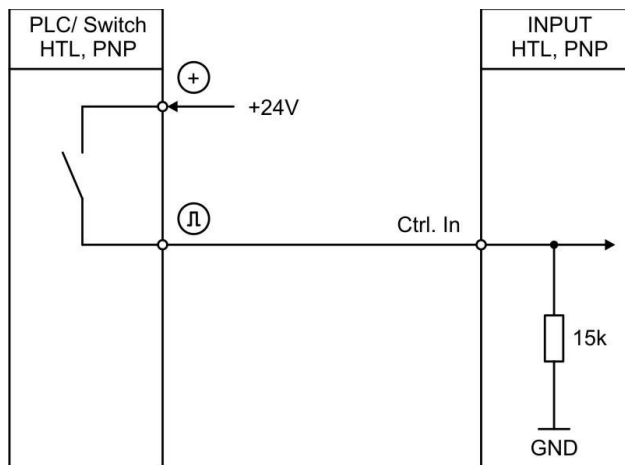
Unconnected PNP control inputs are always "LOW".
All inputs are designed to receive impulses from an electronic impulse source.

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

4.6 Analogue output (-AVI- order code)

Analogue output technical specifications

Configuration:	Current or voltage operation
Voltage output (0):	-10 V ... +10 V (Low: 0 ... 3 V, High 9 ... 30 V)
Current output (1):	0 ... 20 mA (burden: max. 270 Ohm)
Current output (2):	4 ... 20 mA (burden: max. 270 Ohm)
Resolution:	16 bits
Accuracy:	±0.15% at -20°C ... 0°C / -4°F ... +32°F
	±0.1% at 0°C ... +45°C / +32°F ... +113°F
	±0.15% at +45°C ... +60°C / +113°F ... +140°F
Reaction time:	< 150 ms

A 16 bit analogue output is available through terminal blocks 13 and 14 / 15.
It can be configured and scaled in the **Analog** menu, see the "6.12 Analog menu" section on page 75.

The following configurations are available (see the **Analog format** parameter on page 75):

0	Voltage output:	-10 V ... +10 V
1	Current output:	0 ... 20 mA
2	Current output:	4 ... 20 mA

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

WARNING
Voltage and current outputs of the analogue output cannot be operated simultaneously.

4.7 Serial interface (–AVI– and –DO– order codes)

Serial interface technical specifications

Format:	RS-232 (–AVI1– and –DO1–) or RS-485 (–AV2– and DO2–)
Baud rate:	9,600, 19,200 and 38,400 baud

A serial interface (RS-232 or RS-485) is available through terminal blocks 16, 17, and 18.
It can be configured in the **Serial** menu, see the "6.11 Serial menu" section on page 72.

The RS-232 / RS-485 serial interface can be used:

• for easy setup and commissioning of the unit
• to modify settings and parameters during operation
• to read out internal states and current measuring values via PC or PLC

The following drawing shows the RS-232 connection to a PC by using a standard D-Sub 9-pin connector:
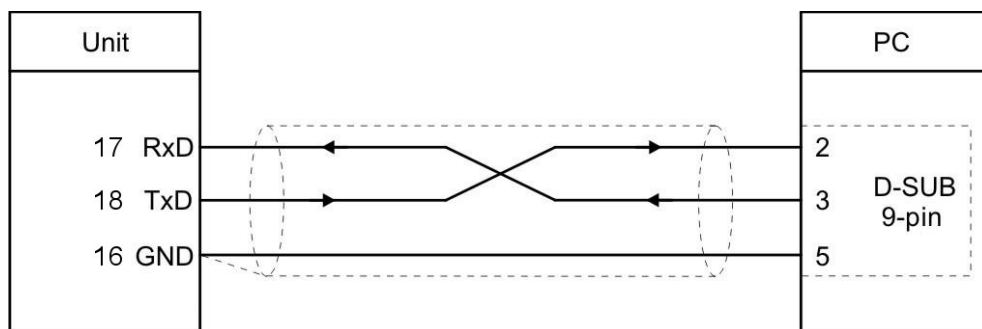
The following drawing shows the RS-485 connection to a PC by using a standard D-Sub 9-pin connector:
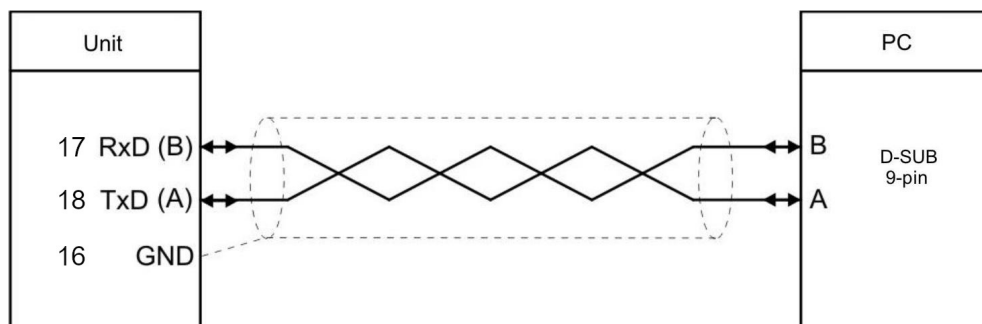
4.8 Control outputs (–AVI– and –DO– order codes)

Control outputs technical specifications

Number of outputs:	4
Format / level:	+5 V ... +30 V (depending on the voltage level provided to terminal block 19 - COM+), PNP
Output current:	max. 200 mA
Reaction time:	< 1 ms

Four control outputs are available at terminal blocks 20, 21, 22, and 23 (+ terminal block 19 for switching voltage).

The switching conditions can be set in the **Preselection 1 ... Preselection 4** menus, see the "6.7 Preselection 1 menu" ... "6.10 Preselection 4 menu" sections on pages 62, 66, 68 and 70 respectively. The outputs "20 - Ctrl. Out 1", "21 - Ctrl. Out 2", "22 - Ctrl. Out 3" and "23 - Ctrl. Out 4" are fast PNP outputs with a switching capability of 5÷30 V / 200 mA per channel. The switching states are displayed (display with unit and status bar) as C1 ... C4, see the "5 - Display and touch screen" section on page 29.

The switching voltage of the outputs must be applied to input terminal block 19 (COM+).
In case of switching inductive loads it is advisable to use an external filtering of the coils.

4.8.1 Wiring of the control outputs
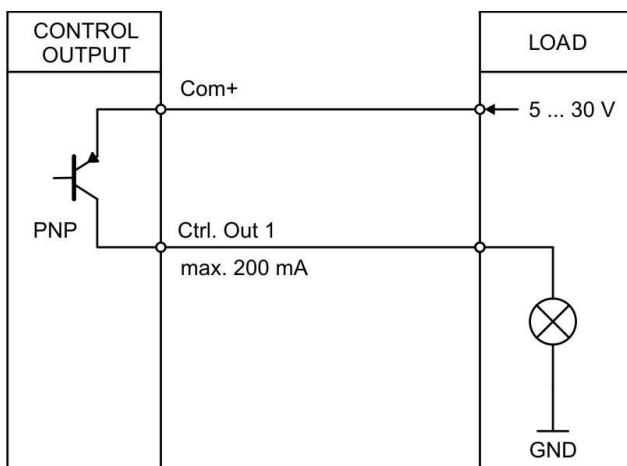
4.9 Relay outputs (–RO order code)

Relay outputs technical specifications

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

Two relay outputs with potential-free changeover contacts are available at terminal blocks 27, 28, 29, 30, 31, and 32. The switching conditions can be set in the **Preselection 1 ... Preselection 4** menus, see the "6.7 Preselection 1 menu" ... "6.10 Preselection 4 menu" sections on pages 62, 66, 68 and 70 respectively.

The switching states are displayed (display with unit and status bar) as `K1` and `K2`, see the "5 - Display and touch screen" section on page 29.

AC switching capacity max. 250 Vac / max. 3 A / 750 VA
DC switching capacity max. 150 Vdc / max. 2 A / 50 W

4.9.1 Wiring of the relay outputs
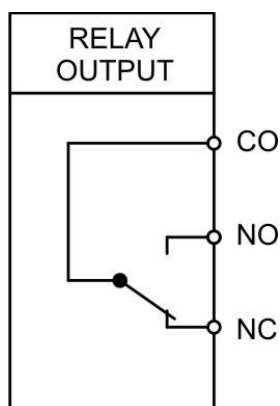
5 – Display and touch screen

5.1 Screen structure for parametrization

Menus and parameters are described in the "6 – Menus and parameters" section on page 34.

Start setup procedure

To enter the menus and edit the parameters, keep the touchscreen pressed for 3 seconds.

Selection of the menu

Select the menu by pressing the arrow keys and confirm the choice by pressing the **Ok** key.

You can exit the selection of the menu by pressing the **C** key.

Selection of the parameter

Select the parameter by pressing the arrow keys and confirm the choice by pressing the **Ok** key.

You can exit the selection of the parameter by pressing the **C** key.

Parameter setting:

After selection the parameter (or its last digit) starts blinking. Set the parameter by pressing the ⬆ and ⬇ arrow keys, shift the cursor by pressing the ⬅ and ➡ arrow keys and save the value by pressing the **Ok** key.

You can exit the editing of the parameter by pressing the **C** key.

Parameter changes become active only after closing the selection of the menu.

5.2 Screen structure during operation

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

5.2.1 Operational screens

<u>Display with unit and status bar</u>

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

<u>Control output states and relay states are only shown with AVI, DO, and RO order codes.</u>

<u>Two-line display without units</u>

Diagnostic window:
Read-in value for diagnostic purposes (raw data).
It can be deactivated by setting the **Diagnostic display** parameter in the **Display** menu, see on page 83.
When the **Diagnostic display** is deactivated, process data is displayed.

<u>Two-line display with units</u>

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

The desired source can be selected in the "6.14 Display menu", see on page 83.

<u>Large display (4 digits)</u>

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

<u>It is available only when **Large display** is active (see on page 80).</u>

<u>Display with command keys</u>

For function refer to the **Command** menu on page 77.

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

<u>Display for quick start of the preselection values setting process (see the "6.6 Preselection values menu" section on page 61)</u>

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

<u>It is available only with AVI, DO, and RO order codes.</u>

<u>Display with current, minimum and maximum values.</u>

To switch to the next display, press the top half of the screen or the SKIP key.

The minimum and maximum values always refer to the source set in the **Source single** parameter, see on page 80.

5.2.2 Error messages
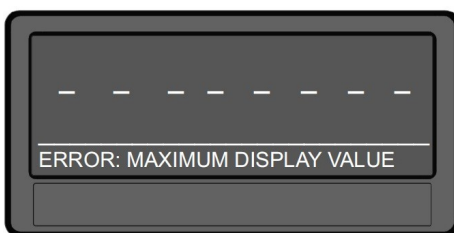
ERROR: MAXIMUM DISPLAY VALUE

The display value of the single line display is greater than +99,999,999

ERROR: MINIMUM DISPLAY VALUE

The display value of the single line display is less than -99,999,999
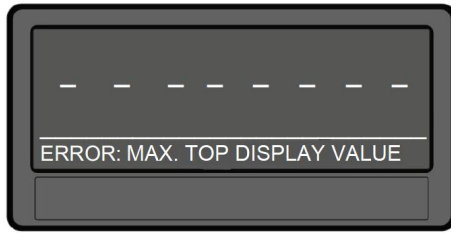
ERROR: MAX. TOP DISPLAY VALUE

The top display value of the two line display is greater than +99,999,999
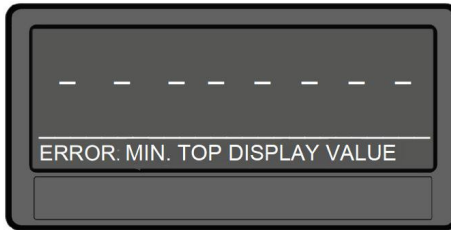
ERROR: MIN. TOP DISPLAY VALUE

The top display value of the two line display is less than -99,999,999
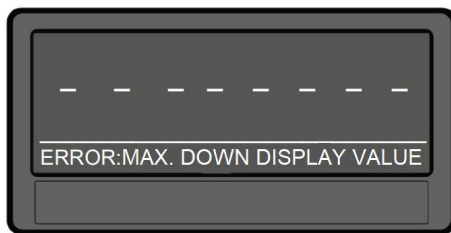
ERROR: MAX. DOWN DISPLAY VALUE

The bottom display value of the two line display is greater than +99,999,999
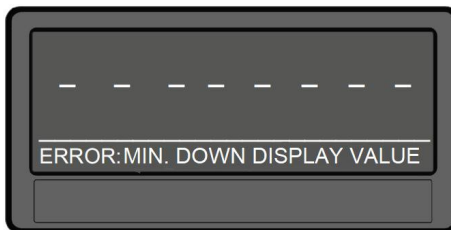
ERROR: MIN. DOWN DISPLAY VALUE

The bottom display value of the two line display is less than -99,999,999
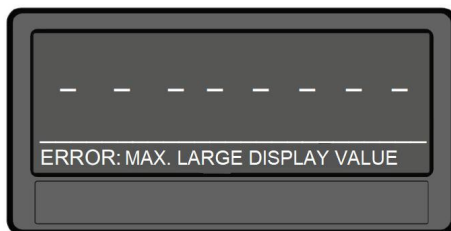
ERROR: MAX. LARGE DISPLAY VALUE

The display value of the large display is greater than +99,999,999
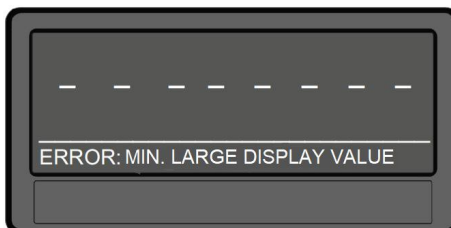
ERROR: MIN. LARGE DISPLAY VALUE

The display value of the large display is less than -99,999,999

```
– – – – – – – –
ERROR: SSI ERROR BIT SET
```
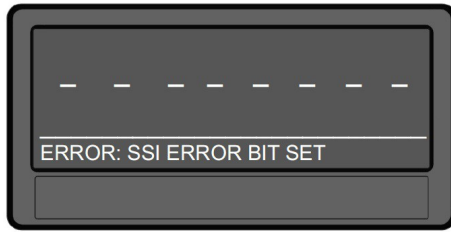
ERROR: SSI ERROR BIT SET

The error bit of the SSI encoder is set

```
– – – – – – – –
ERROR: SSI ENCODER FAULT
```
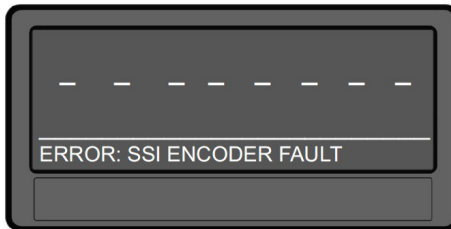
ERROR: SSI ENCODER FAULT

An error is active (if available)

NOTE
The error messages described above are <u>automatically</u> reset as soon as the corresponding display value is within the limits of the range or the error has been corrected accordingly.
With order code AVI, the analogue output will supply 0 V or 0 mA in case of error.

6 – Menus and parameters

The serial interface with a PC and the OS operating software are used for the parametrization of the device. The software is free and can be downloaded from Lika's web site.

6.1 Overview of the structure
The following tables offer an overview of the menus and their relevant parameters. The menu names are printed in bold and the associated parameters are listed under the menu name. Depending on the device model and the selected operation mode, only the available menus / parameters are shown.

NOTE
In the pages that describe the menus, the default values are highlighted with grey background.

General menu, see the "6.2 General menu" section on page 39
Linearization mode, see on page 39
Pin preselection, see on page 39
Pin parameter, see on page 39
Factory settings, see on page 39

SSI properties menu, see the "6.3 SSI properties menu" section on page 41
Mode, see on page 41
Encoder resolution, see on page 41
Bit per revolution, see on page 41
Data format, see on page 41
Baud rate, see on page 42
High bit, see on page 42
Low bit, see on page 42
Direction, see on page 42
Error bit, see on page 43
Error polarity, see on page 43
Encoder supply, see on page 43

Position settings menu, see the "6.4 Position settings menu" section on page 54
Display format, see on page 54
Factor, see on page 54
Divider, see on page 54
Additive value, see on page 55
Decimal point, see on page 55
Scale units, see on page 55
SSI offset, see on page 56
SSI zero, see on page 57
Round loop value, see on page 57
Sampling time (s), see on page 57

Speed settings menu, see the "6.5 Speed settings menu" section on page 58
Factor, see on page 58
Divider, see on page 58
Decimal point, see on page 58
Scale units, see on page 59
Average filter, see on page 60
Sampling time (s), see on page 60

It is only available for devices with order codes AVI, DO or RO.

Preselection values menu, see the "6.6 Preselection values menu" section on page 61
Preselection 1, see on page 61
Preselection 2, see on page 61
Preselection 3, see on page 61
Preselection 4, see on page 61

It is only available for devices with order codes AVI, DO or RO.

Preselection 1 menu, see the "6.7 Preselection 1 menu" section on page 62
Source 1, see on page 62
Mode 1, see on page 62
Hysteresis 1, see on page 63

Pulse time 1 (s), see on page 64
Output target 1, see on page 64
Output polarity 1, see on page 64
Output lock 1, see on page 64
Start up delay 1 (s), see on page 65
Event color 1, see on page 65

It is only available for devices with order codes AVI, DO or RO.

Preselection 2 menu, see the "6.8 Preselection 2 menu" section on page 66
Source 2, see on page 66
Mode 2, see on page 66
Hysteresis 2, see on page 66
Pulse time 2 (s), see on page 66
Output target 2, see on page 66
Output polarity 2, see on page 67
Output lock 2, see on page 67
Start up delay 2 (s), see on page 67
Event color 2, see on page 67

It is only available for devices with order codes AVI, DO or RO.

Preselection 3 menu, see the "6.9 Preselection 3 menu" section on page 68
Source 3, see on page 68
Mode 3, see on page 68
Hysteresis 3, see on page 68
Pulse time 3 (s), see on page 68
Output target 3, see on page 68
Output polarity 3, see on page 69
Output lock 3, see on page 69
Start up delay 3 (s), see on page 69
Event color 3, see on page 69

It is only available for devices with order codes AVI, DO or RO.

Preselection 4 menu, see the "6.10 Preselection 4 menu" section on page 70
Source 4, see on page 70
Mode 4, see on page 70
Hysteresis 4, see on page 70
Pulse time 4 (s), see on page 70
Output target 4, see on page 70
Output polarity 4, see on page 71
Output lock 4, see on page 71
Start up delay 4 (s), see on page 71
Event color 4, see on page 71

It is only available for devices with order codes AVI and DO.

Serial menu, see the "6.11 Serial menu" section on page 72
Unit number, see on page 72
Serial baud rate, see on page 72
Serial format, see on page 72
Serial init, see on page 73
Serial protocol, see on page 73
Serial timer (s), see on page 74
Serial value, see on page 74
MODBUS, see on page 74

It is only available for devices with order code AVI.

Analog menu, see the "6.12 Analog menu" section on page 75
Analog source, see on page 75
Analog format, see on page 75
Analog start, see on page 75
Analog end, see on page 75
Analog gain (%), see on page 76
Analog offset, see on page 76

Command menu, see the "6.13 Command menu" section on page 77
Input 1 action, see on page 77
Input 1 config., see on page 79
Input 2 action, see on page 79
Input 2 config., see on page 79
Input 3 action, see on page 79
Input 3 config., see on page 79

Display menu, see the "6.14 Display menu" section on page 80
Source single, see on page 80
Source dual top, see on page 80
Source dual down, see on page 80
Large display, see on page 80
Start display, see on page 81
Color, see on page 81
Brightness (%), see on page 81
Contrast, see on page 82
Screen saver (s), see on page 82
Up-date-time (s), see on page 82
Font, see on page 82
Skip window, see on page 82
Diagnostic display, see on page 83

It is only available if the Linearization mode parameter in the General menu (see on page 39) is set to either "1 – 1 QUADRANT" or "2 – 4 QUADRANT".

Linearization menu, see the "6.15 Linearization menu" section on page 84
Source, see on page 84
P1(X), see on page 84
…
P24(X), see on page 84
P1(Y), see on page 84
…
P24(Y), see on page 84

6.2 General menu

The default values are highlighted with grey background.

Linearization mode

This parameter activates and sets the linearisation function. See the "6.15 Linearization menu" section on page 84 and the "6.15.1 Description of the linearisation function" section on page 85.

0	OFF	No linearisation
1	1 QUADRANT	Linearisation using 1 quadrant (see on page 85).
2	4 QUADRANT	Linearisation using 4 quadrants (see on page 85).

Pin preselection

This parameter allows to set the PIN code to lock the quick start of the **Preselection values** menu used to enter the preselection values, see the "5.2 Screen structure during operation" section on page 30. Refer also to the "6.6 Preselection values menu" section on page 61. The Master PIN is 6079.
This lock function is only useful if used along with the lock function set in the **Pin parameter**.

0000	No lock
...	
9999	Access after entering PIN Code 9999

Pin parameter

This parameter sets the PIN code for lock function of all parameters. The Master PIN is 6079.

0000	No lock
...	
9999	Parametrization of the unit after entering PIN code 9999

Factory settings

At any time you can return all settings to the factory default values.
Default values are highlighted with grey background in this manual.

WARNING

This action will reset all parameters to factory default values and customised settings will be lost. After reset you will have to repeat your individual set-up procedure.

0	NO	No default values are loaded
1	YES	Load default values of all parameters

6.3 SSI properties menu

The **SSI properties** menu allows to configure the unit according to the technical features of the connected SSI encoder.

Mode

This parameter configures the unit for operation as a Master or as a Slave. For more information please refer to the "6.3.1 Reading the SSI data" section on page 44.

0	MASTER	Master mode: the unit is set to operate as a Master, it provides the clock signals to the SSI encoder.
1	SLAVE	Slave mode: the unit is set to operate as a Slave, an external Master device provides the clock signals to the SSI encoder.

Encoder resolution

It sets the resolution (singleturn + multiturn) of the connected SSI encoder expressed in total number of bits. For more information please refer to the "6.3.1 Reading the SSI data" section on page 44.

10	Minimum value
25	Default value
32	Maximum value

Bit per revolution

It sets the singleturn resolution of the connected SSI encoder expressed in number of bits. It is only used for display and diagnostic purposes, and has no influence on device functions. If the singleturn resolution is higher than 16 bits, set the maximum value. See the "5.2.1 Operational screens" section on page 30.

10	Minimum value
13	Default value
16	Maximum value

Data format

It sets the output code used by the SSI encoder to output the absolute position information. The output code can be Binary or Gray. For more information please refer to the "6.3.2.2 Data conversion" section on page 46.

0	GRAY CODE	Gray code
1	BINARY CODE	Binary code

Baud rate

It sets the clock frequency of the SSI telegrams. For more information please refer to the "6.3.1 Reading the SSI data" section on page 44.

0	2 MHZ	N.A.
1	1.5 MHZ	N.A.
2	1 MHZ	1 MHz clock frequency
3	500 KHZ	500 kHz clock frequency
4	250 KHZ	250 kHz clock frequency
5	100 KHZ	100 kHz clock frequency

N.A. = not available

High bit

This parameter sets the highest bit (MSB) that must be evaluated when the bit blanking function is used. For more information please refer to the "6.3.2.6 Evaluation of the bit blanking" section on page 50.
If you want the full encoder range to be evaluated, it must be set to the total number of encoder bits.

01	Minimum value
25	Default value
32	Maximum value

Low bit

This parameter sets the lowest bit (LSB) that must be evaluated when the bit blanking function is used. For more information please refer to the "6.3.2.6 Evaluation of the bit blanking" section on page 50.
If you want the full encoder range to be evaluated, it must be set to "01".

01	Minimum value
...	
32	Maximum value

Direction

It allows to set the direction of the motion of the connected SSI encoder: clockwise / counter-clockwise (or forward / backward). For more information please refer to the "6.3.2.5 Checking the direction of rotation" section on page 49.

0	FORWARD	Clockwise / Forward direction
1	REVERSE	Counter-clockwise / Reverse direction

Error bit

It enables the error bit diagnostics and the position of the error bit. For more information please refer to the "6.3.2.1 Checking the error bit" section on page 45.

0	No error bit available. Diagnostics on the connected encoder is disabled.
...	
32	Position of the error bit to be evaluated. Diagnostics on the connected encoder is enabled.

Error polarity

This parameter sets the polarity of the error bit in case of error. For more information please refer to the "6.3.2.1 Checking the error bit" section on page 45.

0	In case of error the bit has LOW logic level.
1	In case of error the bit has HIGH logic level.

Encoder supply

It allows to set the voltage level of the auxiliary voltage output (4 = Aux. Out). For more information refer to the "4.3 Auxiliary voltage output" section on page 19.

0	24VDC SUPPLY	+24 Vdc encoder power supply
1	5VDC SUPPLY	+5 Vdc encoder power supply

6.3.1 Reading the SSI data

Received data has always a length of 32 bits.
See the parameters Mode, Encoder resolution and Baud rate, refer to the "6.3 SSI properties menu" section on page 41.

Weight	Bit	Value
1	1	X
2	2	X
4	3	X
8	4	X
16	5	X
32	6	X
64	7	X
128	8	X
256	9	X
512	10	X
1024	11	X
2048	12	X
4096	13	X
8192	14	X
16384	15	X
32768	16	X
65536	17	X
131072	18	X
262144	19	X
524288	20	X
1048576	21	X
2097152	22	X
4194304	23	X
8388608	24	X
16777216	25	X
33554432	26	O
67108864	27	O
134217728	28	O
268435456	29	O
536870912	30	O
1073741824	31	O
2147483648	32	O

Fill to 32

500 kHz BAUD RATE

Clock

MODE "Master"

Data "0"

ENCODER RESOLUTION "25"

CLK

Data

6.3.2 Internal processing and calculation of SSI data

6.3.2.1 Checking the error bit

See the parameters Error bit and Error polarity, refer to the "6.3 SSI properties menu" section on page 41.
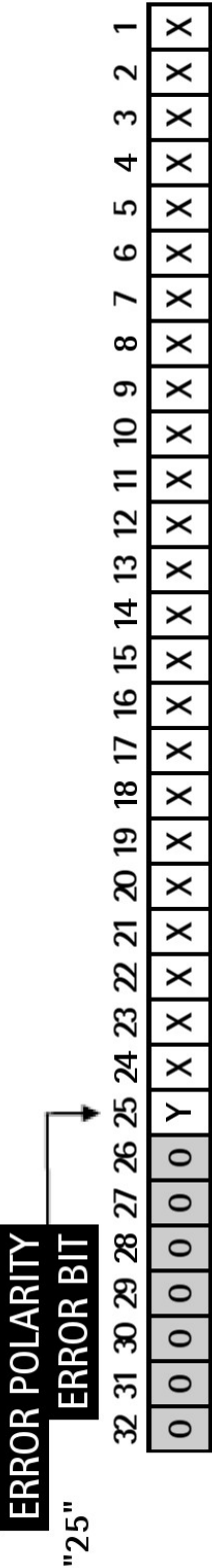
6.3.2.2 Data conversion

See the **Data format** parameter, refer to the "6.3 SSI properties menu" section on page 41. Gray code → Binary code.

lika

LD220
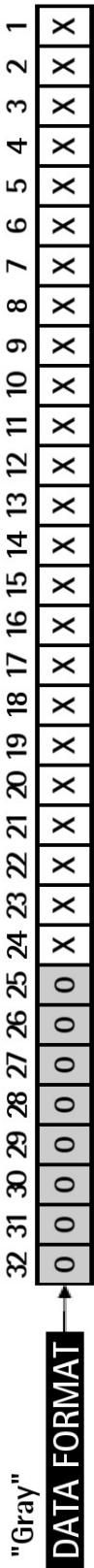
6.3.2.3 Data splitting

See the parameters **Encoder resolution** and **Bit per revolution**, refer to the "6.3 SSI properties menu" section on page 41.
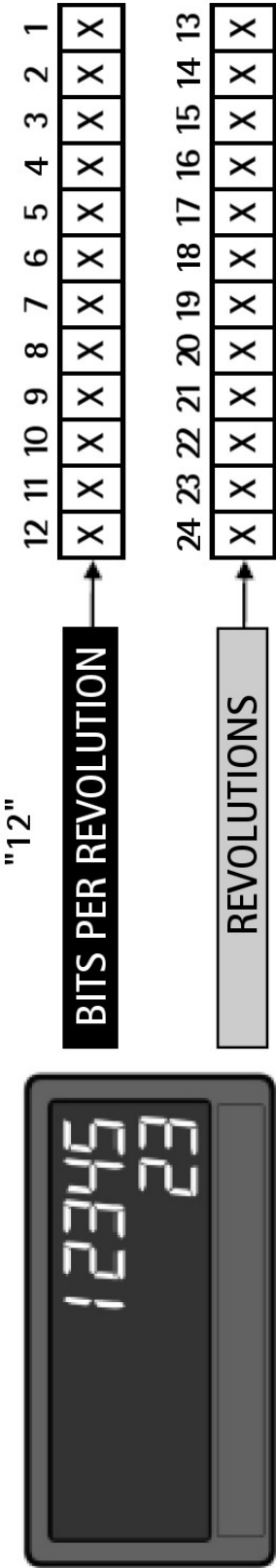
6.3.2.4 Considering SSI zero position

See the SSI zero parameter, refer to the "6.4 Position settings menu" section on page 54.

"0" — SSI ZERO

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

$(u - v) = w$ / $(2^{SSI\ Bits} - 1) = Mask$ / $(w\ \&\ Mask) = x$

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

6.3.2.5 Checking the direction of rotation

See the Direction parameter, refer to the "6.3 SSI properties menu" section on page 41.

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

"0"

↑

DIRECTION
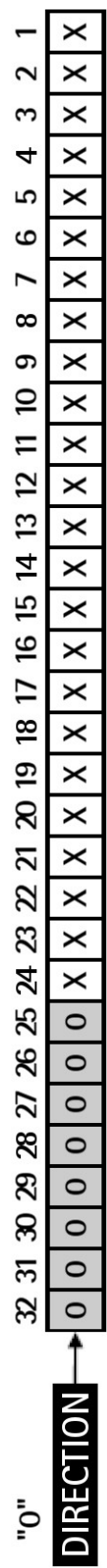
6.3.2.6 Evaluation of the bit blanking

See the parameters **High bit** and **Low bit**, refer to the "6.3 SSI properties menu" section on page 41.
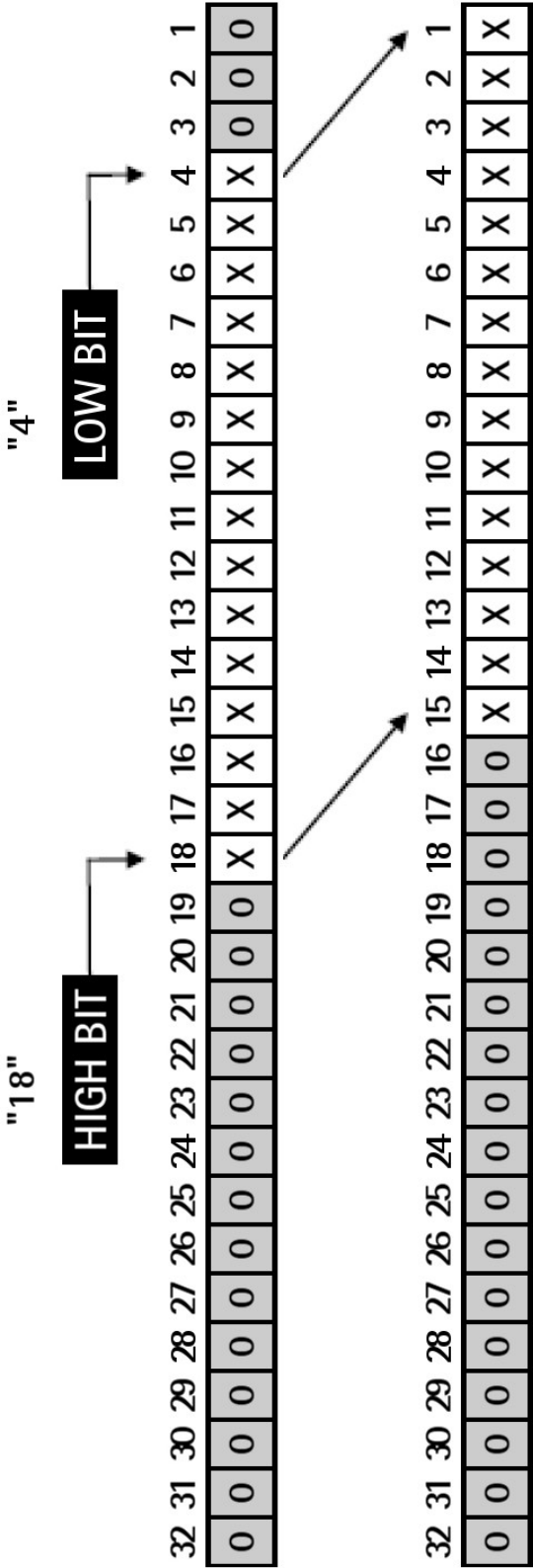
6.3.2.7 Considering the SSI offset

See the SSI offset parameter, refer to the "6.4 Position settings menu" section on page 54.

"0"
SSI OFFSET

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

X – Y = Z

32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
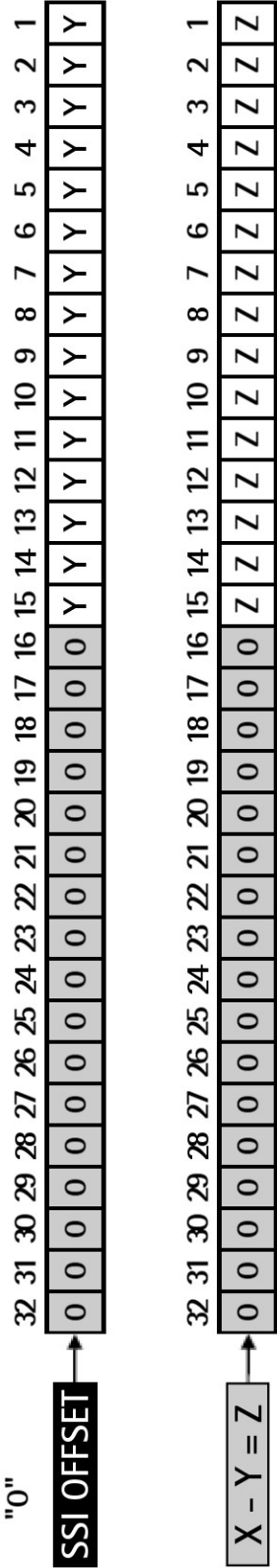
6.3.2.8 Calculation of the display value

See the parameters Factor, Divider, and Additive value, refer to the "6.4 Position settings menu" section on page 54.

EXAMPLE

We need to connect a 16-bit singleturn encoder (resolution: 65,536 cpr) and want to **convert the counts into a degree value**.

There are three methods, depending on how we want to display the degree value.

1. We want to display the position value in "**degrees : minutes of arc**" or "**minutes of arc : seconds of arc**". We must set the **Display format** parameter to "1".

2. We want to display the position value in "**degrees : minutes of arc : seconds of arc**". We must set the **Display format** parameter to "2".

3. We want to display the position value in **decimal degrees** (i.e. we want to display 0.0° to 359.9° -for instance, 359.9° instead of 65,535 counts). We must set the **Display format** parameter to "0". Then we must set the below listed parameters as follows:
   - **Factor** = 3600
   - **Divider** = 65536
   - **Decimal point** = 1 (= 0000000.0)
   - **Scale units** = 8 (= degree)

6.4 Position settings menu

The **Position settings** menu allows to set the values needed to provide the position display information.

Display format

This parameter sets the display format. The decimal point will be set automatically according to 999999:59 or 9999:59:59. The display value depends on the scale (see the parameters **Factor**, **Divider**, and **Additive value**). For more information please refer to the "6.3.2.8 Calculation of the display value" section on page 52.

0	99999999	Without format customization
1	999999:59	Value displayed in "degrees : minutes of arc" or "minutes of arc : seconds of arc"
2	9999:59:59	Value displayed in "degrees : minutes of arc : seconds of arc"

Factor

It sets the factor by which the measured value will be multiplied for the position display. For more information please refer to the "6.3.2.8 Calculation of the display value" section on page 52.

–99999999	Smallest value
1	Default value
+99999999	Highest value

Divider

It sets the divider by which the measured value will be divided for the position display. For more information please refer to the "6.3.2.8 Calculation of the display value" section on page 52.

–99999999	Smallest value
1	Default value
+99999999	Highest value

Additive value

It sets the additive constant that will be added to the measured value. For more information please refer to the "6.3.2.8 Calculation of the display value" section on page 52.

–99999999	Smallest value
0	Default value
+99999999	Highest value

Decimal point

It sets the position of the decimal point for the position display.

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

Scale units

This parameter sets the required engineering unit. It does not affect the calculation of the display value, it is to be intended as a label. The number of decimal places must be set in the **Decimal point** parameter.

0	**inch**	Default
1	**feet**	
2	**mm**	
3	**cm**	
4	**m**	
5	**km**	
6	**dm**	
7	**Grad**	
8	**degree**	
9	**Min:Sec**	
10	**H:M:S**	
11	**inc/s**	

12	inch/s	
13	feet/s	
14	mm/s	
15	cm/s	
16	m/s	
17	Km/s	
18	dm/s	
19	inch/min	
20	feet/min	
21	mm/min	
22	cm/min	
23	m/min	
24	Km/min	
25	dm/min	
26	inch/h	
27	feet/h	
28	km/h	
29	Edit unit	A customized measuring unit with up to 16 digits can be edited using this parameter. When you press the **ok** key the **Edit Unit** menu appears. A measuring unit can be created using the arrow keys (by pressing and holding the arrow key down the characters scroll fast). Press the **ok** key to save the **Edit Unit** menu. Press the **C** key to close 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	{			}	~	

SSI offset

Using the RESET / SET VALUE command (via keyboard command, control input or PC user interface; see the "6.13 Command menu" section on page 77) causes the not yet scaled, currently acquired position value of the encoder (after bit suppression and execution of the encoder zero offset, if possible) to be transferred to the SSI offset parameter. The display is zero set. From the new

display zero point, it is now possible to move toward either the positive or negative direction, depending on the direction of rotation. For more information please refer to the "6.3.2.7 Considering the SSI offset" section on page 51.

0	Smallest value
...	
99999999	Highest value

SSI zero

Using the ZERO POSITION command (via keyboard command, control input or PC user interface; see the "6.13 Command menu" section on page 77) causes the current SSI position value of the encoder to be transferred to the **SSI zero** parameter. The actual encoder zero point is shifted accordingly (encoder zero offset).

0	Smallest value
...	
99999999	Highest value

Round loop value

This parameter sets the number of encoder counts when a round-loop function is desired.

0	The round loop function is disabled, encoder data is displayed as it is
...	
99999999	Number of counts for the round loop function

Sampling time (s)

It allows to set the reading cycle of the SSI signal when the **Mode** parameter is set to MASTER. The value is expressed in seconds (s).

0.001	Shortest measurement time
0.010	Default value
9.999	Longest measurement time

NOTE
The **Sampling time (s)** value of the position measurement must always be set less than the **Sampling time (s)** value of the speed measurement.

6.5 Speed settings menu

The **Speed settings** menu allows to set the values needed to provide the speed display information.

Factor

It sets the factor by which the measured value will be multiplied for the speed display.

-99999999	Smallest value
1	Default value
+99999999	Highest value

NOTE

When the default settings are set (**Factor** = 1; **Divider** = 1), the displayed speed has to be interpreted as the difference between the SSI increments covered per second (SSI inc/s).

Divider

It sets the divider by which the measured value will be divided for the speed display.

-99999999	Smallest value
1	Default value
+99999999	Highest value

NOTE

When the default settings are set (**Factor** = 1; **Divider** = 1), the displayed speed has to be interpreted as the difference between the SSI increments covered per second (SSI inc/s).

Decimal point

It sets the position of the decimal point for the speed display.

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

Scale units

This parameter sets the required engineering unit. It does not affect the calculation of the display value, it is to be intended as a label. The number of decimal places must be set in the Decimal point parameter.

0	inch	
1	feet	
2	mm	
3	cm	
4	m	
5	km	
6	dm	
7	Grad	
8	degree	
9	Min:Sec	
10	H:M:S	
11	inc/s	
12	inch/s	Default
13	feet/s	
14	mm/s	
15	cm/s	
16	m/s	
17	Km/s	
18	dm/s	
19	inch/min	
20	feet/min	
21	mm/min	
22	cm/min	
23	m/min	
24	Km/min	
25	dm/min	
26	inch/h	
27	feet/h	
28	km/h	
29	Edit unit	A customized measuring unit with up to 16 digits can be edited using this parameter.

When you press the `ok` key the **Edit Unit** menu appears.

A measuring unit can be created using the arrow keys (by pressing and holding the arrow key down the characters scroll fast).

Press the `ok` key to save the **Edit Unit** menu.

Press the `C` key to close 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	{			}	~	

Average filter

It sets an average filter to avoid displaying fluctuations in the speed display.

0	No average calculation
1	Average value is calculated within 2 cycles
2	Average value is calculated within 4 cycles
3	Average value is calculated within 8 cycles
4	Average value is calculated within 16 cycles

Sampling time (s)

It allows to set the sampling interval at which the speed evaluation is carried out. The value is expressed in seconds (s).

0.1	Minimum sampling interval
0.5	Default value
9.9	Maximum sampling interval

NOTE

The **Sampling time (s)** value of the speed measurement must always be set higher than the read-in cycle of two consecutive SSI telegrams (see the **Sampling time (s)** value of the position display on page 57).

6.6 Preselection values menu

The **Preselection values** menu is used to set the preselection values or the switching points. They always refer to the SOURCE selected in each **Preselection** menu.

The preselection values / switching points are always referred to the display value.

This menu is only available for devices with order codes AVI, DO, or RO.

Preselection 1

Preselection / switching point 1. The features of Preselection 1 must be set in the **Preselection 1** menu, see "6.7 Preselection 1 menu" section on page 62.

–99999999	Smallest value
1000	Default value
+99999999	Highest value

Preselection 2

Preselection / switching point 2. The features of Preselection 2 must be set in the **Preselection 2** menu, see "6.8 Preselection 2 menu" section on page 66.

–99999999	Smallest value
2000	Default value
+99999999	Highest value

Preselection 3

Preselection / switching point 3. The features of Preselection 3 must be set in the **Preselection 3** menu, see "6.9 Preselection 3 menu" section on page 68.

–99999999	Smallest value
3000	Default value
+99999999	Highest value

Preselection 4

Preselection / switching point 4. The features of Preselection 4 must be set in the **Preselection 4** menu, see "6.10 Preselection 4 menu" section on page 70.

–99999999	Smallest value
4000	Default value
+99999999	Highest value

6.7 Preselection 1 menu

The **Preselection 1** menu is only available for devices with order codes AVI, DO, and RO. It allows to set the characteristics of **Preselection 1**: the reference source, the switching conditions, and other definitions for the preset value / switching point 1.

Source 1

This parameter sets the reference source for **Preselection 1**.

0	POSITION	Result of the position measurement
1	SPEED	Result of the speed measurement

Mode 1

Switching conditions for **Preselection 1**. The output / relay / display switches under the following conditions:

0	|RESULT|>=|PRES|	The absolute display value is greater than or equal to the absolute value of **Preselection 1**. If **Hysteresis 1** is greater than 0, the following switching condition is applied: Display value ≥ **Preselection 1** → ON Display value < **Preselection 1** – **Hysteresis 1** → OFF
1	|RESULT|<=|PRES|	The absolute display value is less than or equal to the absolute value of **Preselection 1** (start up delay setting – see the **Start up delay 1 (s)** parameter on page 65- is advisable). If **Hysteresis 1** is greater than 0, the following switching condition is applied: Display value ≤ **Preselection 1** → ON Display value > **Preselection 1** + **Hysteresis 1** → OFF
2	|RESULT|=|PRES|	The absolute display value is equal to the absolute value of **Preselection 1**. A range (**Preselection 1** +/- ½ **Hysteresis 1**) can be defined and monitored along with a hysteresis value. If **Hysteresis 1** is greater than 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 than or equal to **Preselection 1**, e.g. an overspeed is detected. If **Hysteresis 1** is greater than 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 than or equal to **Preselection 1**, e.g. an underspeed is detected (start up delay setting -see the **Start up delay 1 (s)** parameter on page 65- is advisable). If **Hysteresis 1** is greater than 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 to **Preselection 1**. A range (**Preselection 1** +/- ½ **Hysteresis 1**) can be defined and monitored along with a hysteresis value. If **Hysteresis 1** is greater than 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 than or equal to **Preselection 2** – **Preselection 1** → ON **Preselection 1** is the trailing preselection from **Preselection 2**.
7	ERROR SET	Error messages for device errors.

Hysteresis 1

This parameter sets the switching hysteresis of the switch-off point for **Preselection 1** value.

0	No switching hysteresis
...	
99999	Switching hysteresis = +99999

Pulse time 1 (s)

Duration of the output pulse for the switching condition of **Preselection 1** value.

00.000	No output pulse (static signal)
...	
60.000	Pulse duration = 60 seconds

Output target 1

Assignment of an output or relay for the switching condition of **Preselection 1** value.

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

0	**NO**	No switching condition assigned
1	**CTRL OUT 1**	Switching condition assigned to "20 - Ctrl. Out 1"
2	**CTRL OUT 2**	Switching condition assigned to "21 - Ctrl. Out 2"
3	**CTRL OUT 3**	Switching condition assigned to "22 - Ctrl. Out 3"
4	**CTRL OUT 4**	Switching condition assigned to "23 - Ctrl. Out 4"
5	**RELAY 1**	Switching condition assigned to "27-28-29 - Rel. 1"
6	**RELAY 2**	Switching condition assigned to "30-31-32 - 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**
1	**YES**	Latch for **Preselection 1** (command **4 – LOCK RELEASE** -see the **Input 1 action** parameter on page 77- will clear the latch).

Start up delay 1 (s)

Start up delay setting for the switching condition of **Preselection 1**. It is the delay before starting the monitoring function.

This adjustment only applies to the switching conditions **1 – |RESULT|<=| PRES|** and **4 – RESULT<=PRES** (see the **Mode 1** parameter on page 62). When the display value is 0, the start up delay is set to this parameter. The timer starts when the display value is not equal to 0. The monitoring function remains deactivated until the set time has elapsed.

00.000	No start up delay setting
...	
60.000	Start up delay setting expressed in seconds

NOTE
Start up delay 3 (s) and **Start up delay 4 (s)** (see on pages 69 and 71 respectively) have an automatic start up delay setting.

Event color 1

Event-depending change of colour of the display for the switching condition of **Preselection 1**. **Event color 1** has the lowest priority. **Event color 2**, **Event color 3**, and **Event color 4** are allowed to overwrite this change of colour.

0	NO CHANGE	No change of colour
1	CHANGE TO RED	Colour of display changes to red
2	CHANGE TO GREEN	Colour of display changes to green
3	CHANGE TO YELLOW	Colour of display changes to yellow

6.8 Preselection 2 menu

The **Preselection 2** menu is only available for devices with order codes AVI, DO, and RO. It allows to set the characteristics for **Preselection 2**: the reference source, the switching conditions, and other definitions for the preset value / switching point 2.

Source 2

This parameter sets the reference source for **Preselection 2**. For complete information please refer to the **Source 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

Mode 2

Switching conditions for **Preselection 2**. The output / relay / display switches under the following conditions:

0 ... 5 and 7		For complete information on the switching conditions 0 ... 5 and 7, please refer to the **Mode 1** parameter in the "6.7 Preselection 1 menu" section on page 62.
6	**RES>=PRES–TRAIL**	Trailing **Preselection 2**: Display value is greater than or equal to **Preselection 1** – **Preselection 2** → ON **Preselection 2** is the trailing preselection from **Preselection 1**.

Hysteresis 2

This parameter sets the switching hysteresis of the switch-off point for **Preselection 2** value. For complete information please refer to the **Hysteresis 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

Pulse time 2 (s)

Duration of the output pulse for the switching condition of **Preselection 2** value. For complete information please refer to the **Pulse time 1 (s)** parameter in the "6.7 Preselection 1 menu" section on page 62.

Output target 2

Assignment of an output or relay for the switching condition of **Preselection 2** value. For complete information please refer to the **Output target 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

Output polarity 2

Polarity for the switching condition of **Preselection 2**. For complete information please refer to the **Output polarity 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

Output lock 2

Latch for the switching condition of **Preselection 2**. For complete information please refer to the **Output lock 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

Start up delay 2 (s)

Start up delay setting for the switching condition of **Preselection 2**. It is the delay before starting the monitoring function.

For complete information please refer to the **Start up delay 1 (s)** parameter in the "6.7 Preselection 1 menu" section on page 62.

NOTE
Start up delay 3 (s) and **Start up delay 4 (s)** (see on pages 69 and 71 respectively) have an automatic start up delay setting.

Event color 2

Event-depending change of colour of the display for the switching condition of **Preselection 2**. **Event color 2**, **Event color 3**, and **Event color 4** have the highest priority and are allowed to overwrite the change of colour set next to the **Event color 1** parameter. For complete information please refer to the **Event color 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

6.9 Preselection 3 menu

The **Preselection 3** menu is only available for devices with order codes AVI, DO, and RO. It allows to set the characteristics for **Preselection 3**: the reference source, the switching conditions, and other definitions for the preset value / switching point 3.

Source 3

This parameter sets the reference source for **Preselection 3**. For complete information please refer to the **Source 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

Mode 3

Switching conditions for **Preselection 3**. The output / relay / display switches under the following conditions:

0 … 5 and 7		For complete information on the switching conditions 0 … 5 and 7, please refer to the **Mode 1** parameter in the "6.7 Preselection 1 menu" section on page 62.
6	**RES>=PRES–TRAIL**	Trailing **Preselection 3**: Display value is greater than or equal to **Preselection 4** – **Preselection 3** → ON **Preselection 3** is the trailing preselection from **Preselection 4**.

Hysteresis 3

This parameter sets the switching hysteresis of the switch-off point for **Preselection 3** value. For complete information please refer to the **Hysteresis 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

Pulse time 3 (s)

Duration of the output pulse for the switching condition of **Preselection 3** value. For complete information please refer to the **Pulse time 1 (s)** parameter in the "6.7 Preselection 1 menu" section on page 62.

Output target 3

Assignment of an output or relay for the switching condition of **Preselection 3** value. For complete information please refer to the **Output target 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

Output polarity 3

Polarity for the switching condition of **Preselection 3**. For complete information please refer to the **Output polarity 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

Output lock 3

Latch for the switching condition of **Preselection 3**. For complete information please refer to the **Output lock 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

Start up delay 3 (s)

Start up delay setting for the switching condition of **Preselection 3**. It is the delay before starting the monitoring function.

This adjustment only applies to the switching conditions **1 – |RESULT|<=| PRES|** and **4 – RESULT<=PRES** (see the **Mode 3** parameter on page 68). The automatic start up suppression is activated when the parameter is switched on and the display value is 0. The monitoring function remains deactivated until the preset value / switching point is exceeded for the first time.

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

NOTE
Start up delay 1 (s) and **Start up delay 2 (s)** (see on pages 65 and 67 respectively) have a time-dependent start up delay setting.

Event color 3

Event-depending change of colour of the display for the switching condition of **Preselection 3**. **Event color 2**, **Event color 3**, and **Event color 4** have the highest priority and are allowed to overwrite the change of colour set next to the **Event color 1** parameter. For complete information please refer to the **Event color 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

6.10 Preselection 4 menu

The **Preselection 4** menu is only available for devices with order codes AVI, DO, and RO. It allows to set the characteristics for **Preselection 4**: the reference source, the switching conditions, and other definitions for the preset value / switching point 4.

Source 4

This parameter sets the reference source for **Preselection 4**. For complete information please refer to the **Source 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

Mode 4

Switching conditions for **Preselection 4**. The output / relay / display switches under the following conditions:

0 ... 5 and 7		For complete information on the switching conditions 0 ... 5 and 7, please refer to the **Mode 1** parameter in the "6.7 Preselection 1 menu" section on page 62.
6	**RES>=PRES–TRAIL**	Trailing **Preselection 4**: Display value is greater than or equal to **Preselection 3** – **Preselection 4** → ON **Preselection 4** is the trailing preselection from **Preselection 3**.

Hysteresis 4

This parameter sets the switching hysteresis of the switch-off point for **Preselection 4** value. For complete information please refer to the **Hysteresis 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

Pulse time 4 (s)

Duration of the output pulse for the switching condition of **Preselection 4** value. For complete information please refer to the **Pulse time 1 (s)** parameter in the "6.7 Preselection 1 menu" section on page 62.

Output target 4

Assignment of an output or relay for the switching condition of **Preselection 4** value. For complete information please refer to the **Output target 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

Output polarity 4

Polarity for the switching condition of **Preselection 4**. For complete information please refer to the **Output polarity 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

Output lock 4

Latch for the switching condition of **Preselection 4**. For complete information please refer to the **Output lock 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

Start up delay 4 (s)

Start up delay setting for the switching condition of **Preselection 4**. It is the delay before starting the monitoring function.

This adjustment only applies to the switching conditions **1 – |RESULT|<=| PRES|** and **4 – RESULT<=PRES** (see the **Mode 4** parameter on page 70). The automatic start up suppression is activated when the parameter is switched on and the display value is 0. The monitoring function remains deactivated until the preset value / switching point is exceeded for the first time.

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

NOTE
Start up delay 1 (s) and **Start up delay 2 (s)** (see on pages 65 and 67 respectively) have a time-dependent start up delay setting.

Event color 4

Event-depending change of colour of the display for the switching condition of **Preselection 4**. **Event color 2**, **Event color 3**, and **Event color 4** have the highest priority and are allowed to overwrite the change of colour set next to the **Event color 1** parameter. For complete information please refer to the **Event color 1** parameter in the "6.7 Preselection 1 menu" section on page 62.

6.11 Serial menu

The **Serial** menu allows to configure the basic settings of the serial interface (terminal blocks 16, 17 and 18). For complete information on the serial port features, please refer to the "4.7 Serial interface (-AVI- and -DO- order codes)" section on page 26.

This function is only available for devices with order codes AVI and DO.

Unit number

This parameter allows to set the address of the serial device. You can assign to the unit any address number between 11 and 99. The address must <u>not</u> contain any "0" because such numbers (20, 30, ...) are reserved for collective addressing (broadcast address).

11	Smallest address value
...	
99	Highest address value

Serial baud rate

This parameter allows to set the serial transmission speed (baud rate).
Available options are:

0	9600	9,600 baud
1	19200	19,200 baud
2	38400	38,400 baud

Serial format

This parameter allows to set the bit data format.

		Data Bits	Parity Bit	Stop Bits
0	7-EVEN-1	7	even	1
1	7-EVEN-2	7	even	2
2	7-ODD-1	7	odd	1
3	7-ODD-2	7	odd	2
4	7-NONE-1	7	no	1
5	7-NONE-2	7	no	2
6	8-EVEN-1	8	even	1
7	8-ODD-1	8	odd	1
8	8-NONE-1	8	no	1
9	8-NONE-2	8	no	2

Serial init

This parameter allows to set the baud rate for the transmission of the initialization values to the OS software tool. If you set transmission values higher than 9,600 baud, the duration of the initialization procedure will be shortened.

0	NO	The initialization values will be transmitted at 9,600 baud. After initialization the unit will operate according to the user settings again.
1	YES	The initialization values will be transmitted according to the user defined baud rate (**Serial baud rate** parameter). After initialization the unit will go on operating according to the user settings again.

Serial protocol

It sets the sequence of characters to be sent when using the serial output for cyclic data transmission under time control (see the **Serial timer (s)** parameter). If you set the option "1" the unit address is removed from the string, this results in a slightly faster transmission cycle.

The transmission string will be as follows:
Option 0

UN	UN	+ / -	X	X	X	X	X	X	X	LF	CR

Option 1

+ / -	X	X	X	X	X	X	X	LF	CR

Where:

UN UN = serial address, e.g. "1 1". See the **Unit number** parameter in the previous page (option **0** only)

+ / - = plus / minus signs, i.e. positive / negative sign of transmitted value

X X X X X X X = data to be transmitted according to the setting in the **Serial value** parameter

LF = line feed character

CR = carriage return character

0	Transmission string with serial address
1	Transmission string without serial address

Serial timer (s)

This parameter sets the cycle time for the cyclic transmission of data set in the Serial value parameter when using the serial output. The value is expressed in seconds. In case of a serial request, the cyclic transmission is stopped for 20 s.

00.000	Cyclic transmission is switched off. The unit will send data following a serial request or a "**7 – Serial print**" command (see the Input 1 action, Input 2 action, and Input 3 action parameters on pages 77 and 79).
...	
60.000	Cycle time expressed in seconds.

Serial value

This parameter sets the value to be transmitted.

0	:0	SSI position
1	:1	SSI Data
2	:2	SSI Single
3	:3	SSI Rev
4	:4	SSI Dir Result
5	:5	SSI Mask Result
6	:6	Minimal Value
7	:7	Maximal Value
8	:8	Result speed
9	:9	Result position

MODBUS

This parameter enables the Modbus protocol and allows to set the Modbus address.
For details on the Modbus communication please refer to the "8 - Modbus RTU Interface" section on page 88.

0	Modbus protocol is disabled: the serial interface is using the Lecom protocol.
1 ... 247	Modbus protocol is enabled: the serial interface is using the Modbus RTU protocol. The set value is the Modbus address of the device.

6.12 Analog menu

The **Analog** menu allows to configure the basic settings of the analogue output (terminal blocks 13 and 14 / 15).

For complete information on the analogue output features, please refer to the "4.6 Analogue output (-AVI- order code)" section on page 25.

This function is only available for devices with order code AVI.

Analog source

This parameter sets the reference source for the analogue output.

0	POSITION	Result of the position measurement
1	SPEED	Result of the speed measurement

Analog format

This parameter sets the characteristics of the analogue output. The analogue output is proportional to the display value.

If **Analog format** is set to "**0 = –10...10V**", the polarity of the analogue output depends on the polarity of the display value.

0	–10...10V	–10 V ... +10 V
1	0...20MA	0 ... 20 mA
2	4...20MA	4 ... 20 mA

Analog start

This parameter sets the start value of the analogue conversion. The start value corresponds to the display value for an analogue output of 0 V or 0 mA or 4 mA depending on the set **Analog format**.

–99999999	Smallest start value
00000000	Default value
+99999999	Highest start value

Analog end

This parameter sets the end value of the analogue conversion. The end value corresponds to the display value for an analogue output of (+/-)10 V or 20 mA depending on the set **Analog format**.

–99999999	Smallest start value
+00010000	Default value
+99999999	Highest start value

Analog gain (%)

This parameter sets the maximum output value of the analogue output expressed in percentage (%) of (+/-)10 V or 20 mA.

000.00	Smallest gain
100.00	Default value
110.00	Highest gain

EXAMPLE

If you set "102.00" next to this item the result will be a conversion of 10.2 V or 20.4 mA when the value set next to the **Analog end** parameter is reached.
If you set "95.00" next to this item the result will be a conversion of 9.5 V or 18 mA when the value set next to the **Analog end** parameter is reached.

Analog offset

This parameter sets the zero offset of the analogue output.

–99.99	Smallest offset
00.00	Default value
+99.99	Highest offset

EXAMPLE

If you set "+00.20" next to this item the result will be an offset of 0.02 V or 0.04 mA as regards the **Analog start** value.

6.13 Command menu

The **Command** menu allows to configure the operation of the inputs "10 - Ctrl. In 1", "11 - Ctrl. In 2", and "12 - Ctrl. In 3".

For complete information on the control inputs features, please refer to the "4.5 Control inputs" section on page 24.

Input 1 action

This parameter sets the function of the input "10 - Ctrl. In 1".

0	NO	No function	
1	RESET/SET VALUE	The currently acquired position value is transferred -after bit suppression and possibly performed encoder zero offset- to the SSI offset parameter, see on page 56.	(d) (s)
2	FREEZE	It freezes all display values. **NOTE** Analogue output and switching outputs still react to changes!	(s)
3	KEY LOCK	It disables the touch screen.	(s)
4	LOCK RELEASE	It releases the lock in all outputs / relay.	(d)
5	RESET MIN/MAX	It resets the minimum / maximum values.	(d) (s)
6	SERIAL PRINT	It allows serial data to be transmitted, see the Serial value parameter on page 74.	(d)
7	TEACH PRESEL. 1	The current display value is stored as Preselection 1 (see the Preselection 1 parameter on page 61). The reference source is the one selected in Source 1, see on page 62.	(d)
8	TEACH PRESEL. 2	The current display value is stored as Preselection 2 (see the Preselection 2 parameter on page 61). The reference source is the one selected in Source 2, see on page 66.	(d)
9	TEACH PRESEL. 3	The current display value is stored as Preselection 3 (see the Preselection 3 parameter on page 61). The reference source is the one selected in Source 3, see on page 68.	(d)
10	TEACH PRESEL. 4	The current display value is stored as Preselection 4 (see the Preselection 4 parameter on page 61). The reference source is the one selected in Source 4,	(d)

		see on page 70.	
11	SCROLL DISPLAY	It scrolls through the available display screens (see the "5.2 Screen structure during operation" section on page 30).	(d)
12	CLEAR LOOP TIME	It clears all latched switching conditions.	
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 colour can be changed by setting an event-dependent switching condition (see the parameters Event color 1, Event color 2, Event color 3, and Event color 4 in the "6.7 Preselection 1 menu" … "6.10 Preselection 4 menu" on page 62 ff).	(d)
18	SET GREEN COLOR	The display lights up green. The colour can be changed by setting an event-dependent switching condition (see the parameters Event color 1, Event color 2, Event color 3, and Event color 4 in the "6.7 Preselection 1 menu" … "6.10 Preselection 4 menu" on page 62 ff).	(d)
19	SET YELLOW COLOR	The display lights up yellow. The colour can be changed by setting an event-dependent switching condition (see the parameters Event color 1, Event color 2, Event color 3, and Event color 4 in the "6.7 Preselection 1 menu" … "6.10 Preselection 4 menu" on page 62 ff).	(d)
20	ZERO POSITION	The current SSI value is transferred to the SSI zero parameter (encoder zero offset), see on page 57.	(d) (s)
21	INC. BRIGHTNESS	The brightness of the display is increased.	(d) (s)
22	DEC. BRIGHTNESS	The brightness of the display is reduced	(d) (s)

(s) = static switching (level evaluation)
Input 1 config. parameter must be set to be active at LOW / HIGH level (see options 0 – ACTIVE LOW and 1 – ACTIVE HIGH).

(d) = dynamic switching (edge evaluation)
Input 1 config. parameter must be set to activate at rising / falling edge (see options 2 – RISING EDGE and 3 - FALLING EDGE).

N.A. = not available

Input 1 config.

This parameter sets the switching characteristics of the input "10 - Ctrl. In 1".

0	ACTIVE LOW	It is active at "LOW" level (static)
1	ACTIVE HIGH	It is active at "HIGH" level (static)
2	RISING EDGE	It activates at rising edge
3	FALLING EDGE	It activates at falling edge

Input 2 action

This parameter sets the function of the input "11 - Ctrl. In 2". For complete information please refer to the **Input 1 action** parameter on page 77.

Input 2 config.

This parameter sets the switching characteristics of the input "11 - Ctrl. In 2". For complete information please refer to the **Input 1 config.** parameter on page 79.

Input 3 action

This parameter sets the function of the input "12 - Ctrl. In 3". For complete information please refer to the **Input 1 action** parameter on page 77.

Input 3 config.

This parameter sets the switching characteristics of the input "12 - Ctrl. In 3". For complete information please refer to the **Input 1 config.** parameter on page 79.

6.14 Display menu

The **Display** menu allows to set the features of the display.
Parameter changes become active only after exiting the menu selection.

Source single

It sets the reference source of the value to be displayed in the "single line" AND "large display" visualization modes (see the **Start display** parameter on page 81).

0	POSITION	Result of the position measurement
1	SPEED	Result of the speed measurement

Source dual top

It sets the reference source of the value to be displayed in the first line when the "two line" visualization mode is set (see the **Start display** parameter on page 81).

0	POSITION	Result of the position measurement
1	SPEED	Result of the speed measurement

Source dual down

It sets the reference source of the value to be displayed in the second line when the "two line" visualization mode is set (see the **Start display** parameter on page 81).

0	POSITION	Result of the position measurement
1	SPEED	Result of the speed measurement

Large display

This parameter is used to activate and set the "large display" visualization mode. Using the divider ratio, the large display value can also be adjusted. (The reference source for the large display is the process value set in the **Source single** parameter). The division ratio only affects the values without format adjustment (display format: 99999999).

0	NO	Large display visualization mode is disabled
1	1 : 1	Large display mode with divider ratio 1:1
2	1 : 10	Large display mode with divider ratio 1:10
3	1 : 100	Large display mode with divider ratio 1:100
4	1 : 1000	Large display mode with divider ratio 1:1000
5	1 : 10000	Large display mode with divider ratio 1:10000

Start display

This parameter sets the visualization mode of the display after the device is switched on.

0	STANDARD	The display shows engineering units and status bar. See also on page 30.
1	LARGE	The display starts in the "large display" visualization mode. The **Large display** option must be active, see the next item. See also on page 30.
2	DOUBLE	The display shows two lines without engineering units.
3	DOUBLE WITH UNITS	The display shows two lines with additional engineering units.
4	COMMAND	The display shows the command keys. It is available only when the **Skip window** parameter is enabled.
5	QUICKSTART	The display starts in "quick start" visualization mode and allows to enter the preselection values. It is only available for devices with order codes AVI, DO and RO. See also on page 30.
6	MINIMUM/ MAXIMUM	The display shows maximum and minimum values. See also on page 30.

Color

This parameter sets the colour of the display.

It is also possible to enable an event-depending change of the colour of the display by setting a switching condition (see the parameters **Event color 1**, **Event color 2**, **Event color 3**, and **Event color 4** in the "6.7 Preselection 1 menu" ... "6.10 Preselection 4 menu" on page 62 ff).

Event-depending changes are only available for devices with order codes AVI, DO, and RO.

0	RED	The display is coloured in red
1	GREEN	The display is coloured in green
2	YELLOW	The display is coloured in yellow

Brightness (%)

This parameter sets the brightness of the display in percentage (%).

010	Minimum brightness
090	Default value
100	Maximum brightness

Contrast

This parameter sets the viewing angle.

0	Viewing angle from top
1	Viewing angle from centre
2	Viewing angle from bottom

Screen saver (s)

This parameter sets the time expressed in seconds before the display is switched off, starting from the last touch action.
A new touch action will activate the display again.

0000	Screen saver not active
...	
9999	Longest time before the screen saver is activated

Up-date-time (s)

This parameter sets the update time of the display (refresh of the display), the value is expressed in seconds. It does not affect the parameter values.

0.005	Shortest update time
0.100	Default value
9.999	Longest update time

Font

This parameter sets the font style.

0	Standard
1	Font 1

Skip window

This parameter allows to skip single display windows.

Show all	Visualization of all display windows is enabled.
Skip Command Key	The display window for commands is skipped.
Skip Double	The display windows with double display are skipped.
Skip Quickstart	The display window for the quick start of the preselection values is skipped.

Skip Min / Max	The display window for the maximum / minimum values is skipped.

Diagnostic display

By means of this parameter the double display without units can be used as a diagnostic window. When the diagnostic window is activated, the top line shows the current SSI value in the revolution of the encoder (counts per revolution) while the bottom line shows the total number of revolutions already executed (number of revolutions).

0	NO	Diagnostic window is deactivated
1	YES	Diagnostic window is activated

NOTE

If the diagnostic window is deactivated, the process values set in **Source dual top** and **Source dual down** (see on page 80) is also shown in the double display without units.

6.15 Linearization menu

The linearisation function is configured in this menu. This menu is displayed only if the **Linearization mode** parameter in the **General** menu (see on page 39) is set to either "1 – 1 QUADRANT" or "2 – 4 QUADRANT"; if 0 – OFF option is set the **Linearization** menu does not appear.

For a complete description of the linearisation function and some examples refer to the "6.15.1 Description of the linearisation function" section below.

Source

This parameter sets the reference source which has to be used for linearization.

0	POSITION	Result of the position measurement
1	SPEED	Result of the speed measurement

P1(X)

...

P24(X)

X-coordinate of the linearisation point.
This value represents the display value the unit shows on the display without linearisation.

–99999999	Smallest X-coordinate
00000000	Default value
+99999999	Largest X-coordinate

P1(Y)

...

P24(Y)

Y-coordinate of the linearisation point.
This is the display value the unit will show on the display after linearisation.

EXAMPLE
P2(X) parameter value will be replaced by **P2(Y)** parameter value.

–99999999	Smallest Y-coordinate
00000000	Default value
+99999999	Largest Y-coordinate

6.15.1 Description of the linearisation function

The linearisation function allows to convert a linear input signal into a non-linear representation (or vice versa). 24 programmable X / Y coordinates (interpolation points) are available, they can be freely arranged over the whole conversion range at any desired distance. The unit uses linear interpolation between two coordinates. Therefore it is advisable to set several coordinates where the curvature is greater and only few coordinates where the curvature is lesser.

If you need to set an individual linearisation curve, the **Linearization mode** parameter in the **General** menu (see on page 39) must be set to either "1 - 1 QUADRANT" or "2 - 4 QUADRANT" (see the diagrams below).

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

Parameters **P1(Y)** to **P24(Y)** are the values that the unit will generate instead of the X values, i.e. for instance **P5(Y)** replaces **P5(X)** etc.

The X coordinates must use continuously increasing settings, i.e. P1(X) must have the lowest setting while P24(X) must have the highest setting (P1(X) < P2(X) < P3(X) ... < P23(X) < P24(X)). If the measured value is greater than the last defined X value, the corresponding Y value is displayed.
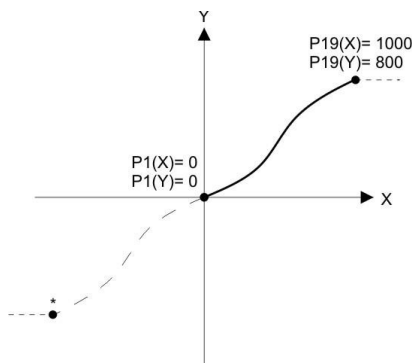
Example: Linearization Mode: 1 Quadrant
* Linearization is point symmetric to 1. Quadrant
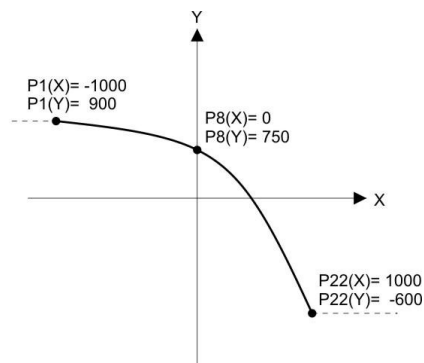
Example: Linearization Mode: 4 Quadrant

If the **Linearization mode** parameter in the **General** menu is set to "1 – 1 QUADRANT", **P1(X)** parameter must be set to zero. Linearisation is only defined in the positive range and the negative range will be mirrored symmetrical with respect to the central point.

If the **Linearization mode** parameter in the **General** menu is set to "2 – 4 QUADRANT", **P1(X)** parameter can be set also to a negative value. If the measured value is smaller than **P1(X)**, **P1(Y)** is displayed.

EXAMPLE

The picture below shows a sluiceway where the gate is controlled by means of an incremental encoder. We want to display the opening of the gate "d", the existing encoder information is proportional to the angular information φ.

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

Incremental Encoder
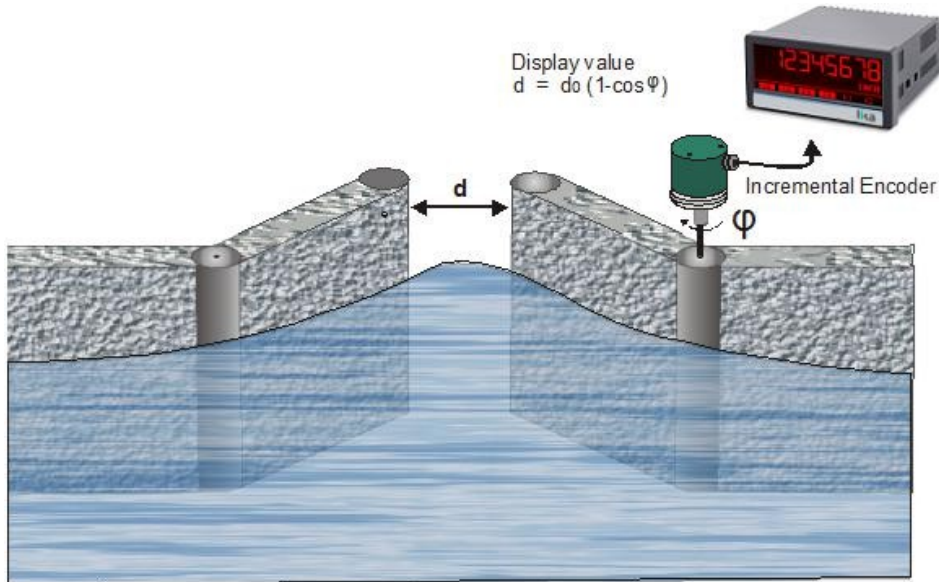
In this case we need to convert a non-linear input signal (incremental encoder signals φ) into a linear representation (opening of the gate "d"). In the x-axis we must set the actual values detected by the encoder while in the y-axis we will set the opening values of the gate.
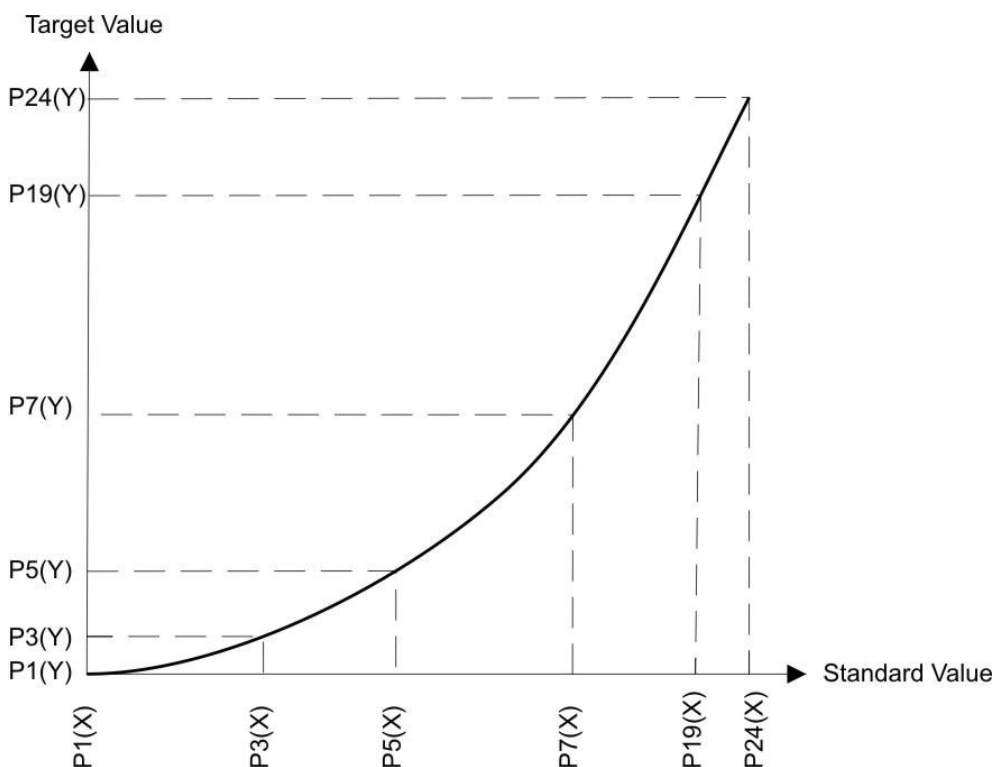
7 – Appendix

7.1 Data readout via serial interface

All codes shown in the **Serial value** parameter (see the "6.11 Serial menu" section on page 72) are available for serial readout by a PC or a PLC. For communication the monitors use the Drivecom Protocol according to ISO 1745. All protocol details can be found in the user's guide "MAN Serial Protocol IFxx_LD25x_LD30x I_E.pdf". It is available for download from our web page www.lika.biz.

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 CTRL D (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 CTRL E (Hex 05)

EXAMPLE
The following example shows the request string for readout of the serial code = 1 from a unit having 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

Following a correct request, the unit will respond:

STX	C1	C2	xxxxx	ETX	BCC

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

8 – Modbus RTU Interface

LD220 series display is a standard Modbus RTU Slave and provides the following Modbus functions:

- Read Coils
- Write Single Coil
- Read Holding Registers
- Write Multiple Registers
- Diagnostic information

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

8.1 Parameter setting

The following parameters available in the "6.11 Serial menu" section (see on page 72) are required for Modbus protocol:

Unit number

Not used for Modbus communication.
If you need to set the Modbus address refer to the MODBUS parameter on page 74.

Serial baud rate

This parameter allows to set the serial transmission speed (baud rate).
Available options are:

0	9600	9,600 baud
1	19200	19,200 baud
2	38400	38,400 baud

Serial format

This parameter allows to set the bit data format.

		Data Bits	Parity Bit	Stop Bits
0	7-EVEN-1			
1	7-EVEN-2			
2	7-ODD-1		Not to be used for Modbus communication	
3	7-ODD-2			
4	7-NONE-1			
5	7-NONE-2			
6	8-EVEN-1	8	even	1
7	8-ODD-1	8	odd	1

8	8-NONE-1	Not to be used for Modbus communication		
9	**8-NONE-2**	8	no	2

Serial init

Not used for Modbus communication.

Serial protocol

Not used for Modbus communication.

Serial timer (s)

Not used for Modbus communication.

Serial value

Not used for Modbus communication.

MODBUS

This parameter enables the Modbus protocol and allows to set the Modbus address.

0	Not to be used for Modbus communication, Modbus protocol is disabled.
1 ... 247	Modbus protocol is enabled: the serial interface is using the Modbus RTU protocol. The set value is the Modbus address of the device.

8.2 Modbus Communication

The Modbus functions described hereafter are available.

8.2.1 Read Holding Registers and Write Multiple Registers

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

All variables (current data) and status registers are mapped into 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 the Modbus function "Write Single Register" is not possible).

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

8.2.2 Access to parameters

Holding Register 0x0000 / 0x0001 hex and the followings allow to access the device parameters.

The holding register numbers for a certain parameter can be calculated by means of the parameter # that can be found in the parameter table in this manual (see the "9 - Parameters / serial codes" section on page 92):
Holding Register low = (parameter #) x 2
Holding Register high = (parameter #) x 2 + 1

EXAMPLE
Access the parameter # 40 Preselection 1 by using the Holding Register 0x0050 and 0x0051 hex.

8.2.3 Access to current data

Holding Register 0x1000 / 0x1001 hex and the followings allow to access the variables of the device (current data registers):
Holding Register 0x1000 / 0x1001 hex → Current data with serial Code ":0" (Display value)
Holding Register 0x1002 / 0x1003 hex → Current data with serial Code ":1"
Holding Register 0x1004 / 0x1005 hex → Current data with serial Code ":2"
Holding Register 0x1006 / 0x1007 hex → Current data with serial Code ":3"
etc.

8.2.4 Access to status registers

Holding Register 0x2000 / 0x2001 hex and the followings allow to access the 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)

8.2.5 Read Coils and Write Single Coil

Using 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
1	55	Freeze Display	Freeze current 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	Sending of serial data (do not use with Modbus)
6	60	Teach Preset 1	Current display value is stored as **Preselection 1**
7	61	Teach Preset 2	Current display value is stored as **Preselection 2**
8	62	Teach Preset 3	Current display value is stored as **Preselection 3**
9	63	Teach Preset 4	Current display value is stored as **Preselection 4**
10	64	Scroll Display	Display switching (see display in operation mode, see on page 30)
11	65	Clear Loop Time	Release all latched switching conditions
12	66	Start Preselection	The preselection starts
13	67	Activate Data	Data is activated (not required with Modbus)
14	68	Store to EEPROM	Store to EEPROM
15	69	Test program	Test program (do not use with Modbus)

8.2.6 Diagnostics

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

9 – Parameters / serial codes

9.1 General menu

See the "6.2 General menu" section on page 39

#	Parameter	Serial code	Min. value	Max. value	Default value
0	Linearization mode	0	0	2	0
1	Pin preselection	1	0000	9999	0000
2	Pin parameter	2	0000	9999	0000
3	Factory settings	3	0	1	0
4	-	4	0	0	0
5	-	5	0	0	0
6	-	6	0	0	0

9.2 SSI properties menu

See the "6.3 SSI properties menu" section on page 41

#	Parameter	Serial code	Min. value	Max. value	Default value
7	Mode	7	0	1	0
8	Encoder resolution	8	10	32	25
9	Bit per revolution	9	10	16	13
10	Data format	10	0	1	0
11	Baud rate	11	0	5	2
12	High bit	12	1	32	25
13	Low bit	13	1	32	1
14	Direction	14	0	1	0
15	Error bit	15	0	32	0
16	Error polarity	16	0	1	0
17	Encoder supply	17	0	1	1
18	-	18	0	0	0
19	-	19	0	0	0

9.3 Position settings menu

See the "6.4 Position settings menu" section on page 54

#	Parameter	Serial code	Min. value	Max. value	Default value
20	Display format	20	0	2	0
21	Factor	21	-99999999	+99999999	+1
22	Divider	22	-99999999	+99999999	+1
23	Additive value	23	-99999999	+99999999	0
24	Decimal point	24	0	7	0
25	Scale units	25	0	29	0
26	SSI offset	26	0	999999999	0
27	SSI zero	27	0	999999999	0
28	Round loop value	28	0	99999999	0
29	Sampling time (s)	29	1	9999	10
30	-	30	0	0	0
31	-	31	0	0	0

9.4 Speed settings menu

See the "6.5 Speed settings menu" section on page 58

#	Parameter	Serial code	Min. value	Max. value	Default value
32	Factor	32	-99999999	+99999999	+1
33	Divider	33	-99999999	+99999999	+1
34	Decimal point	34	0	7	0
35	Scale units	35	0	29	12
36	Average filter	36	0	4	0
37	Sampling time (s)	37	1	99	5
38	-	38	0	0	0
39	-	39	0	0	0

9.5 Preselection values menu

See the "6.6 Preselection values menu" section on page 61

#	Parameter	Serial code	Min. value	Max. value	Default value
40	Preselection 1	A0	-99999999	+99999999	+1000
41	Preselection 2	A1	-99999999	+99999999	+2000
42	Preselection 3	A2	-99999999	+99999999	+3000
43	Preselection 4	A3	-99999999	+99999999	+4000

9.6 Preselection 1 menu

See the "6.7 Preselection 1 menu" section on page 62

#	Parameter	Serial code	Min. value	Max. value	Default value
44	Source 1	A4	0	1	0
45	Mode 1	A5	0	7	0
46	Hysteresis 1	A6	000.0	99999	0
47	Pulse time 1 (s)	A7	00.000	60.000	0
48	Output target 1	A8	0	6	1
49	Output polarity 1	A9	0	1	0
50	Output lock 1	B0	0	1	0
51	Start up delay 1 (s)	B1	00.000	60.000	0
52	Event color 1	B2	0	3	0
53	-	B3	0	0	0

9.7 Preselection 2 menu

See the "6.8 Preselection 2 menu" section on page 66

#	Parameter	Serial code	Min. value	Max. value	Default value
54	Source 2	B4	0	1	0
55	Mode 2	B5	0	7	0
56	Hysteresis 2	B6	000.0	99999	0
57	Pulse time 2 (s)	B7	00.000	60.000	0
58	Output target 2	B8	0	6	2
59	Output polarity 2	B9	0	1	0
60	Output lock 2	C0	0	1	0
61	Start up delay 2 (s)	C1	00.000	60.000	0
62	Event color 2	C2	0	3	0
63	-	C3	0	0	0

9.8 Preselection 3 menu

See the "6.9 Preselection 3 menu" section on page 68

#	Parameter	Serial code	Min. value	Max. value	Default value
64	Source 3	C4	0	1	0
65	Mode 3	C5	0	7	0
66	Hysteresis 3	C6	000.0	99999	0
67	Pulse time 3 (s)	C7	00.000	60.000	0
68	Output target 3	C8	0	6	3
69	Output polarity 3	C9	0	1	0
70	Output lock 3	D0	0	1	0
71	Start up delay 3 (s)	D1	0	1	0
72	Event color 3	D2	0	3	0
73	-	D3	0	0	0

9.9 Preselection 4 menu

See the "6.10 Preselection 4 menu" section on page 70

#	Parameter	Serial code	Min. value	Max. value	Default value
74	Source 4	D4	0	1	0
75	Mode 4	D5	0	7	0
76	Hysteresis 4	D6	000.0	99999	0
77	Pulse time 4 (s)	D7	00.000	60.000	0
78	Output target 4	D8	0	6	4
79	Output polarity 4	D9	0	1	0
80	Output lock 4	E0	0	1	0
81	Start up delay 4 (s)	E1	0	1	0
82	Event color 4	E2	0	3	0
83	-	E3	0	0	0

9.10 Serial menu

See the "6.11 Serial menu" section on page 72

#	Parameter	Serial code	Min. value	Max. value	Default value
84	Unit number	90	11	99	11
85	Serial baud rate	91	0	2	0
86	Serial format	92	0	9	0
87	Serial init	9~	0	1	0
88	Serial protocol	E4	0	1	0
89	Serial timer (s)	E5	00.000	60.000	0
90	Serial value	E6	0	9	0
91	MODBUS	E7	0	247	0

9.11 Analog menu

See the "6.12 Analog menu" section on page 75

#	Parameter	Serial code	Min. value	Max. value	Default value
92	Analog source	E8	0	1	0
93	Analog format	E9	0	2	0
94	Analog start	F0	-99999999	+99999999	0.0
95	Analog end	F1	-99999999	+99999999	+1000.0
96	Analog gain (%)	F2	000.00	110.00	100.00
97	Analog offset	F3	-99.99	+99.99	0.00
98	-	F4	0	0	0

9.12 Command menu

See the "6.13 Command menu" section on page 77

#	Parameter	Serial code	Min. value	Max. value	Default value
99	Input 1 action	F5	0	22	0
100	Input 1 config.	F6	0	3	2
101	Input 2 action	F7	0	22	0
102	Input 2 config.	F8	0	3	2
103	Input 3 action	F9	0	22	0
104	Input 3 config.	G0	0	3	2
105	-	G1	0	0	0
106	-	G2	0	0	0
107	-	G3	0	0	0
108	-	G4	0	0	0
109	-	G5	0	0	0

9.13 Display menu

See the "6.14 Display menu" section on page 80

#	Parameter	Serial code	Min. value	Max. value	Default value
110	Source single	G6	0	1	0
111	Source dual top	G7	0	1	0
112	Source dual down	G8	0	1	1
113	Large display	G9	0	5	0
114	Start display	H0	0	6	0
115	Color	H1	0	2	0
116	Brightness (%)	H2	010	100	090
117	Contrast	H3	0	2	1
118	Screen saver (s)	H4	0000	9999	0
119	Up-date-time (s)	H5	0.005	9.999	0.100
120	Font	H6	0	1	0
121	Skip window	H7	0	4	0
122	Diagnostic display	H8	0	1	1
123	-	H9	0	0	0

9.14 Linearization menu

See the "6.15 Linearization menu" section on page 84

#	Parameter	Serial code	Min. value	Max. value	Default value
124	Source	I0	0	1	0
125	P1(X)	I1	-99999999	+99999999	0.0
126	P1(Y)	I2	-99999999	+99999999	0.0
127	P2(X)	I3	-99999999	+99999999	0.0
128	P2(Y)	I4	-99999999	+99999999	0.0
129	P3(X)	I5	-99999999	+99999999	0.0
130	P3(Y)	I6	-99999999	+99999999	0.0
131	P4(X)	I7	-99999999	+99999999	0.0
132	P4(Y)	I8	-99999999	+99999999	0.0
133	P5(X)	I9	-99999999	+99999999	0.0
134	P5(Y)	J0	-99999999	+99999999	0.0
135	P6(X)	J1	-99999999	+99999999	0.0
136	P6(Y)	J2	-99999999	+99999999	0.0
137	P7(X)	J3	-99999999	+99999999	0.0
138	P7(Y)	J4	-99999999	+99999999	0.0
139	P8(X)	J5	-99999999	+99999999	0.0
140	P8(Y)	J6	-99999999	+99999999	0.0
141	P9(X)	J7	-99999999	+99999999	0.0
142	P9(Y)	J8	-99999999	+99999999	0.0

(continued)

#	Parameter	Serial code	Min. value	Max. value	Default value
143	P10(X)	J9	-99999999	+99999999	0.0
144	P10(Y)	K0	-99999999	+99999999	0.0
145	P11(X)	K1	-99999999	+99999999	0.0
146	P11(Y)	K2	-99999999	+99999999	0.0
147	P12(X)	K3	-99999999	+99999999	0.0
148	P12(Y)	K4	-99999999	+99999999	0.0
149	P13(X)	K5	-99999999	+99999999	0.0
150	P13(Y)	K6	-99999999	+99999999	0.0
151	P14(X)	K7	-99999999	+99999999	0.0
152	P14(Y)	K8	-99999999	+99999999	0.0
153	P15(X)	K9	-99999999	+99999999	0.0
154	P15(Y)	L0	-99999999	+99999999	0.0
155	P16(X)	L1	-99999999	+99999999	0.0
156	P16(Y)	L2	-99999999	+99999999	0.0
157	P17(X)	L3	-99999999	+99999999	0.0
158	P17(Y)	L4	-99999999	+99999999	0.0
159	P18(X)	L5	-99999999	+99999999	0.0
160	P18(Y)	L6	-99999999	+99999999	0.0
161	P19(X)	L7	-99999999	+99999999	0.0
162	P19(Y)	L8	-99999999	+99999999	0.0
163	P20(X)	L9	-99999999	+99999999	0.0
164	P20(Y)	M0	-99999999	+99999999	0.0
165	P21(X)	M1	-99999999	+99999999	0.0
166	P21(Y)	M2	-99999999	+99999999	0.0
167	P22(X)	M3	-99999999	+99999999	0.0
168	P22(Y)	M4	-99999999	+99999999	0.0
169	P23(X)	M5	-99999999	+99999999	0.0
170	P23(Y)	M6	-99999999	+99999999	0.0
171	P24(X)	M7	-99999999	+99999999	0.0
172	P24(Y)	M8	-99999999	+99999999	0.0

9.15 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 PRESELECTION
67	ACTIVATE DATA
68	STORE EEPROM
69	TEST PROGRAM

Document release	Release date	Description
1.0	12.10.2018	First issue
1.1	08.01.2019	**Bit per revolution** information updated
1.2	29.03.2019	RS-485 information added
1.3	07.05.2019	**Mode 1** and **Start up delay 1 (s)** items updated in all Preselection menus
1.4	30.04.2021	New position display, speed display and large display, additional scaling parameters + source parameters for display, analog and switching outputs added, error messages implemented, **SSI zero** parameter added, Modbus interface added
1.5	17.03.2023	Example added to the "6.3.2.8 Calculation of the display value" section, general revision

Dispose separately

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