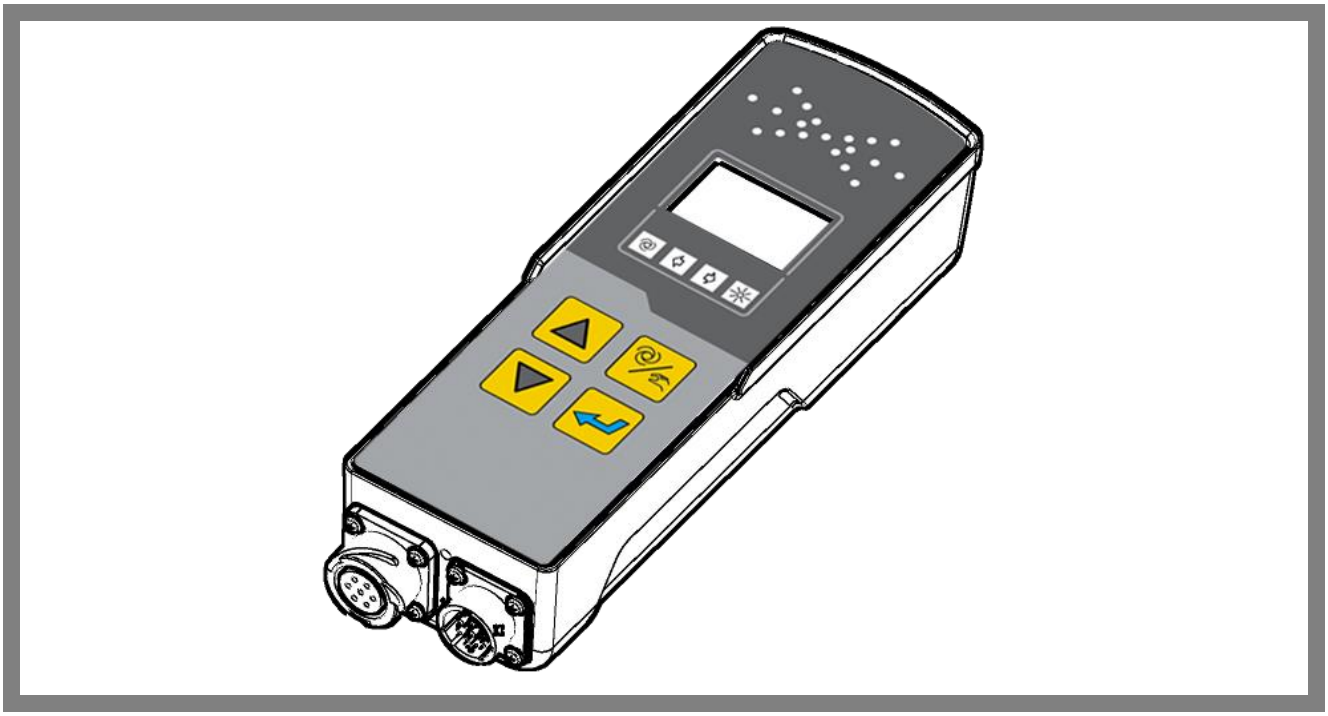
USER MANUAL

MOBA-Matic, CAN, as of Version V2055

MMC-1000

Levelling System for paver, milling machines and other mobile applications



Further applicable documents:

Specifications:

04-03-00415 | 04-21-21010 | 04-25-10300
04-21-10100 | 04-21-30070 | 04-60-11311
04-21-10102 | 04-21-40110 |
CE declaration of conformity

ENGLISH

Translation of the original user manual 10-02-50160
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Please treat this user manual as confidential. It is exclusively intended for people who will be involved with this product.
Text and graphic sections contained in this user manual have been compiled with particular care. No liability can however be assumed for possible defects and their effects.
Information about the layout arrangement and possibly existing errors should be addressed to your dealer. We will of course take up and implement any sensible suggestions and improvement proposals.
Some company and brand names as well as product descriptions are protected by trademark or patent law.
All rights reserved. No part of these documents may be reproduced or transmitted for any purpose without express written permission from MOBA, irrespective of the manner or the means by which this occurs.

Please read this user manual in its entirety before initial use and observe all the safety notices contained within. Always retain this manual for future reference!

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65555 Limburg / Germany
Internet: www.moba.de

1.1 Table of contents

1 General information

1.1 Information relating to the user manual

General

This user manual contains fundamental information that is to be observed during the operation and maintenance of the MOBA-Matic.
A prerequisite for safe operation is the compliance with all specified safety and handling instructions.
It is therefore essential that this user manual be read and utilised by every person who is assigned with the works, such as e.g. operation, troubleshooting and maintenance (service, care).

The user manual is an integral part of the product and must be passed on to third parties or subsequent owners together with the product when applicable. It must be accessible to the operating personnel at the location where the product is used at all times.

In addition, the local accident prevention regulations for the area of application of the product, the general safety regulations and the safety requirements of the machine manufacturer must be observed at all times.

Due to the multiplicity of the possible applications, the function range of the MOBA-Matic in this user manual is primarily explained on the example of a blacktop paver.
Experience has shown that this is the machine model on which the MOBA-Matic is most frequently used.

The MOBA-Matic is available equipped with a wide range of sensor combinations.
When working with your MOBA-Matic System, always execute the works according to this user manual. If your system is not equipped with all sensors, then the description of these sensors is irrelevant for you.

Rights to amendments

We have taken every effort to ensure that this user manual is correct and up-to-date. To maintain our technological advantage, it may however be necessary to initiate amendments to the product and its operation without prior notice which may, in certain cases, differ from this user manual. In this case, your MOBA supplier will always have a current copy of the user manual ready for you. We do not accept liability for malfunctions, faults, failures and resulting damage.

Figures

The figures in this user manual are provided for better understanding. The figures in this user manual may not be to scale or may differ slightly from the original illustrations.

1.2 Explanation of symbols

Warning notices

Warning notices in this user manual are marked by symbols. These notices are described with signal words which express the extent of the danger.
These notices must be strictly complied with and acted upon diligently in order to prevent accidents as well as injuries to people and property damage.

DANGER!

… indicates an immediate hazardous situation which will result in death or serious injury when it is not prevented.

WARNING!

… indicates a potentially hazardous situation which could result in death or serious injury when it is not prevented.

CAUTION!

… indicates a potentially hazardous situation which could result in minor or slight injury when it is not prevented.

CAUTION!

… indicates a potentially hazardous situation which could result in property damage when it is not prevented.

Tips and recommendations

NOTE!

… highlights useful tips and recommendations as well as information for an efficient and malfunction-free operation.

Step by Step	Step by step instructions, which have to be executed by the operating personnel, are enumerated. 1) … 2) … 3) …

Bullet points Enumerations are marked with a black dot.

1.3 Limitation of liability

All instructions and information in this user manual were compiled in observation of the applicable standards and regulations, the current state of the art as well as our many years of expertise and experience.

The manufacturer accepts no liability for damages resulting from:

- Improper mounting and installation
- Failure to observe the operating instructions
- Unintended and improper use
- Use outside of the operating limits
- Use of insufficiently qualified and trained personnel
- Use of unauthorised spare parts and accessories
- Modifications to the product

The current scope of delivery may differ from the explanations and depictions described here in the case of special versions, the utilisation of additional order options, or due to recent technical changes.

1.4 Copyright protection

Refer to Page 2 of this user manual.

1.5 Other applicable documents

Additional information on the installation of the Big Sonic-Skis® and the structure and the setting of the parameter menus of the MOBA-Matic can be found in the following documentation:

10-02-02100 Assembly instructions(s) Big Sonic-Ski®
10-02-00862 Parameter setting MOBA-Matic CAN
10-02-02400 Information sheet for adjusting the sensor IDs to MOBA-MTSC-201

1.6 Spare parts

Genuine spare parts and accessories authorised by the manufacturer serve to enhance safety.
The use of other parts may affect the right of the user to commission the product and may annul liability of the manufacturer for any consequences resulting from use.

CAUTION!

Risk of injury from incorrect spare parts!
Incorrect, faulty or unauthorised spare parts may lead to damages, malfunctions or total failures and may also affect safety.
For these reasons:

- Only use genuine spare parts from the manufacturer.

Ask your MOBA-dealer for original spare parts.

1.7 Final decommissioning / disablement

During the final decommissioning, the components of the MOBA-Matic must be rendered by disablement to protect against recommissioning, particularly by unauthorised third parties.

1) Switch off the power supply of the product.
2) Disconnect all poles of the product.
3) Dismantle the product.
4A) For components with connection cable, → cut off connection cable.
4B) For components with connection plugs, → mechanically destroy connection plug.

1.8 Disposal

Packaging

The products are protected for transport ex-works by special packaging. This packaging consists of environmentally compatible, easily dividable materials and can be recycled. We recommend recycling enterprises for the disposal of the packaging material.

Product

The product must not be disposed of with household waste. Dispose of the product properly.
Provided no return or disposal agreements were made, have disassembled constituent parts recycled:
Scrap any metal material residues;
Dispose of electronic components in accordance with the locally applicable regulations.

CAUTION! **Risk of injury due to improper disposal of the product!**

The burning of plastic parts releases poisonous gases which may cause illness in persons.

For these reasons:

- Properly dispose of product in accordance with the applicable, national, country-specific disposal regulations.

CAUTION! **Risk of injury due to improper disposal of the product!**

Careless disposal enables unauthorised persons to use the product improperly. This could result in severe injury to these persons and/or third parties as well as contaminate the environment.

For these reasons:

- Protect the product from access by unauthorised persons at all times.

1.9 Guarantee provisions

This user manual contains no statement of guarantee.
The guarantee provisions are part of the MOBA MOBILE AUTOMATION AG (MOBA) “Terms and Conditions of Sale and Delivery”.

1.10 Customer Service

Your MOBA Dealer will be pleased to assist with technical requests.

2 Fundamental safety instructions

General

This section provides an overview of all the important aspects of safety for an optimal protection of the personnel as well as for the safe and failure-free operation.
The information should place the operators and users in the position to be able to recognise the danger in time and to prevent it as far as possible in advance.

The operator must ensure that all users understand and adhere to these instructions.

2.1 Intended use

2.1.1 Intended use of the machine

The MOBA-Matic is designed and constructed exclusively for the intended use as described here.

- Automatic control of the tool of the machine (e.g. the planks of a paver) in height and slope in accordance with the reference height, reference line or setpoint value.
- Recording the reference line by utilising ultrasonic sensors.
- Detection of a reference height and/or reference slope by utilising a laser or ultrasonic sensors.
- Recording the tool inclination by utilising a slope sensor.
- Setting various parameters for the hydraulic system performance of the machine.

Any use other than those listed here as well as any use that deviates from the technical data is considered to be a non-intended and improper use.

WARNING! **Danger from improper use!**

Any use that is different and/or goes beyond the intended use of the MOBA-Matic may lead to dangerous situations.
For these reasons:

- Only use the product as intended.
- The drain holes must be regularly inspected for soiling and contamination and must be free at all times in order to avoid moisture in the housing.

2.1.2 Improper use

- Unintended use.
- Operating the buttons with tools or other means.
- Exceeding the limit values specified in the data sheet.
- Using the product without instruction.
- Using the product outside of the operating limits.
- Opening the product (unless explicitly permitted for specific purposes).
- Rebuilding or modifying the product.
- Commissioning the product after misappropriation.
- Using the product if there are obvious deficiencies or damages.
- Using the product with unauthorised accessories from third-party manufacturers.
- Using the product at an inadequately secured construction site area (e.g. during road works)
- Using the product to control machines, systems or moving objects when these are not equipped with an additional control system.

2.2 Operating limits

The MOBA-Matic is designed for use in an atmosphere appropriate for permanent human habitation. It must not be used in aggressive or explosive environments.

Local safety authorities and safety management personnel are to be contacted by the system owner before working in hazardous environments, near electrical systems or in similar situations.

2.3 Modifications and rebuilding the product

To avoid hazards and to ensure optimum performance, neither modifications nor additions or rebuilding may be made to the product unless explicitly approved by the manufacturer.

Contents of the user manual

Any person who is assigned with performing works at or with the product must have read and thoroughly understood the user manual before beginning work. This also applies when the respective person has already worked with a product such as or similar to this one or was trained by the manufacturer or supplier.

2.4 Responsibility of the system owner

The MOBA-Matic will be utilised in the commercial sector. The product owner is therefore subject to the legal obligations regarding occupational safety. In addition to the occupational safety notices in this user manual, the regulations for safety, accident prevention and environmental protection which apply for the field of application must also be adhered to. Applicable in particular are:

- The system owner must inform himself of the applicable occupational safety regulations and, by means of a risk assessment, identify additional dangers which arise from the specific working conditions at the place at which the product is used. He/she must implement these in the form of operating instructions for the operation of the product.
- These operating instructions must be stored in the immediate vicinity of the product and be accessible to persons who work at and with the product at all times.
- The system owner must clearly define the responsibilities of the personnel for the operation of the product.
- The system owner must ensure that the contents of the user manual are understood in full by the personnel who will operate the product.
- The system owner must ensure that all servicing, maintenance, inspection and assembly works are exclusively executed by qualified specialist personnel, who have been sufficiently informed by an in-depth study of the operating instructions.
- The system owner must inform the manufacturer or their authorised dealer when safety deficiencies arise on the product or during its use.

2.4.1 Operating personnel

WARNING! **Risk of injury from insufficient qualification!**

Improper use of the product can result in serious personal injuries and material damages.

For these reasons:

- Particular activities must only be executed by the people stated in the respective chapters of this user manual.

In the operating instructions, the following qualifications for different areas of activity are stated:

Layperson As a non-skilled worker without expert knowledge or layperson, who is neither qualified as a skilled worker nor instructed person.

Instructed person An instructed person is deemed to be a person who has been instructed by the system owner or the manufacturer about the tasks assigned to them and about the possible dangers that may arise in the event of improper behaviour, as well as those who have been given training and instructions when necessary and who have been taught about the necessary protective equipment and precautions.

Qualified specialist personnel Qualified specialised personnel for the purposes of the user manual are people who are familiar with the installation, commissioning and operation of the product and who are appropriately qualified to perform their work. On the basis of their technical training, knowledge and experience as well as knowledge of pertinent regulations, the specialist person is in the position to identify risks and prevent potential hazards which could be caused during the operation or maintenance of the product.

Among other things, knowledge of first aid and of the local rescue

facilities are required.

2.5 Special dangers

General

In the following section, residual risks are listed that were identified in the risk analysis.
Observe the safety notices and warning notices listed here and in the following chapters of this manual to reduce health hazards and avoid dangerous situations.

Electrical current

DANGER! **Danger from electric current!**

During work in the immediate vicinity of electrical systems, e.g. overhead lines or electrical railways, there is a risk of electrocution.
For these reasons:

- Maintain a sufficient safety distance to electrical systems.
- If work in such systems is absolutely necessary, then always inform the relevant bodies or authorities responsible for these systems prior to performing the work and follow their instructions.

Moving components

CAUTION!

Risk of injury by moving machine parts!

While the tool is controlled, components and assembly groups of the machine are moved manually or automatically. Machine components and assembly groups that are moved in a rotating and/or linear manner may cause severe injuries and result in material damages.

For these reasons:

- Always exclude people from the working range of the machine and/or tool.
- Remove objects from the working range of the machine or tool.
- During operation, do not reach into moving components.
- The MOBA-Matic must always be switched off when leaving the driver´s seat or the machine.
- Never perform any works on the sensors when the system is set in automatic mode.

Protruding machine parts

CAUTION! **Risk of injury from protruding machine parts!**

Retrofitted system components (e.g. sensors) could protrude over the typical machine dimensions. This can result in injuries and material damage.

For these reasons:

- Make certain that the machine is operated by a qualified and experienced operator.
- Always exclude people from the working range of the machine and/or tool.
- Remove objects from the working range of the machine or tool.

Malfunction

WARNING! **Risk of injury from malfunction!**

Uncontrolled machine actions resulting from malfunctions of a system component could cause severe injuries to people located in the working range of the machine or result in material damages.

For these reasons:

- Make certain that the machine is only operated, controlled and monitored by a qualified and experienced operator. The operator must be able to initiate emergency measures, such as an emergency stop.
- Always exclude people from the working range of the machine and/or tool.
- Remove objects from the working range of the machine or tool.
- Secure the construction site.

Lack of instructions

WARNING! **Risk of injury from missing or incomplete instructions!**

Missing and incomplete instructions could lead to operating errors or improper use. Accidents with severe personal injuries or severe damage to property and the environment could thereby result.

For these reasons:

- Observe the safety notices from the manufacturer and the instructions from the system owner.

Insufficient safeguarding

WARNING! **Risk of injury due to inadequate safeguarding!**

Inadequate safeguarding of the construction site and for the location of a component, e.g. the laser transmitter, can lead to dangerous situations in road traffic and at the construction site.

For these reasons:

- Ensure sufficient safeguarding of the construction site.
- Ensure sufficient safeguarding of the locations of the individual components.
- Observe the country-specific, legal safety and accident prevention regulations as well as the traffic regulations that apply accordingly.

Faulty measurement results

CAUTION! **Danger from faulty measurement results!**

Faulty measurement results arising from the use of a product following a crash, other non-permitted loading or a modification can lead to considerable material damages.

For these reasons:

- Do not use any products with obvious signs of damage.
- Before reusing a component which has fallen down, always execute a control measurement.

Safety equipment

The MOBA-Matic has no own, superordinated safety device.

However:

The controller on the MOBA-Matic is equipped with an input which can be accessed from an external controller. The processor in the controller monitors the applied voltage on Pin A of the 12-pin device plug socket.

It can be specified in a menu in the software for which applied voltage level the controller is to be switched off with (depending on the wiring).

The installation of an emergency stop switch is the responsibility of the system owner of the machine and is strongly recommended.

In addition, all the luminous diodes of the LED arrow of the MMC-1000 controller will flash in cases of faults and thereby make the operator aware of a malfunction.

Behaviour in the event of dangerous situations and accidents

Preventative measures

Always be prepared for accidents and fire!
Have first aid gear (first aid box, blankets, etc.) and fire extinguishers accessible at all times.
Familiarise personnel with accident reporting, first aid and rescue equipment.
Keep access routes for emergency vehicles free.

In the event of an emergency: Always do the right thing

- Immediately take the product out of operation.
- Initiate first aid measures.
- Remove people from the danger zone.
- Inform responsible people at the place of operation.
- Alert doctor and/or fire brigade.
- Create access routes for emergency vehicles.

3 Transport, packaging and storage

3.1 Transport inspection

To ensure sufficient protection during shipment, the products are carefully packaged.
Upon receipt of delivery, immediately inspect for completeness and for transport damage.

In the event of externally recognisable transport damages, proceed as follows:
Do not accept the delivery or do so only under reservation.
Note the extent of the damage on the transport documents or on the delivery note of the carrier.
File a complaint.
Do not commission products with obvious signs of damage.

Report every defect as soon as it is identified. Claims for damages can only be invoked within the applicable compensation periods.

3.2 Transport

When transporting your equipment to the place of use or in the field, always make certain that the product is transported in suitable transport containers and that these are appropriately secured.
Never transport the product unsecured in a car.
The function of the product can be strongly impaired by impacts and shocks.

When shipping via rail, air or ship, always use the original packaging, transport containers and shipping cartons or appropriate packaging. The packaging secures the product against impacts and vibrations.

3.3 Storage

Only store the product in well ventilated, dry rooms. During storage, protect against moisture. Use the original packaging for this purpose if possible.

Avoid large temperature fluctuations during storage. The formation of condensation can impair the function.

Always observe the storage temperature limits for products, especially in the Summer when the equipment is kept in the vehicle interior. Please refer to the technical data for the products for the permissible storage temperatures.

4 Product description

The MOBA-Matic is a universal control and regulating system for all types of construction machines.
The extensive range of sensors for distance and slope measurement, the great comfort and a high level of operating safety make the MOBA-Matic one of the most flexible and efficient regulating systems for road pavers, concrete pavers, mastic asphalt pavers, milling machine, caterpillar, kilvers and graders.

The system is based on state-of-the-art microprocessor technology and works with a so-called “CAN-Bus” (Controller Area Network).
This CAN-Bus creates the latest standard in automotive electrics and guarantees the highest degree of system safety. It also provides in its simplest form the central operation of the system and, due to its modularity, its gradual expansion. So you can e.g. easily retrofit new sensors, depending on the application requirements, at any time.
The digital controller, the heart of the system, recognises the connected sensors automatically when you turn it on.

In addition, total stations or GNSS receivers can be connected for 3D-control of the 3D-matic on the MOBA-Matic.

Identification of the products

Every component of the system (except for the wiring) is provided with a type label.
The type label contains the CE marking (4), the device designation (2), the article number of the product (1) as well as a consecutive serial number (3).
The following photograph shows an example of a type label.

Conformity

Refer to the “Declaration of Conformity” section in this manual.

Product data

Refer to the “Technical data” section in this manual.

5 Structure and function

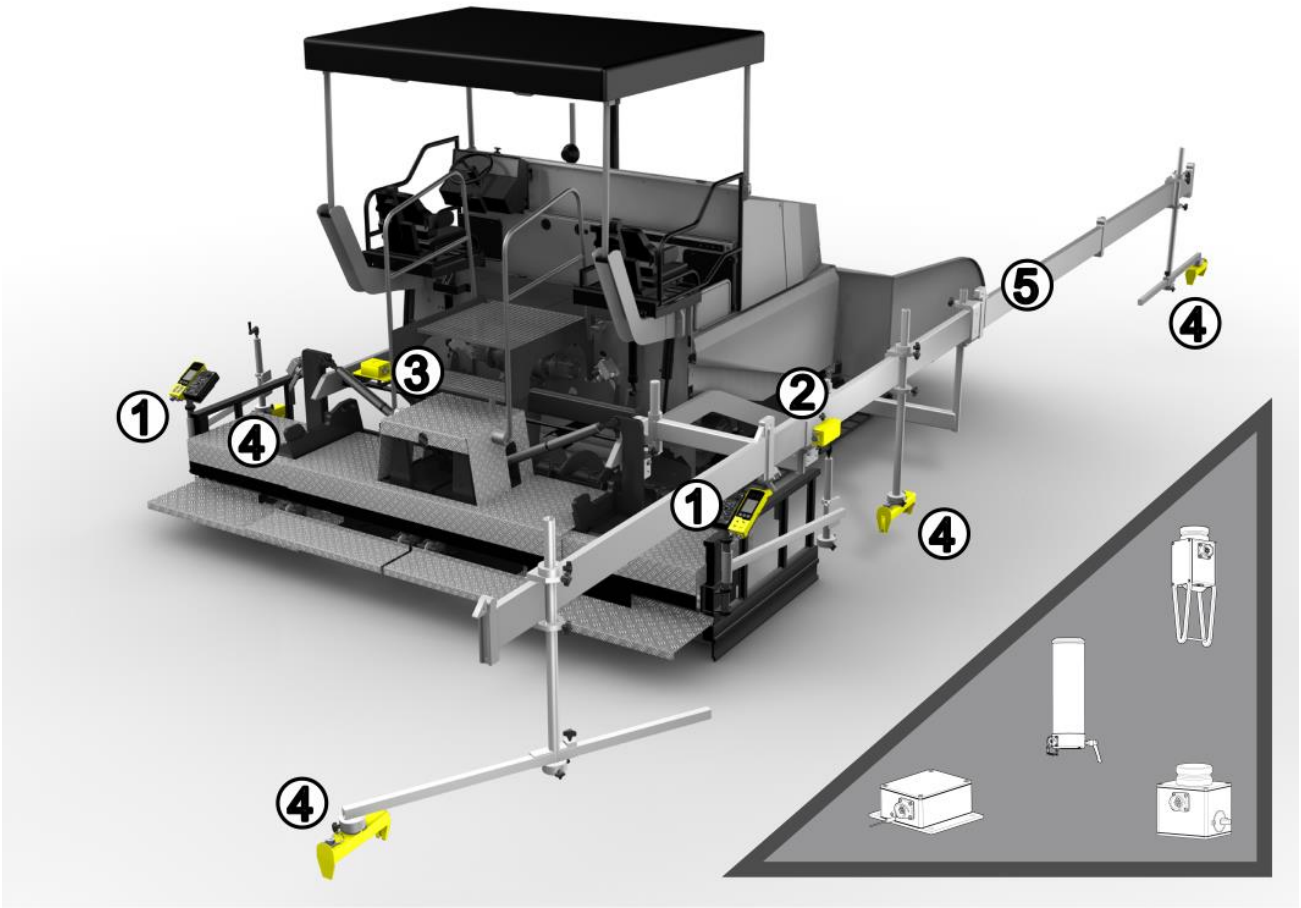
General

In this section, you will learn more about the structure of the MOBA-Matic and its fundamental functionality.

5.1 Structure

The heart of the MOBA-Matic system is the digital controller.
For each control loop or each side of the machine, a separate controller and at least one corresponding sensor will be required.
Depending on the machine and application, the operator can create their own system individually.
For this, they simply select the sensor from the large pool of available sensors which best fulfils their respective requirements and combines it with the digital controller.
The CAN-bus enables the simultaneous connection of several sensors to a controller. In this case the operator selects the respective active sensor by utilising the software.

Configuration example for Big Ski

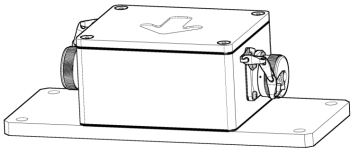


1	Digital controller
2	Distribution box
3	Slope sensor
4	Utilisable sensors (Sonic-Ski, DUAL-Sonic ...)
5	Big Ski framework

5.2 Function description

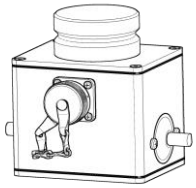
MMC-1000 Digital Controller

The MMC-1000 (04-25-10300) digital controller includes all the required buttons, optical indicators for controlling the system on which, at all times, the current status of the system and the power outputs for the valves can be read out.
The sensor signals and the button input will be processed here and then passed on to the hydraulic system.



SLOS-0150 Slope Sensor

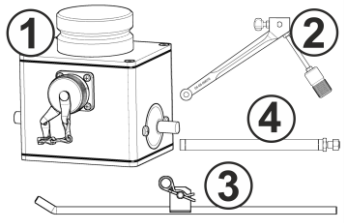
The SLOS-0150 (04-21-21010) slope sensor operates with a highly precise, electro-mechanical measuring unit and is used for the acquisition of the slope for the tool.



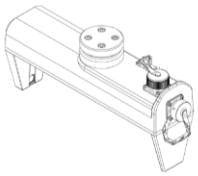
ROTS-0300 Rotary Sensor

The ROTS-0300 (04-21-40110) rotary sensor is a sensor for distance measurement and senses the measured values using mechanical means from an existing reference.
This can be both a taut and measured string as well as a surface (e.g. an already finished road surface).

ROTS-0300 Kit

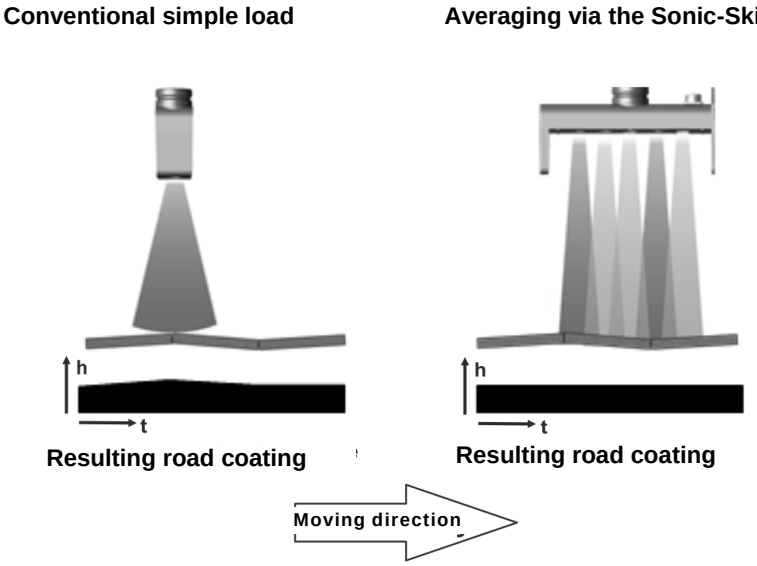


The ROTS-0300 Kit (05-21-40110) consists of all the individual components:
1: 04-21-40110, Sensor
2: 04-05-00070, Sensing arm
3: 04-05-00080, Sensing ski
4: 04-05-00100, sensing tube

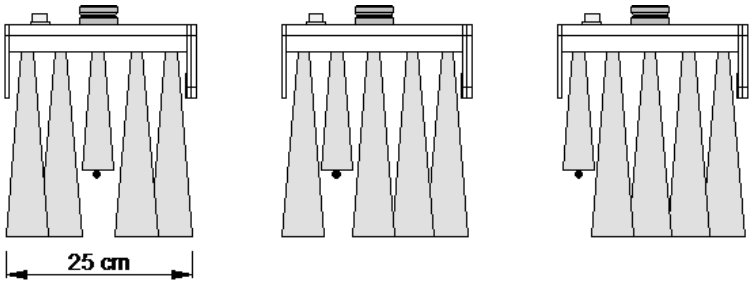


SKIS-1500 Sonic-Ski plus

The multiple ultrasonic sensor SKIS-1500 Sonic-Ski plus (04-21-10120) works with five ultrasonic sensors.
A sixth sensor is used for temperature compensation.
This can therefore capture a reference (ground, string etc.). The Sonic-Ski® plus covers a measurement range from 25 cm up to 150 cm in ground sensing and up to 100 cm in string line sensing.



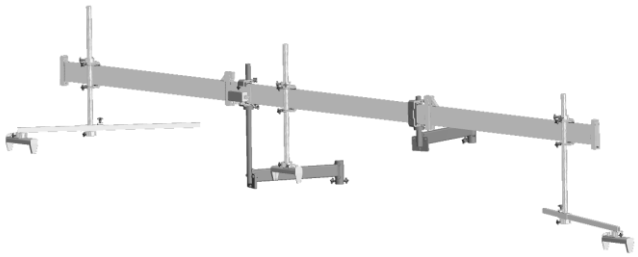
An averaging is executed from the measured values of the five ultrasonic sensors of the Sonic-Ski® plus with ground sensing.



The Sonic-Ski® plus is not able to measure the distance to the reference with string line sensing, rather additionally recognising the position of the string or an edge under the sensor heads over its entire working width of approx. 25 cm.

The principle of the averaging, which has already been recognised by Sonic-Ski® plus will be acquired again by Big Sonic-Ski®.

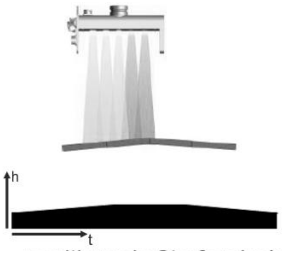
There will be up to 3 sensors assembled as divided on the machine length - or even more by using a corresponding mechanism - and electrically connected via a distribution box.



In exceptional cases, the averaging can also be acquired with just two sensors (e.g. Sonic-Ski® plus front and rear).

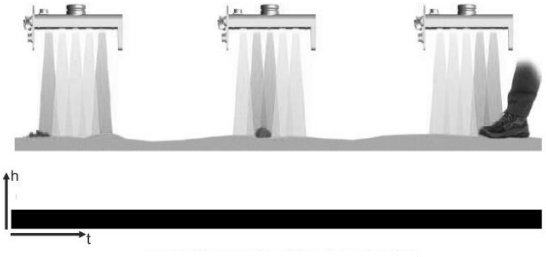
After small unevenness and foreign bodies have already been neutralised by the averaging for every individual Sonic-Ski® plus, the Big Sonic-Ski® attachment now also additionally averages and reduces bulges and small, drawn-out differences in height in the longitudinal profile of the subgrade.

A Sonic-Ski

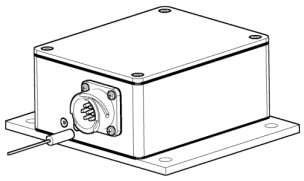
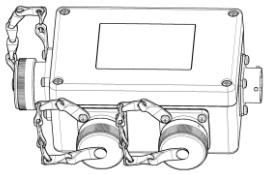
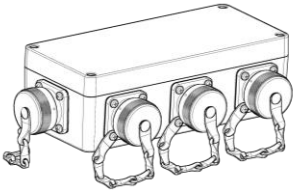


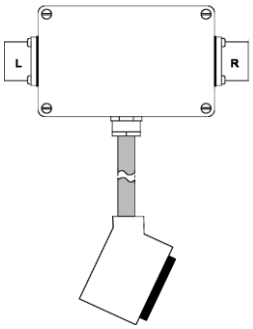
Resulting road coating

Big Sonic-Ski

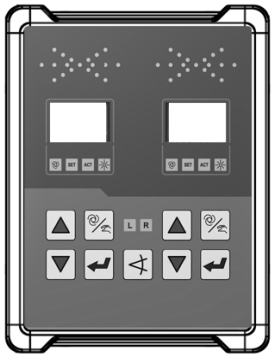


Resulting road coating

 *ROPS-0900 String-line sensor*	The ROPS-0900 (04-21-30070) string-line sensor acquires the measured value via a pull-out steel rope and is utilised frequently when working with the milling machine. It is utilised for the distance measurement.
 *DUAS-1000 Ultrasonic sensor*	The DUAS-1000 (04-21-10100) Dual-Sonic sensor is a sensor for distance measurement and works with ultrasonic technology. By a reference measurement to a bracket with a defined distance parallel to the actual distance measurement, the measured value of the Dual-Sonic sensor will be temperature compensated.
 *LS-3000 Laser receiver*	The LS-3000 (04-60-11311) laser receiver is a sensor for distance measurement which works with all the common rotation lasers, such as e.g. red light transmitters (helium, neon) and infra-red transmitters. It is used among other things for the building of flat sites.
 *Power/CAN-Box Adapter box*	For fixed installation of CAN-Slope sensor and 3D (04-03-00422, adapter box left) (04-03-00423, adapter box right)
 *Big-Ski Junction box*	The (04-03-00415) Junction box is the connection point for all the system active sensors. This makes cable routes shorter whereby possible malfunction sources can be reduced.

 *Adapter box*	Connects 2 controllers to a central connection. (04-03-00080)

Option / accessories and connection elements

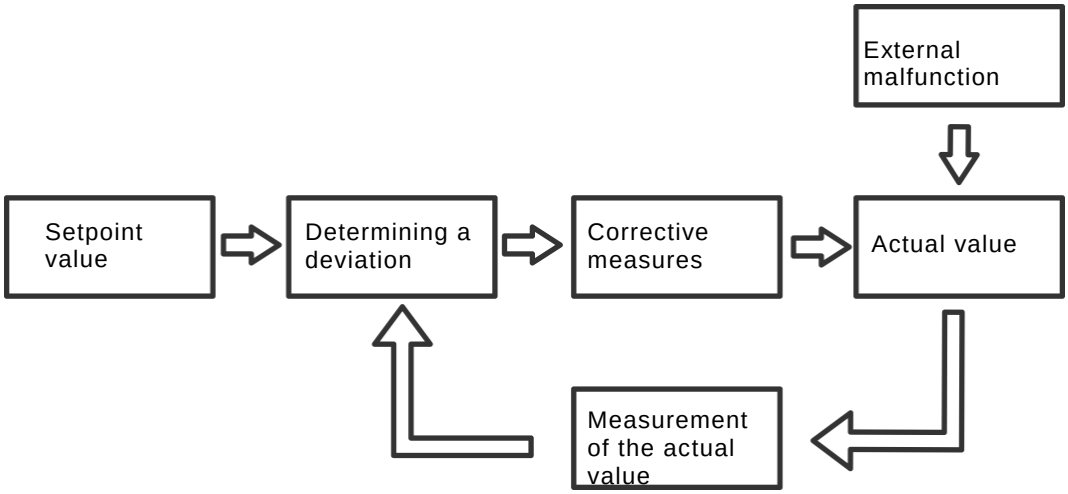
 *MMP-1000 Control panel*	The complete functional scope of the MOBA-Matic is available with two controllers. The control panel now functions as an equal parallel and thereby secondary operating device. (04-25-53301)
MOBA-Matic Case 04-06-00140 04-06-00142 04-06-00040 **LS-3000 Case** 04-06-00210	MOBA-Matic case available in different versions. For maximum: • 2 controller • 3 Sonic-Ski, • 2 Digi-Rotary, • 1 slope sensor • Cables and accessories LS-3000 Case available in standard version. For maximum: • 2 Laser receiver • Cable
Bracket	To attach the controller. Rubberised interior.

Option / accessories and connection elements

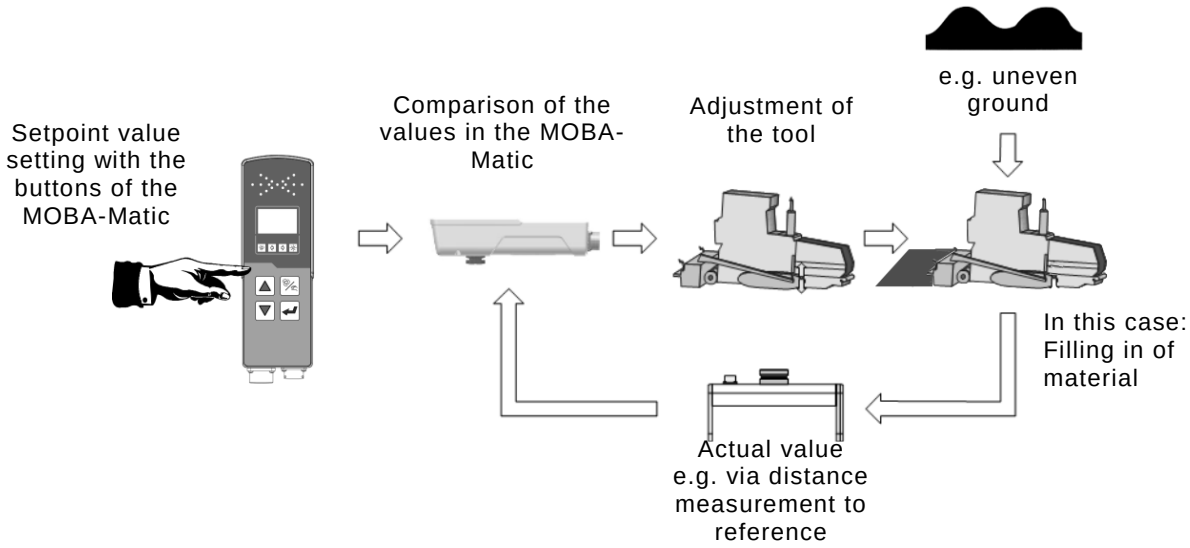
Designation	Article number	Comment
Coil cable, machine CAN-Controller→ (Power-CANBox)→ Machine	**04-02-02560** **04-02-02561** **04-02-02563**	12-pin Bayonet lock, 10-pin, 3 m All pins wired 12-pin Bayonet lock 10-pin, 3 m. Only +, -, UP/DOWN wired 12-pin Bayonet lock 7-pin, 3 m Blaw-Knox
Coil cable, sensor CAN-Controller→ Sensor/junction Box	**04-02-02624**	7-pin Bayonet lock 7-pin bayonet lock, 6 m, Yellow (yellow), 2 x R 120
Coil cable, extension Controller→machine	**04-02-02536** **04-02-02535**	10-pin Bayonet lock 10-pin bayonet lock, 3 m 10-pin Bayonet lock 10-pin bayonet lock, 6 m
Coiled cable For the connection of CAN-sensors on the junction box	**04-02-02620** **04-02-02621**	7-pin Bayonet lock 7-pin bayonet lock, 6 m 7-pin Bayonet lock 7-pin bayonet lock, 12 m
Coil cable, extension Controller→CAN sensor	**04-02-02623**	7-pin Bayonet lock 7-pin bayonet lock, 6 m

Irrespective of which sensor is operated on the digital controller, the fundamental principle of the controller is always the same:

The principle of a control system is the ongoing: Measure - Compare - Adjust
A control loop is utilised to create a given physical variable (control variable) to a desired value (setpoint) and retain it there regardless of any malfunctions which may occur. In order to fulfil the control task, the instantaneous value of the controlled variable - the actual value - must be measured and compared with the setpoint value. If there are any deviations, then these must be adjusted in an appropriate manner.



In the case of the MOBA-Matic, this means:



6 Operating and display elements, operating modes

General

In this section you will learn more about all the elements required for professional, correct operation of the product, which are described in the Sections “Commissioning” and “Operation”.

6.1 The control and display elements of the digital controller

The front of the digital controller contains all the necessary buttons, some function LEDs and a LC display for the advanced operation of the system on which the current status of the system can be read out at all times.

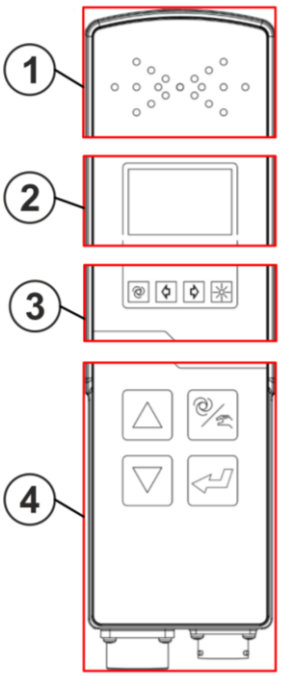
The front of the digital controller can be sub-divided in 4 main function groups:

1) The LED arrow

2) The LC display

3) The function lamps

4) The operating buttons



The up button

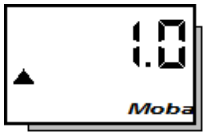
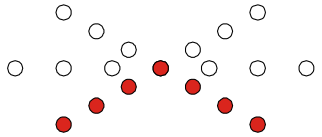
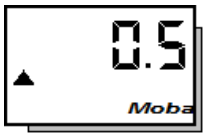
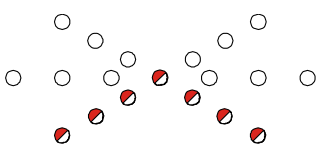
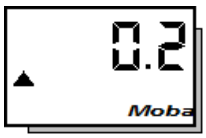
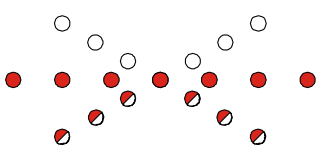
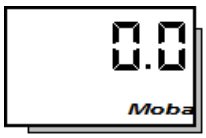
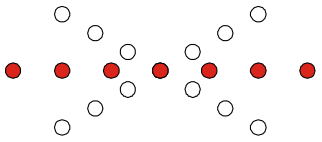
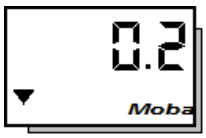
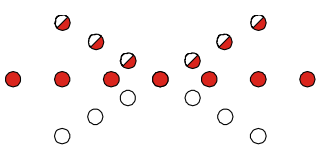
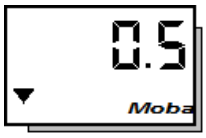
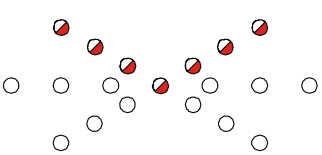
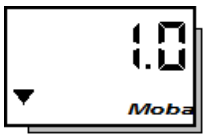
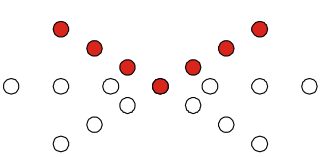
The down button

The auto/manual button

Enter button

6.1.1 The LED arrow

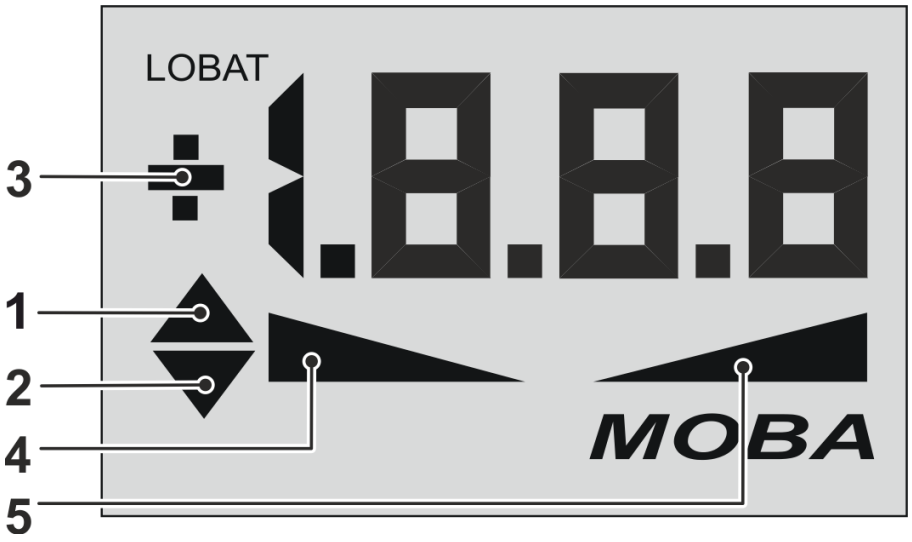
The LED arrow enables the status of each of the controlled valve output to be visible for the operator. Particularly in the case of a larger distance from the operator to the controller, or with stronger sunlight, the LED arrow is a useful display element.

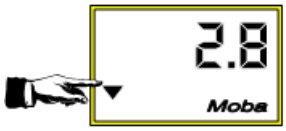
LED display	LED arrow display	Control deviation	Controller output
		Large control deviation	Controller output LIFT constantly on
		Average control deviation	Controller output LIFT cycles with larger pulse width
		Small control deviation	Controller output LIFT cycles with smaller pulse width
		No control deviation	Controller outputs deactivated
		Small control deviation	Controller output LOWER cycles with smaller pulse width
		Average control deviation	Controller output LOWER cycles with larger pulse width
		Large control deviation	Controller output LOWER constantly on

Legend: ○ **= LED is off** ◐ **= LED flashes** ● **= LED is on**

6.1.2 The LC Display

The 3 1/2 digit liquid crystal display is easy to read out due to its integrated lighting, even in poor light conditions. The symbols of the displays have the following meaning



	**1** The LIFT arrow indicates that the controller output for LIFT is currently active.
	**2** The LOWER arrow indicates that the controller output for LOWER is currently active.
	**-** Positive display value (no prefix).
	**3** Negative display value (a "-" prefix).
	**4** Slope to the right (a bar which slopes to the right).
	**5** Slope to the left (a bar which slopes to the left).

The actual value and the setpoint values of the active sensor will be illustrated with a prefix, the setpoint value is also available with a physical measurement unit.
The prefix indicates whether it is a positive or a negative numerical value.

Now a negative prefix i.e. “ – ” will appear in the display!

The directional arrows on the lateral slope will only appear when the slope sensor has been selected as the active sensor.
The slope direction of the illustrated arrow is the prefix for the value of the slope sensor (left slope or right slope). Both arrows only jointly appear simultaneously with the display “0.0 %”.

The resolution and the physical measuring unit of the displayed values can be set in the configuration menu - for separated grade sensors and slope sensors.

The functionlamps:

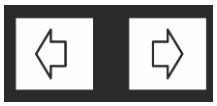
The 4 function lamps of the controller have the following meaning:

Automatic lamp

Lamp on: Automatic mode;

Lamp flashes (1): Semi-automatic mode (only if this optional mode has been pre-set by the dealer);

Lamp off: Manual mode;

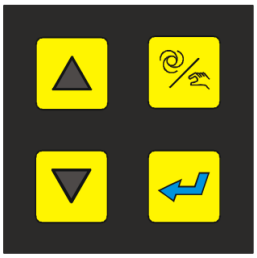


Direction lamps (special function when working with Sonic-Ski)
If both lamps flash simultaneously, then an alarm condition has occurred

String lamp	**With Sonic-Ski plus**	**With Big-Ski**
Lamp on:	String mode active	Averaging from all 3 sensors
Lamp off:	Ground mode active (Averaging)	Only the middle sensor will be evaluated

(1) This signal status also occurs when the automatic for the MOBA-Matic has been locked with the help of the function “External Hand”. The valve outputs are then switched off and the operation of the digital controller is inhibited.
The pin A and/or J (depending on the version of the digital controller) can then be assigned with a defined signal in order to, for example, interrupt in the controller status. Also refer here to Section 11 in the “Technical data” of this manual.

6.1.3 The control buttons:



For the operation of the fundamental control functions of the MMC-1000, only 4 buttons are required.
These buttons enable a simple operation and are only provided for some settings with an additional function.

Up & down buttons

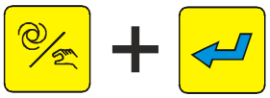
The setpoint value for the controller will be amended in automatic mode with the up and/or down buttons.
In manual mode, the corresponding valve output will be controlled for the duration of the respective button pressure.
In the menus these serve for the selection of menu items or the setting of parameters.

Auto / Manual button

The Auto / Manual button is used for switching between the operating modes manual (manual mode), semi-automatic (optional) and automatic.

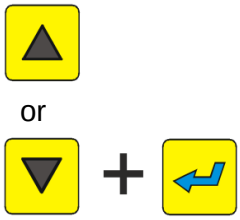
Enter button

With the enter button, the setpoint value is executed as set equal to the actual value and / or a zero calibration.



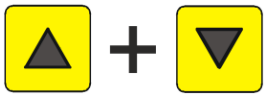
Automatic / Manual buttons + Enter button

By simultaneously pressing both these buttons, the call up of the user menus is executed. Behind them are parameters such as “Sensor selection”, “Sensitivity setting”, “Control window”, “Unit of length”, “Sampling factor” and “Hydraulic Kit”.



Up or Down buttons + Enter button

Both in the manual as well as in automatic mode, pressing the UP and/or the DOWN buttons together with the enter button will amend the displayed value without influence on the control system.



Up + Down buttons

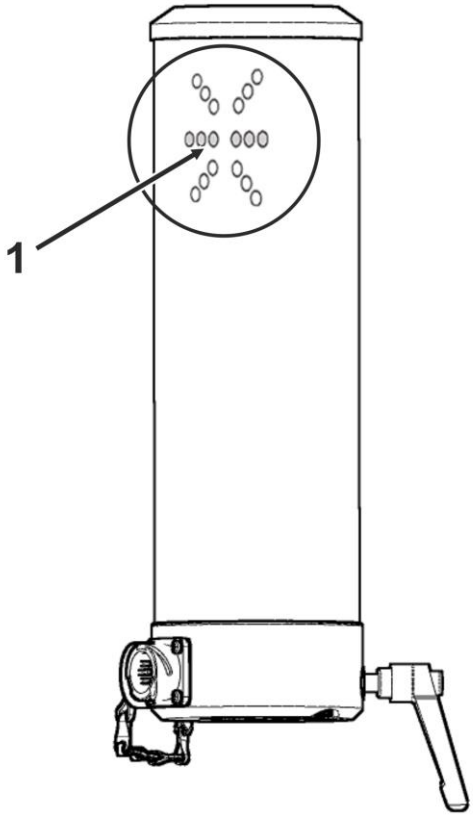
In the manual mode (manual mode), when working with the Sonic-Ski Sensor, simultaneously pressing the UP / DOWN buttons will select between the sampling start for the ground and string switching over.

6.2 The display elements of the prop. Laser receiver

The laser receiver is equipped with a LED arrow (1) - similar to the digital controller.

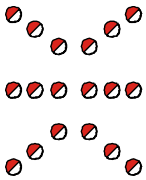
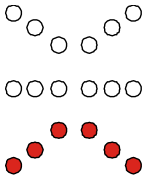
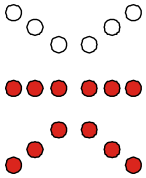
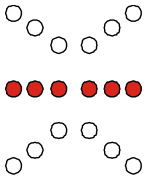
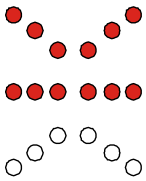
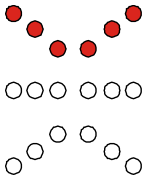
Depending on the operating mode in which the digital controller is located and which it is connected to, the LED arrow of the laser receiver can have a different function.

In the “Manual” mode, it is used as a positioning aid; in the “Automatic” mode, it shows the status of the valve outputs.



Display of the prop. Laser receiver in the “Manual” mode

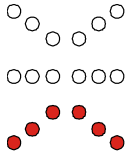
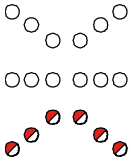
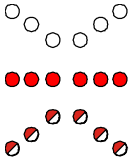
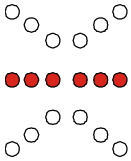
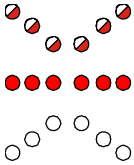
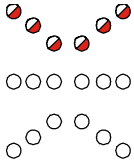
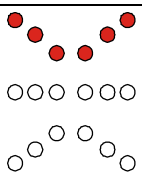
In the “Manual” operating mode, the LEDs of the laser receiver are utilised to display for the operator how the sensor must be displaced so that the laser beam strikes in the middle of the reception area.
They serve as a positioning aid.

Display	Deviation	Action
	No laser beam strikes the receiver;	
	The laser beam strikes above the centre of the receiver;	Displace the laser receiver and/or mast upwards;
	The laser beam strikes above, maximum 2 cm from the centre, on the receiver;	Displace the laser receiver and/or mast upwards slightly;
	The laser beam strikes the centre of the receiver;	
	The laser beam strikes below, maximum 2 cm from the centre, on the receiver;	Displace the laser receiver and/or mast downwards slightly;
	The laser beam strikes below the centre of the receiver;	Displace the laser receiver and/or mast downwards;

Legend: ○ **= LED is off** ◪ **= LED flashes** ● **= LED is on**

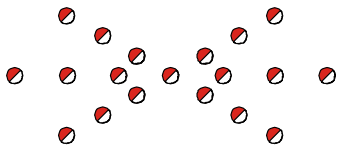
Display of the prop. Laser receiver in the “Automatic” mode

In the “Automatic” mode, the LEDs of the laser receiver are used to visualise the status of the actuated valve output for the operator.
They now work similar as analogue to LED arrow of the digital controller.

Display	Control deviation	Control output
	Large control deviation	Controller output LIFT constantly on
	Average control deviation	Controller output LIFT cycles with larger pulse width
	Small control deviation	Controller output LIFT cycles with smaller pulse width
	No control deviation	Controller outputs deactivated
	Small control deviation	Controller output LOWER cycles with smaller pulse width
	Average control deviation	Controller output LOWER cycles with larger pulse width
	Large control deviation	Controller output LOWER constantly on

Legend: ○ **= LED is off** ◐ **= LED flashes** ● **= LED is on**

6.3 Fault indicators



When all LEDs of the LED-arrows of the digital controller flash simultaneously, then there is a malfunction.
Often these are malfunctions which are not real defects, rather a notice or reference to an attempt for operation under unauthorised conditions.
Information about trouble-shooting can be found in the description of the work with the various sensors as well as in the section for “Assistance with malfunctions”.

= LED flashes

6.4 Operating modes

Manual (manual mode)
The tool will be traversed directly in “manual” operating mode with the up/down buttons of the digital controller.

Automatic
The setpoint value for the tool will be amended in the “Automatic” operating mode with the up/down buttons of the digital controller. If a difference results from the comparison of the measured value and the set setpoint value, then digital controller will control the outputs independently itself until this difference is compensated.

Flashes

Semi-automatic (1)
In the operating mode “Semi-automatic”, the up/down buttons of the digital controller can be utilised to amend the setpoint value for the tool. There is no activation of the tool, since the outputs are locked in this operating mode.

(1) This mode occurs when the optional operator variant with semi-automatic is activated from your MOBA dealer (also refer to the next page) or when the MOBA-Matic system has been locked with the aid of the “External Hand” function.

6.5 Operating variants

Your MOBA dealer can assist you with the operation of the controller and select from three variants. The operations then differentiate as follows:

6.5.1 Standard operation

The default setpoint is executed with the up/down buttons in the “Automatic” mode consecutively in 1 mm steps as long as the affected button remains pressed.
The tool is therefore traversed according to the default settings in the controller.
The display will show the amended setpoint.

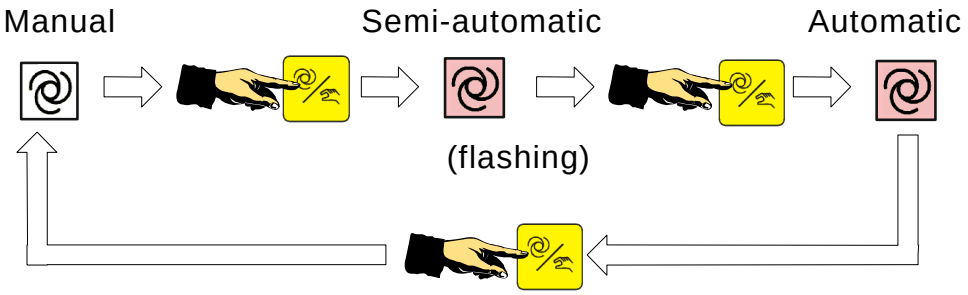
By simultaneously pressing the Enter button in conjunction with the Up button or the Down button, the displayed setpoint can be amended without influencing on the tool position.

6.5.2 Operation with semi-automatic

The setpoint adjustment with the up/down buttons is executed in the operating modes “Semi-automatic” and “Automatic” consecutively in 1 mm steps as long as the affected button remains pressed.
In the operating mode “Semi-automatic”, no control of the tool is initially executed as the outputs are locked in this operating mode.
If there is a switch from the “Semi-automatic” operating mode into the “Automatic” operating mode, then the outputs are enabled and the tool is traversed from the controlling system according to the provisions.
In both operating modes, the display of the modified setpoint is displayed.

By simultaneously pressing the Enter button in conjunction with the Up button or the Down button, the displayed setpoint can be amended without influencing on the tool position.

Switching between the “Manual”, “Semi-automatic” and “Automatic” operating modes is executed as revolving with the Auto/Manual buttons.



6.5.3 Operation with auto zero setting

The setpoint value will be adjusted in the “Automatic” operating mode with each new pressure on the up or the down buttons by 2 mm in the corresponding direction.
The tool is therefore traversed according to the default settings in the controller.

After 5 seconds, the setpoint value will be automatically set to zero and the sensor offset will be set once in accordance with the setpoint amount.

The description of the operation of the different sensors in this manual is based on the standard operation of the controller. Specific differences between the control variants (such as the additional “Semi-automatic” operating mode or the different step size with the setpoint adjustment) have no effect on the basic procedure for operation.

7 Installation and commissioning

General The content of this section should support the authorised personnel for the installation and commissioning with these work steps.

7.1 Safety notices

The installation and commissioning of the product must only be executed by instructed and qualified professional personnel.

CAUTION!

Danger caused by faulty installation!

Unauthorised modifications on, and rebuilding the machine during the installation of the product and errors occurring during the installation can impair the function and safety of the machine and thus lead to dangerous situations or material and property damages.

For these reasons:

- Installation and initial commissioning are only to be executed by personnel with the required training and qualifications.
- Always observe the instructions of the machine manufacturer!
- If there are not sufficient instructions available, then always contact the machine manufacturer before installation.
- Safety and protection equipment, which is dismantled or deactivated for the installation, must be immediately re-installed and/or made functional again upon completion of the works.

7.2 Assembly works

General

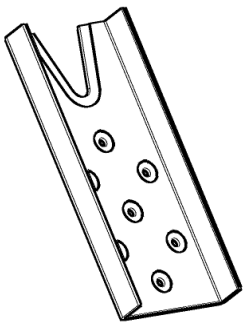
The dimensions of the system components and the position of the assembly fixing holes should be taken from the Section 11 “Technical data” in this manual.
You must take into account when selecting the assembly site for the individual components that additional space for the insertion and removal of the connecting plug is required.

Assembly site & installation position

Due to the wide range of application possibilities for the MOBA-Matic and the diversity of different machines available, only general instructions for the assembly site and installation position for the various components can be given here.

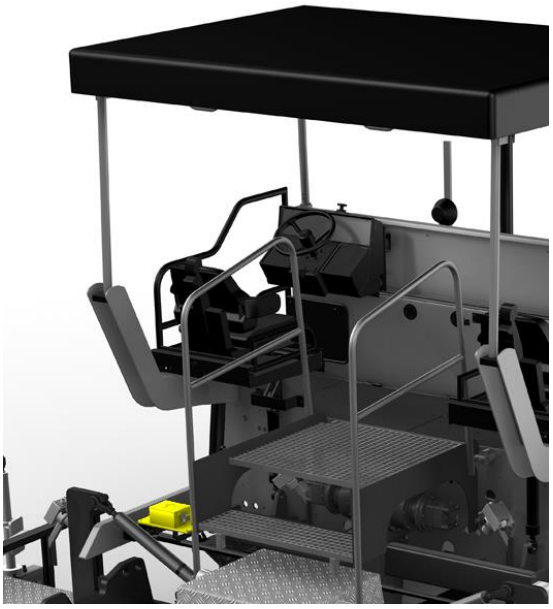
The digital controller

A bracket is provided as an accessory.
Install the bracket on a position that enables a comfortable operation and from which the tool and/or the adjusting device of the tool well can be easily visible.
Always ensure protection against dirt, soiling or splashing water; some form of shading increases the readability.
The digital controller should be installed sloping downwards so that impinging rain on the surface can run off.



The slope sensor

Install the slope sensor parallel to the lower edge of the tool on a machine part that can adjust for all the slope amendments of the tool to the same degree. This therefore creates the measurement value of the sensor exactly with the slope of the tool.
In the event of a road milling machine, this is preferred in the lower area of the machine (e.g. on the milling drum housing); on the transverse traverse between the tow arms for blacktop pavers.
Four fixing holes are provided in the fastening plate of the sensor for the assembly works.
The plug connections must be freely accessible to ensure that the connection of the connecting cable is easily possible.

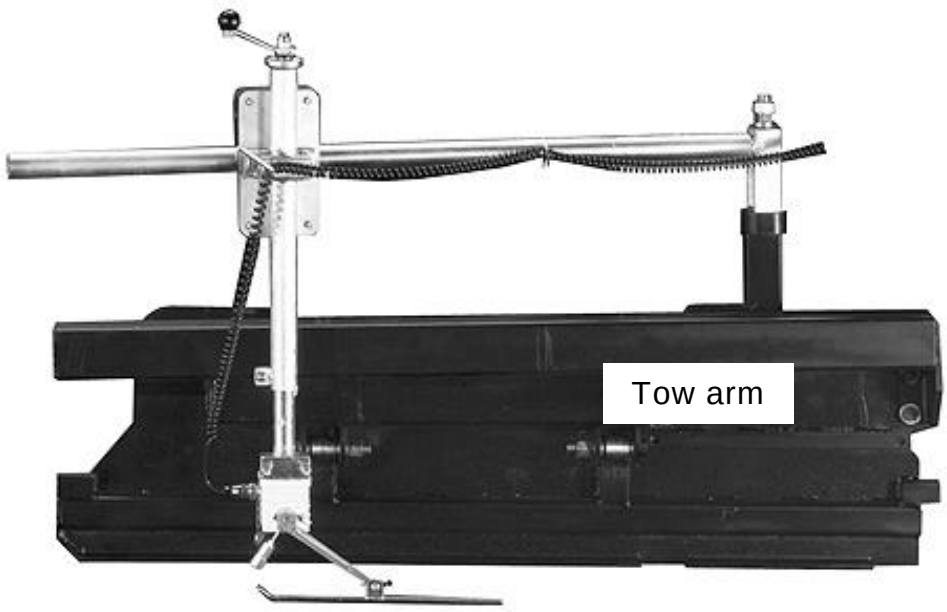


IMPORTANT! **Observe the direction of installation**

Note the direction of installation for the sensor (the arrow on the housing cover points in the direction of travel).

Bracket for grade sensors

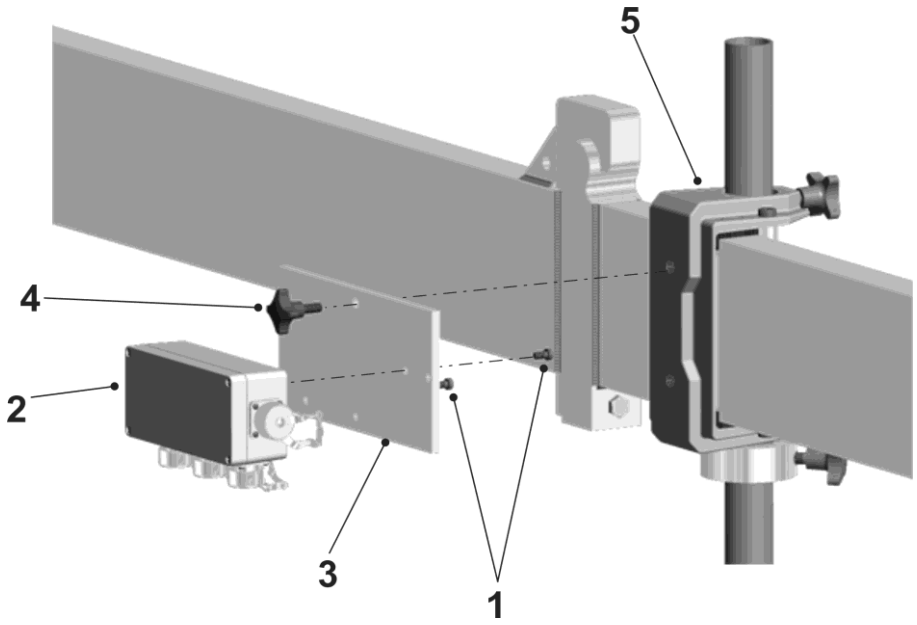
For the grade sensor mounting, a securing pipe must be attached on a suitable point (e.g. On the tow arm for pavers or on the chassis for milling machines).
This securing pipe - with a round mounting for the MOBA grade sensors - should be adjustable in height, swivelling and can be moved horizontally. Refer to the example below.
The round sensor head and the possibility for swivelling the bracket arm enables the sensors to be adjusted without any problems for every reference (e.g. Sonic-Ski® plus in the ground or string line sensing).
This bracket can look different depending on the machine.



The Big Sonic-Ski® junction box

The junction box should be mounted in such a way that simple wiring to the controller and the sensors is possible. The connections for the sensors should always point downwards so that no water can penetrate into the junction box. Inputs which are not required must be sealed with dust protection caps.
The input plug connector should always ideally point in the direction of travel.

Using an M6 x 12 hexagon socket screws (1), the junction box (2) will be initially assembled on the mounting plate (3).
Then the mounting plate (3) will be assembled using a M8 star knob screw (4) to one of the central sliding brackets (5).

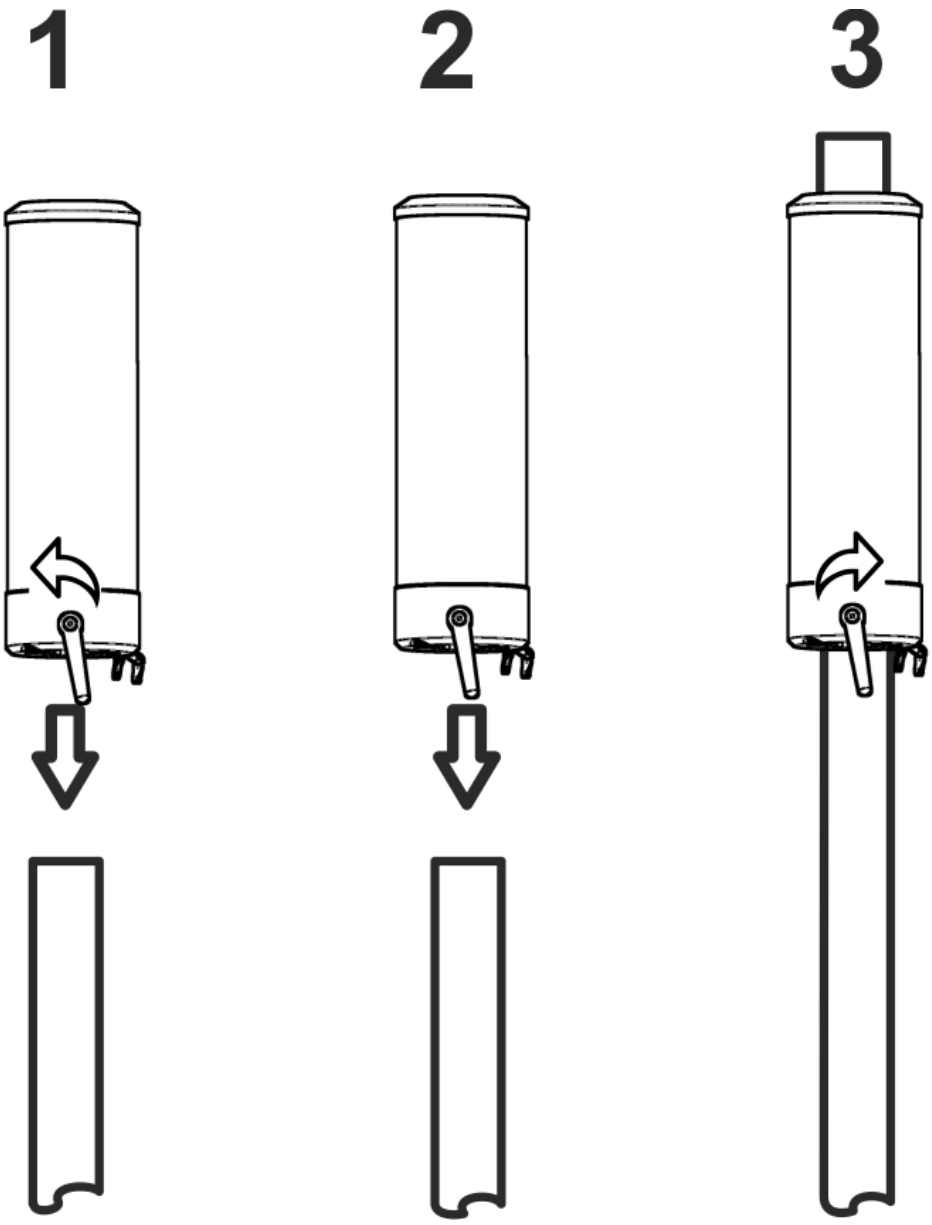


When assembling the Big Sonic-Ski® on the right-hand side of the machine, the box should be assembled on the inside of the support mechanics so that the input plug connector also points in the direction of travel in this instance. Then slide the corresponding sliding bracket, on which the junction box is to be assembled, from the inside towards the outside on the support.

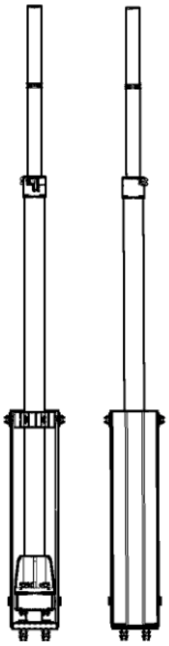
The laser receiver

The assembly of a laser receiver on the mast pipe is relatively simple:

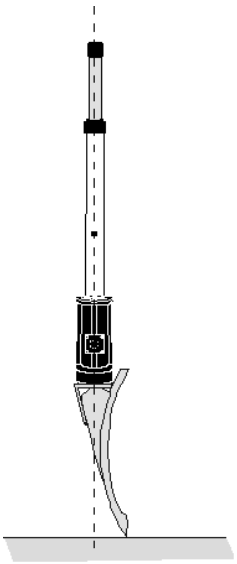
1) Open the mounting clamp.
2) Slide the laser receiver over the mast pipe.
3) Close the mounting clamp.



The laser mast



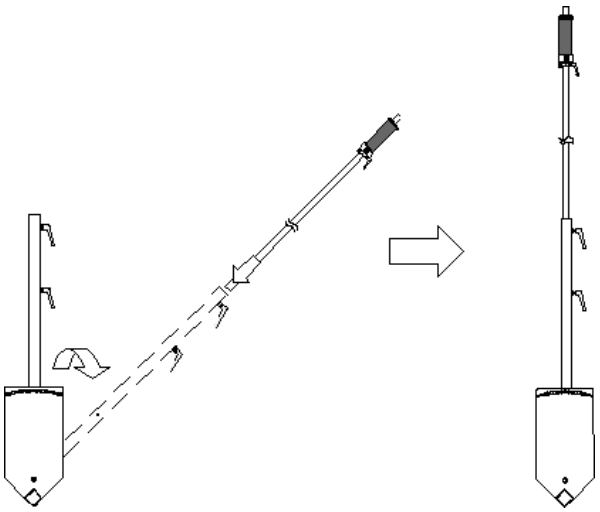
In order to assemble a laser receiver, there should be a rigid mast, a telescopic mast, or - better still - a power mast available on the machine.
A pipe diameter of the mast from 30 mm up to 46 mm enables a MOBA laser receiver to be securely attached.



Regardless of which mast type is utilised, it must be ensured that this is positioned in the typical vertical working position of the tool.

An adjustable assembly position on the mast is ideal so that the variable working position of the tool is guaranteed with the vertical position of the mast.
An adjustable (inclinable) mast also serves to simplify the safety and handling.

e.g.



The best installation location for connecting a laser mast on the milling machine is on the corresponding outer side of the machine above the milling drum axle; for blacktop pavers on the outer beams edge at the height of the auger.

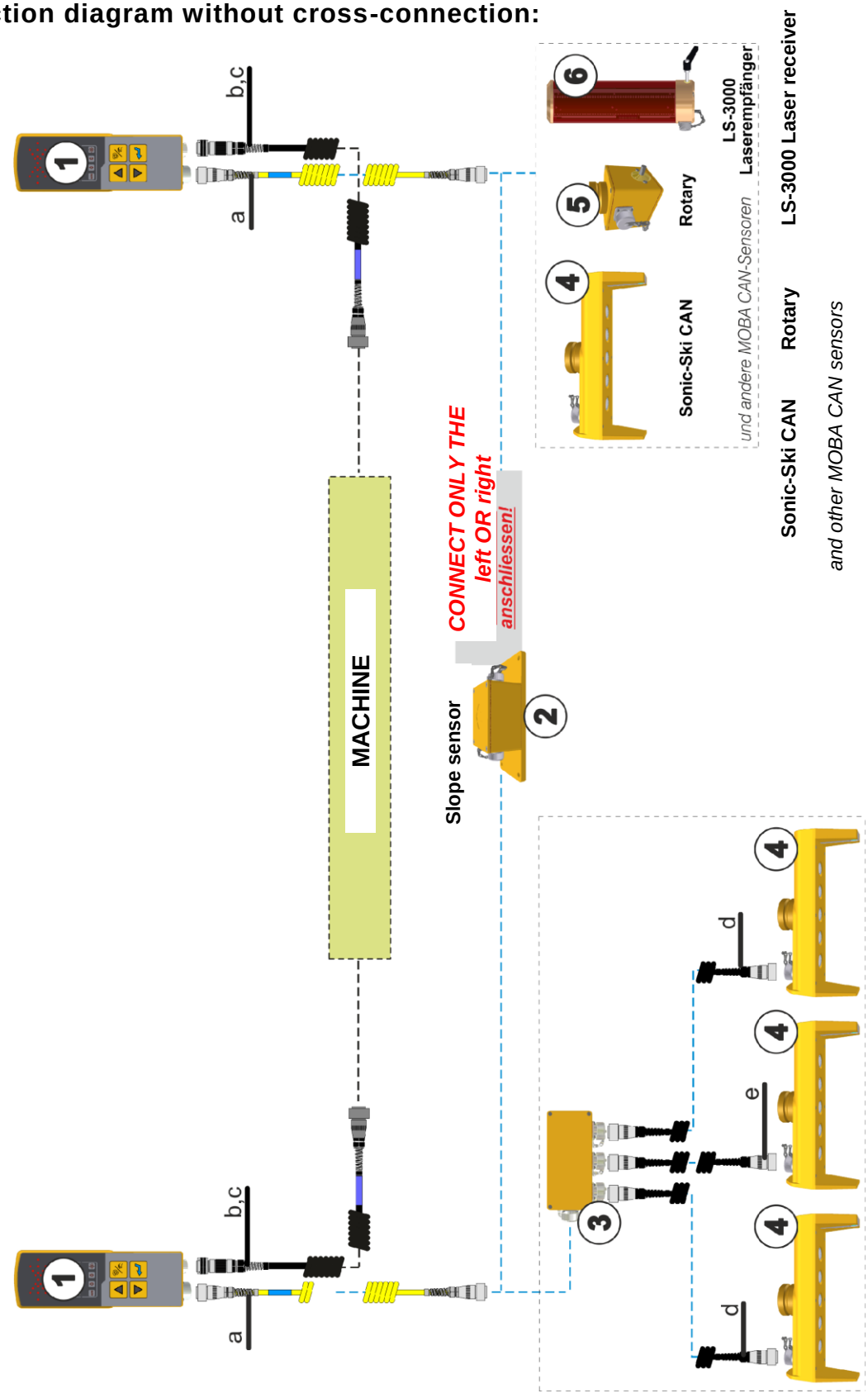
7.3 Wiring

General

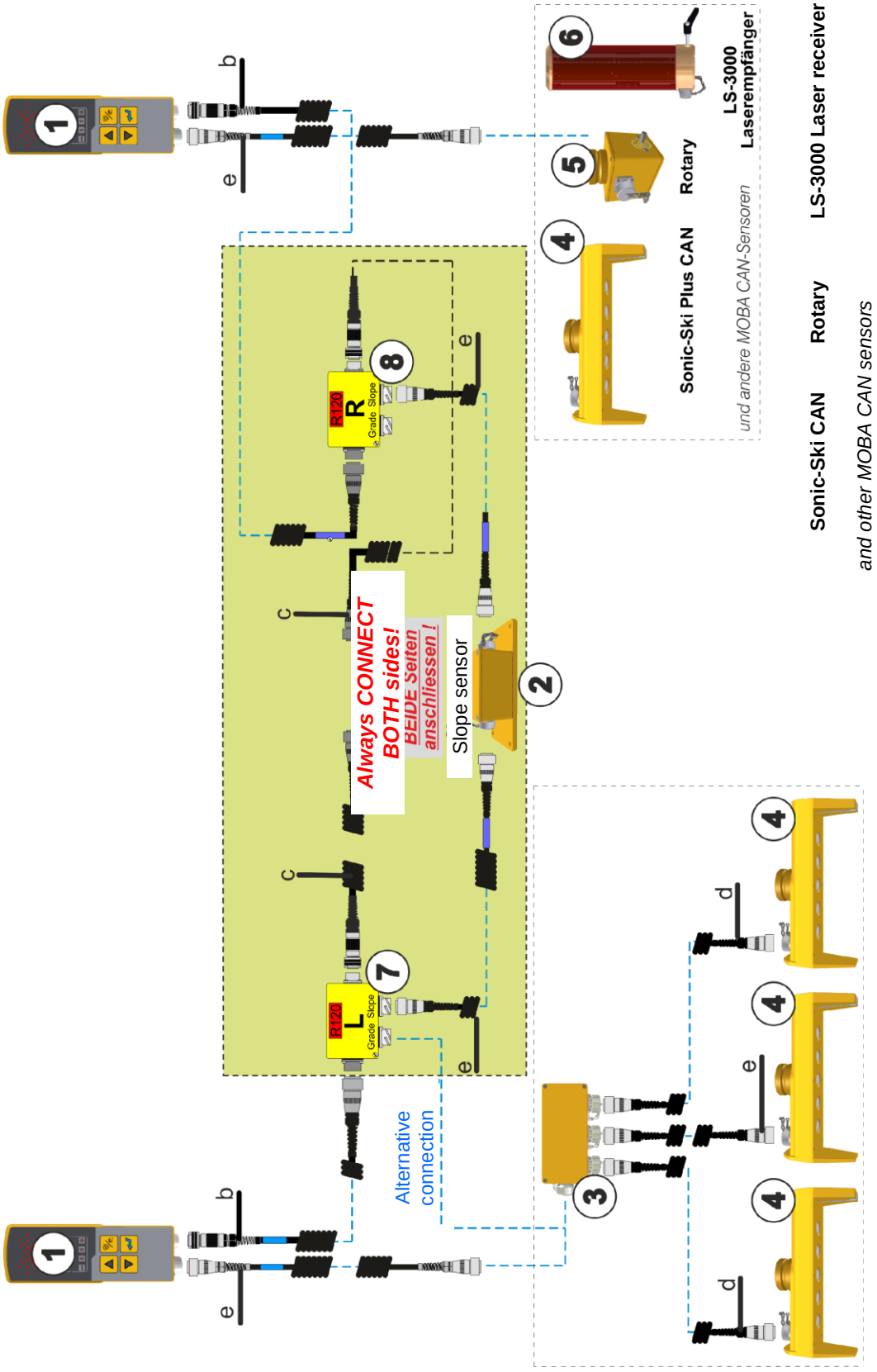
The sensors of the MOBA-Matic are also connected with the digital controller via the already mentioned “CAN-Bus” (Controller Area Network).
The Bus technology requires the completion of the Bus via resistors.
In order to make the wiring as easy as possible, MOBA has already provided a part of its sensor cable already with these terminating resistors.
In order to differentiate this cable from other cables, the jacket material is coloured yellow and the cable glands on the connectors are grey.

The different connection variants are shown in the following.

Connection diagram without cross-connection:



Connection diagram with cross-connection via junction boxes:



Devices:

	Article number	Designation
1	04-25-10300…	Digital controller
2	04-21-21010	Slope sensor
3	04-03-00415	Junction box for Big Ski (CAN) for averaging with up to 3 sensors
4	04-21-10020 04-21-10120 04-21-10130	Sonic-Ski (CAN) Sonic-Ski plus (CAN) Sonic-Ski-plus (CAN / PWM)
5	04-21-40110	Rotary sensor
6	04-60-11311	Laser receiver
7	04-03-00422	Junction box, left
8	04-03-00423	Junction box, right

Cable:

	Article number	Designation
a	04-02-02624	Coil cable, CAN with 2x1 20R Bus resister, 6m
b	04-02-02560	Coil cable, DLS II/CAN machine 3m, fully wired
c	04-02-02561	Coil cable, DLS II/CAN machine 3m, without CAN wiring
d	04-02-02621	Coil cable, CAN 12m
e	04-02-02620	Coil cable, CAN 6m

Initial commissioning

If your machine was already supplied with the MOBA-Matic levelling system, then the manufacturer has probably already executed the commissioning and adjustment of the control parameters on the valves and the hydraulic system of the machine at the factory.

If the system has been retrofitted, please contact your MOBA dealer so that they can support you during the commissioning of the MOBA-Matic.

In the context of this procedure, the adjustment of the control parameters on the valves and the hydraulic of your machine, among others, must still be executed.

8 Operation

General

The descriptions in this section should guide you through the operation of the product. These comprise

- The safe operation of the product
- The full utilisation of all the possibilities of the product
- The economic use of the product

8.1 Safety notices

The product must only be operated by trained and instructed people.

Fundamental principles:

WARNING!

Danger, due to improper operation!

Improper operating can lead to serious personal injuries or property or material damages.

For these reasons:

- Only permit personal with the required qualifications to operate the product.
- Always execute all the operating steps in accordance with the specifications in these operating instructions.

Only utilise the product for the purposes specified in the Section for “Intended Use”.

Getting started

The Chapter “Getting Started” includes information on how to turn on the system as well as the description of the sensor selection and for the view menu.
You will receive instructions on how to navigate in the user menu and for adjusting the parameters contained therein.

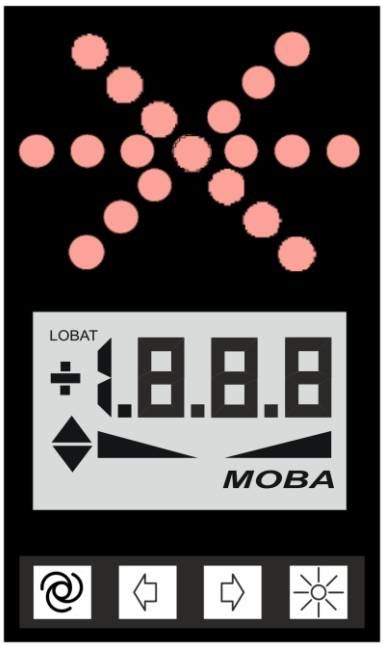
Before switching on

Always visually inspect the MOBA-Matic each time before switching it on.
Inspect all of the components of the system for any obvious damage, the unions of the connecting cable for correct fitting and the sensors for safe and correct assembly.
Always ensure that when you turn on the MOBA-Matic that person or object is present in the area of the tool or in the area of moving parts for controlling the tool.

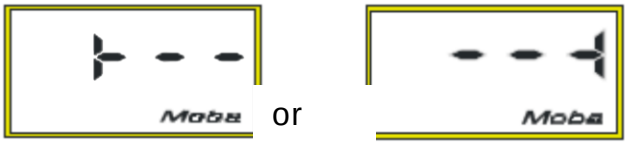
8.1.1 Switching on and switching on message

Switch on the supply voltage of the MOBA-Matic.
This can be, depending on the type of installation of the system, executed by switching on the vehicle ignition or by means of a separate switch in the dashboard.

A display test will be executed after switching on the digital controller. All of the segments of the
LC display, all luminous diodes of the LED display and all 4 function lamps will therefore be controlled for approximately 2 seconds. Should any signs, icons or characters be missing on the display or luminous diodes do not illuminate, then notify the customer service.



8.1.2 Controller-side display



Left hand side

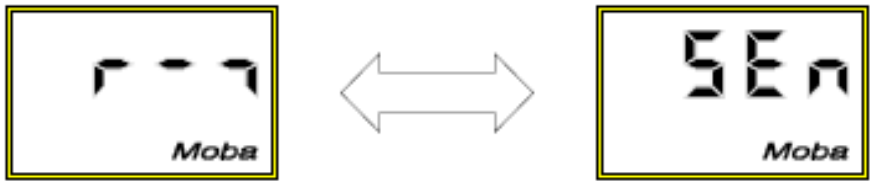
Right hand side

After the display test, the display will indicate on which side of the machine the controller is located.

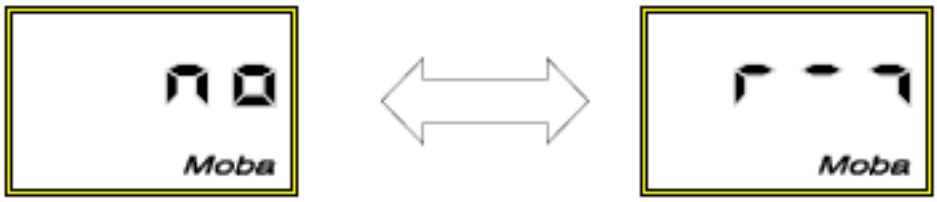
Sensor identification

After the controller-side display, the digital controller indicates twice, in an alternating display representation, the abbreviation of the sensor which was last worked with. The abbreviations of the individual sensors are described in the sections of this manual for which operation they deal with.
In addition, both direction lamps also flash in this presentation.
The controller subsequently switches automatically to the working mode.

Example of sensor identification for the Sonic-Ski Plus:



If the sensor should be replaced or has been removed, then the controller will indicate this clearly with the below represented “No” message. Is should be indicated to the user when switching on that the sensor has been exchanged or removed and that the settings for the new sensor must be acquired and/or inspected.
Acknowledging a message by pressing any preferred button.



8.1.3 Zero adjustment

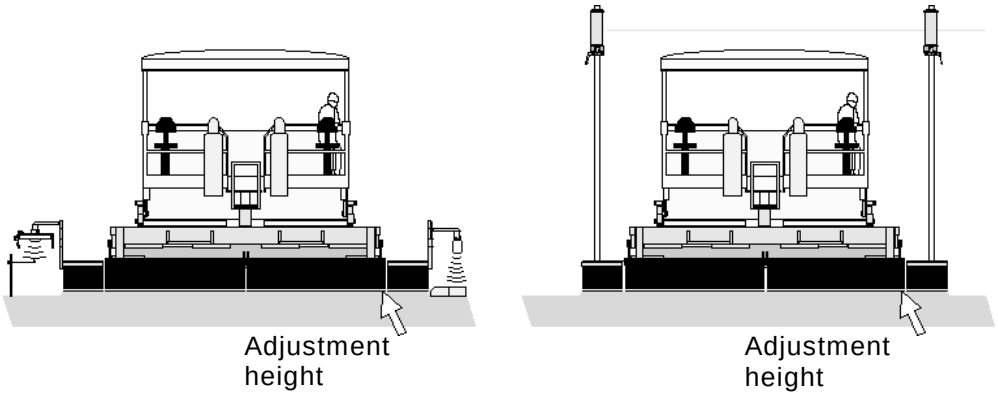
Before describing the works with the different grade sensors on the following pages, the term zero adjustment must be initially explained at this point.

For every new work project or always after a grade sensor has been assembled or dismantled, their current measured value should be adjusted to zero.
The system will then be informed about the current installation height of the grade sensor via the reference and, at the same time, create a clear reference for all following setpoint value specifications.
The process is referred to as zero adjustment.

For this:

1) Place the bottom edge of the tool manually to the adjustment height; i.e. on the level which is decisive for the forthcoming work project (layer thickness, milling depth, level of the plane to be finished etc).

2) Position the grade sensor(s) on the reference.
If you are working with laser receivers, then move them with the help of the integrated positioning aid so that the laser beam strikes in the centre of the receiver.
Note hereby the specific features of the various sensors. These features are described in the Section “Assembly and set-up” for the respective sensor.



The zero adjustment is only effective for grade sensors and when the digital controller is also located in the “Manual” operating mode.

If the tool and sensor(s) are set-up on the adjustment height, then you should proceed with the zero adjustment as follows:

3) Select in the sensor selection for the digital controller for the grade sensor to be adjusted.

4) Press the ENTER button and hold it down until the actual value display “Set” is displayed and after, another approx. 2 seconds, the value springs to “0.0”

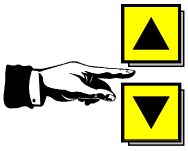
The current measured value of the grade sensor (actual value) will be acquired as the setpoint value and both variables will be assigned the value 0.0. No control deviation exists.

If a sensor on the controller has been disconnected and there is no other sensor connected, then “No / Sen” on the screen.
A sensor on the controller has been disconnected but a slope sensor is, for example, still connected, then “SLo / Sen” will appear as a possible sensor on the display.

8.1.4 Differences in the operation variants

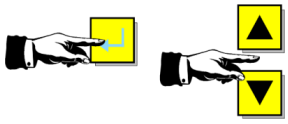
Your MOBA dealer can assist you with the operation of the controller and select from three variants. The operations then differentiate as follows:

STANDARD



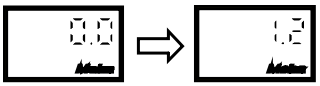
Setpoint value adjustment

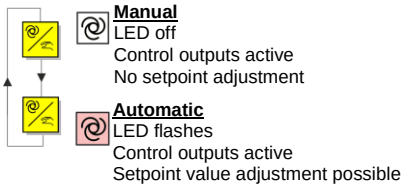
Use the UP/DOWN buttons to select the setpoint value amendment. The setpoint value amendment is executed in automatic mode consecutively in 1 mm steps.



Display value

The displayed setpoint value can be amended by actuating the Enter button together with the UP and/or DOWN buttons without influencing the tool position.





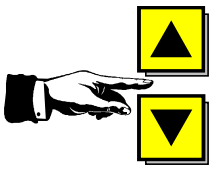
The switching between Manual, Semi-automatic and Automatic is executed revolving with the A/M button.

WARNING! **Tool will be traversed!**

The tool will therefore be traversed. The display will show the amended setpoint value

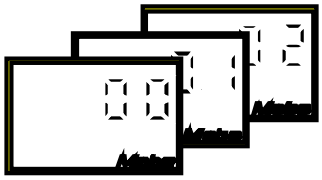
- Keep persons away / remove objects from the machine's danger zone.

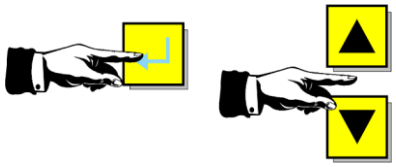
SEMI-AUTOMATIC (setpoint value adjustment without activated controller outputs)



Setpoint value adjustment

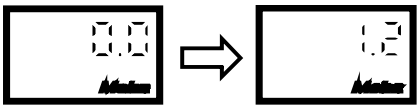
Use the UP/DOWN buttons to select the setpoint value amendment. The setpoint value amendment is executed in automatic mode or semi-automatic mode consecutively in 1 mm steps.

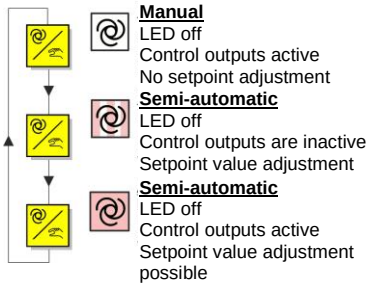




Display value

The displayed setpoint value can be amended by actuating the Enter button together with the UP and/or DOWN buttons without influencing the tool position.

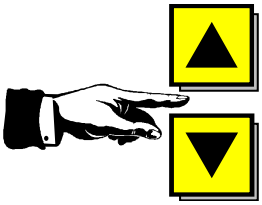




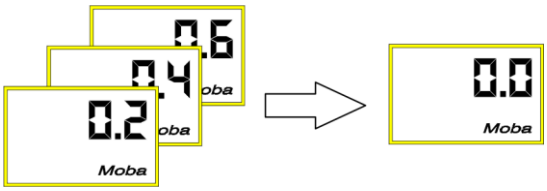
The switching between Manual, Semi-automatic and Automatic is executed revolving with the A/M button.

AUTO ZERO

Setpoint value adjustment



Use the UP/DOWN buttons to select the setpoint value amendment. The setpoint value amendment will be executed in automatic operating mode after respectively pressing again in 2 mm steps.



8.1.5 Retrofitting

Always turn the MOBA-Matic to “Manual” operating mode for sensor replacement, to setting-up works or for working on the sensors.

8.1.6 Switching off

For safety reasons, the digital controller will initially go into the “manual” operating mode with every switching on, also when the “Automatic” operating mode was switched on when the system was turned off.
Always still turn the MOBA-Matic to the “Manual” operating mode even when leaving the machine.
For longer downtime periods and at the end of the works, the power supply must be disconnected and the system dismantled or be reliably secured against being switched on again.

8.2 User menu

Important parameters and setting options for the behaviour of the system in general and for the operation of the individual sensor types can be found in the user menu for the controller in specialised summaries.

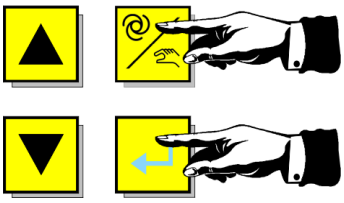
As different as the system can be compiled (depending on the application and the associated selection of sensors), the user menu also presents itself very differently.
Menu items, which are irrelevant in the currently related sensor combination, will also not be displayed when calling up the user menu to prevent unnecessary confusion for the operator. It may be that the user menu comprises only 2 menu items when called up, in other cases respectively with 7 or 8 menu points.

The following will describe all menu items in a sequence in which you can create a complete equipped and appropriately configured system.

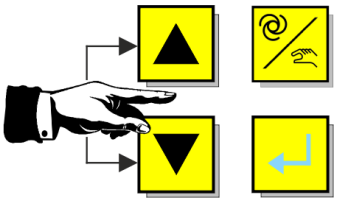
The individual components are:

- The sensor selection;
- The control sensitivity;
- The display of the cross-slope;
- The 3D setpoint assignment;
- The control window;
- The sampling factor;
- The hydraulic kit;

The user menu will be called up from the work menu.

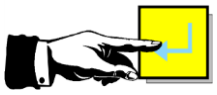


The call up of the first parameter is executed by simultaneously actuating the A/M button and the Enter button. Use the same button combination will also switch from one parameter to the next



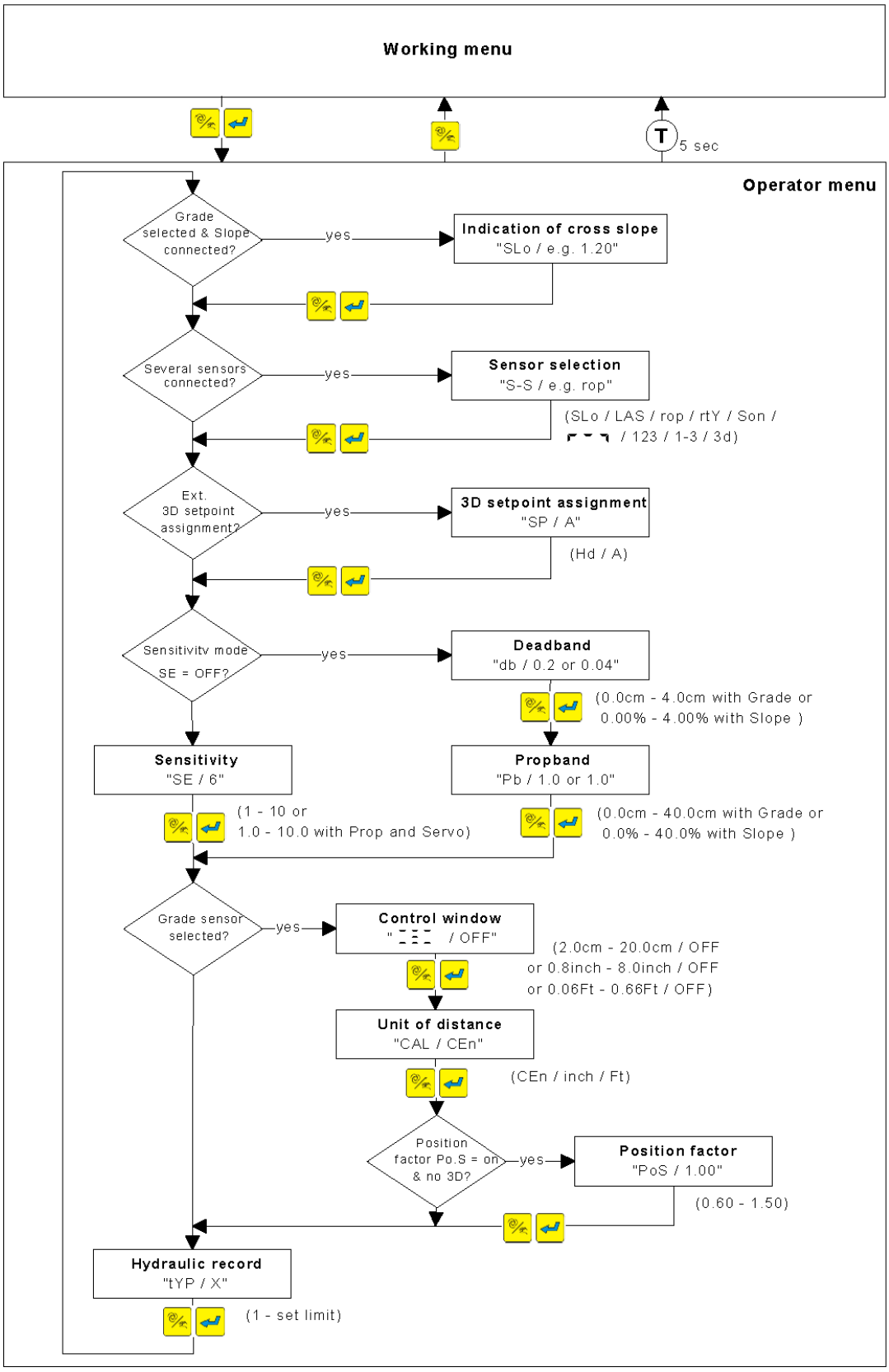
By pressing the UP or the DOWN buttons, the parameter values will be set or function modes will be switched.

The user menu can be exited again at any time by pressing the A/M button again.



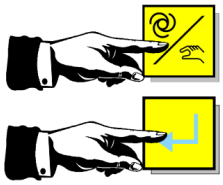
Alternatively you can switch again by utilising the Enter button in the menus.

Graphical representation of the user menu

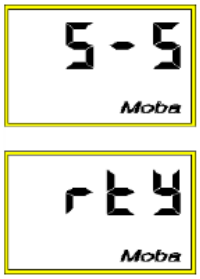


8.2.1 Sensor selection

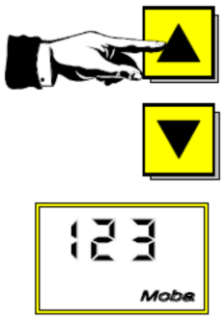
If multiple sensors are connected at the same time on one side of the machine and thus on the CAN Bus of one controller, then the desired sensor can be selected in the user menu under the menu item “Sensor selection” for the respective work project. The controller will then be operated with the selected sensor.



Simultaneously actuate the A/M button and the Enter button several times.



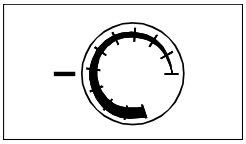
… until the display between the abbreviation for the sensor selection “S-S” and the identifier of the active sensor (here: "rtY for the rotary sensor) switches back and forth.



By actuating the UP and DOWN buttons, alternatively possible other sensors will be displayed (here the Big Ski) but are still not activated!

Working mode will be switched back to by actuating the A/M button. If no button is actuated, then the controller automatically switches back to this position after 5 seconds.
With the return switching, a newly selected sensor is activated.

8.2.2 Sensitivity setting



Sensitivity

The parameter “sensitivity” determines how quickly (or respectively how aggressively) the controller reacts to a deviation.

The setting range starts from 1 (low sensitivity) to 10 (high sensitivity).

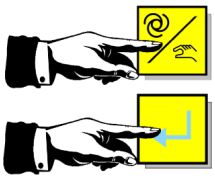
Behind the numerical values, there is an evaluated, meaningful combination of the control parameters “Dead band” and “Prop band” concealed.

The value tables can be found on the following pages.

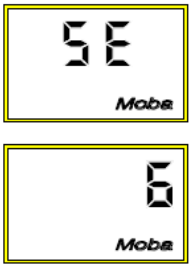
The sensitivity value can be set separately for each type of sensor and will then, when a sensor is changed, be automatically loaded.

Should the MOBA-Matic operate roughly in automatic mode, then the sensitivity on the corresponding digital controller must be reset. If the MOBA-Matic operates too sluggishly in automatic mode, then sensitivity must be increased on the corresponding digital controller.

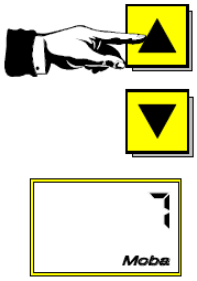
Your MOBA dealer has the possibility to amend the basic setting of the digital controller in such a way that instead of the parameter “Sensitivity”, the control parameters “Dead band” and “Prop band”, which are concealed behind this parameter, can be displayed. These can then be individually adjusted by trained personnel.



Simultaneously actuate the A/M button and the Enter button several times.



… until the display switches back and forth between the abbreviation for the sensitivity setting “SE” and the last set value (preset “6”).



The value will be increased and/or reduced by actuating the UP or DOWN buttons (here: Setting to the value “7”).

Working mode will be switched back to by actuating the A/M button. If no button is actuated, then the controller automatically switches back to this position after 5 seconds.

Sensitivity tables for proportional and servo valves:

Sensitivity	Dead band (mm)	Prop band (mm)
1.0	2.2	46.0
2.0	2.0	41.0
3.0	1.8	36.0
4.0	1.6	31.0
5.0	1.4	26.0
6.0	1.2	21.0
7.0	1.0	16.0
8.0	0.8	11.0
9.0	0.6	6.0
10.0	0.4	1.0

Dual-Sonic-Sensor, Sonic-Ski® plus, Big Sonic-Ski®

Sensitivity	Dead band (mm)	Prop band (mm)
1.0	0.18	2.10
2.0	0.16	1.90
3.0	0.14	1.70
4.0	0.12	1.50
5.0	0.10	1.30
6.0	0.08	1.10
7.0	0.06	0.90
8.0	0.04	0.70
9.0	0.02	0.50
10.0	0.00	0.30

Cable sensor and rotary sensor

Sensitivity	Dead band (%)	Prop band (%)
1.0	0.25	4.00
2.0	0.22	3.61
3.0	0.19	3.22
4.0	0.17	2.83
5.0	0.14	2.44
6.0	0.11	2.06
7.0	0.08	1.67
8.0	0.06	1.28
9.0	0.03	0.89
10.0	0.00	0.50

Slope sensor

Sensitivity tables for the switching mode:

Sensitivity	Dead band (mm)	Prop band (mm)
1	5.0	18.0
2	4.0	16.0
3	3.6	14.0
4	3.4	12.0
5	3.0	10.0
6	2.4	8.0
7	2.0	6.0
8	1.6	5.0
9	1.2	4.0
10	1.0	3.0

Dual-Sonic-Sensor, Sonic-Ski® plus, Big Sonic-Ski®

Sensitivity	Dead band (mm)	Prop band (mm)
1	4.0	18.0
2	3.4	16.0
3	3.0	14.0
4	2.4	12.0
5	2.0	10.0
6	1.4	8.0
7	1.0	6.0
8	0.8	5.0
9	0.6	4.0
10	0.4	3.0

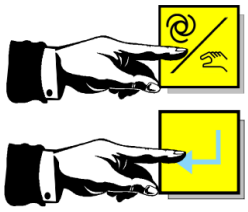
Cable sensor and rotary sensor

Sensitivity	Dead band (%)	Prop band (%)
1	0.40	1.60
2	0.30	1.40
3	0.20	1.20
4	0.14	1.00
5	0.10	0.80
6	0.06	0.60
7	0.04	0.50
8	0.02	0.40
9	0.02	0.30
10	0.00	0.20

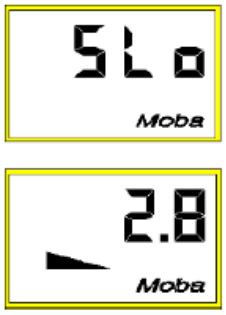
Slope sensor

8.2.3 Display for cross slope

If a slope sensor is connected to the CAN-Bus but a grade sensor is selected as the active sensor for this controller (also refer to item 8.2.1 “Sensor selection”, then the current measured cross slope will be displayed in the operator menu as the third point.



Actuate the A/M button and the Enter button at the same time



The display shows for a short moment (approx. 1 second) the abbreviation for the display of the cross-slope “Slo” and then flashes with the current measured value of the cross-slope sensor.

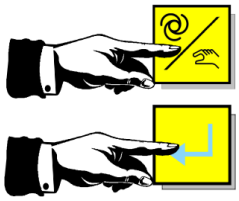
Work mode will be reset by actuating the A/M, as well as the UP and DOWN button.

8.2.4 3D setpoint assignment

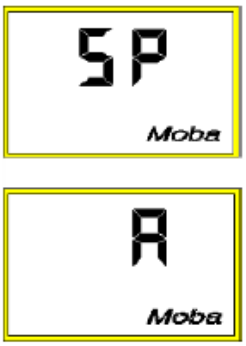
If the controller receives external 3D setpoint settings (for example, because a 3D-control with GPS or total station is integrated), then it can be selected here whether these should be utilised for the controlling or whether the default should still be executed in the conventional way by manual entries made by the operator using the keyboard.

A = Automatic = 3D setpoint setting;

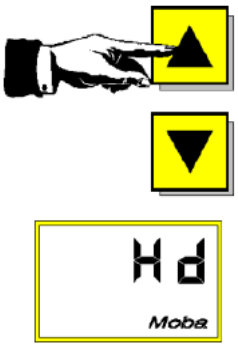
Hd = Manual mode = setpoint assignment is executed by using keyboard entries;



Actuate the A/M-button and the Enter button several times at the same time ...

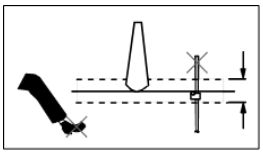


... until the display between the abbreviation for the setpoint assignment “SP” and the current control type (here: “A” for 3D setpoint assignment)



By actuating the UP or DOWN button, the other setpoint assignment set (here: “Hd” for setpoint assignment for input from the keyboard) will be set accordingly.

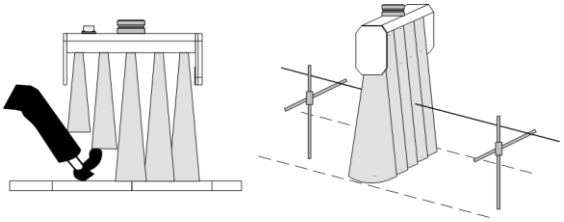
Working mode will be switched back to by actuating the A/M button. If no button is actuated, then the controller automatically switches back to this position after 5 seconds.



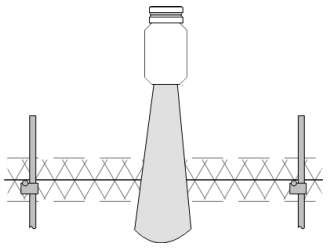
8.2.5 Control window

This menu item is only then displayed when a grade sensor is active.

Erratic amendments in the measured value of a sensor can occur due to various reasons. Causes can be both negligence of the operating personnel (obstacles in the sound beam of an ultrasonic sensor, crossing over a string line holder etc.) as well as technical errors (reference string is torn, etc.).

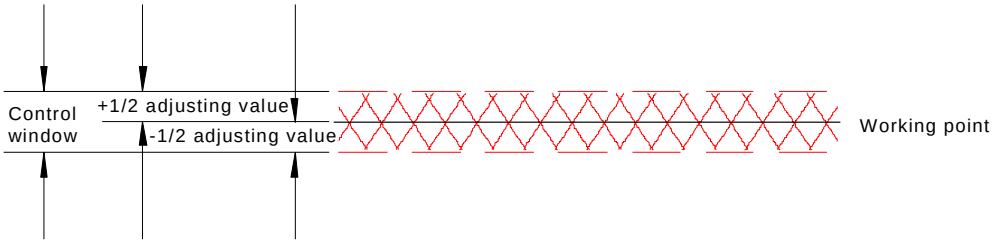


To prevent these unintended measurement errors and the resulting extreme controlling actions of the machine, the measured values of all grade sensors can be allocated with a so-called “control window”.

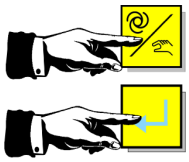


If a control deviation occurs which is greater than the range set here, then this deviation will be detected as an error.
In this case a warning symbol “Measured value is outside the control window” will appear in the display, the complete LED arrow flashes and the activation of the hydraulic cylinder will be switched off.

The variable for the symmetry around the working point of the control window is adjustable.
The setting will be executed, depending on the physical measuring unit for the distance measurement, in 0.1 cm, 0.1 inch or 0.01 feet increments.
The set value for the control window describes a range around the working point; i.e. when a half a set value is once above and one below the working point.
(Example: 6 cm control window = +/- 3 cm around the working point)

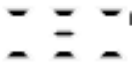


Setting the control window

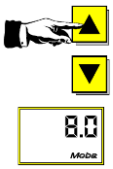


Simultaneously actuate the A/M button and the Enter button several times.

… until the display between the symbol for the control window setting



and the last set value (preset “OFF” - is also deactivated) switches back and forth.



By pressing the UP or DOWN button, this variable for the control window will be increased or reduced (here: setting to the value “8.0”[± 4.0 cm])

Working mode will be switched back to by actuating the A/M button. If no button is actuated, then the controller automatically switches back to this position after 5 seconds.

The function “Control window” can be deactivated.
Increase the value until the symbol “Off” appears in the display instead of a numerical value.

8.2.6 Sampling factor

The sampling factor function is only utilised with the milling application!

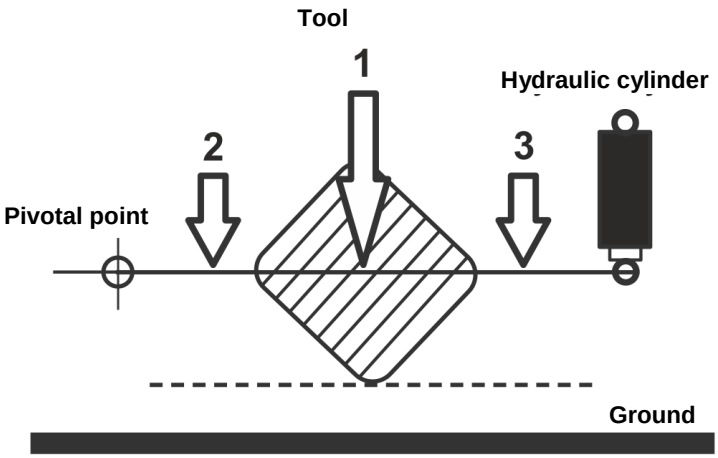
This menu item will only then be displayed when a sensor is activated with the control basic setting and when a grade sensor is selected in the “Sensor selection” menu item.

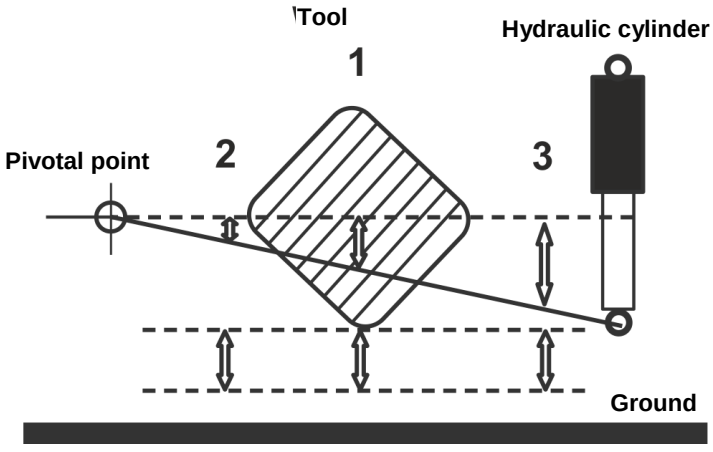
Change in height of the sensor x sampling factor = change in height of the tool

Determining the sampling factor:
Before a sampling factor can be entered, this must of course be initially determined. With the necessary physical principles here:

In most of the applications for which the MOBA-Matic was conceived, the height adjustment of the tool to be regulated is executed via a fixed pivotal point.

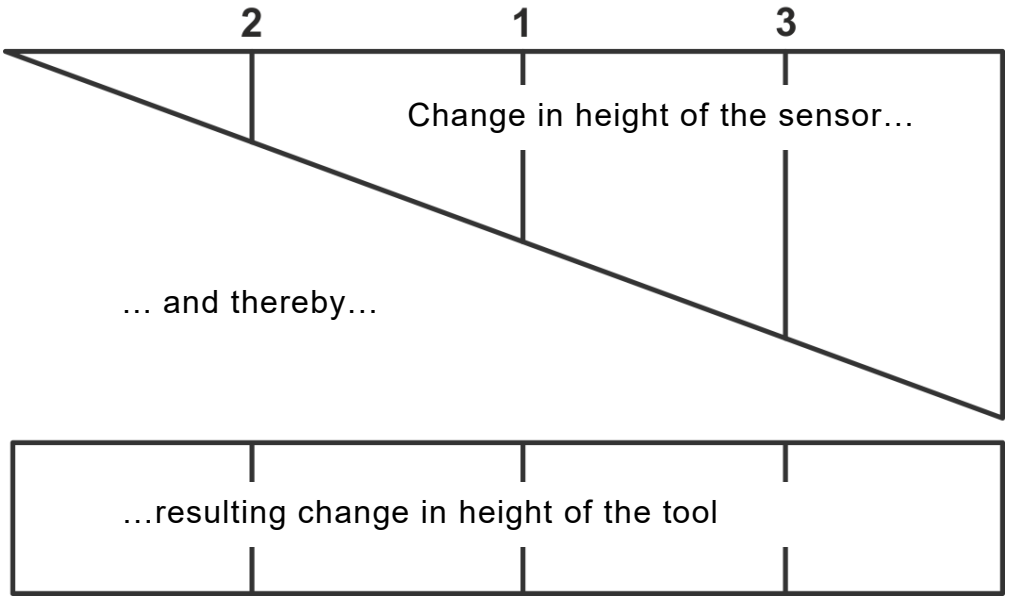
The Positions 1, 2 and 3 on the adjacent diagram specify mounting points for the grade sensors, whereby the Position 1 also corresponds to the tool centre point.
The position of the adjuster (a hydraulic cylinder can be on every optional position here and has no influence for the sampling factor).





If the grade sensor is fixed on Position 1 - i.e. directly above the tool centre point - then a change in height for the tool corresponds exactly to the change in height of the sensor. The sampling factor is exactly 1.00 for this special case.

Otherwise it behaves for the mounting points 2 and 3.

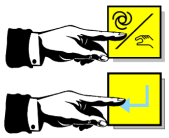


Let us initially consider the mounting position 2:
The same change in height on the tool as previously will only create a minimal change in height of the sensor here, as it is mounted considerably closer to the pivotal point.
It therefore follows that the sampling factor - in the case of a sensor fitting between the pivotal point and tool centre point - must always be larger than 1.00 in order to compensate for this situation.
The change in height of the sensor on sensor Position 3 is however significantly greater than that of the tool. Therefore the sampling factor must be smaller than 1.00 in this case as the sensor is mounted farther away from the pivotal point as the tool itself.

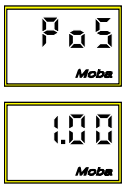
The sampling factor can be calculated with the following formula:

$$\frac{\text{Distance for fixed pivotal point <--> Tool}}{\text{Distance for fixed pivotal point <--> Sensor}} = \text{Sampling factor}$$

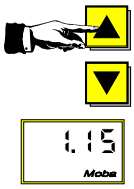
Entering the sampling factor



Simultaneously actuate the A/M button and the Enter button several times.



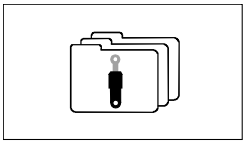
… until the display switches back and forth between the abbreviation for the sampling factor “POS” and the preset value “1.00*”.



The value for the sampling factor will be adjusted by actuating the UP or DOWN button.

Working mode will be switched back to by actuating the A/M button. If no button is actuated, then the controller automatically switches back to this position after 5 seconds.

8.2.7 Hydraulic kit setting



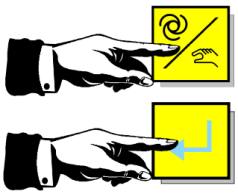
Hydraulic dataset

Should the MOBA-Matic be utilised on different machines, then trained specialised personnel can enter hydraulic parameter settings for up to x different machine types (the maximum possible number of hydraulic kits can be limited in the basic setting of the digital controller by your MOBA dealer).

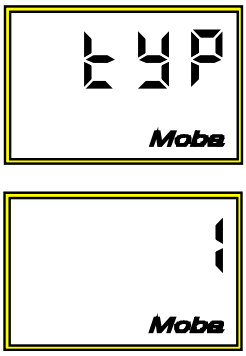
The stored settings for the respective machine can then be loaded via this menu item.

The change of the hydraulic dataset has a direct influence on the control. It is possible that the control of your machine only works with a different dataset or only insufficiently - therefore only make amendments when you are absolutely sure.

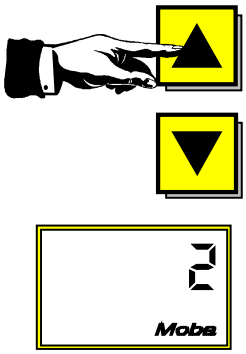
Entering the hydraulic kit



Simultaneously actuate the A/M button and the Enter button several times ...



... until the display switches back and forth between the abbreviation for hydraulic kit setting “tYP” and the last set hydraulic kit setting (preset “1”).



There will be a switching between the saved hydraulic kits when the UP or DOWN buttons are actuated (here: Adjustment of the hydraulic kit “2”).

Working mode will be switched back to by actuating the A/M button. If no button is actuated, then the controller automatically switches back to this position after 5 seconds.

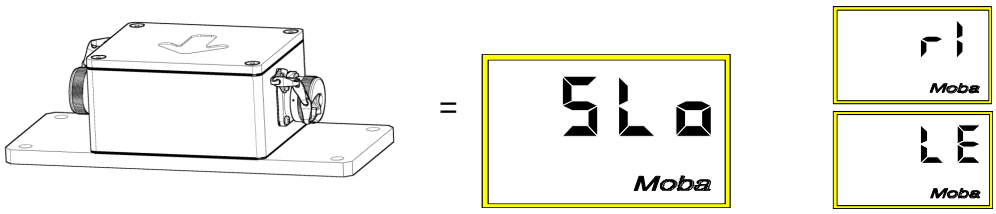
8.3 Working with the slope sensor

8.3.1 Description

The slope sensor operates with a highly precise, electro-mechanical measuring unit and is used for the acquisition of the slope for the tool.

Sensor identification:

When the system is switched on, or with a sensor change, the illustration in the controller display alternates (changes) between the abbreviation for the Digi-Slope sensor and the side detection (right = engl.: right or left = engl.: left).



8.3.2 Information for assembly

The slope sensor must be assembled on a machine part which implements all slope amendments for the tool in the same dimension.

In the case of a road milling machine, this is preferred in the lower area of the machine (e.g. on the milling drum housing); on the transverse traverse between the tow arms for blacktop pavers.

Four fixing holes are provided on the fastening plate of the sensor for the assembly works (refer to Section 11 “Technical data” for the housing drawing).

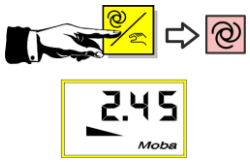
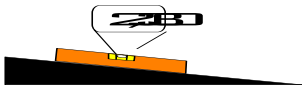
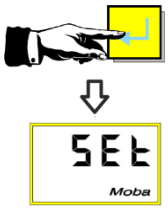
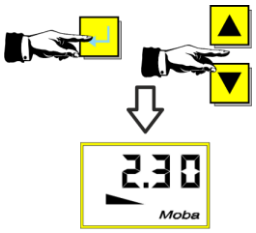
The plug connections must be freely accessible to ensure that the connection of the connecting cable is easily possible. Please also note the direction of installation (FWD/arrow pointing in the direction of travel).

8.3.3 Actual value adjustment

Definition

The slope sensor should be parallel to the bottom edge of the tool during assembly. As this is not always 100 percent possible in practice and sometimes an offset remains, the sensor will be subsequently calibrated in the system.
Once the “Offsets” between measured value and reality have been determined, the slope sensor then exactly indicates the slope of the tool again. We are talking about the actual value adjustment here.

Procedure: Actual value adjustment during automatic mode

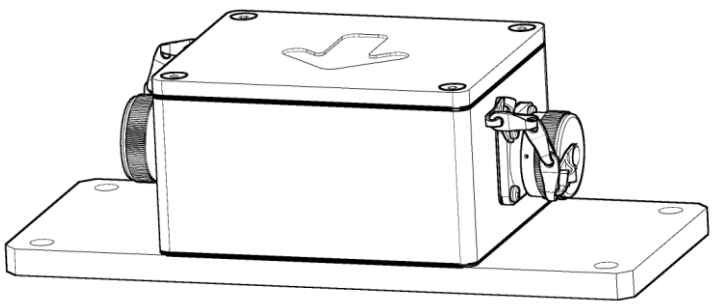
1)	2)	3)	4)
			
The system is located in automatic mode (“AUTO” function lamp is on). Here in our example, the control works with a setpoint value setting of 2.45%.	The results of the work will be measured again with a highly accurate digital spirit level. According to the above presentation, this determined actual value is actually only 2.30%.	Press the enter key and hold it down. Initially “SEt” will appear in the display, then the display changes back to the numerical value.	The Enter key will remain pressed and the value displayed will be corrected with the UP/DOWN buttons to the determined actual value (2.30%) under 2.

Repeat Steps 2) to 4) as necessary until the set value and the built-in slope are identical with each other.

For optimum working results, the actual value display must be inspected at regular intervals and corrected if necessary. A new actual value adjustment must be generally executed when the Digi-Slope sensor is replaced or its installation location had to be changed or when mechanical alterations have been implemented on the tool or its mounting position (e.g. mechanical adjustment of the plank setting angles pitch on the paver).

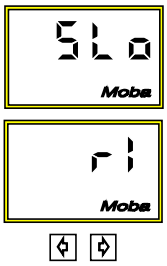
8.3.4 Controlling with the slope sensor

The slope sensor and the digital controller are assembled, the cables are connected and the digital controller is supplied with voltage. After the switch-on message has been issued, digital controller indicates the sensor ID. If the message for the connected sensor changes automatically after a short period of time to display the actual value, then the system is ready for operation. If the sensor is being operated for the first time or has been previously replaced, then the sensor ID must be acknowledged by pressing a preferred button. Otherwise execute sensor selection as described in the last section.



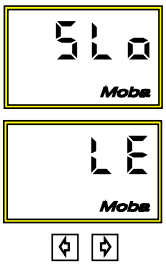
Procedure: Acknowledgement of the sensor ID

1a)



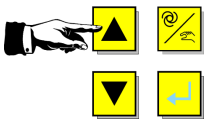
The digital controller indicates the sensor ID (here: right).

1b)



The digital controller indicates the sensor ID (here: left).

2)



If the sensor is being operated for the first time or has been previously replaced, then the sensor ID must be acknowledged by pressing a preferred button.

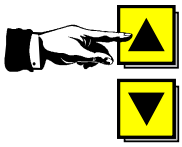
WARNING!

Tool will be traversed!

This step must be executed at all times. In the event of non-compliance, the tool will traverse to an undefined position tool when changing over to automatic mode.

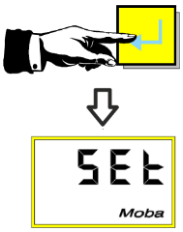
1) 

Manual mode will be switched back to with the A/M button. The “AUTO” function lamp is off.

2) 

The tool will be attached on the machine in the desired working position with the UP/DOWN buttons on the controller or with the operating unit.

(here: 5.35%, right slope)

3) 

The Enter button must now be pressed to acquire the slope of the tool as the setpoint value. The “SEt” message appears in the display.

4) 

The actual value then appears on the display again.

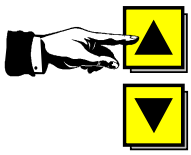
5) 

Actuate the A/M button to switch over to automatic mode. The function lamp “AUTO” is on.

6) 

The controller now displays 5.35% as the setpoint value. It will now be adjusted to this value. A control deviation will be shown with the corresponding RAISE/LOWER arrows.

7)



The setpoint value will be amended as step by step with the UP/DOWN buttons. The controller then regulates to this new value.

(here: 6.00% right slope)

8)

One can reset to the actual value at any time with the A/M button to inspect the slope of the tool. The automatic control of the valve is then however switched off.

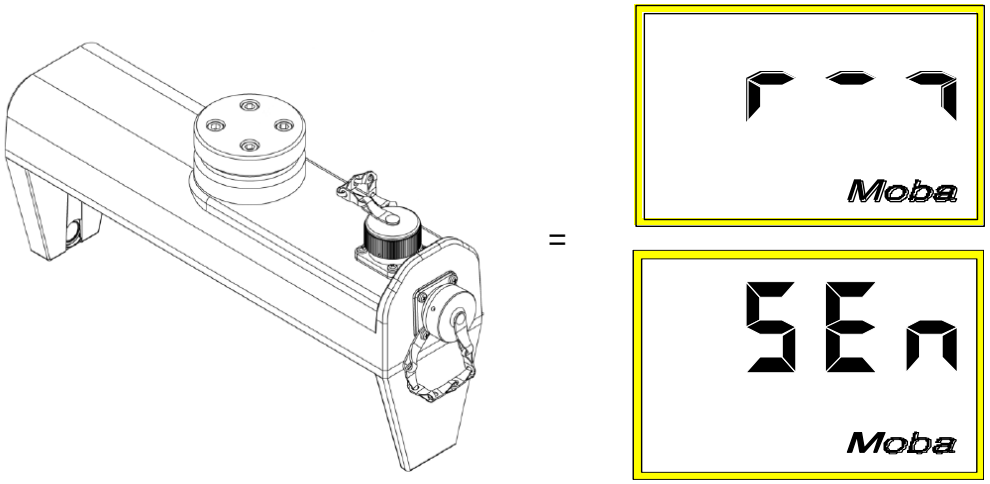
	Sensitivity setting If the system works in automatic mode too sluggishly, then the sensitivity setting should be amended accordingly. The procedure is described under item 8.2.2 of this user manual.

8.4 Working with the Sonic-Ski® plus

8.4.1 Description

The Sonic-Ski sensor is a sensor for distance measurement and works without contact with 5 ultrasonic sensors. A sixth sensor is used for temperature compensation.

Sensor identification:
When the system is switched on, or with a sensor change, the illustration in the controller display alternates (changes) between the design for the Sonic-Ski® and the abbreviation for the sensor.

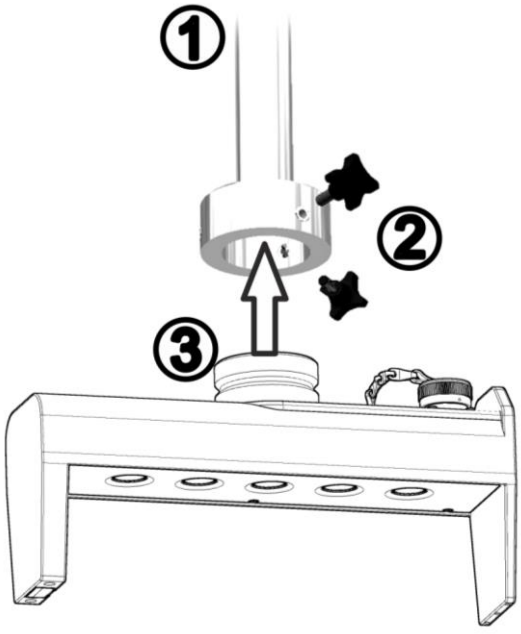


8.4.2 Information for the assembly and the working range

The Sonic-Ski can be easily and quickly assembled with simple tools. For this purpose, a securing pipe should be attached on a suitable point (e.g. on the tow arm for pavers or on the chassis for milling machines).

Procedure:

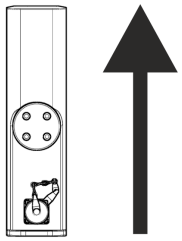
1. Loosen the clamping screws on the securing pipe.
2. Insert the round centring spigot on the top side of the sensor housing vertically in the securing pipe.
3. Rotate the sensor housing according to the moving direction.
4. Secure the centring pivot of the sensor with the clamping screws.



1	Securing pipe
2	Clamping screws
3	Centring pivot

Mounting direction Ground sensing

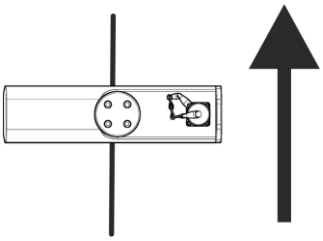
The Sonic-Ski® plus must be operated longitudinal to the direction of travel of the machine (averaging) for ground sensing.



Moving direction

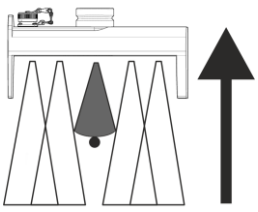
Mounting direction String line sensing

The Sonic-Ski® plus must be operated laterally to the direction of travel of the machine for string line sensing. Align the sensor at the centre of the string.



Moving direction

In order to display the string under the sensor heads of Sonic-Ski® plus in the display as lateral, the sensor must be built in on both sides in such a way that so it is represented as in the sensor symbol i.e. Respectively with the connecting plug to the left (as seen in direction of travel).

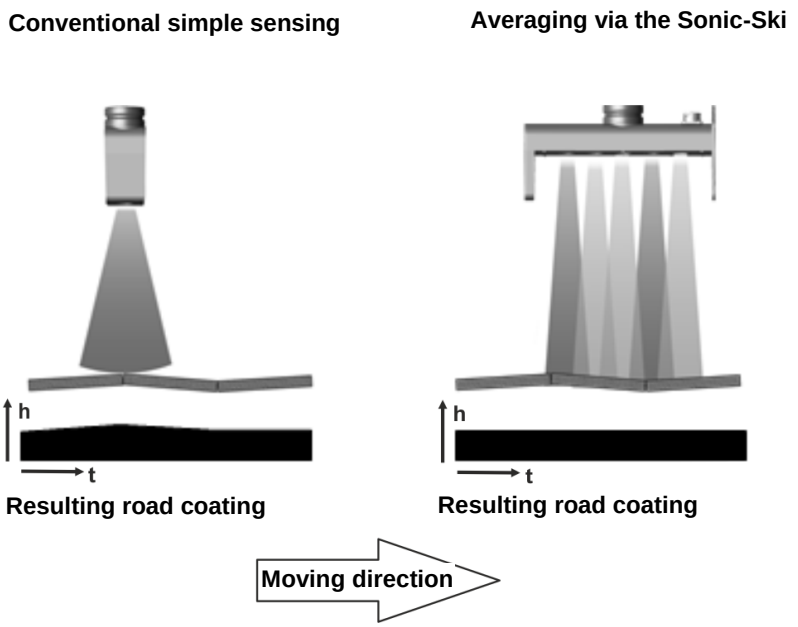


Moving direction

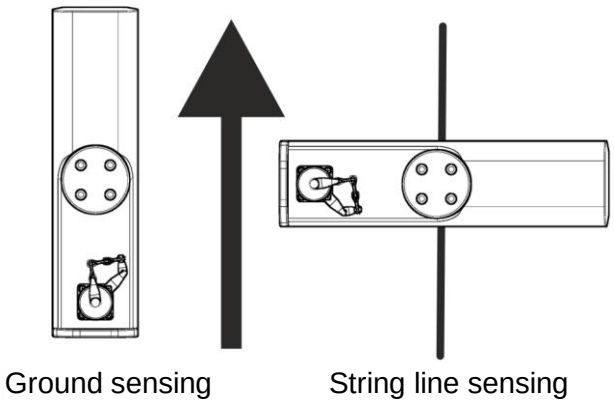
The string will only initially be recognised as a reference point with a diameter of 3 mm.

The moving direction:

The moving direction of the Sonic-Ski® is preassigned as follows: The Sonic-Ski® should operate in a longitudinal direction (averaging by Sonic-Ski®) with ground sensing.

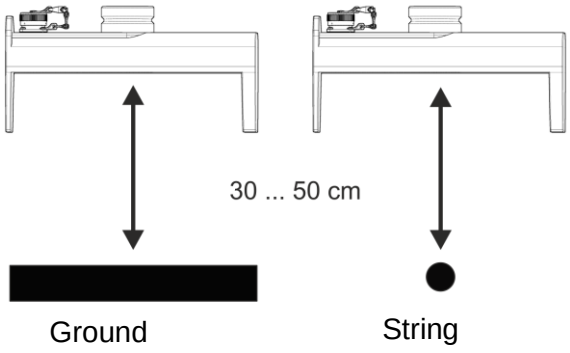


The Sonic-Ski must operate in a lateral direction with string line sensing so that the full working width of 25 cm is available.

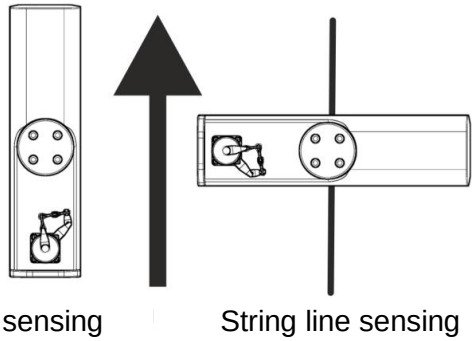


The working range:

The working range for ground and string line sensing for Sonic-Ski is between 30 cm and 50 cm.
The actual value displayed on the LCD display of the controller increases steadily in this range, the display flashes (positioning aid) outside of this range.
The Sonic-Ski® should be aligned to approx. 35 cm distance to the reference. The string will only initially be recognised as a reference point with a diameter of 3 mm.



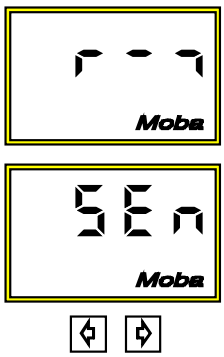
At this point we should once again expressly refer to the preassigned working directions for string and ground sensing and the optimal working range of Sonic-Ski®. Both defaults must be strictly adhered to in order to achieve the best possible results.



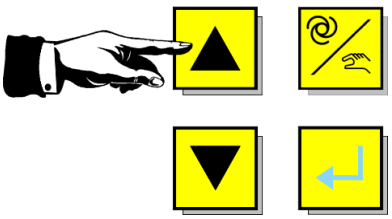
8.4.3 Working with the Sonic-Ski® plus

The Sonic-Ski® and the digital controller are assembled, the cables are connected and the digital controller is supplied with voltage. After the switch-on message has been issued, digital controller indicates the sensor ID. If the message for the connected sensor changes automatically after a short period of time to display the actual value, then the system is ready for operation. If the sensor is being operated for the first time or has been previously replaced, then the sensor ID must be acknowledged by pressing a preferred button. Execute the sensor selection as described in Section 4 when applicable.

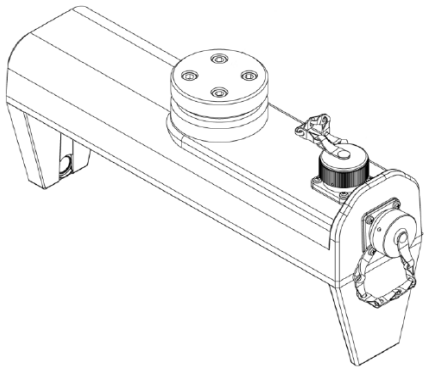
Procedure: Acknowledgement of the sensor ID



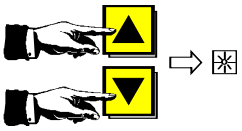
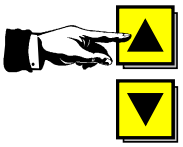
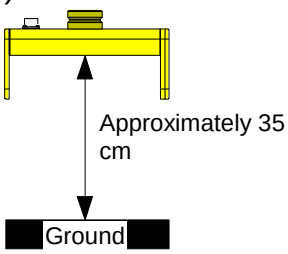
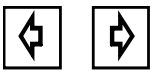
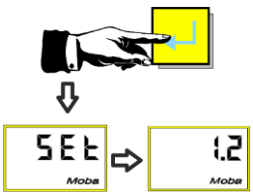
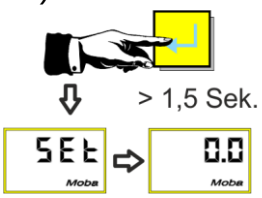
The digital controller displays the sensor identification for the Sonic-Ski.



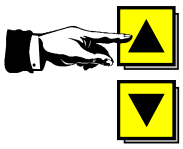
If the sensor is being operated for the first time or has been previously replaced, then the sensor ID must be acknowledged by pressing a preferred button.



8.4.4 Controlling with the Sonic-Ski® plus for ground sensing

1) 	2) 	3) 	4) 
Manual mode will be switched back to with the A/M button. The “AUTO” function lamp is off.	The ground mode will be activated by simultaneously pressing the UP/DOWN buttons. The string lamp is off.	Align the tool to the working position for the zero adjustment with the UP/DOWN buttons on the controller or the operator unit on the machine.	Align Sonic-Ski to a distance of 35 cm above the ground (the actual value display must be constantly on).
5) 	6a) 	6b) 	7) 
The two arrows are irrelevant with ground sensing.	Now press the Enter key. In the event of a brief press, “SEt” appears on the display. The current actual value is then acquired as the setpoint value.	If the button is pressed for longer than 1.5 seconds, then the display will change from “SEt” to “0.0”. The actual value and the setpoint are now set to zero.	Automatic mode will be switched back to with the A/M button. The function lamp “AUTO” is on.  The controller stops the tool on the set value.

8)



Use the UP/DOWN buttons to amend the setpoint value in automatic mode to be therefore able to acquire corrections.

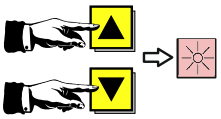
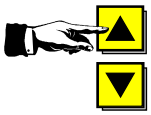
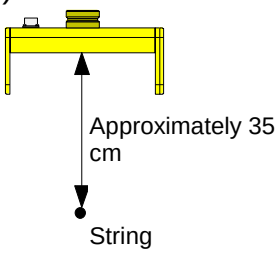
9)

Manual mode can be switched back to at any time with the A/M button. The automatic control of the valve will therefore be switched off.

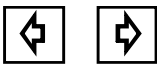
Operating variants

Adjustment and display of the setpoint value, depending on the operating version, as different (also refer to Section 8.1.4 “Differences between the control variants” in this manual).

8.4.5 Controlling with the Sonic-Ski® plus in string line sensing

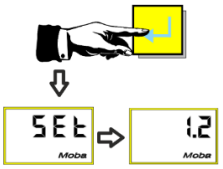
1)	2)	3)	4)
			
Manual mode will be switched back to with the A/M button. The “AUTO” function lamp is off.	The string mode will be activated by simultaneously pressing the UP/DOWN buttons. The string lamp is on.	Align the tool to the working position for the zero adjustment with the UP/DOWN buttons on the controller or the operator unit on the machine.	Align Sonic-Ski to a distance of 35 cm above the string (the actual value display must be constantly on).

5)



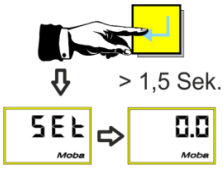
The Sonic-Ski must be aligned centrally over the string (both direction arrows off).
Lamps off = string centre / lamp on = string half outside / lamp flashes = string outside.
If the string is in the outer sensor range, then the Sonic-Ski must be calibrated again.

6a)



Now press the Enter key. In the event of a brief press, “SEt” appears on the display. The current actual value is then acquired as the setpoint value.

6b)



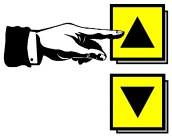
If the button is pressed for longer than 1.5 seconds, then the display will change from “SEt” to “0.0”. The actual value and the setpoint are now set to zero.

7)

Automatic mode will be switched back to with the A/M button. The function lamp “AUTO” is on.

The controller stops the tool on the set value.

8)



Use the UP/DOWN buttons to amend the setpoint value in automatic mode to be therefore able to acquire corrections.

9)

Manual mode can be switched back to at any time with the A/M button. The automatic control of the valve will therefore be switched off.

Function not available

The function is not available when a Big-Ski is connected.

Operating variants

Adjustment and display of the setpoint value, depending on the operating version, as different (also refer to Section 8.1.4 “Differences between the control variants” in this manual).

Sensitivity

If the system works in automatic mode too sluggishly, then the sensitivity setting should be amended accordingly. (Refer to item 8.2.2 of this manual).

Control window

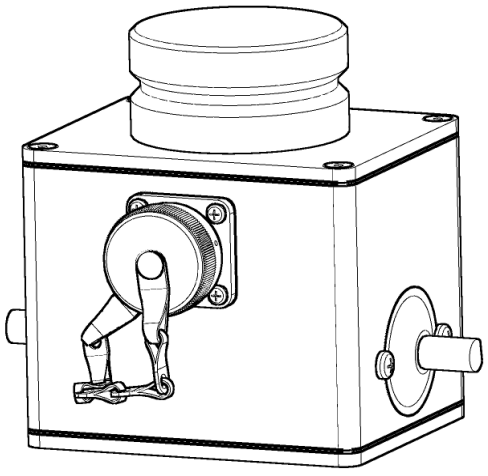
A control window is active when operating the digital controller with the rotary sensor. The setting of the control window can be read out under the item 8.2.5 of this user manual.

8.5 Working with the Digi-Rotary Sensor

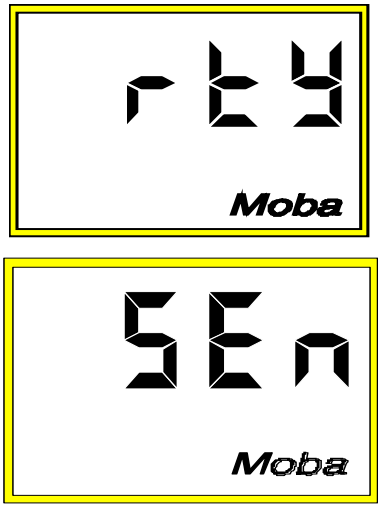
8.5.1 Description

The rotary sensor is a sensor for distance measurement and senses the measured values by using mechanical means from an existing reference. This can be both a taut and measured string as well as a surface (e.g. a road surfacing).

Sensor identification:
When the system is switched on, or with a sensor change, the illustration in the controller display alternates (changes) between the abbreviation for rotary and the abbreviation for sensor.

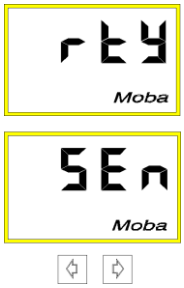


=

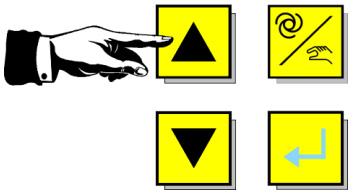


The rotary sensor and the digital controller are assembled, the cables are connected and the digital controller is supplied with voltage. After the switch-on message has been issued, digital controller indicates the sensor ID. If the message for the connected sensor changes automatically after a short period of time to display the actual value, then the system is ready for operation. If the sensor is being operated for the first time or has been previously replaced, then the sensor ID must be acknowledged by pressing a preferred button. Otherwise execute sensor selection as described in Section 8.2.1 .

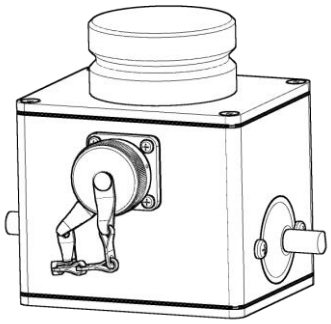
Acknowledgement of the sensor ID



The digital controller shows the sensor identification.



If the sensor is being operated for the first time or has been previously replaced, then the sensor ID must be acknowledged by pressing a preferred button.



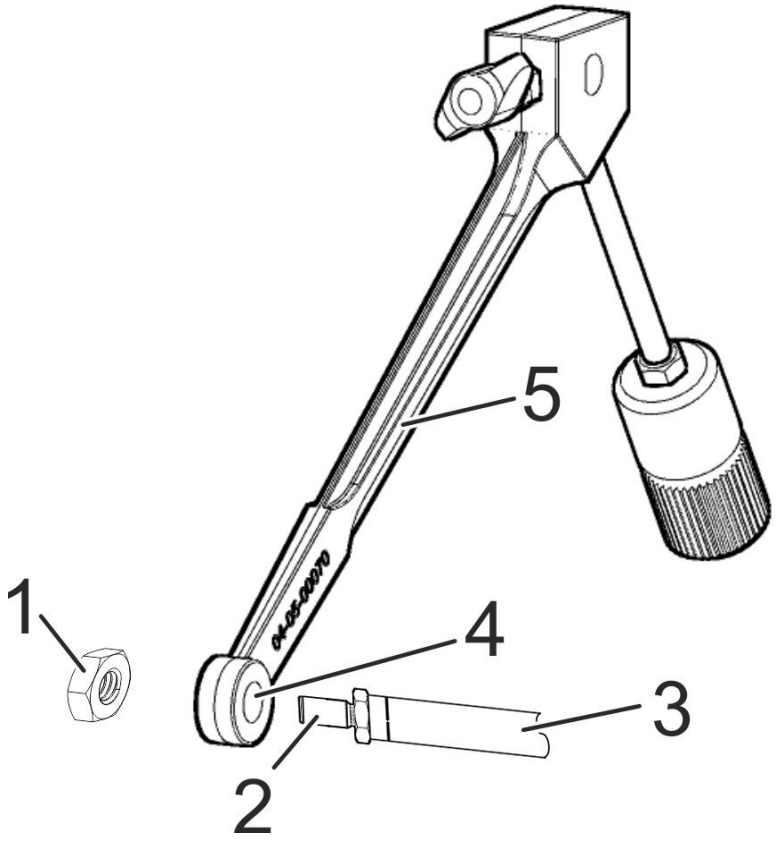
Always observe the contact force of the sensing pipe on the string and/or the sensing ski on the ground.

8.5.2 Information for assembly and applications

Two auxiliary aids are available for sensing the different references. The sensing tube will be utilised for sensing the string; the sensing ski for the ground.

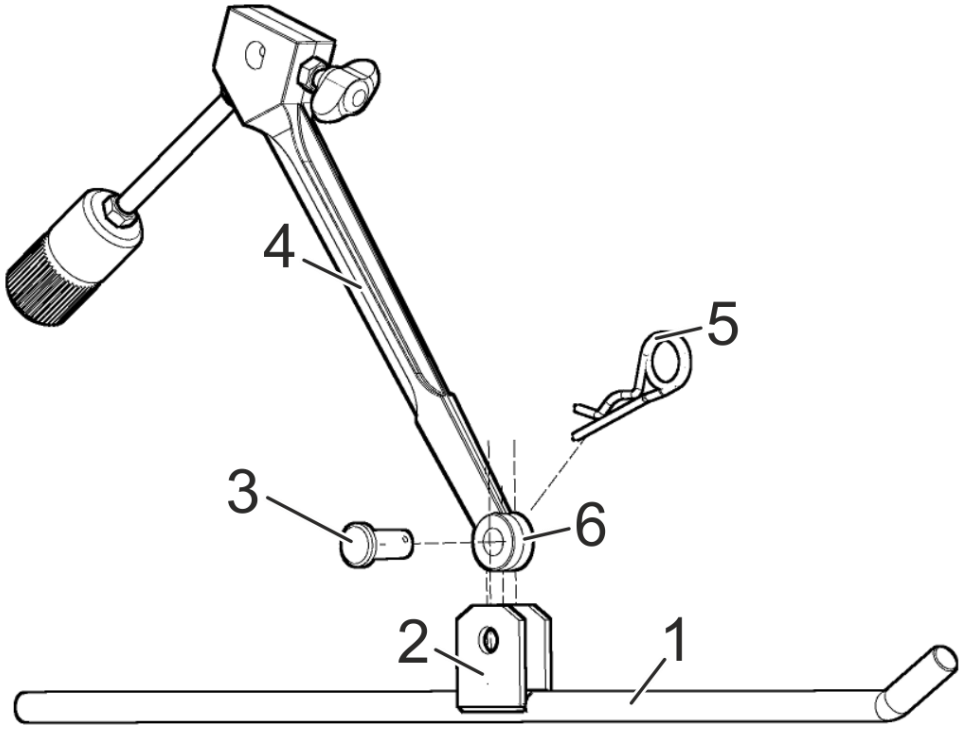
Assembling the sensing tube on the sensing arm

1) Loosen the nut (1) on thread (2) of the sensing tube (3).
2) Slide the sensing tube (3) into the securing ring (4) of the sensing arm (5).
3) Secure the sensing tube (3) with the nut (1).



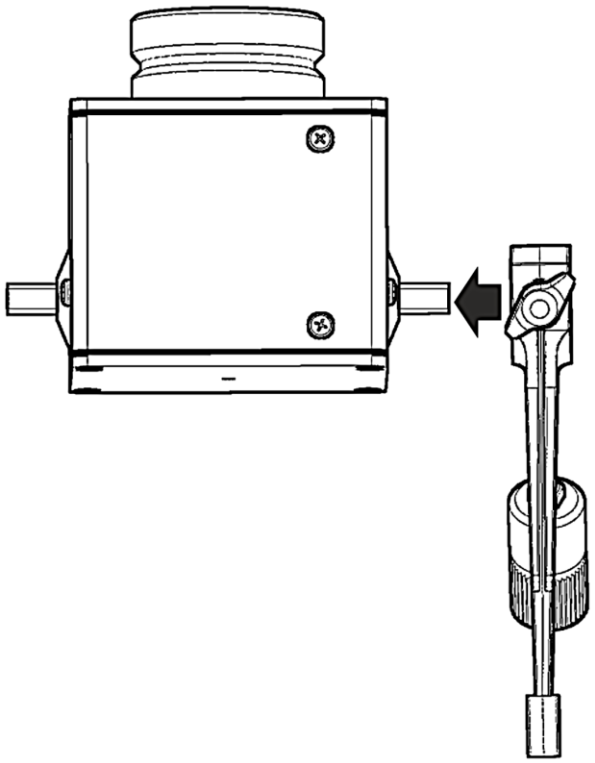
Assembling the sensing ski on the sensing arm

1) Remove the locking pin (5) from the bolt (3) of the sensing ski (1); remove bolt (3).
2) Guide the ski fastening (2) over the locking pin (6) of the sensing arm (4).
3) Insert the bolt (3) through the ski fastening (2) and the locking pin (6).
4) Secure the bolt (3) with the splint pin (5).



Assembling the sensing arm on the rotary sensor

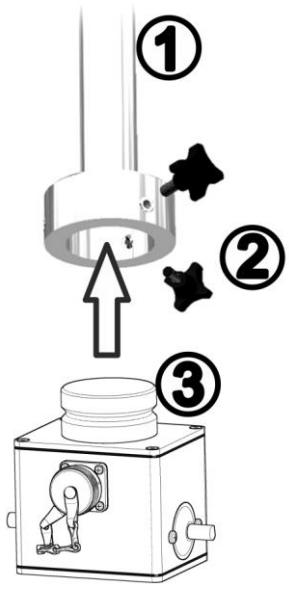
1) Rotate the flattened part of the axis to the opposite side of the sensor connector.
2) Loosen the clamping screw on the sensing arm.
3) Insert the sensing arm on the axis.
4) Securely tighten the clamping screw on the flat part of the axis.



The rotary sensor can be easily and quickly mounted using simple tools. A securing pipe should be attached on a suitable position for this purpose (for paver e.g. On the tow arm at the height of the auger or on the chassis above the milling drum with a milling cutter).

Procedure:

1. Loosen the clamping screws on the securing pipe.
2. Insert the round centring spigot on the top side of the sensor housing vertically in the securing pipe.
3. Rotate the sensor housing according to the moving direction (connecting plug in moving direction).
4. Secure the centring pivot of the sensor with the clamping screws.

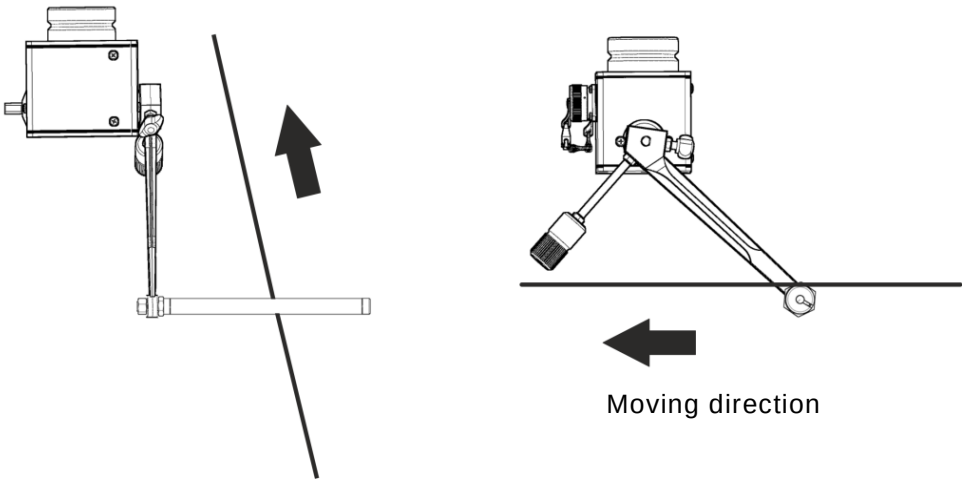


1	Securing pipe
2	Clamping screws
3	Centring pivot

The rotary encoder “drags” the sensing arm with the thereby located auxiliary aids behind itself.
Two different auxiliary aids are available for sensing the different references.
The rotary encoder should be aligned in such a way that the flat side of its sensor axis is vertical to the reference with an overlaying sensing tube and/or sensing ski. This position results in the perfect angle for the measured value recording. (Also refer to the diagrams below.)

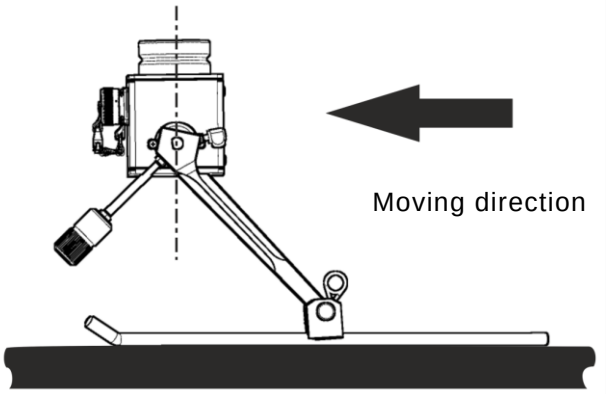
Sensing the string

The sensing tube is implemented for sensing the string.
Align the counter weight by screwing in or unscrewing so that the sensing tube applies a slight pressure on the string from above.
If the string to be utilised as a reference indicates to little tension, then there is a possibility to introduce the sensing tube from under the string. The counterweight must be set here in such a way that the sensing tube slightly presses against the string from underneath.

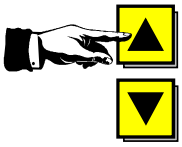
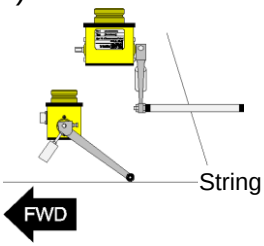
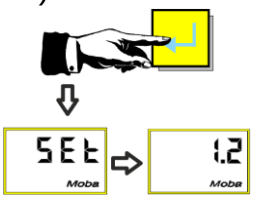


Sensing the ground

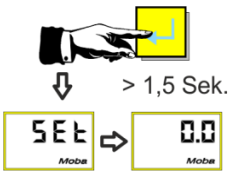
The sensing ski is utilised when sensing the ground.
Align the counter weight by screwing in or unscrewing so that the sensing ski applies a slight pressure on the reference.



8.5.3 Controlling with the Digi rotary sensor (string line sensing)

1)	2)	3)	4a)
			
Manual mode will be switched back to with the A/M button. The “AUTO” function lamp is off.	Align the tool to the working position for the zero adjustment with the UP/DOWN buttons on the controller or the operator unit on the machine.	The sensing tube must apply slight pressure on the string. This can be set with the counterweight.	Now press the Enter key. In the event of a brief press, “SEt” appears on the display. The current actual value is then acquired as the setpoint value.

4b)



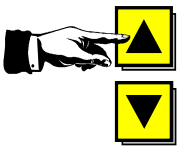
If the button is pressed for longer than 1.5 seconds, then the display will change from “SEt” to “0.0”. The actual value and the setpoint are now set to zero.

5)

Automatic mode will be switched back to with the A/M button. The function lamp “AUTO” is on.

The controller stops the tool on the set value.

6)



Use the UP/DOWN buttons to amend the setpoint value in automatic mode to be therefore able to acquire corrections.

7)

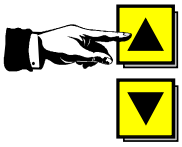
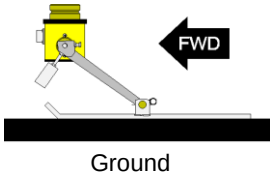
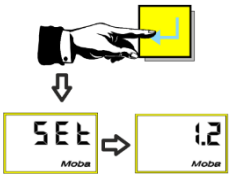
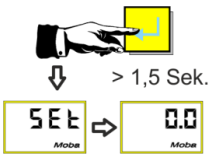
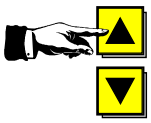
Manual mode can be switched back to at any time with the A/M button. The automatic control of the valve will therefore be switched off

Reaction force for sensing tube

The reaction force of the sensing tube changes with the adjustment.

Adjustment and display of the setpoint value, depending on the operating version, as different (also refer to Section 8.1.4 “Differences between the control variants” in this manual).

8.5.4 Controlling with the Digi Rotary Sensor (ground sensing))

1)  Manual mode will be switched back to with the A/M button. The “AUTO” function lamp is off.	2)  Align the tool to the working position for the zero adjustment with the UP/DOWN buttons on the controller or the operator unit on the machine.	3)  The sensing ski must apply slight pressure on the ground. This can be set with the counterweight.	4a)  Now press the Enter key. In the event of a brief press, “SEt” appears on the display. The current actual value is then acquired as the setpoint value.
4b)  If the button is pressed for longer than 1.5 seconds, then the display will change from “SEt” to “0.0”. The actual value and the setpoint are now set to zero.	5)  Automatic mode will be switched back to with the A/M button. The function lamp “AUTO” is on.  The controller stops the tool on the set value.	6)  Use the UP/DOWN buttons to amend the setpoint value in automatic mode to be therefore able to acquire corrections.	7)  Manual mode can be switched back to at any time with the A/M button. The automatic control of the valve will therefore be switched off.

Reaction force for sensing tube

The reaction force of the sensing tube changes with the adjustment.

Operating variants

Adjustment and display of the setpoint value, depending on the operating version, as different (also refer to Section 8.1.4 “Differences between the control variants” in this manual).

Sensitivity

If the system works in automatic mode too sluggishly, then the sensitivity setting should be amended accordingly. (Refer to item 8.2.2 of this manual).

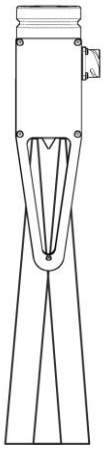
Control window

A control window is active when operating the digital controller with the rotary sensor. The setting of the control window can be read out under the item 8.2.5 of this user manual.

8.6 Working with the Dual-Sonic

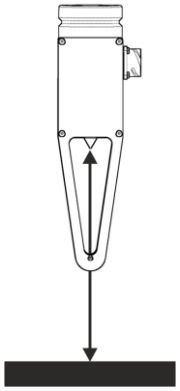
8.6.1 Assembling and setting up

The emitted ultrasonic pulses from the Dual-Sonic sensor have cone-shaped characteristic; i.e. the sound beam is greater with increasing intervals.
When working with the Dual-Sonic sensor, there must therefore be a free space of > 20 cm retained around the sound beam axis to prevent disturbing reflections in the entire specified working range.



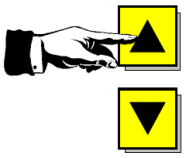
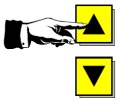
Working range

The optimal working range for the Dual-Sonic sensor is between 30 cm and 50 cm.
The Dual-Sonic sensor should be set to approx. 35 cm distance to reference.



Approximately
35 cm

8.6.2 Controlling with the Dual-Sonic

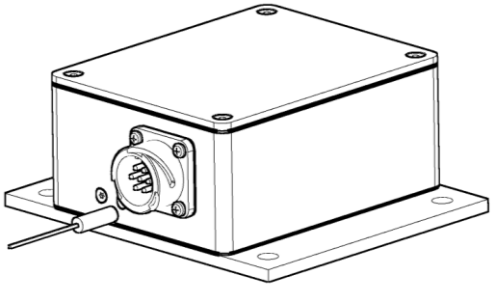
1)  Switch controller with the Auto/Manual button to the “Manual” operating mode. The “AUTO” function lamp is off. Select Dual-Sonic sensor as described.	2)  Align the tool to the working position for the zero adjustment with the UP/DOWN buttons on the controller or the operator unit on the machine. Align the sensor as described in the section for assembling and setting up over the reference position.	3)  Press the Enter button. The actual setpoint value will be acquired as the setpoint value.
4)  Press the Enter button an hold for approximately 2 seconds. Actual value and setpoint will be set to “0.0”.	5)  Switch controller with the Auto/manual key into the “Automatic” operating mode. The function lamp “AUTO” is on. The controller stops the tool on the set value.	6)  Use the UP/DOWN buttons to amend the setpoint value in automatic mode to be therefore able to acquire corrections.

8.7 Working with the wire rope sensor

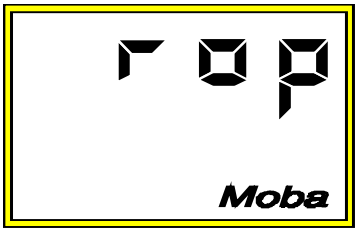
8.7.1 Description

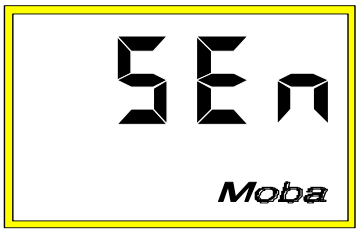
The wire rope sensor is primarily used as an application in conjunction with the milling machine. It is used for the distance measurement and has a measuring range of 50 cm.

Sensor identification:
When the system is switched on, or with a sensor change, the illustration in the controller display alternates (changes) between the sign for the wire rope and the abbreviation for the sensor.



=





8.7.2 Assembling and setting up

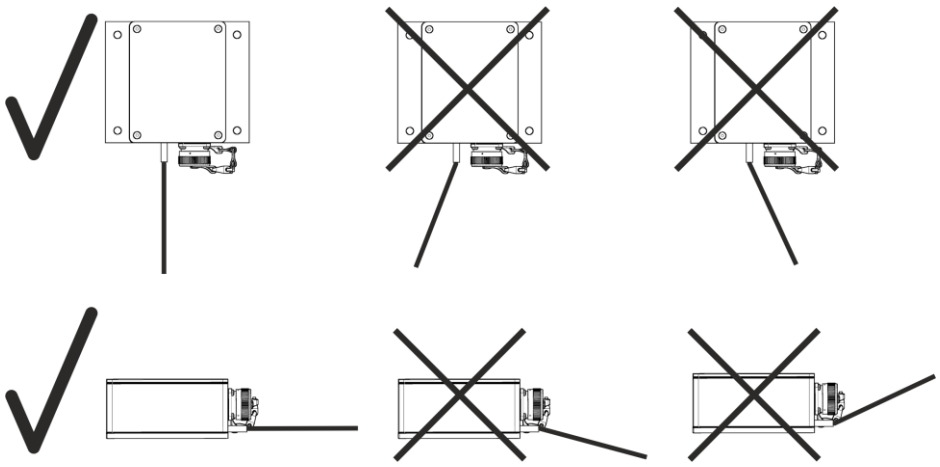
Information for assembly

Fixing holes are provided for the wire rope sensor on the outer side of the machine above the milling drum (refer to Section 11 “Technical Data” for the housing diagram of the sensor). The sensor with the wire outlet will be assembled here with the outlet opening downwards (so that no moisture can penetrate e.g. by rain). The wire can be pulled out by approx. 50 cm and is then hooked and/or fixed on the space provided on the side plate of the milling machine.

In the milling application, the wire of the wire rope sensor should be pulled out by approx. 3 cm with the stop side shield hanging, in order to have the maximum measuring range of the sensor available.

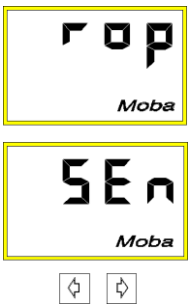
The wire of the wire rope sensor should always be mounted individually so that the planned application has a largest possible working range is available.

The wire entry and/or wire outlet should be always be horizontally and vertically at right angles to the sensor.

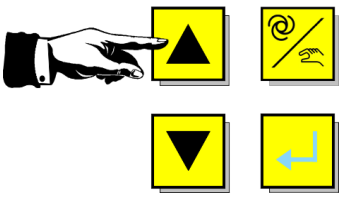


The wire rope sensor and the digital controller are assembled, the cables are connected and the digital controller is supplied with voltage. After the switch-on message has been issued, digital controller indicates the sensor ID. If the message for the connected sensor changes automatically after a short period of time to display the actual value, then the system is ready for operation. If the sensor is being operated for the first time or has been previously replaced, then the sensor ID must be acknowledged by pressing a preferred button. Otherwise execute sensor selection as described in Section 8.2.1 .

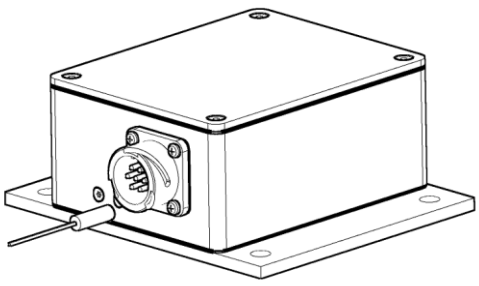
Acknowledgement of the sensor ID



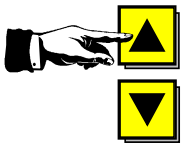
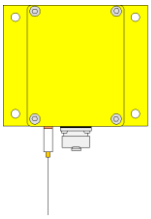
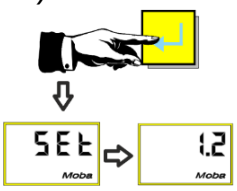
The digital controller shows the sensor identification.



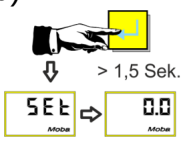
If the sensor is being operated for the first time or has been previously replaced, then the sensor ID must be acknowledged by pressing a preferred button.



8.7.3 Controlling with the wire rope sensor

1)	2)	3)	4a)
			
Manual mode will be switched back to with the A/M button. The “AUTO” function lamp is off.	Align the tool to the working position for the zero adjustment with the UP/DOWN buttons on the controller or the operator unit on the machine.	Inspect the wire attachment: Is there a sufficiently large working range available for the planned application?	Now press the Enter key. In the event of a brief press, “SEt” appears on the display. The current actual value is then acquired as the setpoint value.

4b)



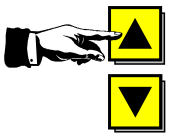
If the button is pressed for longer than 1.5 seconds, then the display will change from “SEt” to “0.0”. The actual value and the setpoint are now set to zero.

5)

Automatic mode will be switched back to with the A/M button. The function lamp “AUTO” is on.

The controller stops the tool on the set value.

6)



Use the UP/DOWN buttons to amend the setpoint value in automatic mode to be therefore able to acquire corrections.

7)

Manual mode can be switched back to at any time with the A/M button. The automatic control of the valve will therefore be switched off.

Operating variants

Adjustment and display of the setpoint value, depending on the operating version, as different (also refer to Section 8.1.4 “Differences between the control variants” in this manual).

Sensitivity

If the system works in automatic mode too sluggishly, then the sensitivity setting should be amended accordingly. (Refer to item 8.2.2 of this manual).

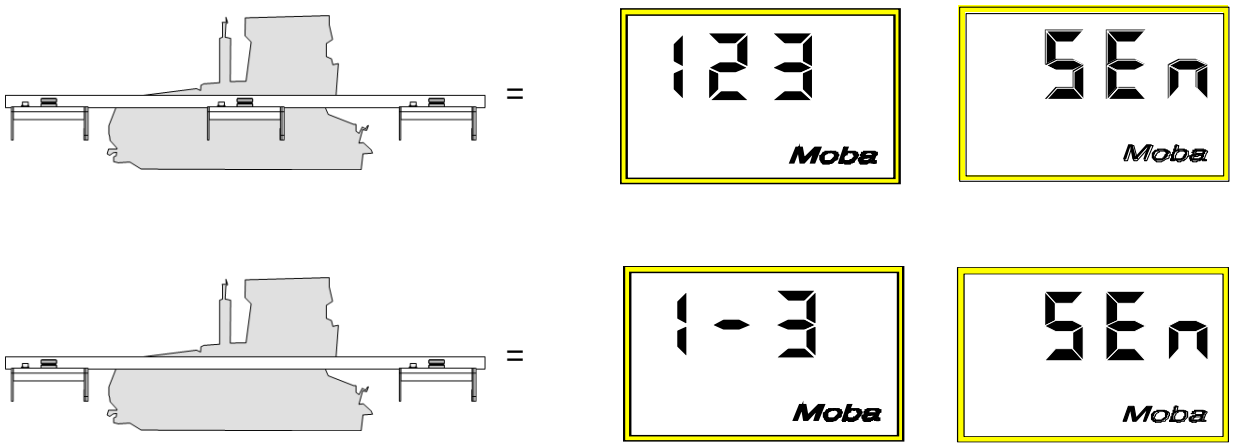
Control window

A control window is active when operating the digital controller with the rotary sensor. The setting of the control window can be read out under the item 8.2.5 of this user manual.

8.8 Working with the Big Ski

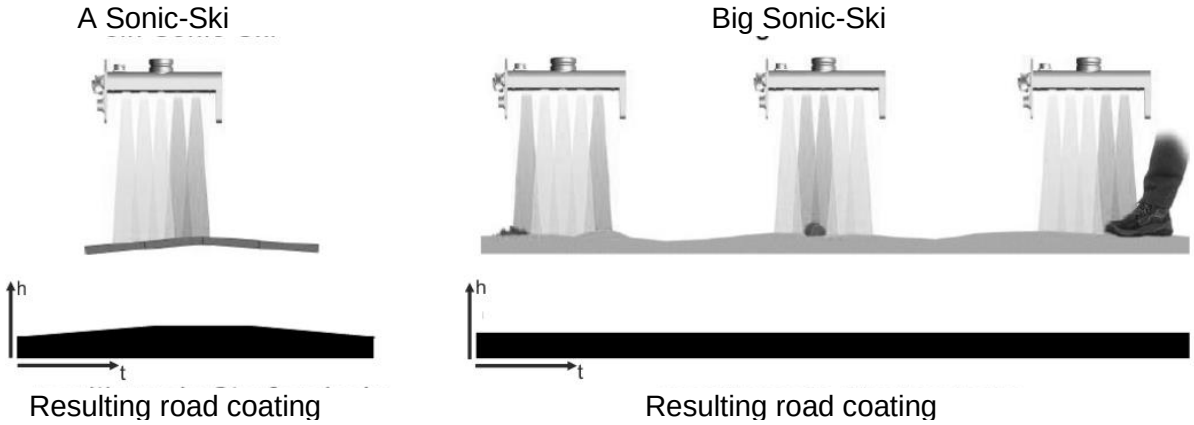
8.8.1 Sensor ID

When the system is switched on or in the case of a sensor change, the representation in the in the display of the controller alternates (changes) between a numerical representation - the numbers 1 to 3 are used to represent the occupied connector of the Big-Ski connection box and/or the occupied “Big-Ski connector” for the in-house wired up CAN-Bus wired machine - and the abbreviation for sensor.



8.8.2 Functionality

After small unevenness and foreign bodies have already been neutralised by the averaging for every individual Sonic-Ski sensor, the Big-Ski attachment now additionally averages and reduces bulges and small, drawn-out differences in height in the longitudinal profile of the subgrade. Large deviations remain, with the appropriate setting of the control window, as excluded from averaging.



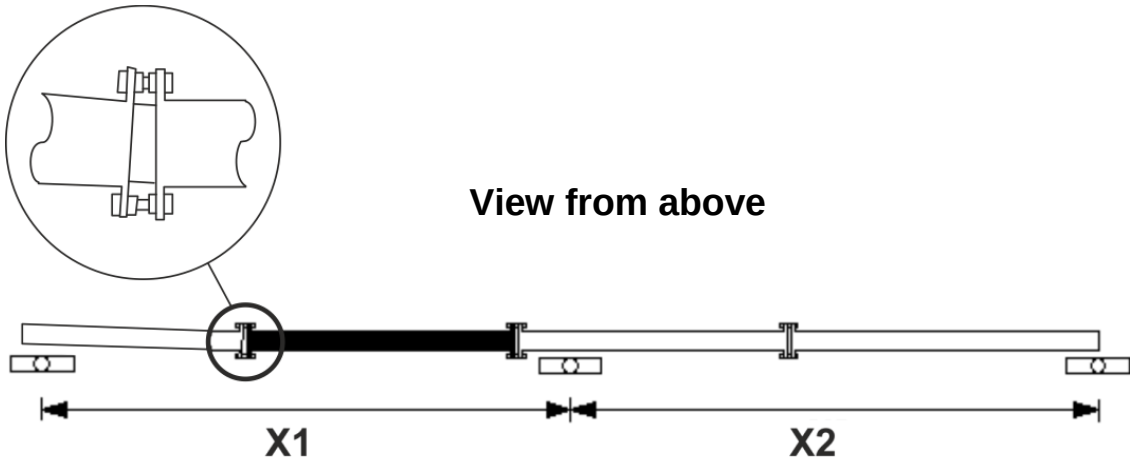
8.8.3 Information for assembly and installation

Mechanical systems

Your MOBA dealer retains installation instructions ready for you in which the assembly of the mechanics of the Big Sonic-Ski® is described in detail. (Also refer to Section “Additionally applicable documents”.)

The mechanical design plays a very important role when implementing Big-Ski systems.
However, as these are individually designed by the dealer or customer, only a basic assembly process can be described here.
The carrier for the sensors should be, partially due to the extensive length, designed as very stable and securely screwed to the tool carrier.

It is advantageous to produce the construction from numerous parts in order to simplify transport and to facilitate fitting. Furthermore, it has proven to be practical in the past when the individual parts can be easily connected at an angle (refer to the sketch). This thereby simplifies the alignment of the individual sensors via the reference (it is not unusual in practice for Sonic-Ski® to be even positioned in front of and behind the machine to also ensure the safe sensing of the reference).

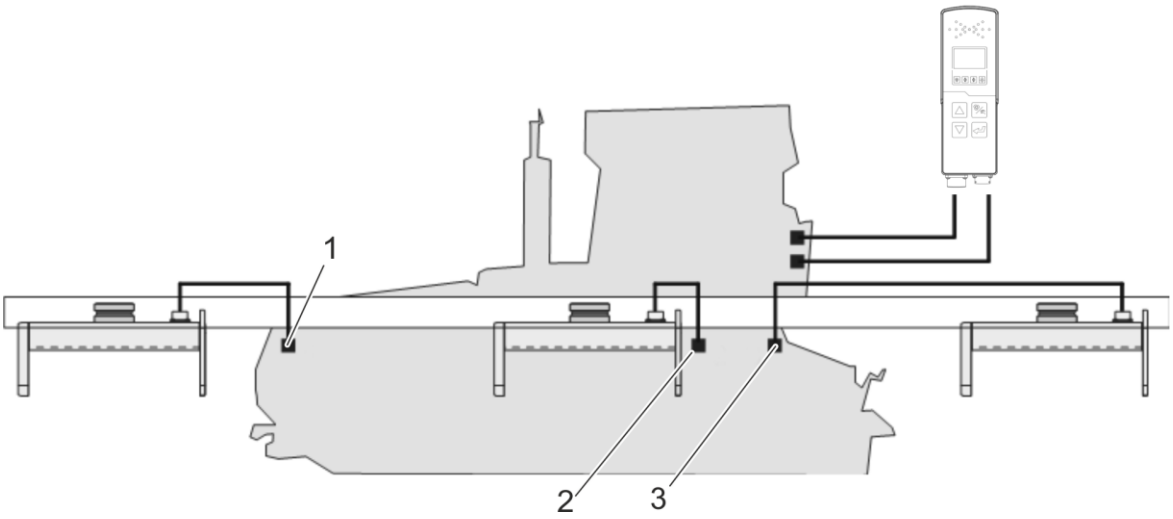


The distances between the sensors are ideally equal (X1 = X2). The centre sensor is to be placed where it would be attached when also only working with one sensor.

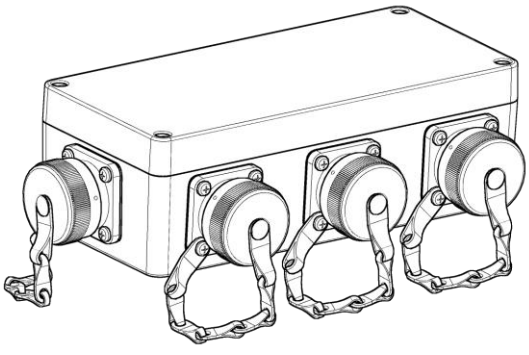
8.8.4 Electrical system

The sequential numbering, also that which refers to the representation in the display of the controller for the sensor ID, is always carried out from the front to the rear (in moving direction).

On Positions 1 and 3 - i.e. front and rear - only ultrasonic sensors may be implemented.



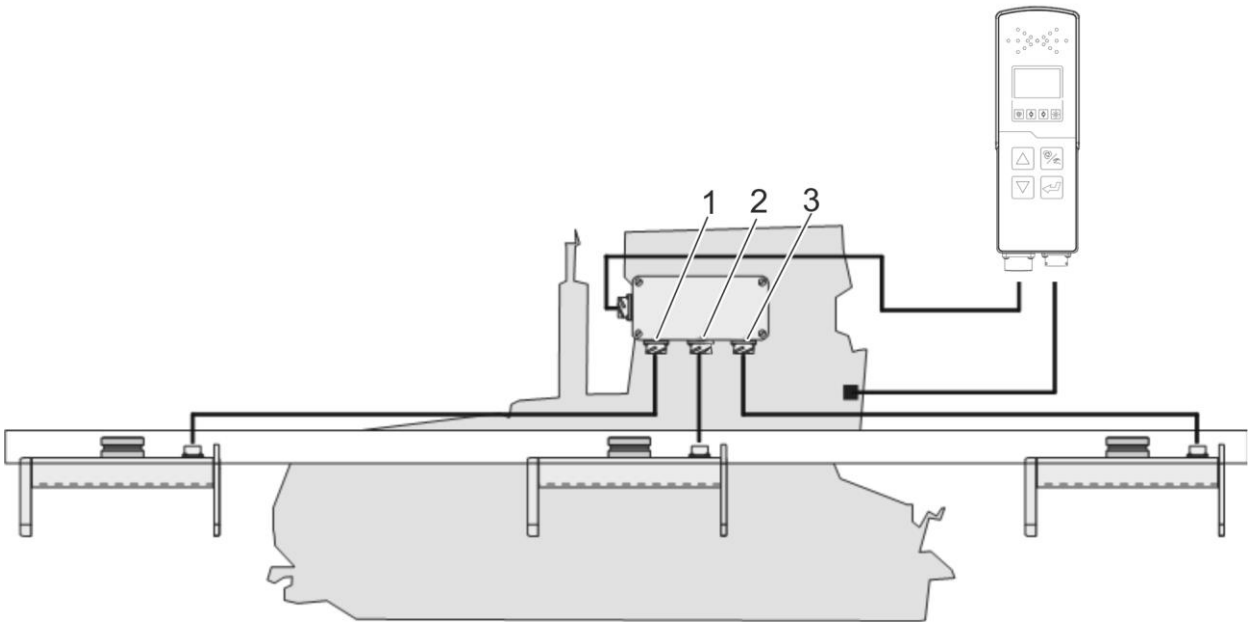
In this case the 3 sensors will be connected via a special “Big-Ski Junction Box” with the corresponding coded connectors connected with the controller.



The junction box should be mounted in such a way that simple wiring to the controller and the sensors is possible. The connections for the sensors should always point downwards so that no water can penetrate into the junction box. Inputs which are not required must be sealed with dust protection caps.

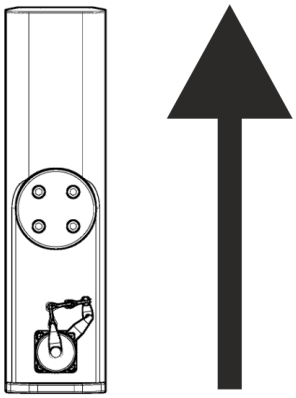
Initially connect the digital controller to the input of the distribution box.
Then connect the desired sensor combination, as shown schematically below, at the outputs of the junction box. Allowing for the moving direction, the front sensor will be connected to output 1, the centre sensor at output 2 and the rear to output 3. This sequence also applies for the numeric representation in the display of the controller for the sensor ID.

On Positions 1 and 3 - i.e. front and rear - only ultrasonic sensors may be implemented.

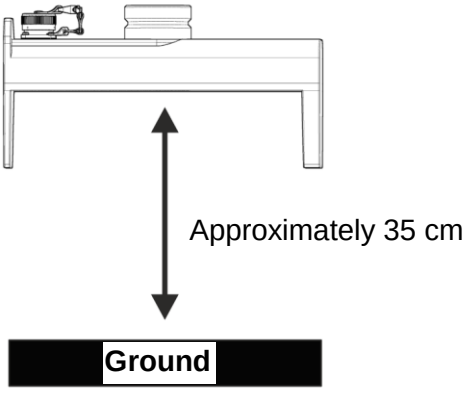


8.8.5 Setting up

The Big-Ski works in ground mode.
Therefore all Sonic-Skis® must be aligned as longitudinal when to the moving direction when working to achieve an optimum result.



Every one of the Sonic-Ski® sensors must be aligned at a distance of 30 cm to 40 cm to the reference.



8.8.6 Switching from single sensor to Big Ski

The Big-Ski and the digital controller are assembled, the cables are connected and the digital controller is supplied with voltage. After the switch-on message has been issued, digital controller indicates the sensor ID. If the message for the connected sensor changes automatically after a short period of time to display the actual value, then the system is ready for operation. If the Big-Ski is being operated for the first time or its sensor combination has been previously replaced, then the sensor ID must be acknowledged by pressing a preferred button.
Otherwise execute sensor selection as described in Section 8.2.1 .
Is the sensor is selected as the active Big-Ski, lights up the function lamp “rope” of the digital controller.

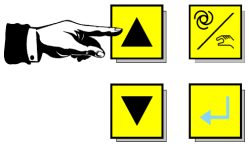
1a)

The digital controller shows the sensor ID (here: averaging from Sonic-Ski front and rear).

1b)

The digital controller shows the sensor ID (here: averaging from 3 sensors).

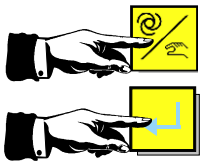
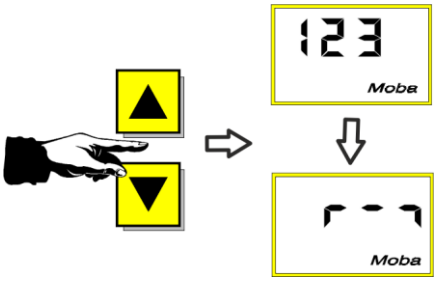
2)



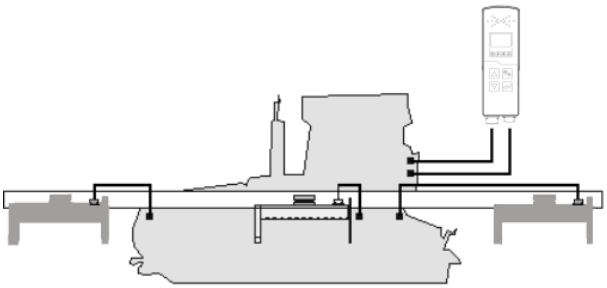
If the Big-Ski is connected for the first time or its sensor combination has been previously amended, then the sensor ID must be acknowledged by pressing a preferred button.

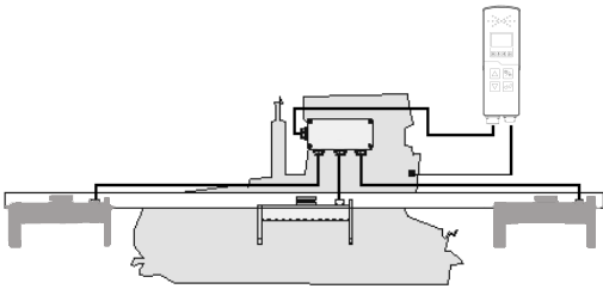
If the Big-Ski is selected as an active sensor, then the operator has the easy possibility to switch to single ski evaluation via the operator menu.
This is often useful at the end of a narrow asphalt installation before the front ski no longer measures the correct reference measures (transition edge from milling area to the old road surface).

Single sensor selection:

1)  Activating manual mode	2)  Press Auto/Manual and Enter buttons at the same time.	3)  Select the sensor with UP and DOWN buttons.
4)  Press Auto/Manual buttons.	4a)  Function lamp goes out, the centre sensor is selected.	

Once the button has been pressed, only the measuring signal of the sensor connected to the centre position of the Big-Ski will be evaluated. The operation and display of this sensor then corresponds to the description in this manual.





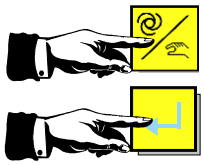
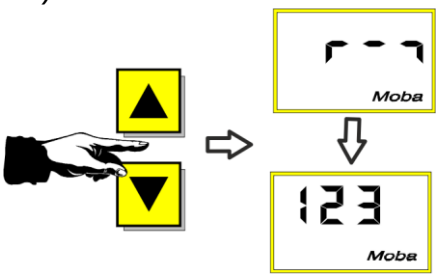
CAUTION!

Risk of injury due to moving tool!

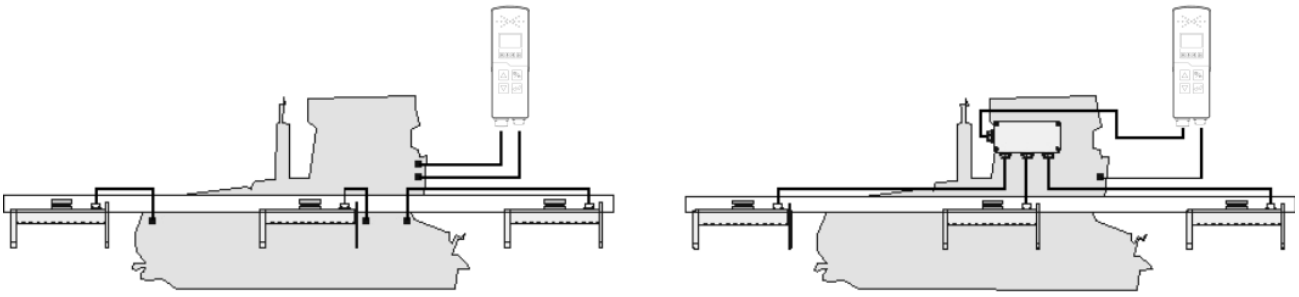
When switching from single sensor application to Big Sonic-Ski®, the actual value of the single sensor is automatically taken over as actual value for the Big Sonic-Ski®. There are no deviations of the setpoint or the actual value.

However, when switching vice versa from Big Sonic-Ski® to single sensor application, the single sensor's value is not adjusted; i.e. there may be an abrupt change of the actual value and a respective readjustment of this deviation.

Switch back to ski formation (averaging with 3 sensors):

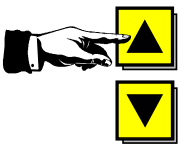
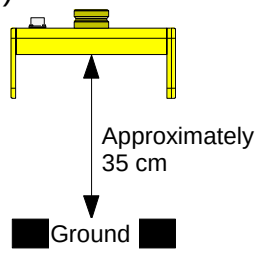
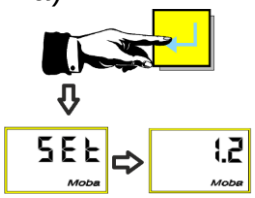
1)  Activating manual mode	2)  Press Auto/Manual and Enter buttons at the same time.	3)  Select the sensor with UP and DOWN buttons.
4)  Press Auto/Manual buttons.	4a)  Function lamp illuminates, the Big-Ski (123) is selected.	

After the button is pressed again, the mean value from the measured signals of all 3 connected sensors on Big-Ski are represented.

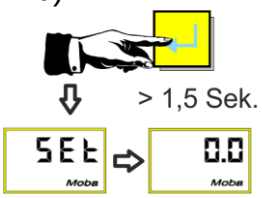


8.8.7 Controlling with the Big-Ski

Procedure: Controlling with the Big-Ski

1)	2)	3)	4a)
			
Manual mode will be switched back to with the A/M button. The “AUTO” function lamp is off.	Align the tool to the working position for the zero adjustment with the UP/DOWN buttons on the controller or the operator unit on the machine.	Align all Sonic-Skis at a distance of 35 cm from the ground.	Now press the Enter key. In the event of a brief press, “SEt” appears on the display. The current actual value is then acquired as the setpoint value.

4b)



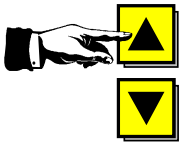
If the button is pressed for longer than 1.5 seconds, then the display will change from “SEt” to “0.0”. The actual value and the setpoint are now set to zero.

5)

Automatic mode will be switched back to with the A/M button. The function lamp “AUTO” is on.

The controller stops the tool on the set value.

6)



Use the UP/DOWN buttons to amend the setpoint value in automatic mode to be therefore able to acquire corrections.

7)

Manual mode can be switched back to at any time with the A/M button. The automatic control of the valve will therefore be switched off.

Operating variants

Adjustment and display of the setpoint value, depending on the operating version, as different (also refer to Section 8.1.4 “Differences between the control variants” in this manual).

Sensitivity

If the system works in automatic mode too sluggishly, then the sensitivity setting should be amended accordingly. (Refer to item 8.2.2 of this manual).

Control window

A control window is active when operating the digital controller with the rotary sensor. The setting of the control window is described under the item 8.2.5 .

8.9 Working with the prop. Laser receiver

8.9.1 Safety notices

Laser beams

CAUTION! **Risk of eye injury due to laser beams!**

The laser transmitter works with light beams of high intensity. Looking directly into the laser beam can cause eye injuries.

For these reasons:

- Do not look directly into the laser beam.
- Do not point the laser beam into the eyes of other people.
- Always operate the laser transmitter well above eye level.

Improper assembly

CAUTION! **Risk of injury from improper mounting!**

The laser transmitter and laser receiver must be completely assembled at a considerable height above the ground. Assembling with unsuitable auxiliary aids can lead to injuries.

For these reasons:

- Never climb on the machine and the mast.
- Always utilise suitable auxiliary aids (e.g. steps) and safety equipment for assembling the laser transmitter on a tripod and the laser receiver on the mast.

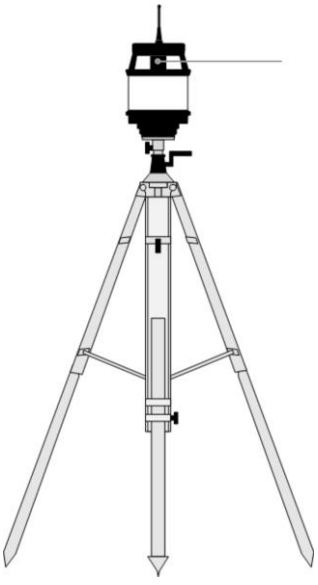
8.9.2 Assembling and setting up

General

The following points must always be adhered to when assembling the laser receiver:
There must be no obstacles (e.g. cable) in front of the sensor;
The laser transmitter and laser receiver must always have a “free view” to each other;
Ideally assemble both at such a height that the rotating laser beam can freely stretch over the roof of the machine.
There must not be any reflecting surfaces in the area of the laser beam(windows, automotive glazing etc.);
In order to minimise the occurrence of reflections, it is advisable to cover the laser transmitter to the actually required circular section.
The specified operating range of the laser transmitter must not be exceeded (observe environmental influences);

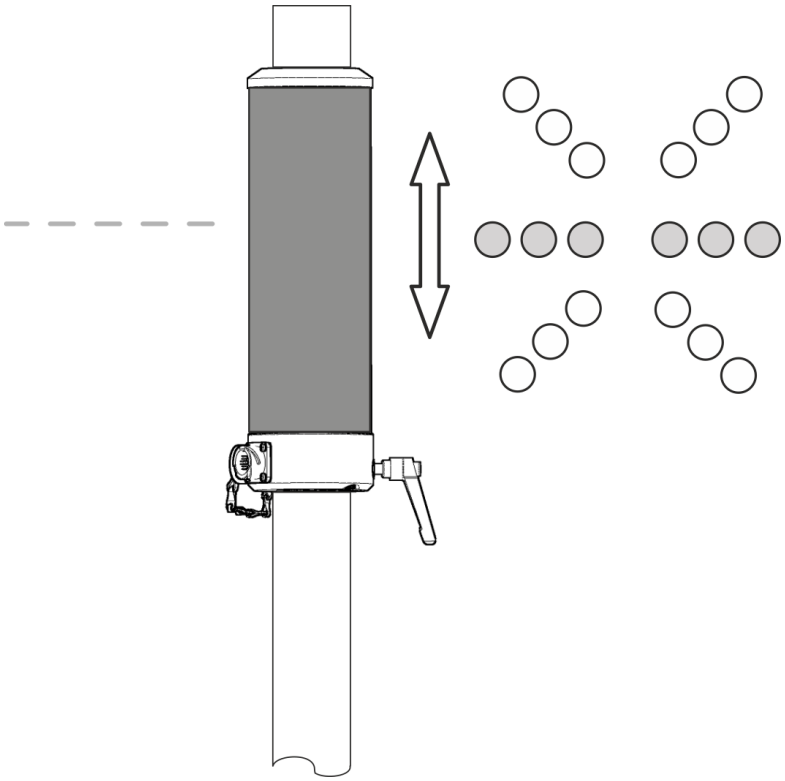
Working point

Set up a suitable laser transmitter (wavelength between 600 and 1030 nm) in accordance with this user manual at a sufficient height in operation.



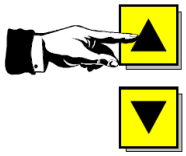
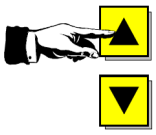
Set up the mast, on which the laser receiver is mounted, vertically.

The prop. laser receiver must be able to side-shift freely on its mast.
Use the integrated positioning aid of the sensor for setting up the laser receiver and side-shift the sensor and/or the mast so that the laser beam hits in the middle of the reception area. (Also refer here to Section 6.2 “Display elements of the prop. Laser receiver”.)
Only in this way can the setpoint be amended subsequently when working on the full range of +/- 14 cm.



The working point can in principle be acquired at any preferred point of the laser receiver.
Depending on the planned application, this can even be useful. With an asymmetric working point, the available adjustment range of a direction (raise and/or lower) increases, the other reduces however at the same level.

8.9.3 Controlling with the prop. Laser receiver

1)  Switch controller with the Auto/Manual button to the “Manual” operating mode. The “AUTO” function lamp is off. Select Dual-Sonic sensor as described.	2)  Align the tool to the working position for the zero adjustment with the UP/DOWN buttons on the controller or the operator unit on the machine. Align the sensor as described in the section for assembling and setting up over the reference position.	3)  Press the Enter button. The actual setpoint value will be acquired as the setpoint value.
4)  Press the Enter button an hold for approximately 2 seconds. Actual value and setpoint will be set to “0.0”.	5)  Switch controller with the Auto/manual key into the “Automatic” operating mode. The function lamp “AUTO” is on. The controller stops the tool on the set value.	6)  Use the UP/DOWN buttons to amend the setpoint value in automatic mode to be therefore able to acquire corrections.

9 Repair and maintenance

General

The MOBA-Matic was developed for high operating safety.
Only minimal effort is required for upkeep of the product.
All electronic components are housed in rugged casings to avoid possible mechanical damage.
Nevertheless, the devices as well as the connecting cables should be examined for possible damage and soiling at regular intervals.
Dirt on the oscillation heads will impair the functioning of the ultrasonic sensors and, with sensors with moving parts, this will lead to sluggishness in the mechanical systems.
The drain holes must be regularly inspected for soiling.

9.1 Cleaning and drying

Cleaning works on the MOBA-Matic can also be carried out by lay people, when they adhere to the following specifications.

Devices

1) Turn the MOBA-Matic off;
2) Apply customary cleaner for synthetics on a soft, lint-free and moist cloth;
3) Use hand-hot water
4) Clean the surfaces of the device without applying pressure;
5) Remove the cleaning agent with a clean cloth to completely remove it from the devices;

Never clean the display at any time with cleaning agents containing abrasive substances. The surface will therefore be scratched and matt; the display will be difficult to read.

The digital controller and the sensors must be cleaned and dried at a maximum of 40°. Only repack equipment when it is completely dry.

Cable

The connector contacts and the threads of the plug-in connectors and cable fasteners are to be protected to prevent bad contacts to keep them free of dirt, grease, asphalt or other foreign materials and to protect them against moisture. Blow off soiled plug connectors on the connecting cable.

9.2 Repair

In the event that the device becomes damaged or worn, contact your MOBA dealer.

10 Help in the event of faults

General

When working with the MOBA-Matic, a difference is made between the warning and error messages.

In this section you will find some information about what measures you can or must take when the system issues a warning or error message.
Causes for warning messages can in some cases be excluded due to the strict compliance with the specifications in the user manual.
This then saves the hassle and costs of unnecessary downtime.

- The devices and associated components may only be opened in the framework of a reconfiguration, and when they are therefore explicitly requested to be!
- Errors must only be remedied and eliminated by an authorised professional eliminated!
- Never work hastily during troubleshooting!
- Always adhere to the accident prevention regulations and safety rules!

10.1 Error messages and remedies

Error message	Error diagnostics	Control outputs	Counter measures
no / SEn	Controller does not detect a sensor.	Outputs in the automatic operating mode are locked.	Connect the sensor. Inspect the connection cable and replace it when necessary. Replace the sensor.
SLo / out **rtY / out** **LAS / out** **-23 / out**	Measured value of the active sensor is outside the permissible measuring range.	Outputs in the automatic operating mode are locked.	Inspect the sensor alignment and/or position. Replace the sensor.
/ --3	Measured value of the active sensor is outside the set control window.	Outputs in the automatic operating mode are locked.	Inspect the sensor alignment and/or position. Reset the sensor.
rop / dEF **Slo / dEF**	Controller detects faulty sensor.	Outputs in the automatic operating mode are locked.	Inspect the connection cable and replace it when necessary. Replace the sensor.

Error message	Error diagnostics	Control outputs	Counter measures
E. 2	Data loss of the battery-buffered memory.	Outputs in the automatic operating mode are locked.	Acknowledge the error message with any preferred button. Reacquire the working position (zero point and setpoint).
E. 3 **E. 4** **E. 5**	Data loss of the battery-independent saved parameters.	Outputs in the automatic operating mode are locked.	Acknowledge the error message with any preferred button. The machine parameters will therefore be set to the basic values. Re-adjust if necessary. Enter the working position (zero point and setpoint) again.

10.2 Safety notices

Fault correction and errors on the product must only be executed by qualified service personnel.

Always switch the MOBA-Matic to off for fault correction or, when the power supply is required for fault correction, switch to “Manual” operating mode.

CAUTION!

Risk of injury from improper fault correction!

Improper troubleshooting can lead to personal injuries or material damage.

For these reasons:

- Only permit personal with the required qualifications to implement fault correction.
- Do not work hastily during fault correction.
- Observe the country-specific, legal safety and accident prevention regulations.

11 Technical data

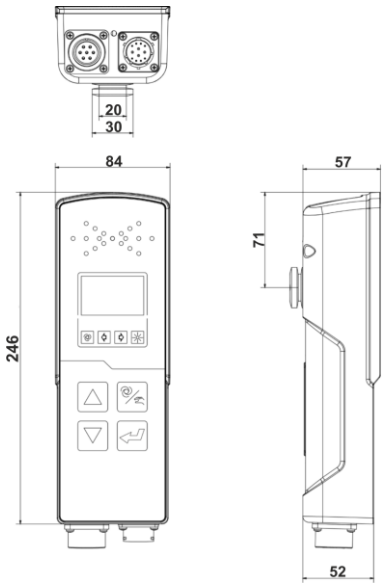
General

On the following pages you will find data sheets for the components of the system which were valid at the time of writing this user manual.
These contain, in addition to a dimensioned technical drawing of the device, a description of the interfaces and some basic technical information.

Rights to amendments

To maintain our technological advantage, it may however be necessary to initiate amendments to the product without prior notice which may, in certain cases, differ from this data sheets. In this case, your MOBA supplier will always have a current copy of the data sheet available for you.

Controller



Technical data:

Operating voltage:
(10 … 30) V DC

Current consumption [1]:
300 mA @24 V

Outputs:
ON/OFF, NPN, maximum 3 A
ON/OFF, PNP, maximum 2.5 A
PROP, PNP, maximum 2.5 A
SERVO, maximum 250 mA

Interface (CAN-interface):
ISO 11898 24 V
125 kBit/s

Working temperature range
-25 °C … + 70 °C

Storage temperature range:
-25 °C … + 85 °C

Protection class:
IP67

Weight:
1.1 kg

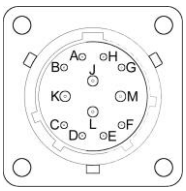
Connector pin assignment

12-pin Device plug, bayonet connection

A	Input, external manual
B	CAN-
C	CAN+
D	Input, side detection
E	Input, grade / slope changeover
F	Output, alarm
G	n.c. (not consigned)
H	n.c.
J	Output, lowering
K	Output, raising
L	+Operating voltage
M	-Operating voltage

7-pin Device connection box, bayonet connection

A	+Operating voltage
B	CAN+
C	-Operating voltage
D	CAN-
E	Address 1
F	n.c.
G	Shield



Remark:

1) Without valves

Switching logic of the 3 digital inputs of the MOBA-Matic:

Input, “grade/slope changeover”:

Pin on mass	=	cross-slope sensor (Slope)
Pin on +Bat.	=	Grade sensor (Grade)
Pin open (n.c.)	=	Grade sensor (Grade)

Input, “External manual”: *

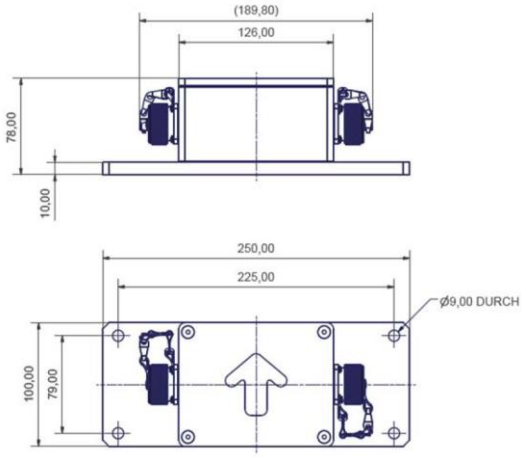
Pin on mass	=	Stops the automatic
Pin on +Bat.	=	Stops the automatic
Pin open (n.c.)	=	Automatic free

Input, “Side detection”:

Pin on mass	=	right
Pin on +Bat.	=	left
Pin open (n.c.)	=	left

* The logic of the input “External manual” can be amended by using the CAN configuration message or in the advanced menu of the controller parameters.

Slope sensor



Technical data:

Operating voltage:
(11 ... 30) V DC

Current consumption:
Maximum 50 mA

Measurement range:
+/- 15°

Internal resolution:
0.01%

Zero point stability:
0.1%

Working temperature range:
-10°C ... +70°C

Storage temperature range:
-25°C ... +70°C

Protection class:
IP67

Shock resistance
15 g 15 ms / DIN EN 60068-2-29

Weight:
Approx. 1.9 kg

Pin assignment:

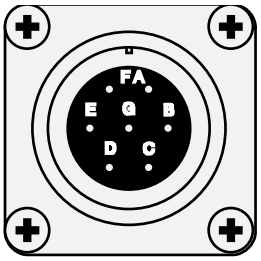
CAN-Schnittstelle (CAN-interface)
ISO 11898 - 24V - 125kBit/sec
7-pin Device plug connector; bayonet connection

Links (left):

A: +Supply voltage
B: CAN+
C: -Supply voltage
D: CAN-
E: Adr. 1 IN
F: Adr. 2 IN
G: Shield

Rechts (right):

A: +Supply voltage
B: CAN+
C: -Supply voltage
D: CAN-
E: Out supply voltage [1]
F: n.c.
G: Shield



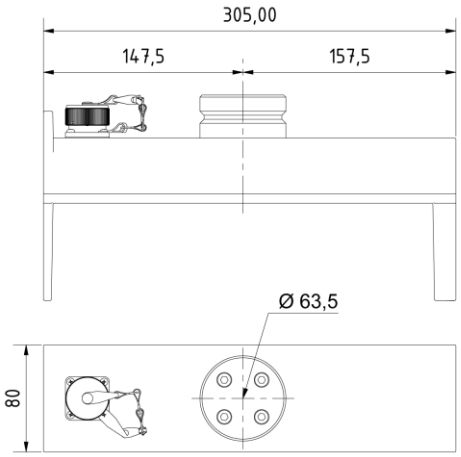
Remark:

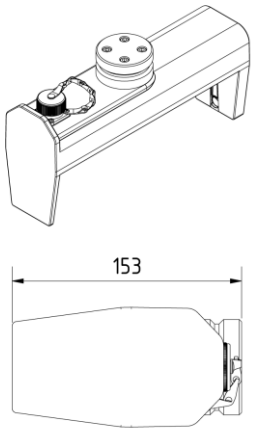
= negative slope

= positive slope

([1]) maximum current 10mA

Ultrasonic sensor Sonic-Ski plus





Technical data:

Operating voltage:
(10 ... 30) V DC

Maximum power consumption:
300 mA

Permissible residual ripple:
+/- 10%

Detection range:
(20 ... 100) cm

Reproducibility:
+/- 1 mm

Working temperature range:
-25 °C ... +85 °C

Storage temperature range:
-40 °C ... +85 °C

Working range:

Ground sensing:
(20 ... 150) cm

String line sensing:
(20 ... 100) cm

Technical data:

Storage temperature range:
-25 °C ... +80 °C

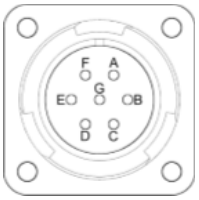
Protection class:
IP67

Weight:
approx. 2.1 kg

Pin assignment:

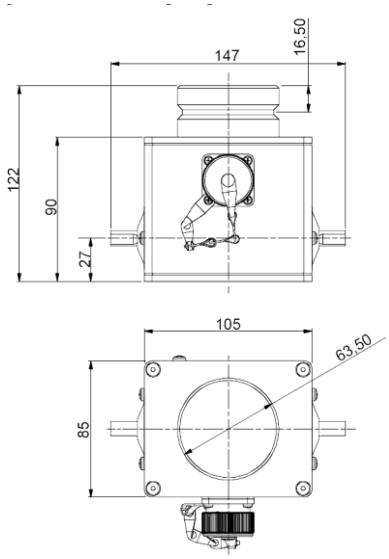
CAN interface:
ISO 11898 - 24 V - 125 kBit/sec
7-pin Device plug connector; bayonet connection

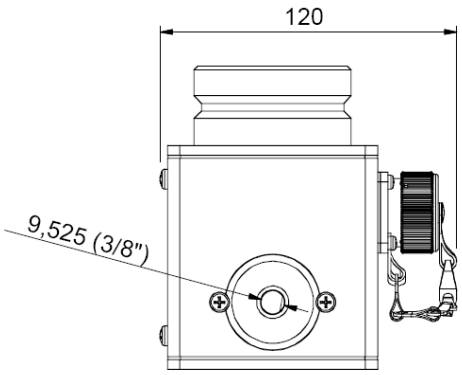
A = + Operating voltage:
B = CAN+
C = - Operating voltage:
D = CAN-
E = Adr.1
F = Adr.2
G = Shield:



Remark:

Rotary sensor





Technical data:

Operating voltage:
(10 ... 30) V DC

Current consumption:
40mA @24 V

Permissible residual ripple:
+/- 10%

Detection range:
+/- 30°

Internal resolution:
0.1°

Reproducibility:
+/- 0.1°

Working temperature range:
-10 °C ... +85 °C

Storage temperature range:
-25 °C ... +85 °C

Technical data:

Measurement range:
340°

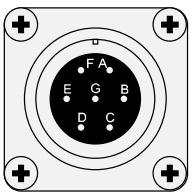
Protection class:
IP67

Weight:
approx. 1.2 kg

Pin assignment:

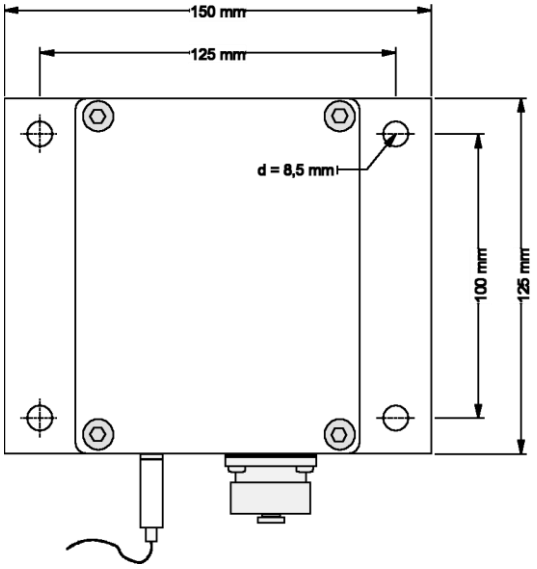
CAN interface:
ISO 11898 - 24 V; 125 kBits/sec
7-pin Connector; bayonet connection

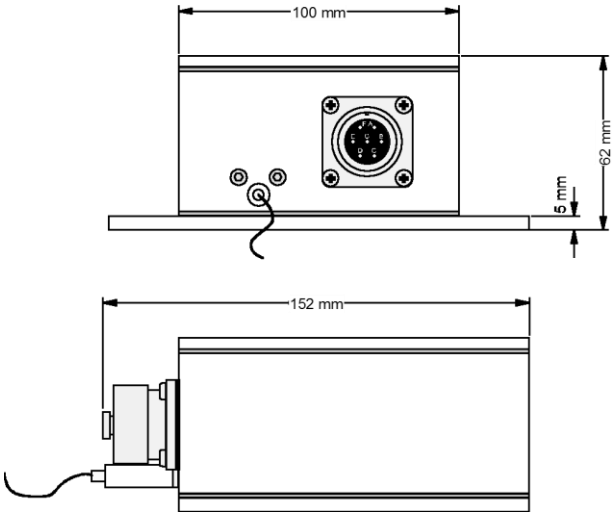
A = + Operating voltage:
B = CAN+
C = - Operating voltage:
D = CAN-
E = Adr.1
F = Adr.2
G = Shield



Remark:

Wire rope sensor





Technical data:

Operating voltage:
(10... 30) V DC

Current consumption:
≤ 200 mA

Measurement range:
50 cm

CAN interface:
ISO 11898 - 24 V;
125 kBit/sec.;

Working temperature range:
-10 °C ... +60 °C

Storage temperature range:
-25 °C ... +75 °C

Protection class:
IP54

Weight:
approx. 1.75 kg

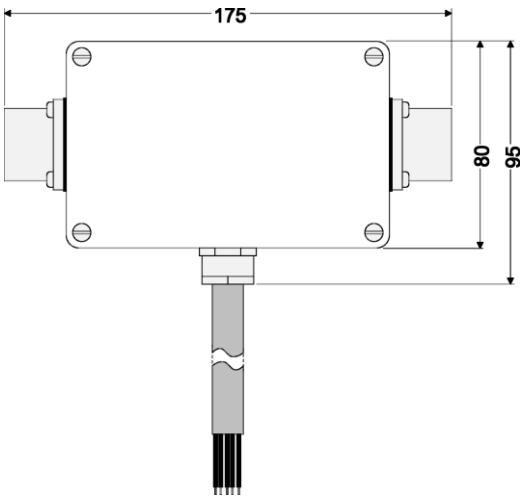
Pin assignment:

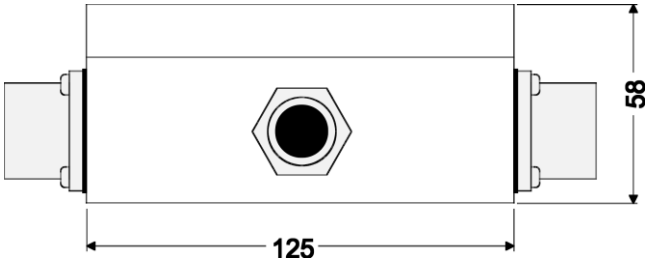
7-pin Device plug connector; bayonet connection

A = + Operating voltage:
B = CAN+
C = - Operating voltage:
D = CAN -
E = Address1:
F = Address2:
G = Shield:

Remark:

Adapter box





Technical data:

Operating voltage:
(11 ... 30) V DC

Switching outputs:
ON/OFF, PNP, 2 Amp. Imax. per output
(ON/OFF, PNP, 2 Amp. Imax. per output):

Working temperature range
-15 °C ... +65 °C

Storage temperature range
-25 °C ... +85 °C

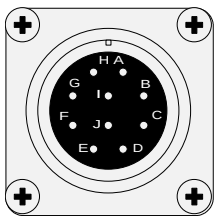
Weight:
approx. 1.4 kg

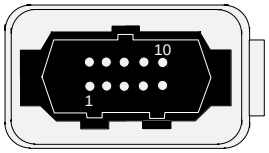
Protection class:
IP67

Method of tightening:
M6 threaded holes on the rear side:

Pin assignment:

A = - Operating voltage:
B = + Operating voltage:
C = Raise:
D = Lower:
E = n.c.
F = n.c.
G = n.c.
H = n.c.
I = n.c.
J = ext. Manual



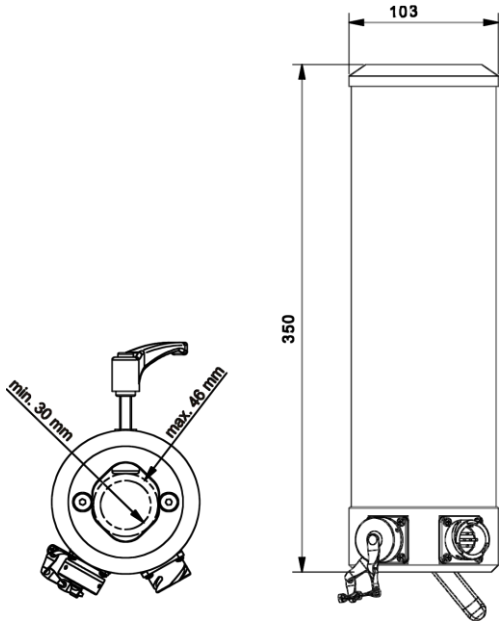


1 = + Operating voltage:
2 = Raise right:
3 = ext. Manual
4 = Raise left:
5 = + Operating voltage:
6 = n.c.
7 = Lower right:
8 = - Operating voltage:
9 = Lower left:
10 = n.c.

Remark:

Also available without Vögele plug
Order no.: 04-03-00080

Laser receiver



Technical data:

Operating voltage:
(10 ... 30) V DC

Current consumption:
Approx. 260 mA @12 V
Approx. 135 mA @24 V

Working diameter:
600 m transmitter-dependent

Receiving angle:
360°

Receiving range
290 mm

Measurement range:
284 mm

Resolution:
0.1 mm

Transmitter rotation frequency:
10 Hz ... 20 Hz (+/- 10%)

Technical data:

Wavelength:
Sensitivity >30% @ 600 < λ < 1030 nm
Maximum sensitivity::

@ λ = 850 nm

Interfaces:
1x PWM-Interface
1x CAN-Interface
ISO 11898 - 24 V
50/125/250/500/1000 kBit/sec

Working temperature range
-40 ... +70 °C

Storage temperature range:
-40 ... +70 °C

Protection class:
IP 67

Weight:
Approx. 1.8 kg

Mast diameter:
Up to 46 mm

Remark:

Integrated positioning aid;

Dynamic adjustment of the sensitivity with changing light conditions;

12 Declaration of conformity

MOBA
MOBILE AUTOMATION

KONFORMITÄTSERKLÄRUNG
Declaration of Conformity
Declaration de Conformité

This corresponds to EN ISO/IEC 17050-1

Wir / We / Nous

MOBA Mobile Automation AG
Kapellenstraße 15
D-65555 Limburg (Germany)

erklären in alleiniger Verantwortung, dass das Produkt
declare under our sole responsibility that the product
déclarons sous notre seule responsabilité que le produit

MOBA-matic I Controller "MMC-1000", CAN
04-25-10300

auf das sich diese Erklärung bezieht, mit den folgenden Normen übereinstimmt
to which this declaration relates is in conformity with the following standards
auquel se réfère cette déclaration est conforme aux normes

EN 13309 (2010)

verified standards

EN55022, Class B (2011-12)

EN61000-4-2 (2009-12)

EN61000-4-3 (2011-04)

EN61000-4-4 (2013-04)

EN61000-4-6 (2014-08)

ISO 7637-2 Puls 1, 2, 2b, 4, 5 (2011-03)

gemäß den Bestimmungen der Richtlinie
following the provisions of Directive
conformément aux dispositions de Directive

Electromagnetic compatibility 2004/108/EC

Limburg, den 17.11.2015

i.V. Matthias Weber
Leiter Qualitätsmanagement

Hausanschrift:
MOBA Mobile Automation AG
Kapellenstraße 15
65555 Limburg
Germany
Telefon: +49 6431 9577-0
Fax: +49 6431 9577-177

Sitz der Gesellschaft: Limburg
Registergericht Limburg, HRB 2552
Vorsitzender des Aufsichtsrats: Harald Robl
Vorstand: Volker G. Harms, Dr. Holger Barthel, Alfons Horn
USt-IdNr.: DE 113865988

Bankverbindungen:
Deutsche Bank AG, Limburg BLZ 511 700 10 Konto-Nr. 494 070 600
IBAN: DE 83 5117 0010 0494 0706 00 • BIC/SWIFT-Code: DEUTDEFF 511
Commerzbank AG, Limburg BLZ 511 400 29 Konto-Nr. 377 348 800
IBAN: DE 16 5114 0029 0377 3488 00 • BIC/SWIFT-Code: COBADEFF 511
Kreissparkasse Limburg BLZ 511 500 18 Konto-Nr. 30 350 615
IBAN: DE 10 5115 0018 0030 3506 15 • BIC/SWIFT-Code: HELADEF1LIM

MOBA
MOBILE AUTOMATION

CE KONFORMITÄTSERKLÄRUNG

entsprechend ISO/IEC Guide 22 und EN 45014

Name des Herstellers: MOBA Mobile Automation AG

Anschrift des Herstellers: MOBA Mobile Automation AG
Kapellenstraße 15
D-65555 Limburg (Germany)

erklärt, dass das Produkt:

Produktname: **Dual Sonic Sensor, CAN**
04-21-10100

den folgenden Produktspezifikationen entspricht:

EMV (EMC): EN13309:2000 / Schmalband, Breitband Störaussendung

EN61000-4-2 (2001)

EN61000-4-3 (2003)

EN61000-4-4 (2002)

EN61000-4-6 (2001)

ISO 7637-2 (Impulse 1, 2)

ISO 7637-2 ISO Puls 5

Das Produkt entspricht den Anforderungen der EMV- Verordnung 89/336/EWG.
Es wurde in einer typischen Konfiguration getestet.

Limburg, den 05. Februar 2007

i.V. Matthias Weber
Leiter Qualitätsmanagement

Hausanschrift:
Mobile Automation AG
Kapellenstraße 15
65555 Limburg
Germany
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Fax +49 6431 9577-177

Sitz der Gesellschaft: Elz
Registergericht Limburg, HRB 2552
Vorsitzender des Aufsichtsrates: Paul G. Harms
Vorstand: Volker G. Harms, Willibald Sehr

Bankverbindungen:
Commerzbank AG Limburg BLZ 511 400 29 Konto-Nr. 377348800
Commerzbank AG Dresden BLZ 850 400 00 Konto-Nr. 1035047
Kreissparkasse Limburg BLZ 511 500 18 Konto-Nr. 30350615
Dresdner Bank AG Hoechst BLZ 500 800 00 Konto-Nr. 770626100
Deutsche Bank AG Limburg BLZ 511 700 10 Konto-Nr. 494070600
Postbank Frankfurt/Main BLZ 500 100 60 Konto-Nr. 55554601

MOBA
MOBILE AUTOMATION

KONFORMITÄTSERKLÄRUNG
Declaration of Conformity
Declaration de Conformité

This corresponds to EN ISO/IEC 17050-1

Wir / We / Nous

MOBA Mobile Automation AG
Kapellenstraße 15
D-65555 Limburg (Germany)

erklären in alleiniger Verantwortung, dass das Produkt
declare under our sole responsibility that the product
déclarons sous notre seule responsabilité que le produit

Sonic-Ski plus, (CAN)
04-21-10120

auf das sich diese Erklärung bezieht, mit den folgenden Normen übereinstimmt
to which this declaration relates is in conformity with the following standards
auquel se réfère cette déclaration est conforme aux normes

EN 13309 (2000)

verified standards

EN55022, Class B (2008-5)

EN61000-4-2 (2001-12)

EN61000-4-3 (2008-06)

EN61000-4-4 (2005-07)

EN61000-4-6 (2008-04)

ISO 7637-2 Puls 1, 2, 2b, 4, 5 (2004-06)

gemäß den Bestimmungen der Richtlinie
following the provisions of Directive
conformément aux dispositions de Directive

Electromagnetic compatibility 2004/108/EC

Limburg, den 27.07.2009

i.V. Matthias Weber
Leiter Qualitätsmanagement

Hausanschrift:
MOBA Mobile Automation AG
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65555 Limburg
Germany
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Fax: +49 6431 9577-177

Sitz der Gesellschaft: Limburg
Registergericht Limburg, HRB 2552
Vorsitzender des Aufsichtsrats: Harald Robl
Vorstand: Volker G. Harms, Dr. Holger Barthel, Alfons Horn, David Shelstad
USt-IdNr.: DE 113865988

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Commerzbank AG, Limburg BLZ 511 400 29 Konto-Nr. 377 348 800
IBAN: DE 16 5114 0029 0377 3488 00 • BIC/SWIFT-Code: COBADEFF 511
Kreissparkasse Limburg BLZ 511 500 18 Konto-Nr. 30 350 615
IBAN: DE 10 5115 0018 0030 3506 15 • BIC/SWIFT-Code: HELADEF1LIM

MOBA MOBILE AUTOMATION

KONFORMITÄTSERKLÄRUNG
Declaration of Conformity
Declaration de Conformité

This corresponds to EN ISO/IEC 17050-1

Wir / We / Nous

MOBA Mobile Automation AG
Kapellenstraße 15
D-65555 Limburg (Germany)

erklären in alleiniger Verantwortung, dass das Produkt
declare under our sole responsibility that the product
déclarons sous notre seule responsabilité que le produit

Junctionbox,Big-Ski (CAN),3Sensor
04-03-00415

auf das sich diese Erklärung bezieht, mit den folgenden Normen übereinstimmt
to which this declaration relates is in conformity with the following standards
auquel se réfère cette déclaration est conforme aux normes

EN 13309 (2000)

verified standards

EN55022, Class B (2008-5)

EN61000-4-2 (2001-12)

EN61000-4-3 (2008-06)

EN61000-4-4 (2005-07)

EN61000-4-6 (2008-04)

ISO 7637-2 Puls 1, 2, 2b, 4, 5 (2004-06)

gemäß den Bestimmungen der Richtlinie
following the provisions of Directive
conformément aux dispositions de Directive

Electromagnetic compatibility 2004/108/EC

Limburg, den 27.07.2009

i.V. Matthias Weber
Leiter Qualitätsmanagement

Hausanschrift:
MOBA Mobile Automation AG
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65555 Limburg
Germany
Telefon: +49 6431 9577-0
Fax: +49 6431 9577-177

Sitz der Gesellschaft: Limburg
Registergericht Limburg, HRB 2552
Vorsitzender des Aufsichtsrats: Harald Robl
Vorstand: Volker G. Harms, Dr. Holger Barthel, Alfons Horn, David Shelstad
USt-IdNr.: DE 113865988

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Commerzbank AG, Limburg BLZ 511 400 29 Konto-Nr. 377 348 800
IBAN: DE 16 5114 0029 0377 3488 00 • BIC/SWIFT-Code: COBADEFF 511
Kreissparkasse Limburg BLZ 511 500 18 Konto-Nr. 30 350 615
IBAN: DE 10 5115 0018 0030 3506 15 • BIC/SWIFT-Code: HELADEF1LIM

MOBA MOBILE AUTOMATION

CE KONFORMITÄTSERKLÄRUNG

entsprechend ISO/IEC Guide 22 und EN 45014

Name des Herstellers: MOBA Mobile Automation AG

Anschrift des Herstellers: MOBA Mobile Automation AG
Kapellenstraße 15
D-65555 Limburg (Germany)

erklärt, dass das Produkt:

Produktname: **Digi-Slope-Sensor,CAN,LSTA**
04-21-21010

den folgenden Produktspezifikationen entspricht:

EMV (EMC): EN13309:2000 / Schmalband, Breitband Störaussendung

EN61000-4-2 (2001)

EN61000-4-3 (2003)

EN61000-4-4 (2002)

EN61000-4-6 (2001)

ISO 7637-2 (Impulse 1, 2)

ISO 7637-2 ISO Puls 5

Das Produkt entspricht den Anforderungen der EMV- Verordnung 89/336/EWG.
Es wurde in einer typischen Konfiguration getestet.

Limburg, den 19. April 2007

i.V. Matthias Weber
Leiter Qualitätsmanagement

Hausanschrift:
MOBA Mobile Automation AG
Kapellenstraße 15
65555 Limburg
Germany
Telefon: +49 6431 9577-0
Fax: +49 6431 9577-177

Sitz der Gesellschaft: Limburg
Registergericht Limburg, HRB 2552
Vorsitzender des Aufsichtsrates: Paul G. Harms
Vorstand: Volker G. Harms, Willibald Sehr
USt-IdNr.: DE 113865988

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IBAN: DE 16 5114 0029 0377 3488 00 • BIC/SWIFT-Code: COBADEFF 511
Kreissparkasse Limburg BLZ 511 500 18 Konto-Nr. 30 350 615
IBAN: DE 10 5115 0018 0030 3506 15 • BIC/SWIFT-Code: HELADEF1LIM

MOBA MOBILE AUTOMATION

KONFORMITÄTSERKLÄRUNG
Declaration of Conformity
Declaration de Conformité

This corresponds to EN ISO/IEC 17050-1

Wir / We / Nous

MOBA Mobile Automation AG
Kapellenstraße 15
D-65555 Limburg (Germany)

erklären in alleiniger Verantwortung, dass das Produkt
declare under our sole responsibility that the product
déclarons sous notre seule responsabilité que le produit

Seilzugsensor IV, KL, MCD-090, CAN
04-21-30070

auf das sich diese Erklärung bezieht, mit den folgenden Normen übereinstimmt
to which this declaration relates is in conformity with the following standards
auquel se réfère cette déclaration est conforme aux normes

EN 13309 (2000)

verified standards

EN55022, Class B 1998 + A2:2003

EN61000-4-2 (2001)

EN61000-4-3 (2003)

EN61000-4-4 (2002)

EN61000-4-6 (2001)

ISO 7637-2 (Puls 1, 2)

ISO 7637-2 ISO Puls 5

gemäß den Bestimmungen der Richtlinie
following the provisions of Directive
conformément aux dispositions de Directive

Electromagnetic compatibility 2004/108/EC

Limburg, den 04.03.2010

i.V. Matthias Weber
Leiter Qualitätsmanagement

Hausanschrift:
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Sitz der Gesellschaft: Limburg
Registergericht Limburg, HRB 2552
Vorsitzender des Aufsichtsrats: Harald Robl
Vorstand: Volker G. Harms, Dr. Holger Barthel, Alfons Horn, David Shelstad
USt-IdNr.: DE 113865988

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Commerzbank AG, Limburg BLZ 511 400 29 Konto-Nr. 377 348 800
IBAN: DE 16 5114 0029 0377 3488 00 • BIC/SWIFT-Code: COBADEFF 511
Kreissparkasse Limburg BLZ 511 500 18 Konto-Nr. 30 350 615
IBAN: DE 10 5115 0018 0030 3506 15 • BIC/SWIFT-Code: HELADEF1LIM

MOBA
MOBILE AUTOMATION

CE KONFORMITÄTSERKLÄRUNG

entsprechend ISO/IEC Guide 22 und EN 45014

Name des Herstellers: MOBA Mobile Automation AG

Anschrift des Herstellers: MOBA Mobile Automation AG
Kapellenstraße 15
D-65555 Limburg (Germany)

erklärt, dass das Produkt:

Produktname: **Digi-Rotary-Sensor, (CAN)**
04-21-40110

den folgenden Produktspezifikationen entspricht:

EMV (EMC): EN13309:2000 / Schmalband, Breitband Störaussendung

EN61000-4-2 (2001)

EN61000-4-3 (2003)

EN61000-4-4 (2002)

EN61000-4-6 (2001)

ISO 7637-2 (Impulse 1, 2)

ISO 7637-2 ISO Puls 5

Das Produkt entspricht den Anforderungen der EMV- Verordnung 89/336/EWG.
Es wurde in einer typischen Konfiguration getestet.

Limburg, den 05. Februar 2007

i.V. Matthias Weber
Leiter Qualitätsmanagement

Hausanschrift:
Mobile Automation AG
Kapellenstraße 15
65555 Limburg
Germany
Telefon: +49 6431 9577-0
Fax: +49 6431 9577-177

Sitz der Gesellschaft: Elz
Registergericht Limburg, HRB 2552
Vorsitzender des Aufsichtsrates: Paul G. Harms
Vorstand: Volker G. Harms, Willibald Sehr

Bankverbindungen:
Commerzbank AG Limburg BLZ 511 400 29 Konto-Nr. 377348800
Commerzbank AG Dresden BLZ 850 400 00 Konto-Nr. 1035047
Kreissparkasse Limburg BLZ 511 500 18 Konto-Nr. 30350615
Dresdner Bank AG Hoechst BLZ 500 800 00 Konto-Nr. 770626100
Deutsche Bank AG Limburg BLZ 511 700 10 Konto-Nr. 494070600
Postbank Frankfurt/Main BLZ 500 100 60 Konto-Nr. 55554601

MOBA
MOBILE AUTOMATION

KONFORMITÄTSERKLÄRUNG
Declaration of Conformity
Declaration de Conformité

This corresponds to EN ISO/IEC 17050-1

Wir / We / Nous

MOBA Mobile Automation AG
Kapellenstraße 15
D-65555 Limburg (Germany)

erklären in alleiniger Verantwortung, dass das Produkt
declare under our sole responsibility that the product
déclarons sous notre seule responsabilité que le produit

Laserempfänger LS-3000
04-60-11311

auf das sich diese Erklärung bezieht, mit den folgenden Normen übereinstimmt
to which this declaration relates is in conformity with the following standards
auquel se réfère cette déclaration est conforme aux normes

EN 13309 (2010)

verified standards

EN55022, Class B (2008-5)

EN61000-4-2 (2009-12)

EN61000-4-3 (2011-04)

EN61000-4-4 (2010-11)

EN61000-4-6 (2009-12)

ISO 7637-2 Puls 1, 2, 2b, 4, 5 (2011-03)

gemäß den Bestimmungen der Richtlinie
following the provisions of Directive
conformément aux dispositions de Directive

Electromagnetic compatibility 2004/108/EC

Limburg, den 19.01..2012

i.V. Matthias Weber
Leiter Qualitätsmanagement

Hausanschrift:
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65555 Limburg
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Sitz der Gesellschaft: Limburg
Registergericht Limburg, HRB 2552
Vorsitzender des Aufsichtsrats: Harald Robl
Vorstand: Volker G. Harms, Dr. Holger Barthel, Alfons Horn, David Shelstad
USt-IdNr.: DE 113865988

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Definition of terms / Glossary

Term	Definition
Working point	Point (distance, grade or angle) for which the actual value and setpoint are equal and no control is required.
CAN-Bus	The CAN-Bus (Controller Area Network) is defined as a system for serial data transmission. It was developed for the networking of control units in the car industry to reduce the cable loom (up to 2 km per vehicle) and to reduce, and secure, the data transfer.
Actual value	The currently measured value of a sensor, e.g. the distance of a grade sensor to a reference or the measured slope from a slope sensor.
Minimum pulse	Minimum triggering pulse which is required to traverse a hydraulic cylinder in the smallest possible way.
Maximum pulse	Trigger pulse which defines the maximum permissible working speed of a hydraulic cylinder.
Zero adjustment	The current measured value of the grade sensor will be assigned the value of “0.0” and at the same time acquired as the setpoint for the controller.
Offset	A constant, systematic error a variable or a measured value (e.g. an offset when the slope sensor cannot be assembled absolutely parallel to the lower edge of the tool).
Prop band	The area above and below the dead band in which a “metered” triggering of the output is executed. The length of the pulses is therefore dependent on the control deviation.

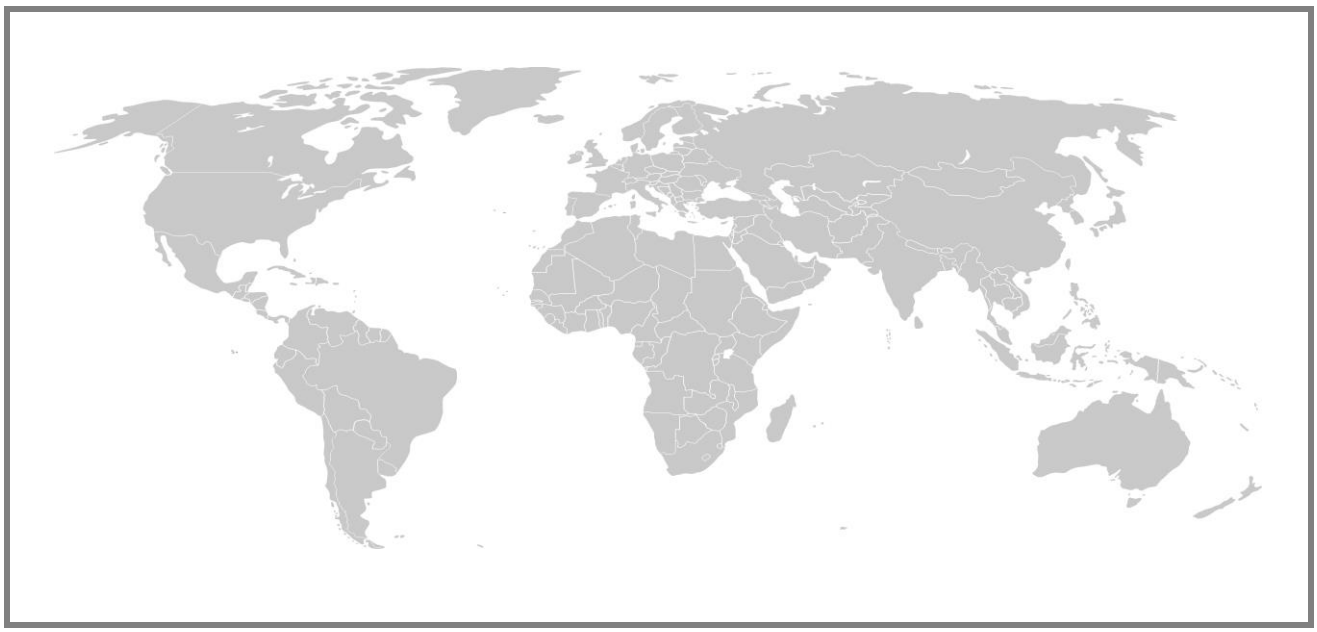
Control deviation The difference between the setpoint and actual value. During controlling, the controller traverses the actuator in such a way that the measured value of the sensor (actual value) complies with the specified value (setpoint).

Setpoint value The preset target figure from the operator which should be achieved by a control loop and complied with.

Actuator Sets the controller signals in (usually) mechanical work - that means movement -; e.g. a valve that opens or closes.

Dead band Symmetrical, around the working point positioned, range in which no control of the output is executed. It serves the purpose of achieving a stable behaviour of the tool in the working point.

Notes:



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