



Operating manual

Version 1.0.1

Digital position display

DRO 3





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Preface

Dear customer,

Thank you very much for purchasing a product made by OPTIMUM.

OPTIMUM metal working machines offer a maximum of quality, technically optimum solutions and convince by an outstanding price performance ratio. Continuous enhancements and product innovations guarantee state-of-the-art products and safety at any time.

Before commissioning the device please thoroughly read these operating instructions and get familiar with the device. Please also make sure that all persons operating the device have read and understood the operating instructions beforehand.

Keep these operating instructions in a safe place nearby the device.

Information

The operating instructions include indications for safety-relevant and proper installation, operation and maintenance of the device. The continuous observance of all notes included in this manual guarantee the safety of persons and of the device.

The manual determines the intended use of the device and includes all necessary information for its economic operation as well as its long service life.

The illustration and information included in the present manual can possibly deviate from the current state of construction of your device. Being the manufacturer we are continuously seeking for improvements and renewal of the products. Therefore, changes might be performed without prior notice. The illustrations of the device may be different from the illustrations in these instructions with regard to a few details. However, this does not have any influence on the operability of the device.

Therefore, no claims may be derived from the indications and descriptions. Changes and errors are reserved!

Your suggestion with regard to these operating instructions are an important contribution to optimising our work which we offer to our customers. For any questions or suggestions for improvement, please do not hesitate to contact our service department.

If you have any further questions after reading these operating instructions and you are not able to solve your problem with a help of these operating instructions, please contact your specialised dealer or directly the company OPTIMUM.

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1 Safety

Representation Conventions

 gives additional advices

 calls on you to act

 enumerations

This part of the operating instructions

- defines the intended use of the device,
- points out the dangers that might arise for you or others if these instructions are not observed,
- informs you about how to avoid dangers.

In addition to these operation instructions, please observe

- the applicable laws and regulations,
- legal regulations for accident prevention,
- the prohibition, warning and mandatory signs as well as the warning labels on the device.

During installation, operation, maintenance and repair of the device, the European standards need to be observed.

PLEASE KEEP THIS DOCUMENTATION ALWAYS CLOSE TO THE DEVICE.

INFORMATION

If you are unable to solve a problem using these operating instructions, please contact us for advice:

Optimum Maschinen Germany GmbH
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1.1 Target group

This operating manual is addressed to operation organizations, the operators and the maintenance staff.

1.2 Intended use

WARNING!

In the event of improper use, the digital position display

- **there may be a risk to the staff,**
- **will endanger the device and other material property of the operator,**
- **may affect proper operation of the device.**



The device provided for the position display of traveling tools respectively tool slides on lathes, milling machines, etc. The device is designed and manufactured to be used universally in environments where there is no potential danger of explosion. For the operation, additionally absolute or incremental measuring systems for the position acquisition are required.

If the device is used in any way other than described above or modified without the approval of the company Optimum Maschinen Germany GmbH then the device is being used improperly.

We do not take any liability for damages caused by intended use.



It is also part of proper use that the operating manual and inspection and maintenance instructions are observed.

1.3 Invalid modification of the device

WARNING!

Extremely severe injuries.

It is forbidden to make any modifications or alterations to the operating values of the device! They could endanger personnel working on the device and cause damage to the device.

We expressly point out that the guarantee will expire due to any constructive technical or procedural changes which had not been performed by the company Optimum Maschinen Germany GmbH.



1.4 Possible dangers caused by machine tools

The device is operated in immediate proximity of machine tools.

→ Always switch off the device and pull the mains plug when performing cleaning or maintenance work on the device or on the machine tool.

WARNING!

Machine tools must only be used with activated safety devices. Disconnect the machine tool whenever you detect a failure in the safety devices or when they are not fitted!



1.5 Possible dangers caused by the device

The operating safety of digital position display has been tested. It has been designed and built using the latest technological advances.

Nonetheless, there remains a residual risk, since the device operates with electrical voltages and currents.

We have used construction resources and safety techniques to minimize the health risk to personnel resulting from this hazard.

Nonetheless, if the device is operated or maintained by personnel who are not duly qualified, there may be a risk resulting from incorrect operation or improper maintenance.

1.6 Authorized staff

Persons authorized to operate and maintain should be trained technical staff and instructed by the ones who are working for the operating company and for the manufacturer.

All personnel involved in assembly, commissioning, operation and maintenance need to be duly qualified and follow this operating manual.



1.7 Additional requirements regarding the qualification

Work on electric components or equipment must only be carried out by qualified electricians.

1.8 Obligations of the operating company

The operator must instruct the staff on all safety standards that apply to the device and to the operation.

1.9 Obligations of the operator

The operator must

- have read and understood the operating instructions,
- be familiar with all safety devices and instructions,
- be capable of operating the device.

1.10 Safety during operation

Check the digital position display at least once per shift. Inform the person responsible immediately of any damage, defect or change in operating function.

WARNING!

Before activating the device, double-check that this will, even in combination with the machine tool, not

- **lead to any danger with respect to people,**
- **cause any damage to equipment.**

Avoid any unsafe working practices:

- ➔ Do not work on the device or the machine if your concentration is reduced, for example, because you are taking medication.
- ➔ Observe the accident prevention regulations issued by your Employers Liability Insurance Association or other competent supervisory authority, responsible for your company.



1.11 Safety during maintenance

Inform operators timely on maintenance and repair work.

Report all safety-relevant changes or performance details of the device. Document all changes, have the operating manual changed accordingly and train the machine operators.

1.11.1 Disconnecting and making it safe

- ➔ Switch off the device before starting any maintenance or repair work.
- ➔ Pull the mains plug.
- ➔ Place a warning sign on the machine tool.



1.12 Accident report

Inform your superiors and Optimum Maschinen Germany GmbH immediately in the event of accidents, possible sources of danger and any actions which almost led to an accident (near misses) that are connected with the digital position display and the machine tool.



1.13 General instruction

This manual explains the installation, the operation and the maintenance of the position display DRO 3 in detail, which is widely used as add-on to axis-driven machine tools.

1.13.1 Technical data

- Technical data Mains voltage: AC 230V + - 10 %, 50 - 60Hz
- Power consumption: about 5W, fuse 2A
- Display: X, Y, Z axis with 8-digit LED display, where the first digit is for the algebraic sign.

1.13.2 Working conditions

- Avoid exposing the device direct solar radiation or high temperatures, and it should be used in temperatures ranging from 0°C to 40°C;
- Environment temperature for storage must be ranging from -30°C to 70°C;
- Environmental relative humidity: <90% (at 20°C± 5°C); <90% (at 20°C± 5°C);
- Keep away from high voltage, strong electric current and strong magnetic field;
- Signal cable should be far away from the power cable;
- Avoid working in environments with scrap iron, oil, water, dust and strong vibration;
- Do not expose the position display to corrosively acting chemicals and highly corrosive acids or bases.

1.13.3 Precautions

- When unpacking, perform a visual check if the position display is in good order. If anything is out of order, please immediately contact our company or the distributor. Do not dismantle the device by yourself in order to repair it;
- Please do not connect the position display to any readers of other trademarks, otherwise it may cause display errors or damages on the position display;
- Please do not open the cover of the position display, do not remove the reader before having disconnected the whole measuring system;
- Make sure that the position display is well grounded.

1.13.4 Regular maintenance

- Switch off the power before cleaning the position display;
- Polish the cover with soft and dry cloth;
- Do not clean the cover using abrasive cleaning agents or agents which would change the surface of plastic materials;
- Clean the display window at the front side of the position display using an neutral and anti-statically acting cleaning agent.

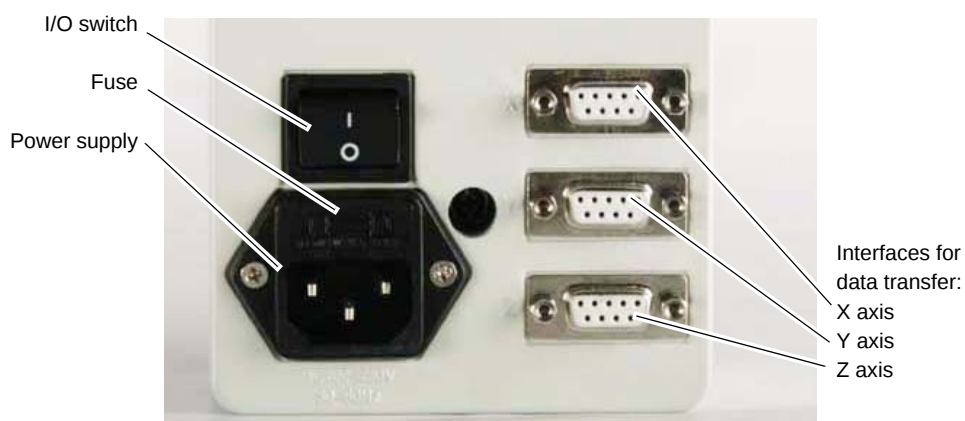
2 Digital 3-axes position display DRO 3

2.1 The front panel



Img.2-1: front side DRO 3

2.2 The rear panel



Img.2-2: rear side DRO 3



2.3 Description of the keys

No.	Sign on the key	Name of the key	Function description
1		Delete key	To clear displayed value of a specific axis or give up the current operation
2		SEL key	To select the X/ Y/ Z coordinate axis
3		The metric / inch conversion key	To convert metric / inch
4		Programming key	For internal parameter settings

2.4 Measuring device - Pin Assignment

The functional designation of the wires, that each pin at the 9-Pin-SubD-plug is allocated, must have the same assignment as the connector at the digital display. The assignment is shown in the following tables.

INFORMATION

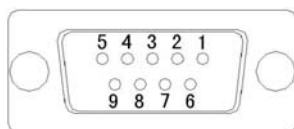
The DRO 3 is designated for the operation with measuring devices, that provides a Sine 1Vpp output signal (= voltage between the upper and lower peak of the wave is 1 Volt).



INFORMATION

We are recommending the application of original OPTIMUM measuring gibs, because this will ensure a quick and failure-free operation.

If it is indented to operate the digital display with measuring devices from other manufacturers, pay attention that this measuring gib is providing an output signal from the type „Sine 1Vpp“ and the pin assignment is consistent to the following table.



PIN No.	1	2	3	4	5	6	7	8	9
sine 1Vpp signal for OPTIMUM measuring gauge ML	A+	A-	+5V	0V	B+	B-	Z+	Z-	Shielding



2.5 Assembly and commissioning

INFORMATION

If you want to use the digital position display you need at least one measuring gauge. Measuring gauges are not part of the delivery volume of the digital position display.

Only use original OPTIMUM path-measuring systems, since the position display is only adjusted to such path-measuring system and this way will guarantee a safe functioning.



2.6 Scope of delivery

Upon delivery immediately check if the device had been damaged during transport. Compare the delivery volume with the data on the delivery note.

2.7 Storage

ATTENTION!

In case of wrong and improper storage components might get damaged and destroyed. Store the packed or already unpacked device only at dry environmental conditions at a temperature from 0 °C to 40 °C.



Consult Optimum Maschinen Germany GmbH if the device or accessories are stored for more than three months or are stored under different environmental conditions than those given here.

2.8 Adding the device

2.8.1 Requirements regarding the installation site

ATTENTION!

When choosing the installation site, please take into account the length of the connection lines for the measuring gauges.



The installation site needs to be dry and vibration-free and comply with the ergonomic requirements of a working place. Observe the safety instructions for working nearby machine tools.

The working area for the operation, maintenance and repair works must not be hindered by adding the position display.

2.8.2 Mounting the Display Unit

The Display needs to be mounted securely to a horizontal or vertical surface in a location where it can be used freely without overreaching any rotating or moving machine parts.

Supplied with the unit is a Plate Magnet that can be fastened with the 2 short metal screws provided to the base or sides of the display allowing you to mount it to a metal surface easily.

There are 4 Extra nylon push in plugs provided. Ensure these are pushed into the remaining 4 holes before connection to power to stop the ingress of dust, moisture and swarf .

If the Unit is mounted differently using the tapped holes provided, Caution Must be taken to ensure screws used do not enter the unit more than 10mm, due to live 240 Volt parts inside. Ensure all remaining holes have screws in before use and connection to power,



2.8.3 Assembling the measuring gauges

Measuring gauges are linear measuring systems which collect the position of mobile machine parts via a sensor and forward them coded to the position display.

ATTENTION!

Only use path-measuring systems recommended by OPTIMUM. When assembling the path-measuring systems imperatively follow the instructions of the manufacturer.



- Before mounting it on the machine, check the operability of the measuring gauges. To do so, use the digital position display DRO 3 or a similar device.
- Install the measuring gauge in a way that it will not be damaged by cutting tools or coolants. If required, mount a cover.
- If possible, mount the enclosed measuring gauges with the sealing lips showing downward.
- If possible, place the reading head stationary in order to avoid damages of the connection lines by its movements.

ATTENTION!

The path-measuring system and its add-on pieces can cover important components on the machine tool (e.g. lubricating nipples).

Before mounting the path-measuring systems, please note such limitations in functions and make arrangements accordingly.



2.8.4 Assembly of the reading head

- Mount a fixture for the reading head.
- Fix the reading head to the fixture.
- Remove possibly existing assembly aids from the reading head.
- Check the orientation of the reading head using a dial gauge (refer to the tolerances for the assembly given by the manufacturer).
- Check if all components are moving freely.

2.9 First commissioning

WARNING!

When first commissioning the device by inexperienced persons you will endanger persons or the device.

We do not take any liability for damages caused by incorrectly performed commissioning.

2.9.1 Connecting the measuring gauges

The measuring gauges are firmly connected to the rear side of the device using couplings.

- Slightly press the plug of the path-measuring system on the coupling.
- In doing so, turn the plug until the inner guiding pin of the plug has cammed in the groove of the coupling.
- Firmly bolt the screw cap of the plug on the coupling.

2.9.2 Connecting the power supply

The device is connected using a power cable. The coupling for the power cable is at the rear side of the device.

The plug of the power cable is provided for shock-proof sockets.

Please observe the technical indications regarding the electrical connection of the device.

👉 "The rear panel" on page 24



2.9.3 Switching on the device

The device will be switched on using the main switch at the rear side.

ATTENTION!

Only switch on the device by using the main switch if the measuring gauges are connected and the power cord is connected to the electrical power supply.



2.10 Internal parameter setting

The display is shipped from the factory with default programming. To change the default programming the device must be switched to the programming mode.

Factory setting:

Parameter	Value	Parameter setting
Resolution	0.005 mm	R5
Counting direction	positive	C0

2.10.1 Change of counting direction

Parameter	Value	How to change the parameter setting	
Counting direction	C0	1.	Turn off the DRO 3 with the 1/0 switch.
Counting direction	C1	2.	Press and hold the MEM"button down while turning on the DRO with the 1/0 switch
		3.	Change the value of "rd" to "1" or "0" by pressing the "INCH / mm" button. With the "SEL" button you can select the value in the individual axes.
		4.	Confirm the value by pressing the "MEM" button.

Each coordinate axis is shown her own set point value for the counting direction.

2.10.2 Function diameter - radius

Parameter	Value	How to change the parameter setting	
rd	0	1.	Turn off the DRO 3 with the 1/0 switch.
rd	1	2.	Press and hold the MEM"button down while turning on the DRO with the 1/0 switch
		3.	Change the value of "rd" to "1" or "0" by pressing the "INCH / mm" button.
		4.	Confirm the value by pressing the "MEM" button.

When the X-axis indicates rd 0, the axis is set to radius function.

When the X-axis indicating rd 1, the axis is set to diameter function and shows the double value.

Press the "INCH / mm" - button to switch the diameter function ON or OFF.

If the X-axis is set to diameter function, the LED lights below the "SEL" button.



2.10.3 Summing function of axes

Parameter	Value	How to change the parameter setting	
SU	0	1.	Turn off the DRO 3 with the 1/0 switch.
U	1	2.	Press and hold the MEM"button down while turning on the DRO with the 1/0 switch
		3.	Change the value of "SU" to "1" or "0" by pressing the "INCH / mm" button.
		4.	Confirm the value by pressing the "MEM" button.

If Y axis indicates SU 0, the Z and Y axes are not summed. The display is in the standard operating mode.

If the Y axis indicates SU 1, the axes Z and Y are summed.

Press the "INCH / mm" - button to switch the summing function of axes ON or OFF.

2.10.4 Change of resolution

Parameter	Value	How to change the parameter setting	
Resolution	0.005 mm	1.	Turn off the DRO 3 with the 1/0 switch.
		2.	Press and hold the MEM"button down while turning on the DRO with the 1/0 switch
		3.	Change the value R5" or „R1" or „R10" by pressing the "INCH / mm" button. Meaning: • R1 = 0.001 mm • R5 = 0.005 mm • R10 = 0.01 mm
		4.	With the "SEL" button you can select the value in the individual axes.
		5.	Confirm the value by pressing the "MEM" button.

INFORMATION

Modification of the current parameters can not be saved if there occur power failure or the DRO 3 is turned off during the process of parameter setting.





I. Functions of the Keys

1. The "MEM" key

Function 1: to show the coordinate values of volatile memory under normal working mode;

Function 2: to enter the parameter setting mode when starting the DRO and to confirm the modification of parameters under the parameter setting mode.

2. The "INCH/mm" key

Function 1: to switch between INCH/mm under normal working mode;

Function2: to select parameter values under the parameter setting mode.

3. The "SEL" key

Function: to select coordinate.

4. The "CE" key

Function: to clear the displayed values of the selected coordinates under normal working mode.

To cancel the state of volatile memory.

II. Operating Instructions

1. Starting: When the DRO is started, it will show its type, software version number, etc. And after 2 seconds the DRO enters into the normal working interface. It will show the coordinate values of volatile memory if any when it was switched off last time and the indicating light on the "MEM" key will shine. When the machine tool works again, the indicating light on the "MEM" key will go out. If there was no coordinate value of volatile memory when it was switched off last time, all its coordinates will show zero in metric system.

2. Coordinates clearing: First press the "SEL" key to select the coordinate to be cleared . Then press the "CE" key and the displayed value of this coordinate will be cleared.

3. "INCH/mm" switching: Press the "INCH/mm" key and the indicating light on this key will shine if it is switched to the British system mode. When the DRO is started, it will show the last "INCH/mm" display state saved by the volatile memory operation.

4. Turning off the DRO: Press the "MEM" key before turning off the DRO, the indicating light on the key will shine and the DRO will save the current coordinate value as volatile memory coordinate value. But the light will be off when the machine tool works again. When the DRO is started next time, this value will be shown again.

III. Parameter Setting

When the DRO is started and shows its type, software version number, etc. press the "MEM" key for 2 seconds the DRO will enter the parameter setting mode(Or you can press "MEM" when the Z axis light is on). Now you can set the counting direction and resolution of each coordinate axis.

1. Counting direction setting

Each coordinate axis will show its own set values of counting direction respectively, e.g. "C 0" or "C 1" denote the normal direction.

Press the "SEL" key to select the coordinate axis and the selected coordinate axis will show in reverse display.

Press the "INCH/mm" key to switch the counting direction of the selected coordinate axis.

Press the "MEM" key to confirm the modification and to enter the resolution setting mode.

2. Resolution setting

Each coordinate axis will show its own set values of resolution respectively, e.g. "R 5" denotes that the resolution is 5 μ m.

Press the "SEL" key to select the coordinate axis and the selected coordinate axis will show in reverse display.

Press the "INCH/mm" key to switch the resolution (1 μ m, 5 μ m and 10 μ m) of the selected coordinate axis.

Press the "MEM" key to confirm the modification and to enter the display resolution setting mode.

3. Display Resolution setting

Each coordinate axis will show its own set values of display resolution respectively, e.g. "dR 10" denotes that the display resolution is 10 μ m.

Press the "SEL" key to select the coordinate axis and the selected coordinate axis will show in reverse display.

Press the "INCH/mm" key to switch the display resolution (1 μ m, 5 μ m ,10 μ m and 20 μ m) of the selected coordinate axis.

Press the "MEM" key to confirm the modification and to enter the normal working mode.

4. D/R function and Su function setting:

When X axis display rd 0, Press the "INCH/mm" button to switch diameter radius function. (1 stand for diameter 0 stand for radius), when rd 1, the light under the key "SEL" will be turn on, At this time the X axis display double value of number.

When Y axis display Su 0, Press the "INCH/mm" button to switch this function (1 turn on , 0 turn off)

When exit parameters setting, if setting is Su 1, Y axis display -----, and Z axis show SUM of X axis and Y axis. If setting is Su 0, then enter the normal working mode.

Note: Modification of the current parameters can not be saved if there occur power failure or the DRO is turned off during the process of parameter setting.

Meanings of the 9-pin D-type socket:

Pin No.	1	2	3	4	5	6	7	8	9
Differential TTL Square Wave Signals	A+	A-	+5V	0V	B+	B-	Z+	Z-	Shielding



3 Troubleshooting DRO 3

Failures	Failure causes	Troubleshooting
The digital display does not display anything	1 Make sure that the power cable is well connected. 2 Make sure that the power switch is on. 3 Make sure that the voltage is suitable. 4 Short circuit inside the reading device. 5 Make sure that the fuse is working.	1 Make sure that the power cable is well connected. Then switch on the power supply. 2 Switch on the power switch. 3 The voltage should be 230V +/- 10 %. 4 Pull out the plug of the reading device. 5 Check and replace the fuse if necessary.
The cover is charged.	1 Make sure that the machine tool and the position display cover are well grounded. 2 Make sure that the 230V power supply is available	1 The machine tool and the position display cover must be well grounded. 2 Check the 230V +/- 10 % power supply.
One position display axis does not count	1 Check if the position display still does not count after you have exchanged the reading device with the other axis. 2 The position display is in a deviating function range.	1 If the position display counts normally, it may be a failure of the reading device, otherwise, it is a failure of the position display. 2 Leave the deviation function range.



4 Annex

4.1 Copyright

This document is copyright. All derived rights are also reserved, especially those of translation, re-printing, use of figures, broadcast, reproduction by photo-mechanical or similar means and recording in data processing systems, neither partial nor total.

Subject to technical changes without notice.

4.2 Liability claims for defects / warranty

Beside the legal liability claims for defects of the customer towards the seller, the manufacturer of the product, OPTIMUM GmbH, Robert-Pfleger-Straße 26, D-96103 Hallstadt, does not grant any further warranties unless they are listed below or have been promised in the framework of an individual contractual agreement.

- The processing of the liability claims or of the warranty is performed as chosen by OPTIMUM GmbH either directly or through one of its dealers.
Any defective products or components of such products will either be repaired or replaced by components which are free from defects. The property of replaced products or components passes on to OPTIMUM GmbH.
- The automatically generated original proof of purchase which shows the date of purchase, the type of machine and the serial number, if applicable, is the precondition in order to assert liability or warranty claims. If the original proof of purchase is not presented, we are not able to perform any services.
- Defects resulting from the following circumstances are excluded from liability and warranty claims:
 - Using the product beyond the technical options and proper use, in particular due to overstraining of the machine.
 - Any defects arising by one's own fault due to faulty operations or if the operating manual is disregarded
 - Inattentive or incorrect handling and use of improper equipment
 - Non-authorised modifications and repairs
 - Insufficient installation and safeguarding of the machine
 - Disregarding the installation requirements and conditions of use
 - Atmospheric discharges, overvoltage and lightning strokes as well as chemical influences
- The following items are as well not subject to the liability or warranty claims:
 - Wearing parts and components which are subject to a standard wear as intended such as e.g. V-belts, ball bearings, illuminants, filters, sealings, etc.
 - Non reproducible software errors
- Any services which OPTIMUM GmbH or one of its servants performs in order to fulfil in the frame of an additional guarantee are neither an acceptance of the defects nor an acceptance of its obligation to compensate. Such services do neither delay nor interrupt the warranty period.
- Place of jurisdiction among traders is Bamberg.
- If one of the above mentioned agreements is totally or partially inefficient and/or null, it is considered as agreed what is closest to the will of the warrantor and which remains in the framework of the limits of liability and warranty which are predefined by this contract.



4.3 Change information manual

Chapter	Short note	new version no.
3.5.2	Function diameter - radius added	1.0.1
3.5.3	Summing function of axes added	1.0.1

4.4 Advice for disposal / Options of re-use

Please dispose of your machine in an environmentally friendly way, not by disposing of the waste not in the environment, but by acting in a professional way.

Please do not throw away the packaging and the used machine later on, but dispose of your material according to the guidelines established by your municipality or by the responsible waste management company.

4.4.1 Disposal of electrical and electronic components

Please make sure that the electrical components are disposed of professionally and according to the legal regulations.

The machine is composed of electrical and electronic components and must not be disposed of as household waste. According to the European directive 2002/96/EC regarding electrical and electronic used devices and the implementation of national legislation used power tools and electrical machines need to be collected separately and supplied to an environmentally friendly recycling centre.

Being the machine operator, you should gather information regarding the authorised collection or disposal system which applies for your company.

Please make sure that batteries and/or accumulators are disposed of in a professional way and according to the legal regulations. Please throw empty accumulators only into the collection boxes of retail markets or municipal waste disposal companies.

4.5 Disposal via municipal collecting points

Disposal of used electrical and electronic components

Disposal of used electric and electronic devices (Applicable in the countries of the European Union and other European countries with a separate collecting system for such devices).

The sign on the product or on its packing indicates that the product must not be handled as common household waste, but that it needs to be delivered to a central collection point for recycling. Your contribution to the correct disposal of this product will protect the environment and the health of your fellow men. The environment and the health are endangered by incorrect disposal. Recycling of material will help to reduce the consumption of raw materials. Your District Office, the municipal waste collection station or the shop where you have bought the product will inform you about the recycling of this product.



4.6 RoHS, 2002/95/EC

The sign on the product or on its packaging indicates that this product complies with the European guideline 2002/95/EC.





EC - Declaration of Conformity



**The manufacturer /
retailer:**

Optimum Maschinen Germany GmbH
Dr.-Robert-Pfleger-Str. 26
D-96103 Hallstadt

hereby declares that the following product,

Name: **Digital position display**

Designation **DRO 3**

Year of construction: 20__

EU directives:

2014/30/EC EMC Directive

2006/95/EG Low Voltage Directive

**meets the provisions of the aforementioned directives, including any amendments
valid at the time of this statement.**

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