

Operating Manual

SERIES PMIX

Mechanically guided Incremental Linear Encoder



- Wear-free alternative to conventional linear measuring systems
- Also ideally suited as a digital potentiometer replacement
- Technically based on LMIX resp. EMIX sensors or in combination with a battery powered ELGO display units of the series IZ
- Available resolutions: 0.1 / 0.025 / 0.01 or 0.001 mm depending on selected measuring system (LMIX, EMIX, EMIX23 or IZ display unit)
- Measuring lengths of 100, 200, 400 and 600 mm (others on request)
- The sensor head and the magnetic tape are permanently integrated in the guide cylinder, which ensures an optimal mechanical guidance

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2 General, Safety, Transport and Storage

2.1 Information Operating Manual




This manual contains important information regarding the handling of the device. For your own safety and operational safety, please observe all safety warnings and instructions. Precondition for safe operation is the compliance with the specified safety and handling instructions. Moreover, the existing local accident prevention regulations and the general safety rules at the site of operation have to be observed.

Please read the operating manual carefully before starting to work with the device! It is part of the product and should be kept close to the device and accessible for the staff at any time. The illustrations in the manual are for better demonstration of the facts. They are not necessarily to scale and can slightly differ from the actual design.


2.2 Explanation of Symbols

Special notes in this manual are characterized by symbols. The notes are introduced by signal words which express the magnitude of danger. Please follow this advice and act carefully in order to avoid accidents, damage, and injuries.


Warning notes:

	DANGER! This symbol in connection with the signal word "Danger" indicates an immediate danger for the life and health of persons. Failure to heed these instructions can result in serious damage to health and even fatal injury.
	WARNING! This symbol in connection with the word „Warning“ means a possibly impending danger for the life and health of persons. Failure to heed these instructions can result in serious damage to health and even fatal injury.
	CAUTION! This symbol in connection with the signal word "Caution" indicates a possibly dangerous situation. Failure to heed these instructions can lead to minor injuries or damage of property.



Special safety instructions:

	DANGER! This symbol in connection with the signal word "Danger" indicates an immediate danger for the life and health of persons due to voltage. Failure to heed these instructions can result in serious damage to health and even fatal injury. The operations may only be carried out by a professional electrician.
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Tips and recommendations:

	NOTE! ...points out useful tips and recommendations as well as information for an efficient and trouble-free operation.
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Reference marks:

-  Marks a reference to another chapter of this manual.
-  Marks a reference to another chapter of another document.

2.3 Statement of Warranties

The producer guarantees the functional capability of the process engineering and the selected parameters.

2.4 Demounting and Disposal

Unless acceptance and disposal of returned goods are agreed upon, demount the device considering the safety instructions of this manual and dispose it with respect to the environment.

Before demounting, disconnect the power supply and secure against re-start. Then disconnect the supply lines physically and discharge remaining energy. Remove operational supplies and other material.

Disposal:

Recycle the decomposed elements: Metal components in scrap metal, Electronic components in electronic scrap, Recycle plastic components, dispose the remaining components according to their material consistence.



CAUTION!

Wrong disposal causes environmental damages!
Electronic scrap, electronic components, lubricants and other auxiliary materials are subject to special refuse and can only be disposed by authorized specialists!

Local authorities and waste management facilities provide information about environmentally sound disposal.

Safety



CAUTION!

Please read the operating manual carefully, before using the device! Observe the installation instructions!
Only start up the device if you have understood the operating manual.
The operating company is obliged to take appropriate safety measure.
The initial operation may only be performed by qualified and trained staff.
Selection and installation of the devices as well as their embedding into the controlling system require qualified knowledge of the applicable laws and normative requirements on the part of the machine manufacturer.

2.5 General Causes of Risk

This chapter gives an overview of all important safety aspects to guarantee an optimal protection of employees and a safe and trouble-free operation. Non-observance of the instructions mentioned in this operating manual can result in hazardous situations.

2.6 Personal Protective Equipment

Employees have to wear protective clothing during the installation of the device to minimize danger of health.

Therefore:

Change into protective clothing before performing the works and wear them throughout the process.

Additionally observe the labels regarding protective clothing in the operating area.

Protective clothing:

	<p>PROTECTIVE CLOTHING ... is close-fitting working clothing with light tear strength, tight sleeves and without distant parts. It serves preliminarily for protection against being gripped by flexible machine parts. Do not wear rings, necklaces or other jewelry.</p>
	<p>PROTECTIVE GLOVES ...for protecting the hands against abrasion, wear and other injury of the skin.</p>
	<p>PROTECTIVE HELMET ...for protection against injuries of the head.</p>

2.7 Conventional Use

The product described in this manual was developed to execute safety-related functions as a part of an entire assembly or machine. The ELGO device type PMIX only serves to measure lengths and linear movements.

**CAUTION!**

Danger through non-conventional use!

Non-intended use and non-observance of this operating manual can lead to dangerous situations.

Therefore:

- Only use the device as described
- Strictly follow the instructions of this manual

Avoid in particular:

- Remodeling, refitting or changing of the construction or single components with the intention to alter the functionality or scope of the device.

Claims resulting from damages due to non-conventional use are not possible.
Only the operator is liable for damages caused by non-conventional use.

2.8 Safety Instructions for Transport, Unpacking and Loading

**CAUTION!**

Transport the package (box, palette etc.) professionally.

Do not throw, hit or fold it.

2.9 Handling of Packaging Material

Notes for proper disposal: ☞ 2.4

2.10 Inspection of Transport

Check the delivery immediately after the receipt for completeness and transport damage.

In case of externally recognizable transport damages:

- Do not accept the delivery or only accept under reserve.
- Note the extent of damages on the transportation documents or delivery note.
- File complaint immediately.

**NOTE!**

Claim any damage immediately after recognizing it.

The claims for damage must be filed in the lawful reclaim periods.

2.11 Storage

Store the device only under the following conditions:

- Do not store outside
- Keep dry and dust-free
- Do not expose to aggressive media
- Protect from direct sun light
- Avoid mechanical shocks
- Storage temperature (☞4) needs to be observed
- Relative humidity (☞4) must not be exceeded
- Inspect packages regularly if stored for an extensive period of time (>3 months)

3 Product Features

3.1 General

The guided measuring system PMIX is based on the magnetic length measuring systems LMIX or EMIX. Due to the magnetic (and therefore contactless) measuring principle, it is a wear-free alternative to conventional linear encoders.



Figure 1: PMIX in combination with an IZ16E display unit

Depending on the ordered version, an LMIX, EMIX or EMIX23 sensor can be integrated in the PMIX housing. As shown in the photo above, the PMIX system can be combined with the battery-powered ELGO position indicators IZ14E, IZ15E, IZ16E and IZ17E. In this case sensor and resolution comply with the selected IZ unit. Further no wiring is necessary. The respective ordering suffix is specified in the type designation (☞ 8).

The sensor head and the magnetic tape (☞ 4.4) are already integrated in a mechanical cylinder (standard measuring lengths are 100/200/400/600 mm). The sensor is optimally guided at linear movements. Thus the system can immediately be installed and connected.

3.2 Functional Principle

Integrated in the sensor head are the magneto-resistive measuring-bridges, the interpolation circuit and the output drivers. The bridge generates the distance dependent counting pulses for the signal processing electronic.

The sensor cable is an 8-wire cable, highly flexible and suitable for drag chains. It consists of twisted pair wires and is shielded.

3.3 Typical Applications

The series PMIX is suitable for a variety of applications in machine and plant engineering. For example, it can be used everywhere where linear potentiometers are used, since the PMIX linear encoder is also suitable as a digital potentiometer replacement.

Typical applications in the range of machine engineering are e. g.

- Hydraulic presses
- Injection molding machines
- Stroke adjustments
- Pick & Place systems
- Dosing machines and systems
- and many other applications in the plastics, metal, wood, paper and textile processing or with packaging machines.

3.4 Measuring Systems and Resolutions

The PMIX resolution is depending on the selected basis measuring system (see type designation 8). The following table will show all available versions.

Table 1: Measuring Systems and Resolutions

Measuring System	Resolution	Magnetic tape pole pitch
LMIX	0.1 mm at single edge triggering 0.025 mm at four edge triggering	5 mm
EMIX	0.01 mm at four edge triggering	2 mm
EMIX23	0.001 mm at four edge triggering	2 mm
IZ14E/15E/16E/17E	0.01 mm / 0.1 mm (einstellbar via Parameter)	2.5 mm

3.5 Power Supply Voltages and Output Levels

For the LMIX and EMIX based versions, the following combinations are available:

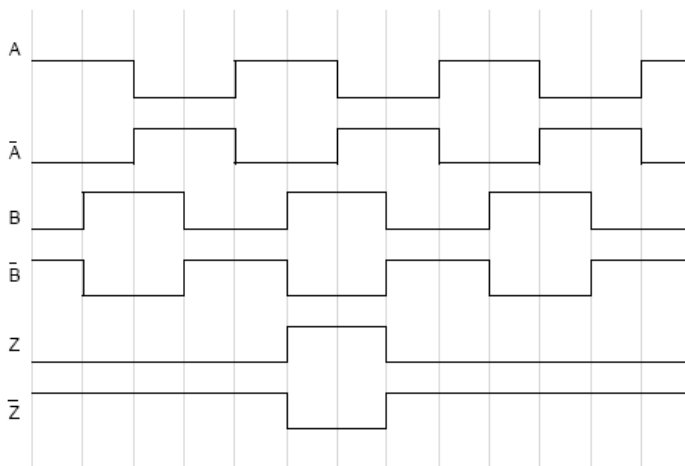
1. Order suffix 00* = 10 ... 30 VDC power supply / output levels 10 ... 30 V-HTL
2. Order suffix 01* = 10 ... 30 VDC power supply / output levels 5 V-TTL line driver
3. Order suffix 11* = 5 VDC power supply / output levels 5 V-TTL line driver

* Order suffix (see type designation 8)



Note: To reach the largest possible interference distance it is recommended to supply the PMIX linear encoder with 10 ... 30 VDC and to select the A/B signals 5 V-TTL-compatible with differential evaluation.

3.6 Pulse diagram



Channel A and B are phase shifted by 90°

The index pulse output is periodically every 2 mm (EMIX) resp. 5 mm (LMIX)

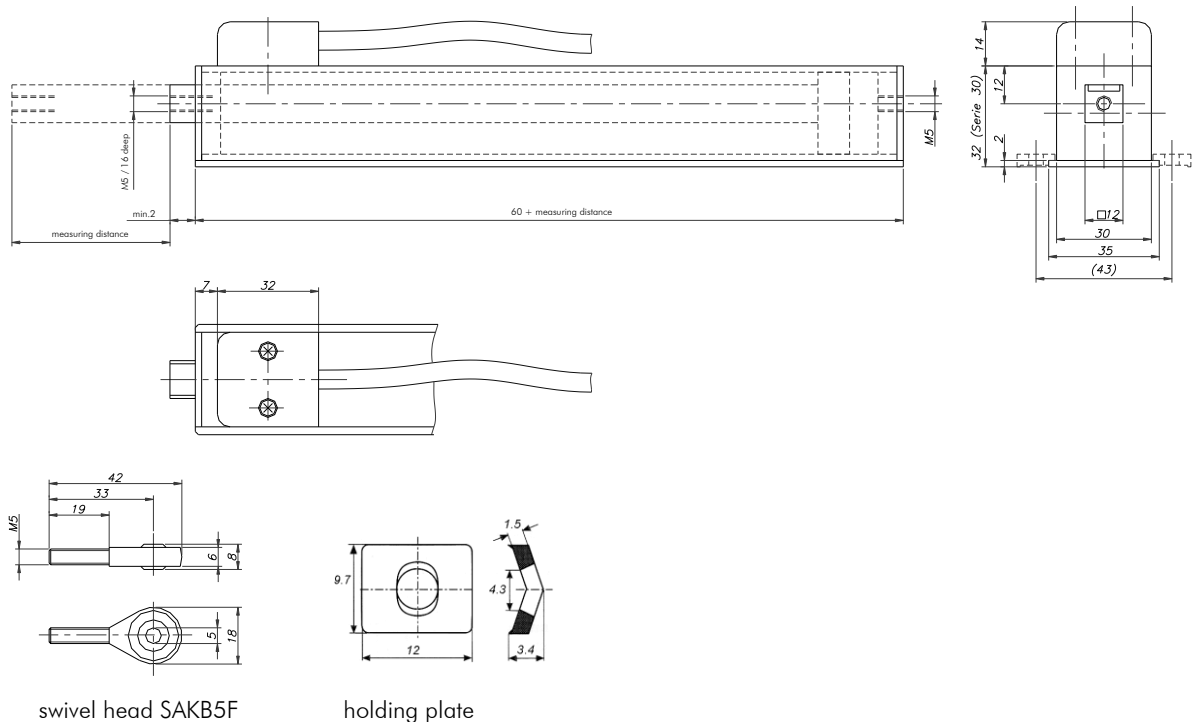
Figure 2: Output pulse diagram

4 Technical Data

4.1 Identification

The type label serves for the identification of the unit. It is located on the housing of the sensor and gives the exact type designation (☞ 8) with the corresponding part number. Furthermore, the type label contains a unique, traceable device number. When corresponding with ELGO please always indicate this data.

4.2 Dimensions Sensor



Note: The swivel head „SAKB5F“ shown in the drawing above is an accessorial part (see option M1 and M2 in the type designation ☞ 8). With M0 standard versions the scope of delivery includes always 4 holding plates as mounting parts (see also above).

4.3 Technical Data PMIX

While the mechanical data at PMIX are fixed, the electrical data differ because they are based on the respective selected measuring system. In addition, there are differences with the variants of supply voltages and output levels. The table below will show all available variants with the corresponding technical data.

Table 2: Technical Data PMIX

PMIX-000					
Mechanical data					
Housing material cylinder	Aluminium				
Housing material sensor	Plastic				
Dimensions	☞ 4.2				
Integrated magnetic tape	☞ 4.4				
Electrical data					
Order suffix (☞ 8)	Power supply voltage	Outputs levels	Consumption	Cable length	
00	10 ... 30 VDC, +/- 10 %	10 ... 30 V	max. 150 mA	max. 30 m	
01	10 ... 30 VDC, +/- 10 %	5 V-TTL Line Driver	max. 150 mA	max. 50 m	
11	5 VDC, +/- 5 %, (Residual ripple < 50 mV)	5 V-TTL Line Driver	max. 200 mA	max. 10 m	
99	The sensor is already supplied by the battery power of the IZ position indicator				
Output current	max. 20 mA pro channel				
Outputs	Push-pull, durable short circuit proof				
Index pulse	The pulse duration depends on the operation speed				
Resolution and Repeat Accuracy	LMIX: 0.025 mm (four edge triggering), resp. 0.1 mm (single edge triggering) EMIX: 0.01 mm (four edge triggering) EMIX23: 0.001 mm (four edge triggering) Series IZ: 0.01 mm / 0.1 mm (selectable by parameter menu)				
Output frequency	LMIX: max. 80 kHz per channel EMIX: max. 200 kHz per channel EMIX23: max. 1 MHz per channel				
Operation speed (at optimal evaluation)	LMIX: max. 5.0 m/s EMIX: max. 4.0 m/s EMIX23: max. 2.0 m/s Series IZ: max. 4.0 m/s				
Ambient conditions					
Operating temperature	-10 ... +70° C (-25 ... +85° C) on request				
Storage temperature	-25 ... +85° C				
Protection class	Cylinder: IP40 Sensor: IP65				

4.4 Technical Data Magnetic Tape

With a PMIX system, the magnetic tape is already integrated in the guide cylinder and thus must not be installed. The magnetic tape consists of two components:

- The actual magnetic tape which carries the position information
- A mechanical stainless steel back iron

Table 3: Technical Data Magnetic Tape

Magnetic tapes for PMIX	
Used type of magnetic tape	with LMIX sensor: MB20-50-10-1-R with EMIX sensor: MB20-20-10-1-R with IZ indicator: MB 20-25-10-1-R
Coding	Incremental, single track system
Pole pitch	with LMIX sensor: 5 mm with EMIX sensor: 2 mm with IZ indicator: 2.5 mm
Operating temperature	-20 °C ... +65 °C
Relative humidity	max. 95 %, non-condensing
Accuracy at 20° C in mm	with LMIX sensor: +/- (25 μm + 20 μm x L) with EMIX sensor: +/- (20 μm + 20 μm x L) with IZ indicator: +/- (25 μm + 20 μm x L) (L = measuring length in meters)
Material carrier tape	Precision strip 1.4310 / X10CrNi 18-8 (EN 10088-3)
Double-faced adhesive tape	3M-9088
Length expansion coefficient	$\alpha \approx 16 \times 10^{-6} \text{ 1/K}$
Thermal length expansion	$\Delta L[\text{m}] = L[\text{m}] \times \alpha[1/\text{K}] \times \Delta \vartheta[\text{K}]$ (L = tape length in meters, $\Delta \vartheta$ = relative temperature change)
Influence of external magnets	External magnetic fields must not exceed 64 mT (640 Oe; 52 kA/m) on the surface of the magnetic tape because this could damage or destroy the code on the tape.
Protection class	IP65


4.4.1 Resistance against Chemical Influence

In contact with various substances behaves the magnetic tape (integrated in the guide cylinder) as follows:


Table 4: Resistance against Chemical Influence


Show no or little effect in constant contact after 2-5 years:			
formic acid	glycerol 93°C	linseed oil	soy beans oil
cotton seed oil	N-hexane	lactic acid	
formaldehyde 40%	Iso octane	petroleum	
Show weak to moderate effects in constant contact after approximately 1 year:			
acetone	gasoline	acetic acid 30%	oleic acid
acetylene	steam	acetic acid, pure acetic acid	sea water
ammonia	acetic acid 20%	isopropyl ether	stearic acid 70°C, anhydrous
kerosene			
Have strong effects when contacting permanently after 1-5 months:			
benzene	nitric acid 70%	turpentine	toluene
lacquer solvent	nitric acid, red, vitriolic	carbon tetrachloride	tetrahydrofuran
trichloroethylene	nitrobenzene	hydrochloric acid 37%, 93°C	xylene






5 Installation and First Start-Up

	<p>CAUTION Please read the operating manual carefully before using the device! Strictly observe the Installation instructions! In case of damage caused by failure to observe this operating manual, the warranty expires.</p> <p>ELGO is not liable for any secondary damage and for damage to persons, property or assets.</p> <p>The operator is obliged to take appropriate safety measures.</p> <p>The first start-up may only be performed by qualified staff that has been trained and authorized by the operator.</p>
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5.1 Operating Area

	<p>WARNING! Do not use the device in explosive or corrosive environments! The device must not be installed close to sources of strong inductive or capacitive interference or strong electrostatic fields!</p>
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	<p>NOTE: External Magnetic Fields The magnetic tape must not be influenced by external magnetic fields! The PMIX cylinder equipped with magnetic tape must not come into direct contact with other magnetic fields (e.g. permanent magnets, magnetic clamps, electromagnets, magnetic stands)! This may cause irreparable damage, which will compromise the measuring accuracy or even the functioning.</p>
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	<p>CAUTION! The electrical connections must be made by suitably qualified personnel in accordance with local regulations.</p>
	<p>The device may be designed for switchboard mounting. During work on the switchboard, all components must be de-energized if there is a danger of touching the energized parts! (protection against contacts)</p>
	<p>Wiring works may only be performed in the de-energized state!</p>
	<p>Thin cable strands have to be equipped with end sleeves!</p> <p>Before switching on the device, connections and plug connectors have to be checked!</p>
	<p>The device must be mounted in a way that it is protected against harmful environmental influences such as splashing water, solvents, vibration, shock and severe pollution and the operating temperature must not be exceeded.</p>

6 Connections

6.1 Pin assignment with open cable ends (standard)

Table 5: Pin Assignment (standard version)

Color	Function
White	0 V (GND)
Brow	5 VDC / 10-30 VDC in
Green	Channel A
Yellow	Channel B
Black	Channel Z
Violet	Channel A'
Orange	Channel B'
Grey	Channel Z'
Screen/Shield	PE \perp

6.2 Pin assignment with 9 pin D-SUB (Option D1)

Table 6: Pin Assignment (Option D1)

Color	Function
1	0 V (GND)
2	5 VDC / 10-30 VDC in
3	Channel A
4	Channel B
8	Channel Z
6	Channel A'
7	Channel B'
9	Channel Z'
Screen/Shield	connected to housing

7 Disturbances, Maintenance, Cleaning

This chapter describes possible causes for disturbances and measures for their removal. In case of increased disturbances, please follow the measures for fault clearance in chapter 7.1. In case of disturbances that cannot be eliminated by following the advice and the fault clearance measures given here, please contact the manufacturer (see second page).

7.1 Fault Clearance

**CAUTION!**

The device, the connection line and the signal cable must not be installed next to sources of interference that emit strong inductive or capacitive interference or strong electrostatic fields.

External perturbations can be avoided through suitable cable routing.



The screen of the signal output cable should only be connected to the following circuit on one side. The screens should not be grounded on both sides. Signal cables always have to be routed separately from the load power line. A safety distance of at least 0.5 m has to be kept from inductive and capacitive sources of interference such as contactors, relays, motors, switching power supplies, clocked controllers etc.!

If interferences occur in spite of all the items stated above being observed, please proceed as follows:

1. Installation of RC-circuits via contactor coils of AC-contactors (e.g. 0,1 μ F / 100 Ω)
2. Installation of recovery diodes via DC-inductors
3. Installation of RC-circuits via the different motor phases (in the terminal box of the motor)
4. Do not connect protective earth and ground
5. Connect a mains filter ahead of the external power pack

7.2 Re-start after Fault Clearance

After the fault clearance:

1. Reset the emergency stop mechanism if necessary
2. Reset the error report at the super-ordinate system if necessary.
3. Ensure that there are no persons in the danger area.
4. Follow the instructions from chapter 5.

**WARNING!****Danger of injury through non-conventional fault clearance!**

Non-conventional fault clearance can lead to severe injuries and damage of property.

Therefore:

- Any work to clear the faults may only be performed by sufficiently qualified staff
- Arrange enough space before starting the works
- Make sure that the mounting area is clean and tidy. Loose components and tools are sources of accidents.

If components need to be replaced:

- Pay attention to a correct installation of the spare parts.
- Reinstall all the fixing elements properly
- Before turning on the device, ensure that all covers and safety equipment is installed correctly and functions properly

7.3 Maintenance

The device is maintenance-free.

7.4 Cleaning



WARNING!

The device can only be cleaned with a damp cloth, do not use aggressive cleanser!

8 Type designation

PMIX - AAA - BB,B - C - DD - EEEE - FF - G

Series / Type: _____

PMIX

SN Number: _____

00 ELGO standard

01 First special version, etc.

Signal cable length in XX.X m _____

1,5 m standard length for LMIX/EMIX/EMIX23

1,0 m standard length for IZ14E/IZ15E/IZ16E/IZ17E

Resolution / basis system: _____

1 0,025 mm* with LMIX sensor

2 0,01 / 0,1 mm** combined with IZ14E

3 0,01 mm* with EMIX sensor

6 0,01 / 0,1 mm** combined with IZ17E

7 0,001 mm* with EMIX23 sensor

8 0,01 / 0,1 mm** combined with IZ15E

9 0,01 / 0,1 mm** combined with IZ16E

*) at 4 edge triggering

**) selectable by parameter menu

Power supply / output levels: _____

00 10 ... 30 VDC / 10 ... 30 V-HTL

01 10 ... 30 VDC / 5 V-TTL line driver

11 5 VDC / 5 V-TTL line driver

99 Battery powered (for combinations with IZ display units)

Measuring length:* _____

0100 100 mm

0200 200 mm

0400 400 mm

0600 600 mm (other lengths on request)

*) Entire length of PMIX = Measuring length + 60 mm

Options: _____

D1 9 pin D-SUB connector

(ELGO standard pin assignment)

Mounting parts: _____

M0 with 4 holding plates (standard)

M1 with 1 swivel head „SAKB5F“ and 4 holding plates

M2 with 2 swivel heads „SAKB5F“

Ordering example:

PMIX-000-01.5-1-00-0200-D1-M0

ELGO standard PMIX with a 1.5 m long signal cable, 0.025 mm resolution (at 4 edge triggering), power supply 10 ... 30 VDC / output levels 10 ... 30 V, a measuring length of 200 mm, with a 9 pin D-SUB connector and 4 holding plates (without swivel heads).



NOTE

When ordering, please use the here described ordering code (Type Designation).
Options that are not required are filled in with „-“.



Notes:



Notes:

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