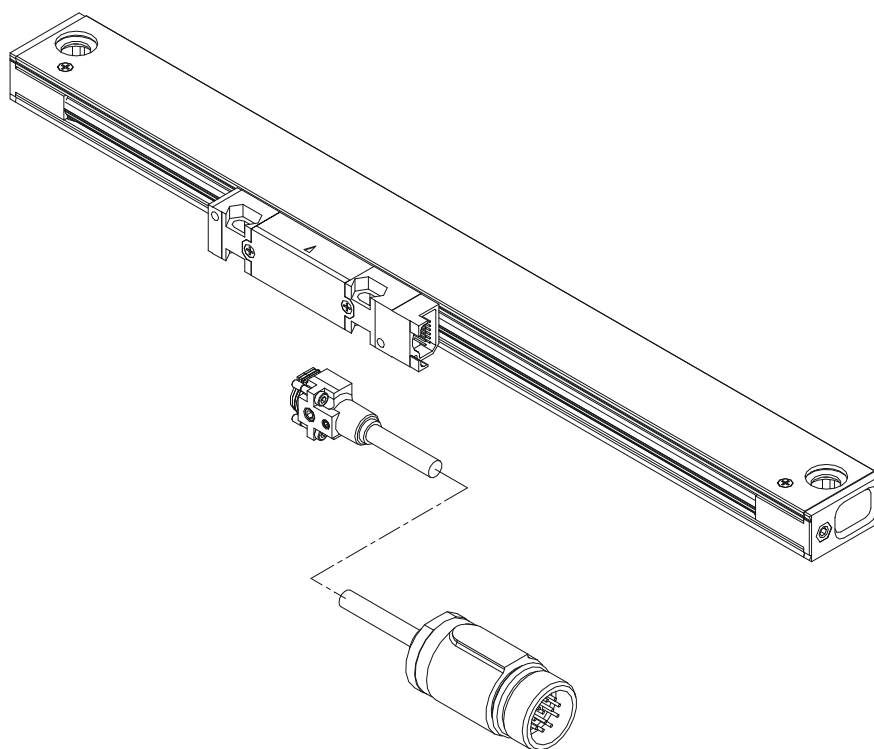


# Scale Unit TGM133/134

## Instruction Manual



## Safety Precautions

TELAmS products are designed in full consideration of safety. However, improper handling during operation or installation is dangerous and may lead to fire, electric shock or other accidents, resulting in serious injury or death. In addition, these actions may also worsen machine performance. Therefore be sure to read this Manual before operating, installing, maintaining, inspecting, repairing or otherwise working on this unit.

### Warning, Caution



- Do not use this unit with voltages other than specified supply voltage as this may result in fire or electric shock.



- Do not disassemble or modify the unit as this may result in injury or damage the internal circuits.



- Be sure to check the machine and device conditions to ensure safety work on a machine.



- Be sure to switch off the power supply, air and other sources of drive power before working on the machine.



- When turning on a machine power supply, take care about moving parts of a machine and corresponding devices.

## General precautions

When using TELAmS products, observe the following general precautions along with those given specifically in this manual to ensure proper use of the products.

- Provide adequate safety measures to prevent damages in case the product should develop malfunctions.
- Use outside indicated specifications or purposes and modification of our products will void any warranty of functions and performances
- When using our products in combination with other equipment, the functions and performances as noted in this manual may not be attained, depending on operating and environmental conditions.

---

## **Installation precautions**

When installing this unit, care should be given to the following points to prevent noise and electromagnetic wave interference from other equipment.

1. Do not pass lead and connection cables through the same ducts as power lines.
2. Be sure to install the unit at least 0.5 m or more away from high voltage or large current sources or high-power relays.

---

## **Installation place precautions**

1. Mount the scale as closely as possible to the work-piece or to the object being measured. Further the scale is mounted, greater is measuring error.
2. The scale unit should be used within an ambient temperature range of 0 to 50°C. Avoid locations where the scale is exposed to direct sunlight and heat sources such as motors.
3. Do not place anything on the mounted scale, or step on it: excessive force to the scale causes trouble.

## **Before installation**

- ① Do not disassemble parts other than scanning unit holder. All electrical adjustments have also been completed before shipment. So do not tamper any additional adjustment at time of its installation.
- ② This scale unit consists of precision mechanism parts and electromagnetic parts. Therefore, applying excessive pressure to the unit can seriously harm the performance and service life of the scale. Be careful not to apply excessive pressure to the scale unit when proceeding with the work.
- ③ When the unit is to be carried, support the scale unit and reading head altogether. Do not hold the unit by the head cable, connectors, etc.
- ④ Ensure that the scale unit housing and reading head as well as the circuit breaker for the supply power are properly grounded.

Standard procedure for EMC compliance.

When equipment such as controller does not function properly due to the effects of large noise from power line please provide ground lines at one point intensively. Power source which has a remote sensing function, must be used for TGM133. Power unit without remote sensing unit may fail to prove optimum functions. Please provide proper power source by referring to Section 5.

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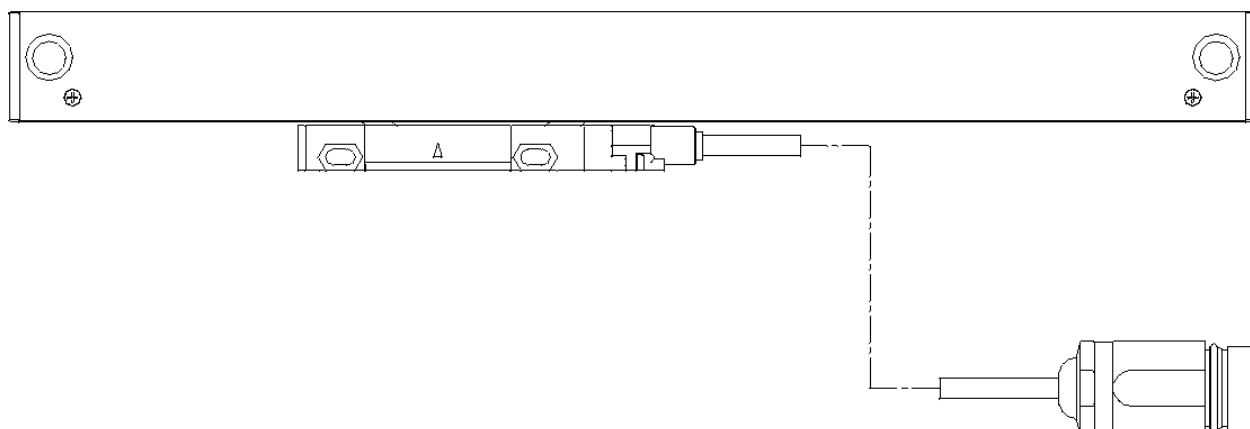
# 1. Outline

## 1-1. Before Operation

TGM133/134 series is small, light and high-accuracy optical feedback scale.  
This series provides Line driver (A, A-, B, B-, RI, RI- digital output) or Sinusoidal signals (1V<sub>pp</sub> or 11μA output).  
Output signals are adjusted before shipment, ex.-factory, each signal can be readily used for connection to control device as it is.

## 1-2. List of standard parts supplied with scale unit

TGM133 Scale unit



### Parts supplied with scale unit

① HSB	M8 x 20	2	(For mounting channel)
② HSB	M4 x 20	2	(For mounting scanning unit)
③ Cable clamp (small)		3	(For cable clamp)
④ +P M4 x 10		3	(For cable clamp)
⑤ Inspection certificate (Accuracy chart)		1	
⑥ Instruction manual		1	
⑦ Air injection valve		1	

## 1.3. Model configuration

TGM133-XX<sub>1</sub>-X<sub>2</sub>-XX<sub>3</sub>-X<sub>4</sub>-X<sub>5</sub>-XXXX<sub>6</sub>-XX<sub>7</sub>-X<sub>8</sub>-X<sub>9</sub>-X<sub>10</sub>

TGM134-XX<sub>1</sub>-X<sub>2</sub>-XX<sub>3</sub>-X<sub>4</sub>-X<sub>5</sub>-XXXX<sub>6</sub>-XX<sub>7</sub>-X<sub>8</sub>-X<sub>9</sub>-X<sub>10</sub>

Standard requirements				
XX <sub>1</sub>	Voltage supply	05 ... 5V		
X <sub>2</sub>	Resolution	0.1...0.1µm	0.5 ... 0.5 µm	1 ... 1 µm
XX <sub>3</sub>	Output signals	DS	SI	SV
X <sub>4</sub>	Reference mark	0 ... without		
		1 ... in the middle		
		2 ... on agreement		
		4 ... distance coded reference		
X <sub>5</sub>	Accuracy	3 ... ± 3 µm	5 ... ± 5 µm	
XXXX <sub>6</sub>	Measuring length	Standard length [mm] (see specifications on next page)		
Special requirements:				
XX <sub>7</sub>	Cable length	3m : 03	Example: 1.5m : 1.5, 25m : 25	
X <sub>8</sub>	Connector	*		
X <sub>9</sub>	Metal flexible tube	0 ... without		
		1 ... with		
X <sub>10</sub>	Mounting bar	0 ... without		
		1...with: recommended for Lm ≤ 1240 mm, required for Lm > 1240mm		

\* **Connector** is defined with electrical versions SV, DS or SI:

- 1 ... Amphenol 12 pin (DS)
- 4 ... Contact 12 pin connector (DS, SV)
- 5 ... Contact 9 pin connector (SI)
- 6 ... Contact 12 pin coupling (DS, SV)
- 7 ... D-sub 9 pole (DS)
- 9 ... other (specify)
- 0 ... without connector

The difference between TGM133 and TGM134 see in section 6.

## 2. Specifications

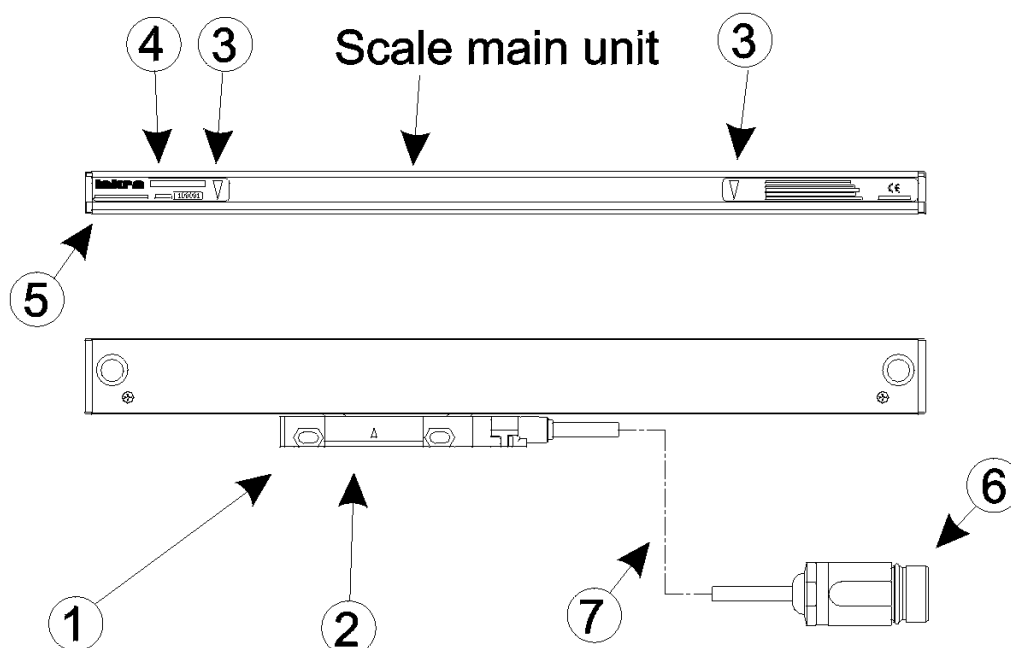
Items	Unit	TGM133/134	
Measuring length	mm	70, 120, 170, 220, 270, 320, 370, 420, 470, 520, 570, 620, 670, 720, 770, 820, 920, 1020, 1140, 1240, 1340, 1440, 1540, 1640, 1740, 1840, 2040	
Scale accuracy (at 20°C)	μm	±3, ±5 (per meter)	
Output		Line driver: A, A-, B, B-, RI, RI- Sinusoidal signal: 1Vpp or 11μA	
Reference point		Distance Coded Reference (position is reproduced by passing two adjacent reference marks that are 20 mm apart from each other.) (NOTE 1)	
Resolution	μm	0.1, 0.5, 1.0 (DS signals)	
Signal period	μm	20	
Maximum response speed	m/min	20 (at 0.1 μm)	120 (SI, SV)
		50 (at 0.5 μm)	
		60 (at 1.0 μm)	
Scale temperature expansion coefficient	K <sup>-1</sup>	(8.8 ± 1) X 10 <sup>-6</sup>	
Protection grade		Standard: IP53, with injecting air: IP64	
Power supply		+5 V 120mA max (DS) +5 V 100mA max (SV, SI) (NOTE 2)	
Scanning unit sliding resistance	N	3	
Maximum capable cable length	m	Standard 3 (1, 5, 7, 10, 15, 20, 25, 30, 50, 100, 150 possible) (NOTE 3)	
Operating temperature	°C	0 to +50	
Storage temperature	°C	-30 to +70	
Operating humidity	%RH	30 to 90 (No condensation)	
Vibration resistance	m/s <sup>2</sup>	70	
Shock resistance	m/s <sup>2</sup>	300	

(NOTE 1) Any one location can be designated as the reference point, and multiple reference points (at a pitch of 20 mm) can also be supported.

(NOTE 2) When load resistance of A/B/RI/ALM is 120Ω, refer to section 5-3 for details of power voltage.

(NOTE 3) SV can perform output range of 0.6 V to 1.2 V as A/B phase output with 150 m cable made by TELAMs.

### 3. Name and Function of Parts



- ① Reading head  
This holds the scanning unit. When shipped, it is secured with a scanning unit holder.
  - ② Centre of scanning unit  
This indicates the mechanical centre of the scanning unit. It serves as a reference when viewing the relative position to the measuring length marks.
  - ③ Measuring length marks  
These indicate the effective movement range over which accuracy is assured with respect to the centre of scanning unit. The measuring length represents the length of the effective movement range.
- Note**
- When mounting and using the scale unit, be sure to operate the unit within this range. Using the scale unit in excess of the effective movement range may damage the unit.
- ④ Model name  
This indicates the scale unit model name.
  - ⑤ Serial No.  
This indicates the scale unit serial No.
  - ⑥ Connector.
  - ⑦ Head cable.



## 4. Mounting

### 4-1. Mounting precautions

#### 4-1-1. Checking the mounting posture

Check that the scale unit can be mounted in the relative positions shown in the Fig. 4-1.

Do not mount the scale in any other posture otherwise difficulties in servicing and maintenance may arise.

The mounting position A in particular is recommended: cutting oil and chips may be effectively kept out.

Do not install at Position B, in case cutting oils or coolant may fall on the scale.

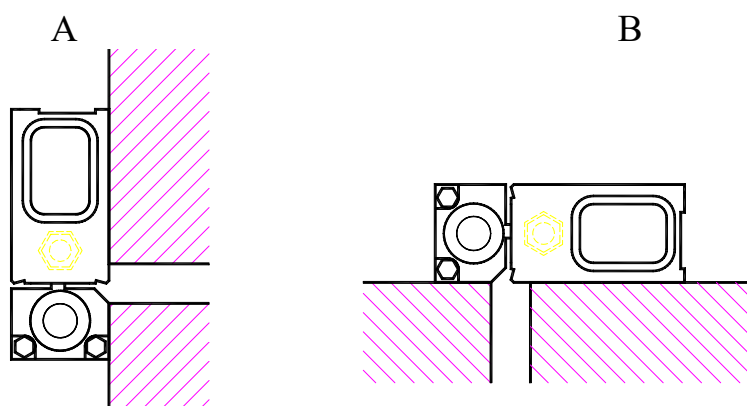


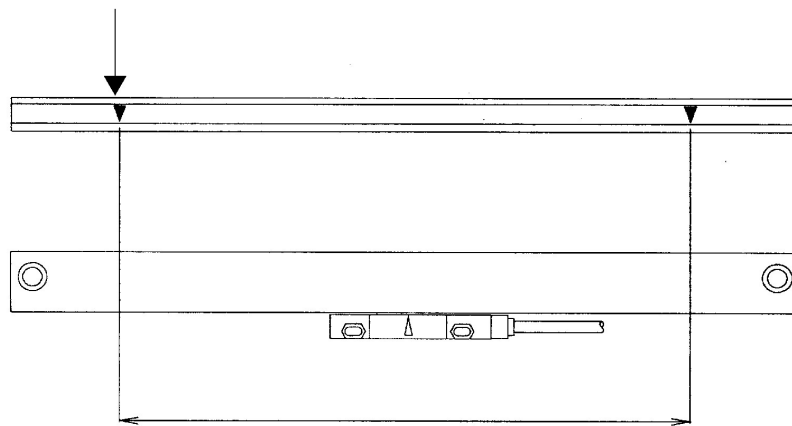
Fig. 4-1

When a scale is installed on a vertical axis it should be mounted in such a manner that its scanning unit will face opposite to a work piece (cutting tool).

#### 4-1-2. Setting the operation range

- The measuring length of scale is the distance between the measuring length marks at the both ends of the scale.
  - Mount the scale in such a position that the slider center moves within these measuring length marks.
  - Take special care not to move the scanning unit beyond the range between measurement length marks otherwise the scale may be damaged.
- Mechanical limit mechanism (stoppers, etc.) is required if scanning unit needs to move for its full stroke in measurement length near to measurement length marks.

Measuring length mark



Be sure to install the scale that the center of scanning unit is held in this area.

Fig. 4-2

#### 4-1-3. Protection of the head cable

The head cable is secured on a slider with screw.

Take care not to pull the cable forcefully or bend it repeatedly otherwise the cable may be broken or a connector may be damaged.

#### 4-1-4. Mounting a protective cover

If chips or coolant will be splattered directly onto the scale during operation, it is recommended that a cover which will hide it as much from outside view as possible be mounted in order to maintain the scale's performance. Such a cover is shown in Fig. 4-3.

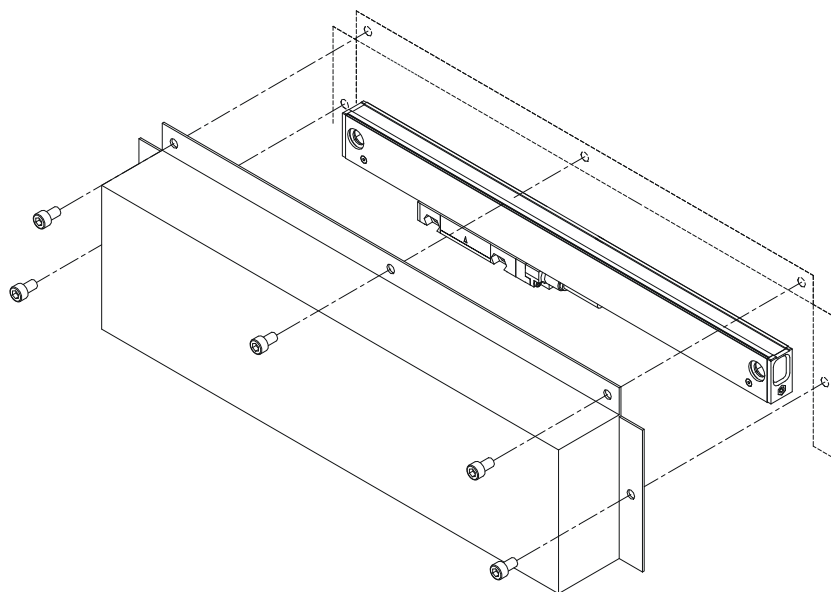


Fig. 4-3

## 4-2. Tools required for scale installation

In addition to accessories, prepare following tools.

- Bracket for mounting scale (Refer to Fig. 3-4) 1 or 2
- Bracket for mounting scanning unit (Refer to Fig. 3-4)
  
- 0.01mm pick tester (or Dial gauge) 1 or 2
- Hexagon wrench for M4 (3mm) 1
- Hexagon wrench for M8 (6mm) 1
- Driver No.2 (+) 1
- Tap M4 1
- Tap M8 1
- Drill  $\phi 3.2$  1
- Drill  $\phi 6.8$  1
- Thickness gage = 0,7 mm 1
- Thickness gage = 1,0 mm 1
- Thickness gage = 1,4 mm 1

## Accessories

- |                       |                                |
|-----------------------|--------------------------------|
| ① HSB M8 x 20         | 2 (For mounting channel)       |
| ② HSB M4 x 20         | 2 (For mounting scanning unit) |
| ③ Cable clamp (small) | 4                              |
| ④ +P M4 x 10          | 4 (For cable clamp)            |

## 4-3. Mounting procedure

### 4-3-1. Mounting scale main unit

1. Machine the mounting surface of the scale main unit to a flatness of 0.1 mm/M (where “M” is the machine guide) over the entire length of the mounting area.

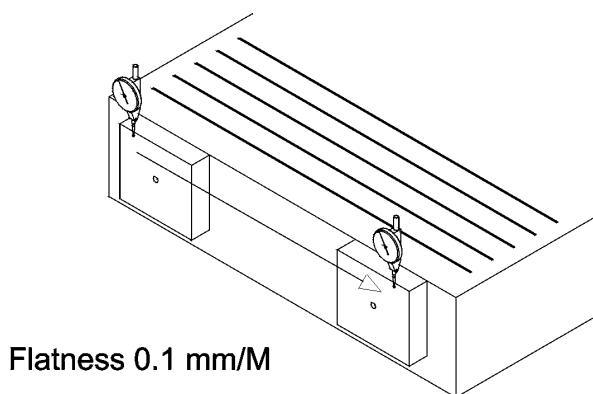


Fig. 4-4

Although Fig. 3-4 shows that brackets are being used, they are not needed if the mounting surface of the machine main unit has already been machined to the designated flatness before the scale is mounted.

2. Check the flatness of the mounting surface, and then attach the scale main unit to this surface by tightening up the M8 x 20 screws. Check the parallelism of the top surface of the scale unit at both ends across a range of 40 mm at each end as shown in Fig. 3-5. The allowable parallelism value is 0.1 mm.

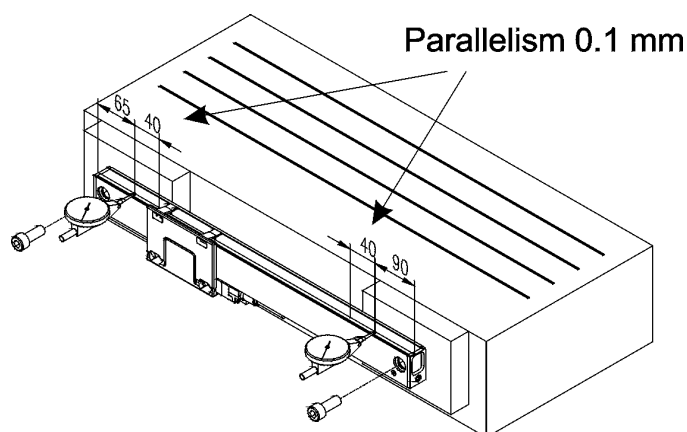


Fig. 4-5

After adjusting the parallelism to 0.1 mm, attach the M8 screws using a tightening torque of 22 Nm (220 kgf.cm).

### 4-3-2. Mounting scanning unit

- ① Setting mounting surface of scanning unit and mounting tolerances (“M” is the machine guide)

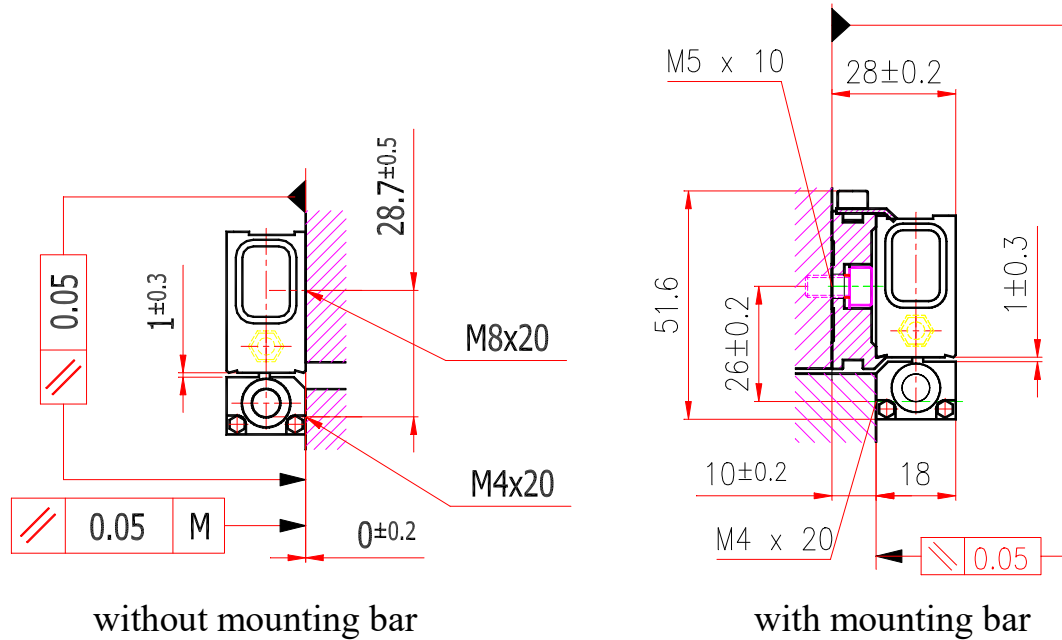


Fig. 4-6

- The mounting surface must be clean
  - free of paint
  - dry and without chips

It is also possible to mount in the following condition.

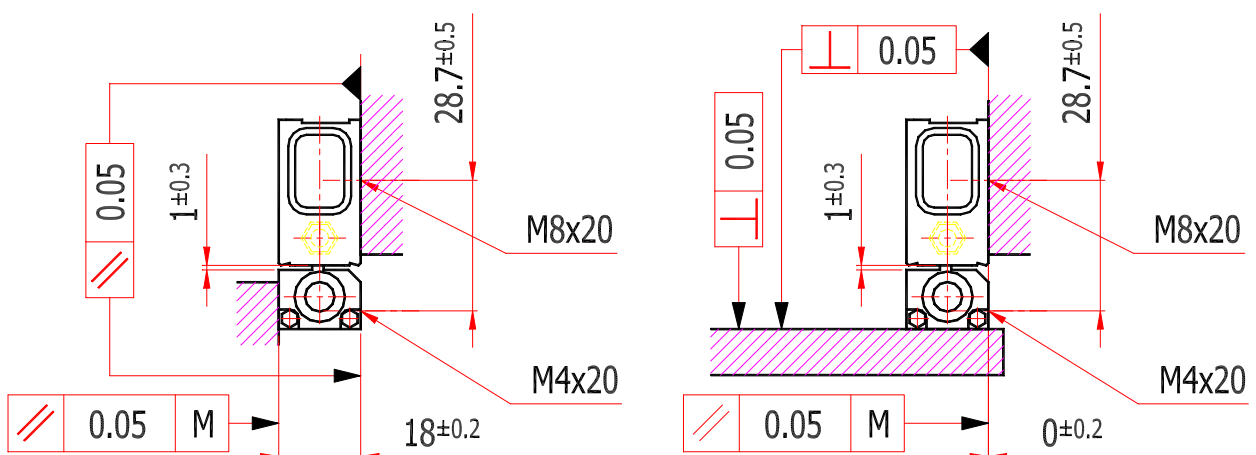


Fig. 4-7

## ② Mounting scanning unit

Mount screws with scanning unit holder fixed in order to change dimensions.

Use screws of two HSB M4 x 20 at screw torque 2.5 Nm (25 kgf.cm).

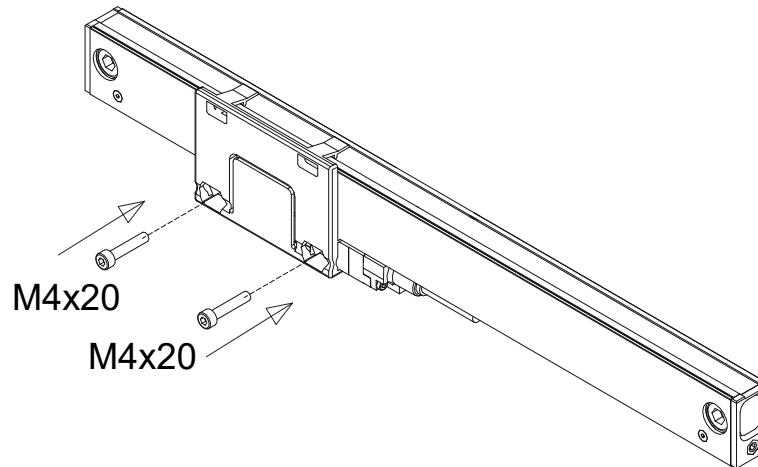


Fig. 4-8

### 4-3-3. Removing scanning unit holder

The scanning unit holder can be removed in a single-action operation. When, as shown in Fig. 4-9A, area ① is pressed, the tab attached to the scanning unit is disengaged so that the scanning unit can then be moved in the lengthwise direction of the scale unit and completely separated from the scale unit. The scanning unit holder can now be removed by lifting it free from the scale unit.

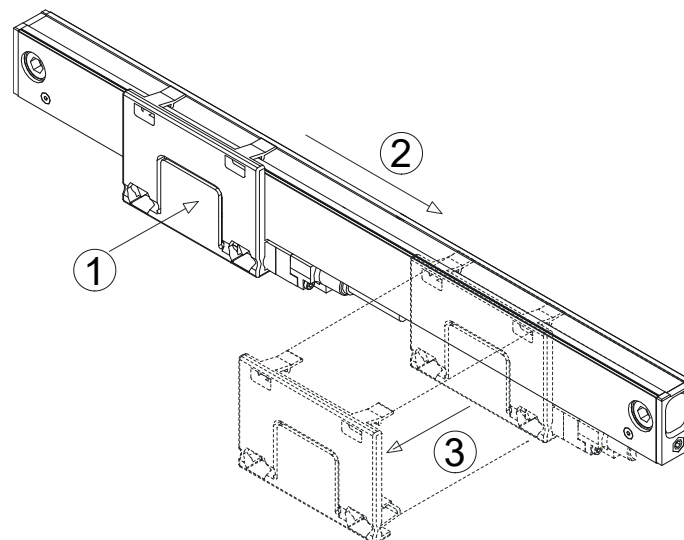


Fig. 4-9 A

Make sure to install the edge of scanning unit within  $1 \pm 0.3$  mm range.

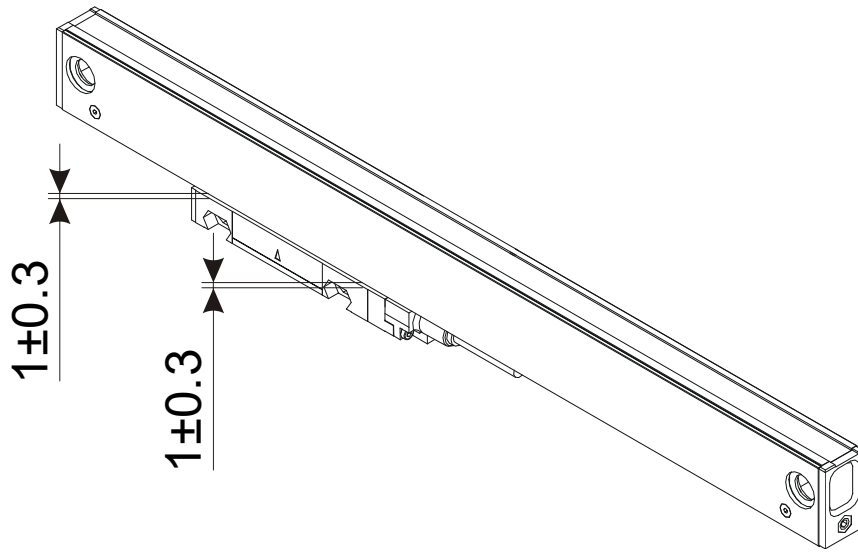


Fig. 4-9 B

#### 4.3.4. Checking the operation range

After mounting the scale and scanning unit, be sure to always move the machine over its entire length to check that the machine movement range is within the scale measuring length.

Be careful that the scale movement range does not exceed the scale measuring length + range of movement. If it does, the scale can be damaged.

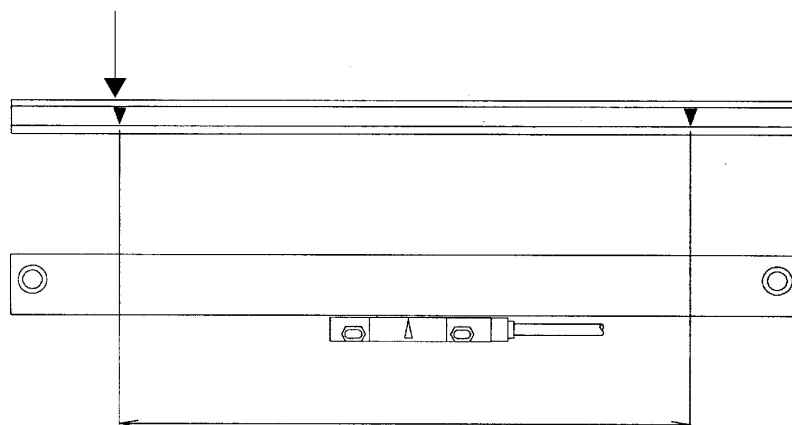


Fig. 4-10

#### 4-3-5. Attaching the head cable

Secure the head cable with a cable clamp so that it does not get entangled.

##### **Note**

Note that the wiring should be made to allow enough room for machine movement during operation.

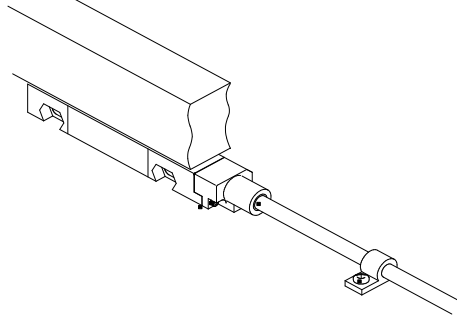


Fig. 4-11

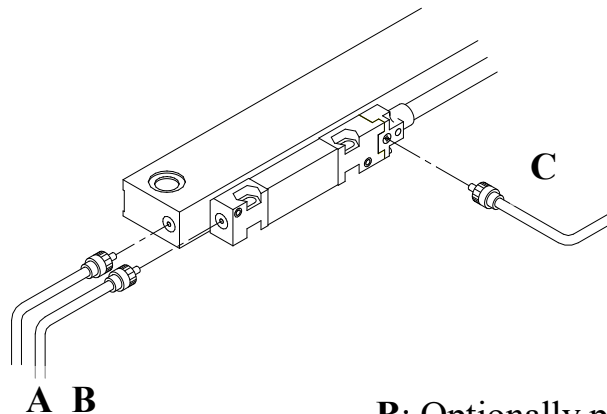
#### 4.3.6. Air injection

Air can be injected from both sides of the scale side cover (or, optionally, from the slider).

In the case of using scale unit under circumstances as follows, clean air injection will minimize their influence.

- ① Dusty
- ② High humidity
- ③ Probable condensation inside scale by temperature and humidity change

Actual effects are different depending on working condition. Adopt after verifying effects enough.



**B:** Optionally provided

Fig. 4-12



Air injection to upper scale unit (A) and air injection to slider connector (C) on Fig. 4-12, is possible with nipple in accessory. But air injection to slider (B) is optional, so separate order for it required.

An example of air pipe route and device configuration is shown as follows.

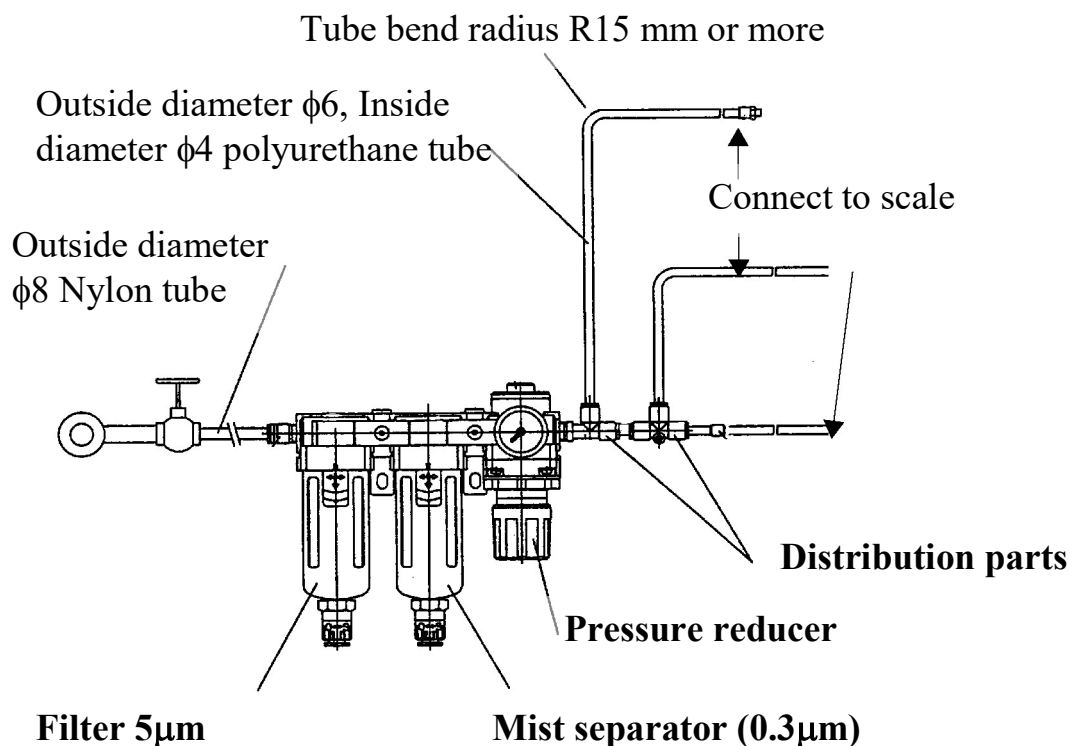


Fig. 4-13

The air supply unit and equipment are provided by the customer. Specifications of standard device are shown for your reference.

Item	Specifications
Guaranteed maximum pressure	1.5 MPa
Max. working pressure	1020 kPa
Adjustable pressure range	20 to 200 kPa
Working fluid	Air
Ambient temperature and working fluid temperature	-5 to 30°C (No condensation)
Filtration grade	Air filter: 5 μm Mist separator: 0.3 μm
Pressure gauge tester connecting bore	2-RC (PT) 1/8
Pipe connecting bore	IN side: Tube shape φ8 OUT side: Tube shape φ6
Automatic drain working pressure	150 to 1020 kPa

Table 4-1

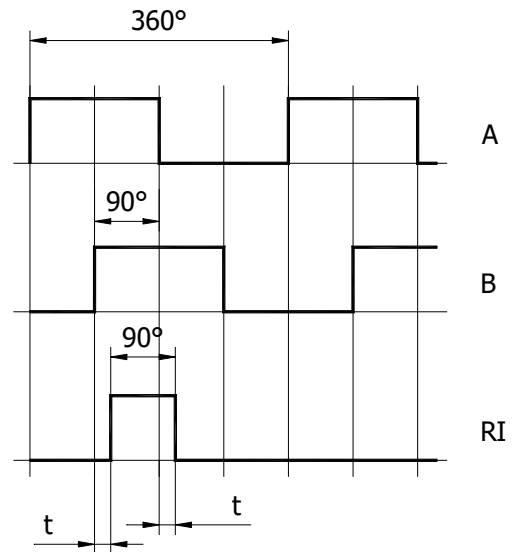
## 5. Connecting to device

### 5.1. Output signals

- Digital output – DS (TTL):  
supply 5V (150mA max.)

$$|t| \leq 0.1 \mu\text{s}$$

Fig. 5-1

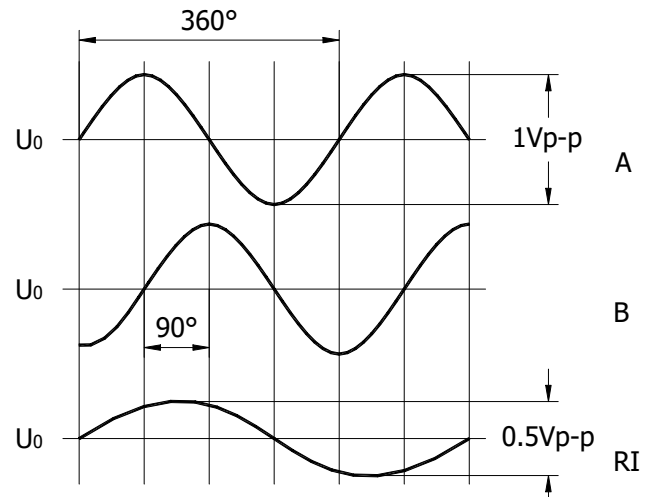


- Sinusoidal output – SV (1Vpp) :  
supply 5V (100mA max.)

$$U_0 = 2.5V \quad (U_d/2)$$

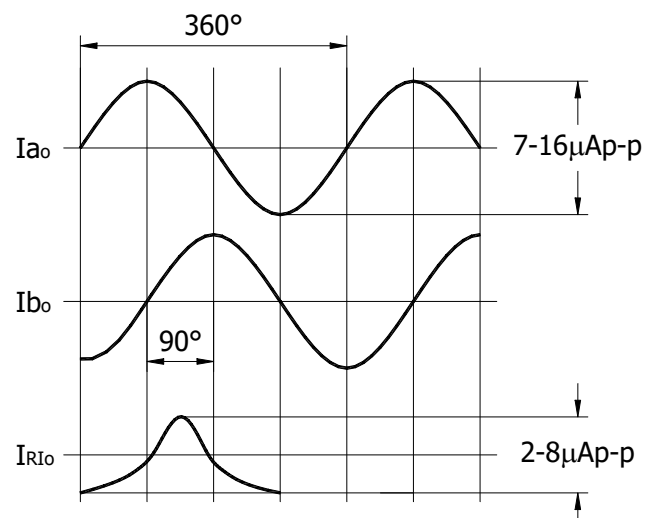
$$\lambda = 20 \mu\text{m}$$

Fig. 5-2



- Sinusoidal output – SI (11μA) :  
supply 5V (100mA)

Fig. 5-3



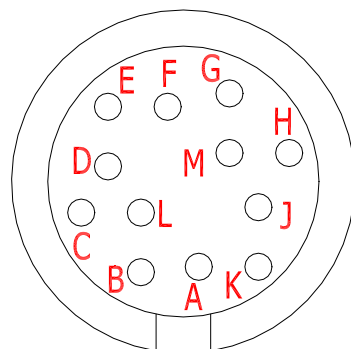
## 5.2. Output connectors

- Digital output - DS, 12 pin Amphenol connector:

L	$\bar{B}$	BLACK
D	$\bar{A}$	BROWN
H	$\bar{RI}$	GREY
	$\bar{E}$	BLUE (isolate)
B	0V	GREEN/WHITE
	0V (sens)	VIOLET
E	B	RED
C	A	GREEN
G	RI	PINK
K	+5V	GREEN/YELLOW
	+5V (sens)	WHITE
Housing	shield	SHIELD

Connect shield to connector housing

Fig. 5-4

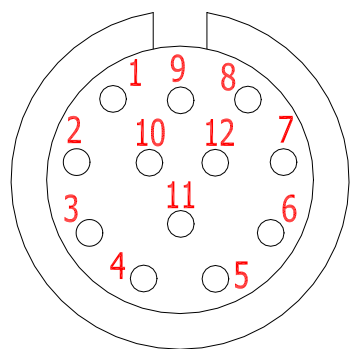


- Digital output - DS, 12 pin Contact connector or coupling:

1	$\bar{B}$	BLACK
6	$\bar{A}$	BROWN
4	$\bar{RI}$	GREY
7	$\bar{E}$	BLUE
10	0V	GREEN/WHITE
11	0V (sens)	VIOLET
8	B	RED
5	A	GREEN
3	RI	PINK
12	+5V	GREEN/YELLOW
2	+5V (sens)	WHITE
Housing	shield	SHIELD

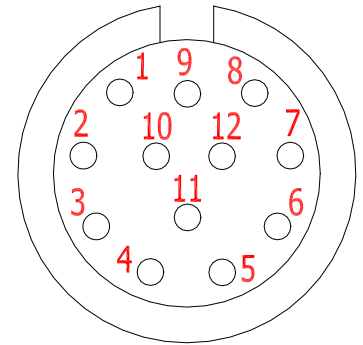
Connect shield to connector housing

Fig. 5-5



- Sinusoidal output – SV (1Vpp), 12 pin Contact connector or coupling:

1	$U_{\bar{B}}$	RED
6	$U_{\bar{A}}$	BROWN
4	$U_{\bar{R}I}$	PINK
10	0V	GREEN/WHITE + VIOLET
11	0V (sens)	BLUE
8	$U_B$	BLACK
5	$U_A$	GREEN
3	$U_{RI}$	GREY
12	+5V	GREEN/YELLOW
2	+5V (sens)	WHITE
Housing	shield	SHIELD

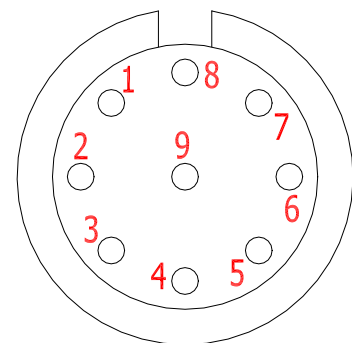


Connect shield to connector housing

Fig. 5-6

- Sinusoidal output – SI (11 $\mu$ App), 9 pin Contact connector:

6	Ib-	RED
2	Ia-	BROWN
8	Iri-	PINK
4	0V	GREEN/WHITE
4	0V	VIOLET, BLUE
5	Ib+	BLACK
1	Ia+	GREEN
7	Iri+	GREY
3	+5V	GREEN/YELLOW
3	+5V	WHITE
Housing	(Shield)	SHIELD



Connect shield to connector housing

Fig. 5-7

- ① Wires for signals must be twisted pairs, cross section 0.14 mm<sup>2</sup> (AWG26) and voltage supply wires 0,25 mm<sup>2</sup> (AWG22), Calculated  
Structure: Twisted wire, Electrical resistance: 141  $\Omega$ /km or less
- ② Shielding structure: all wires must be covered with braided shield

### 5.3. Alarm (DS versions optionally)

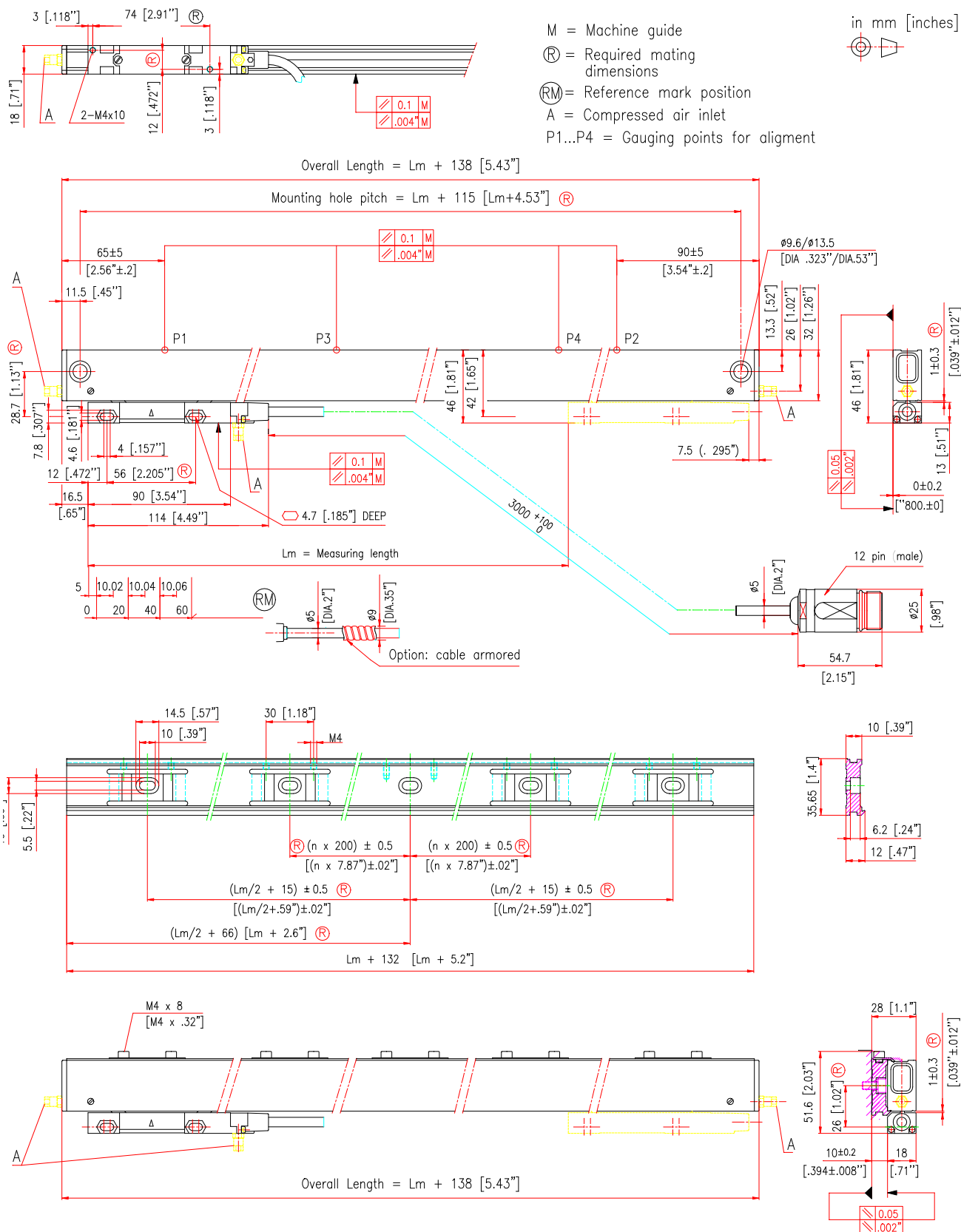
DS outputs an alarm in the following cases:

1. Exceeding max. response speed of scale.
2. Broken head cable.
3. Malfunction occurred by noise.

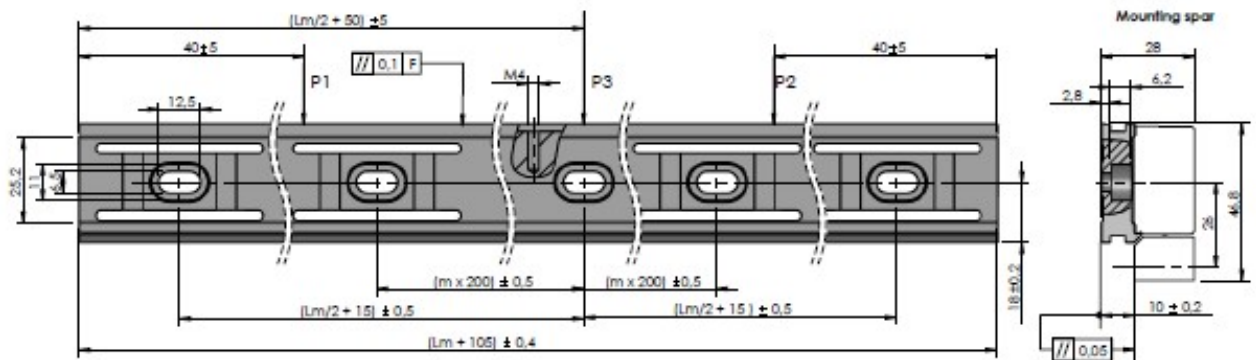
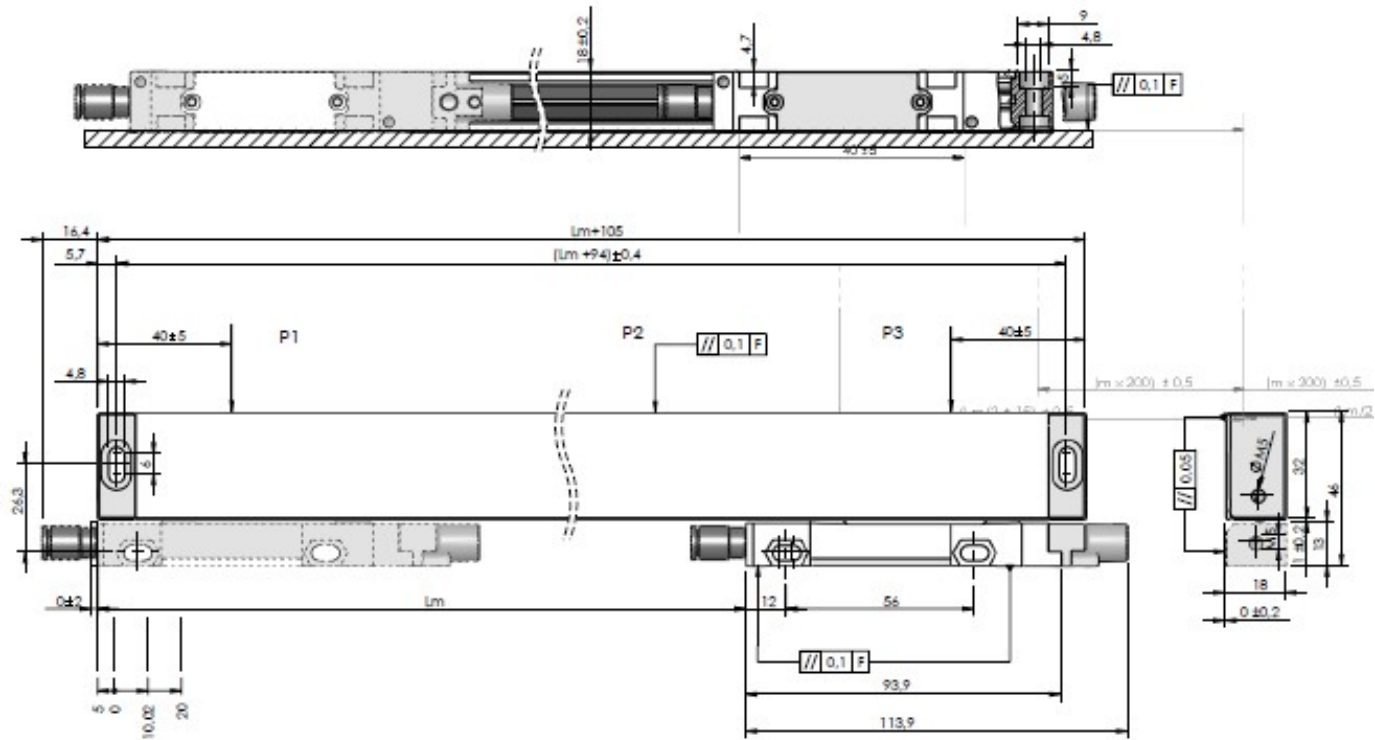
When an alarm occurs E output goes to High and  $\bar{E}$  goes to Low. At that time  $\bar{A}$ , A,  $\bar{B}$  and B turn to high impedance. Alarm signal will be automatically released when cause of alarm is eliminated. To release an alarm signal, disconnect the power supply once and turn on the power again.

## 6. Dimensions

## TGM133



# TGM134



ML	m
70...520	0
570...940	1
1020...1340	2
1440...1740	3
1840...2040	4

F = Machine guideway  
 Lm = Measuring length  
 P1...P3 = Gauging points  
 Air inlets for tube d = 6 mm

## 7. Trouble Prevention

- Repairs are required in the event of an overrun, cable damage, deformation of the scale unit, or other conditions detrimental to the functioning of the scale. If any of these events occur, immediately stop the machine, and contact your distributor.
- Depending on the degree of damage, some repairs may be unable to be carried out.

Regular cleaning is recommended to prevent the following types of device troubles:

- Ensure that chips are cleaned up before starting work and at the end of work everyday to prevent them from accumulating around the scale.
- The accumulation of chips can prevent the scale from sliding and cause breakdowns.
- Do not use air guns or similar devices for cleaning the chips. Although the travelling part of the scale unit is sealed, it is not completely air-tight for structural reasons. Therefore, use of an air gun can cause chips or other debris to enter the sealed area of the scale and cause breakdowns.

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