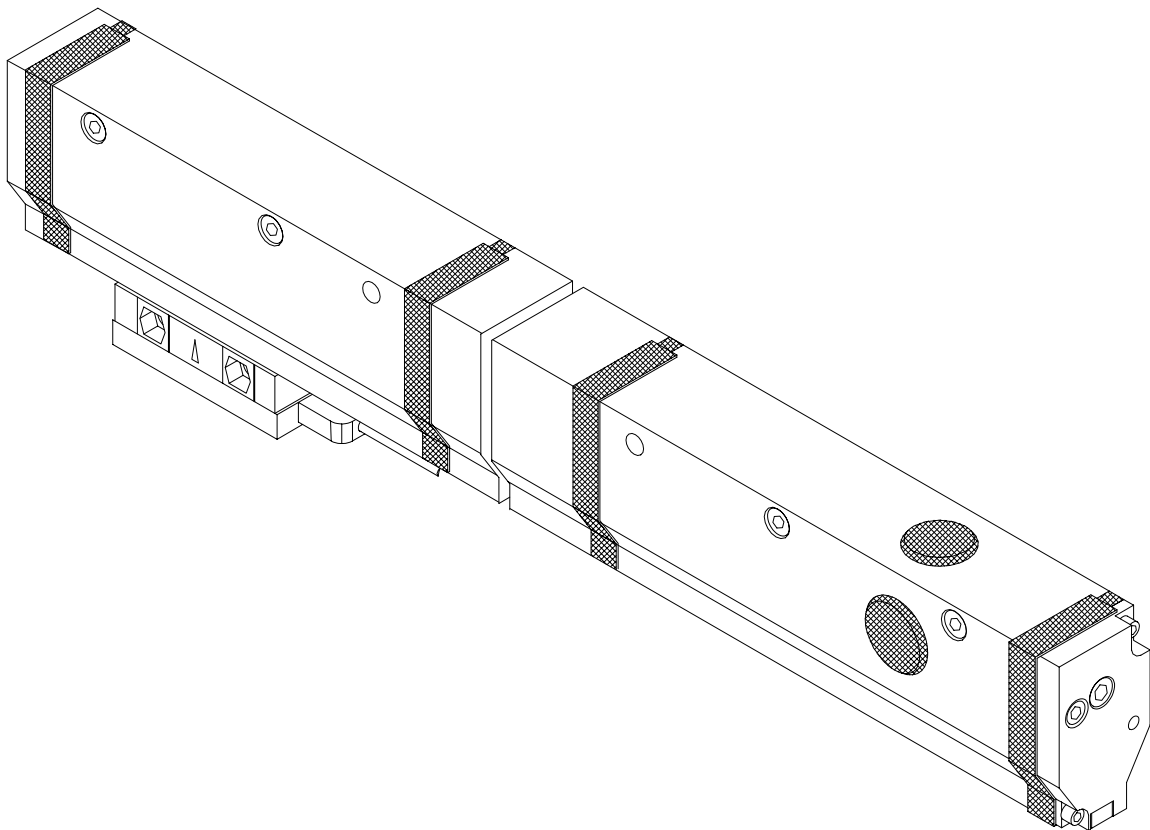




Scale Unit TGM190

Instruction Manual





Safety Precautions

Iskra TELA 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 observe the following safety precautions in order to prevent these types of accidents, and to read these “Safety Precautions” before operating, installing, maintaining, inspecting, repairing or otherwise working on this unit.

Warning indication meanings

The following indications are used throughout this manual, and their contents should be understood before reading the text.



Warning

Failure to observe these precautions may lead to fire, electric shock or other accidents resulting in serious injury or death.



Caution

Failure to observe these precautions may lead to electric shock or other accidents resulting in injury or damage to surrounding objects.

Note

This indicates precautions, which should be observed to ensure proper handling of the equipment.

**Warning****i**

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

• Do not perform installation work with wet hands as this may result in electric shock.



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

**Caution**

• Be sure to check the machine and device conditions to ensure work safety before working on the machine.



• Be sure to cut off the power supply, air and other sources of drive power before working on the machine. Failure to do so may result in fire or accidents.



• When turning on the power supply, etc. to operate the machine, take care not to catch your fingers in peripheral machines and devices.



Handling Precautions

ii

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 for more precise positioning as closely as possible to the workpiece or to the object being measured.
(The farther the scale is mounted from workpiece, the greater the mechanical errors grow.)
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.

■ General precautions

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

- Before and during operations, be sure to check that our products function properly.
- Provide adequate safety measures to prevent damages in case our products should develop malfunctions.
- Use outside indicated specifications or purposes and modification of our products will void any warranty of the functions and performance as specified of our products.
- 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.



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TGM190

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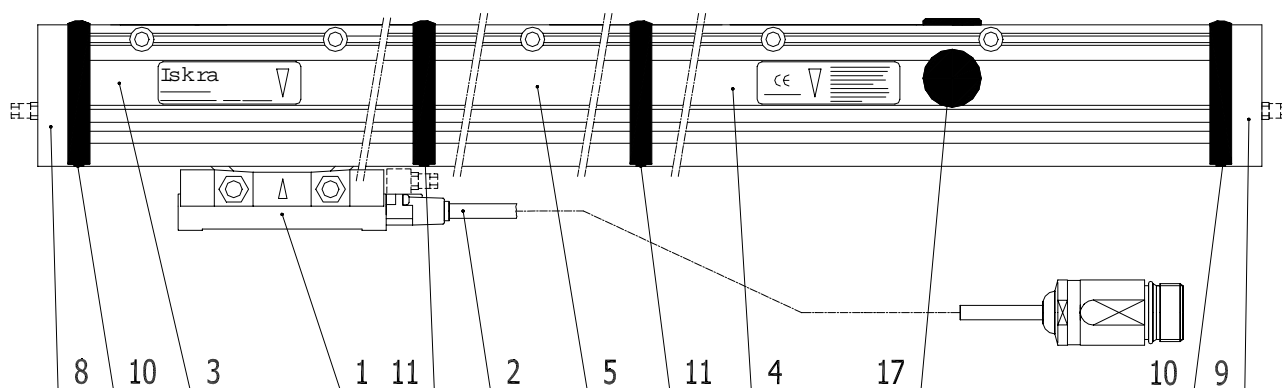
Printed in Slovenia
2003.05



List of deliveries

Scale elements and assemblies

- 1) Reading head 1
- 2) Cable 1
- 3) Housing Start 1
- 4) Housing End 1
- 5) Housing Segments L=1000, 1200, 1400, 1600, 1800 or 2000 mm for qty. see Table 1, page 2
- 6) Tape with grating 1
- 7) Guiding tape 1
- 8) End Cap Left 1
- 9) End Cap Right 1
- 10) Junction Seal for End Caps 2
- 11) Junction Seal = Housing Segments (qty. see Table 1, page 2) + 1
- 12) M5 x 90 (DIN912 - HSB) 1 (with washer and O-seal)
- 13) M4 x 80 (DIN912 - HSB) 1 (with washer and O-seal)
- 14) M4 x 18 (DIN912 - HSB) 4 (+ 4x washer)
- 15) M4 x 8 (DIN912 - HSB) 2 (+ 2x washer)
- 16) M2.5x16 (DIN7985A - +P) 4 (+ 4x washer)
- 17) Rubber Bolt $\Phi 18$ 2
- 18) Dust lips 2 x (Lm+0.5m), Lm=Measuring length



Accessory parts supplied for installation:

- | | | |
|--|----------------|---|
| 1) M5 x 50 | DIN912 (HSB) | $n = (Lm - 240) / 200 + 4$, (Lm=16840mm; n=87) |
| 2) M5 washer | DIN 433 | $n = (Lm - 240) / 200 + 4$ |
| 3) M6 x 40 | DIN912 (HSB) | 2 (For reading head mounting) |
| 4) Cable clamp (small) | | 4 |
| 5) M4 x 10 | DIN 7985A (+P) | 4 (For cable clamping) |
| 6) Inspection certificate (Accuracy chart) | | 1 |
| 7) Instruction manual | | 1 |
| 8) Air injection valve | | 2 (For scale housing) |
| (if specified by order) | | 1 (For reading head) |



Table 1:

Measuring length [mm]	Hous. Start	Hausing Segment	Hous. End	Measuring length [mm]	Hous. Start	Hausing Segment	Hous. End	Measuring length [mm]	Hous. Start	Hausing Segment	Hous. End
3640	1	2	1	12640	1	7	1	21640	1	11	1
3840	1	2	1	12840	1	7	1	21840	1	11	1
4040	1	2	1	13040	1	7	1	22040	1	11	1
4240	1	2	1	13240	1	7	1	22240	1	11	1
4440	1	3	1	13440	1	7	1	22440	1	12	1
4640	1	3	1	13640	1	7	1	22640	1	12	1
4840	1	3	1	13840	1	7	1	22840	1	12	1
5040	1	3	1	14040	1	7	1	23040	1	12	1
5240	1	3	1	14240	1	7	1	23240	1	12	1
5440	1	3	1	14440	1	8	1	23440	1	12	1
5640	1	3	1	14640	1	8	1	23640	1	12	1
5840	1	3	1	14840	1	8	1	23840	1	12	1
6040	1	3	1	15040	1	8	1	24040	1	12	1
6240	1	3	1	15240	1	8	1	24240	1	12	1
6440	1	4	1	15440	1	8	1	24440	1	13	1
6640	1	4	1	15640	1	8	1	24640	1	13	1
6840	1	4	1	15840	1	8	1	24840	1	13	1
7040	1	4	1	16040	1	8	1	25040	1	13	1
7240	1	4	1	16240	1	8	1	25240	1	13	1
7440	1	4	1	16440	1	9	1	25440	1	13	1
7640	1	4	1	16640	1	9	1	25640	1	13	1
7840	1	4	1	16840	1	9	1	25840	1	13	1
8040	1	4	1	17040	1	9	1	26040	1	13	1
8240	1	4	1	17240	1	9	1	26240	1	13	1
8440	1	5	1	17440	1	9	1	26440	1	14	1
8640	1	5	1	17640	1	9	1	26640	1	14	1
8840	1	5	1	17840	1	9	1	26840	1	14	1
9040	1	5	1	18040	1	9	1	27040	1	14	1
9240	1	5	1	18240	1	9	1	27240	1	14	1
9440	1	5	1	18440	1	10	1	27440	1	14	1
9640	1	5	1	18640	1	10	1	27640	1	14	1
9840	1	5	1	18840	1	10	1	27840	1	14	1
10040	1	5	1	19040	1	10	1	28040	1	14	1
10240	1	5	1	19240	1	10	1	28240	1	14	1
10440	1	6	1	19440	1	10	1	28440	1	15	1
10640	1	6	1	19640	1	10	1	28640	1	15	1
10840	1	6	1	19840	1	10	1	28840	1	15	1
11040	1	6	1	20040	1	10	1	29040	1	15	1
11240	1	6	1	20240	1	10	1	29240	1	15	1
11440	1	6	1	20440	1	11	1	29440	1	15	1
11640	1	6	1	20640	1	11	1	29640	1	15	1
11840	1	6	1	20840	1	11	1	29840	1	15	1
12040	1	6	1	21040	1	11	1	30040	1	15	1
12240	1	6	1	21240	1	11	1				
12440	1	7	1	21440	1	11	1				



2. Mounting

2-1. Mounting precautions

2-1-1. Checking the mounting posture

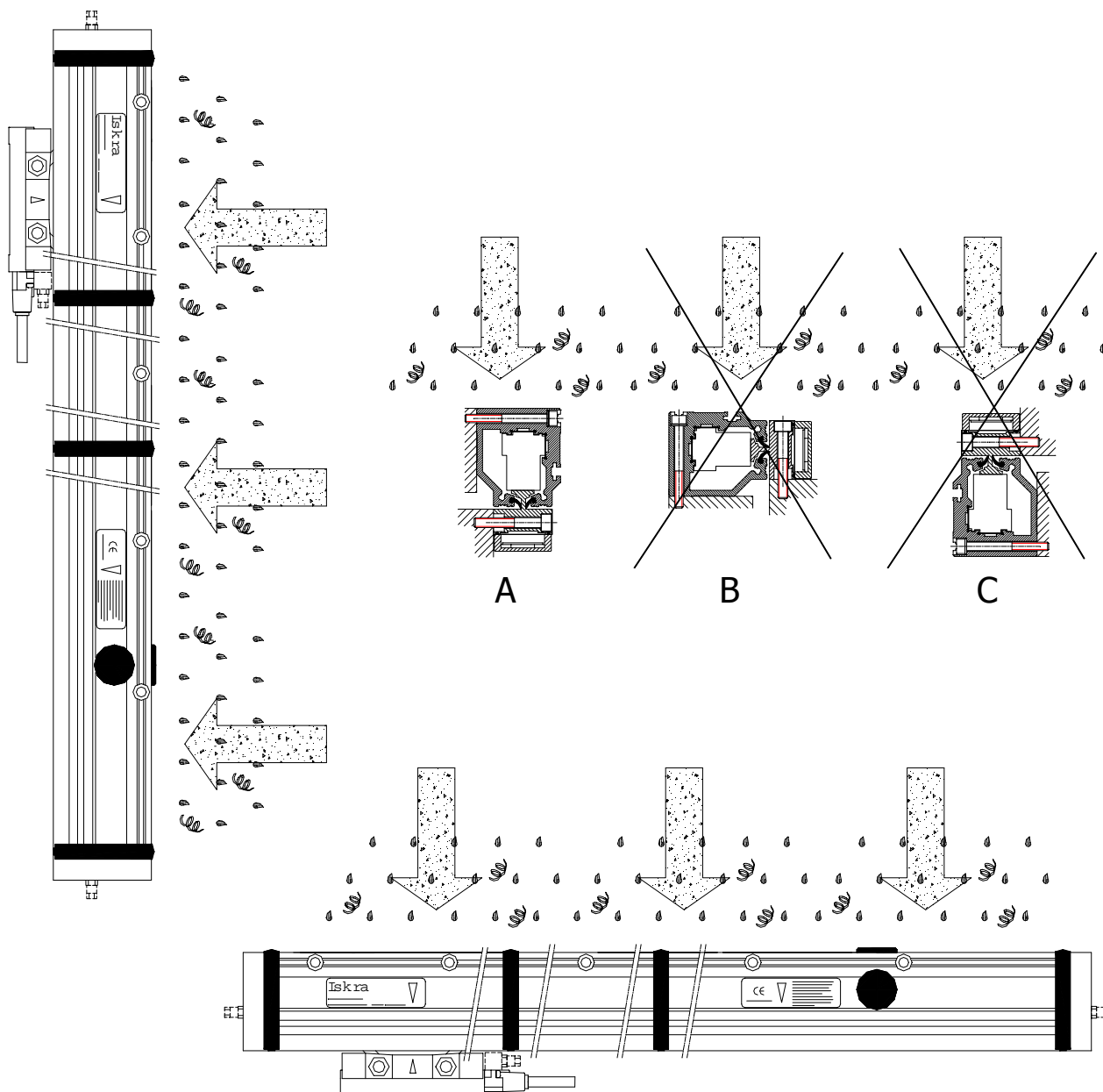


Fig. 2-1



2-1-2. Setting the operation range

Mechanical limit mechanism (stoppers, etc.) is required if reading head needs to move for its full stroke in measurement length.

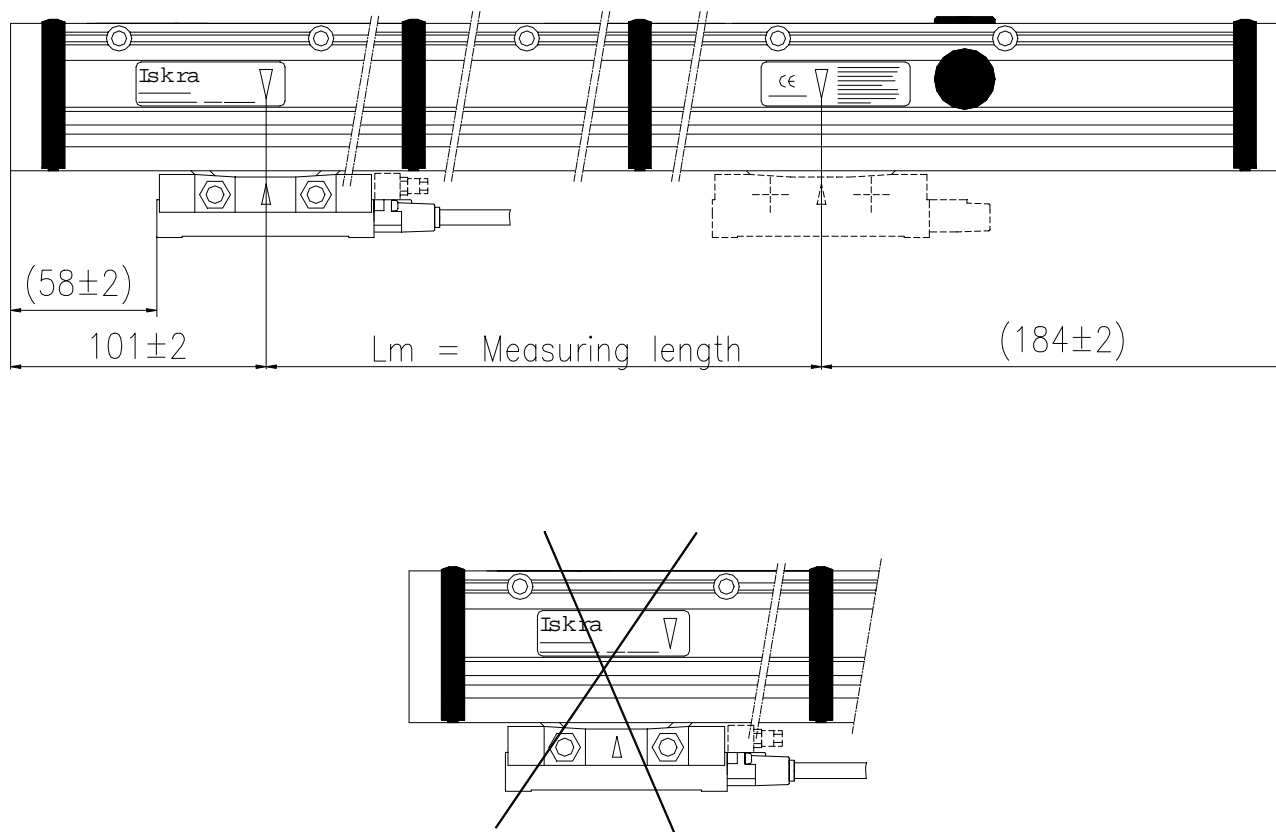


Fig. 2-2



2-1-3. 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.

2-2. Tools required for scale installation

For mounting prepare following tools.

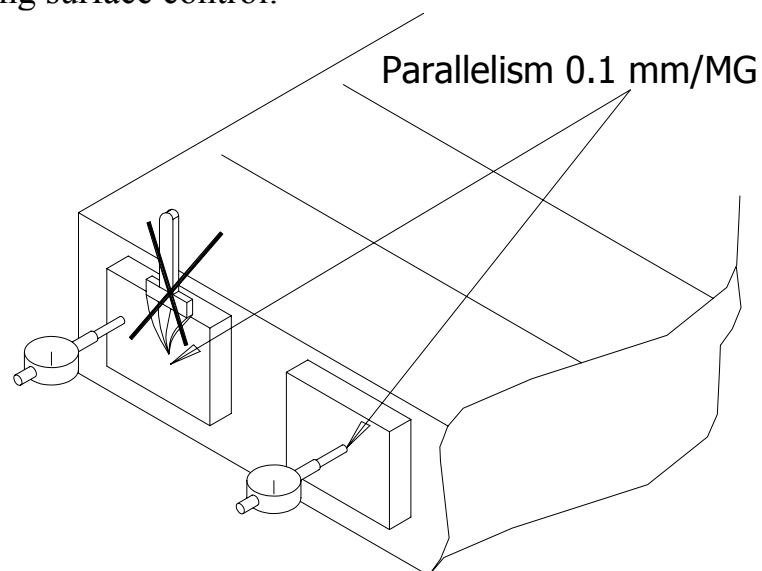
- Jig 1; for mounting Profile segments with junction seal (Refer to Fig. 2-6 and 2-7)
- Distance plate 4mm; for positioning Profile segments (Refer to Fig. 2-6)
- Marking pin $\Phi 6$; for marking the position of thread holes M5 on the machine (Refer to Fig. 2-6)
- Dust lips holder; for inserting of the Dust lips (Refer to Fig. 2-12)
- Bracket for mounting scale housing (Refer to Fig. 2-3)
- Bracket for mounting reading head
- 0.01mm pick tester (or Dial gauge) 1 or 2
- Hexagon wrench for M2.5 (2mm) 1
- Hexagon wrench for M5 (4mm) 1
- Hexagon wrench for M6 (5mm) 1
- Screw driver No.2 (+) 1
- Tap drill M5 1
- Tap drill M6 1
- Drill $\phi 4.2$ 1
- Drill $\phi 5$ 1
- Thickness gauge = 1,2 mm 1
- Thickness gauge = 1,5 mm 1
- Thickness gauge = 1,9 mm 1



2-3. The way of mounting

2-3-1. Setting mounting surface

1. Mounting surface control:



- MG - machine guide

Fig. 2-3

2. Setting mounting surface of reading head:

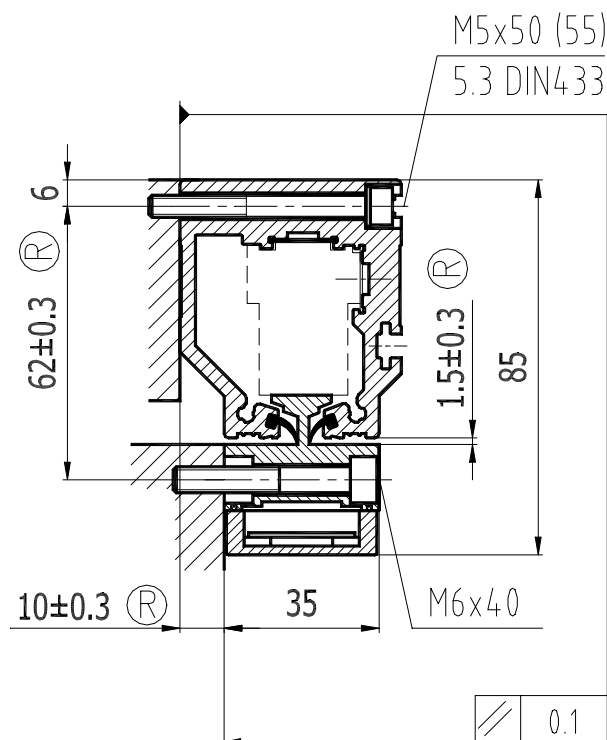


Fig. 2-4a

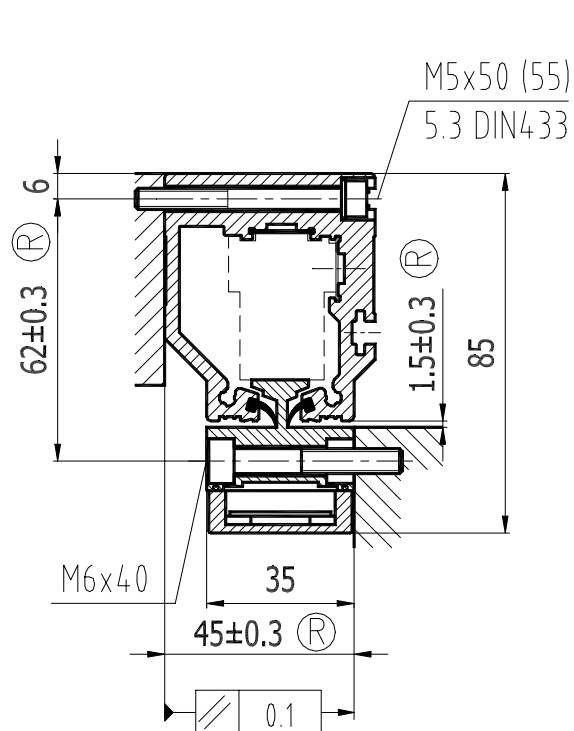


Fig. 2-4b

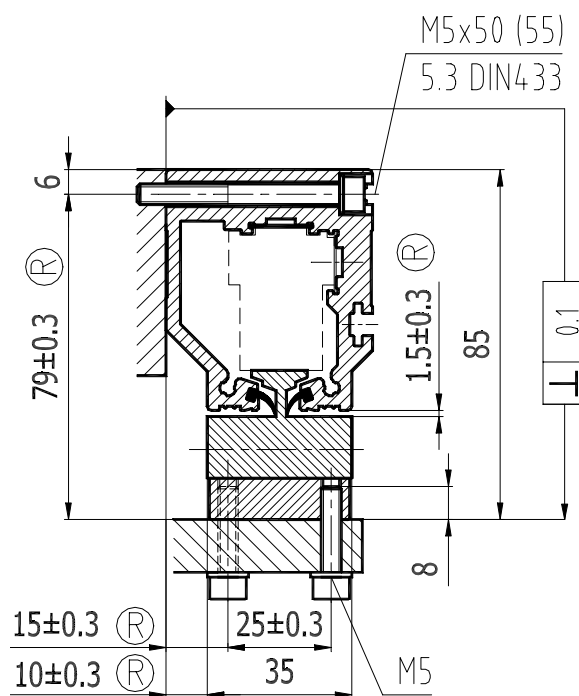


Fig. 2-4c

2-3-2. Mounting scale body:

1. Attaching the profile parts:
 - a. Housing start:

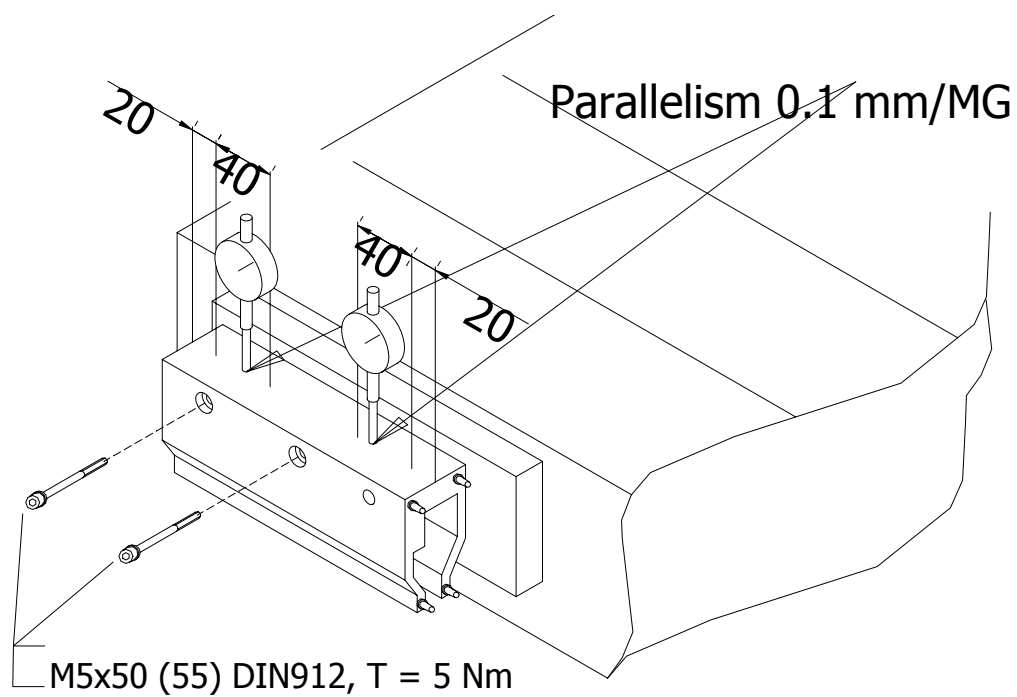


Fig. 2-5



b. Housing segment:

- i. Insert the distance plate 4 mm on 4 bolts.
- ii. Fix the housing segment to the housing start (or segment) with jig 1.
- iii. Align the housing segment to 0.1 mm/MG (Machine Guide) and all the housing segments (including start and end segment) to 0.3 mm/MG.
- iv. Mark the centre position for thread hole M5.
- v. Remove the housing segment and prepare the thread holes for M5 screws.

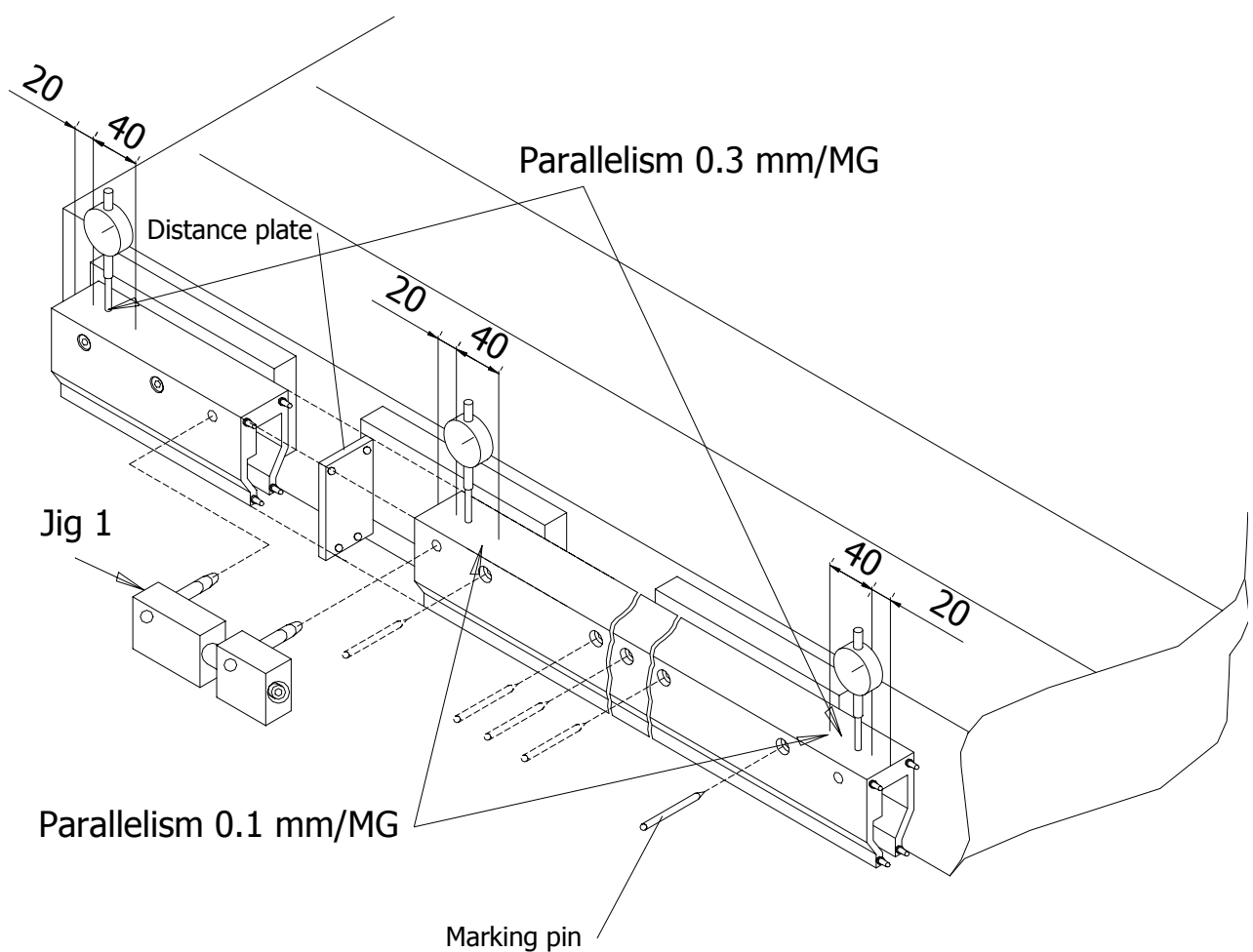


Fig. 2-6

- vi. Insert the junction seal on 4 bolts.
- vii. Fix the housing segment to the housing start (or segment) with jig 1.
- viii. Align the housing segment to 0.1 mm/MG and with the housing start and other parts to 0.3 mm/MG.
- ix. Tighten M5x50 (55) screws with torque of 5Nm.

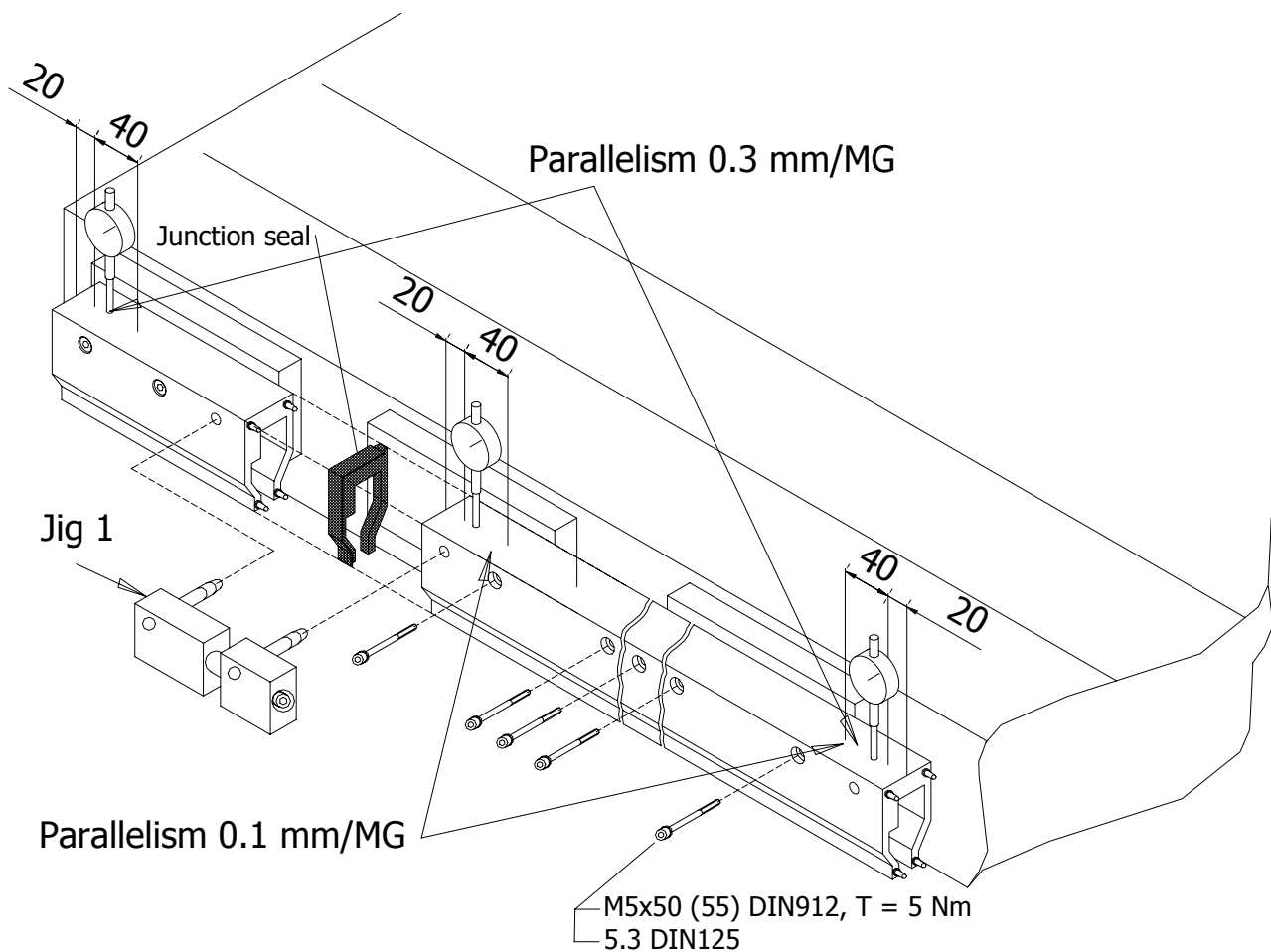


Fig. 2-7

Note: All housing segments must be within the parallelism of 0.3mm/MG!

**Note**

The junction seal protects scale from intrusion of parts and liquids from environment best at distance between housing segments of 4 ± 0.15 mm – shown in Fig. 3-6.

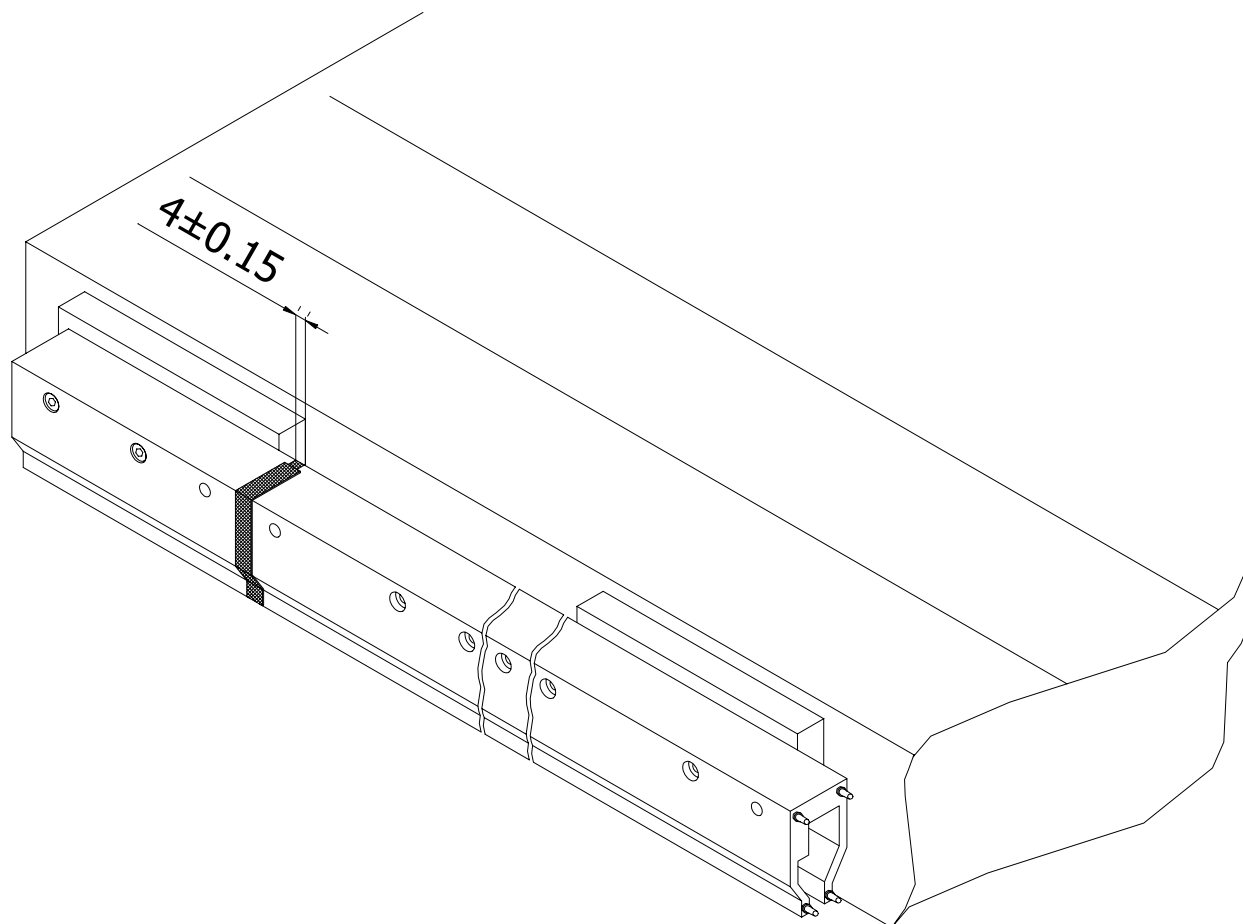


Fig. 2-8

Repeat the operation **2-3-2 1b** until all the housing segments are mounted.



2. Insert the guiding and measuring metal tape:
 - a. Insert the guiding tape. Start inserting on the side of Iskra label – housing start.

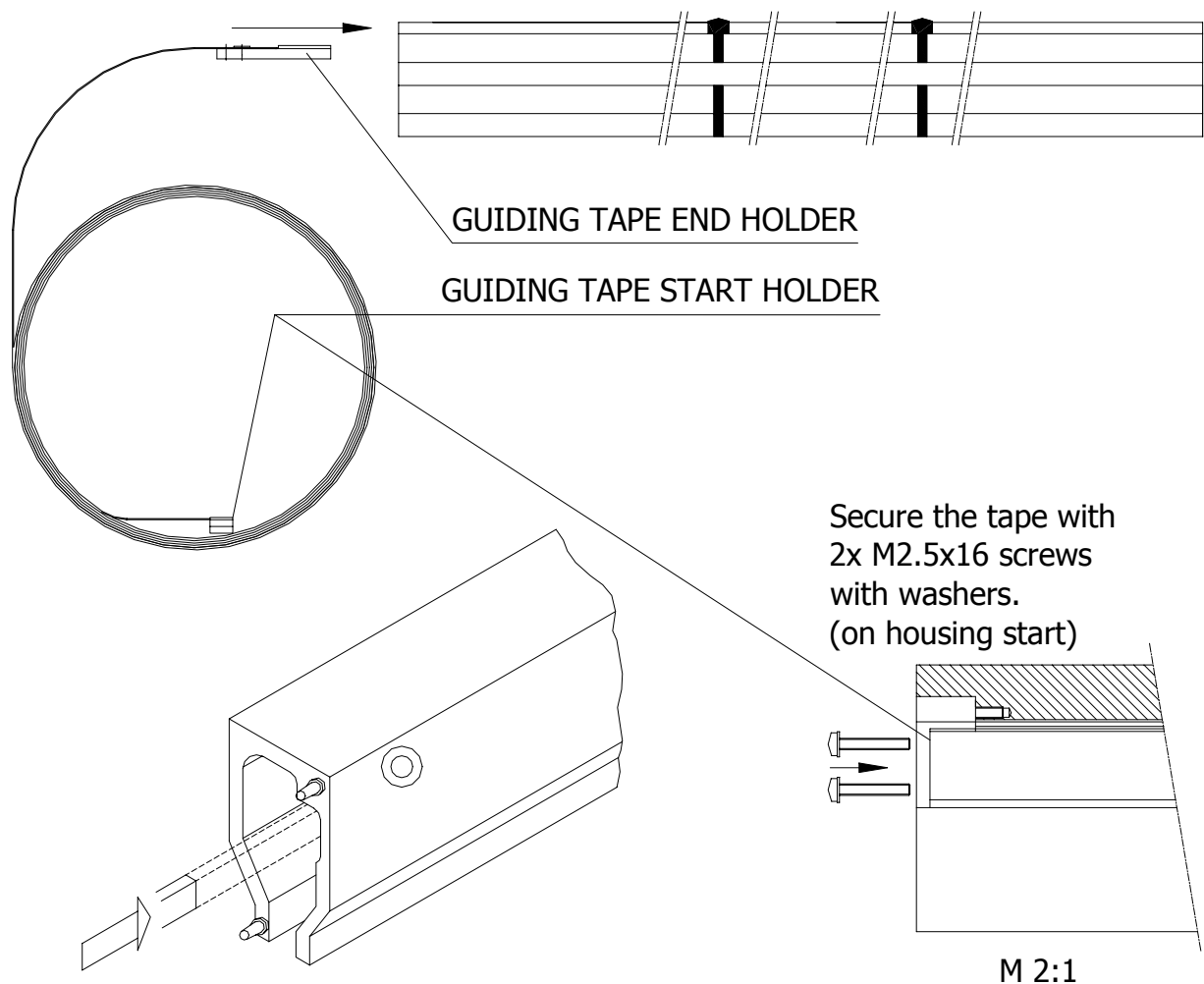


Fig.2-9

Note: Be careful not to put any dirt on the tape. Clean the tape with a soft cloth and alcohol during insertion.



b. Insert the measuring tape:

Remove remains of glue and clean the tape surface with a soft cloth and alcohol.

Remove protective foil.

TENSIONING MECHANISM

TAPE WITH GRATING START HOLDER

Secure the tape with 2x M2.5x16 screws with washers (on housing start)

M 2:1

Fig. 2-10

Note: Be careful not to put any dirt on the tape. Clean the tape with a soft cloth and alcohol during inserting it.



c. Fix the right end cap:

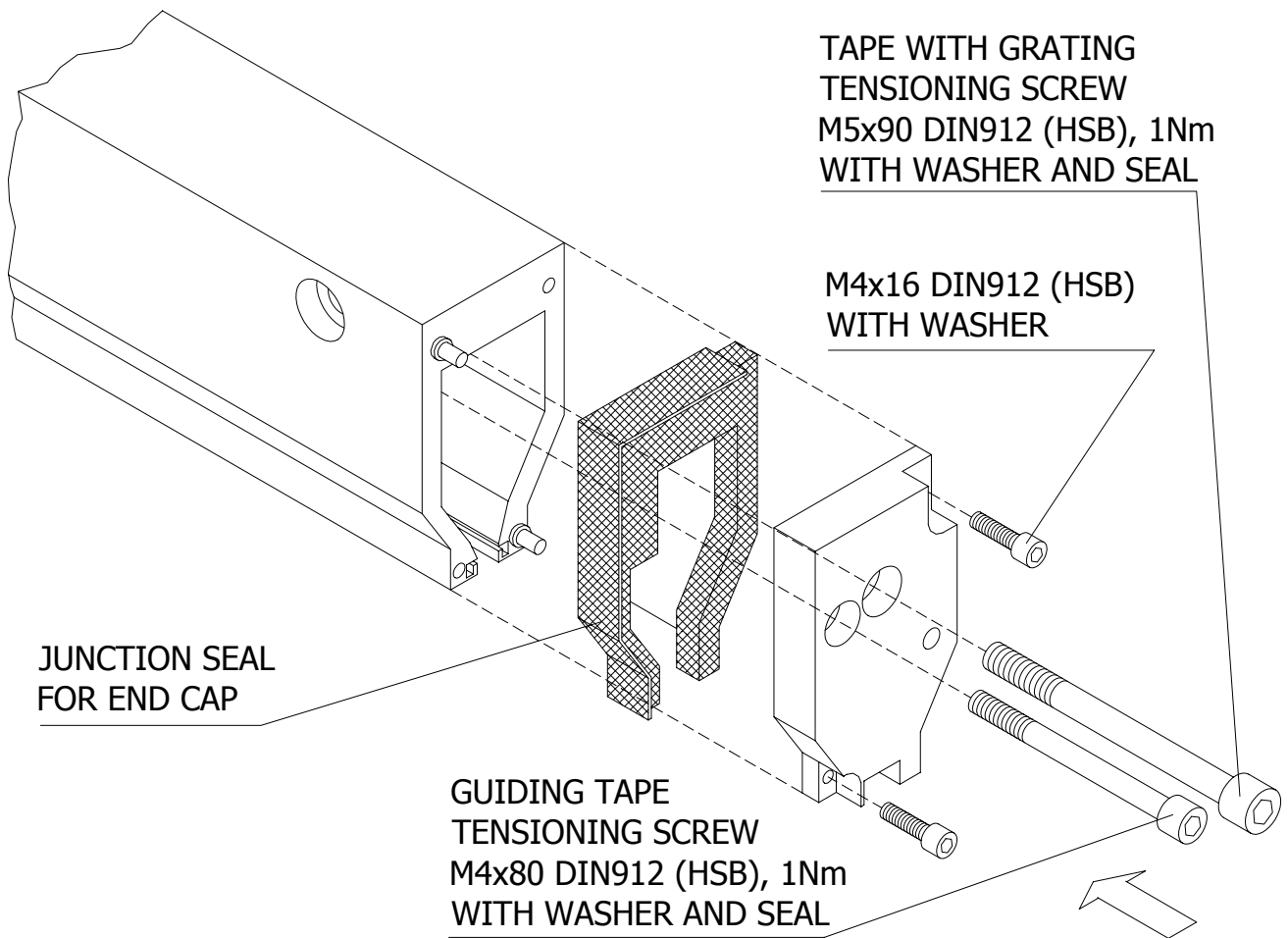


Fig. 2-11



3. Insert dust lips:

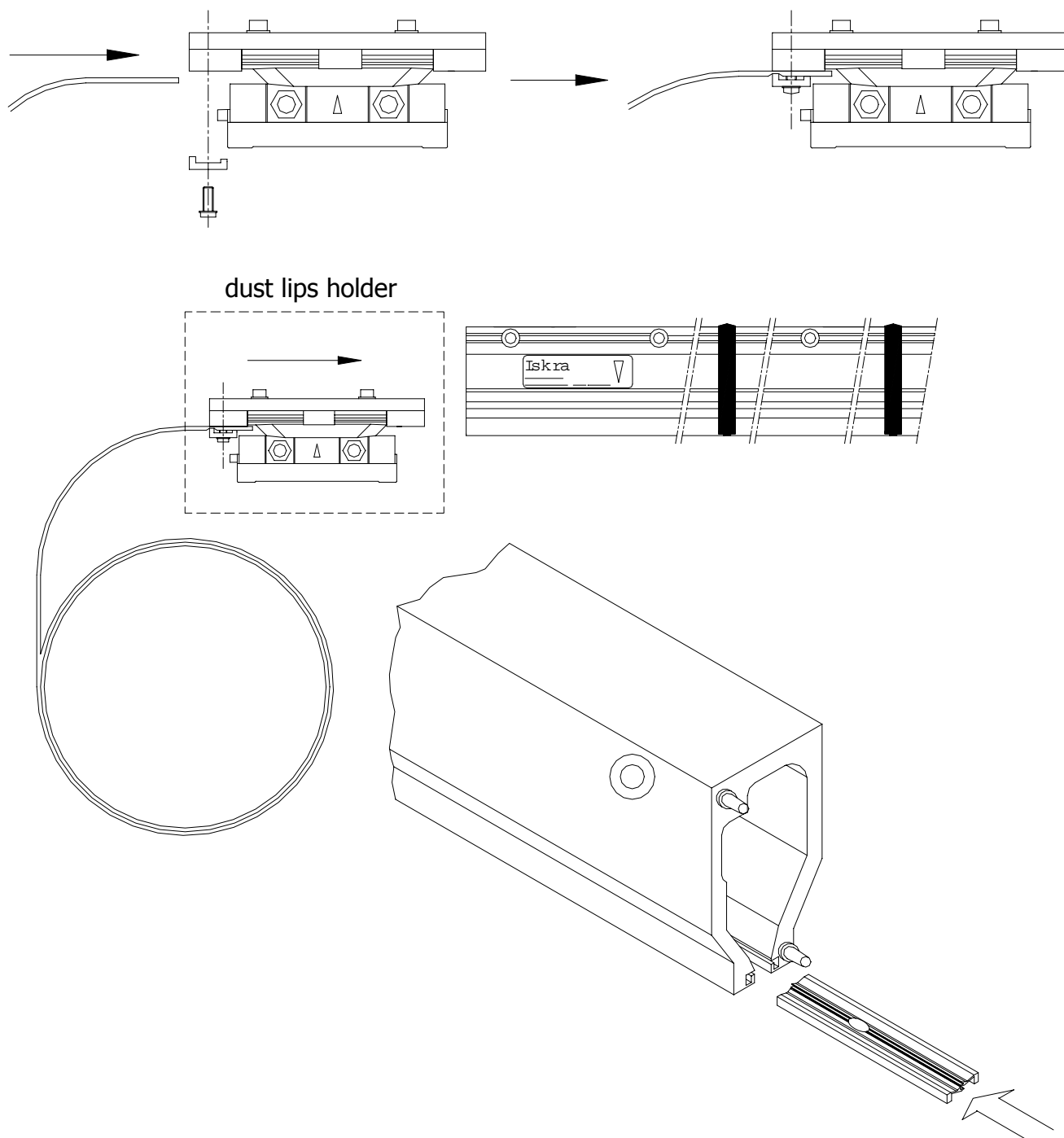


Fig. 2-12

- i. Engage both 2 dust lips on the puller.
- ii. Slide the puller with the lips in the housing and pull the lips through.



2-3-3. Mounting reading head

1. Selecting cable orientation:

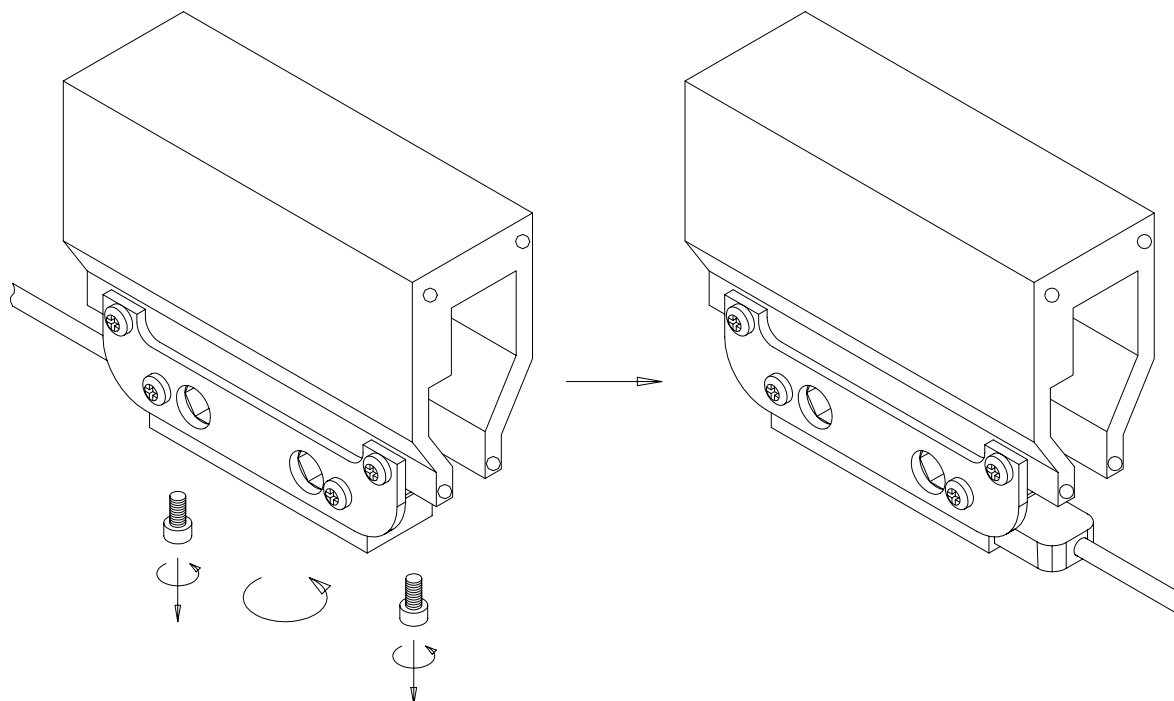


Fig. 2-13

2. Insert the reading head:

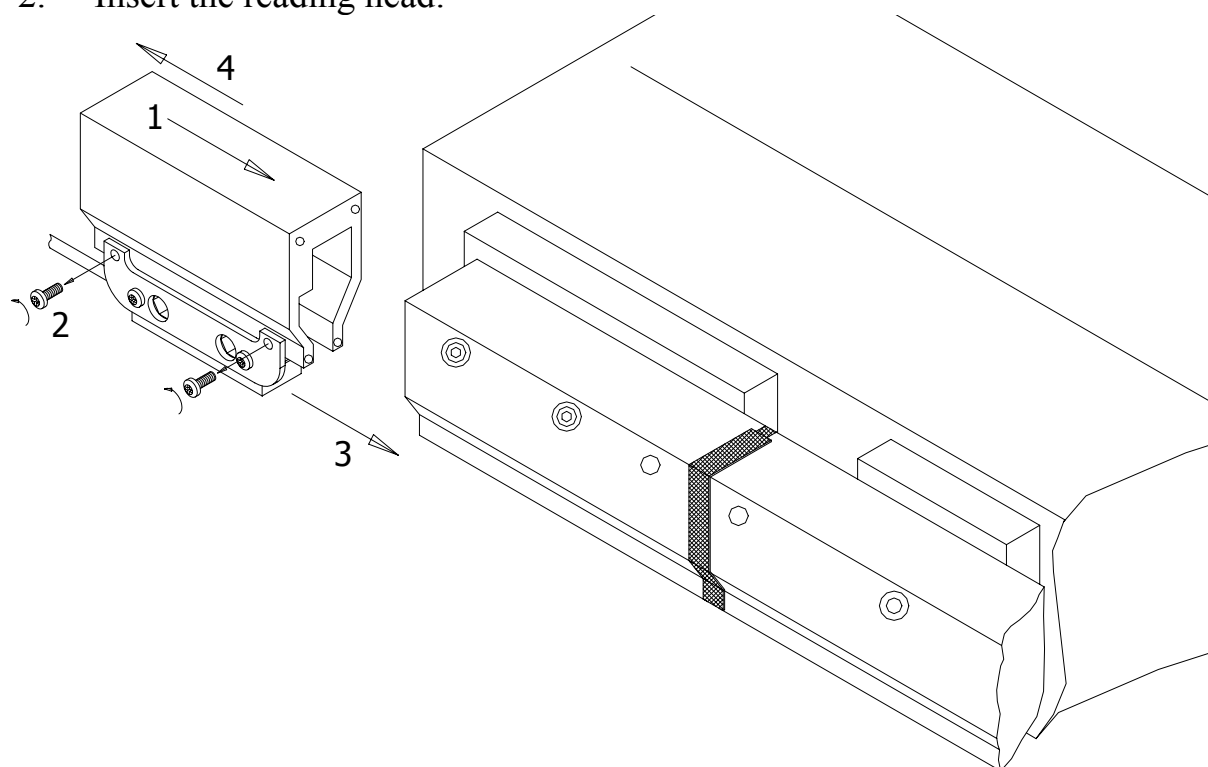


Fig. 2-14



3. Fix the reading head:

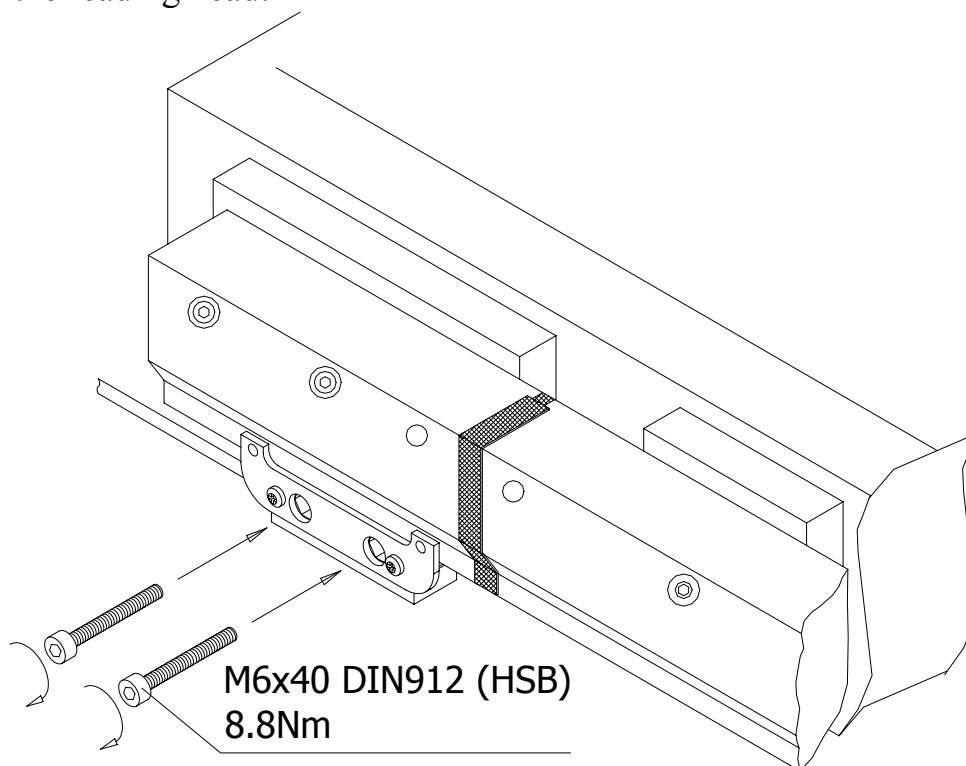


Fig. 2-15

4. Remove the reading head holder:

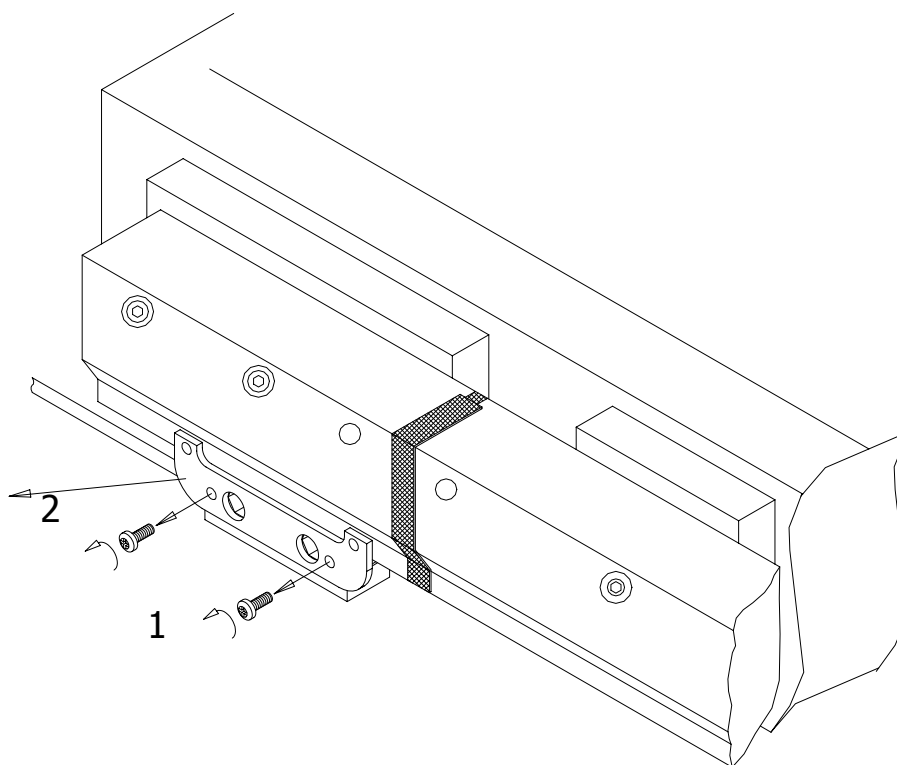


Fig. 2-16



Fix the left end cap the same way like right end cap.

Make sure to install the edge of reading head within 1.5 ± 0.3 mm distance to the housing.

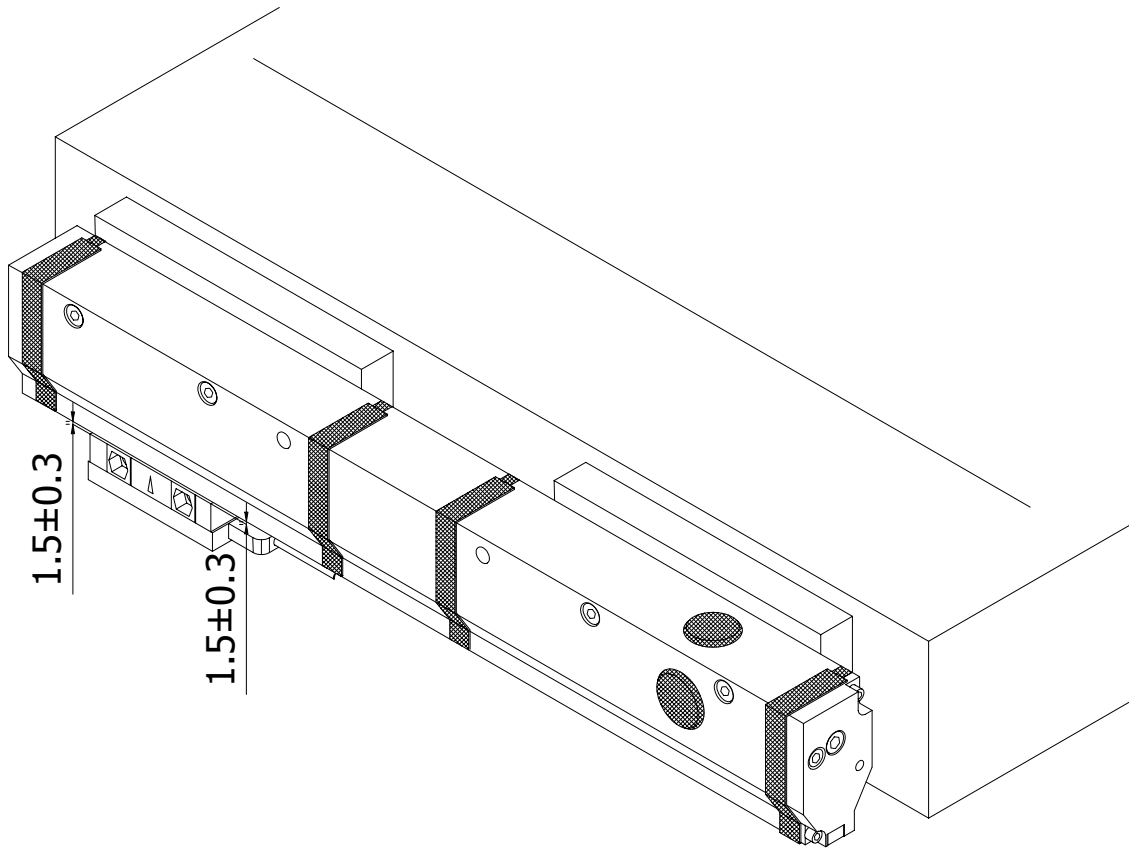


Fig. 2-17

2-3-4. Attaching the cable

Fix the cable with M2.5 screws to the reading head.
Secure the cable with cable clamps.

Note

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



2-4. Tensioning the tape with grating

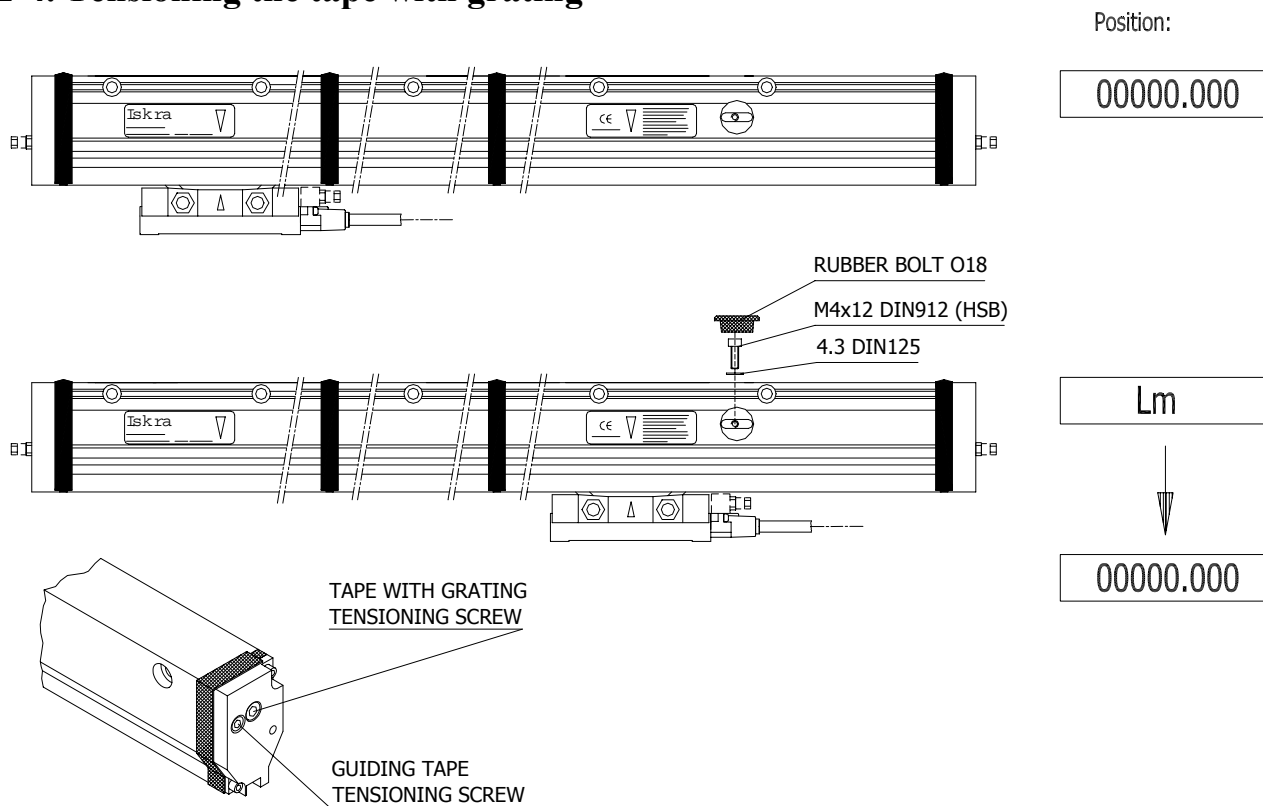


Fig. 2-18

Procedure:

- Position reading head to measuring length start and set the position to 0.000.
- Position the reading head to measuring length end, note measuring length L_m .
- Loosen the tape with grating tensioning screw until the position stops changing.
- Set the position to 0.000.
- Turn the tape with grating tensioning screw clockwise until the displayed position is ΔL ,

$$\Delta L = L_m \times 0.1/1000$$

- Secure the tensioning mechanism with M4x12 screw and close the profile with the rubber bolt $\Phi 18$.

Example:

$$L_m = 6640 \text{ mm}, \Delta L = 6640 \times 0.1/1000 = 0.664 \text{ mm}$$

Secure the guiding tape with M4x12 screw and close the profile with the rubber bolt $\Phi 18$.



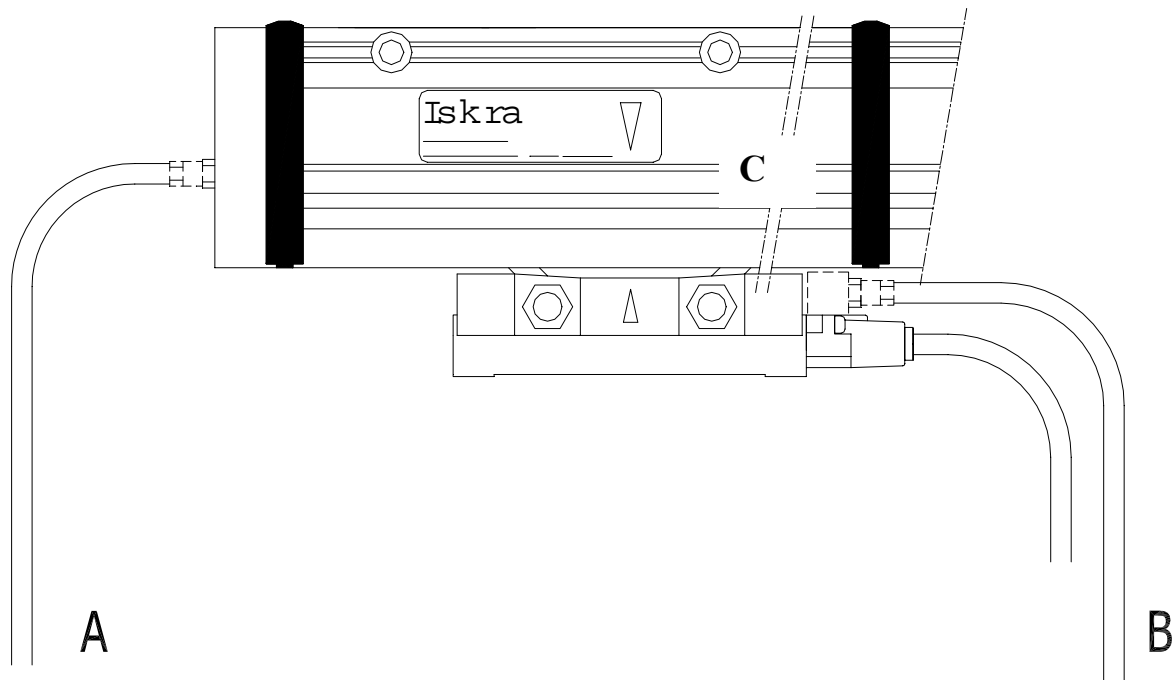
2-5. Air injection

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

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. 2-19

Air injection to upper scale unit (A) and air injection to slider connector (B) on Fig. 2-19, is possible with nipple in accessories.

Regarding air injection to scale unit, select by taking pipe route of either right or left inlet into consideration.



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

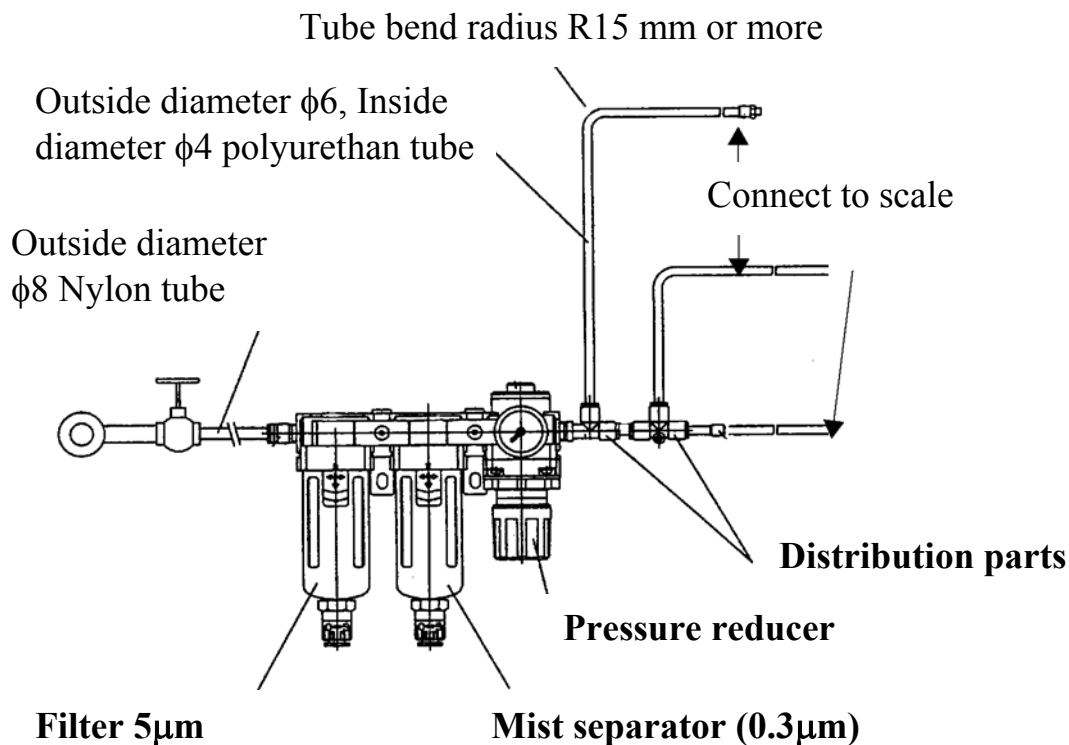


Fig. 2-20

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

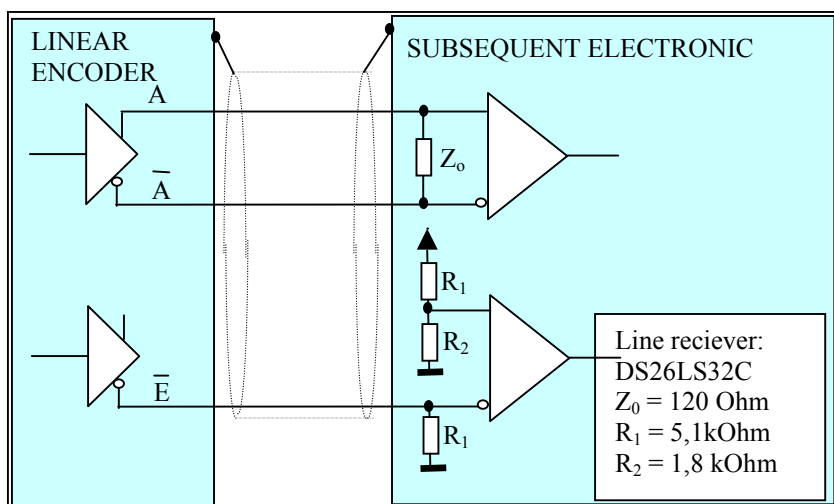
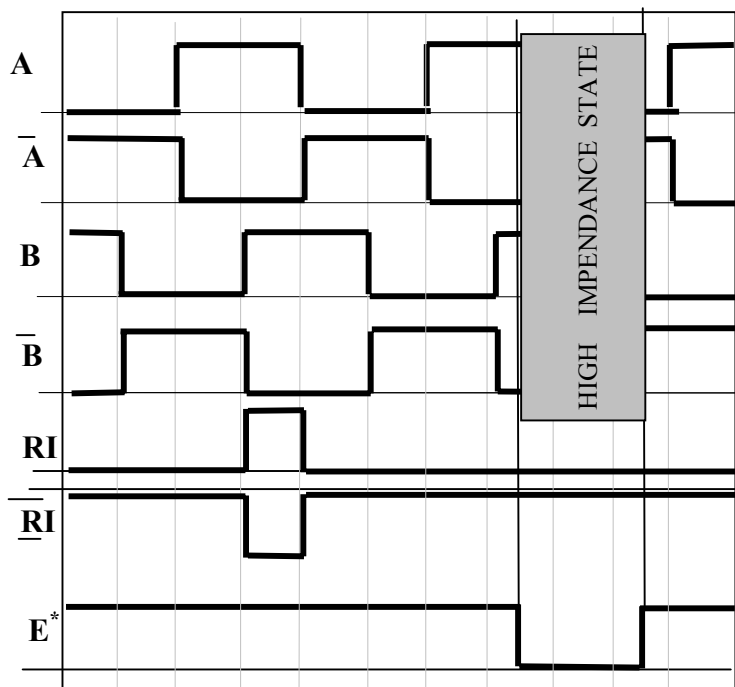
Item	Specifications
Guaranteed maximum pressure	1.5 MPa
Max. working pressure	1020 kPa
Adjustable pressure range	20 to 200 kPa
Working fluid	Air
Ambient temperature and working fluid temperature	-5 to 30°C (No condensation)
Filtration grade	Air filter: 5 µm Mist separator: 0.3 µm
Pressure gauge tester 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 2-1

3. Connecting to device

3-1.1. Output signals DS (RS 422-A EIA):

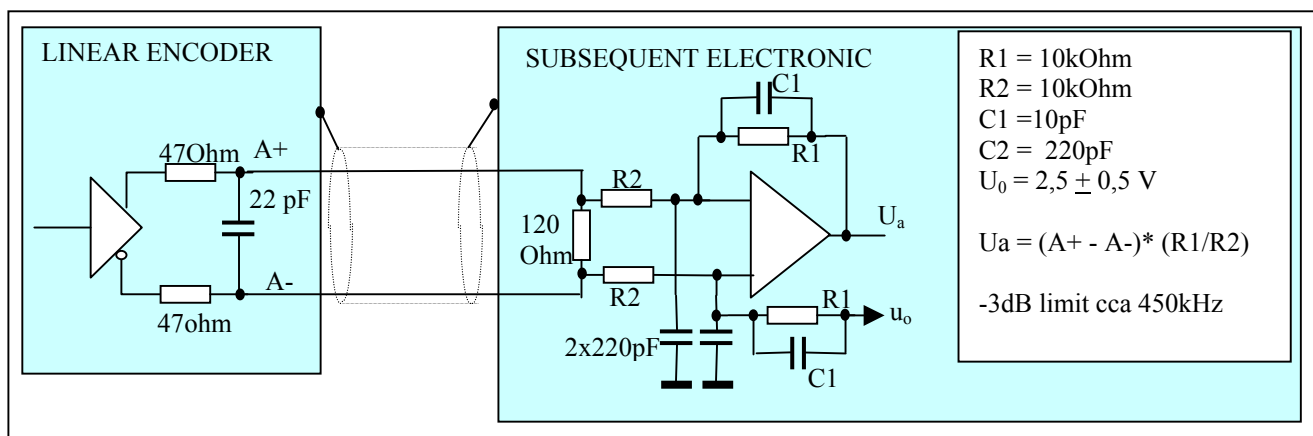
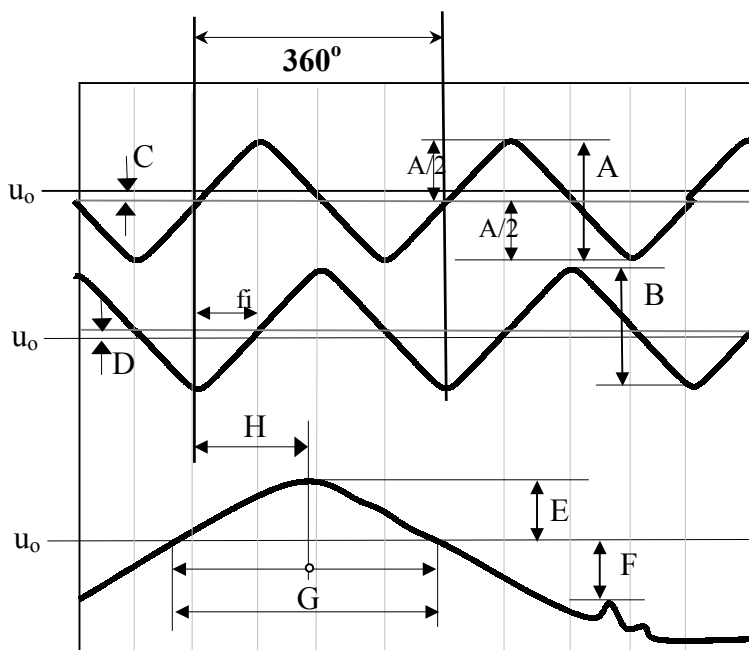
	Unit	Nominal
Signal levels	V	$U_H > 2,5V$ at $I_H = -20 \text{ mA}$ $U_L < 0,5V$ at $I_L = 20 \text{ mA}$
Transition times Rise and fall time	ns	<50
Maximum load current	mA	20





3-1.2. Output signals SV:

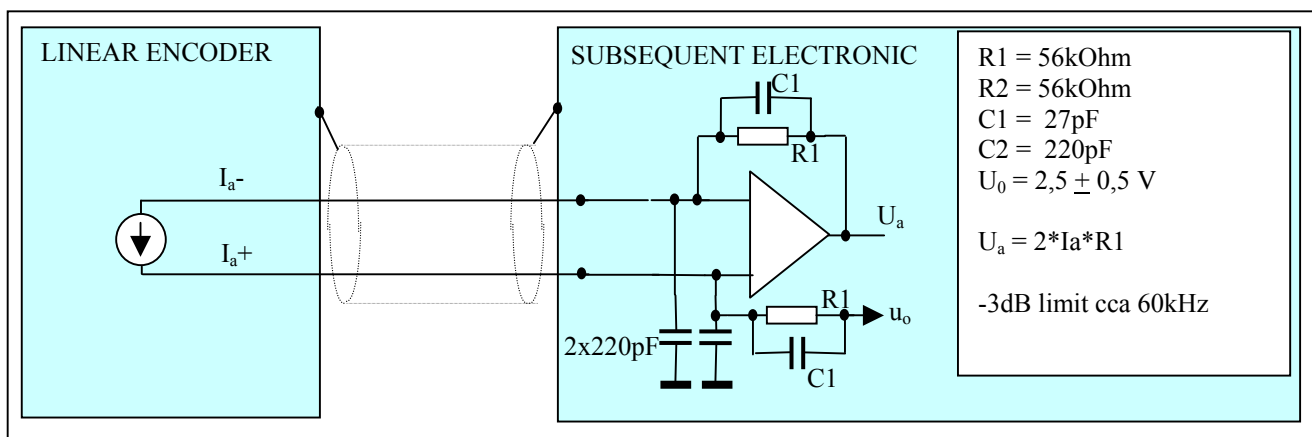
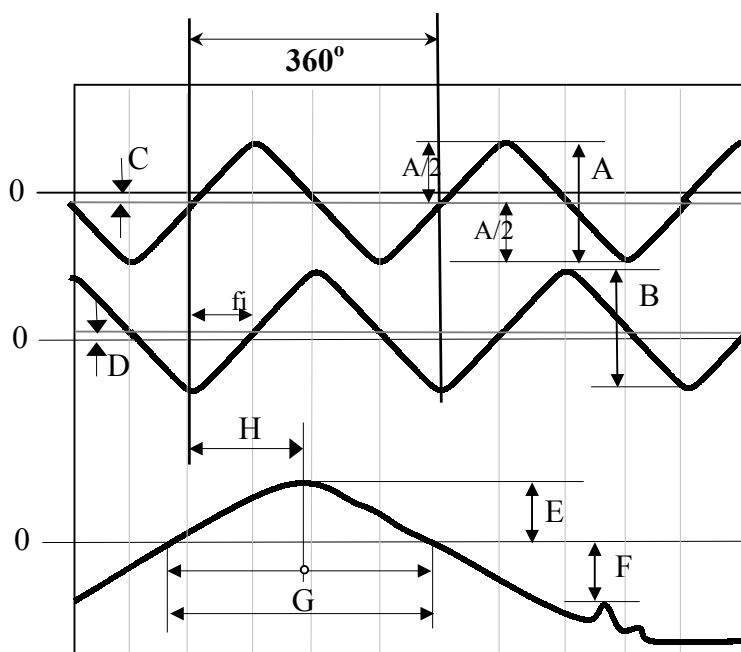
	Marcation	Unit	Nominal	Tolerances
Incr. Signal amplitude	A, B	V	1	$\pm 0,2$
Incr. Signal DC offset	C, D	V	0	$\pm 0,03$
Amplitude unbalance	$(A+B)/(A+B)$	%	0	± 10
Phase shift	Fi	°	90	± 10
Reference signal width	G	°	360	± 90
Reference signal ampl	E	V	0,5	$\pm 0,25$
Ref. Signal peak position	H	°	135	± 45
Ref. Sign. Secondary amplitude	F	V	-0,5	$\pm 0,25$





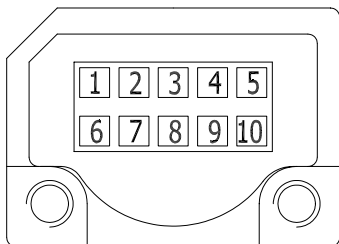
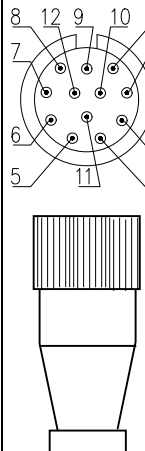
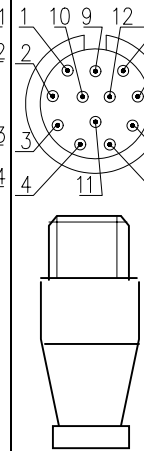
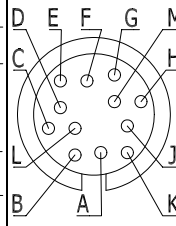
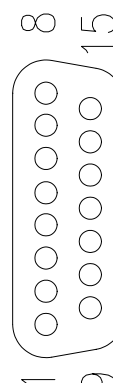
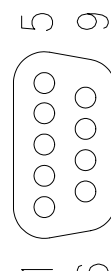
3-1.3. Output signals SI:

	Marcation	Unit	Nominal	Tolerances
Incr. Signal amplitude	A, B	uA	11	± 3
Incr. Signal DC offset	C, D	uA	0	$\pm 0,3$
Amplitude unbalance	$(A+B)/(A+B)$	%	0	± 10
Phase shift	Fi	°	90	± 10
Reference signal width	G	°	360	± 90
Reference signal ampl	E	uA	5	± 3
Ref. Signal peak position	H	°	135	± 45
Ref. Sign. Secondary amplitude	F	uA	-5	± 3





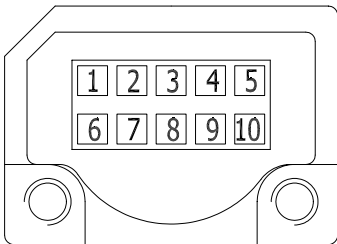
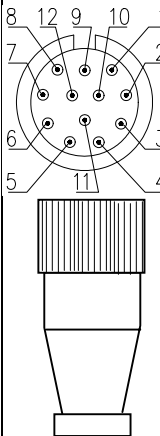
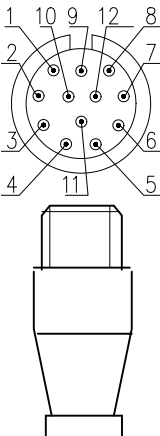
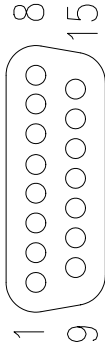
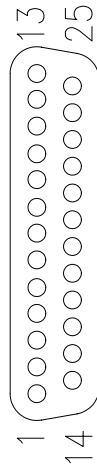
3-2. Output from connector

Connect. on the reading head	colour for cable without metal flexib. tube	colour for cable with metal flexibile tube	Output signals DS (RS-422-A)					
			SIGNAL	type of connector				
				CONTACT		AMPHENOL	D-sub	
				12-pole connector	12-pole coupling	12-pole	15 - pole	9 - pole ISKRA
1	RED in pair with brown	RED	B	8	8	E	6	7
2	BROWN in pair w. green	YELLOW	A -	6	6	D	4	4
3	GREY in pair with violet	GREY	RI -	4	4	H	12	2
4	BLUE	GREEN	E-	7	7	insulate this wires	13	insulate this wires
5	GREEN - WHITE	BROWN	0V	10 ⁽¹⁾	10 ⁽¹⁾	B ⁽¹⁾	2	9
	VIOLET		0V sense	11 ⁽¹⁾	11 ⁽¹⁾	F ⁽¹⁾	11	insulate this wires
6	BROWN in pair with red	WHITE	B -	1	1	L	7	3
7	GREEN in pair w. brown	BLUE	A	5	5	C	3	8
8	VIOLET in pair with grey	ORANGE	RI	3	3	G	10	6
9	WHITE	VIOLET	5V sense	2	2	M	9	insulate this wires
10	GREEN - YELLOW	BLACK	+5V	12	12	K	1	5
Conn. housing	SHIELD	SHIELD		to connect. housing	to connect. housing	to connector housing	to conn. housing	to conn. housing
								

¹⁾ In the case of cable in metal flexible tube connect these pins together.

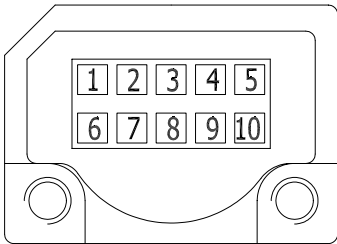
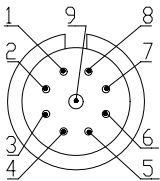
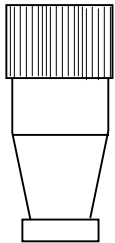
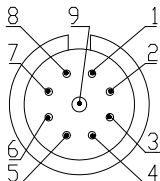
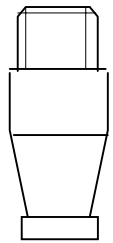
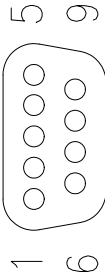
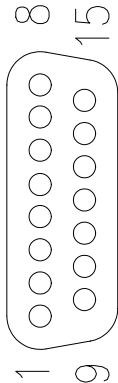
²⁾ All connectors are drawing on contact side view.



connector on the reading head	colour for cable withouth metal flexibile tube	colour for cable with metal flexibile tube	Output signals SV(1Vpp)				
			SIGNAL	type of connector			
				CONTACT (male)		D-SUB (male)	
				12-pole connector	12-pole coupling	15-pole	25-pole
1	RED in pair with brown	RED	B-	1	1	7	6
2	BROWN in pair with green	YELLOW	A-	6	6	4	4
3	GREY in pair with violet	GREY	RI	3	3	10	17
4	BLUE	GREEN	0V sense	11	11	11	16
5	GREEN - WHITE	BROWN	0V	10	10	2	2
6	BROWN in pair with red	WHITE	B	8	8	6	4
7	GREEN in pair with brown	BLUE	A	5	5	3	6
8	VIOLEt in pair with grey	ORANGE	RI-	4	4	12	18
9	WHITE	VIOLET	5V sense	2	2	9	14
10	GREEN - YELLOW	BLACK	+5V	12	12	1	1
Connector housing	SHIELD	SHIELD		to connector housing	to connector housing	to connector housing	to connector housing
							

All connectors are drawing on contact side view.



connector on the reading head	colour for cable without metal flexible tube	colour for cable with metal flexible tube	Output signals SI (11uA)				
			SIGNAL	type of connector			
				CONTACT (male)		D-SUB (male)	
				9-pole connector	9-pole coupling	9 - pole ISKRA	15-pole
1	RED in pair with brown	RED	lb-	6	6	3	7
2	BROWN in pair with green	YELLOW	la-	2	2	4	4
3	GREY in pair with violet	GREY	lri+	7	7	6	10
4	BLUE	GREEN		insulate this wires	insulate this wires	insulate this wires	insulate this wires
5	GREEN - WHITE	BROWN	0V	4	4	9	2
6	BROWN in pair with red	WHITE	lb+	5	5	7	6
7	GREEN in pair with brown	BLUE	la+	1	1	8	3
8	VIOLEt in pair with grey	ORANGE	lri-	8	8	2	12
9	WHITE	VIOLET		insulate this wires	insulate this wires	insulate this wires	insulate this wires
10	GREEN - YELLOW	BLACK	+5V	3	3	5	1
Connector housing	SHIELD	SHIELD		to connector housing	to connector housing	to connector housing	to connector housing
				 	 		

All connectors are drawing on contact side view.

3-3. Voltage drop by cable

When +5V is provided to TGM190, voltage drop due to cable length may occur. Measure voltage drop and provide corresponding power voltage taking expected voltage drop into consideration.

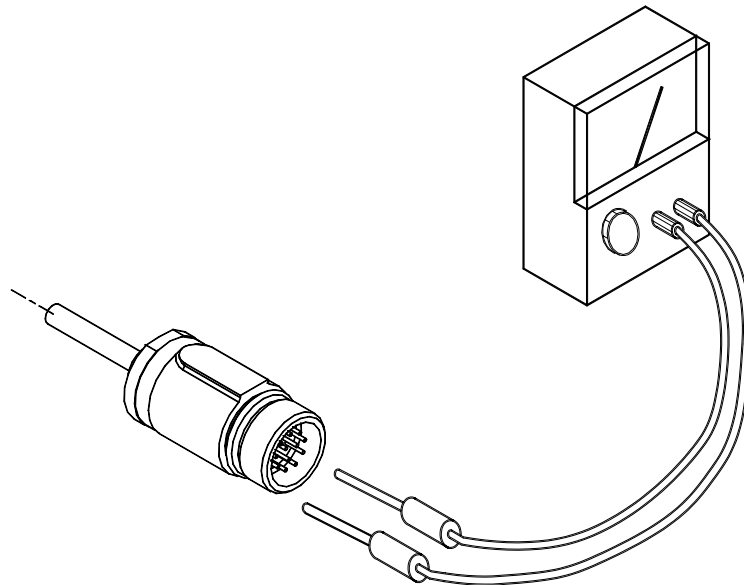


Fig. 3-4

(The way of measuring)

Measure resistance with a tester on connector pin 0V sensor and pin 5V sensor (see chart 3-1 to 3-4).

Shown in Table 3-1 is a chart of voltage drop according to resistance increase.

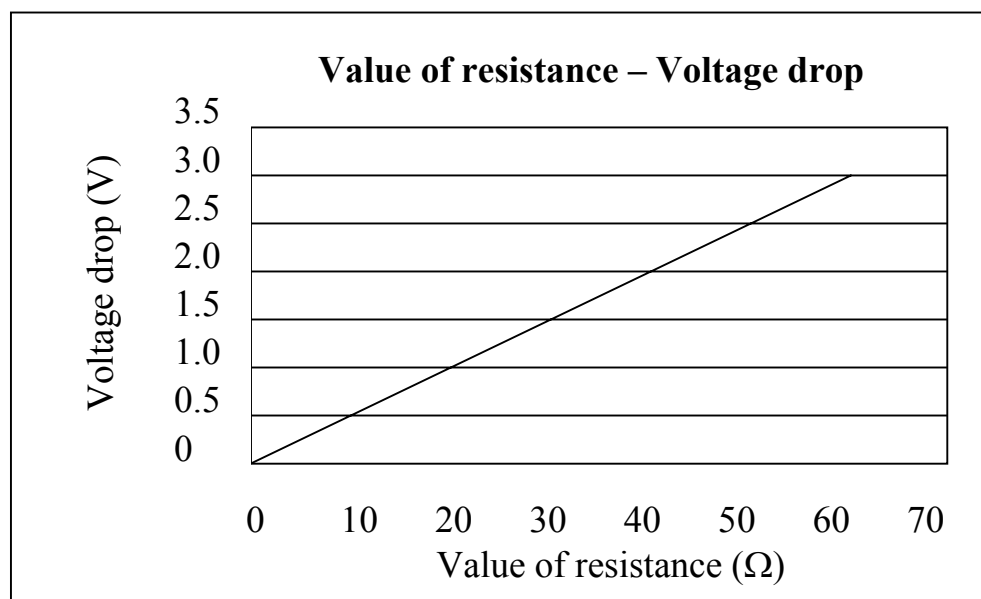


Table 3-1



3-4. Procedure of power on (only DS versions)

Procedure of power on is as follows:

Connect:

1. Connect TGM190.
2. Switch on receiver unit.

Disconnect:

1. Switch off receiver unit.
2. Disconnect TGM190.



4. Ordering data

TGM190-XX₁-X₂-XX₃-X₄-X₅-XXXX₆-XX₇-X₈-X₉-X₁₀

Standard requirements					
XX ₁	Voltage supply	05 ... 5V			
X ₂	Resolution	1...1μm	2 ... 2 μm	5 ... 5 μm	0 ... 10 μm
	Signal period	40 μm			
XX ₃	Output signals	DS - Line driver output: A/B and RI square wave			
		SV - Sinusoidal signals: A/B 1Vp-p, RI 0.5 V p-p			
		SI - Sinusoidal signals: A/B 11μAp-p, RI 5 μAp-p			
X ₄	Reference mark	0 ... without			
		1 ... selectable with magnet selector			
		3 ... every 100mm			
		4 ... Distance Coded - 80 mm pitch			
X ₅	Accuracy (at 20°C)	0 ... ± 10 μm			
XXXX ₆	Measuring length	Standard length [mm] 3240 ... 30040 by 200 mm steps			
Special requirements:					
XX ₇	Cable length	03 : 3m	Example: 1.5 : 1,5m, 25 : 25m		
X ₈	Connector*	See below			
X ₉	Metal flexible tube	0 ... without			
		1 ... with			
X ₁₀	Air inlet	0 ... without			
		1 ... with			

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

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



5. Specifications

MECHANICAL DATA:		
Standard measuring length "Lm" (mm)	3 m ÷ 30 m	
Reference mark	Standard: Positions at spacing of approximately 100 mm along the measuring length (magnet selector plate each 100 mm available) Option: Distance Coded Reference Mark – 80 mm pitch	
Accuracy class	± 10 µm/m	
Interval	40 µm	
Resolution	1, 2, 5, 10 µm	
Maximal speed	120 m/min	
Permissible acceleration	30 m/s ²	
Moving force for scanning unit	≤ 6N	
Degree of mechanical protection	IP 53, IP 64 (in compliance with mounting instructions)	
Vibrations (50...2000 Hz)	≤ 100 m/s ²	
Shocks (11ms)	100 m/s ²	
Temperature	operating: 0°C to 50°C storage: -20°C to 70°C	
Permissible relative humidity	20% - 70%	
Cable length	standard 3 m, extension on order to 20 m (SI output signals), extension on order to 50 m (DI, DS output signals), 150 m SV	
Mass	0.4 kg + 2.2 kg/m measuring length	
ELECTRICAL DATA:		
Output signals:	Voltage U _n	Current I _n
DS - square wave inverted RS422A standard:	5 V + 5%	≤ 150 mA
SV - sine-wave voltage 1V _{pp} :	5 V + 5%	≤ 100 mA
SI - sine-current wave:	5 V + 5%	< 100 mA

[illegible]



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.