Magnescale®

Compact High Accuracy Magnescales

SR27A-＊＊＊SAZY

SR27A-＊＊＊AAZY

(SIEMENS DRIVE CLiQ Model)

Exclusive Cables

CH22 Series

Specifications

Magnescale Co., Ltd.

Content

1. Product overview

1-1. Overview

This product is a position detection system for machine tools. The shielded high-precision absolute magnescale and the connection cable support the SIEMENS DRIVE-CLiQ serial communication.
This product adopts the magnetic detection system for superior environmental resistance from condensation and other effects.

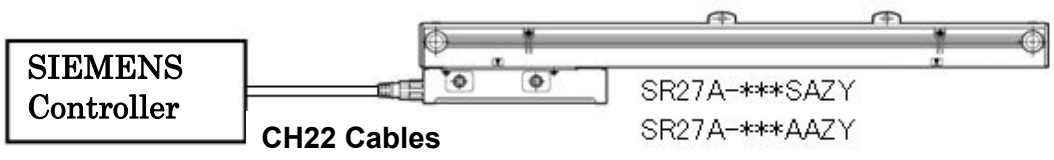
1-2. Scale

• The scale unit uses a shielded case made of steel to achieve a high rigidity despite its small cross-section.
• The scale unit and connecting cable are separated by connectors. This simplifies installing the scale unit and connecting the cable.
• The scale unit includes a built-in function for correcting variations in scale signal levels for enabling high-precision positioning. High-precision correction function developed exclusively by Magnescale Co., Ltd. is used to realize high precision and high resolution.
• The connection cable is designed to allow connection to either end of the scale head. The cable can therefore be routed from the left or right depending on the installation location.
• The unit contains a SIEMENS DRIVE-CLiQ interface chip to enable direct connection to a compatible controller.

1-3. Connection cable

• Two types of the connection cables are prepared. They are cables with and without conduits.
•The standard cables are 3, 5, 10, 15 m respectively. However, special order cables are available in 0.5 m units.

1-4. System configuration



1-5.Standard model name

Standard model name	Description	Function	Remark
SR27A-***SAZY	Magnescale (Absolute)	Precision grade 3+3L/1000 μmp-p	***: Effective length Expressed in cm units
SR27A-***AAZY		Precision grade 5+5L/1000 μmp-p	
CH22-***NSMY	Connection cable	6-wire twisted pair Conduit not included PU sheath	***: Cable length Expressed in 0.5m units

1-6. Details of SR27A and CH22 model names

S R 2 7 A – x x x ○ A Z Y

Reference point
Y: SIEMENS model

Communication protocol
Z: SIEMENS model

Resolution and polarity
A: SIEMENS model

Precision grade
A: 5 + 5L/1000 μm p-p
S: 3 + 3L/1000 μm p-p

Effective length
Expressed in cm units

C H 2 2 – x x x ○ □ △ #

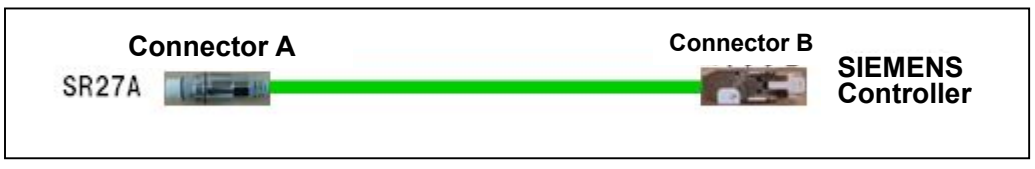
Cable length
(Example)
010 1.0 m
105 10.5 m

Terminal B specification
Y: RJ45
Z: RJ45(Waterproof)
F: M12

Terminal A specification
M: Magnescale
F: M12
E: M12 Pmt

Cable specification
S: SIEMENS Motion Connect 800 plus

Conduit specification
C: Including conduit
N: Not including conduit
R: Resin tube



1-7 Machinery Directive

This product is a functional safety magnescale which is compliant with the Machinery Directive 2006/42/EC.

1-8. Functional Safety

This product is a functional safety magnescale which is compliant with EN 61800-5-2:2007 / IEC61508:2010 / IEC 62061:2005 SC3 SIL 2 and EN ISO 13849-1:2008 Cat.3 PL d.

Behavior of the product when anomalies arise : The product shift s to a safe state within 5 ms when dangerous faults are detected.

Dangerous fault : The position information has an error(*1) of more than ±1 mm.

Safe state : The product shuts down position information communication with a controller and shift s to a safe state.

(*1) : The error position information described here is a threshold value which is considered as a dangerous fault value in terms of functional safety and is not the accuracy of the product. As for the accuracy of the product, see Section 2. “Specifications.”

The product is maintenance-free and it is not necessary to replace the parts periodically.

Functional safety specifications

Item \ Mode of operation		High demand / continuous mode
Probability of dangerous failure	Operating temperature : +50°C	PFH = 26.0 × 10-9 (1/h)
	Operating temperature : +25°C	PFH = 8.7 × 10-9(1/h)
	Operating temperature : 0°C	PFH = 3.8 × 10-9(1/h)
MTTFd		120.6 years (High)
DCavg		64.07% (Low)
Hardware fault tolerance		1
Product type		Type B
SIL		2

Normative references

Standard	Applied specification
IEC 61508:2010	Functional safety
IEC 62061:2005	Functional safety
EN ISO 13849-1:2008	Functional safety
IEC 60664-1:2007	Clearances (between PWB (Printed wiring board) patterns)specification
EN 61800-5-2:2007	Requirements related to Table D.16 Motion and position feedback sensors
IEC 62061:2005	Table D.1 Failure Mode
IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-6, IEC 60068-2-14, IEC 60068-2-27, IEC 60068-2-30 IEC 60068-2-32	Environmental Tests
IEC 61000-6-4:2006 +A1:2010 CISPR 16-1-1:2010, clause 4 CISPR 16-1-4:2010, clause 4.4 and 5 CISPR 16-2-3:2010, clause 7.2	Emission
IEC61000-6-2:2005 IEC 61326-3-1:2008 IEC 61000-4-2:2008 IEC61000-4-3:2006 +A1:2007 +A2:2010 IEC 61000-4-4:2004 +A1:2010 IEC 61000-4-6:2008	Immunity

For details about functional safety, contact our functional safety department.
45 Suzukawa, Isehara-shi, Kanagawa 259-1146, Japan
TEL: +81 (0)463 92 1011 FAX: +81 (0)463 92 1012

2.Specifications

2-1.SR27A

Item	SR27A-***SAZY, SR27A-***AAZY
Effective length (ML)	70 to 2040 mm (27 types) 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
Thermal expansion coefficient	12±1 × 10–6/ °C
Output signal	Compliant with SIEMENS DRIVE-CLiQ
Data format	Absolute
Detecting method	Magnetic(MR sensor)
Accuracy (at 20 °C) ML: Effective length (mm)	3 + 3ML/1000 μmp-p or 5 + 5ML/1000 μmp-p
Resolution	0.01 μm
Maximum response speed	200 m/min
Operating temperature range	0 to +50°C
Storage temperature range	–20 to +55°C
Vibration resistance	150 m/s2 (50 Hz to 3 kHz)
Impact resistance	350 m/s Minion Pro (11 ms)
Protective design grade	IP54 (Air purge not included), IP65 (Air purge included)
Power supply voltage	DC 24 V (DC 17 to 30.8 V) Compliant with SIEMENS DRIVE-CLiQ
Power consumption	Less than150 mA （Reference value: 28.8 V：less than1.75 W）
Inrush current	Less than 4 A (When the power supply rise time is 10 ms)
Power supply protection	In the case of errors such as a reverse-connected power supply or overvoltage, the internal fuse is cut to protect the power being supplied and wiring.
Dimensions	See section 7, “Dimensional Diagrams.”
Scale head sliding resistance	Less than 1 N
Mass	Approx. 0.27kg + 1.36kg/m

The information here is subject to change without notice.

2-2.CH22 Connection cable

Item	CH22-***NSMY
Conduit	None(standard) Cables with conduit or resin tube are available as special order products.
Cable sheath	PU(Polyurethane) (MOTION CONNECT 800+ made by SIEMENS)
Cable length	3, 5, 10, 15 m (standard product), Supports only 0.5 m units from 1 to 30 m (special-order product)
Connector	Scale head side：10 pin circular connector(Magnescale exclusive) Controller side：6FX2003-0DC20(RJ45)made by SIEMENS
Connection connector	RJ45 connectors(waterproof) or M12 connectors are available as special order products.
Protective design grade	IP65（when scale head and connector are connected）
Safety standard Safety regulation	Not applicable
Operating temperature range	0 ~ +50 □
Storage temperature range	-20 ~ +55 □
Mass	Approx. 0.02 kg + 0.157 kg/m
Recommended minimum bending radius (when there is repeated bending)	75 mm
Recommended minimum bending radius (when there is no repeated bending)	35 mm
Dimensions	See section 7, “Dimensional Diagrams.”

2-3. Standard accessories

Item	Quantity
Instruction Manual	1
Supplemental Manual	1
M4 Hex. nuts	2
Liner	1
M4 × 10 Hex. socket-head cap screws	2
M4 × 20 Hex. socket-head cap screws	2
M4 × 25 Hex. socket-head cap screws	2
M8 × 16 Hex. socket-head cap screws	2
Spacer: t = 0.1 mm	2
Spacer: t = 0.2 mm	2

2-4. Alarms

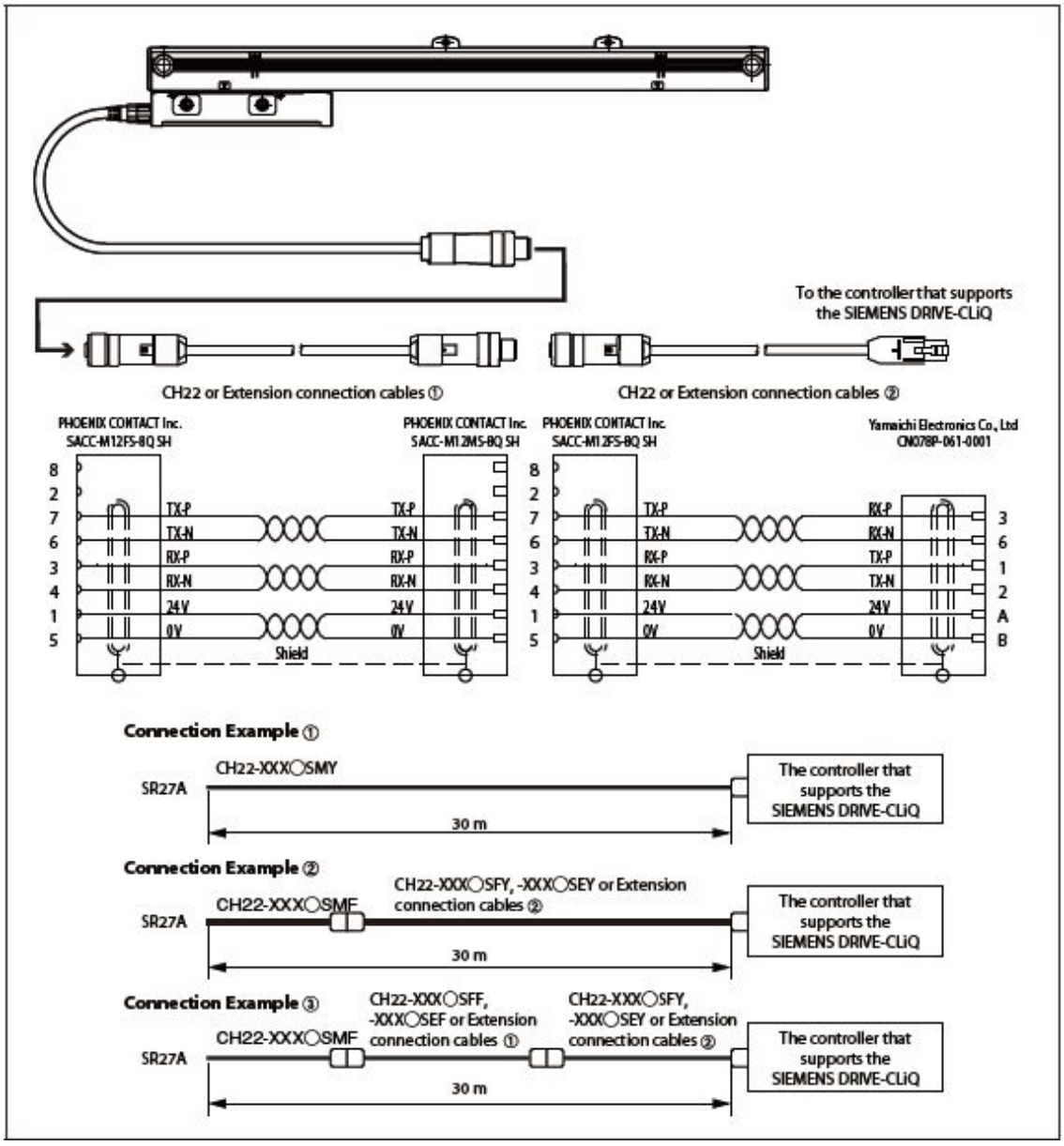
This product outputs alarm information to the controller based on the errors detected and the results of self-diagnosis.
Contained in the alarms is the bit information which indicates the causes of the alarms referred to as “fault causes,” and these are defined for this product as below. If you suspect a fault in this product, please contact our sales or service department with all available alarm data.

bit	Name		Details
31	Functional safety redundant system statuses	Reserved	Normally 1
30		Reserved	Normally 0
29		Service code 2 [3]	Service information 2 [3] Normal 0
28		F2	alarm fl ag: 1 no alarm: 0
27		Service code 2 [2]	Service information 2 [2] Normal 0
26		Service code 2 [1]	Service information 2 [1] Normal 0
25		Service code 2 [0]	Service information 2 [0] Normal 0
24		PDV	Position data valid: 1 invalid: 0
23		Hardware Fault	Hardware system fault
22		Wrong Pos detected	FS position fault
21		Reserved	Normally 0
20		Reserved	Normally 0
19		INC Level Fault	Incremental sensor fault
18		Other Fault	Other faults
17		Self Test Fault	P-on diagnostic fault
16		Mutual Diag Fault	FS monitoring fault
15	Status of precision measurement system	Reserved	Normally 0
14		Reserved	Normally 0
13		Service code 1 [3]	Service information 1 [3] Normal 0
12		F1	alarm fl ag: 1 no alarm: 0
11		Service code 1 [2]	Service information 1 [2] Normal 0
10		Service code 1 [1]	Service information 1 [1] Normal 0
9		Service code 1 [0]	Service information 1 [0] Normal 0
8		PDV	Position data valid: 1 invalid: 0
		Hardware Fault	Hardware system fault
6		Wrong Pos detected	FS position fault
5		INC Speed Fault	Over speed fault
4		ABS Sensor Fault	Absolute sensor fault
3		INC Level Fault	Incremental sensor fault
2		Other Fault	Other faults
1		Self Test Fault	P-on diagnosis fault
0		Mutual Diag Fault	FS monitoring fault

3.Wiring Connections with a Controller

3-1. Wiring Connections with a Controller

This product and the controller that supports the SIEMENS DRIVE-CLiQ can be connected with a cable made by SIEMENS. Both of the power and signal can be connected with a cable made by SIEMENS.



Extension connection cable①

SIEMENS model no. 6FX8002-2DC34-□□□□

Extension connection cable②

SIEMENS model no. 6FX8002-2DC30-□□□□

AS for the specifications of extension connection cables and purchasing of the cables, contact SIEMENS.

3-2. Version Numbers of a Controller

Be sure to use the following combination of the controller version numbers when using the magnescale that supports the SIEMENS DRIVE-CLiQ.

SINUMERIK soft ware version : 4.4SP2 or later

SINAMICS firmware version : 4.4SP1 or later

The functions of the controller may be restricted with any combinations other than the above.

As for details of the versions and functions of the controller, contact SIEMENS.

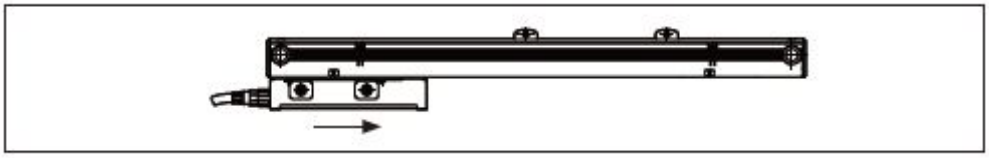
3-3. Others

3-3-1. Details of output signal

(1) Measurement direction

This product performs data communication with the controller using the SIEMENS DRIVE-CLiQ protocol.

Moving the scale head in the direction of the arrow gives an addition. (polarity +)



(2) Color of cable wiring

The following describes colors of wiring cables and signals.

Color of cable	Signal
Red	POWER
Black	POWER GND
Pink	RX_P
Blue	RX_N
Green	TX_P
Yellow	TX_N

4. Air Purge

In the standard configuration, an M5 tap hole for air purging is provided in the end cap section of the scale.

Air can be injected into the scale unit to reduce the effects of the environments shown below.

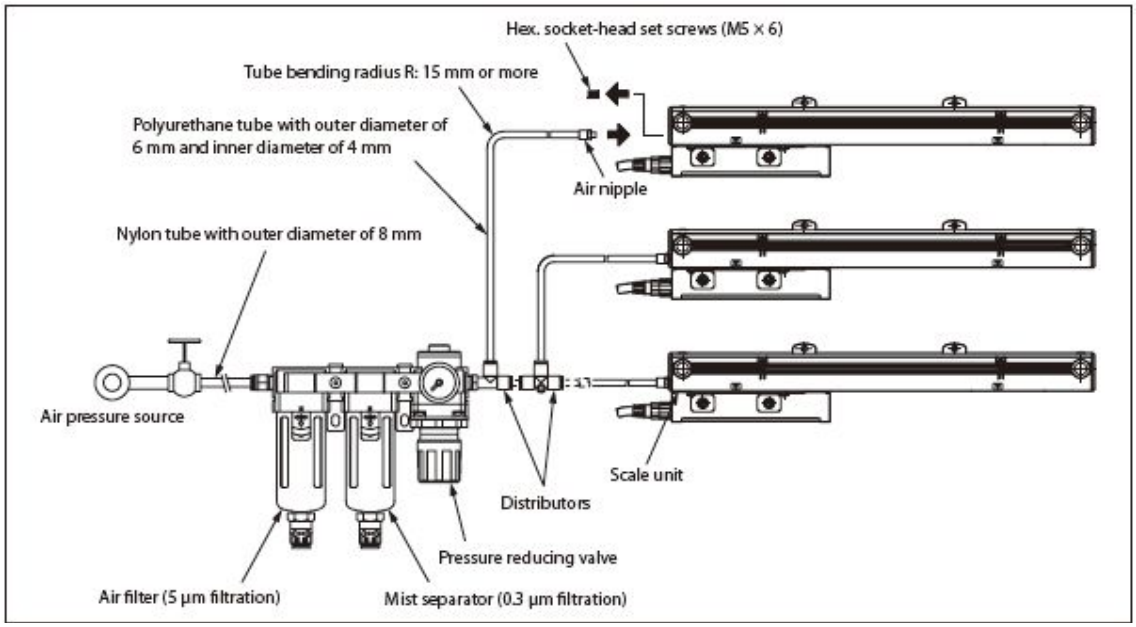
The actual effects, however, will vary depending on operating conditions. Therefore, be sure to fully check the effects before using air purge.

• Use in dusty area

• Use in locations close to coolants

Air Tube Route and Device Configuration

Prepare the devices as shown in the figure below, and air is injected into the scale by connecting the air tubes.



The customer must obtain the air supply unit and input/output air tube. The recommended main air supply components are shown in the table below.

Manufacturer	Model	Name	Quantity
SMC Corporation	AF3000-02C	Air filter: Filtration 5 µm	1
SMC Corporation	AFM3000-02C	Mist separator: Filtration 0.3 µm	1
SMC Corporation	AR3000-02G-1	Regulator with 200 kPa pressure gauge	1
SMC Corporation	Y30L	Spacer assembly with L-type bracket	2

Tube Layout Notes

Tube arrangement

Use tubes with a bending radius of at least 15 mm and make sure that there are no sharp bends. Also, if the tubes are laid parallel within the ducts for the electrical wiring or hydraulic tubes, be careful that the tubes are not crushed by the movement of the ducts.

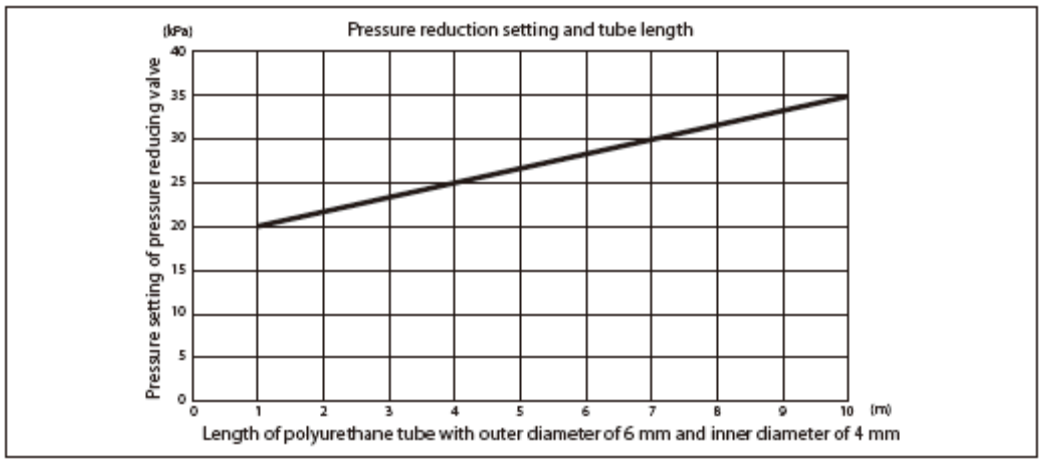
Tube length

To inject air simultaneously into multiple scales, make the tubes the same length from the distributor of the air supply unit to each scale so that the injection air pressure is uniform for each scale.

Pressure setting and tube length for pressure reducing valve

If the air injection pressure for each scale is around 20 ±10 kPa, the air in the scale can be maintained at a low humidity. However, setting the air injection pressure only via the pressure reducing valve will not result in an air injection pressure of 20 ±10 kPa due to pressure losses stemming from the tube length.

Refer to graph below to determine the pressure setting of the pressure reducing valve.



This graph illustrates the relationship between the regulator pressure setting and tube length when the air injection pressure is 20 kPa. The tube length here is considered to be the length from the distributor of the air supply unit to the scale. When the air injection pressure is 20 kPa, the air consumption amount per scale unit is approximately 30 N /min.

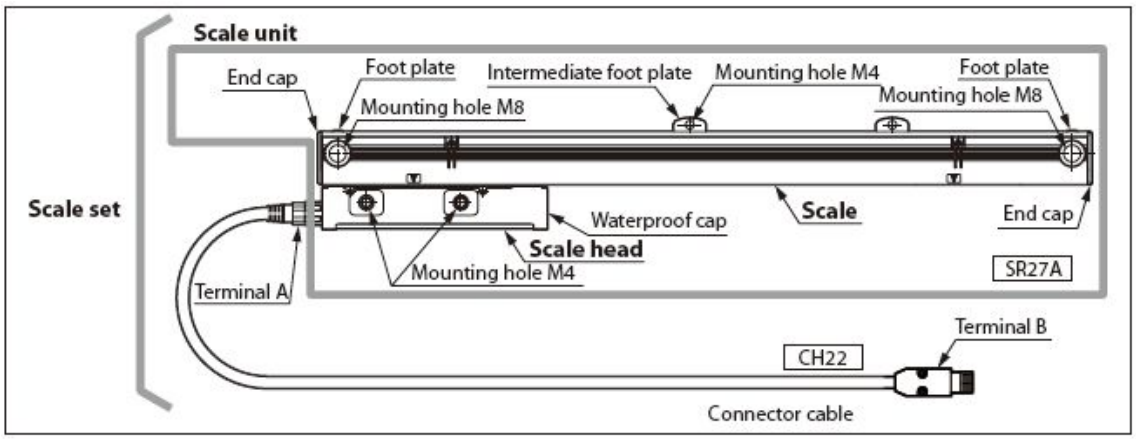
Tube flushing

Flush the tube from the air pressure source to the air supply unit connectors and each scale connector.

Flushing cleans the tubes, prevents the embedding of foreign objects in the equipment, and is also useful to check the tubes.

5. Installation

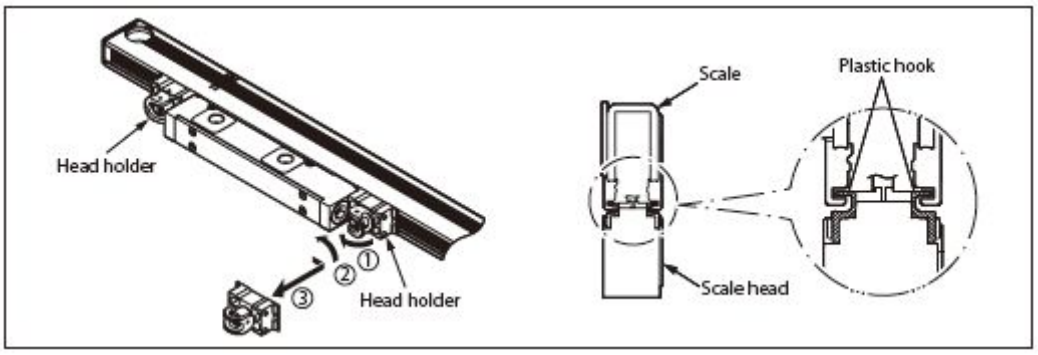
5-1. Names of parts



5-2. Installing the scale unit

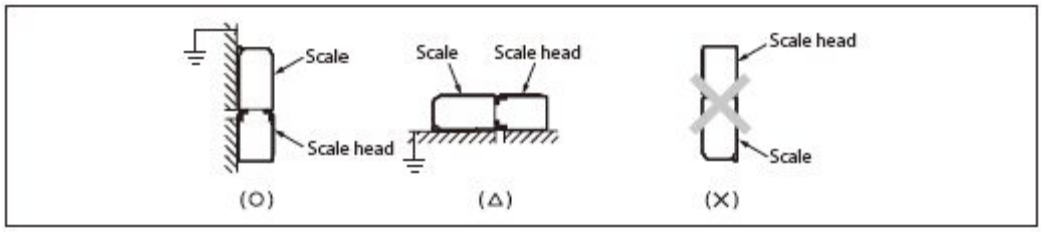
• Do not turn on the power before installing the scale unit.

• Do not take off the head holders, if possible, until immediately before securing the scale head. Even if the head holders are removed, the approximate positional relationship of the scale and scale head will be maintained. However, the plastic hook can come off if the scale head is forcibly twisted or other excessive force is applied. If the plastic hook comes off , return the plastic hook back to its original position before performing the installation.



• The scale head will be damaged if the scale head is moved outside the effective length (ML). The scale head must always be moved within the effective length.

• Install the scale unit so that the scale is on the upper side of the scale head.
If the upper side is not available, set it to face horizontally.



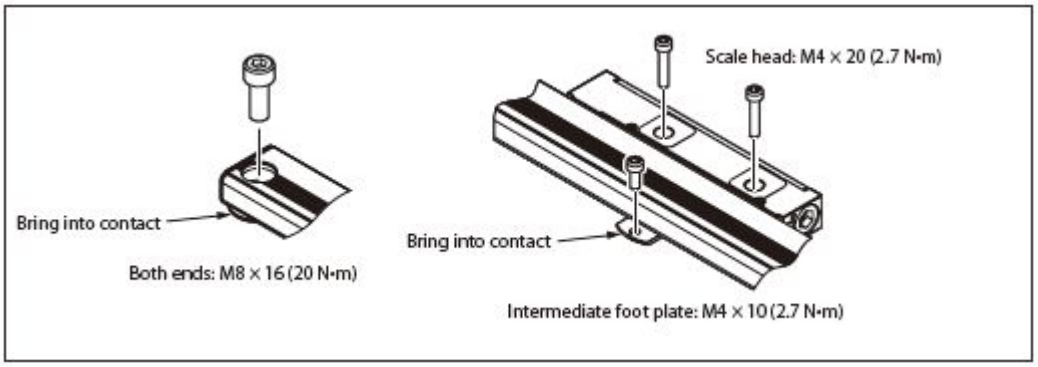
• Use a scale installation bracket, where applicable, having length covering the entire scale length. The parallelism of the scale may be harmed if only using a bracket divided for the installation section.

• Check that the alignment of the installation surface (or installation brackets) is within the standards.

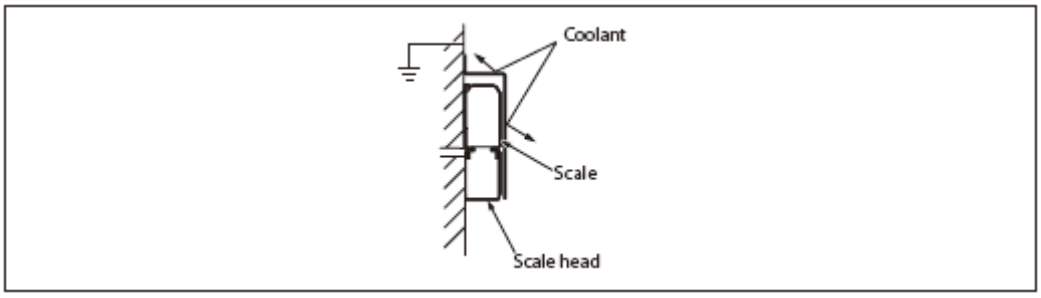
• Remove off the coating around the tap hole to ground the scale unit using the installation surface contact with the scale.

• The foot plates and intermediate foot plate(s) installed on the scale are used as the installation guides. The head holders are used for securing the scale head when transporting the head holders and cannot therefore be used as an installation guide.

• Loosely turn the mounting screws first. Determine the alignment and then tighten the screws to fasten the scale.



• In environments where coolant can splash directly on the scale unit, be sure to mount a cover on the scale unit to protect the scale unit from splashing.

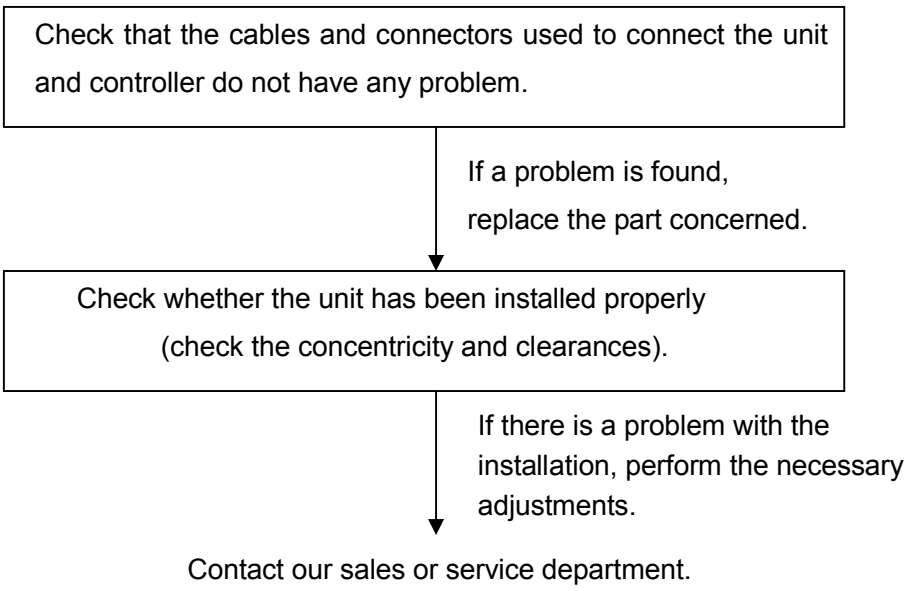


• In order to protect from noises,

- Locate relays, solenoids and motors to be used in conjunction with the scale far from the scale unit and signal output cable.
- Do not place the power line of the equipment to be used with the scale close to the scale output cable. Keep at least 20 cm distance between them.
- If the power line of the equipment crosses the scale output cable, place them at right-angle intersection.

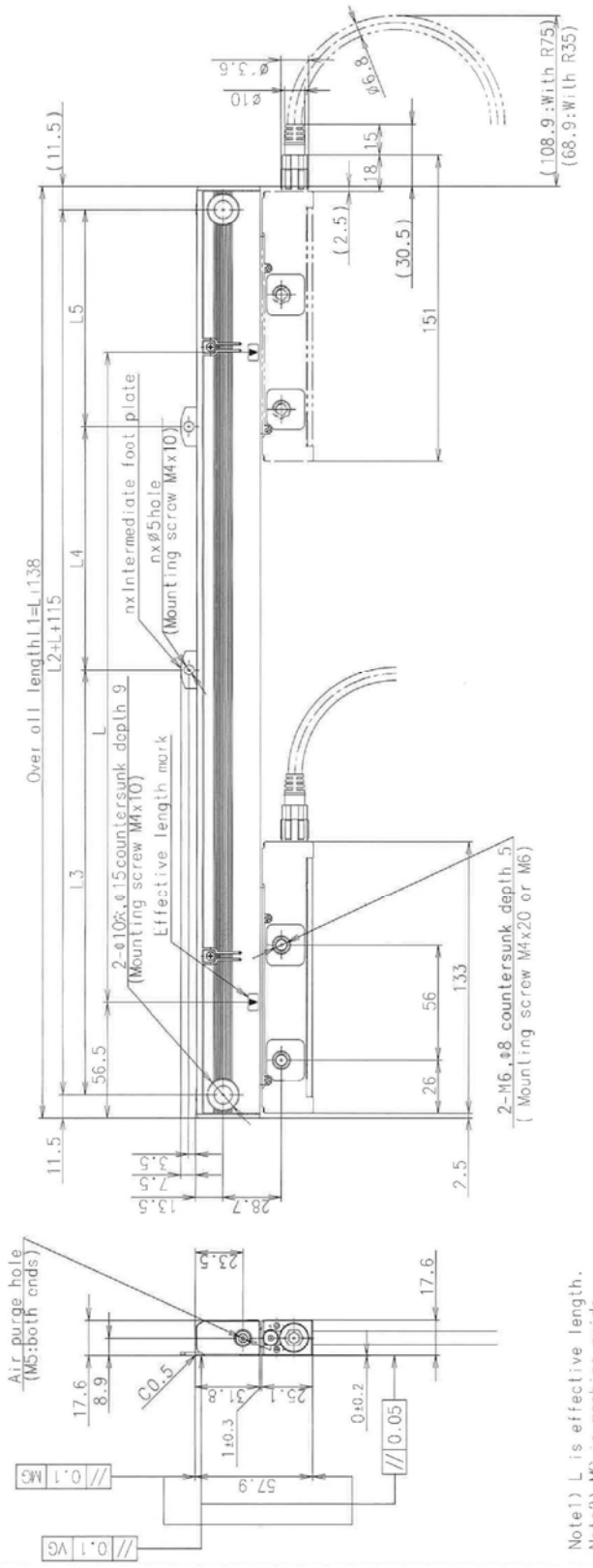
6. Trouble shooting

If a problem with the rotary magnescale is suspected, take the steps below to resolve the problem.



7. Dimensional diagrams

7-1. SR27A(cable extending to right)



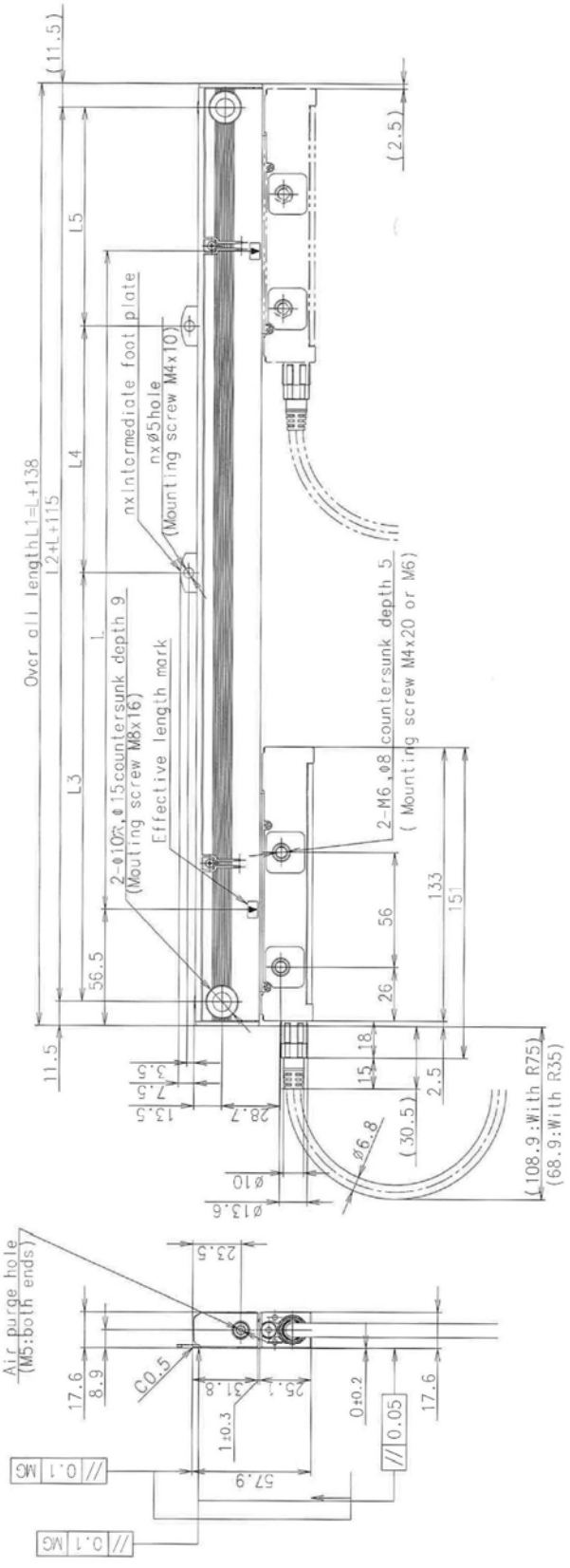
Note1) L is effective length.
Note2) M5 is machine guide.
※Intermediate foot plate : Installed in one location when L ≧ 720mm and two locations when L ≧ 1440mm.

unit:mm

L	L1	L2	L3	L4	L5	n
70	208	185	-	-	-	0
120	258	235	-	-	-	0
170	308	285	-	-	-	0
220	358	335	-	-	-	0
270	408	385	-	-	-	0
320	458	435	-	-	-	0
370	508	485	-	-	-	0
420	558	535	-	-	-	0
470	608	585	-	-	-	0
520	658	635	-	-	-	0
570	708	685	-	-	-	0
620	758	735	-	-	-	0
670	808	785	392.5	-	392.5	1
720	858	835	417.5	-	417.5	1

L	L1	L2	L3	L4	L5	n
770	908	885	442.5	-	442.5	1
820	958	935	467.5	-	467.5	1
920	1058	1035	517.5	-	517.5	1
1020	1158	1135	567.5	-	567.5	1
1140	1278	1255	627.5	-	617.5	1
1240	1378	1355	677.5	-	677.5	1
1340	1478	1455	727.5	-	727.5	1
1440	1578	1555	520	520	515	2
1540	1678	1655	550	550	555	2
1640	1778	1755	585	585	585	2
1740	1878	1855	620	620	615	2
1840	1978	1955	650	650	655	2
2040	2178	2155	720	720	715	2

7-2. SR27A(cable extending to left)



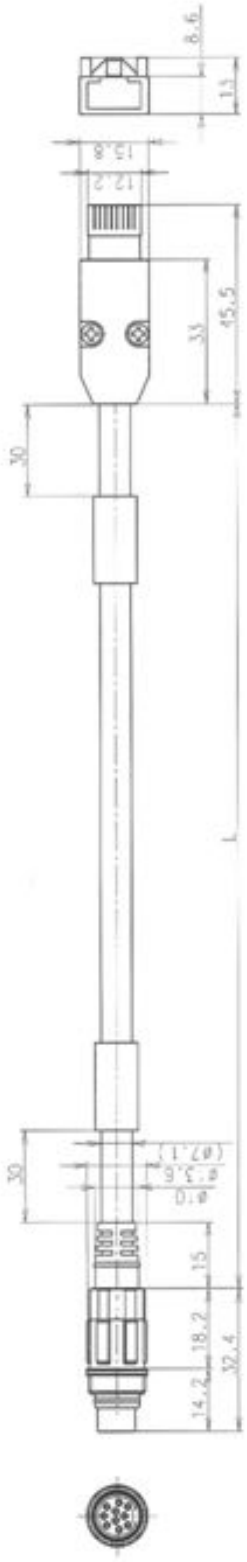
Note1) L is effective length
Note2) MG is machine guide
※Intermediate foot plate : Installed in one location when L ≧ 720mm and two locations when L ≧ 1440mm

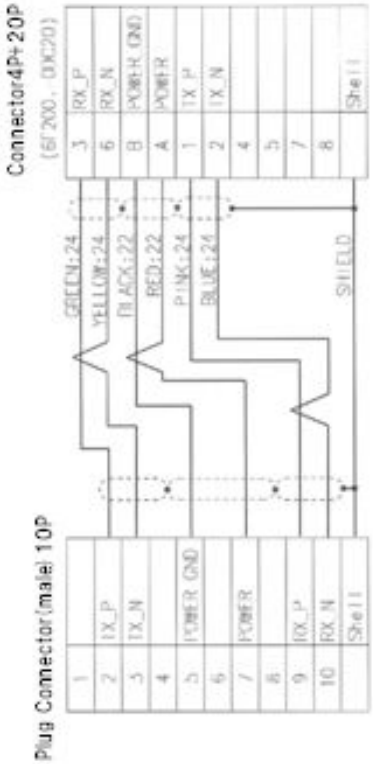
unit:mm

L	L1	L2	L3	L4	L5	n
70	208	185	-	-	-	0
120	258	235	-	-	-	0
170	308	285	-	-	-	0
220	358	335	-	-	-	0
270	408	385	-	-	-	0
320	458	435	-	-	-	0
370	508	485	-	-	-	0
420	558	535	-	-	-	0
470	608	585	-	-	-	0
520	658	635	-	-	-	0
570	708	685	-	-	-	0
620	758	735	-	-	-	0
670	808	785	392.5	-	392.5	1
720	858	835	417.5	-	417.5	1

L	L1	L2	L3	L4	L5	n
770	908	885	442.5	-	442.5	1
820	958	935	467.5	-	467.5	1
920	1058	1035	517.5	-	517.5	1
1020	1158	1135	567.5	-	567.5	1
1140	1278	1255	627.5	-	617.5	1
1240	1378	1355	677.5	-	677.5	1
1340	1478	1455	727.5	-	727.5	1
1440	1578	1555	520	520	515	2
1540	1678	1655	550	550	555	2
1640	1778	1755	585	585	585	2
1740	1878	1855	620	620	615	2
1840	1978	1955	650	650	655	2
2040	2178	2155	720	720	715	2

7-3. CH22


8.6
13
12.2
33
45.5
30
L
30
15
18.2
32.4
14.2


Connector4P+20P
(6/200 . DK/20)
3 RX_P
6 RX_N
8 POWER GND
A POWER
1 TX_P
2 TX_N
4
5
7
8 Shell
GREEN:24
YELLOW:24
BLACK:22
RED:22
PINK:24
BLUE:24
SHIELD
Plug Connector(male) 10P
1
2 TX_P
3 TX_N
4
5 POWER GND
6
7 POWER
8
9 RX_P
10 RX_N
Shell