MANUAL No. 29706E1.9
Published in Jul.1997
Revised in Jul.2009

VN SERIES

THICKNESS MEASUREMENT CONVERTER

INSTRUCTION MANUAL

SHINKAWA Sensor Technology, Inc.

FOREWORD

VN

For Use in Safety.....

Thank you for your using our VN Thickness Measurement Converter.

SHINKAWA Sensor Technology applies strict quality control and inspections to ensure the high reliability of its products.

This instruction manual contains descriptive, information, specifications, operating, setting, and adjusting procedures.

Please study contents of this manual and related manuals thoroughly before installing or operating the equipment, and keep it handy for future reference.

> ⚠ CAUTION
>
> 1. Do not measure insulation resistance and dielectric strength other than those at places specified.
>
>   If measured, transducer damage may result.
> 2. Do not remodel this unit without permission. Otherwise the guarantee can not be made.
> 3. This unit is designed for use by specialists or persons thoroughly familiar with the field.
> 4. Make sure that the end user receives the Instruction Manual delivered with this unit.

Before Use.....

When the unit is delivered, inspect it for damage suffered in transport and check whether it is the item you ordered. In the unlikely event that it was damaged in transport or does not function according to specifications, please contact the SHINKAWA Office or dealer nearest you.

Store the unit under the ambient conditions given in the specification.

Avoid places where it is exposed to high humidity or corrosive gases.

TABLE OF CONTENTS

VN

1. GENERAL INFORMATION VN

1-1 GENERAL

This Thickness Maeasurement Converter is composed of an eddy current type Model VN Displacement Transducer (consisting of a sensor, an extension cable, and a displacement converter) and Touch-Roll attachment.

This system is used to measure the thickness of sheet type non-conducting products such as plastic film or rubber sheet etc.

Based on the eddy current principle, this converter features superior environmental resisatnce because it is not affected by water, oil, dust, etc. as are optical, ultrasonic, or x-ray systems. In addition, it is safe and easy to operate and allows the user to build up a compact system.

1-2 FEATURES

- Superior temperature characteristics

	Measured range 1,000μm、2,000μm	Measured range more than 4,000μm
Sensor	Within ±0.015% of F.S./℃	Within ±0.03% of F.S./℃
Extension cable	Within ±0.01% of F.S./℃	Within ±0.02% of F.S./℃
Converter	Within ±0.04% of F.S./℃	Within ±0.05% of F.S./℃

- High accuracy

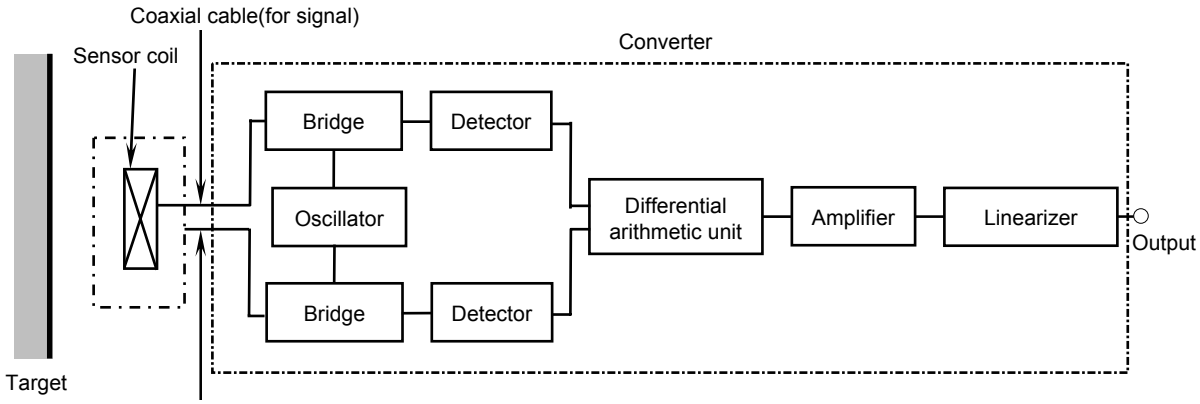
  Linearity : Within ±0.5% of F.S. at 25°C

- Superior environmental resistance

  Features a high-reliability eddy-current non-contact type displacement sensor that is not affected by water, oil, dust, etc.

2. PRINCIPLE OF OPERATION VN

2-1 EDDY-CURRENT NON-CONTACT DISPLACEMENT CONVERTER



Block diagram

This eddy-current non-contact type displacement converter is a touch-roll type high-accuracy thickness measuring system consisting of a sensor with built-in coil, two coaxial cables for signal transmission and compensation bundled together to form an extension cable, and the circuit block shown in the drawing.

As shown in the drawing, a high frequency current of several MHz is supplied from an oscillator to the sensor coil, producing high frequency magnetic flux in the sensor coil. When a metal object (target) approaches this magnetic field, eddy-current is generated on the target surface. The magnitude of these eddy-currents varies with the distance between sensor coil and target, thereby changing the sensor coil inpedance. The inpedance variation is converted through bridge and detection circuits to voltage variation, and from this the voltage corresponding to the sensor-target distance is obtained.

To minimize output drift caused by impedance variation of the signal cable with canges in temperature, a compensation cable is provided in parallel to the signal cable. The cable impedance variation that is the cause of drift is detected in the form of voltage variation. The value obtained by differential calculation is used to compensate for temperature drift of the extension cable.

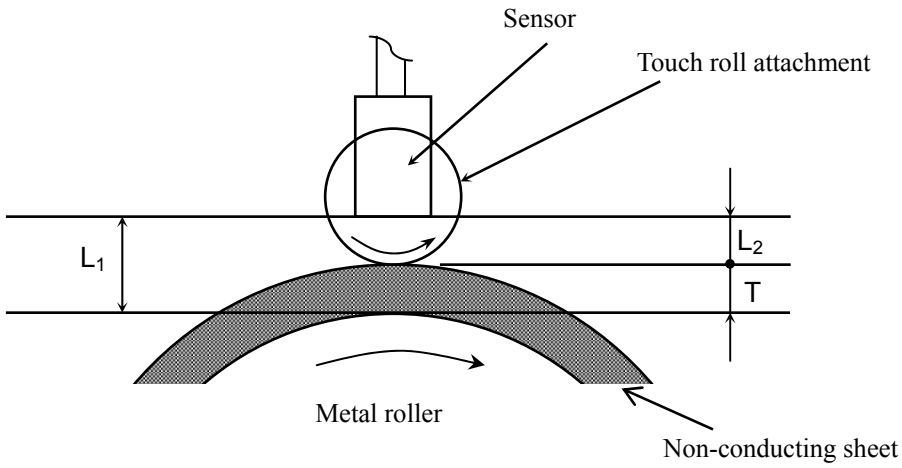
The highly stable voltage signal corresponding to the sensor-target distance obtained in this way is linearized and output as a voltage signal proportional to the distance.

2-2THICKNESS MEASUREMENT WITH THE TOUCH-ROLL ATTACHMENT

As shown in the drawing, the eddy current displacement sensor is fixed to the touch-roll attachment at a constant offset L_2 (standard 800μm). According to this measurement principle, the eddy current displacement sensor always measures the distance L_1 to a metal roller without detecting the non-conducting sheet, and determines the thickness T of the non-conducting sheet as $T=L_1-L_2$.

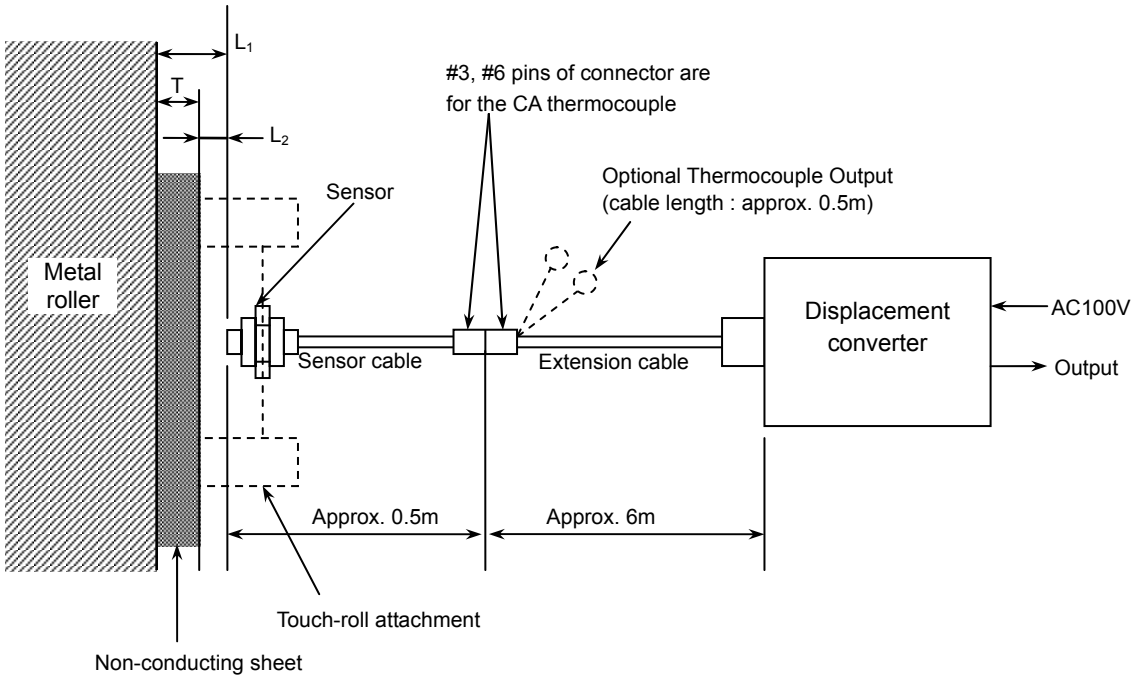
The converter output is adjusted to becomes 0V when the distance between sensor and metal roller equals L_2 (standard 800μm), so that a voltage proportional to the thickness T of the non-conducting sheet is obtained.

Moreover, adjustment of the sensitivity to 1V/mm makes scaling with the voltmeter or recording meter unnecessary and allows direct reading of the measured thickness value.



3. CONFIGURATION

VN



L_1 ; The distance between sensor tip and metal roller

L_2 ; The fixed distance (standard 800μm), which varies according to the attachment

T ; The thickness of the non-conducting sheet

CAUTION

As the case of the displacement transducer is connected to 0V, isolate the case from ground if trouble occurs.

To prevent noise, the junction connector should not be grounded after connection.

4. SPECIFICATION

4-1 SPECIFICATIONS

Model Code / Additional Spec. Code(No entry if additional spec. code is not specified.)

• Converter

VN- □□□ A- □□ /SLC

Thickness measured range		Power supply		Extension cable		Silicon
010	0 to 1,000μm	0	100VAC	0	With 6m extension cable	
020	0 to 2,000μm	1	115VAC			
040	0 to 4,000μm	2	200VAC	1	Without extension cable	
050	0 to 5,000μm	3	220VAC			
080	0 to 8,000μm					
100	0 to 10,000μm					
250	0 to 25,000μm					

• Extension cable(length : 6m)

NW-100A (without thermocouple)

NW-100B (with thermocouple)

• Sensor

NS- □□□ A (without thermocouple)

NS- □□□ B (with thermocouple)

NS- □□□ C (without thermocouple, extension cable)

Thickness measured range	
020	0 to 1,000 or 0 to 2,000μm
050	0 to 4,000 or 0 to 5,000μm
080	0 to 8,000μm
100	0 to 10,000μm
250	0 to 25,000μm

• Touch-roll attachment

NT- □□□A/AG □ /SGL/NWT

Specification		Angle*1		Roller oscillation *1	No weight
020	For NS-020□	0	0°	Horizontal±15°	
050	For NS-050□	1	10°		
080	For NS-080□	2	20°		
100	For NS-100□	3	30°		
250	For NS-250□	4	40°		

*1 Applicable for NT-020,NT-050 only.

SPECIFICATIONS

Measured range (specified by Model Code No.)	Thickness measured range	Actual gap	Note) • Actual gap (distance between sensor tip and target) is thickness measured range + off set gap (800μm). • Actual gap shall be indicated as the measured range in inspection report and name plate etc.
	0 to 1,000μm	800 to 1,800μm	
	0 to 2,000μm	800 to 2,800μm	
	0 to 4,000μm	800 to 4,800μm	
	0 to 5,000μm	800 to 5,800μm	
	0 to 8,000μm	800 to 8,800μm	
	0 to 10,000μm	800 to 10,800μm	
	0 to 25,000μm	800 to 25,800μm	
Calibration	Material ( ) Shape ( )		• Calibrated using a specified target. Supply the target if it has a special material and shape.
Linearity	Within ±0.5% of F.S. at 25°C (77°F REF.)		
Frequency response	DC to 20Hz(-1dB)		
SN ratio	More than 60dB (typical value)		

Output signal	Thickness measured range	Actual gap	Output	Output sensitivity
	0 to 1,000μm	800 to 1,800μm	0 to 1V	1V/1,000μm
	0 to 2,000μm	800 to 2,800μm	0 to 2V	
	0 to 4,000μm	800 to 4,800μm	0 to 4V	
	0 to 5,000μm	800 to 5,800μm	0 to 5V	
	0 to 8,000μm	800 to 8,800μm	0 to 8V	
	0 to 10,000μm	800 to 10,800μm	0 to 10V	
	0 to 25,000μm	800 to 25,800μm	0 to 2.5V	1V/10,000μm

Zero shift	VN-010A to VN-050A : ±100μm VN-080A to VN-250A : ±5% of F.S.
Output impedance	Less than 1kΩ
Operating temperature	Converter : 0 to 50°C Sensor : -30 to +130°C(connector : -25 to +85°C) Extension cable : -25 to +85°C The above specifications may alter due to measuring conditions such as humidity and temperature gradient, etc. Contact us for details.
Power supply (specified by Model Code No.)	100VAC or 115VAC or 200VAC or 220VAC±10% 50/60Hz

Note) Thickness measured range is the actual measurable thickness of the measured object.

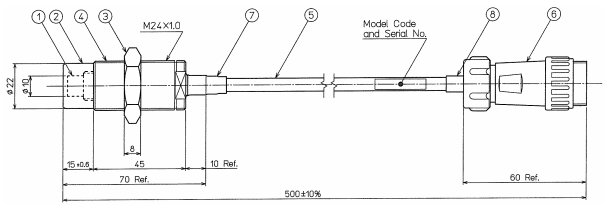
5. OUTLINE DRAWINGS

VN

5-1 SENSOR

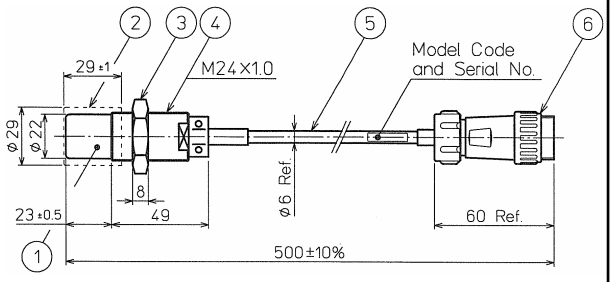
No.	Name	Remarks
1	Sensor tip	Ceramics
2	Sensor cover	Glass epoxy
3	Jam nut	Stainless steel
4	Threaded Portion	Stainless steel
5	Sensor cable	———
6	Connector	———
7	Cable protective tube	NBR.

NS-020



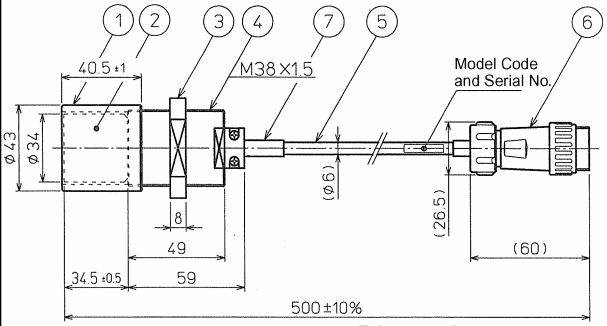
Dimensions : mm

NS-050



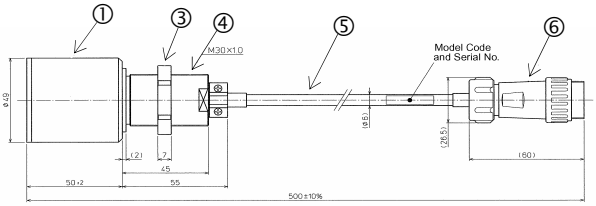
Dimensions : mm

NS-080



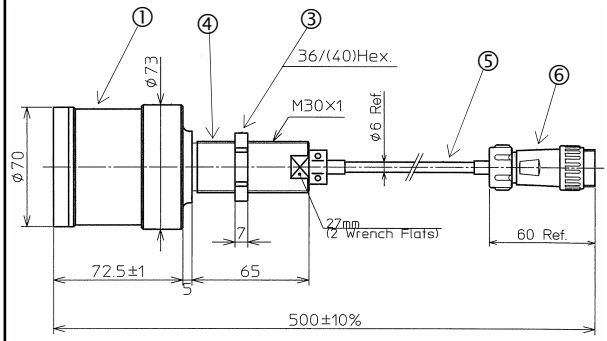
Dimensions : mm

NS-100



Dimensions : mm

NS-250

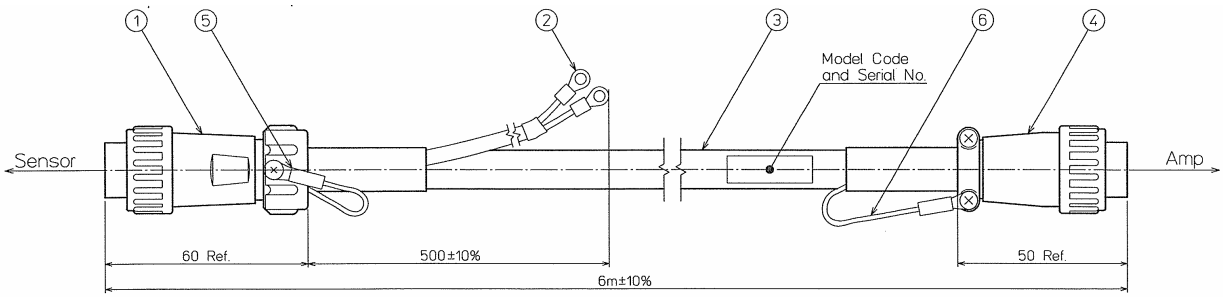


Dimensions : mm

5. OUTLINE DRAWINGS

5-2 EXTENSION CABLE

No.	Name	Remarks
1	Connector	NJW-207-PF
2	Thermocouple cable	——
3	Extension cable	——
4	Connector	NJC-207PF
5	Earth cable	——
6	Earth cable	——



Dimensions : mm

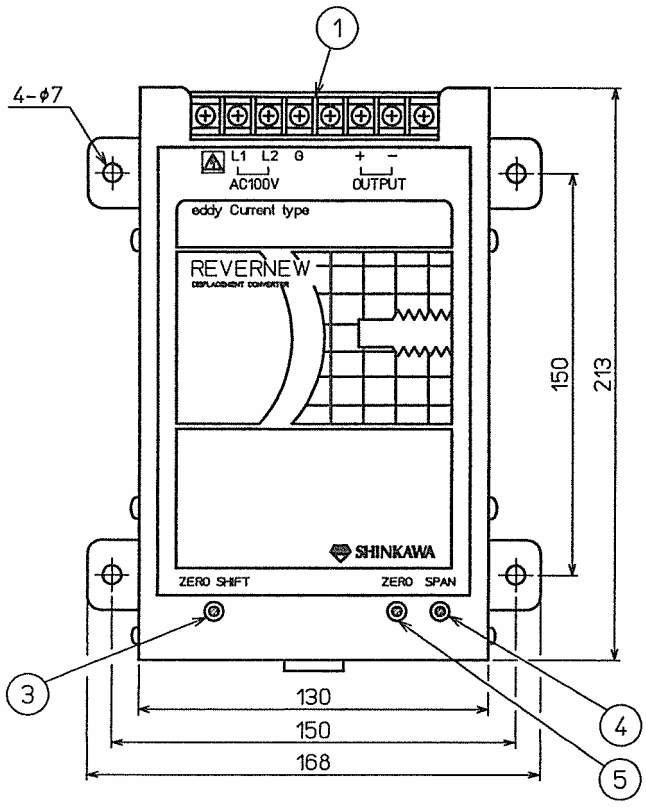
Without thermocouple cable : NW-100A
With thermocouple cable : NW-100B

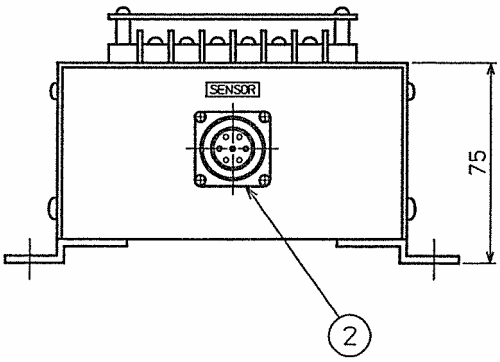
5-3 DISPLACEMENT CONVERTER

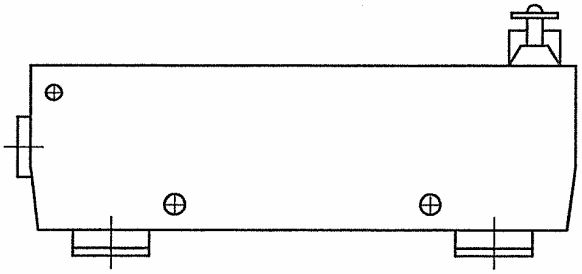
No.	Name	Remarks
1	Terminal block	6P
2	Input connector	——
3	Zero shift volume	——
4	Zero adjustment volume	——
5	Span adjustment volume	——

FINISH : Munsell 7.5GY5/2（equiv.）

WAIGHT : Approx. 2kg







Dimensions : mm

VN-□□□A

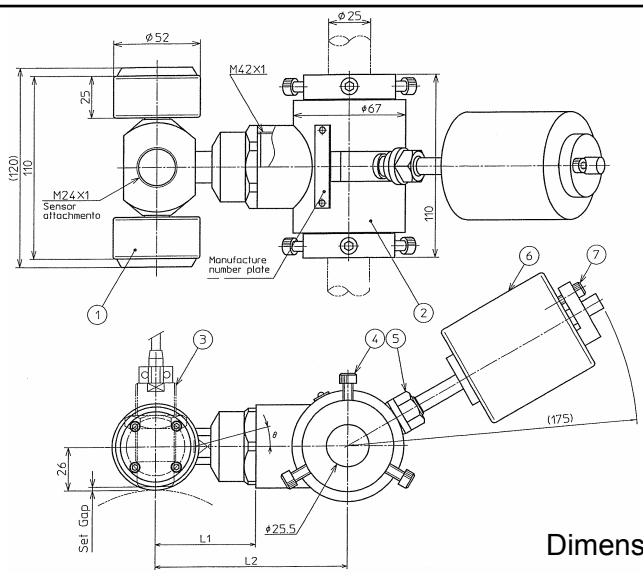
5. OUTLINE DRAWINGS

VN

5-4 TOUCH-ROLL ATTACHMENT

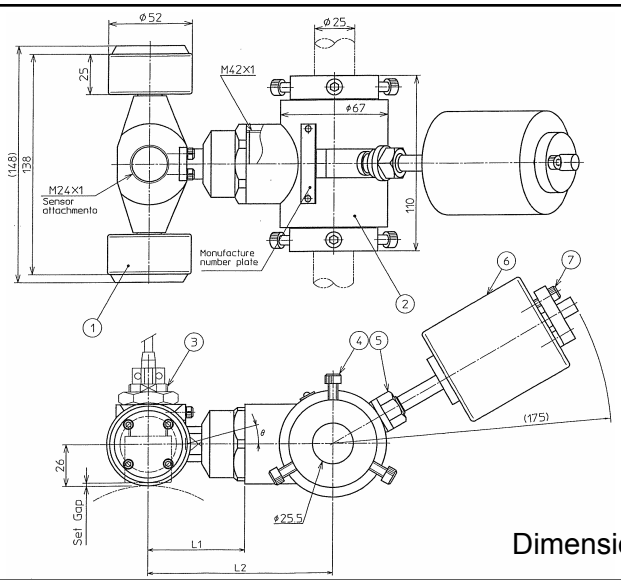
No.	Name	Remarks
1	Roller	———
2	Body	———
3	Sensor	———
4	Clamp nut	———
5	Adjust nut of angle	———
6	Weight	Approx. 2Kg
7	Clamp screw	———

NT-020A



Dimensions : mm

NT-050A

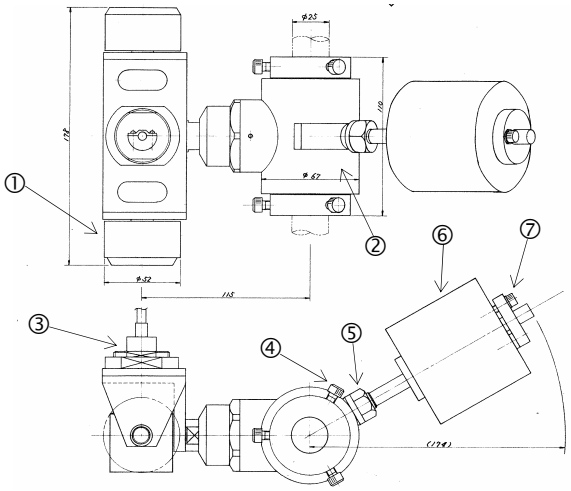


Dimensions : mm

5. OUTLINE DRAWINGS

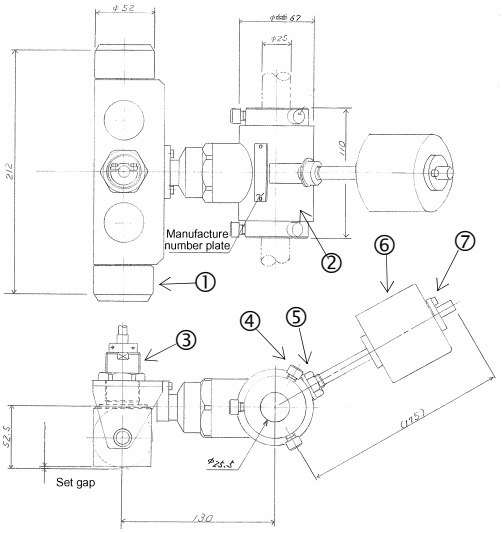
VN

NT-080A



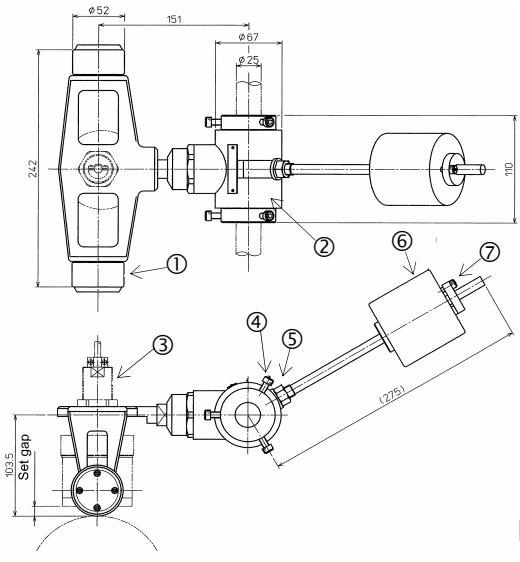
Dimensions : mm

NT-100A



Dimensions : mm

NT-250A



Dimensions : mm

6. OPERATING METHOD VN

6-1 MOUNTING OF CONVERTER

If mounting the converter in a panel or rack, etc., fix the mounting angles of the converter with M6 screws or bolts. (The mouting screws are not supplied.)

CAUTION Avoid installing the converter in locations where it is unstable or exposed to strong vibration, high temperatures, high humidity, etc

6-2 INTERCONNECTION

Connect the extension cable between the sensor cable connector and the connector marked ″SENSOR″ of the converter. (Connect the black connector to the sensor and the green one to the converter.)

Connect the power cable (AC100V) to the L1, L2 terminals on the ″AC100V″ terminal block at the top of the converter.

Connect the G terminal on the terminal board at the top of the converter to ground.

The converter output is available at the ″OUT″ terminal block at the top of the converter. Use it for connection of instruments, such as a digital multimeter or recorder. The signal is supplied from the ″+″ terminal, 0V from the ″-″ terminal.

CAUTION The sensor with thermocouple has a CA thermocouple embedded and supplies a thermocouple signal. Connect the thermocouple signal to the approx. 50 cm long compensation cable exiting from the connector（7P）at the sensor side of the extension cable.

CAUTION Connecting a cable to the wrong terminal may cause electric shock.
Some of the wiring on the terminal block carries high voltage.

7. ADJUSTMENT

7-1 POWER ON

Verify once more that all cables are connected correctly. Then connect the power cable to the AC100V power supply.

7-2 ADJUSTMENT

Perform the following adjustments while observing the output voltage on a digital multimeter.

1) Move the sensor away from the target up to the zero point, and turn the ZERO volume at the top of the converter to adjust the output to coincide with the zero point output voltage. (The ZERO and SPAN volumes are multi-turn trimmers.)

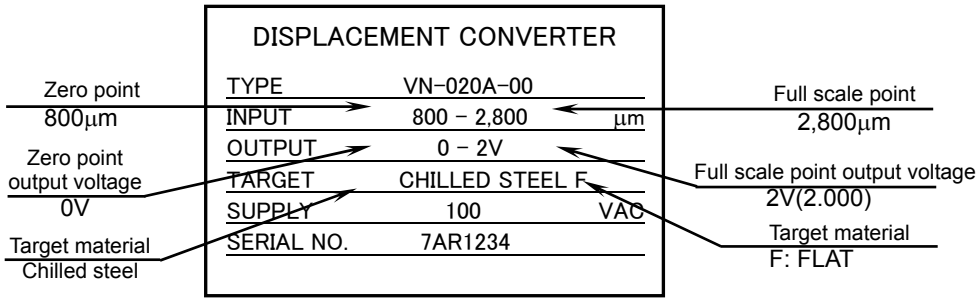
2) Move the sensor away from the target up to the full-scale point, and turn the SPAN volume at the top of the converter to adjust the output to coincide with the full-scale output voltage.

3) Repeat step 1 and 2 above until the desired voltage is reached.

CAUTION

The target material and shape, zero point, zero point output voltage, full-scale point, and full-scale output voltage are indicated on the nameplate attached to the converter case. Make sure to check the information on the nameplate before starting operation.

Example of a Converter Nameplate



7-3 ZERO SHIFT

This volume allows shifting the zero point within a range of approx. -100μm or 5% of F.S.※. After installing the sensor on the touch-roll attachment, turn this ZERO SHIFT volume to make ZERO SHIFT volume to make zero output of the converter coincide with zero thickness.

※ Zero shifting range

VN-010A to VN-050A : ±100μm

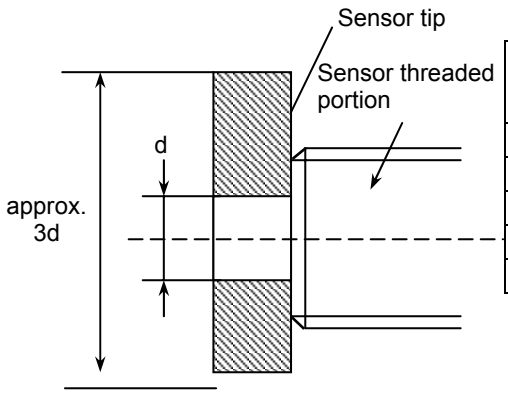
VN-080A to VN-250A : ±5% of F.S.

7-4 MEASUREMENT

This complates preparations. Observe the cautions given next page and start measurement.

8. Note

8-1 INFLUENCE OF CONDUCTING BOJECTS (METAL, ETC.) IN THE SENSOR SURROUNDINGS



Sensor new model code no.	Sensor tip d (mm)
NS-020	ϕ 10
NS-050	ϕ 22
NS-080	ϕ 34
NS-100	ϕ 49
NS-250	ϕ 70

The presence of conducting objects (metal, etc.) in the hatched area shown in the above drawing may impair the sensor functions.

8-2 TARGET SHAPE AND MATERIAL

The displacement converter has been calirated for the target material specified in your order. Changing the shape or material of the target may affect the gain and carse loss of linearity. If this occurs, recalibrate the converter.

8-3 CONFIGURATION

The combination of sensor, extension cable, and main unit of the VN Series Displacement Converter is determined prior to shipment. There is no compatibility between these components, so ues of a different combination may result in loss of measuring accuracy, poor performance, etc.

When using several converter units, make sure they are mutually compatible. For the correct combination (by serial No.), check the ″Inspection Record ″ supplied with each product prior to use.

8-4 OTHER

The costants and volumes of the converter have been adjusted to optimum levels prior to shipment. Do not change them unless absolutely necessary.

9. ADJUSTING THE POSITION OF THE TOUCH-ROLL ATTACHMENT WEIGHT VN

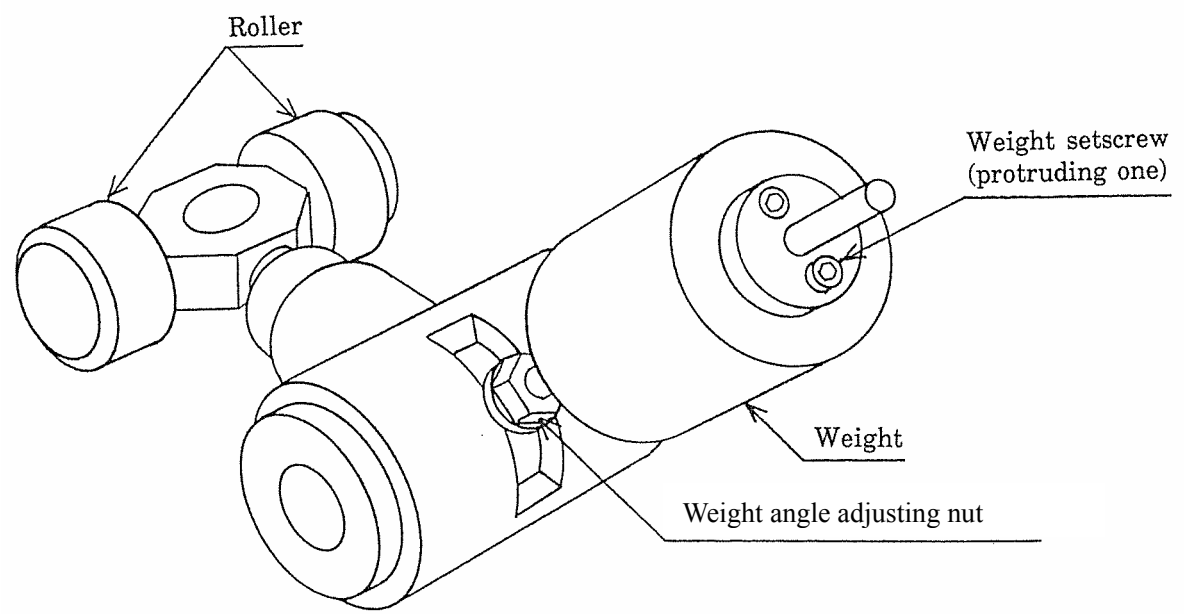
ADJUSTING THE WEIGHT POSITION

The pressure of the measuring roller can be changed by adjusting the position of the weight.

The roller pressure must be adjused according to the feed rate, hardness, and surface unevenness of the sheet to be measured.

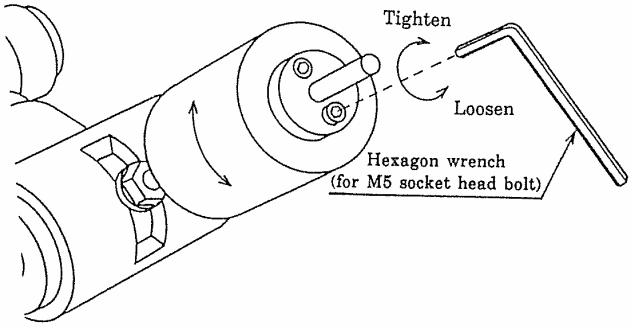
For example, if the sheet is fed at a rapid rate and has a highly uneven surface, increasing the roller pressure will prevent the roller from jumpig. In the opposite case, if the sheet material is soft, the roller pressure must be reduced to prevent the roller from sinking into the material. Make sure to abjust the weight position to ensure stable measurement of the sheet thickness at all times.

9-1 NAME OF PARTS

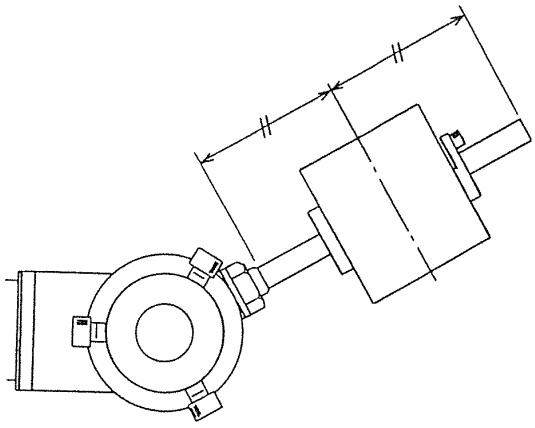


9-2 COARSE ADJUSTMENT OF WEIGHT POSITION

Loosen the weight setscrew, and fix the weight in the center of the shaft on which it rotates.

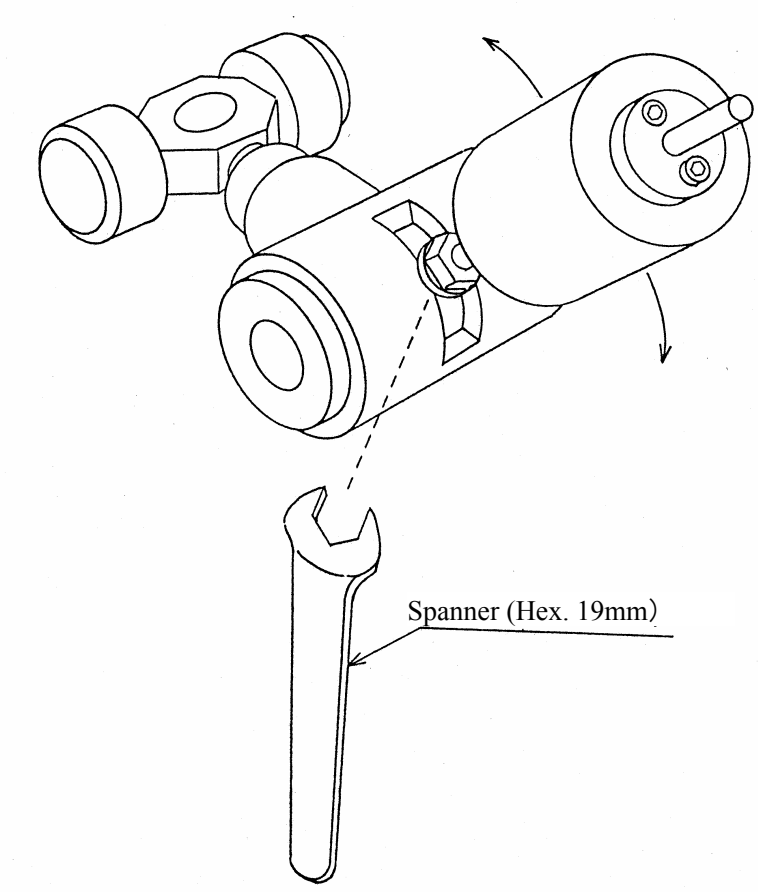


Loosen the weight setscrew and rotate the weight



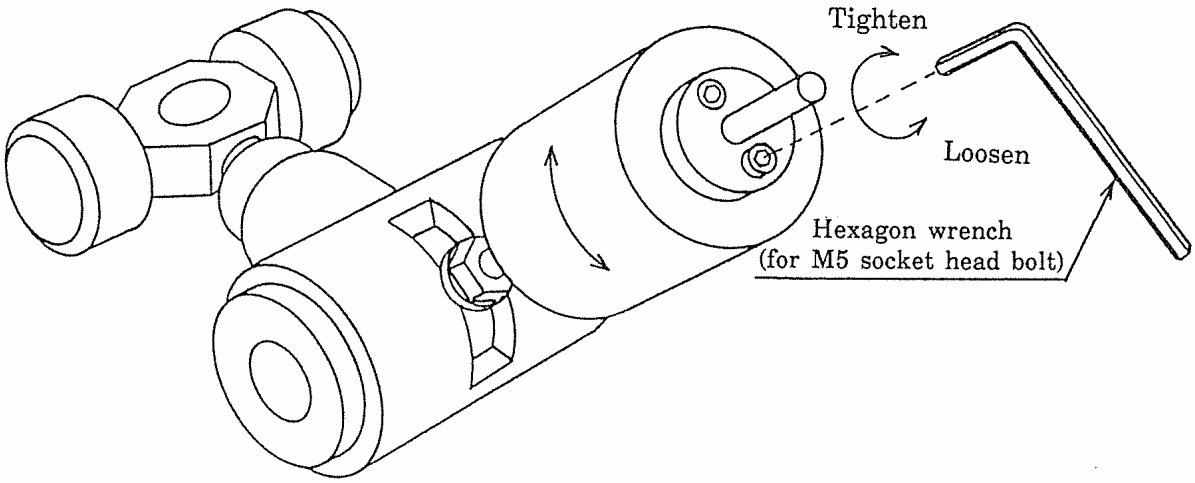
Fix in the center of the shaft

For coarse adjustment of the roller pressure, loosen the weight angle adjusting nut, and change the weight angle. Raising the weight will increase the roller pressure. Tughten the weight angle adjusting nut.



9-3 FINE ADJUSTMENT OF WEIGHT POSITION

Perform fine adjustment of the pressure applied to the roller by rotating the weight. Turning the weight clokwise will increase the roller pressure. Tighten the weight setscrew.



9-4 OPERATION CHECK

Carry out an actual thickness measurement to check the operation.

10. TROUBLESHOOTING

VN

Trouble	Probable cause	Countermeasures
Adjustment of Zero Span not pssible	1) Length of exetension cable has been chanbed.	Have it readjusted by the manufacturer.
	2) Target too small.	Make the target larger.
	3) Electric resistivity of target is too high.	Change the target.
	4) Sensor excessively influenced by conductors other than targers.	Change sensor installation position so as to eliminate the influence of other conductors
Poor linearity	1) Target material or shape differs from that used for adjustment.	Readjust,or prepare and use a calibration table.
	2) Length of extension cable has been changed	Have it readjusted by the manufacturer.
	3) Sensor excessively influenced by conductors other than targets.	Remove any objects causing such influence.
	4) Measurement range was increased or reduced.	Return to specified measurement range.
	5) Fault in the displacement converter.	Have it repaired by the manufacturer.
Output does not change (output : 0V)	1) No power supplied to the converter.	Supply voltage.
	2) Melted fuse.	Replace it by new one.
	3) Broken output cable.	Repair the output cable.
	4) Fault in the displacement converter.	Have it repaired by the manufacturer.
	5) Fault in the measuring instrument (voltmeter).	Repair or replace the measuring instrument.
Output does not change (voltage output)	1) Target is not within the measuring distance	Change sensor position.
	2) Length of extension cable has been changed.	Have it readjusted by the manufacturer.
	3) Zero span adjustment of convereter has shifted.	Recalibrate.
	4) Disconnection between sensor and converter (anywhere including junction connrctor).	Properly connect the sensor to the converter.
	5) Sensor wire broken.	Replace sensor.
	6) Fault in the displacement converter.	Have it repaired by the manufacturer.

Warranty

The warranty period for the delivered product shall be 3 years from the date of delivery from our factory. But the warranty period for the special order product and software shall be 1 year, and for the repairing parts shall be 6 months. In the event that the delivered product develops any defects within the warranty period for which Shinkawa Electric is liable, the defective part will be replaced or repaired in our factory at our own expense.

In the event that an engineer needs to be dispatched for repair purposes during the warranty period, travel expenses for the said engineer will be changed in accordance with the above item. The cost of repair will be borne by Shinkawa Electric.

However, the following are excluded from our warranty:

(1) Any defects due to improper handling or operation by the user.
(2) Any defects, the case of which is not attributable to Shinkawa Electric.
(3) Any modifications or repairs made by others then Shinkawa Electric or persons commissioned by Shinkawa Electric.
(4) Any handling, storage and operation under severe environmental conditions that exceed the design specifications.
(5) Any defects due to fire, flood, earthquake, lightning and other Acts of God.
(6) The consumables
(7) Other defects considered not to be attributable to Shinkawa Electric.

This warranty applies exclusively to the delivered product units.

Shinkawa Electric will not be held liable for consequential damage caused either directly or indirectly through a defect of the delivered product.

The warranty period and scope of machinery and equipment made by manufacturers other than Shinkawa Electric shall be in accordance with the conditions of the respective manufacturer, regardless of the provisions made above.

SHINKAWA Sensor Technology, Inc.
Hiroshima Factory
4-22 Yoshikawa-kogyodanchi, Higashi-hiroshima 739-0153, Japan
Tel. +81-82-429-1118 Fax. +81-82-429-0804
[Field support & Repair Dept] E-Mail : service@sst.shinkawa.co.jp