MULTI

POSITION SENSOR

TRANSMITTER TM10…
PROCESSOR PD3…

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Application for Spindle Drawbar

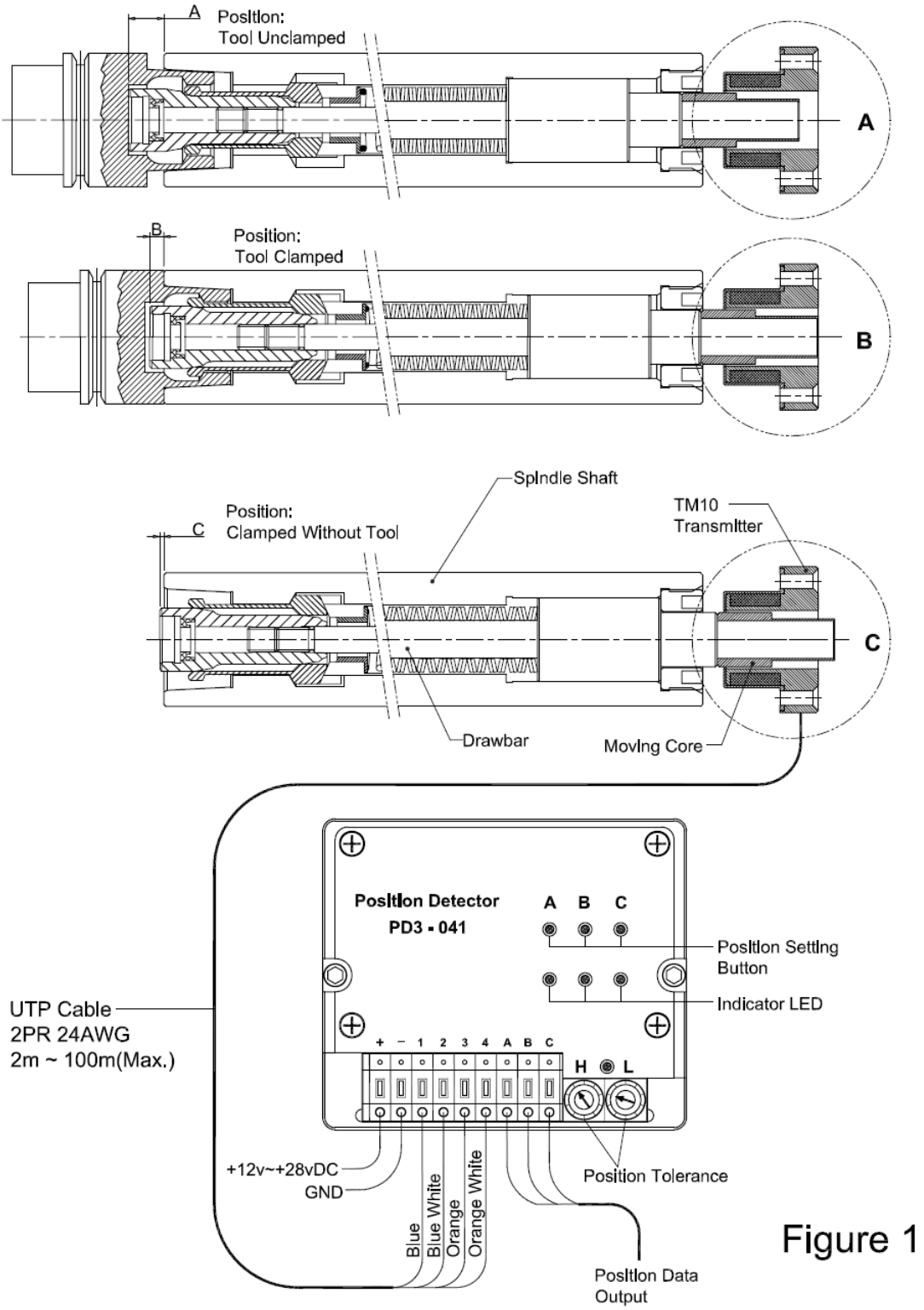


Figure 1

Electric Wiring

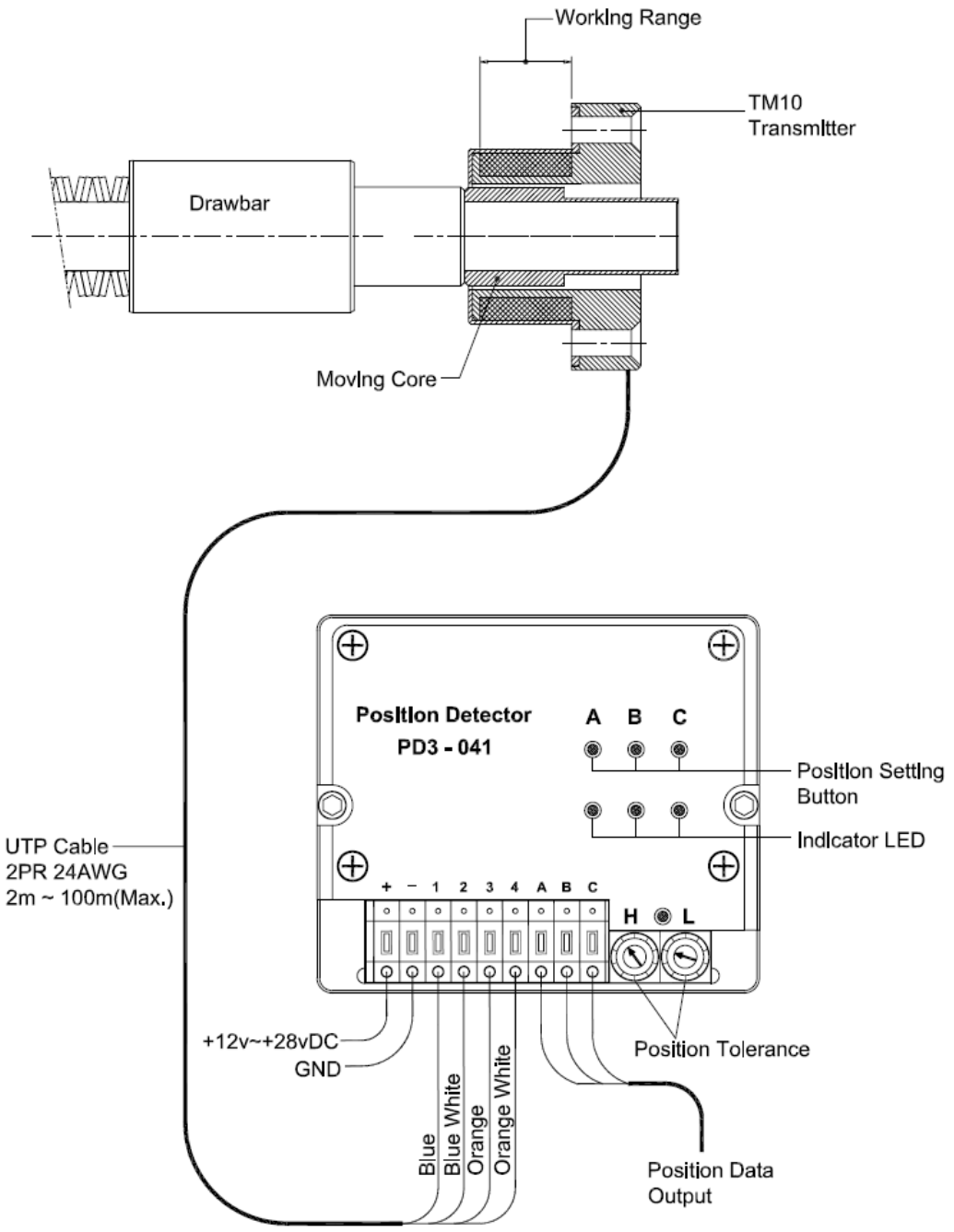


Figure 2

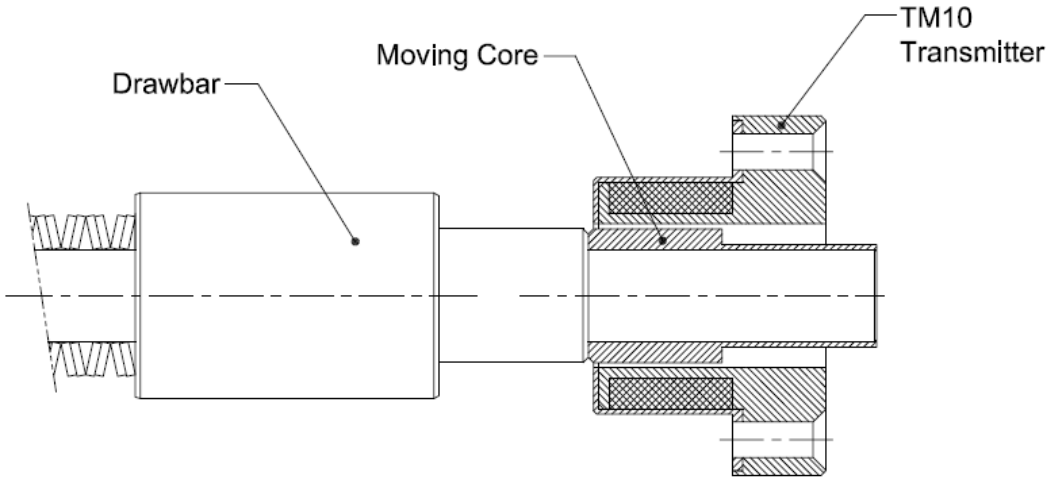


Figure 3

TM10 Transmitter Dimensions

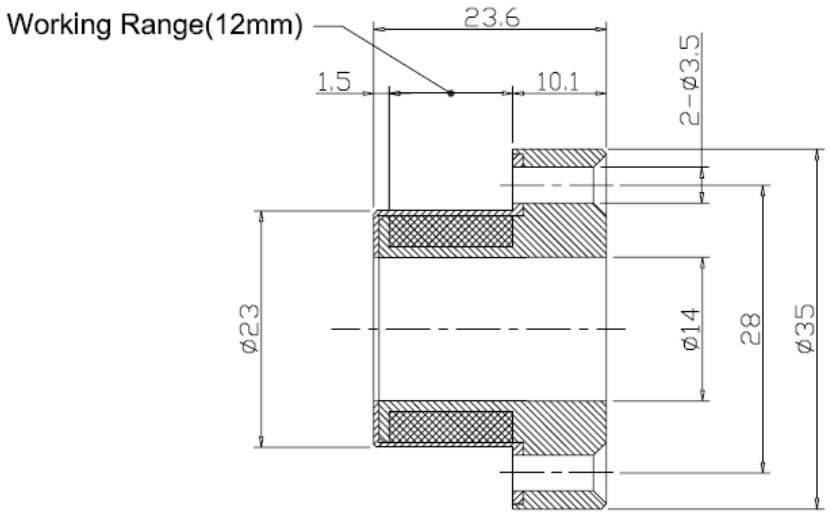


Figure 4

Plug Direction

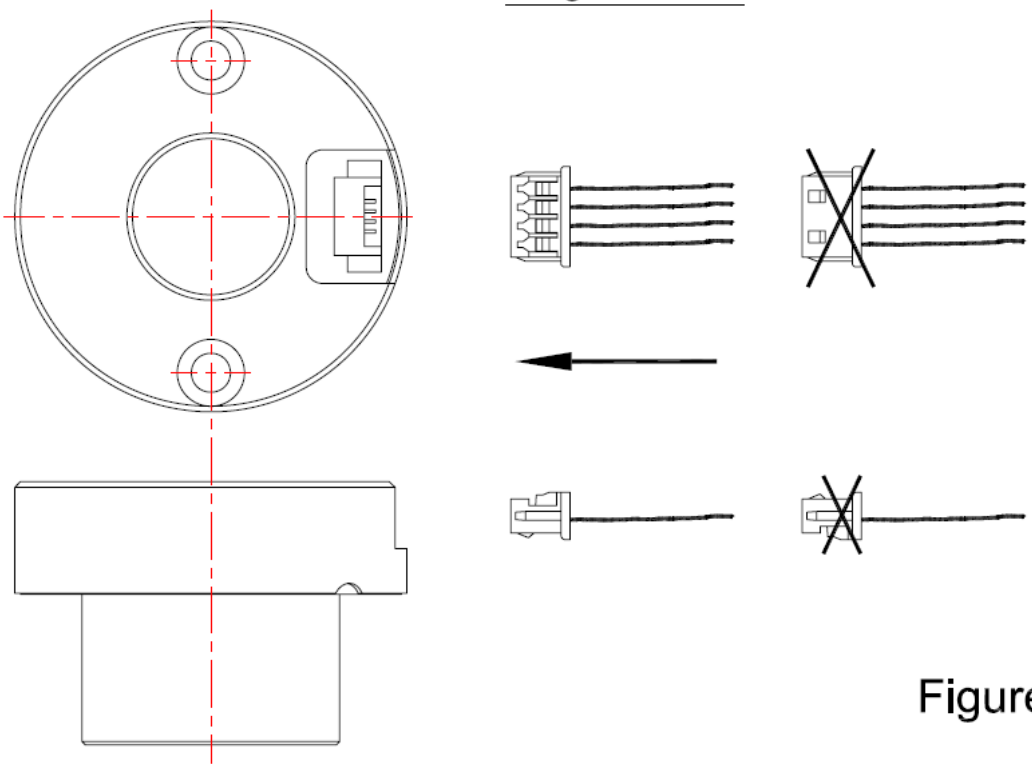
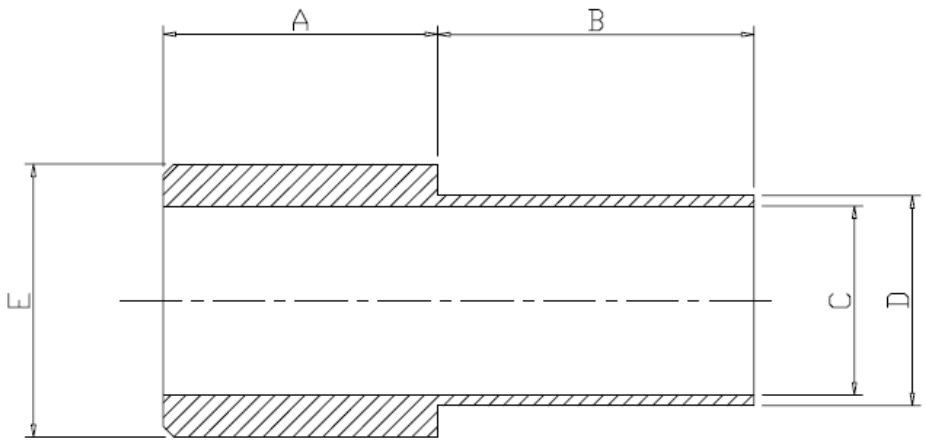


Figure 5

Plug Pin Description

Figure 6

Moving Core Dimensions



AISI 304
JIS SUS304
DIN X5CrNi1810

A	Min. 13mm
B	Min. 15mm
C	Max. ∅8.8
D	∅10
E	∅13

Figure 7

Outputs

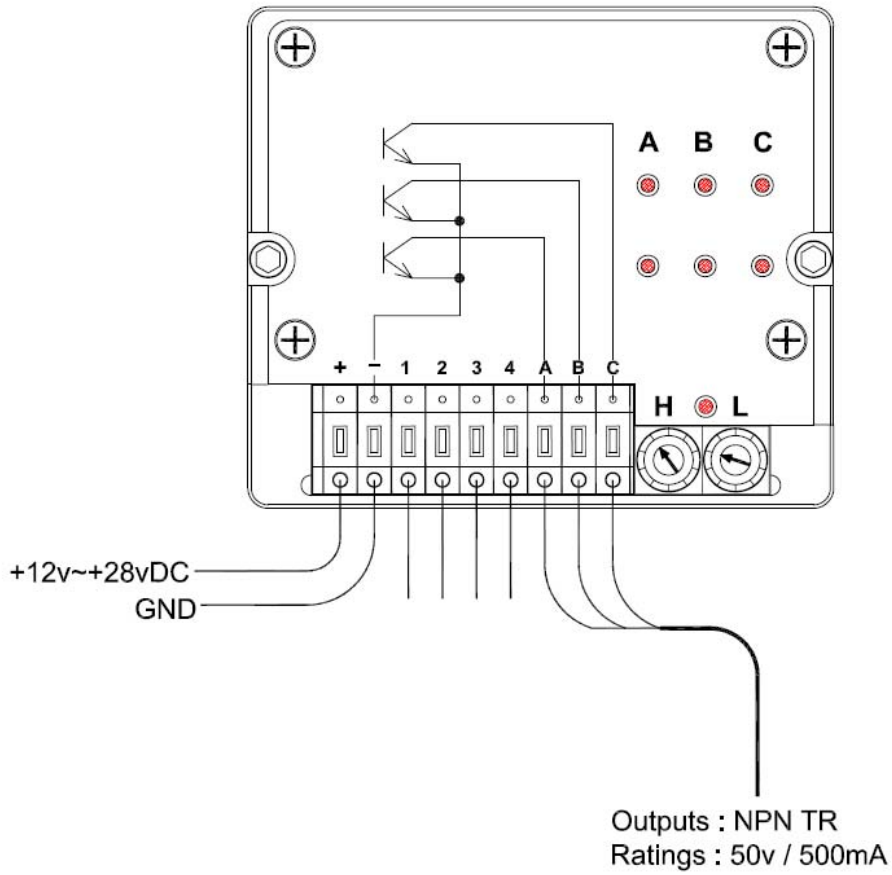


Figure 8

Processor Dimensions

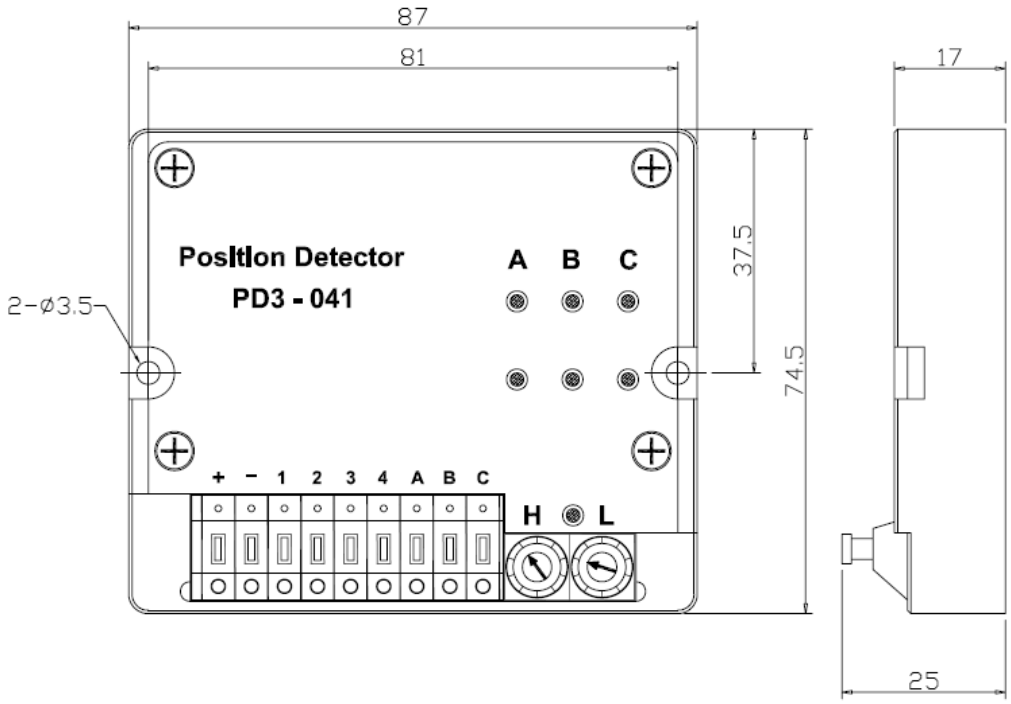


Figure 9

SPECIFICATION

TRANSMITTER TM10…

WORKING RANGE	10 mm Min	12 mm Max
RESOLUTION	0.01 mm – 0.04 mm	
RESPONSE TIME	0.04 Sec	
TEMPERATURE DRIFT	0.001 – 0.003 mm / ℃	
SUPPLY VOLTAGE	5 VDC	
CURRENT	60 mA Max	
OUTPUT SIGNAL	FREQUENCY SIGNAL	
CABLE LENGTH	5 m STANDARD, UP TO 100 m AVAILABLE	
AMBIENT TEMPERATURE	0 ℃ … +70 ℃	

PROCESSOR PD3 – 041

NUMBER OF OUTPUS INDICATING POSITION	
	3 OUTPUTS BY OPEN COLLECTOR NPN TRANSISTORS
RATINGS OF OUTPUTS	50 V / 500 mA Max
TOLERANCE SETTING	SELECTABLE 0 – 9 STAGES
SUPPLY VOLTAGE	12 VDC – 28 VDC
WORKING CURRENT	200 mA Max + LOAD CURRENT
NO LOAD CURRENT	130 mA Max

HOW TO USE

Multi-position sensor comprises of Transmitter and Signal Processor.
Transmitter generates signal of varying frequency in accordance to the position of **moving core**.
Processor receives the signal from the transmitter and if the three positions of draw bar have previously been preset into the memory of processor, processor compares it with memorized preset positions.
If the signal from transmitter is coincide with one of the preset positions, the processor outputs an output signal through the three output terminals.
And it is very easy to preset the three positions of draw bar.
Simply by pressing one of the three buttons, present position of draw bar is memorized into the processor.
Position information is output through the three output terminals.
The three output terminals are open collector transistors of NPN type.

ELECTRIC WIRING

For a proper electric wiring, it is recommended to take reference to the figure 2 in the previous part of this data sheets.

Processor PD3-041 is working at 12 – 28 VDC.
Transmitter TM10… are working at 5 VDC and the voltage must be controlled by regulator.
But users don't need to care about that because Transmitter must get power from Processor PD3-041.

Connection between the processor and transmitter should be made by using UTP cable, size of 2 pairs of 24 AWG.
UTP cable is commonly known as LAN cable and contains twisted pairs of cables.
Connector harnessed UTP cable is included with processor and transmitter. The maker supplied UTP cable is recommended to use.
Standard cable length is 5 m but the length of the UTP cable can be longer than 100 m.
The UTP cable between the processor and transmitter should be well arranged so as to avoid rolling, sharp turn, folding and kept so as to be stable from vibration or movement by swinging or dangling.
Surplus length of the UTP cable should be arranged tightly and kept at a location stable from vibration or movement.

MOVING CORE

Moving core must be made of non-magnetizable metals and must be machined into certain designated dimensions shown in the figure 7 in previous part of this data sheets. The through hole of the moving core is to be filled with another material which is prolonged from the draw bar. **But make sure that the diameter of the through hole must be as small as possible and it must not exceed than 8.8 mm.**
As a proper material, Austenite Stainless Steel is recommended. Below it shows cross reference in industrial standards.

AISI	304
JIS	SUS304
DIN	X5CrNi1810

Moving core is an important factor to get an ideal performance of the sensor. Users should keep the specifications suggested by maker.

If user needs higher strength material, it is possible to get a material which has 750 MPa (or 75 Kgf / mm^2) tensile strength from the maker by special request.

PRESETTING THE POSITION TO DETECT

The positions you want to detect can be set very easily by pressing each one of the three presetting buttons. The positions once preset are memorized in non-volatile memory and they do not change even at power off state until you change it by pressing the presetting buttons again.
The three of presetting buttons are labeled A, B, C respectively on the printed surface of the processor.

Move the moving core and place it at the position you want to detect. And push the one of the three presetting buttons of A, B, C.
By pressing each one of the A, B, C buttons, the processor memorizes each one of three positions where the moving core is located at the moment.
Afterwards at any moment if the moving core is located at the same position the processor has memorized, each one of the output terminals of A, B, C becomes active. When the output terminals are active, the output transistor of each one of the outputs becomes “on” state so that the output terminals can sink current to the GND.

TOLERANCE SETTING

A factory set tolerance value is roughly +/- 0.5mm.
Users can change and newly set the tolerance value at user's will.

For each one of the positions you want to detect, you can set a proper tolerance for each one of the positions respectively through the rotary switches.
Values of tolerance are set only at the moment you preset the position to detect by pushing the A, B, C buttons.
This means you can give tolerances differently for each one of A, B, C positions.

The rotary switch at left is for setting a tolerance toward higher direction. Higher direction means where the longer portion of the moving core is inserted into the transmitter than the preset position.
The rotary switch at right is for setting a tolerance toward lower direction. Lower direction means where the less portion of the moving core is inserted into the transmitter than the preset position.

However, the values set at the rotary switches do not stand exactly for distance.
Because in the transmitter, the variance of frequency value is not linear to the distance of movement of the moving core, the amounts of changed frequency are different even at a same distance of movement of the moving core and it depends upon where the moving core is located at the moment.
So the value of tolerance set at the rotary SW stands for different distances according to where the moving core is located.
The amount of changed frequency value is larger when the moving core is located at the center area in working range span than it is at both ends areas.

Roughly, the value 1 at rotary switch stands for 0.1 – 0.2 mm in distance.
More accurately, it stands for 0.1 mm when the moving core is nearly at center area and it stands for 0.2 mm at both ends area.
This means every 1 increase at rotary switch makes the tolerance distance increase 0.1 – 0.2 mm.
For example, if you set 1 at both rotary switches then the tolerance is +/- 0.1 mm when the moving core is at center area of working range span and the tolerance is +/- 0.2 mm when the moving core is at both ends areas.
If you set 2 at both rotary switches then the tolerance is +/- 0.2 mm at center area and +/- 0.4 mm at both ends areas.
Tolerances can be set differently toward high and low.
If you set 3 at left rotary switch (H) and 1 at right rotary switch (L), then the tolerance is +0.3, -0.1 mm.
The tolerance values at rotary switches become effective when the A, B, C buttons

are pushed to preset positions.
For example, if you set tolerance value of 4 at both rotary switches and push the button A, then the tolerance for preset position A is +/- 0.4 mm.
If you then changed the tolerance value at both rotary switches to 6 and push the B button, then the tolerance for preset position B is +/- 0.6 mm.

ACCURACY AND RELIABILIY

This sensor is based on LC oscillator principle.
In the LC oscillator, the frequency is varying in accordance to the portion of the moving core inserted into the inductor coil.
This sensor can detect a certain preset positions because the frequency becomes same with the preset frequency when the moving core is located at the same position where the preset position is determined.
This model has been developed especially for draw bar position detector in a spindle of Automatic Tool Changing.
Actual resolution of this sensor is approximately 0.01 – 0.04 mm with **response time** of 0.04 second. The resolution is varying at areas of working range. Highest resolution can be obtained at center area of the working range and the resolution is lower at both of the ends areas.

Theoretically, the resolution can reach higher when the operating frequency is higher.
At the same time, the response time gets faster with higher operating frequency.
The response time becomes slower when the resolution is higher if it is using the same operating frequency.
Technically, it is not very hard to realize the resolution of 1/100,000 of full working range with this technology. Just for practical aspect, the resolution is 1 / 1000 FS in this sensor.

Every sensors has drift by temperature.
In this sensor, the **temperature drift** is controlled less than 0.002mm / degree C at its center area of working range.
The whole temperature drift between 20 – 50 ℃ could be less than 0.06 mm and this well satisfies the condition of draw bar position detector because the draw bar's temperature expansion is 0.2 mm at working temperature range.

Notice : Specifications are subject to change without notification.

NOTE