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9407

OPTICAL TRANSMISSION PROBES FOR CNC MACHINE TOOLS OPERATION MANUAL

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VIDEO

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Attention

- The installation position of any interface must be far away from any potential electrical noise source, such as transformer, servo system driving device, etc;
- All 0V / grounding connections should be connected to the "zero point" of the machine tool ("zero point" is the single point circuit of all equipment grounding and shielded cables). This is very important.
  Failure to comply with this regulation will result in potential difference between grounding;
- All shielding devices must be connected as described in the operation manual;
- The cable line shall not be parallel with high current sources such as motor power cable or close to high-speed data transmission line;
- The cable length shall always be kept to a minimum.

Description

The probe has the following display functions:

- Install battery activation: flash once
- Quick touch of measuring styli: flash once
- The measuring styli is pressed: normally on for 25 seconds and then off
- Low voltage, continuous slow flashing

Setting of optical transmission range:
Open battery box, install battery, press battery box, and the probe is powered on for detection. The display light will flash. The setting of short, medium and long distance (1-5m) is judged according to the flashing times of the red light. The probe defaults to short range.

- Distance setting: open battery box and press the measuring styli at the same time to prevent it from closing. Press the battery box and wait for 5 seconds to display:

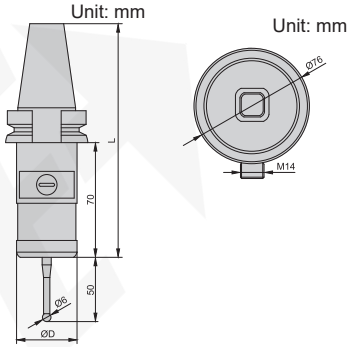
Set to short, repeat the setting steps to set to other distances.
Set to medium, repeat the setting steps to set to other distances.
Set to long, repeat the setting steps to set to other distances.

- After setting the transmission distance and locking the battery box, the probe can be used.

The probe has two modes:
Working mode: as long as the styli is touched, the probe will enter the normal working mode until styli is not touched for 3seconds, and then enter the low-power standby mode.

Standby mode: in this mode, the probe enters the low-power standby mode until the styli is touched.

1 Product dimensions:



Probe distance limit		
Probe length	±X / ±Y	+Z
50mm	12.5°	5mm
100mm	25°	5mm

2 Specification:

OPTICAL PROBE SPECIFICATION

Code	9407-1	9407-2
Probe length (L)	140mm	180mm
Probe diamete (ØD)	40mm	46.5mm
Trigger acciracy of styli in any dirction	1μm	
Protection stroke triggered by styli in all directions	X and Y axis stroke: ±12.5°, Z axis stroke: 5mm	
Trigger force of styli in all directions	X and Y axis: 0.9N, Z axis: 6N	
Applicable spindle	BT30	BT50
Measuring speed	≤5m/min	
Dust/waterproof	IP68	
Power supply	2×LS14250 lithium battery	

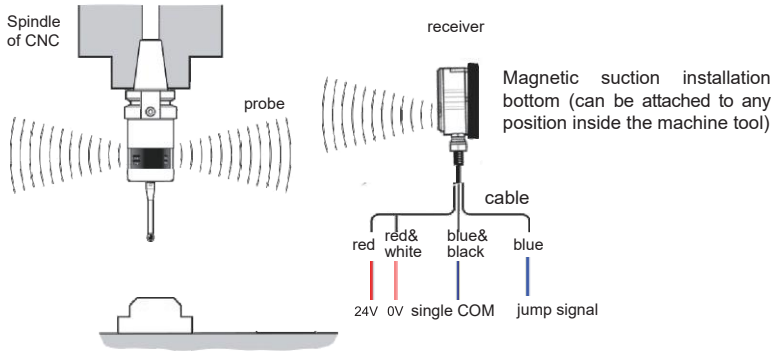
RECEIVER SPECIFICATION

Code	9407-1	9407-2
Protection function	no	low battery voltage or probe** transmitting signal all the time
Applicable probe	code **9407-1**	code **9407-2**
Cable lenth	5m	
Dust/waterproof	IP68	

** When the battery voltage is low or the probe transmits signal all the time, the receiver will send a signal to the machine tool to stop working.

Install

1 The hardware installation and connection diagram of onboard measurement system

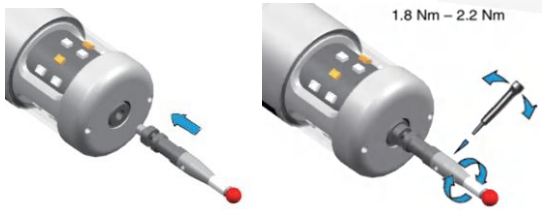


2 Installation and replacement of probe

1.In order to avoid damage to probe and styli during transportation,the styli has been removed from the probe and packaged separately before delivery.
Therefore, after receiving the product, please install the styli according to the following instructions.

2. As shown in the figure below, when installing the styli, the special wrench matched with the product shall be used: first fix it on the styli base with screw hole with an open-ended wrench to prevent it from bearing torque during the tightening of the styli. Then screw the styli into the styli base. When the styli is screwed to the fixed position, properly tighten it with a matching cylindrical wrench.

3. The probe can be installed with a variety of styli with M4 standard thread. When the user needs to replace the styli, the removal and installation of the styli shall follow the above instructions, that is, fix the styli base first, and then remove or install the styli.



Attention: after replacing the styli every time, the fine adjustment link between the probe and the mounting handle must be readjusted to make the position accuracy of the styli reach a reasonable state.

3 Installation and replacement of battery

1. The probe uses two LS14250 lithium batteries as the power supply, which is a disposable battery of industrial standard specification. When the power is exhausted, the red light of the probe will flash slowly to remind that the battery should be replaced.

2. When replacing the battery, a coin can be used as a wrench to remove and install the battery compartment cover. As shown in the figure.
Attention: Do not install the battery in the wrong direction.

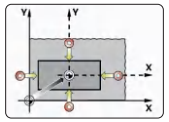
3. When installing battery cover, please pay special attention to the waist seal ring on its edge to prevent loss or damage during installation.
The battery cover shall be screwed to the fixed position as shown in the figure to ensure the reliable sealing of the battery compartment.

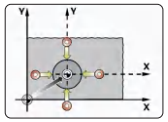
Basic principle of measurement

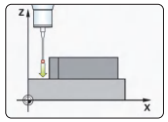
1. When measuring with a probe on CNC machine tool, the probe is actually a part of this "measuring device" (probe + machine tool). It plays a role in determining the coordinates of the measuring points through accurate contact with the workpiece, sending out indication signals, ensuring the accuracy of the measurement results and convenient, rapid, safe and reliable measurement operation.

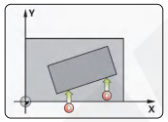
2. Measurement process: first install probe on spindle of the machine tool, and the operator manually controls the movement of spindle or workbench of the machine tool to make the measuring ball at the ront end of styli in accurate contact with measured surface (or point) of workpiece, and then calculate the coordinate data of the measured point of the workpiece through the coordinate data displayed by the CNC system. Then calculate the required measurement results according to the data of different measurement points.

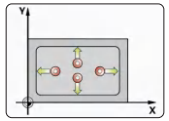
3. Precise contact: it means that the measuring ball on the styli is in just contact with the workpiece surface. That is, the two have been in contact, but the movement (swing or retraction) of the styli relative to the probe is verysmall (generally 0.001-0.002mm), so that the resulting measurement error can be basically ignored (the error will be different according to the accuracy of the machine tool).
4. In order to ensure the measurement accuracy, the coordinate value of each measurement point shall be recorded when the measuring ball is in accurate contact with the workpiece.
5. The method to obtain accurate contact state is to control the measuring ball and the workpiece surface for 2-3 times of micro adjustment of contact and disengagement. In this process, the feed rate of the machine tool shall be gradually reduced, and finally the contact or disengagement shall be realized within the minimum step of a machine tool.
6. Processing of measuring ball size in calculation when calculating the measurement results, special attention shall be paid to using the measuring ball to calculate the diameter data and processing the measuring ball diameter (or radius) size. For example: measure the groove/inner circle.

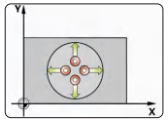

find center of rectangular boss

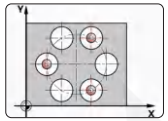

find center of the round boss

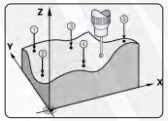

measure position of point on any axis


measure inclination of line


measure rectangular cavity


measure round cavity


measure center of holes


measure freeform surfaces

Attention: when measuring the width, the coordinate difference of the corresponding length of the two measuring points shall be added with the diameter of the measuring ball; When measuring the wall thickness, the coordinate difference of the corresponding length of the two measuring points shall subtract the diameter of the measuring ball; When measuring the step surface distance, the coordinate difference of the corresponding length of the two measuring points is the measurement result.

Accuracy of probe and measurement

The factors affecting the measurement accuracy mainly depend on the positioning accuracy of the machine tool, the reset accuracy of the probe and the position accuracy of the probe. The positioning accuracy of the machine tool varies according to the control type of the machine tool. Taking small and medium-sized CNC machine tools as an example, the positioning accuracy ranges of various control modes are as follows:
Closed loop control: ±0.002-0.004(mm)
Semi closed loop control: ± 0.005-0.008(mm)
Open loop control: ±0.015-0.020(mm)
The accuracy of probe means that when the probe is installed with a standard styli with a length of 50mm, the accuracy of any direction is± 0.001mm. The position accuracy of the probe (i.e. the coaxiality between the center of the measuring ball and the axis of the probe handle) can reach 0.002-0.003mm through accurate adjustment.
Attention: when calculating the measurement data, the calculated diameter of the measuring ball is used instead of the actual diameter of the measuring ball, which can compensate the systematic error of the trigger probe structure and improve the measurement accuracy.

Comprehensive accuracy of measuring workpiece

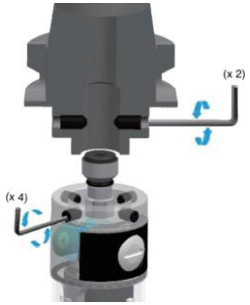
Comprehensive estimation of accuracy range measured by probe on CNC:
Closed loop control machine tool: 0.002-0.004(mm)
Semi closed loop control machine tool: 0.005-0.010(mm)
Open loop control machine tool: 0.015-0.025(mm)

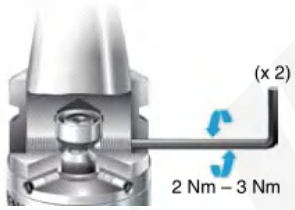
Inspection and adjustment of probe accuracy

Accuracy inspection of probe in order to ensure the comprehensive accuracy of measurement, the user shall regularly self check the accuracy index of probe (i.e. reset accuracy and position accuracy of probe).The self inspection of the probe can be carried out not only in the special metering department, but also by the operator on the machine tool.

Adjustment of accuracy of newly installed styli

The user can adjust the position accuracy of the styli on the machine tool as follows:
Step 1: connect the measuring head with the tool handle through two M6 screws and install it on the spindle of the CNC, then fix the lever dial indicator and magnetic gauge base on the workbench of machine tool to make the styli of the lever gauge slightly contact with the measuring ball of the measuring head, and then rotate the measuring head slowly by hand to observe the deviation between the center of the measuring ball and the centerline of spindle on machine tool.
Step 2: gradually adjust the tightness of the four M5 set screws to gradually reduce the swing range of the dial indicator pointer to 0.001-0.002(mm).
Step 2: gradually adjust the tightness of the four M5 set screws to gradually reduce the swing range of the dial indicator pointer to 0.001-0.002(mm).
Step 3: tighten the four screws step by step, and keep the four screws basically the same tightening force on the premise of ensuring that the position accuracy of the styli is less than 0.001-0.002(mm).
Step 4: remove the probe from the spindle of the machine tool, gently tap the main body of the probe with a rubber hammer, and then retest the position accuracy of styli. If the accuracy changes, make another micro adjustment (step 3), and the adjustment operation is over.





Calibration of probe

Why calibrate the probe?
The workpiece probe is only a component of the measurement system communicating with the machine tool. Each part of the system can introduce a constant between the trigger position of the probe and the position reported to the machine tool.

If the probe is not calibrated, the constant value will produce an error in the measurement.
Calibrating the probe allows the measurement software to compensate for this constant value.
During normal use, the constant value between the trigger position and the report position will not change, but it is very important to calibrate the probe in the following cases:

- When using the probe system for the first time;
- When a new probe is installed on the probe;
- When it is suspected that the styli is deformed or the measuring point collides;
- Regularly compensate the mechanical changes of the machine tool;
- When the repeatability of probe handle reinstallation is poor. In this case, it may be a good idea to re map the end of the measuring target every time the probe is used, because it will reduce the impact caused by the change of spindle and tool direction.

Calibration with ring gauge or standard ball:
Calibrating the probe with a ring gauge or a standard ball of known diameter will automatically store the radius value. The stored data is automatically used by the measurement cycle to obtain the actual size of the feature. These values are also used to obtain the actual position of a single plane.
Attention: the stored radius value is based on the actual electronic trigger point. They differ from physical dimensions.
Calibration probe length:
Calibrating the probe on a known reference plane can determine the length of the probe at the electronic trigger point. The stored length value is different from the physical length of the probe assembly. In addition, by adjusting the stored probe length value, this operation can automatically compensate the height error of the machine tool and fixture.

Maintenance of probe

The main body of probe and the styli are made of antirust materials.
Only the installation and positioning surface of the probe handle is a precision grinding surface, so special attention should be paid to the moisture-proof and antirust of this part.In the process of using probe,avoid the contact between the probe handle and the liquid that can produce corrosion;

If it cannot be avoided, the surface of the measuring ball shall be cleaned in time after use. When storing the probe at ordinary times, the above important surfaces shall be coated with anti rust oil.

Maintenance of probe reset fault:

The trigger probe may have a probe reset fault, that is, the probe has been separated from the workpiece surface, but the indicator light of the probe is still on, which indicates that the probe has not been reset normally. In case of abnormal reset of the measuring needle, the work shall be suspended, the measuring needle shall be pulled by hand for several times, and the reset of the measuring needle shall be observed; If normal, you can continue to work, otherwise, you can try again several times. If the failure frequency is very high, it may be that the internal parts of the probe are seriously worn, please contact professionals.

Maintenance of battery compartment:

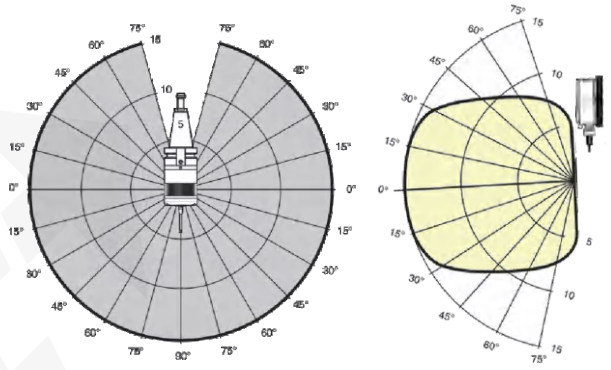
The battery compartment cover of the probe is the main part that may allow cutting fluid and other liquids to enter the battery compartment.

Each time the battery is replaced, be sure to screw the compartment cover into a reasonable position, and first check whether the waist rubber ring is in good condition. If the probe is not used for a long time, take out the battery to prevent the pollution of the probe battery from electric shock.

Attention

1. Coolant and cutting debris accumulated on the probe and receiver can adversely affect transmission performance. The glass window shall be wiped frequently to ensure free signal transmission.
2. When working, do not touch the front cover of receiver or the glass window of probe with your hand, as this will affect the performance.
   When working at 0°-5°C and 50°-60°C, the transmission range may be reduced.
3. The probe and receiver must be within the receiving range of each other, as shown below: the signal range reflects the line of sight performance, and the range of optical path less than 1-5m belongs to the signal transmission range.

range(unit:m)



4. The stylus position adjustment mechanism can make the main body move 0-0.5mm in any direction relative to the handle. The meaning of the adjusting screw in the front is: tighten any one screw, and at the same time mean that the opposite screw is also tightened.
   Therefore, if the screw that has been tightened is already very tight and can not continue to tighten, the screws should be loosened properly.
5. Relationship between screw rotation and styli movement: tighten the adjusting screw to move the probe body (including stylus) in the direction of the screw relative to the handle axis.
6. The adjustment process should be a gradual process. First loosen the opposite screws slightly, and then screw them gradually in turn;
   When the position accuracy of the measuring needle reaches the ideal state, the tightness of the four screws shall be balanced.
7. The tightening force of the adjusting screw should be fully tightened when tightened with a standard hexagonal wrench.
   Excessive force should be avoided to damage the screw or wrench and make it impossible to continue adjustment.
8. Do not loosen the adjusting screw too much unless you want to separate the probe body from the handle; Because the adjusting screw simultaneously undertakes the connection between the probe body and the handle, if the adjusting screw is loosened too much, the probe body and the handle may be separated.