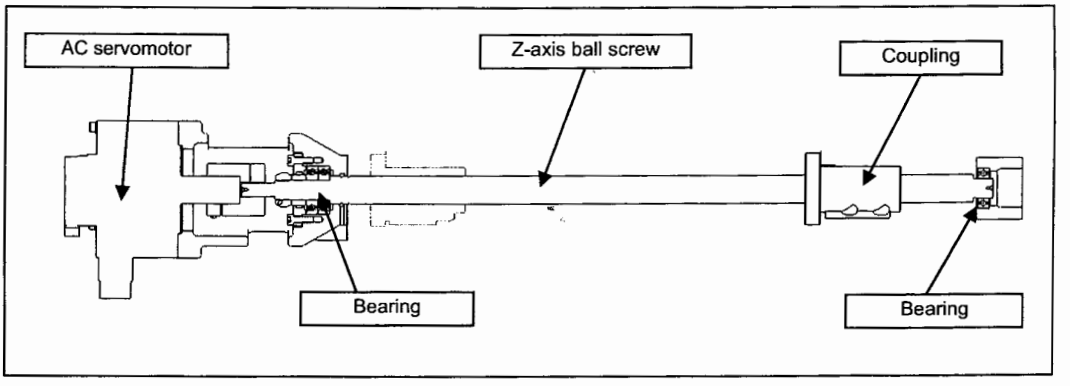


Fig. 5-26 Construction of Z-axis

5-4-2 Zero-point setting method

In case of the zero-point return operation using the operating panel, since the machine zero-point becomes the machining standard for the NC unit (MAZATROL), the zero-point return position must be adjusted accurately.

Since this machine is shipped after setting the zero-point, there is almost no need for the customer to make any adjustments. When the customer replaces the ball screw, removes the coupling or removes the encoder, or in case of data loss due to insufficient servo amplifier battery capacity, it becomes necessary to adjust the zero-point position.

However, in case of loss of zero-point position due to battery insufficiency, carry out this operation after replacing the battery with a new one.

1. Machine zero-point settings using the proximity sensor

A. Principle of zero-point return using the proximity sensor

Since this machine is of the absolute positioning specifications, zero-point return immediately after turning on the power is not necessary. However, when operating it using the zero-point dog and proximity sensor in cases such as the loss of absolute position zero-point, "zero-point return operation" must be carried out before automatic operation and the zero-point position should be stored in NC.

By performing the zero return operation, a predetermined point is established as the machine zero point in the following manner.

(1) When the zero return key on the operation panel is pressed, the zero return mode signal is turned on.

(2) Using the axis movement keys, move the turret to the zero point of respective axis.

(3) When the zero point proximity sensor is tripped by the dog, the deceleration signal is turned on, turret motion is decelerated, and the turret moves at the predetermined feedrate.

(4) After the zero point proximity sensor is released from the dog, the turret continuously moves to the point far from the last grid signal by the amount preset in parameter **N10**. (This is the electrical zero point.) The turret further moves from this point by the zero-point shift amount set in parameter **M16**.

Parameter settings are as follows:

Axis	Parameter	Setting	Parameter	Setting
X-axis	**N10**	10 (fixed)	**M16**	Shift amount from the electrical to the machine zero point (variable, machine-specific)
Z-axis	**N10**	12 (fixed)	**M16**	

The grid signal is always turned on at the fixed position unless the relative position between the encoder input shaft and the ball screw is not changed. The zero point shift amount is a fixed amount set with a parameter in the NC.

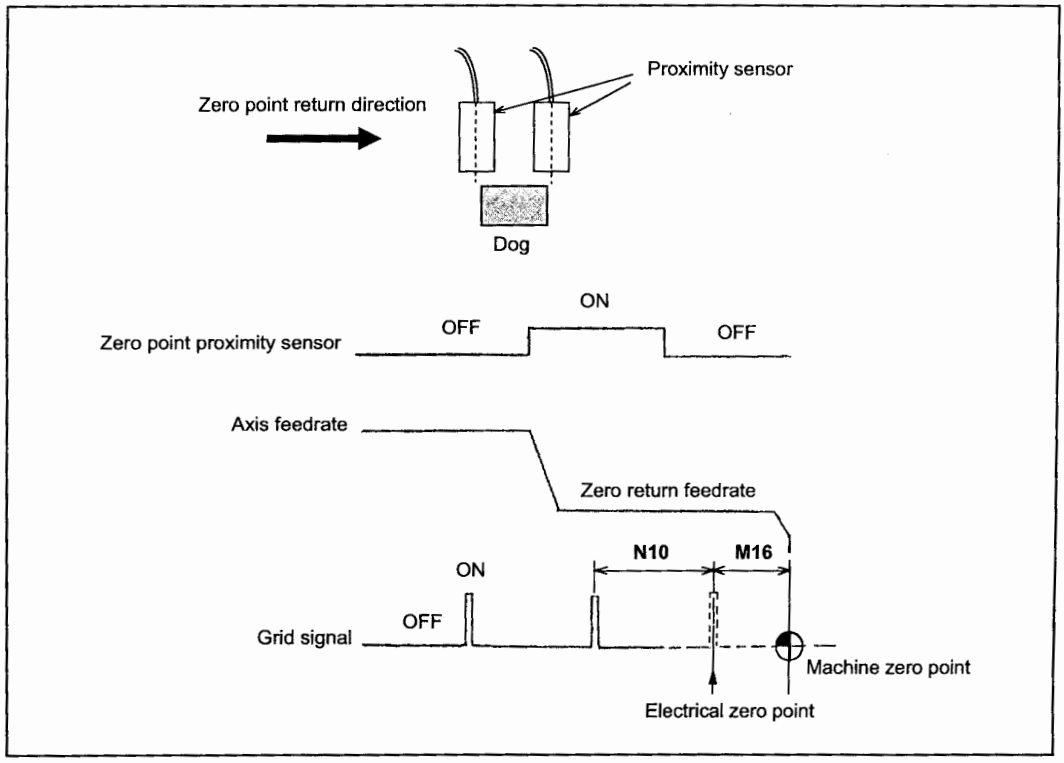


Fig. 5-27 Principle of X- and Z-axes machine zero point

B. Adjusting the proximity sensor and setting zero-point shift amount

When resetting the machine zero-point at the time of replacement of the proximity sensor, the servo motor and the ball screw, the adjustment of the proximity sensor and reset of the zero-point shift amount become necessary.

(1) Adjust the gap between the proximity sensor and the dog to 0.5 - 1.0 mm (0.02 - 0.04 in). (For the adjustment method, refer to "5-14-3 Procedure for replacing the proximity sensor")

(2) Consider the zero-point shift amount set in the X-axis and Z-axis of parameter **M16** as 0.

(3) Adjust the position of dog such that the distance from proximity sensor OFF to grid point is half of the grid interval.

- The grid interval for the X-axis is 10 mm (0.39 in), and for the Z-axis is 10 mm (0.39 in).
- The ON, OFF operation of the zero-point proximity sensor can be confirmed by the DIAGNOSIS memory I/O check of **DIAGNOSIS(MAKER) - DIAGNOSIS MONITOR** display.

  X-axis zero-point sensor: Proximity sensor ON when **X04** is 0 and proximity sensor OFF when **X04** is 1.

  Z-axis zero point sensor : Proximity sensor ON when **X1A** is 0 and proximity sensor OFF when **X1A** is 1.

- The distance from proximity sensor OFF to the initial grid can be confirmed by the GRID, 2/3 page of **DIAGNOSIS(MAKER) - SERVO MONITOR**.

(4) Carry out zero-point return and record the counter value after zero-point return.

(5) In the following method given in "2. Determining zero-point", the counter value is recorded after moving the X-axis and the Z-axis to the zero-point.

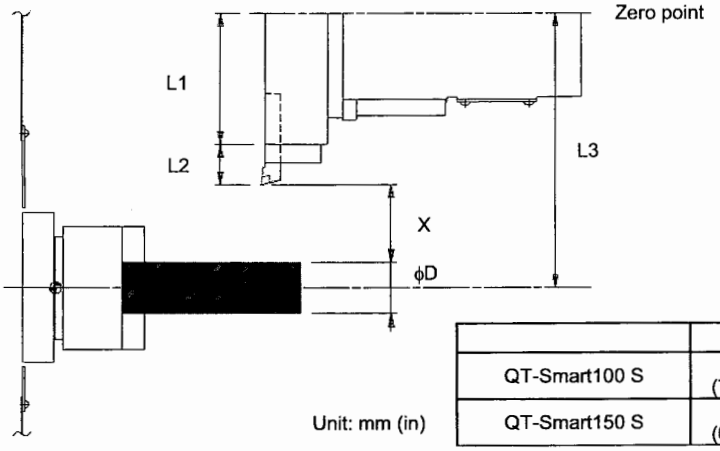
(6) The difference in the counter values of (4) and (5) is set as the zero-point shift amount on the X-axis and Y-axis of parameter **M16**.

2. Determining zero-point

A. X-axis

Determining after cutting the testpiece

Mount a test piece (round bar) in the chuck and turn outside diameter. Measure the diameter accurately after cutting. Let the diameter be D.



	L1	L2	L3
QT-Smart100 S	180 (7.09)	55 (2.25)	375 (14.84)
QT-Smart150 S	160 (6.30)	50 (2.00)	375 (14.80)

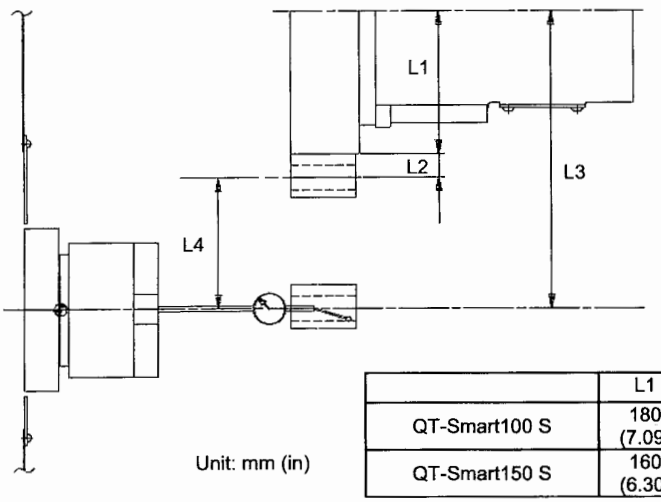
Fig. 5-28 X-axis zero-point return (1/2)

The X-axis zero-point is L3 mm (L3 in) distant from the spindle center. Therefore, move the X-axis by [L3 – (L1 + L2 + D/2)] (mm) or [L3 – (L1 + L2 + D/2)] (in) while observing the counter reading. The point reached is the X-axis zero-point position.

Note: The X-axis counter reads the diameter value. A value double the above value should be read on the counter.

When determining by the center of the hole of the boring bar holder and the center of the spindle

Mount a boring bar holder on the turret. Mount a pick tester mounting jig on the chuck. Match the pick tester with the inner diameter of the hole of the boring bar holder, rotate the chuck and measure the movement of the pick tester. Move the X-axis such that the movement is 0.02 mm (0.0008 in) or less.



	L1	L2	L3	L4
QT-Smart100 S	180 (7.09)	30 (1.125)	375 (14.84)	165 (6.625)
QT-Smart150 S	160 (6.30)	50 (2.00)	375 (14.80)	165 (6.50)

Fig. 5-29 X-axis zero-point return (2/2)

The X-axis zero-point is L4 mm (L4 in) distant from the spindle center. Therefore, move the X-axis by [L4] mm (in) while observing the counter reading. The point reached is the X-axis zero-point position.

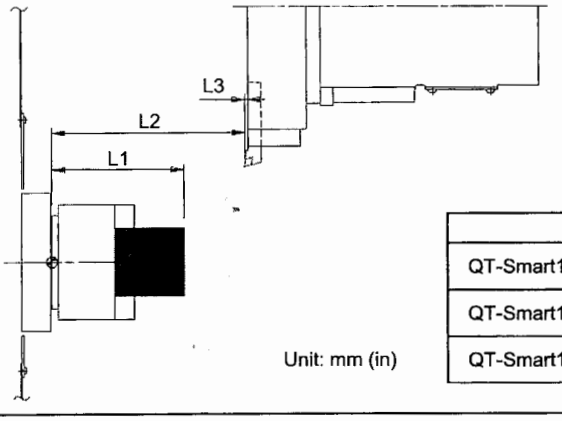
Note: The X-axis counter reads the diameter value. A value double the above value should be read on the counter.

B. Z-axis

Determining after cutting the testpiece

Mount a test piece in the chuck and perform face turning.

Measure the length from the spindle nose to the test piece edge. Let the measurement be L1.



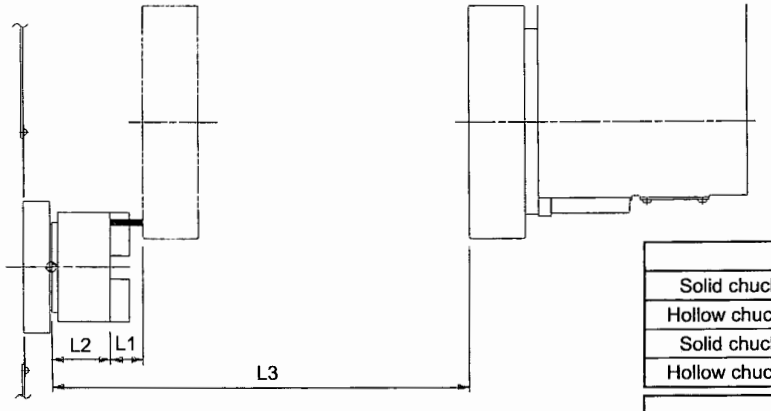
	L2	L3
QT-Smart100 S 300U	429 (16.875)	5 (0.25)
QT-Smart150 S 300U	424 (16.75)	7 (0.25)
QT-Smart150 S 500U	659 (26.00)	7 (0.25)

Fig. 5-30 Z-axis zero-point return (1/2)

The Z-axis zero-point is L2 mm (in) distant from the spindle edge. Therefore, move the Z-axis by [L2 – L1] mm (in) while observing the counter reading. The point reached is the Z-axis zero-point position.

When determining by the distance between the chuck edge and the turret edge

Set a block gauge on the chuck edge. Move the Z-axis using manual pulse (x10) such that it slightly hits the edge of the block gauge (L1).



	L2
Solid chuck (N-06)	84 (3.31)
Hollow chuck (B-206)	91 (3.58)
Solid chuck (N-08)	97 (3.82)
Hollow chuck (B-208)	103 (4.06)

	L3
QT-Smart100 S 300U	434 (17.125)
QT-Smart150 S 300U	431 (17.00)
QT-Smart150 S 500U	666 (26.25)

Unit: mm (in)

Fig. 5-31 Z-axis zero-point return (2/2)

The Z-axis zero-point is L3 mm (in) distant from the spindle edge. Therefore, move the Z-axis by [L3 - (L1 + L2)] mm (in) while observing the counter reading. The point reached is the Z-axis zero-point position.

5-4-3 Lubrication

The greasing pump unit/lubricating pump unit supplies lubricating oil (grease) to the linear motion guide blocks and ball screw nuts.

A lubricating oil (grease) is automatically supplied every 24 hours from the motor-driven greasing pump unit mounted on the right side of the machine.

5-4-4 Adjustment

1. Backlash compensation

The following factors between the X- or Z-axis position encoder and the turret generate errors between the axis motion command value and actual turret position.

- Backlash in bearings and ball screws
- Ball screw pitch deviation

Backlash in the mechanical power transmission system is an unavoidable factor.

A too small backlash imposes overload on bearings, gears and other mechanical parts causing noise and shortening their life.

The NC has the ability to compensate electronically for errors generated in the mechanical system. This is called the backlash compensation function.