5-2 Turret

5-2-1 Construction and operation

For construction of the turret see Fig. 5-11.

1. Component parts of the turret

The turret unit consists of following components.

A. Turret base unit

The base unit of the turret is where the turret component parts are mounted. It is fixed to the X-axis linear motion guide.

B. Turret head

The turret head has 12 faces (8 for specifications for Southeast Asia and QT-Smart150 S) and each face (position) may be mounted with a cutting tool.

C. AC servomotor

The AC servomotor controlled by the servo driver rotates the turret head.

2. Turret head clamping

The turret head is hydraulically clamped to the turret base while it is not rotating. The index coupling with which the turret head is engaged ensures accurate indexing of the turret head to the required tool position.
3. Operation of turret

When the turret rotation command becomes active, the turret head is disengaged from the index coupling and unclamped. The turret head is then rotated by the AC servomotor. The turret head position is detected by the encoder at the end of the AC servomotor; when the turret head is indexed to the commanded position, the motor stops and the turret head is clamped to the turret base.

During automatic operation, the turret rotation direction is determined from the currently located turret head position and the target index position so that it will rotate in the shortest way. During manual operation, the turret rotation direction is selected with the tool select button.

→ : Forward, clockwise viewed from the turret face

← : Reverse, counterclockwise viewed from the turret face

Fig. 5-11  Construction of turret
4. Turret rotation

A. Turret head rotation method
The turret head is rotated by the AC servomotor, and during automatic operation it makes a short-cut turn toward the next tool. The turret head conducts two-step gear reduction via an intermediate gear shaft and is set to achieve a final gear ratio of 1/30 with respect to the motor.

B. Turret position detection
Turret position is detected by the encoder at the end of the turret motor.

C. Turret rotation direction
Forward (FWD): The turret rotates clockwise when viewed from the turret face.

D. Relationship between the turret rotation direction and the AC servomotor rotation direction
The relationship between the turret rotation direction and the AC servomotor rotation direction is shown in the figure below.

AC servomotor rotation direction needed to rotate the turret in the forward direction (when the turret head rotates in CW direction): CW

![Diagram of turret rotation and gear reduction](image)

Fig. 5-12 Rotation direction of turret head
5. Turret indexing sequence

The turret indexing sequence is explained below. This shows how the command to select tool No. 5 is executed while the turret is in the position of tool No. 1.

A. Flow chart

```
Tool No. 5 command
    ▼
  YV-1: ON ▼
     ▼
  SQ-4: OFF ▼
     ▼
  Timer T15 ▼
     ▼
  Turret motor ON ▼
     ▼
  In-position signal: ON ▼
     ▼
  YV-2: ON ▼
     ▼
  SQ-4: ON ▼
     ▼
  Turret motor OFF ▼
    ▼
  Turret rotation completed
```

Addresses
- Valve for turret head unclamp ON (Y0D)
- Turret clamp confirmation signal OFF (X03)
- Turret unclamp confirmed (T15)
- Turret rotation start
- Turret rotation stop
- Valve for clamp ON (Y0C)
- Clamp confirmation signal ON (X03)

Note: For details of signal and sensor designations refer to the electric circuit diagram.

B. Timing chart

![Timing chart](image)

Fig. 5-13 Timing chart
5-2-2 Adjustment

1. Reference position of turret indexing

The turret head is driven and indexed by a servomotor on the basis of an absolute positioning system. The controller has the factory-set reference position stored in its memory to perform absolute positioning. If the stored data should be lost due to a drop of the battery voltage or if the controller itself has been replaced, set and store the reference position anew by the following procedure:

(1) Press the machine menu key [F1] to call up the machine menu.

(2) Select [MAINTENANCE1] from the machine menu.

(3) Select the [TURRET UNCLAMP] menu item in manual operation mode to unclamp the turret.

Highlight the menu item.

![Diagram](image)

Fig. 5-14 Setting the reference position for turret indexing (1/2)

(4) Press the [TURRET INI.SET] menu key together with the MF1 and MF2 keys to highlight the menu item.
(5) Using the tool select button, rotate the turret so as to direct the face of tool No. 1 to the axis of spindle revolution. Perform this setting to the reference angular position only approximately in this step by visually checking the required face for its parallelism with the upper side of the turret base.
Unlike the regular rotation movement, the turret rotates continuously till the tool selector button is held pressed when the [TURRET INI.SET] menu is highlighted.

Fig. 5-15 Setting the reference position for turret indexing (2/2)

(6) Select the [TURRET UNCLAMP] menu item again to clamp the turret.
The highlight display of the menu is cleared.
When the turret is clamped properly, clamping-piston contact sounds or motor beating sounds will not occur. Make sure that these sounds do not occur. Determine the position of tool number 1 in this state.

(7) Select the [TURRET UNCLAMP] menu item anew to unclamp the turret.
Highlight the menu item in highlight display.

(8) Confirm that the [TURRET INI.SET] menu is highlighted.
When it is not highlighted, press the [TURRET INI.SET] menu key together with the MF1 and MF2 keys to highlight the menu item.

(9) Press the [TURRET HOME SET] menu key to fix the home position after the menu is highlighted.

(10) Press the [TURRET INI.SET] menu key to clear the highlight display.

(11) Select the [TURRET UNCLAMP] menu item once again to clamp the turret.
The highlight display of the menu is cleared.
When the turret is clamped properly, clamping-pin contact sounds or motor beating sounds will not occur. Make sure that these sounds do not occur.