

Operation Manual



222-410 10" Tilting Rotary Table
222-412 12" Tilting Rotary Table

Please read and save instructions. Read carefully before attempting to assemble, install, operate, or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury or property damage! Retain instructions for future reference

OPERATION AND SERVICE MANUAL

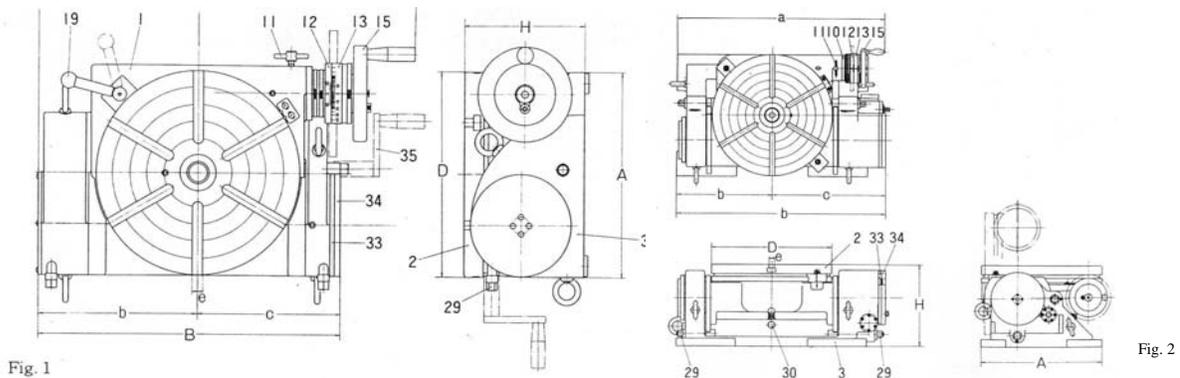


Tilting Rotary Table

This is an accurate and solidly designed table for use in milling machines, drilling machines and other machine tools. This table allows indexing, tilting, facing, boring, spot-facing and other work to be carried out rapidly with extreme precision.

Specifications

One turn of the tilting handle tilts the table by 1°. Combination of the main tilting scale (34) with the vernier (33) makes easy reading up to 2". The worm gear ratio is 1:90. The table rotates 4° for one turn of handle. One graduation of the dial (13) represents 1". Use of the vernier (12) enables reading up to 10". Before machining, lock the table securely by means of the table clamp lever (19) and the tilt position locking nut 29.



Operation and Maintenance

This device has been fully adjusted and has undergone a rigorous inspection before it leaves our factory. Remove the protective oil prior to use. After completion of operations, clean thoroughly, removing all dirt, metal chips, cutting oil, etc. If it will be out of service for long, apply protective oil and store in an appropriate place. Rusting is very harmful, resulting in the reduced precision of the equipment.

Standard Accessories

- Hex wrench key
- 222-410.....G2 G2.5 G3 G4 G5 G6
- 222-412.....G2 G2.5 G3 G4 G5 G6

Stock Number and Dimensions (refer to Fig. 1 & 2)

Stock No	Dia of Table D	Tbl Ht Hoz. H	Max Tilt angle	Center Height	Base Dimension		a	b	c	Width of T-slot e	Center sleeve
					A	B					
222-410	9.81	8.07	90°	5.51	10.24	12.2	19.49	8.27	7.36	0.47	MT-3
222-412	12.6	11.0	90°	6.89	13.07	14.96	21.7	9.25	8.35	0.55	MT-4

Reference numbers and Parts Names for 222-410 & 222-412 Tilting Rotary Tables

Reference No.	Description	Reference No.	Description
01	Main Body	15	Handle
02	Table	19	Table Clamp Lever
03	Base	29	Tilt position Locking nut
10	Switch Metal	33	Vernier
11	Metal Clamp Handle	34	Main Tilting Scale
12	Vernier Ring	35	Tilting Handle
13	Dial		

*** Suggestions for Ordering**

The parts reference numbers and parts names expressed in the operation and service manual are abbreviated for description. Therefore, when ordering parts for replacement, be sure to specify stock number of the rotary table and reference numbers that are shown in the table above.

Example:

Stock Number	Reference Number	Description
222-412	15	Handle

Operating Instruction and Functions of Each Unit

Operation of Table Turning Handle

Turn the handle clockwise at all times. When this handle has been turned until it passes the desired position, turn it back once counterclockwise past the desired position and then softly rotate it clockwise so as not to cause the backlash of the gear.

Table clamping Mechanism

When turning the table clamp lever (19) clockwise, namely inwards, the clamp piece (17) is pushed down because its projected part is fitted into the center slot on the side of the table, thus clamping the table. Be sure to clamp the table before working.

Hole for Fitting Jigs, Measuring Apparatus, etc.

The center hole of the table has a morse tapered sleeve, so that jigs, measuring apparatus, etc. can be fitted with precision.

Worm Gear Ratio

The worm gear ratio is 1:90 turns of the handle lead to one turn of the table and the table moves 4° for one turn of the handle. ($360^\circ \div 90 = 4^\circ$)

Dividing of 2 to 100 can be carried out quickly and accurately by attaching a Dividing Plate (stock no. 241-101) see page 5.

Adjusting Mesh of Worm Gear

Loosen the metal handle (11) and rotate the switch metal (10) clockwise until it touches the stopper screw. The worm gear and wheel have now been disengaged, thus enabling the table to be turned manually.

Angle Setting of Table Top

The main body 01 can be tilted to a desired angle from 0° to 90°. Therefore, it is possible to set the work piece supported by the main body to the angle desired. One turn of the handle tilts the table by 1°. Lock the table with the tilt position locking nut 29.

Tilting Mechanism of Table

Operation of Tilting Handle

Refer to the drawing on Page 1. After loosening the tilt position locking nut (29), turn the tilting handle (35) once, thereby giving the worm of the handle shaft (24) one turn. Consequently, its rotation is transmitted to the wheel of the tilting worm (22), Worm gear ratio 1:90 (222-410, 222-412). In addition, the worm fixed to the shaft of this wheel transmits the rotation to the wheel for tilting attached to the main body (01) Worm gear ratio 1:40 (222-410, 222-412). As a result, one turn of the handle tilts the table by 1°.

Adjustment of Handle Position

The tilting handle is fitted into the handle shaft by a serration mechanism. Therefore, after drawing out the handle once, it can be reset to a more convenient position. If it interferes with the table turning handle, it can be also pulled out.

Main Tilting Scale

The main tilting scale is graduated each 1°. In addition, the scale is equipped with a vernier, on which the length of 29 graduations of the main scale are divided into 30 equal parts. Combination of the main scale with the vernier makes easy reading up to 2".

How to Adjust Each Unit

Worm Gearing Adjustment on rotating the switch metal (10) clockwise until it hits the stopper after loosening the metal clamp handle (11), the worm gear will become free from engagement. Conversely, when the switch metal is made to rotate until it hits the stopper, the worm gear will be engaged. In case where the depth of the gear engagement is shallow, remove the screw A and the steel ball and rotate the screw B inside the unit counterclockwise so that the gear engagement proportionately becomes deepened. Reversely, when the screw B is made to rotate clockwise, the depth of engagement will proportionately become shallow. After adjustments are over, replace the steel ball and clamp the screw A tight with the metal clamp handle tightened. (see fig.3).

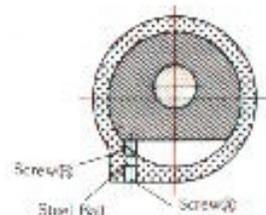


Fig. 3

Worm Shaft Direction Adjustment

When looseness in the axial direction of the worm shaft has been found, remove the handle (15), vernier ring (12) and switch metal (10), and then tighten the worm shaft nut AN04 housed inside so that the adjustment of looseness may be achieved. After adjustment, do not forget to use stopper for nut rotations.

Zero-Setting on Micro-Collar

Loosen the pressure screw, and the steel ball is lowered, thereby the micro-collar becoming idle. Set the zero point to the dial accurately.

18. Micro-collar
 19. Zero-set bolt
 20. Loosen it, and the micro-collar becomes idle.
- Then set the zero point.

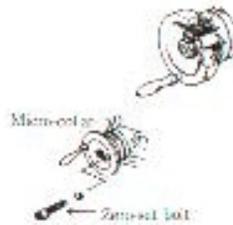


Fig. 4

Adjustment of Horizontal Position of Table

Adjust the main body to set at the horizontal position by tilting the handle until the parallelism of the table (02) to base (03) reads 0 on the main tilting scale. When the table is not level at this stage, loosen the supporting bolt 30 for the main body and adjust the height so that the table may be level.

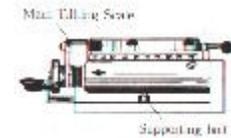


Fig. 5

Optional Accessories Tailstock

In case where the machine proper is set down on a vertical mill accurate centering operation is possible with this tailstock. The direction of centering is provided with a righthand type.

Dividing Plate Device

When using the Dividing plate (Dividing mechanism) device, the indexing of 2 to 100 positions can be carried out accurately and rapidly with the use of two index plates, sector, crank handle, etc.

When the Optional Dividing Plates Are Used

Indexing of 2 to 100 Can be made accurately and quickly.

Equation of Indexing

Since the worm ratio is 1:90, when the handle rotates one 360° revolution, the table therefore will rotate a 1/90 revolution. The relationships between handle revolution N and dividural number T to be sought are shown in the following equation:

$$N = \frac{9}{T}$$

Remarks: The index table on page 6 of this manual is made on the basis of this equation.

Example:

In a case where the operator wants to index the position divided into 29 equal parts.

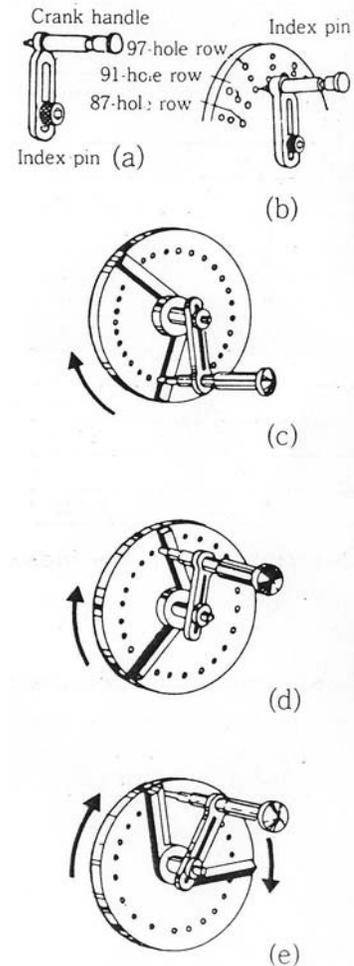
Hints on Operation

As for 29 individual numbers, the number of crank handle revolutions (N) is $3\frac{9}{87}$ as shown in the table on the page 6 of this manual, so that the handle should be rotated a full 360° revolution three times plus an interval of nine holes, this means hole intervals not hole numbers). After setting this point as a start point, rotate the handle a full 360° revolution three times plus an interval of nine holes. When the procedure is repeated in turn as many as 29 times, the indexing of dividing into 29 equal parts is thus achieved.

Operations of Crank Handle and Sector

In case of the example 'division into 29 equal parts' aforesaid, it is natural that indexing operation should proceed with the intervals of nine holes after setting the index plate (B plate) on which a row of 87 holes are provided. But in this method, the operator has to count nine hole intervals one by one. It is therefore necessary to use a device called 'sector' to avoid such troublesome procedures. The following will describe some necessary procedures for operation of the sector.

- a. Loosen the crank handle lock nut, adjust its length so as to cause the index pin to fall in the train of 87 holes, and retighten it.
- b. Loosen the set-screws of the sector, open two arms in accordance with the interval of nine holes (total numbers of holes are ten), and retighten with set screws.
- c. First, bring the left arm of the sector near to the index pins left side.
- d. Next, rotate the crank handle clockwise to apply it to the right arm of the sector so that the index pin will fall in the hole located at the right arms left side surface.
- e. Rotate the sector clockwise this time, and put the right side surface of the left arm to the left side of the index pin. In this time, the relationships between the index pin and the sectors left arm in their positions are the same as in Par. (c). The index hole plate that actually accommodates the index pin located at the point where goes across ten holes to the right away from the hole as in Par. (c).
- f. Repeat the same procedures as necessary.



Dividing Chart

T	H	N	T	H	N	T	H	N	T	H	N
2	*	45	31	B-62	2 56/62	60	A-50	1 25/50	98	B-49	45/49
3	*	30	32	B-64	2 52/64	61	A-61	1 29/61	99	A-44	40/44
4	A-50	22 25/50	33	A-44	2 32/44	62	B-62	1 28/62	100	A-50	45/50
5	*	18	34	A-34	2 22/34	63	B-49	1 21/49	102	A-34	30/34
6	*	15	35	B-49	2 28/49	64	B-64	1 26/64	104	A-52	45/52
7	B-49	12 42/49	36	A-50	2 25/50	65	A-39	1 15/39	105	B-49	42/49
8	A-44	11 8/44	37	A-37	2 16/37	66	A-44	1 16/44	106	B-53	45/53
9	*	10	38	A-38	2 14/38	68	A-34	1 11/34	108	B-54	45/54
10	*	9	39	A-39	2 12/39	69	B-46	1 14/46	110	A-44	36/44
11	A-44	8 8/44	40	A-44	2 11/44	70	B-49	1 14/49	111	A-37	30/37
12	A-50	7 25/50	41	A-41	2 8/41	72	A-44	1 11/44	112	A-56	45/56
13	A-52	6 48/52	42	B-49	2 7/49	74	A-37	1 8/37	114	A-38	30/38
14	B-49	6 21/49	43	A-43	2 4/43	75	A-50	1 10/50	115	B-46	36/46
15	*	6	44	A-44	2 2/44	76	A-38	1 7/38	116	B-58	45/58
16	A-56	5 35/56	45	*	2	78	A-39	1 6/39	117	A-39	30/39
17	A-34	5 10/34	46	B-46	1 44/46	80	B-64	1 8/64	118	B-59	45/59
18	*	5	47	B-47	1 43/47	81	B-54	1 6/54	120	A-44	33/44
19	A-38	4 28/38	48	A-56	1 49/56	82	A-41	1 4/41	122	A-61	45/61
20	A-50	4 25/50	49	B-49	1 41/49	84	A-56	1 4/56	123	A-41	30/41
21	B-49	4 14/49	50	A-50	1 40/50	85	A-34	1 2/34	124	B-62	45/62
22	A-44	4 4/44	51	A-34	1 26/34	86	A-43	1 2/43	125	A-50	36/50
23	B-46	3 42/46	52	B-52	1 38/52	87	B-58	1 2/58	126	B-49	35/49
24	A-44	3 33/44	53	A-53	1 37/53	88	A-44	1 1/44	128	B-64	45/64
25	A-50	3 30/50	54	A-39	1 26/39	90	*	1	129	A-43	30/43
26	A-52	3 24/52	55	A-44	1 28/44	92	B-46	45/46	130	A-39	27/39
27	A-39	3 13/39	56	B-56	1 34/56	93	B-62	60/62	132	A-44	30/44
28	A-56	3 12/56	57	B-57	1 33/57	94	B-47	45/47			
29	B-58	3 6/58	58	B-58	1 32/58	95	A-38	36/38			
30	*	3	59	B-59	1 31/59	96	B-64	60/64			

T= Desired dividural number

N= Number of revolution of the crank handle

H= Hole number of the dividing plate

*=using A or B plate

A= using A plate

B= using B plate

Worm Gear / Eccentric Sleeve Adjustment for H/V Rotary Tables

First Loosen Handle **A** for the eccentric sleeve lock and proceed to unscrew **Bolt B**.

Screw clockwise the **Limiting Bolt A** to adjust the mesh of the worm gear to the table top gear. At this time, rotate the handle wheel clockwise and counterclockwise to ensure the mesh of the worm gear is within 6° and then tighten the **Locking Bolt B** and then clamp the **Handle A** to lock the eccentric sleeve.

Screw counterclockwise the **Limiting Bolt A** to reduce the mesh and proceed to rotate the handwheel to ensure the mesh of the worm gear is within 6° and then tighten **Locking Bolt B**.

Rotate the **Indicator** counterclockwise until the **Bolt C** is touching the **Locating Pin**. This procedure has just disengaged the worm gear. Rotate the indicator clockwise until **Bolt D** is touching **Bolt A**. Now the worm gear is engaged.

