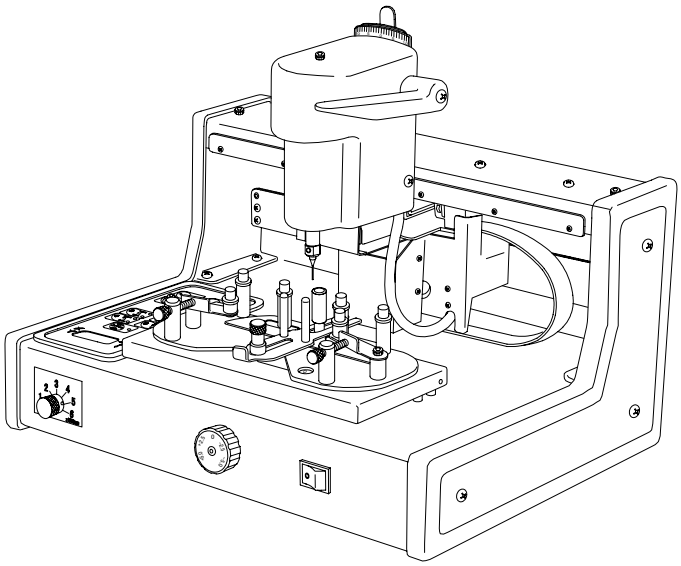
Dia

LENS DRILLING MACHINE

DM-50

Instruction Manual



Please be sure to read this manual carefully before using the instrument and keep it handy for ready reference.

Original Instructions

DIA OPTICAL CO.

IMPORTANT INFORMATION

<PURPOSE OF THIS MANUAL>

- The purpose of this manual is to provide the customer with the necessary and important information of the instrument related with its safety, unpacking & installation, operating procedures, and maintenance for safer and efficient use of the instrument.

<INTENDED USE OF THIS INSTRUMENT>

- This is an instrument to drill holes to plastic eyeglass lenses with the functions of simple positioning and angular adjustment.

Do not use the instrument for any other purposes not intended! Do not use this instrument for any purposes other than drilling holes to plastic eyeglass lenses. For example, drilling metals may cause a fire or damage the instrument.

< LIMITED WARRANTY >

- **Manufacturer** will not be liable for any damage or injury arising from an individual's failure to follow the instructions contained in this manual and to pay attentions and/or cautions normally required.
- **Manufacturer** will not be liable for any damages or consequential damages, including, without limitation thereof, damages or other costs resulting from any abuse, misuse, misapplication of the instrument and its components supplied by the **manufacturer**.
- Provisions stated in the written guarantee separately submitted shall constitute the sole remedy for any breach of the warranty of the **manufacturer**.

<OTHER IMPORTANT INFORMATION>

- When operating or servicing the instrument, take extreme caution on the generally required safety rules as well as on the items described in this manual.
- Allow the operation and maintenance of this instrument only to the persons who are educated about technical matters of this instrument and trained in the hazards involved in the instrument and the measures to avoid such hazards.
- To prevent occurrence of an accident, do not attempt to carry out any operation or maintenance in a manner other than those described in this manual or use the instrument for any unapproved purposes.
-

<INQUIRY AND REPAIR>

- If you have questions, require further information, or place an order for spare parts, contact your authorized distributor or our service representative with your following information:

  Model / Name: DM-50 / DigiDrill
  Date of Purchase: Date, Month, Year
  Serial No.: Printed on the name plate at the rear side of main body
  Details: State the contents of your question or requirement in detail.

■ Manufacturer:
TAKUBO MACHINE WORKS CO., LTD.
1-7-11, Tadanoumi-tokonoura, TAKEHARA, HIROSHIMA, 729-2314 JAPAN

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1: SAFETY

This section describes the safety precautions to secure safety when unpacking & installing, operating, and servicing the instrument.
The persons who handle the instrument must strictly observe the following safety precautions for its safer use.

1.1 MEANINGS OF SIGNAL WORDS

The following signal words are used in this manual so that the instrument may be handled safely; therefore, their definitions must be completely understood before reading the body of this manual.

Indicates a potentially hazardous situation which, if not heeded, could result in death or serious injury.

Calls attention to instructions that must be observed to avoid possible minor or moderate injury and possible damage to the instrument.

NOTE **Used to emphasize essential information.**

1.2 SAFETY PRECAUTIONS

When using the instrument, basic safety precautions as well as the safety precautions on the following pages should always be observed to reduce the risk of electric shock, personal injury and damage to the instrument.

(a) General Precautions

- **Read this manual!**
  Carefully read all the instructions contained in this manual before attempting to unpack, install, operate or service the instrument and follow those instructions.
- **Keep unauthorized persons away!**
  Do not let unauthorized persons, especially children, touch the instrument, its accessories, and its power cord, keeping them away from the working area.

- **Carefully handle the power plug and the power cord!**
  <Handling of power plug>
  Pull out the power plug from the wall outlet when the instrument is not used for a long time. Also, do not put anything near the wall outlet so that the power plug can be easily pulled out at any time. (If these are not observed, the power plug cannot be pulled out in case of an emergency.)
  Do not connect many loads to one wall outlet.
  <Handling of power cord>
  Never yank the power cord to disconnect it from the wall outlet.
  Keep the power cord away from heat, oil and sharp edges.

- **Stay alert!**
  Watch what you are doing and do not operate or service the instrument when you are tired.

- **Keep working area clean!**
  Always keep working area neat and clean.
  (Cluttered area and workbench invite injury.)

- **Immediately ask for repair of defective parts!**
  Ask our service representative for repair or replacement of defective parts or switches as soon as possible.

(b) Safety precautions during unpacking and installation

⚠ CAUTION

- **Consider environmental conditions for storage and installation of the instrument!**
  Do not keep or install the instrument where it may be exposed to direct sunlight, high humidity, temperature extremes, or dew depositions.
  (If not observed, an instrument failure or malfunction, electric shock, or a fire may result.)

- **Select appropriate place for installation!**
  Place the instrument where it can be operated easily and keep proper footing and balance at all times.
  (The instrument, if falls or drops, may result in personal injury.)

- **Keep sufficient space for working area!**
  (See 6.1 for the dimensions of required working space.)
  Keep the specified space at the rear of the instrument for maintenance of the power cord.
  Keep the specified space on both sides of the instrument for easier handling of the instrument.
  Also, keep the specified space in front of the instrument for easier and safer handling, operation and maintenance of the instrument.

- **Avoid unexpected startup of the instrument!**
  Ensure that the power switch of the instrument is at its OFF position before plugging the power plug to the wall outlet.

(c) Safety precautions before operation

⚠ CAUTION

- **Check parts for damage!**
  Before operating the instrument, the instrument and its accessories should be carefully checked to see if they operate properly and perform their intended functions.
  Also, check the movable parts for the mounted condition, connection, damage, and any other conditions that may affect their operation.
  Ask our service representative for repair or replacement of a damaged cover or other parts.

(d) Safety precautions during operation

WARNING

- **Allow only qualified persons to operate the instrument!**
  Allow the operation of this instrument only to the persons who are educated about technical matters of this instrument and trained in the hazards involved in the instrument and the measures to avoid such hazards.
- **Do not use the instrument for any other purposes not intended!**
  Do not use this instrument for any purposes other than drilling eyeglass lenses.
  For instance, do not drill metals, which may cause a fire or damage the instrument.
- **Take caution on rotating drill!**
  Never have access to the drill with hand or fingers while it rotates.
- **Actions to take when abnormality has occurred!**
  When some abnormality (abnormal sound or smell) has occurred to the instrument, turn OFF the power switch of the instrument, pull out the power plug from the wall outlet, and be sure to ask our service representative for repair.
  (Continuing operation under the abnormal condition may cause a fire or electric shock, or damage the instrument.)

CAUTION

- **Turn OFF the power switch before working!**
  When a drill and drill holder have to be removed from the spindle by pressing the spindle lock button unavoidably, be sure to turn OFF the power switch in advance.
- **Provide with sufficient lighting!**
  Provide with lighting of **300 lx or more** at the working area for the operation and maintenance of the instrument and partial lighting of **500 lx or more** at the LCD screen, the switch board, and other scale readout section of the instrument.

(e) Safety precautions during maintenance

WARNING

- **Allow only qualified persons to service the instrument!**
  Maintenance of this instrument must be done only by the persons who are well-educated and trained in the technical matters of this instrument, the hazards contained in this instrument, and the measures to avoid such hazards.
- **Turn OFF the power switch and pull out the power plug before maintenance!**
  Always turn OFF the power switch and pull out the power plug before cleaning, adjusting, inspecting, or replacing the parts of the instrument unless otherwise specified in this manual as the work to be done with the power ON.

CAUTION

- **Carefully service the instrument!**
  Keep the instrument and its accessories clean for better and safer performance.
- **Use a spare part specified by the manufacturer!**
  Use a spare part specified by the manufacturer when replacing a part of the instrument.
  (Using a spare part not specified by the manufacturer may damage the instrument.)
- **Inspect the power cord!**
  Inspect the power cord of the instrument periodically, and if damaged, have it repaired by our service representative.
- **Prohibition of disassembly and modification!**
  Never perform any disassembly and/or modification of the instrument not specified in this manual. Ask our service representative for repair.
  (Unauthorized repair and modification will lead to electric shock, a fire, or a failure of the instrument.)
- **Install only the specified drill!**
  The drill is a dangerous tool. Therefore, be sure to install only the drill designated by the manufacture.
  (Installing a drill not specified by the manufacturer may cause personal injury or damage to the instrument.)

1.3 DANGER ZONE AND ACCESS TO DANGER ZONE

(a) Danger Zone

This instrument involves the following danger zone.

Danger Zone ①: Drill section

- **Injury of hand or fingers by drill**

(b) Access to Danger Zone ①

Observe the following precautions when having access to Danger zone ①.

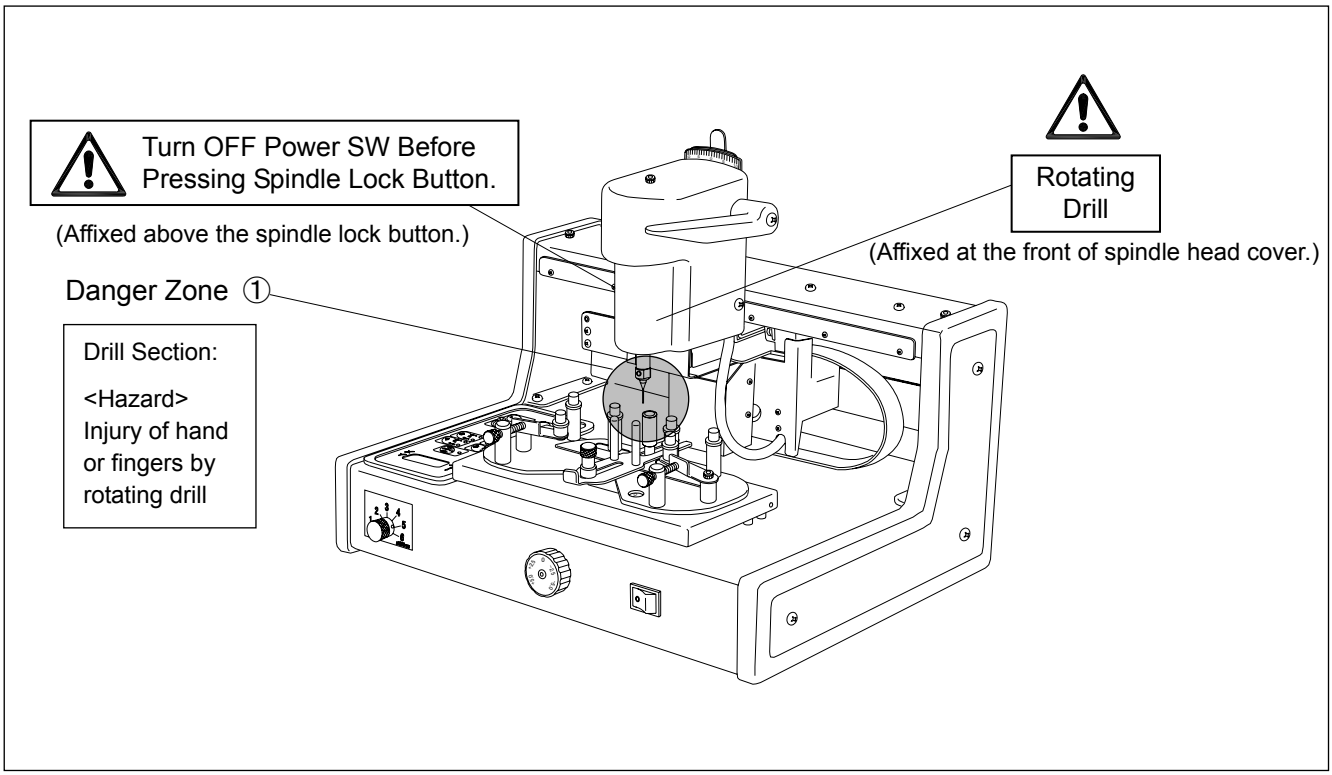
- While drilling an eyeglass lens, do not have access to the drill section by hand or fingers.
- When exchanging a drill unit, set the spindle speed adjusting control to (1), securely set the drill set/removal jig to the bottom of the spindle, and then press [REMOVE] or [SET] button. Besides, do not press the button longer than necessary.
- When a drill unit has to be removed from the spindle by pressing the spindle lock button unavoidably, be sure to turn OFF the power switch in advance.
- For the maintenance work other than the above, always turn OFF the power switch and disconnect the power plug from the wall outlet before having access to the drill section.

(c) Safety Labels

The types of the safety labels affixed on the instrument and their positions are shown in the Safety Information Drawing below.

WARNING **Always follow the warnings instructed on the safety labels and described in the manual when unpacking & installing, operating, or servicing the instrument.**

NOTE **If a safety label is damaged or missing, affix a new label according to the illustration in this manual.**



SAFETY INFORMATION DRAWING

2: UNPACKING & INSTALLATION

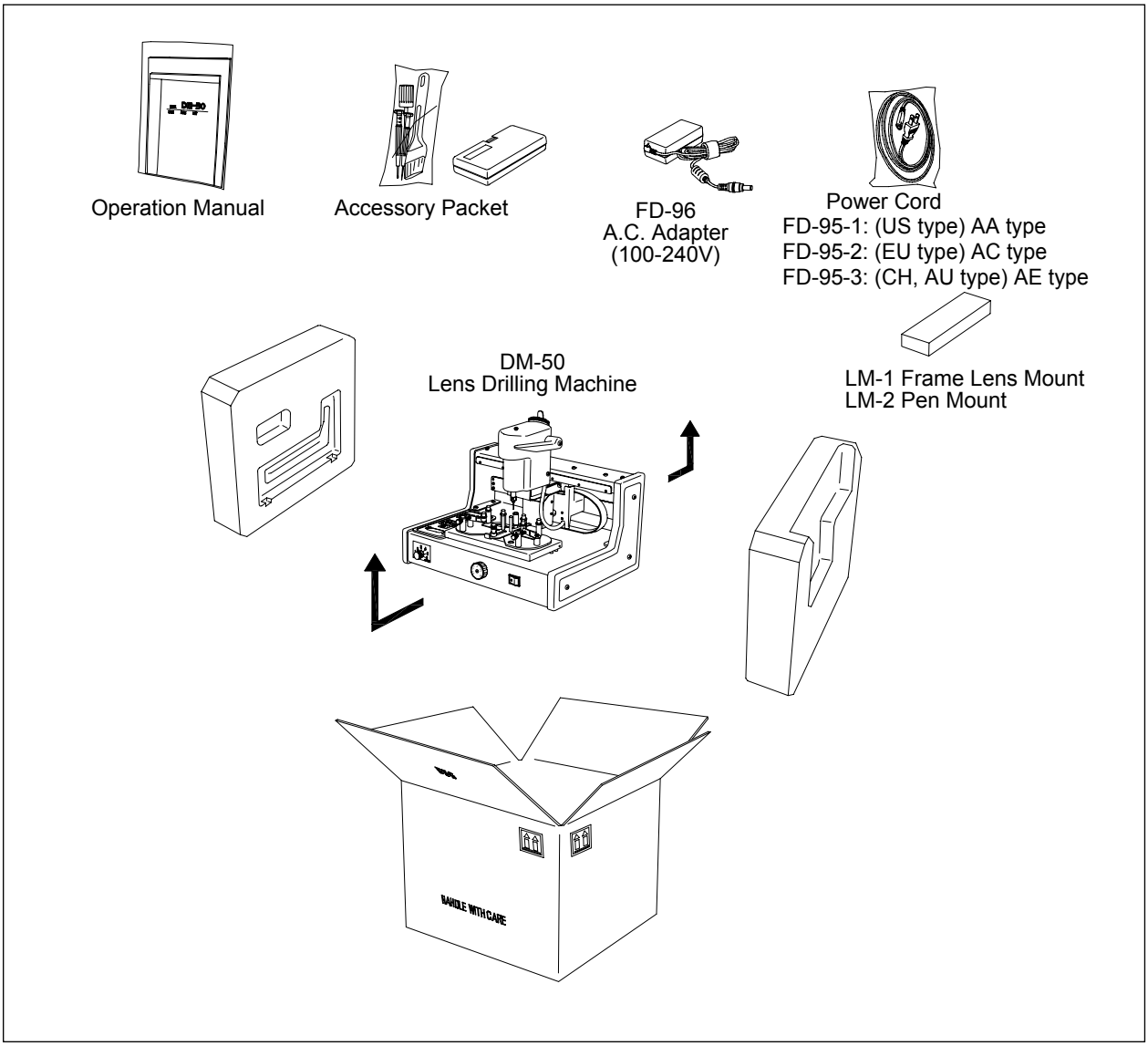
This section describes the procedures to unpack the cardboard carton of the instrument and its accessories and install the instrument after its delivery.

2.1 UNPACKING CARTON

Unpack the carton of the instrument and its accessories in the following procedures.

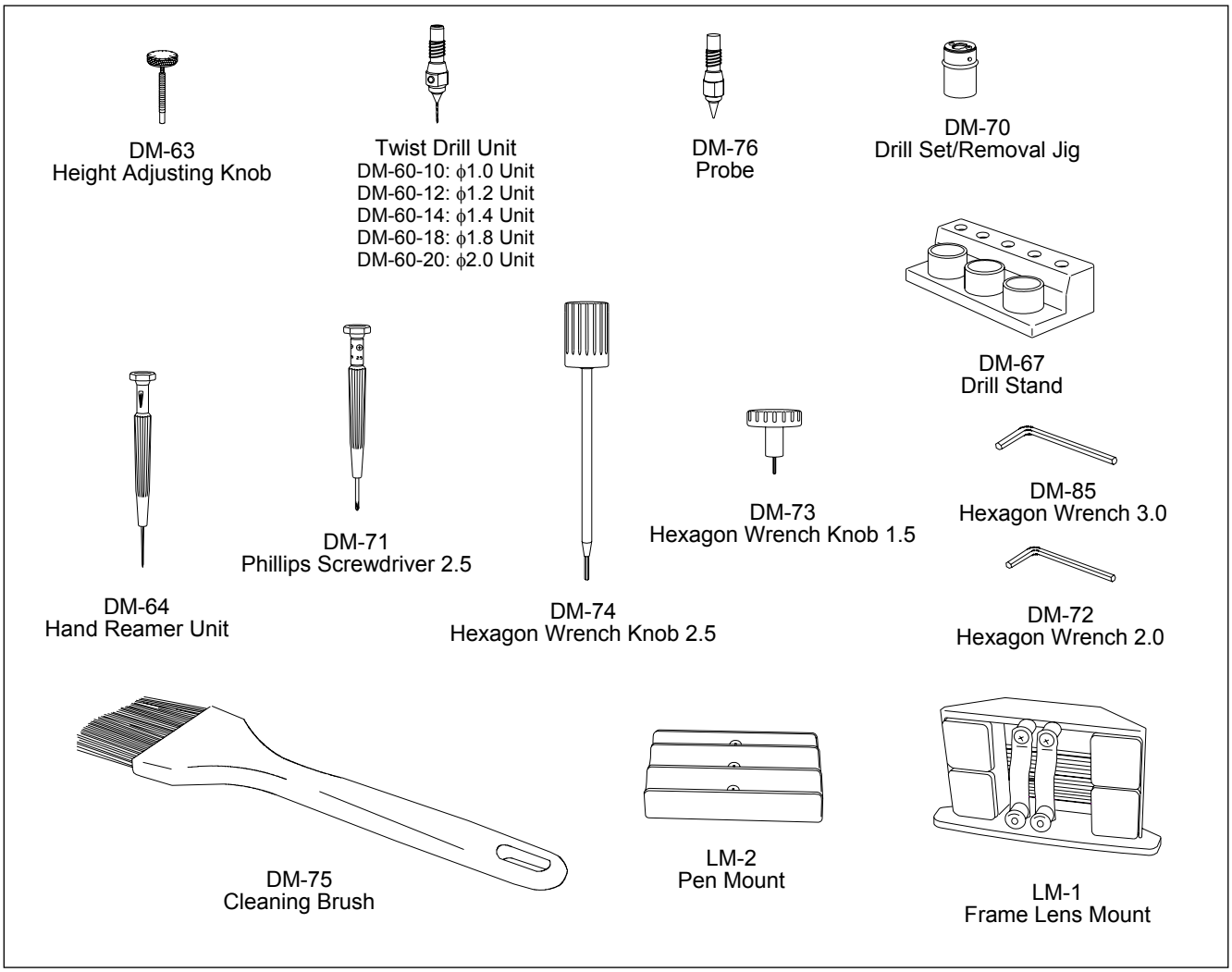
⚠ CAUTION **Take special caution when handling this instrument since it is a precision instrument.**
Weight of carton: 6.5 kg (Weight of instrument: 5 kg)

(1) Open the carton of the instrument and take out the accessories and attached documents.
(2) Take the instrument out of the carton in the direction shown by the arrows in the figure below and place it on the stable workbench.
(3) Verify that all the items (the items below and the accessories listed on the following page) are included in the carton and there is no damage to them.



Items included As Accesories

Item Code	Name of Item	Quantity
DM-60-10	Twist Drill Unit ϕ1.0	1
DM-60-12	Twist Drill Unit ϕ1.2	1
DM-60-14	Twist Drill Unit ϕ1.4	1
DM-60-18	Twist Drill Unit ϕ1.8	1
DM-60-20	Twist Drill Unit ϕ2.0	1
DM-63	Height Adjusting Knob	1
DM-64	Hand Reamer Unit	1
DM-67	Drill Stand	1
DM-70	Drill Set/Removal Jig	1
DM-71	Phillips Screwdriver 2.5	1
DM-72	Hexagon Wrench 2.0	1
DM-73	Hexagon Wrench Knob 1.5	2
DM-74	Hexagon Wrench Knob 2.5	1
DM-75	Cleaning Brush	1
DM-76	Probe	1
DM-85	Hexagon Wrench 3.0	1
LM-1	Frame Lens Mount	1
LM-2	Pen Mount	1



2.2 INSTALLATION

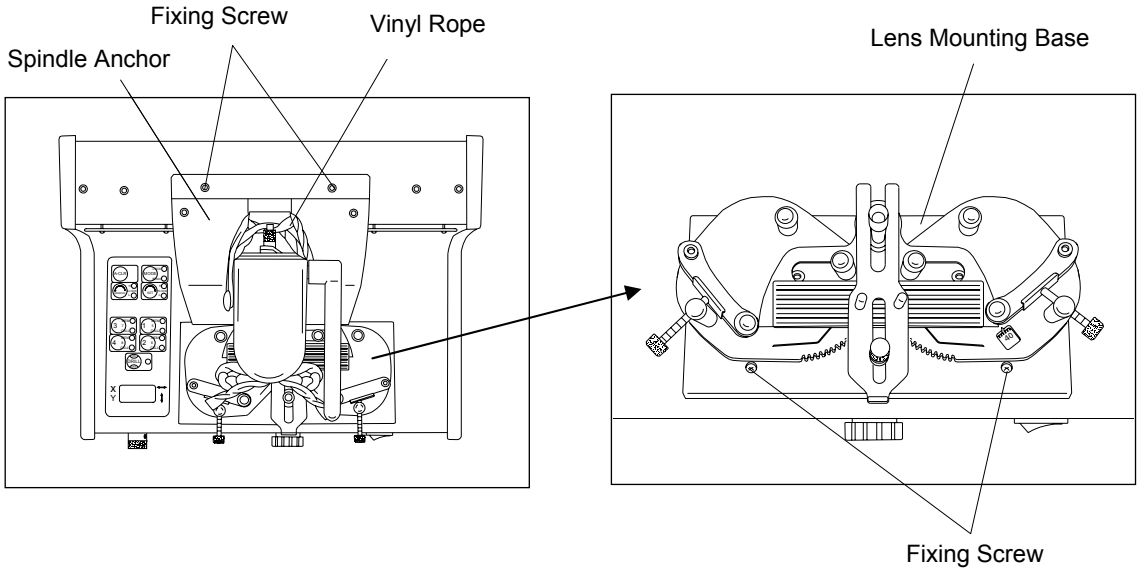
Install the instrument by following the instructions in this section.

2.2.1 Environmental Conditions for Installation

The place for installing the instrument must maintain the environmental conditions specified at <Installation Requirements> in "6.1 SPECIFICATIONS OF INSTRUMENT".

2.2.2 Installation Procedures

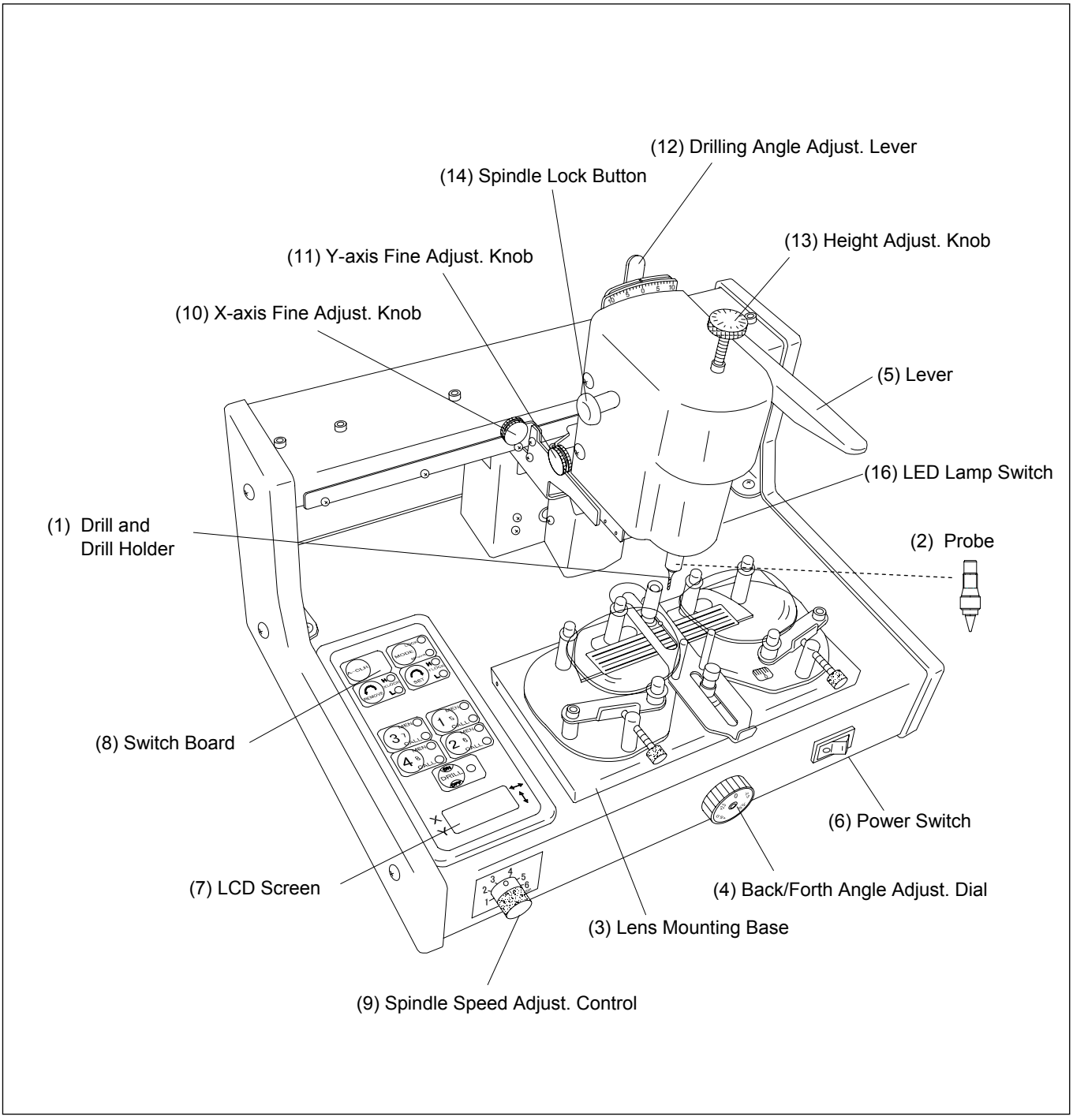
(1) Place the instrument on the appointed workbench.
(2) Loosen the vinyl rope for packing.
(3) Loosen two fixing screws of the spindle anchor with the hexagon wrench knob 3.0 (DM-85) and remove the spindle anchor.
(4) Remove two fixing screws of the lens mounting base with the Phillips screwdriver 2.5 (DM-71)



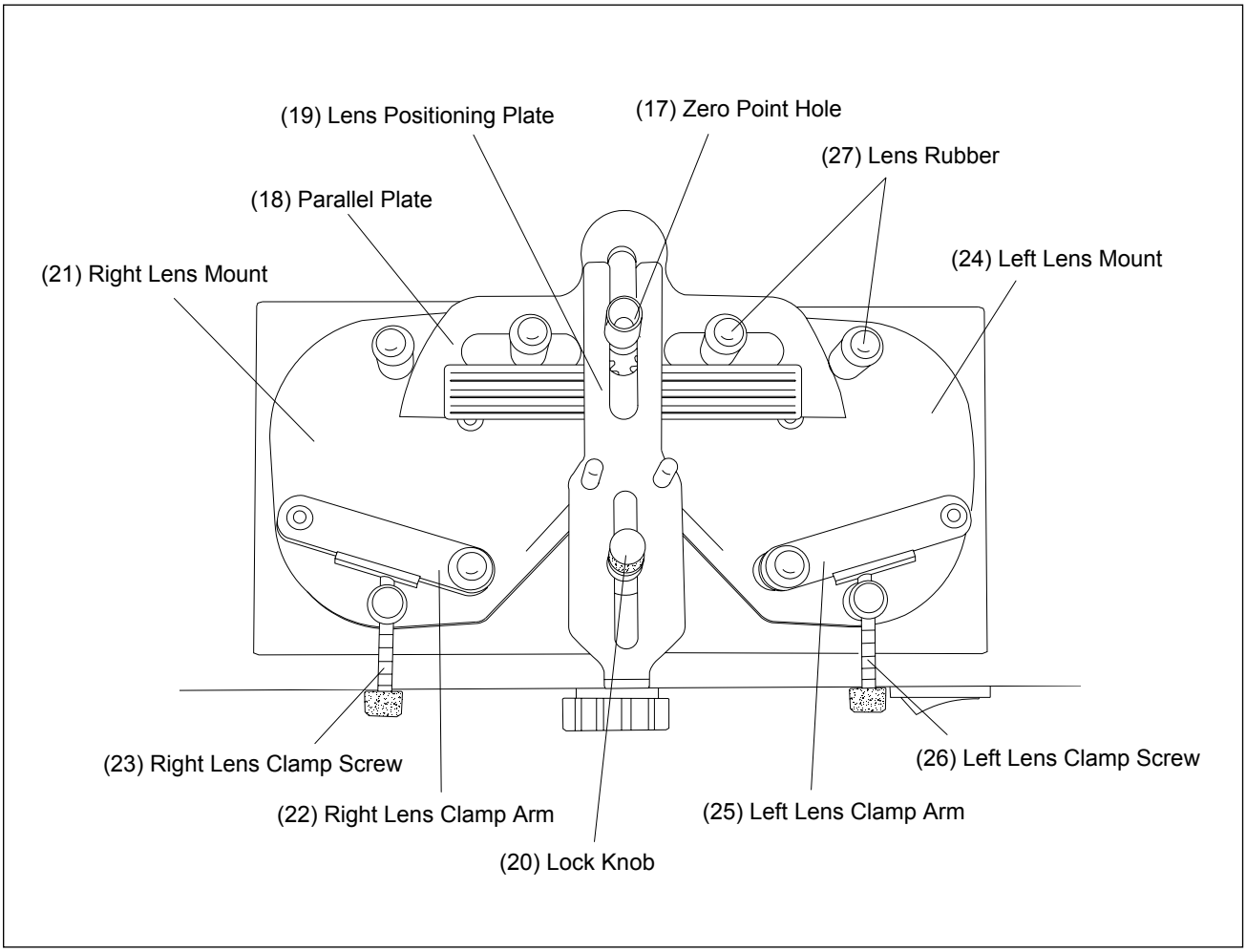
NOTE **Return and tighten the removed fixing screws to their original positions after the spindle ancher is removed. Likewise, return and tighten the fixing screws for the lens mounting base to their original positions under the lens mounting base.**

3: BASIC INFORMATION OF INSTRUMENT

3.1 NAMES AND FUNCTIONS OF MAJOR COMPONENTS



<Details of Lens Mount Section>



(1) Drill and Drill Holder

These are the drill and drill holder for drilling eyeglass lenses. To remove (or set) the drill and drill holder, use the special drill set / removal jig and press [REMOVE] button (or [SET] button) on the switch board.

(2) Probe

This is a probe for detecting a hole, which is set at the bottom of the spindle when memorizing the positions of holes in a model lens. The position of a hole is memorized by inserting the taper portion of this probe into corresponding hole in a model lens or fitting ϕ4 portion of the probe to the lens edge.

(3) Lens Mounting Base

This lens mounting base is furnished with the mechanism to set model lenses (right and left) or eyeglass lenses (right and left) to be drilled on its top. See Items (17)-(27) in **<Details of Lens Mount Section>** for details.

(4) Back/Forth Angle Adjusting Dial

Adjust the back/forth angle (slant) of the lens mounting base to match the drilling direction with this dial. Pull the dial, turn it right or left and release it to change its setting. Back/forth angle can be set every 2.5º. (Setting range: –5º, –2.5º, 0º, +2.5º, +5º)

(5) Lever

Push down this lever to lower the spindle.
Push down this lever for positioning a hole (when a model lens is set), drilling an eyeglass lens, and resetting the instrument to zero point when the instrument is powered ON.

(6) Power Switch

This is the power switch of the instrument.

⚠ CAUTION **Verify that this power switch is OFF before plugging the power plug of the A.C. adapter into the wall outlet.**

(7) LCD Screen

Shows operating guidance, X-axis position value, and Y-axis position value.
(See 3.2 for details.)

(8) Switch Board

Furnished with various operation buttons and indication lamps to operate the drill machine.
(See3.2 for details.)

(9) Spindle Speed Adjusting Control

This control adjusts the rotating speed of the spindle.
The spindle rotates at the minimum speed even when set to (1).
(Adjustment range: Approx. 500 – 6400 rpm)

(10) X-axis Fine Adjusting Knob

Operate this knob to make a fine adjustment of the X-axis value when the X-axis is weakly locked.
(Turn the knob while pushing it downward.) (See3.2 for the details of X-axis weak lock.)

(11) Y-axis Fine Adjusting Knob

Operate this knob to make a fine adjustment of the Y-axis value when the Y-axis is weakly locked.
(Turn the knob while pushing it downward.) (See 3.2 for the details of Y-axis weak lock.)

(12) Drilling Angle Adjusting Lever

Adjust the spindle angle to match the direction of drilling.
By leaning the lever right or left, the spindle angle can be adjusted every 5º.
(Setting range: 10º left, 5º left, 0º, 5º right, 10º right)

(13) Height Adjusting Knob

When countersinking a lens for jewelries, adjust the milling depth with this height adjusting knob. One graduation corresponds to 0.1 mm milling depth.

(14) Spindle Lock Button

When it is difficult to remove a drill unit (drill and drill holder) with the drill set/removal jig, remove the drill and drill holder from the spindle by applying a spanner on the drill holder.

(15) AC/DC Adapter (Not shown in the figure.)

This is the power supply adapter for the instrument.

⚠ CAUTION **Verify that the power switch (6) is OFF before plugging the power plug of the A.C. adapter into the wall outlet.**

(16) LED Lamp Switch

This is the ON/OFF switch of the LED lamp to illuminate drilling surface.

<Details of Lens Mount Section>

(17) Zero Point Hole

This is the hole for setting the zero point to the instrument.
In order to set the proper zero point to the instrument, turn ON the power switch (6) of the instrument, then move the spindle to the position just above this hole, push down the lever to insert the probe (or drill) into this hole, and press A-CLR button.

(18) Parallel Plate

Set a model lens or an eyeglass lens with its horizontal line (marking points) matched the line of this parallel plate. Use this plate for the axial alignment of a model lens or an eyeglass lens.

(19) Lens Positioning Plate

Push and fit two rods in the middle of this lens positioning plate to the lower parts on the nasal side of model lenses or eyeglass lenses to make the horizontal (right and left) positioning of the lenses.

(20) Lock Knob

Lock knob secures the lens positioning plate.

(21), (24) Right / Left Lens Mount

This is the mount to set the right/left model lens or eyeglass lens. The axial angle of a set lens can be changed by moving the right and left clamp screws (23) (26) right and left with your fingers. (Both the right and left lens mounts rotates in reverse direction synchronously.)

(22), (25) Right / Left Lens Clamp Arm

By tightening the right and left clamp screws (23) (26), the right and left lenses set on the right and left lens mounts (21) (24) are clamped from their bottoms.

(23), (26) Right / Left Lens Clamp Screw

By tightening these right and left clamp screws (23) (26), the right and left lenses set on the right and left lens mounts (21) (24) are clamped from their bottoms.

(27) Lens Rubber

Place the edge of a model lens or an eyeglass lens to be drilled on the collars of these lens rubbers for clamping.

3.2 Switch Board and LCD Screen

<Switch Board>

Beep sound:
- A short beep sound is issued at every pressing the button.
- Double-short beep sounds are issued as soon as the spindle has reached each memory value (V value, Y value) and been locked.

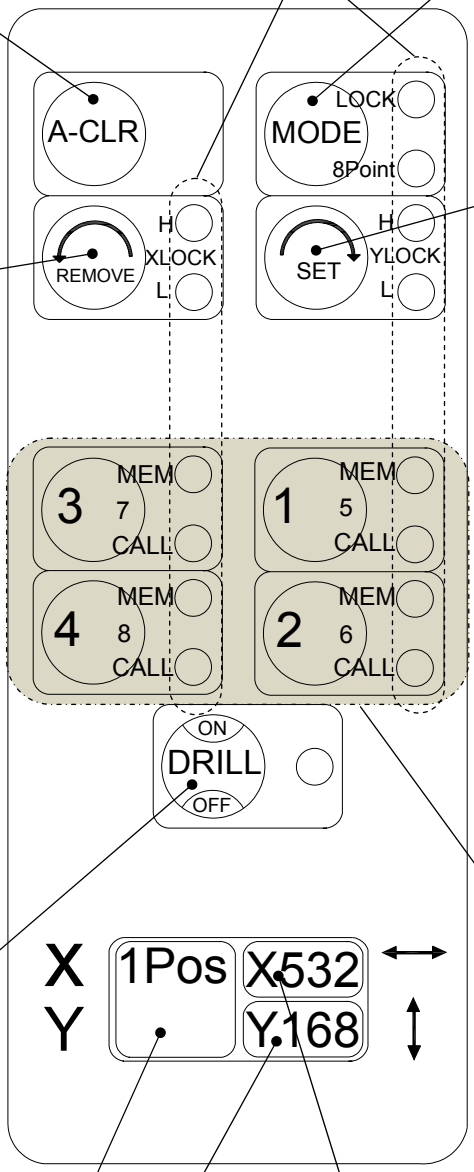
[MODE] button:
When pressed once, LED lamp (Lock) turns ON to enter "Lock" mode.
In Lock mode, every pressing [REMOVE] or [SET] button will switch over the selected axis to Weak-lock, Strong-lock, and Lock-release, by turns.

When pressed for 2 sec. or more, LED lamp "8 Point" turns ON to enter "5-8 MEM" mode.
When pressed for 2 sec. or more in 5-8 MEM mode, 1-4 MEM mode is restored, LED lamp turns OFF and LED screen returns to normal indication.

[A-CLR] button:
Memory clear button

When pressed for 2 sec. or more, all the memory values memorized by 1 to 4 (5 to 8) MEM/CALL buttons are cleared.

LED Lamp



[REMOVE] button:
Button to remove drill (or probe)

While pressed, spindle rotates in reverse direction.
By setting drill set/removal jig on drill holder and pressing this button, drill (or probe) is removed from spindle.

[SET] button:
Button to set drill (or probe)

While pressed, spindle rotates in forward direction.
By setting drill and drill holder (or probe) to bottom of spindle with drill set/removal jig and pressing this button, drill (or probe) is set to spindle.

[X LOCK] button:
Every pressing this button after [MODE] button is pressed, V-axis is switched over to Weak-lock (one LED ON), Strong-lock (both LEDs ON), and Lock-release (both LEDs OFF), by turns.

<Lo: Weak lock>
Semi-lock condition in which X-axis can be moved by fine adjusting knob
<Hi: Strong lock>
Lock condition for drilling

[Y LOCK] button:
Every pressing this button after [MODE] button is pressed, Y-axis is switched over to Weak-lock (one LED ON), Strong-lock (both LEDs ON), and Lock-release (both LEDs OFF) by turns.

<Lo: Weak lock>
Semi-lock condition in which Y-axis can be moved by fine adjusting knob
<Hi: Strong lock>
Lock condition for drilling

[DRILL ON/OFF] button:
When pressed once, drill starts rotating.
When pressed again, drill stops.

1-4 (5-8) [MEM/CALL] buttons:
Memory/Call button for drilling position
(Eight points can be memorized at maximum.)

<Independent clear function>
When pressed for 3 sec. or more, memorized value is cleared independently.

<LCD Screen>

LCD Screen:

- Operating guidance display
- X-axis position value (↔ direction) display
- Y-axis position value (⇕ direction) display

(Contents displayed: Absolute value from zero point, memorized value, relative value from memorized value)

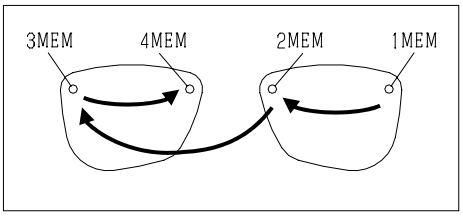
4: DRILLING

4.1 FOUNDAMENTAL OF LENS DRILLING MACHINE DM-50

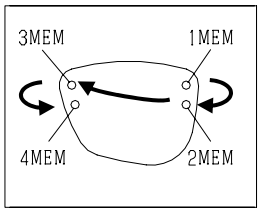
<Memorizing> Memorizes hole positions in two methods below.
Reference Hole method:
Memorizes the distance from the reference hole to the lens edge.
Next Hole method:
Memorizes the distance from the reference hole to the next hole.

<Drilling> Drilling is done by displaying the memorized distance from the lens edge to a hole (or from the reference hole to the next hole) and moving the drill to the displayed position.

<Examples of Hole Positions and Memory Numbers>

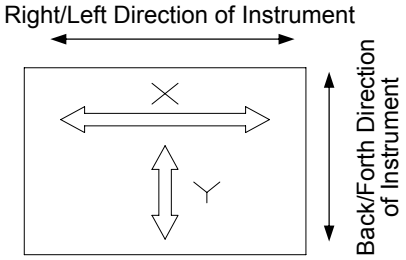


Example of 2-point Type Drilling



Example of 3-/4-point Type Drilling

<Movement Directions of X-axis and Y-axis>



<Memorizing/Drilling Guidance>

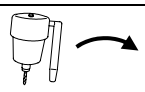
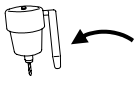
Operating procedures are guided by the LCD screen and LED lamp. (Successive operation is indicated by flashing of LED lamp.) (Mirror method in which memorized data for one lens is used for drilling of another lens is always available.).

<Beep Sound>

- Single-short-beep sound is issued at every pressing each button.
- Double-short-beep sound is issued as soon as the spindle has reached each memorized value (X-axis value and Y-axis value) and been locked.

<Spindle Angle>

Holes are memorized and drilled with the standard spindle angle 5°slant to the left or right.

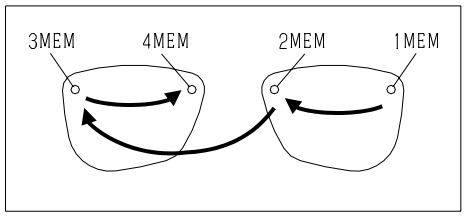
For Left lens (Temple side hole) and Right lens (Nasal side hole)	 Lean to Right by 5°
For Left lens (Nasal side hole) and Right lens (Temple side hole)	 Lean to Left by 5°

<Axis Lock>

- At Y-axis positioning, Y-axis is weakly locked () when "00.0" is displayed on the screen, while it is strongly locked () when "00.0" is displayed.
- At X-axis positioning, X-axis is weakly locked () when "00.0" is displayed on the screen and even when "00.0" is displayed. X-axis is strongly locked () as soon as the spindle starts.

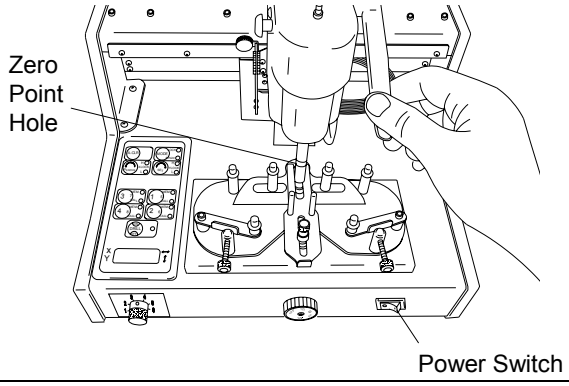
NOTE When  button is pressed with the probe (or drill) fit to the lens edge for drilling a hole on the nasal side, the arrow on the LCD screen may point out the opposite direction. In such a case, press  button to correct the direction of the arrow.

4.2 2-POINT TYPE (BASIC TYPE) DRILLING



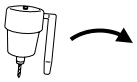
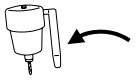
① Power Switch ON

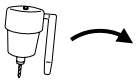
② Zero Point Setting of Instrument

Step	Manipulation	Switch/Button Operation
1	Lower the lever to insert the probe to the zero point hole. 	
2		Press A-CLR button.

③ Setting Model Lens ⇨ Sec. 4.4.2

④ Memorizing Hole Positions of Model Lens

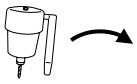
Step	Manipulation	Switch/Button Operation
3	 Lean the spindle to Right by 5°.	
4	Inserting the probe to No. 1 hole, 	Press 1 5 MEM CALL button.
5	Fitting the probe to the lens edge, 	Press 1 5 MEM CALL button.
6	 Lean the spindle to Left by 5°.	
7	Inserting the probe to No. 2 hole, 	Press 2 6 MEM CALL button.
8	Fitting the probe to the lens edge, 	Press 2 6 MEM CALL button.
9	Inserting the probe to No. 3 hole, 	Press 3 7 MEM CALL button.
10	Fitting the probe to the lens edge, 	Press 3 7 MEM CALL button.

Step	Manipulation	Switch/Button Operation
11	 Lean the spindle to Right by 5°.	
12	Inserting the probe to No. 4 hole, 	Press  button.
13	Fitting the probe to the lens edge, 	Press  button.

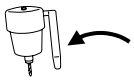
⑤ Exchanging Probe to Drill

⑥ Removing Model Lens and Setting Lens to be Drilled. ⇨ Sec. 4.4.2

⑦ Drilling – No.1 Hole

Step	Manipulation	Switch/Button Operation
14	 Lean the spindle to Right by 5°.	
15		Press  button. (Vertical distance (Y value) is displayed.)
16	Move the spindle in the direction of the arrow (on screen) to match Y value to “0”.	
17	Fit ϕ4 portion of the drill to the lens edge. 	
18		Press  button. (Horizontal distance (X value) is displayed.)
19	Move the spindle in the direction of the arrow (on screen) to match X value to “0”.	
20	Drill No. 1. hole. 	Press  button. After drilling, press again to stop the drill.

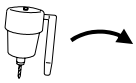
⑧ Drilling – No.2 Hole

Step	Manipulation	Switch/Button Operation
2 1	 Lean the spindle to Left by 5°.	
2 2		Press  button. (Vertical distance (Y value) is displayed.)
2 3	Move the spindle in the direction of the arrow (on screen) to match Y value to “0”.	
2 4	Fit ϕ4 portion of the drill to the lens edge. 	
2 5		Press  button. (Horizontal distance (X value) is displayed.)
2 6	Move the spindle in the direction of the arrow (on screen) to match X value to “0”.	
2 7	Drill No. 2. hole. 	Press  button. After drilling, press again to stop the drill.

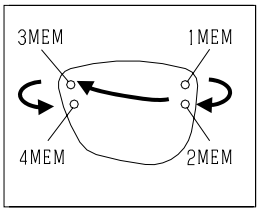
⑨ Drilling – No. 3 Hole

Step	Manipulation	Switch/Button Operation
2 8		Press  button. (Vertical distance (Y value) is displayed.)
2 9	Move the spindle in the direction of the arrow (on screen) to match Y value to “0”.	
3 0	Fit ϕ4 portion of the drill to the lens edge. 	
3 1		Press  button. (Horizontal distance (X value) is displayed.)
3 2	Move the spindle in the direction of the arrow (on screen) to match X value to “0”.	
3 3	Drill No. 3. hole. 	Press  button. After drilling, press again to stop the drill.

⑩ Drilling – No. 4 hole

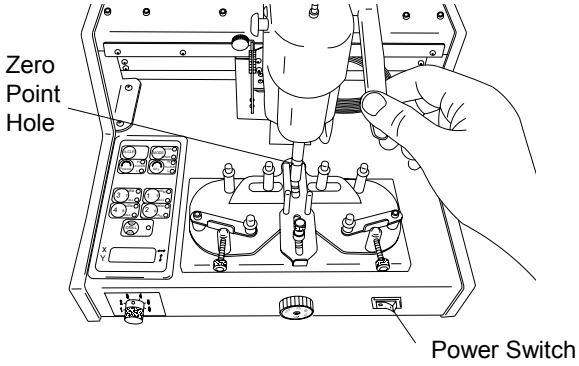
Step	Manipulation	Switch/Button Operation
34	 Lean the spindle to Right by 5°.	
35		Press  button. (Vertical distance (Y value) is displayed.)
36	Move the spindle in the direction of the arrow (on screen) to match Y value to “0”.	
37	Fit ϕ4 portion of the drill to the lens edge. 	
38		Press  button. (Horizontal distance (X value) is displayed.)
39	Move the spindle in the direction of the arrow (on screen) to match X value to “0”.	
40	Drill No. 4. hole. 	Press  button. After drilling, press again to stop the drill.

4.3 3-POINT / 4-POINT TYPE DRILLING



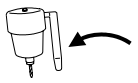
① Power Switch ON

② Zero Point Setting of Instrument

Step	Manipulation	Switch/Button Operation
1	Lower the lever to insert the probe to the zero point hole. 	
2		Press A-CLR button.

③ Setting Model Lens ⇨ Sec. 4.4.2

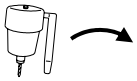
④ Memorizing Hole Positions of Model Lens

Step	Manipulation	Switch/Button Operation
3	 Lean the spindle to Right by 5°.	
4	Inserting the probe to No. 1 hole, 	Press 1 5 MEM CALL button.
5	Fitting the probe to the lens edge, 	Press 1 5 MEM CALL button.
6	Inserting the probe to No. 2 hole, 	Press 2 6 MEM CALL button twice. ⇒ 2 6 MEM CALL
7	 Lean the spindle to Left by 5°.	
8	Inserting the probe to No. 3 hole, 	Press 3 7 MEM CALL button.
9	Fitting the probe to the lens edge, 	Press 3 7 MEM CALL button.
10	Inserting the probe to No. 4 hole, 	Press 4 8 MEM CALL button twice. ⇒ 4 8 MEM CALL

⑤ Exchanging Probe to Drill. ⇨ Sec. 4.4.1

⑥ Removing Model Lens and Setting Lens to be Drilled. ⇨ Sec. 4.4.2

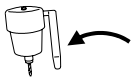
⑦ Drilling – No.1 Hole

Step	Manipulation	Switch/Button Operation
11	 Lean the spindle to Right by 5°.	
12		Press  button. (Vertical distance (Y value) is displayed.)
13	Move the spindle in the direction of the arrow (on screen) to match Y value to “0”.	
14	Fit ϕ4 portion of the drill to the lens edge. 	
15		Press  button. (Horizontal distance (X value) is displayed.)
16	Move the spindle in the direction of the arrow (on screen) to match X value to “0”.	
17	Drill No. 1. hole. 	Press  button. After drilling, press again to stop the drill.

⑧ Drilling – No.2 Hole

Step	Manipulation	Switch/Button Operation
18		Press  button. (Vertical distance (Y value) is displayed.)
19	Move the spindle in the direction of the arrow (on screen) to match Y value to “0”.	
20		Press  button. (Horizontal distance (X value) is displayed.)
21	Move the spindle in the direction of the arrow (on screen) to match X value to “0”.	
22	Drill No. 2. hole. 	Press  button. After drilling, press again to stop the drill.

⑨ Drilling – No.3 Hole

Step	Manipulation	Switch/Button Operation
23	 Lean the spindle to Left by 5°.	
24		Press  button. (Vertical distance (Y value) is displayed.)
25	Move the spindle in the direction of the arrow (on screen) to match Y value to “0”.	
26	Fit ϕ4 portion of the drill to the lens edge. 	
27		Press  button. (Horizontal distance (X value) is displayed.)
28	Move the spindle in the direction of the arrow (on screen) to match X value to “0”.	
29	Drill No. 3. hole. 	Press  button. After drilling, press again to stop the drill.

⑩ Drilling – No.4 Hole

Step	Manipulation	Switch/Button Operation
30		Press  button. (Vertical distance (Y value) is displayed.)
31	Move the spindle in the direction of the arrow (on screen) to match Y value to “0”.	
32		Press  button. (Horizontal distance (X value) is displayed.)
33	Move the spindle in the direction of the arrow (on screen) to match X value to “0”.	
34	Drill No. 4. hole. 	Press  button. After drilling, press again to stop the drill.

4.4 OTHER OPERATIONS (DETAILS)

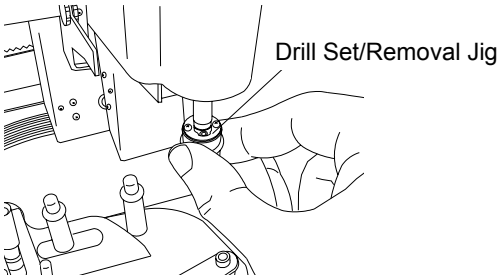
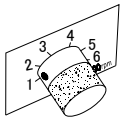
4.4.1 Exchanging Probe with Drill Unit and Vice Versa

This instrument uses the probe for memorizing hole positions and the drill unit for drilling holes. Exchange the probe with a drill unit or a drill unit with the probe in the following procedures.

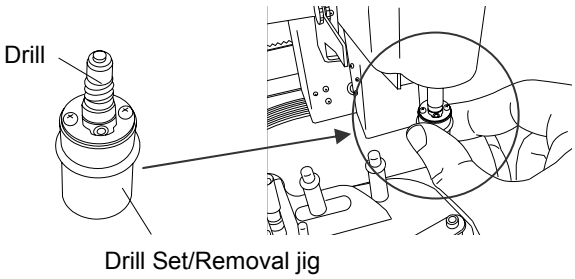
⚠ CAUTION **Take caution on the following points when exchanging the drill unit not to have your hand or fingers injured with the drill.**

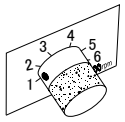
- **Before pressing REMOVE or SET button;**
  - **Install or remove with the spindle speed adjusting control set to (1), and**
  - **Securely set the drill set/removal jig to the bottom of the spindle.**
- **Do not press respective button longer than necessary.**

① Removal of Probe

Step	Manipulation	Switch/Button Operation
1	Push the jig to the bottom of the spindle. 	
2		Set the spindle speed adjusting control to (1). 
3		Press  button. (The probe is removed.)

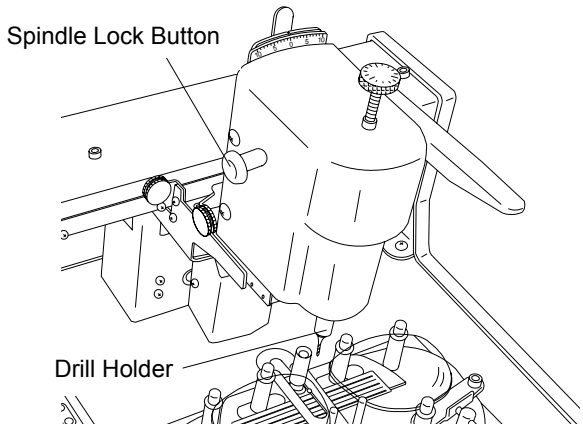
② Setting of Drill

Step	Manipulation	Switch/Button Operation
1	Set the drill to the drill set/removal jig and push the jig to the bottom of the spindle. 	

Step	Manipulation	Switch/Button Operation
2		Set the spindle speed adjusting control to (1). 
3		Press  button. (The drill is set.)

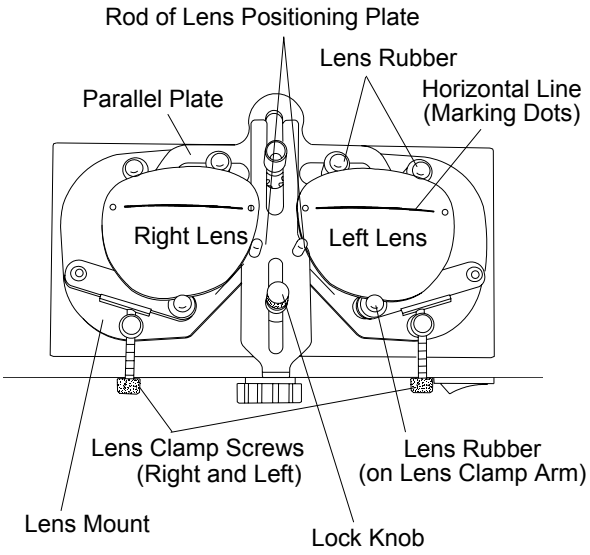
Follow the same procedure when exchanging the drill with the probe.

NOTE **Other Removal Method**:
If the drill or probe cannot be removed in the procedure above as it is tightened too hard, remove in the following procedure.

Step	Manipulation	Switch/Button Operation
1		Turn OFF the power switch of the instrument.
2	While pressing the spindle lock button, apply the spanner on the hexagonal portion of the probe or drill unit 	
3	Turn the spanner clockwise (CW) when seen from the top to remove the probe or drill unit.	

4.4.2 Method to Set Model Lens or Lens to be Drilled

Set the right and left model lenses or lenses to be drilled in the following procedures.

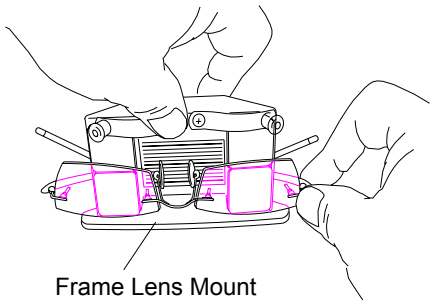
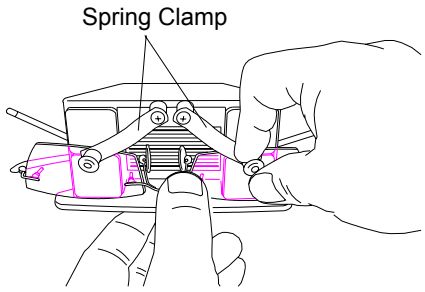
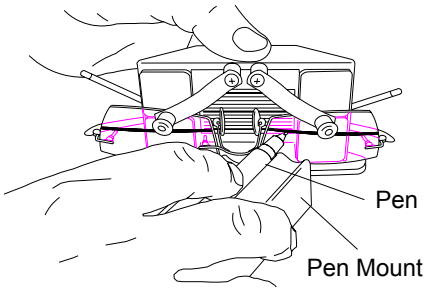
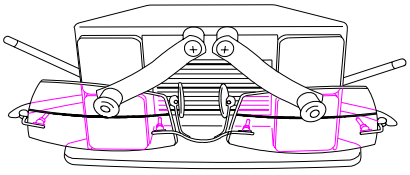
<table>
<tr><th>Step</th><th>Operation</th><th>Explanatory Figure</th></tr>
<tr><td>1</td><td>Draw a horizontal line (marking dots) on each lens.(⇒ Sec. 4.4.3)
<u>NOTE</u> This work is not always necessary. However, it is very effective for lenses in a round shape. This work is only for the confirmation whether or not lenses are properly set.</td><td rowspan="5"> 
</td></tr>
<tr><td>2</td><td>Set the left lens.
(Set to the center of three lens rubbers.)</td></tr>
<tr><td>3</td><td>Turn each lens mount so that the horizontal line (marking dots) on the model lens and the line of the parallel plate become in parallel.
<u>NOTE</u> If no horizontal line is drawn, turn the lens mount to the angle where the lens is set to a frame.</td></tr>
<tr><td>4</td><td>Push the positioning plate so that its rod fits the nasal side lower part of the lens, and then tighten the lock knob.
<u>NOTE</u> Fix the positioning plate at the position where it does not interfere with any hole on the nasal side.</td></tr>
<tr><td>5</td><td>Set the right lens to the lens mount.
(Set to fit upper two lens rubbers and the rod of the positioning plate, and then tighten the right and left lens clamp screws to clamp both lenses.)</td></tr>
</table>

4.4.3 Drawing Horizontal Line to Lens (Using Line Marker)

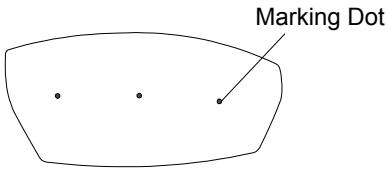
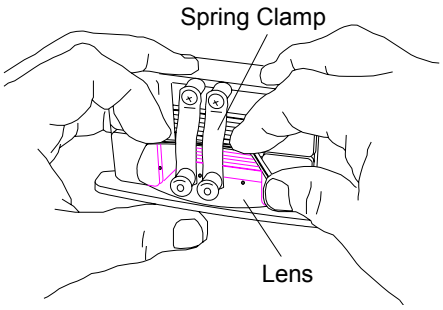
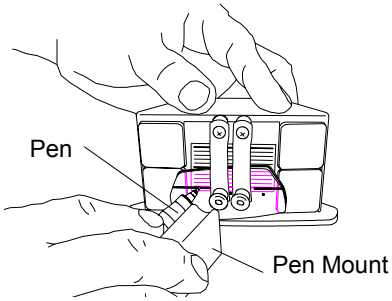
The following two methods are explained below.

- How to Draw Horizontal Line to 2-Point Frame Lens
- How to Draw Horizontal Line to Lens to be Drilled

<How to Draw Horizontal Line to 2-Point Frame Lens>

Step	Operation	Explanatory Figure
1	Set a 2-point lens to the frame lens mount.	
2	Clamp the frame lenses with the spring clamps. **NOTE** Clamp the upper portion of the lenses so that lines can be drawn without applying excess force to the frame.	
3	Set a pen on to a stage of the pen mount optimal to draw lines.	
4	Draw lines to both the right and left lenses. **NOTE** Draw lines without touching the frame.	
5	Confirm that straight lines have been drawn.	

<How to Draw Horizontal Line to Lens to be Drilled>

Step	Operation	Explanatory Figure
1	Confirm that marking dots put with the lens meter are on the edged lens.	
2	Set a lens to the center of the frame lens mount and clamp the center of the lens with the spring clamps.	
3	Match the marking dots on the lens to the horizontal line of the frame lens mount for correct setting of the lens.	
4	Draw lines to the right and left sides of the lens.	
5	Confirm that the marking dots and the drawn lines are in parallel.	

4.5 NOTICES ON DRILLING

<Decision of Hole Position in 2-Point Type Drilling>

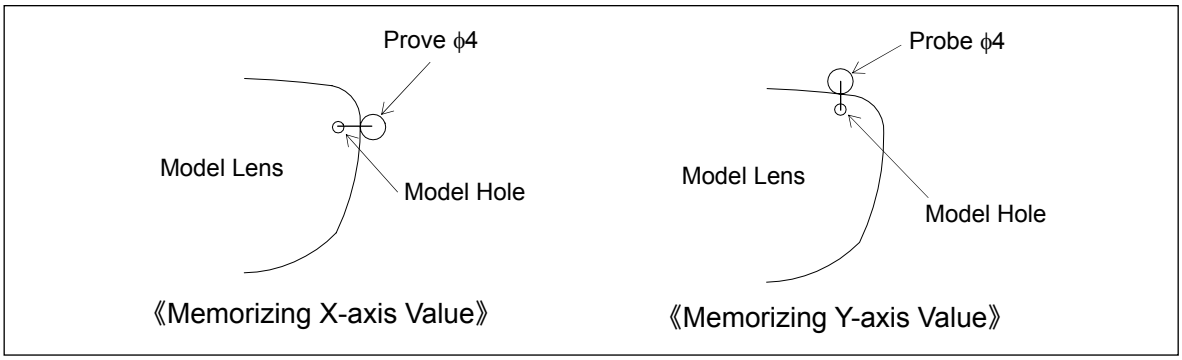
In case of a 2-point type frame, hole positions of a model lens may not match the hole positions of the frame. The position of the hole to be drilled has to be decided by confirming the play or tightness between the model lens edge and the frame when the nuts fastening the model lens are loosened. Generally, it is recommended that a hole should be drilled a bit tightly and then finely adjusted with the attached special hand reamer unit afterward. (As a guideline, drill a hole 0.1 – 0.3 mm inward of the memorized hole position.

<About Hole and Lens Edge>

When memorizing the distance between a hole and the lens edge, either X-axis value or Y-axis value perpendicularly closer to the lens edge can be memorized more precisely. In general, X-axis value (right – left distance) is memorized. However, if Y-axis value is perpendicularly closer to the lens edge than X-axis value, the Y-axis value should be memorized.

To memorize Y-axis value, press the 

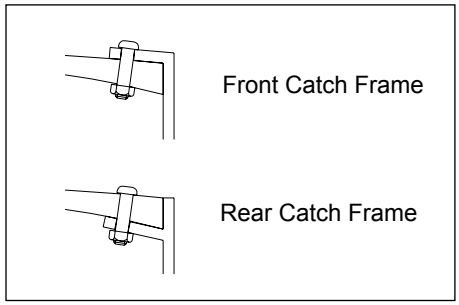
button for the hole position to be memorized for 2 sec. or more. Then, X axis will be locked.

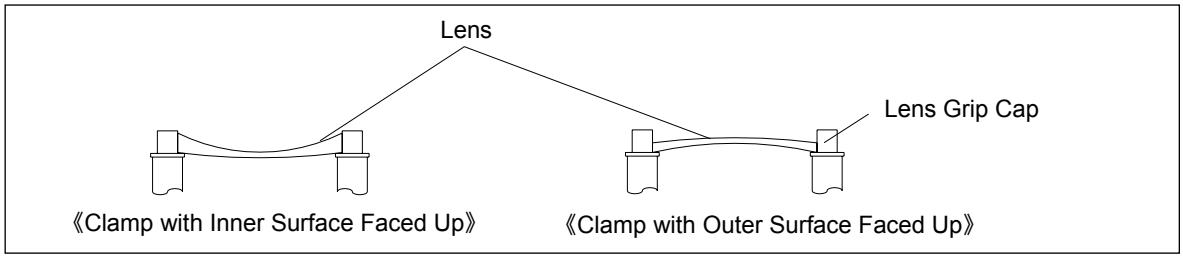


<Difference in Drilling Between Front Catch Frame and Rear Catch Frame>

- DM-50 memorizes and drills holes with the outer surface of a model lens and an eyeglass lens to be drilled faced up (in case of a front catch frame with a weak refractive lens).

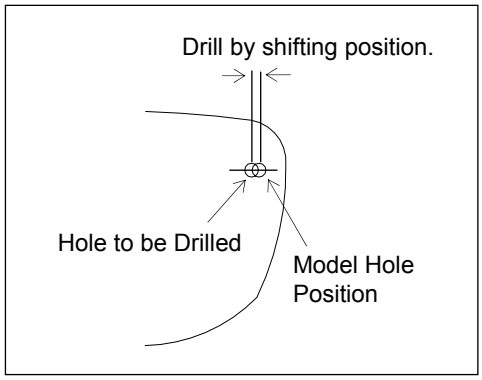
- However, in case of a rear catch frame with a high refractive lens, memorizing and drilling a hole are to be done with the inner surface of a model lens and an eyeglass lens to be drilled faced up.





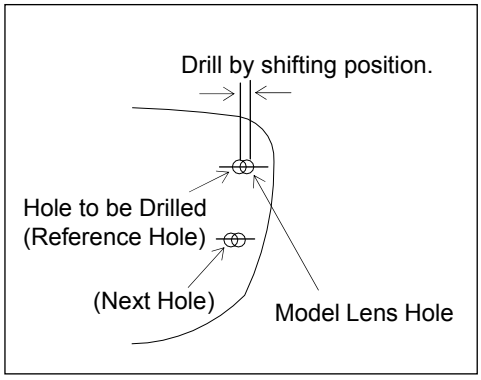
4.6 DRILLING HOLE AT POSITION SHIFTED FROM MEMORIZED HOLE

4.6.1 Method to Shift X-axis Value in 2-Point Type Drilling



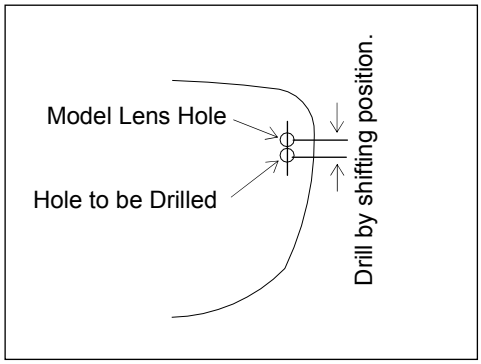
Usage	Drilling a hole at a position to set a lens to the frame a bit tightly.	
Step	**Manipulation**	**Switch/Button Operation**
1	Perform the operations up to Step 18 in 4.2 “2-Point Type Drilling”.	
2	In the operation in Step 19 in 4.2 “2-Point Type Drilling”, shift the X-axis of the spindle to an intended value from “0” for drilling.	(e.g. Shift X-axis by “00.1”.)

4.6.2 Method to Shift X-axis Value in 3-Point/4-Point Type Drilling



Usage	Setting the frame at an inner or outer position of a lens than the model lens	
Step	**Manipulation**	**Switch/Button Operation**
1	Match X- and Y-axes of the spindle to “0” for the reference hole by the operations up to Step 16 in 4.3 “3-Point/4-Point Type Drilling”.	
2	Shift the spindle to an intended X value with the X-axis fine adjusting knob.	
3	Reconfirm that Y value is Zero (0).	
4		Press  button. (Current position will be the reference hole position.)

4.6.3 Method to Shift Y-axis Value in 3-Point/4-Point Type Drilling



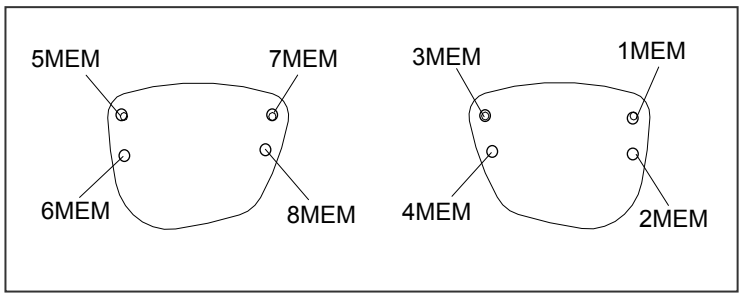
Usage	Changing the vertical position (Y-axis value) of the frame when a lens to be drilled is smaller or larger than the model lens	
Step	**Manipulation**	**Switch/Button Operation**
1	Match X- and Y-axes of the spindle to “0” for the reference hole by the operations up to Step 16 in 4.3 “3-Point/4-Point Type Drilling”.	
2		Press  button. (“Lock” LED turns ON.)
3		Press  button. (X-axis strong lock)
4		Press  button twice. (Y-axis weak lock)
5	Shift the spindle to an intended Y value with the Y-axis fine adjusting knob.	
6	Reconfirm that X value is Zero (0).	
7		Press  button. (Current position will be the reference hole position.)

NOTE Shift the position of the hole downward when the size of the model lens is increased and upward when the size is decreased.

4.7 DRILLING EXAMPLES (FOR REFERENCE)

4.7.1 8-Point Type Drilling

(Mode that can memorize the positions of 8 holes)



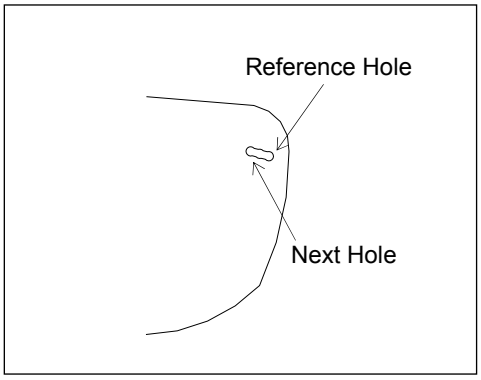
① Memorizing Hole Positions of Model Lens

Step	Manipulation	Switch/Button Operation
1	Memorize the positions of No.1 through No.4 holes by the operations up to Step 10 in 4.3 “3-Point/4-Point Type Drilling”.	
2		Press MODE (LOCK / 8Point) button for 2 sec. or more. (“8 Point” LED turns ON.)
3	Memorize the positions of No.5 through No.8 holes by the operations from Step 3 through Step 10 in 4.3 “3-Point/4-Point Type Drilling”.	

② Drilling Holes

Step	Manipulation	Switch/Button Operation
1	Exchange the probe with the drill. (⇒ Sec. 4.4.1)	
2	Remove the model lens and set the lens to be drilled. (⇒ Sec. 4.4.2)	
		Press MODE (LOCK / 8Point) button for 2 sec. or more. (“8 Point” LED turns OFF.)
3	Drill No.1 through No.4 holes by the operations from Step 11 through Step 34 in 4.3 “3-Point/4-Point Type Drilling”.	
4		Press MODE (LOCK / 8Point) button for 2 sec. or more. (“8 Point” LED turns ON.)
5	Drill No.5 through No.8 holes by the operations from Step 11 through Step 34 in 4.3 “3-Point/4-Point Type Drilling”.	

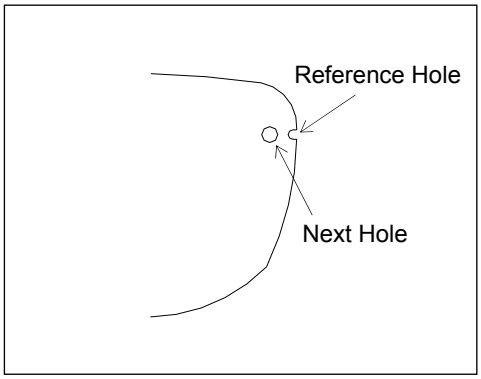
4.7.2 Drilling Long-hole



Step	Manipulation	Switch/Button Operation
1	Memorize the positions of the reference hole and the next hole by the operations from Step 1 through Step 6 in 4.3 "3-Point/4-Point Type Drilling".	
2	Exchange the probe with the drill. (⇒ Sec. 4.4.1)	
3	Remove the model lens and set the lens to be drilled. (⇒ Sec. 4.4.2)	
4	Drill the reference hole by the operations from Step 11 through Step 17 in 4.3 "3-Point/4-Point Type Drilling".	
5	**Without moving the drill position,**	Press MEM 2 CALL button, and make notes of X and Y values.
6	Move the spindle in the direction of the arrow (on screen) to match Y value to "0".	
7	Move the spindle in the direction of the arrow (on screen) to match X value to "0".	
8	Drill the next hole.	Press DRILL ON/OFF button. After drilling, press again to stop the drill.
9	**Without moving the drill position,** (If shifted, match to "0".)	Press MEM CALL button which memorizes the next hole position. (A double-short-beep sound is issued within 5 seconds.)
10		While pressing SET H YLOCK L button,
11	Move the spindle to a half of the written Y value with the Y-axis fine adjusting knob.	
12		Press SET H YLOCK L button. (Y axis is strong-locked.)

Step	Manipulation	Switch/Button Operation
13		While pressing  button,
14	Move the spindle to a half of the written X value with the X-axis fine adjusting knob.	
15		Press  button. (X axis is strong-locked.)
16	Perform drilling	Press  button. After drilling, press again to stop the drill.
17	Correct the wavy portion between two holes with a small flat file.	

4.7.3 Drilling Half-round Hole



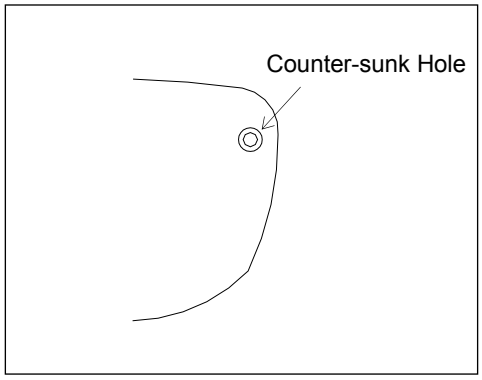
① Memorizing Hole Positions of Model Lens

Step	Manipulation	Switch/Button Operation
1	Perform the operations up to Step 3 in 4.3 "3-Point/4-Point Type Drilling".	
2	Regarding the half-round hole at the lens edge as the reference hole, fit the taper portion of the probe to the half-round hole. (Slightly pushing the probe downward and push it toward the lens edge side.) **NOTE** Confirm that the taper portion of the probe is fit to the half-round hole.	
3		Press MEM 1 5 CALL button. (The reference hole (half-round hole) is memorized.)
4	While inserting the probe to the next hole,	
5		Press MEM 2 6 CALL button twice. (Next hole is memorized.)

② Drilling Holes

Step	Manipulation	Switch/Button Operation
1	Exchange the probe with the drill. (⇒ Sec. 4.4.1)	
2	Remove the model lens and set the lens to be drilled. (⇒ Sec. 4.4.2)	
3	Drill the holes by the operations from Step 11 through Step 22 in 4.3 "3-Point/4-Point Type Drilling".	
4	**NOTE** When drilling a half-round hole, the hole to a lens is drilled approximately 0.1 mm outer than the position of model lens hole. Therefore, shift the hole position inward by 0.1 mm according to the steps in 4.6.2.	

4.7.4 Countersinking to Rear Side of High-index Minus Lens



① Memorizing Hole Position

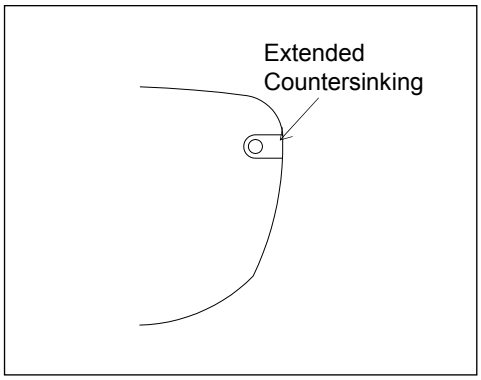
Step	Manipulation	Switch/Button Operation
1	Set the drilled lens to the lens mount with its inner side faced up.	
2		Press A–CLR button for 2 sec. or more. (Memorized data is cleared.)
3	While inserting the probe to the counter-sunk hole,	
4		Press 1 MEM 5 CALL button twice. (X value and Y value of the counter-sunk hole position become Zero (0).)
5	While inserting the probe to the counter-sunk hole again,	
6		Press 1 MEM 5 CALL button twice with an interval.
7		Confirm that X value and Y value are Zero (0).

② Countersinking Hole

Step	Manipulation	Switch/Button Operation
1	Move the spindle aside with the X-axis fine adjusting knob and replace the probe with the countersinking tool (End mill).	
2	Match X value to Zero (0) and countersink a hole.	
3	**NOTE** Countersinking screwdriver can be purchased separately as an optional part. (⇒ Sec. 6.2)	

NOTE

- Set the spindle angle to zero (0) in case of extended-countersinking.
- Slowly turn the height adjusting knob so that any vibration does not occur during countersinking.
- When extending countersinking by moving to the right and left, keep Y-axis locked strongly and X-axis locked weakly, and then operate the X-axis fine adjusting knob to perform extend countersinking. Also, keep the cutting depth of the height adjusting knob to two scales (0.2 mm).



5: MAINTENANCE

This section describes the maintenance to be performed periodically.
Perform the preventive maintenance properly to always keep the instrument in good conditions.

WARNING **The instructions in this section are intended for the persons familiar with the purpose, use, and operation of this instrument, as well as the maintenance of precision instrument of this type. Always review the safety instructions in Section 1 before proceeding with any maintenance work.**

5.1 CLEANING OF INSTRUMENT (DAILY)

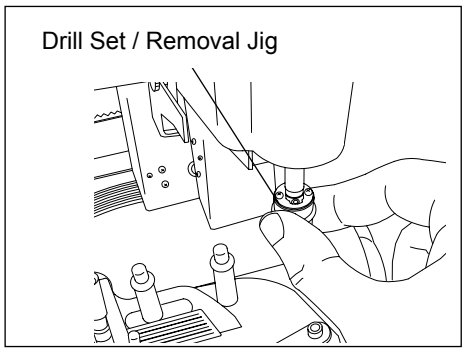
CAUTION **Be sure to turn OFF the power switch before cleaning.**

Vacuum the lens refuse on the top surface of the instrument and around the right and left lens mounting bases with a vacuum cleaner. Move the spindle to the right and left as necessary.

5.2 EXCHANGING TWIST DRILL (AS NECESSARY)

Exchange the twist drill in the following procedures when its drilling quality becomes worse or it is damaged.

CAUTION **When exchanging a twist drill, take caution not to have your hand or finger cut by the drill. Besides, be sure to install only the drill specified by the manufacturer.**



<Removing Drill Unit>

(1)Securely set the drill set/removal jig to the bottom of the spindle.

(2)Set the spindle adjusting control to (1).

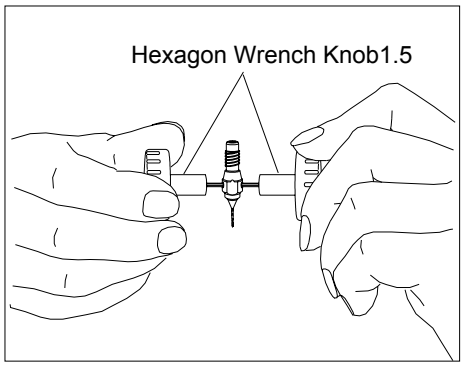
(3)Press REMOVE button.

- The drill unit (the drill and drill holder) will come off the spindle.

NOTE **If the drill unit cannot be removed in the procedure above, turn OFF the power switch of the instrument, put a spanner on the hexagonal part of the drill unit, and turn it clockwise when seen from the top while pressing the spindle lock button to remove the drill unit.**

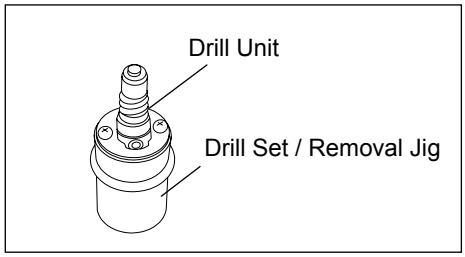
<Exchanging Twist Drill >

(1) Loosen two screws at the right and left sides of the drill holder with the hexagon wrench knob 1.5 (DM-73) to pull out the twist drill.
(2) Set two hexagon wrench knob 1.5 (DM-73) on both the screws as shown and tighten them with the same torque (to prevent the shake of the twist drill).



<Setting Drill Unit>

(1) Set a drill unit to the drill set/removal jig and push the jig to the bottom of the spindle.
(2) Set the spindle adjusting control to (1).
(3) Press SET button.
    - The drill unit will be set to the spindle.



6: OTHER INFORMATION

As the other information to be provided to the customer, this section includes the major specifications and the optional parts list of the Lens Drilling Machine DM-50.

6.1 SPECIFICATIONS OF INSTRUMENT

Item	Specifications
Outside Dimensions	300 (width) × 225 (depth) × 185 (height) mm
Weight	5 Kg
Power Source (Instrument)	24 V d.c., 22W (to be used with A.C. adapter)
Power Source (A.C. Adapter)	100 -240 Va.c., 50/60Hz
Rated Continuous Operating Time	30 min.
Lens Materials to be Drilled	High refractive plastic (1.6, 1.67), Polycarbonate, and Trivex
Possible Drilling Range	ϕ0.8 – ϕ2.2 mm
Drill Speed	500 – 6400 rpm
Noise Level	Below 70 dB (Aeq)
<Installation Requirements>	
Place for Installation	Indoor (Avoid direct sunlight.)
Altitude	Max. 2000 m
Ambient Temperature	41°F – 104°F (5°C – 40°C)
Max. Relative Humidity	50% at 104°F (40°C)
Min. Working Space	800 mm (front), 200 mm (rear), 200 mm (both sides)

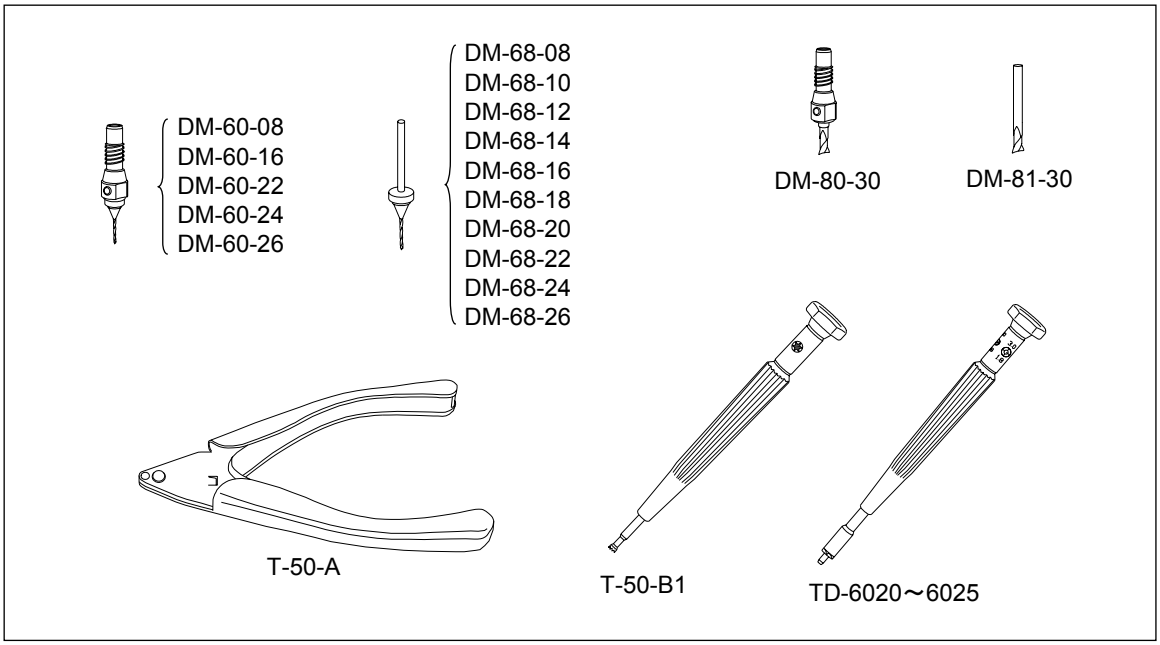
6.2 OPTIONAL PARTS

The following optional parts can be purchased for the Lens Drilling Machine DM-50.
When placing a purchase order for these optional parts, ask our service representative nearest you, the exporter or our company written at **<Inquiry and Repair>** in the front general section in this manual.

Optional Parts List

DM-60-08	Twist Drill Unit ϕ0.8
DM-60-16	Twist Drill Unit ϕ1.6
DM-60-22	Twist Drill Unit ϕ2.2
DM-60-24	Twist Drill Unit ϕ2.4
DM-60-26	Twist Drill Unit ϕ2.6
DM-68-08	Twist Drill ϕ0.8
DM-68-10	Twist Drill ϕ1.0
DM-68-12	Twist Drill ϕ1.2
DM-68-14	Twist Drill ϕ1.4
DM-68-16	Twist Drill ϕ1.6
DM-68-18	Twist Drill ϕ1.8
DM-68-20	Twist Drill ϕ2.0
DM-68-22	Twist Drill ϕ2.2
DM-68-24	Twist Drill ϕ2.4
DM-68-26	Twist Drill ϕ2.6
DM-80-30	End Mill Unit ϕ3.0
DM-81-30	End Mill ϕ3.0 (Carbide)
T-50-A	Screw Cutter (ϕ0.6, 0.8, 1.0, 1.2)
T-50-B1	Trimmer
TD-6020	Countersinking Screwdriver ϕ1.2×ϕ3.0
TD-6021	Countersinking Screwdriver ϕ1.2×ϕ3.5
TD-6022	Countersinking Screwdriver ϕ1.4×ϕ3.0
TD-6023	Countersinking Screwdriver ϕ1.4×ϕ3.5
TD-6024	Countersinking Screwdriver ϕ1.8×ϕ3.0
TD-6025	Countersinking Screwdriver ϕ1.8×ϕ3.5

Optional Parts List



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