# brother.





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## DISASSEMBLY AND ASSEMBLY FOR TRANSPORTING

The sewing machines are 1820 mm wide for BAS-370, 2620 mm wide for BAS-375, and they both are 1415 mm long, and 1363 mm high. The sewing machines are disassembled to make them easy to transport. Assemble the sewing machines referring to item " <sup>6</sup> Needle plate mechanism" in ASSEMBLY.





The above figure shows the sewing machine without the needle plate, the rack cover, the oil pan, and the presser hinge, when the needle plate support bracket is folded.



<BAS-375 sewing area: 1200x400 mm>



The above figure shows the sewing machine without the needle plate, the rack cover, the oil pan, and the presser hinge, when the needle plate support bracket is folded.



## MECHANICAL DESCRIPTIONS

## **1** Needle bar and thread take-up, lower shaft, and rotary hook mechanisms



- 1. Needle bar and thread take-up mechanism
- 1) When the motor ① rotates in the direction of the arrow, the motion is transmitted to the thread take-up crank ③ through the upper shaft ②.
- 2) The needle bar crank ④ secured to the thread take-up crank ⑤ moves the needle bar clamp ⑤ up and down via the needle bar crank rod ⑤.
- 3) The needle bar 😨 attached to the needle bar clamp 🗇 is guided by needle bar bushes (U) 🙂 and (D) 😔, and the needle bar guide slide block 🕕, and smoothly moves up and down.

#### 2.Lower shaft and rotary hook mechanism

- When the motor rotates in the direction of the arrow, the motion is transmitted to timing pulley (U)
   through the upper shaft ②.
- 2) Timing pulley (D) (D) secured to the lower shaft (D) transmits the motion to the lower shaft (D) via the timing belt (D).
- 3) The spiral gear (1) is secured to the tip of the lower shaft (1), and engaged with the pinion (1) attached to the rotary hook shaft (1). When the lower shaft (2) rotates one time, the rotary hook shaft (1) rotates two times.
- 4) The rotary hook (1) secured to the tip of the rotary hook shaft (1) rotates similarly.
- <To turn the pulley manually >

When the pulley 0 is pressed in the direction of the arrow, the stopper lever 0 is locked, and the pulley shaft gear 0 is engaged with the gear 0, the upper shaft 0 can be turned manually. When the stopper lever 0 is pulled in the direction of the arrow, it is unlocked.

#### 2 Presser plate mechanism



- 1) When the air pressure is supplied to the cylinder ② from the air tube ①, the presser arm front ③ secured to the cylinder ③ is pushed forward, and the motion is transmitted to link (A) ④.
- 2) Link (A) ④ is connected to link (B) ⑤ via the stud ⑥, and also connected to the presser arm ⑦ via the clevis pin ⑧. The presser arm ⑦ is lowered by pivoting the clevis pin ⑨.
- 3) When the presser arm ⑦ is lowered, and the clevis pin ③, the stud ③, and the cylinder support shaft ① are arranged in a line, the material pressing pressure is at its maximum, and the material is securely held.
- 4) When the air pressure is supplied to the cylinder @ from the air tube ①, the presser arm ② rises.

### 3 Drive, feed mechanism

#### <X direction >



- 1) When the AC servo motor ① rotates, the motion is transmitted to the X-Y timing pulley ③ through the gear ④ and the X-gear ⑤, and the X-timing belt ⑤ operates.
- 2) The X-timing belt (5) operates the ball spline (7) via the X-driving timing pulley (3).
- 3) The ball spline 🕢 operates the rack gear 😕 via the X-driving gear 🕄 .
- 4) The rack gear ⊕ is secured to the X-movable plates ⊕, and the X-movable plates ⊕ are guided by the LM guide ⊕. The rotating motion of the AC servo motor ⊕ is converted to X-direction movement.

#### <Y direction >



- 1) When the AC servo motor () rotates, the X-Y timing pulley () rotates via the gear () and the Y-gear (), and the Y-timing belt () operates.
- 2) The Y-timing belt  $\oplus$  rotates the Y-shaft  $\oplus$  via the Y-driving timing pulley  $\oplus$ .
- 3) When the Y-shaft <sup>(1)</sup> rotates, the timing belt <sup>(1)</sup> operates via the Y-R timing pulley <sup>(2)</sup>.
- 4) The timing belt @ is secured to the belt retention plate @, which is secured to the X-hold frame @.
- 5) The X-hold frame  ${}^{\textcircled{}}$  is guided by the LM-guide  ${}^{\textcircled{}}$ , and moves in the Y direction.

### Intermittent presser foot mechanism

#### <When the pulley rotates>



- 1) When the upper shaft ① rotates, the presser lifter cam ② attached to the upper shaft ① moves eccentrically, the intermittent presser connecting rod ③ oscillates intermittent feed arm (R) ④.
- 2) The oscillation of intermittent feed arm (R) ④ is transmitted to link (L) ⑤ through U-UD feed arm (L) ⑤.
- 3) Link (L) ③ oscillates the intermittent lever ④ guided by the intermittent support ⑦ and the intermittent guide ③ .
- 4) The oscillation of the intermittent lever ⊕ is transmitted to the presser bar clamp ⊕, and the presser bar clamp ⊕ moves up and down.



<When the presser foot is raised >

- 1) When the valve operates, and the presser bar lifter cylinder ① operates presser bar lifter arm (B) ② in the direction of the arrow, the presser bar lifter connecting rod ③ is pulled in the direction of the arrow.
- 2) The presser bar lifter connecting rod 1 operates the presser bar lifter lever 1 in the direction of the arrow, and raises the presser bar clamp 1. 1-5

#### **5** Thread trimmer mechanism



- 1) When the thread trimming signal is sent, and the valve operates, the thread trimmer cylinder **()** operates in the direction of the arrow.
- 2) The thread trimmer cylinder ① operates the movable knife holder ③ in the direction of the arrow via the thread trimmer connecting rod ④.
- 3) The movable knife ④ secured to the movable knife holder ⑤ is engaged with the fixed knife ⑤, then the thread is trimmed.

#### 6 Auto eject mechanism



- When the cassette plate assembly ① is attached to the feed mechanism, and either the ejector sensor ② detects the two positionings (A) ③, or the presser lifter pedal is depressed, the valve stops operating and the ejector cylinder ③ operates in the direction of the arrow.
- 2) The motion is transmitted to the cylinder connecting plate (a) and the guide plate (b) which are attached to the ejector cylinder (b).
- 3) Because the guide plate ③ is guided by the pin of the pin plate assembly ④, the horizontal movement of the ejector cylinder ④ is converted to vertical movement, and the motion is transmitted to the guide plate ③.
- 4) When the guide plate ③ pulls into positioning (A) ④, the cassette plate assembly ① is secured to the feed mechanism.
- 5) When sewing is completed or the presser lifter pedal is depressed, the valve operates, and the ejector cylinder ④ moves in the opposite direction to the arrow. The guide plate ⑤ pushes positioning (B) ③, and the cassette plate assembly ① comes off the feed mechanism.

#### **7** Bottom mechanism



- 1) When the valve operates at the start of sewing, the bottom cylinder ① operates in the direction of the arrow.
- 2) The bottom lever ② attached to the bottom cylinder ① transmits the motion to the bottom plunger ③ via the belt shift bar ③.
- 3) When the valve stops operating at the end of sewing, the bottom cylinder **()** moves in the opposite direction to the arrow, and the bottom plunger **()** returns to its original position.

## DISASSEMBLY

#### 1 Covers



- 1) Remove the screws, the front cover  $\mathbf{0}$ , the frame side covers  $\mathbf{2}$ , and the rear cover  $\mathbf{3}$ .
- 2) Remove the screws, and tables (A) (2) and (D) (3).
- 3) Remove the screws, and the table cover ③.
- A) Remove the nut Ø, and the operation box assembly ③.
   NOTE: The operation box assembly ③ is connected to the cord. Be careful when removing it.
- 5) Remove the screws, and tables (B)  $\ensuremath{\mathfrak{S}}$  and (C)  $\ensuremath{\mathfrak{D}}$ .
- 6) Remove the screws, the belt presser plates m 0 , and the dust belt m 0 .
- 7) Remove the screws, the arm motor cover  ${f O}$ , the arm rear cover  ${f O}$ , and the arm front cap  ${f O}$ .
- 8) Remove the screws, the eye guard  ${f O}$ , and the face plate  ${f O}$ .

#### 2 Presser plate mechanism



- Remove the four bolts ①, and the presser plate assembly ②.

#### 3 Needle plate mechanism



- Remove the screws, the needle plate left ①, the needle plate inner ②, and the needle plate right ③.
- 2) Remove the bolt **(**), the four needle plate supports **(**), and two needle plate supports (B)
  (**(**).

NOTE: For the BAS-375, remove the bolt **•**, and the needle plate support side **•**.

- 3) Remove the four bolts ⑤.
- 4) Loosen the four bolts  $\oplus$ .
- 5) Fold the needle plate support bracket **①** inside (in the direction of the arrow).

## A Rotary hook mechanism



- Remove the two screws ①, and the needle plate ②.
- Remove the screw (2), and the rotary hook bobbin case holder (2).
- 3) Loosen the three screws ⊕, and the rotary hook⊕.

#### **5** Bottom mechanism



Be sure to release the air.

- 1) Remove the stop rings **0**, and the link pin **2**.
- Remove the stop ring 𝔅, the washers 𝔅 and 𝔅, and the bottom lever 𝔅.
- 3) Remove the two air tubes 🕢.
- Remove the stop ring ③, the washer ⑤, and the bottom cylinder ⊕.

#### **6** Thread trimmer mechanism



Be sure to release the air.

- 1) Remove the two screws  $\mathbf{0}$ , and the needle plate  $\mathbf{2}$ .
- 2) Remove the two screws ②, and the movable knife ④.
- 3) Remove the two bolts (**③**, and the fixed knife presser (**③**).
- 4) Remove the screw **②**, and the fixed knife **③**.
- 5) Remove the screw  $\Theta$ , and the lower thread finger  $\Phi$ .
- 6) Remove the bolt (1), the stud screw (2), and the thread trimmer connecting rod (2).
- 7) Remove the stop ring (0), and the movable knife holder (0).
- 8) Remove the two air tubes 🛈 .
- 9) Remove the set screw  $\mathbf{O}$ , the support lever shaft  $\mathbf{O}$ , and the thread trimmer cylinder assembly  $\mathbf{O}$ .

#### Intermittent presser foot mechanism



- 1) Remove the three screws **0**, and the face plate **2**.
- 2) Remove the adjust screw ③, the spring guide ④, the spring ⑤, and the washer ⑤.
- 3) Remove the screw 🛛 , and the presser foot 🕤 .
- 4) Loosen the screw (9), and remove the presser bar (10) by pulling it downward.
- 5) Remove the two bolts  $\oplus$ , the intermittent guide  $\oplus$ , and the U-UD feed lifter lever roller  $\oplus$ .
- 6) Remove the stop ring 🛈 .
- 7) Loosen the set screw  $\oplus$ , and remove the set collar  $\oplus$ .
- 8) Remove the intermittent support assembly  $\oplus$ .
- 9) Remove the stud screw (1).
- 10) Remove the roller shaft  $\oplus$ , and the intermittent lever  $\oplus$  along with link (L)  $\oplus$ .
- 11) Remove the presser bar clamp  $\boldsymbol{\mathcal{D}}$ .

#### **8** Needle bar and thread take-up mechanism



- 1) Remove the three screws **0**, and the face plate **2**.
- 2) Remove the set screw  $\boldsymbol{\Theta}$ , the needle  $\boldsymbol{\Theta}$ , and the needle bar thread guide  $\boldsymbol{\Theta}$ .
- 3) Remove the oil cap ③.
- 4) Loosen the screw ②, and remove the needle bar ③ from the arm by lifting it upward.
- 5) Remove the screw (left-hand screw) (and the needle bar crank rod (1) along with the needle bar clamp (1). Be sure not to drop the needle bearing (2) and the needle bar guide slide block (2).
   NOTE: The needle bearing (2) is not used for the thick material specification.
- 6) Remove the oil cap  $\mathbf{O}$ .
- 7) Loosen the two set screws (), and remove the needle bar crank (). Be sure not to drop the needle bearing () and the washer ().
- 8) Loosen the set screw (19), and remove the thread take-up support shaft (10), and the thread take-up (10).

## ASSEMBLY

#### **1** Needle bar and thread take-up mechanism



- 1) Attach the thread take-up to the arm using the thread take-up support shaft ②, and tighten the set screw ③.
- 2) Insert the needle bearing ④ into the thread take-up ●. Holding the washer ⑤ with one hand, insert the needle bar crank ⑥ into the thread take-up ●, the needle bearing ④, and the washer ⑤, and then tighten the two set screws ⑦ so that they are aligned with the screw flats of the needle bar crank ③.
- 3) Attach the oil cap ③.

NOTE: The needle bearing  $\oplus$  is not used for the thick material specification.

- 5) Pass the needle bar guide slide block (2) through the needle bar guide of the machine arm, and insert the tip of the needle bar clamp (3).
- 6) Insert the needle bar () into the arm from the top of the machine, pass it through the needle bar clamp
   (), and temporarily tighten the screw ().
- 7) Attach the oil cap ().
- 8) Attach the needle bar thread guide (1) and the needle (1) to the tip of the needle bar (1), and secure the set screw (1).

#### 2 Intermittent presser foot mechanism



- Slide the guide part of the presser bar clamp ① into the arm channel. Insert the presser bar ② into the arm from the top of the machine head. Then temporarily tighten the screw ③. (The screw hole of the presser bar ② should be facing toward the front.)
- 3) Fit the U-UD feed lifter lever roller ♥ into the roller shaft ③, attach the intermittent guide ④ to the arm, and temporarily tighten the bolt ⑤.
- 4) Move the presser bar ② up or down until it moves smoothly, and attach the intermittent guide ③ to the presser bar ② using the bolt ⑤.
- 5) Insert the shaft of the intermittent support assembly  $\oplus$  into needle bar crank bush (R), and put the intermittent support assembly  $\oplus$  into the U-UD feed lifter lever roller  $\oplus$ .
- 6) Attach the set collar  ${f O}$ , and tighten the set screw  ${f O}$ .
- 7) Place the stop ring (1) on the roller shaft (1).
- 8) Attach link (L) ( to U-UD feed arm (L) ( using the stud screw ().
- 9) Place the washer (1) on the presser bar (2). Insert the spring (1) and the spring guide (2). Tighten the adjust screw (2).
- 10) Attach the presser foot  ${}^{\textcircled{\mbox{\scriptsize $0$}}}$  to the presser bar  ${}^{\textcircled{\mbox{\scriptsize $0$}}}$  using the screw  ${}^{\textcircled{\mbox{\scriptsize $0$}}}$ .

#### **3** Thread trimmer mechanism



- 1) Attach the thread trimmer cylinder ② to the bed using the support lever shaft ●, and tighten the set screw ③.
- 2) Attach the two air tubes  $\mathbf{O}$  to the two elbows  $\mathbf{O}$  of the thread trimmer cylinder  $\mathbf{O}$ .
- 3) Place the movable knife holder ③ on the bed, and attach the washer ④ and the stop ring ③.
- 4) Attach the thread trimmer connecting rod (1) to the thread trimmer cylinder (2) using the bolt (5).
- 6) Attach the lower thread finger () using the screw ().
- 7) Attach the movable knife 0 to the movable knife holder 0 using the two screws 0.
- 8) Insert the fixed knife  $\oplus$  into the bed, and then tighten the screw  $\oplus$ .
- 9) Attach the fixed knife presser () using the two bolts ().

#### Bottom mechanism



- 1) Attach the bottom cylinder **①** to the cylinder support shaft **②** using the washer **③** and the stop ring **④**.
- 2) Fit the bottom lever ③ into the Y-type fitting ⑤ of the bottom cylinder ①, and secure them using the link pin ⑦ and the stop ring ③.
- 3) Pass the bottom lever O through the belt shift bar O, and secure them using the washers O and O, and the stop ring O.
- 4) Fit the two air tubes () on the M5 elbows () of the bottom cylinder ().

#### **5** Rotary hook mechanism



- 1) Temporarily attach the rotary hook **1** to the rotary hook shaft **3** using the three set screws **3**.
- 2) Attach the rotary hook bobbin case holder **(3)** to the bed using the screw **(3)**.
- 3) Turn the pulley to raise the needle 2.2 mm from its lowest position. Tighten the three set screws ② so that the rotary hook ③ point is aligned with the center of the needle. Adjust the clearance between the rotary hook point and the needle to 0.01 0.08 mm.
- 4) Turn the pulley to align the rotary hook point ③ with the center of the needle. Loosen the set screws ⑦.
   Adjust the position of the needle bar by moving it vertically so that the clearance between the upper end of the needle hole and the rotary hook point ③ is as follows:
  - < Distance from the upper end of the needle hole to the rotary hook point> Rotary hook (B1) (S29785-001)(for medium thick material) 0.5 - 1.5 mm Rotary hook (BR) (S27851-001)(for thick material) 1.0 - 2.0 mm Rotary hook (BRTR) (S31739-001)(for extra thick material) 1.0 - 2.0 mm

#### 6 Needle plate mechanism



- 1) Loosen the bolt **0**, and pull the needle plate support bracket **2** out.
- 2) Temporarily attach the needle plate support bracket ② using the four bolts ③.
- 3) Temporarily attach the four needle plate supports ④ and the two needle plate supports (B) ⑤ to the needle plate support brackets ④, and tighten the bolts ⑤ from the underside of the needle plate support bracket ④.

NOTE: For the BAS-375, temporarily attach the needle plate support side  $\Theta$  to the needle plate support  $\Theta$  using the bolt  $\Theta$ .

- Put the needle plate left ⊕, the needle plate inner ⊕, and needle plate right ⊕ on the needle plate supports, and tighten the screws after adjusting the screw holes.
- 5) Fully tighten the bolts **0**, **O**, and **O**.

#### 7 Covers



- 1) Attach the eye guard **0** and the face plate **2** using the respective screws.
- 2) Attach the arm rear cover ③, the arm front cap ④, and the arm motor cover ⑤ using the respective screws.
- 3) Attach the dust belt O and the belt presser plates O to the X-hold frame O.
- Attach tables (A) (B) (B) (D), (C) (D), and (D) (D), using the bolts.
   NOTE: Insert the earth plate (B) under table (C) (D).
- 5) Insert the operation box assembly  $\oplus$  into table (C)  $\oplus$ , and tighten the nut  $\oplus$ .
- 6) Attach the two table covers 🕲 using the screws.
- 7) Attach the front cover  $\mathbf{O}$ , the side covers  $\mathbf{O}$ , and the rear cover  $\mathbf{O}$  using the respective screws.

## STANDARD ADJUSTMENTS

## 1 Adjusting the needle bar stroke



Turn the pulley to raise the needle bar 2.2 mm from its lowest position. Loosen the three set screws O. Adjust the needle bar stroke by turning the rotary hook O so that the rotary hook point O is aligned with the center of the needle.

#### 2 Adjusting the needle bar height



Turn the pulley to align the rotary hook point with the center of the needle. Remove the oil cap @, and loosen the screw O. Adjust the position of the needle bar by moving it vertically so that the clearance between the upper end of the needle hole and the rotary hook point O is as follows: <Distance from the upper end of the needle hole to the rotary hook point> Rotary hook (B1) (S29785-001)

•	
(for medium thick material)	0.5 - 1.5 mm
Rotary hook (BR) (S27851-001)	
(for thick material)	1.0 - 2.0 mm
Rotary hook (BRTR) (S31739-001)	
(for extra thick material)	1.0 - 2.0 mm

#### **3** Adjusting the clearance between the needle and the rotary hook



#### Adjusting the presser foot height



#### **5** Adjusting the presser foot



Turn the pulley to align the rotary hook point with the center of the needle. Loosen the three screws ①. Adjust the position of the rotary hook ② by moving it back and forth so that the clearance between the needle and the rotary hook ③ point is 0.01 - 0.08 mm.

- Tighten the air cock to release the air in the cylinder ①. Set the stroke of the cylinder to the minimum.
- Turn the pulley to set the presser bar and the presser bar clamp to their lowest positions.
- 3) Set the clearance between protrusion A of the the presser bar lifter lever and the bottom of the presser bar clamp to 0.5 1.0 mm. Tighten the set screws for the shaft that connects presser bar lifter arms (A) and (B)
  7.
- 4) Set the stroke of the cylinder to the maximum. Adjust the position of the knuckle joint ① so that the height of the presser foot ① is 16 mm. Set the knuckle joint ① to direction A to increase the stroke; set the knuckle joint ① to direction B to decrease it.
- 5) Repeat step 3.
- Turn the pulley to set the needle bar to its lowest position. Loosen the screw ②. Adjust the clearance between the bottom of the presser foot ① and the front face of the material so it is approx. 0.5 mm.
  - NOTE: If the presser foot is lowered excessively, the material may slip during sewing; if it is too high, skipped stitches may occur.
- Turn the pulley manually to make sure that the needle enters the center of the needle hole on the presser foot ①. If the needle is not aligned with the center of the needle hole, remove the oil cap ③, loosen the screw ④, and adjust the position of the presser foot ① by turning the presser foot ① (the presser bar).

#### 6 Adjusting the intermittent presser foot lift stroke



The standard lift stroke of the presser foot **0** is 3.2 mm. (The maximum is 7.2 mm.)

<Adjusting the intermittent presser foot stroke>

- 1) Remove the face plate ②.
- Loosen the nut 

   and adjust the position of the intermittent presser connecting rod
   Slide the intermittent presser connecting rod
   to the upper position to increase the lift stroke; slide the intermittent presser connecting rod
   to the lower position to decrease it.
- 3) Turn the pulley to set the presser foot ① to its lowest position.
- 4) Loosen the screw ③ of U-UD feed arm (L) ⑤ . Adjust the position of U-UD feed arm (L) ⑤ so that the screw ③ of the presser bar clamp ⑦ is positioned at the center of the slot on the intermittent support assembly ⑤. Then, tighten the screw ⑤.

< If it is not necessary to move the presser foot up and down>

- 1) Remove the stud screw (1), and reattach link (L) (1) to the other screw hole of the intermittent feed shaft (12).
- 2) Turn on the power. Make sure that the red lamp on the sensor (1) is lit. If the lamp is not lit, adjust the position of the sensor (1).

NOTE: If the lamp is not lit, the sewing speed will not exceed 2000 spm.

## 7 Adjusting the presser plate height



Attach the presser plate ①, and raise it. Adjust the distance between the underside of the presser plate and the needle plate top to 50 mm by moving the two nuts ②. Move the nuts ③ in the A direction to increase the height of the presser plate; move them in the B direction to decrease it. Adjust the angle of the presser plate so that it is positioned horizontally.

#### 8 Adjusting the presser plate moving speed



<Presser plate rising speed >

If the presser plate rising speed is too fast, the presser plate will vibrate.

Loosen the nuts ① and ②, and adjust the speed by using the speed controllers ③ and ③ so that the presser plate does not vibrate.

Turn the speed controllers ③ and ④ counterclockwise to decrease the speed; turn them clockwise to increase it.

< Presser plate descending speed >

If the presser plate descending speed is too fast, impact may occur.

Loosen the nuts  $\bigcirc$  and  $\bigcirc$ , and adjust the speed using the speed controllers  $\oslash$  and  $\bigcirc$  so that the presser plate does not make impact.

Turn the speed controllers **O** and **O** counterclockwise to decrease the speed; turn them clockwise to increase it.

NOTE: Adjust the angle of the presser plate so that it moves horizontally.

### **9** Adjusting the presser plate pressure



## Madjusting the bottom plunger



- Use the regurator to adjust the presser plate pressure. Raise the cap **0** of the regulator. Turn the cap **0** of the regulator counterclockwise to decrease the pressure, turn it clockwise to increase it The standard presser plate pressure is 2 kg/cm<sup>2</sup>.
- 2) Lower the cap **①** after adjustment.

Be sure to release the air.

- 1) Remove the cylinder **①**.
- 2) Adjust the position of the stroke adjusting part
  ③ by moving the rod joint ④ manually so that the cylinder stroke is 1.5 1.8 mm. Tighten the nut ④.
- Set the stroke of the cylinder to the minimum. Position the rod joint ② so that the dimension in the left figure is 143 ± 0.2 mm. Tighten the nut ⑤.
- 4) Push the bottom lever ⊕ down by hand, then turn the pulley to lower the needle bar. Loosen the two screws ⊕, and adjust the position of the bottom plunger ⊕ by moving it so that the needle comes to the center of the needle hole on the plunger ⊕.

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11 Adjusting the auto eject mechanism



Slide positioning (A) ② of the cassette plate assembly ① between positionings (D) ③ of the auto eject mechanism when the presser plate is raised and the auto eject mechanism pushes the cassette plate assembly ①. The auto eject mechanism will automatically retract into the cassette plate assembly ①, and the presser plate will lower.

<Adjusting the auto eject mechanism force for pushing and drawing>

Loosen the nuts ③ that links the ejector cylinder ④ and the cylinder connect plate ⑤. Adjust the guide plate ⑦ force to push and draw the presser plate so that the distance between the claw of the guide plate ⑦ and positioning (B) ③ is approx. 5 mm when the ejector comes off the cassette plate assembly ①.

<Positioning the cassette plate assembly and the auto eject mechanism>

Loosen the bolts O. Adjust the position of positioning (A) O attached to the cassette plate assembly O so that positioning (A) O is fitted between the positionings (D) O of the auto eject mechanism without gaps. Use the bolts O to adjust the position of positionings (D) O.

NOTE: If positioning (A) cannot be adjusted by loosening the bolts  $\textcircled$  and  $\textcircled$ , loosen the bolt  $\textcircled$  to adjust the position of the auto eject mechanism, and try again.

<Adjusting the ejector sensor>

When the cassette plate assembly **①** is placed on the auto eject mechanism, make sure that the two red lamps for the ejector sensors **②** light while the power is turned on. If the red lamps are not lit, loosen the screws **③** of the ejector sensors **③**, and adjust the positions of the ejector sensors so as to light the red lamps.

#### 12 Adjusting the thread trimmer



<Adjusting the cutting edge pressure of the fixed knife>

- 1) Remove the two screws **0**, and the needle plate **2**.
- 2) Adjust the cutting edge pressure of the fixed knife by turning the set screw ③ attached to the fixed knife presser ⑤. Turn the set screw ④ clockwise to increase the pressure.
- 3) Release the air in the thread trimmer cylinder. Wind the thread around the cutting edge of the movable knife, and move the cylinder rod manually to trim the thread; find the appropriate cutting edge pressure.
- NOTE: If the pressure is too high, the lower thread finger 🛛 is jammed between the fixed knife 🕤 and the movable knife 🕤, resulting in the thread not being trimmed. Do not increase the pressure too much.

## 13 Adjusting the backlash



#### <Y direction>

- 1) Remove the rear cover.
- 2) Loosen the four bolts ①, and adjust the Y-servo motor ② by moving it so that there is no backlash between the driving gear ③ and the idle gear ④.

#### <X direction>

- 2) Loosen the two nuts (1) that are used to attach the eccentric cam follower (1) to the cam follower set plate (2).
- 3) Loosen the bolt (1) that is used to attach the rack gear (1) to the left and right X-movable plates (2) and (1). Adjust the position of the rack gear so that there is no backlash between the rack gear (2) and the X-gear (3). Then tighten the bolts (3).
- 4) Move the left and right X-movable plates @ and in the X direction. Adjust the position of the eccentric cam follower to the height where the surface of the eccentric cam follower and the top surface of the rack gear make contact in spite of the position of the rack gear. Then tighten the nut and the bolt .

#### Madjusting the belt tension



#### <Y direction>

- 1) Remove the left and right needle plates (1) and (2), and tables (A) (3), (B) (3), (C) (5), and (D) (5).
- 2) Loosen the bolt 🛛 that is used to attach the slider plate 🔊 to the rail base ③.
- 3) Move the left and right slider plates 🕢 using the bolt 🛈 for adjusting the belt tension in the Y direction. Adjust the positions of the left and right slider plates so that the belt tension is evenly subjected to the left and right.
- 4) Adjust the tension of the timing belt () by changing the tightening position of the nuts () and () that connect the L-type bolt () and the Y-motor bracket ().

#### <X direction>

- 1) Remove the left and right needle plates ① and ②, and tables(A) ③, (B) ③, (C) ③, and (D) ③.
- 2) Adjust the tension of the timing belt <sup>(1)</sup> by changing the tightening position of the nuts <sup>(1)</sup> and <sup>(1)</sup> that connect the L-type bolt <sup>(1)</sup> and the X-motor bracket <sup>(1)</sup>.

### 1 Adjusting the timing between the needle and feed mechanism



**16** Adjusting the home position



- The needle upper stop position is adjusted by the needle upper sensor circuit board **①** so that the machine is normally stopped with the needle at its highest position after thread trimming. Adjust the needle upper stop position so that the machine is stopped with the needle at its highest position.
- 2) The timing between the needle stop position and the feeding mechanism is adjusted by the synchronizing sensor circuit board ② so that the feeding operation starts after the needle has come out of the material and stops before the needle enters the material. To get faster feeding times, loosen the screw ③ of the synchronizing sensor circuit board ③, and move the synchronizing sensor circuit board ③ in the direction of the arrow.
- NOTE: The standard positions for the above two sensor circuit boards are that they are attached to the centers of the oval screw holes using the screws.

< Checking the home position >

- Turn on the power. Press the eject switch on the operation panel to light the ejector lamp. Depress the presser lifter pedal, and remove the cassette plate assembly ①.
- 2) Attach the home position standard plate ② to the ejector.
- 3) Press the P key on the programmer. The feed mechanism will move to the home position.
- 4) Turn the pulley to lower the needle. Make sure that the needle tip is aligned with the home position of the home position standard plate 2.





<Adjusting the home position>

1. X direction

- 1) Remove the X-home position sensor cover ①.
- The three sensor circuit boards are attached to the sensor set plate. The X-home position sensor ② is positioned on the left, looking from the front of the machine.
- Loosen the two bolts ②, and adjust the position of the X-home position sensor ②. Loosen the two bolts ③, and adjust the position of the slit ⑤.
- 4) Check the home position.

Move the X-home position sensor ② in the direction of ③; the home position of the Xdirection will be moved toward ③. Move the X-home position sensor ③ in the direction of ⑧; the home position of the Xdirection will be moved toward ⑤.

- 2. Y direction
- 1) Remove the screw, and the frame side cover  $\Theta$ .
- The three sensor circuit boards are attached to the sensor set plate. The Y-home position sensor is positioned right in the middle.
- Loosen the two bolts ③, and adjust the position of the Y-home position sensor ⑦. Loosen the two bolts ⑤, and adjust the position of the slit ①.
- 4) Check the home position.

Move the Y-home position sensor  $\bigcirc$  in the direction of A; the home position of the Ydirection will be moved toward (a).

Move the Y-home position sensor  $\bigcirc$  in the direction of (B); the home position of the Ydirection will be moved toward (b).

#### **M**Adjusting the over travel



Referring to item " 16 Adjusting the home position," attach the home position standard plate, and remove the X-home position sensor cover, and the frame side cover.

<X direction>

- 1) Turn on the power. Press the P key on the programmer to move the feed mechanism to the home position.
- 2) Press the P key again to make the indication on the programmer disappear.
- 3) Move the feed mechanism to the right slowly by hand. Loosen the two bolts ②, and adjust the position of the over travel sensor ③ at the left end so that error b appears when the feed mechanism extends 3 mm beyond the furthest left reference line of the home position standard plate ①.
- 4) Turn off the power. Move the feed mechanism to within the sewing area manually, then turn on the power again.
- 5) Press the P key on the programmer to move the feed mechanism to the home position.
- 6) Press the  $\rightarrow$  key to move the feed mechanism until it stops.
- 7) Press the P key to make the indication on the programmer disappear.
- 8) Move the feed mechanism to the left slowly by hand. Loosen the two bolts (2), and adjust the position of the over travel sensor (3) at the right end so that error b appears when the feed mechanism extends 3 mm beyond the furthest right reference line of the home position standard plate (1).



#### <Y direction>

- 9) With the same procedure as the X-direction feed, move the feed mechanism to the home position using the programmer, then make the indication on the programmer disappear.
- 10) Move the feed mechanism to the front slowly by hand. Loosen the two bolts ③, and adjust the position of the rear over travel sensor ② so that error b appears when the feed mechanism extends 3 mm beyond the furthest reference line from the front of the home position standard plate ①.
- 11) Turn off the power. Move the feed mechanism to within the sewing area manually, then turn on the power again.
- 12) Press the P key on the programmer to move the feed mechanism to the home position, then press the  $\downarrow$  key to move the feed mechanism until it stops.
- 13) Press the P key to make the indication on the programmer disappear.
- 14) Slowly move the feed mechanism manually all the way to the back. Loosen the two bolts ③, and adjust the position of the forward over travel sensor ⑤ so that error b appears when the feed mechanism extends 3 mm beyond the nearest reference line to the front of the home position standard plate ①.
# **ELECTRICAL EQUIPMENT**

Be sure to turn off the power switch before replacing or adjusting electrical equipment. Never touch the high-voltage charged parts or short-circuit any parts if making any adjustment while the power is turned on.

### 1 Fuse



 Fuse position
 Remove the front cover.
 Fuses F1 - F3 are attached to the connector mounting plate for the power supply.

#### 2. Fuse capacities

No	Fuse types a	nd capacities	Uses Servo motors (X-axis, Y-axis, sewing machine motors)		
F1	Glass-tube fuse	20 A - 250 V			
F2	Glass-tube fuse	3 A - 250 V	Control circuit board FDD control Work light Marker light	( + 5 V, + 12 V, -12 V) ( + 5 V) ( + 6 VAC) ( + 4.5 VAC)	
F3	Glass-tube fuse	5 A - 125 V	Air valve	( + 24 V)	

#### 3. Replacing fuses

When replacing a fuse, refer to the table below listing possible problems that caused the fuse to blow. Be sure to replace a fuse with one of the same capacity.

No	Problem	Ref. page
F1	The feeder and the sewing machine motor do not move at all.	5-23
F2	The display of the operation box and the power indicator do not light. The feeder and the sewing machine motor do not move at all.	5-21
F3	The air valves (for the presser plate, the eject mechanism, and the thread trimmer) do not move at all.	5-22

### 2 Power supply equipment



The AVR ( $\pm 5$  V,  $\pm 12$  V) supplies the power required for the control circuit board. When the AVR is operating correctly, the red LED inside the AVR is lit. If the AVR is not operating correctly, the indication on the operation box will disappear, and the machine will not work.

How to replace the AVR

- A. Make sure that the power is turned off.
- B. Remove the connector ①.
- C. Loosen the screws ② and ③ securing the AVR to the connector mounting plate, and then remove the AVR.
- D. Attach a new AVR following the reverse of the above procedure.

A high volage remains in the capacitor of the power supply equipment after the power is turned off. Never touch the capacitor or short-circuit any parts.

# **3** Circuit board

#### 1. Circuit board position

1) Open the front cover to make sure that the control circuit board is installed as shown in the figure below.



Open the front cover to make sure servo motor drivers (X), (Y), and (Z) are installed as shown in the figure below.
 NOTE: Serve drives (Z) is the section serve driver.

NOTE: Servo driver (Z) is the machine motor servo driver.



3) Remove the screws holding the operation box to make sure the operation panel circuit board is installed inside the operation box as shown in the figure below.



#### 2. Circuit board functions

#### 1) Control circuit board

- Outputting a command signal to driver (X)
- Outputting a command signal to driver (Y)
- Outputting a command signal to driver (Z)
- Controlling a floppy disk drive
- Driving the air valves (for clamp, eject mechanism, bottom mechanism, presser foot, thread trimmer, needle cooler, and main thread tension)
- Checking the state of each switch
- Controlling programming
- Controlling the operation panel
- 2) Servo motor drivers (X), (Y), and (Z)
  - Driving each servo motor
- 3) Operation panel circuit board
  - Checking the state of each switch
  - Showing the state of LED's

# A Replacing the circuit board

Be sure to turn off the power switch and open the front cover before replacing a circuit board.







- 1. Control circuit board
- 1) Remove the 17 connectors.
- 2) Bend down the clips of six card spacers ①, and remove the control circuit board.
- 3) Pinch the clips, and insert the card spacers **1** into the holes of the circuit board.
- 4) Insert the connector, holding the back of the connector so that excessive pressure is not applied to any part of the circuit board. Failure to do so may cause the print pattern to crack and the circuit to be broken.
  - NOTE: Follow this precaution when replacing the PROM @.
- 2. Servo motor drivers (X), (Y), and (Z)
- 1) Remove the two connectors **①**.
- NOTE: Each connector is attached with two screws.
- 2) Remove the wires connected to the terminal block.
- NOTE: Remember the order of removal.
- 3) Remove the screws ② securing the driver, and pull the driver forward.
- 4) Pull out the driver, and replace it with a new one.
- NOTE: Reattach the wires to the terminal blocks in order.
- 3. Operation panel circuit board
- 1) Remove the connector ①.
- 2) Remove the knob ② of the speed dial, and the nut. Remove the speed dial ③ from the operation panel.
- 3) Remove the four screws **(2)**, and the operation panel circuit board.

### **5**LEDs of servo motor driver



#### 1) RDY (ready)

The RDY LED will light when the input voltage of the power supply is 270 V (specified value ) or more and the SLM LED is not lit. Usually, only the RDY LED will light.

2) OV (over voltage)

The OV LED will light when a load added to the motor increases the required power supply which would result in the driver being damaged, and causes the over voltage relay to trip.

3) OC (over current)

The OC LED will light when there is a current surge in the main circuit of the driver because, for example, the motor contact terminals are short-circuited by mistake.

#### 4) ST (sensor trouble)

The ST LED will light when the signal from the encoder mounted on the motor is received when an error occurs because of wire breakage.

5) OL (overload)

The OL LED will light when the motor overheats because of an overload.

6) SLM (servo alarm)

The SLM LED will light when quickly stopping the motor to prevent motor burn-out.

## **G**Function and position of sensors

### Sensor position



#### <Standard sensors>

- 1. X over travel sensor
- 4. + Y over travel sensor
- 7. Eject sensor (2 pcs.)
- 2. X-home position sensor
- 5. Y-home position sensor
- 3. + X over travel sensor 6. - Y over travel sensor
- 8. Intermittent operation sensor 10-1. Needle position sensor (needle up sensor)
- 9. Thread breakage detector sensor 10-2. Needle position sensor (synchronizing sensor)

11. Air control switch

< Optional sensors >

- 12. Cam home position sensor
- 14. Fiber unit (needle thread breakage detector)
- 13. Amp unit (needle thread breakage detector) 15. Jig pattern sensor



#### 1. Home position sensor

- 1) When the starting pedal is depressed after the power is turned on, the feed mechanism moves in the X axis direction to the right and in the Y axis direction toward the front, and stops when the lamps of the X and Y home position sensors are lit. Then it moves to the sewing start position.
- 2) If the sensor is broken or is blocked by dust, the feed mechanism moves 20 mm in the opposite direction to the home position, error b appears, and the machine is stopped.



#### 2. Over-travel sensor

- 1) The over-travel sensor controls the movable area of the X and the Y axes.
- 2) If the feed overruns while feeding, and the sensor operates, the motor driver automatically stops, and the driving motor stops.
- 3) When the sensor connecting part is defective, or when the connectors are not attached properly, the fail safe function displays error b, and the machine stops even if the feed does not overrun.

Repair the effective part, and turn on the power again.

- 3. Eject sensor
- When the cassette plate assembly is attached to the eject mechanism, the eject sensor is activated to automatically draw the cassette plate assembly, and the presser plate is lowered.
- 2) If the eject sensor is defective, the above operation can not be done. Referring to the page 4-6 " 11 Adjusting the auto eject mechanism", adjust the position of the eject sensor. If the sensor still misoperates, replace the sensor with a new one.



### 4. Intermittent operation sensor

- The intermittent operation sensor is lit when setting the presser foot so that it will not move up and down during sewing. (Refer to " 6 Adjusting the intermittent presser foot lift stroke.")
- 2) When this sensor does not light, the sewing speed cannot exceed 2000 spm.
- 3) If this sensor does not light, adjust the position of the sensor, or replace it with a new one.

### 5. Needle thread breakage detector

- The needle thread breakage detector consists of the rotating plate and the photosensor.
- The detector sends a signal when thread breakage occurs.
- This signal displays error No. 8 and stops the machine.
- The needle thread breakage function can be ignored by controlling the DIP switch setting.

#### 6. Needle position sensors

- 1) Needle up sensor
  - The needle up sensor sends a signal when the needle bar approaches its top dead center.
  - This signal stops the machine with the needle at its upper position.
- 2) Synchronizing sensor
  - The synchronizing sensor sends a synchronizing signal for the machine motor and the feeder.
- 7. Air control switch
- When the air pressure is 3.5 kg/cm<sup>2</sup> or less, error No. 9 will appear, and the machine will stop.
- Set the air pressure to 4.1 kg/cm<sup>2</sup> or more, and press the emergency stop switch. The error will be cancelled.

#### 8. Sensors for options

Refer to page 6-2 "2 Beam sensor thread breakage detector," page 6-2 "5 Intermittent presser foot control mechanism," and page 6-8 "6 Jig pattern sensor."

# **7** Connectors explanations

Most of the machine trouble is due to connector problems, including improper connections or poor contacts. It is, therefore, necessary to check each connector number and pin contact for correct connection prior to the troubleshooting procedures.

The tables below list the connector numbers and symptoms resulting from incorrect connections. Refer to the control block diagram for the connector numbers.

Connector No.	Connected part	Main signal	Problem caused by defective connection
P13 = CN4 CN4 = P13	Power supply - Control circuit board	+ 5 V (whole of the control circuit board) + 12 V (RS232C) -12 V (RS232C) + 24 V (air valve)	Control function does not work. Programmer does not work correctly. Air cylinder does not operate. Machine cannot control sewing speed.
P1 = P011	Control circuit board - Programmer	Programmer input output signal (RS232C) Programmer power supply	Programmer does not work. Programmer switch does not function. Programmer display is improper.
P5 = P051 CN6 = P052	Control circuit board - Floppy disk drive Power supply - Floppy disk drive	Floppy disk input output signal Floppy disk drive power supply	Floppy disk can not be used. Floppy disk drive fails to read or write data on floppy disk.
P14=P141= P142 P143 P144 P144 P145 P145 P146 P147	Control circuit board - Home position sensor Control circuit board - Over travel sensor	Home position sensor signal Over limit sensor signal	Machine can not detect home position. Error "b" appears, and machine does not operate.
P15 = P151	Control circuit board - Air control switch	Air control switch signal	Error No. 9 appears, and machine does not operate.
P6 = P061 = P062 P063	Control circuit board - Needle position sensor	Needle up signal Synchronizing signal	Machine does not stop with needle at its upper position. Machine does not cut thread. Feed mechanism can not operate.
P6 = P061	Control circuit board - Thread breakage detector sensor	Thread breakage detector signal	Error No. 8 appears when needle thread is not broken.

Connector No.	Connected part	Main signal	Problem caused by defective connection
P12 = P121 P122	Control circuit board - Air valve	Clamp driving signal Ejector driving signal Presser foot cylinder driving signal Bottom mechanism Thread trimmer Needle cooler	Those listed to the left do not operate correctly.
P9 = P091	Control circuit board - Operation panel	Operation panel input indication	Nothing is displayed. Defective switch operation
P2 = P021 P3 = P031	Control circuit board - X driver Control circuit board - Y driver	X driver control signal Y driver control signal	Defective feed motor operation Error No. 2 appears, machine stops as for an emergency, and emergency stoppage cannot be
CN1 CN2 P022 = P023 P032 = P033 P024 P034	Power supply - X driver Power supply - Y driver X driver - Drive motor Y driver - Drive motor X driver - X motor Y driver - Y motor	270 VDC (for driving motor) Encoder signal Motor driving signal	canceled even if emergency stop switch is depressed.
P4 = P041 CN3 P042 = P043 P044	Control circuit board - Z driver Z driver - Machine motor Z driver - Machine motor Power supply - Z driver	Z driver control signal Encoder signal Motor driving signal 270 V (for driving motor)	Defective machine motor operation Error No. 2 appears, machine stops as for an emergency, and emergency stoppage cannot be canceled even if emergency stop switch is depressed.
P10 = P101 = P103 P102 P104	Control circuit board - Eject sensor	Efect sensor signal (Left and right ejectors)	Eject mechanism does not operate. Eject sensor LED does not light.
P16 = P161 = P162	Control circuit board - Emergency stop switch	Emergency stop switch signal	Error No. 1 appears, and is not cancelled. Emergency stop switch does not function.
P17 = P171	Control circuit board - Foot switch	Starting pedal switch signal Presser lifter pedal switch signal	Machine can not start sewing. Presser plate cannot move up and down.
P11 = P111 = P112	Control circuit board - Intermittent operation sensor	Intermittent operation sensor signal	Sewing machine speed does not exceed 2,000 spm when intermittent operation of presser foot is deactivated by operator.

#### <Options>

Connector No.	Connected part	Main signal	Problem caused by defective connection
P7 = P071 = P072 P11 = P111 = P113	Control circuit board - Intermittent presser foot control mechanism motor Control circuit board - Cam home position sensor	Motor driving signal Cam home position signal	Intermittent presser foot control mechanism does not operate.
P11 = P111	Control circuit board - Beam sensor thread breakage detector	Thread breakage detector signal	Error No. 8 appears when needle thread is not trimmed.
P11 = P114	Control circuit board - Jig patter sensor	Jig pattern sensor signal	Jig cannot be recognized.

# **8** Setting the DIP switch

Be sure to turn off the power before changing the DIP switch settings.



# 1) DIP switch A

No.	When ON
1 ·	Presser plate does not rise when sewing is completed.
2	Presser plate and sub clamp hold material. (Sub clamp is optional.)
3	Needle thread presser assembly operates. (Needle thread presser assembly is optional.)
4	Two-stage thread tension mechanism operates. (Two-stage thread tension is optional.)
5	Presser plate does not rise during split mode.
6	Unused
7	Single pedal operation possible using starting pedal.
8	Needle thread breakage detector is activated.

### 2) DIP switch B

No.	When ON
1	Continuous feeding can be performed at 3,200 spm (maximum sewing speed).
2	After thread trimming, pulley does not rotate in reverse direction, and machine stops with thread take-up lever at its highest position.
3	Thread is not trimmed when emergency stop is released.
4	Needle cooler is activated.
5	Needle thread breakage detection stitch margin setting can be changed from 8 to 14 stitches.
6	Bottom plunger is activated.
7	Machine stops within three stitches after thread breakage. (When it is set to OFF, machine stops within nine stitches.)
8	Unused

### 3) DIP switch C

No.	When ON
1	Beam sensor needle thread breakage detector is activated.
2	Step back switch is used to cancel emergency stop.
3-8	Factory-adjusted. Do not change settings.

# **9** Setting the memory switch

# 1) Memory switch 0

No.	Setting	Function				
0-0		0-OFF	1-OFF	2-OFF	Presser plate returns to home position normally.	
0-1 0-2		0-ON	1-OFF	2-OFF	Presser plate returns to home position in X direction.	
		0-OFF	1-ON	2-OFF	Presser plate returns to home position in Y direction.	
		0-OFF	1-OFF	2-ON	Presser plate returns to home position indirectly.	
0-3	ON	Sets feed to high speed. (Note that the feed moves faster.)				
	OFF	Sets fee	Sets feed to normal speed.			
0-4	ON	Sets fee	Sets feed to low speed.			
	OFF	Sets fee	d to norm	al speed.		
0-5 to 0-F		Unused				

2) Memory switch 1

No.	Setting	Function		
1-0	ON	Checks that machine stops with needle at its upper position at start of sewing.		
	OFF	Checks that machine stops with needle at its lower position at start of sewing.		
1-1	ON	Jig pattern sensor is activated.		
	OFF	Jig pattern sensor is deactivated.		
1-2	ON	Floppy disk can only be read from.		
	OFF	Floppy disk can be read from and written to.		
1-3	ON	Moves intermittent presser foot control mechanism 0.5 mm each interval.		
	OFF	Moves intermittent presser foot control mechanism 1.0 mm each interval.		
1-4	ON	Starting pedal is deactivated after emergency stoppage is canceled during sewing.		
	OFF	Staring pedal is activated after emergency stoppage is canceled during sewing.		
1-5	ON	Sewing starts through eject sensor in single pedal mode regardless of pedal operation.		
	OFF	Sewing does not start through eject sensor in single pedal mode.		
1-6 to 1-F		Unused		

3) Memory switch 2 and 3 Reserved

# **10** Using the optional output



<Connecting>

- 1) Remove connector P12 for valve output attached to the control circuit board.
- 2) Pins 6B and 7A are used for optional output. Pins 1A and 1B are used for power supply (+24V). Attach the air valves to the corresponding pins for the optional output and power supply.
- 3) Reattach the connector in its original position.
- NOTE: Use the socket PS-SF-C1-1 produced by Japan Aviation Electronics Inc. for the connecting pin.

Optional valve 1 is wired near the air valve because it is used for the two-stage thread tension (option).

When optional valve 1 is used for other than the twostage thread tension, attach the connector marked with 4 to the air valve.





#### <Programming>

- 1) Press the P key to select the program mode.
- 2) Using the 
  → and 
  → keys, move the needle to the position where you wish to set the optional output to ON and OFF.
- Press the 7 key twice, followed by 1, 2, or 3, then the L key to set the desired optional output you have selected.
- 4) Repeat steps 2 and 3 above until you reach the final stitch point.
- NOTE: The valve will always be set to OFF at the first stitch point.

# 1 Diagnosis flowchart

### 1. Explanation of shapes







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Test







#### 3. Countermeasures

<Notes for failure diagnosis>

- 1. Be sure to turn off the power before plugging in or unplugging the machine.
- 2. Be sure to turn off the power before opening the cover.
- 3. In the following tables, the check, repair or adjustment item letters in () require the resistance to be measured after turning off the power. The item letters with an asterisk require the voltage to be measured after turning on the power.
- 4. Be sure to replace a fuse with new one which has the same quality and capacity.

<Before adjustment>

- 1. Check for blown fuses.
- 2. Make sure that each plug is securely attached.
- 3. #1, #2 ... in the following tables correspond to those numbers in the flowchart.

Problem	(De	Cause efective parts)		Check, repair, adjustment	Parts to be replaced	Ref. page
#1 The power Iamp does not light when power is turned on.	1.	Power cord defective	a.	Remove power supply connector from breaker in control box, then turn on power, and measure voltage. If it is not 200 V AC (200, 220, 380, 415 V AC, according to each specification), power cord is defective.	Power supply cord	
	2.	Fuse blown	(a)	Remove fuse No. 2, and check it for continuity. If there is no continuity, replace fuse.	Fuse No. 2	5-1
	3.	Power supply unit defective	a*.	Remove connector P13 from control circuit board. Turn on power, and measure voltage between pins 1 and 3; it should be 5 V DC. NOTE: Insert a tester probe into connector from lead wire side.	AVR	5-2
	4.	Operation panel circuit board defective	Che boa	eck connection between control circuit ard P9 and operation panel circuit board.	Operation panel circuit board	5-5

Problem	(D	Cause efective parts)	Check, repair, adjustment	Parts to be replaced	Ref. page
#2 When R/W switch is pressed, indicator lamp	1. Connector contact improper		Check connections, harnesses, and pin contacts between connector P9 of control PCB and the operation panel PCB, and between connectors P5 and CN6 of control PCB and the FDD.		
disk drive (FDD) does not light, and FDD does not read floppy disk data.	<ul> <li>2. Control PCB defective</li> <li>a. Turn on power, and press EMERGENCY STOP switch to check if buzzer sounds intermittently. Then press switch again to check if buzzer stops. If buzzer does not operate in such a manner, control PCB is defective.</li> <li>b. Depress presser lifter pedal. If presser plate does not work normally, control PCB is defective.</li> </ul>		Control PCB	5-5	
	<ul> <li>Foot switch defective</li> <li>a. If presser plate automatically operates just by turning on power without any other operator action, presser plate is defective.</li> <li>b. Remove foot switch from connector P171, and press R/W switch. If machine operates normally, foot switch is defective.</li> </ul>		Foot switch (Adjust 2-stage switch.)		
	4.	Floppy disk drive (FDD) defective	Replace FDD with a new one.	FDD	
#3 Error number appears a few second after	1.	Floppy disk defective	Check if error No. 6 appears. If yes, insert another floppy disk. If newly inserted floppy disk is normally read, old floppy disk is defective.	Floppy disk	
pressed.	2.	Floppy disk drive (FDD) defective	Replace FDD with a new one. Error No. 4 appears.	FDD	
	3.	Control PCB defective	Replace control PCB with a new one.	Control PCB	5-5
#4 Presser plate will not rise	1.	Fuse blown	(a) Remove fuse No. 3, and check it for continuity. If there is no continuity, replace fuse.	Fuse No. 3	5-1
lifter pedal is pressed.	2.	Power supply unit defective	a*. Turn on power while connector P13 of control PCB is plugged in, then measure voltage between pins 5 and 6. It should be approx. 24 V DC.	Control box	
	3.	Presser lifter pedal or its cord defective	Remove connector P17 from control box, and check it for continuity between pins 1 and 2, and pins 3 and 4. It should be 0 ohms when presser lifter pedal is pressed; $\infty$ ohms when presser lifter pedal is released.	Presser lifter pedal or its cord	
	4.	Circuit board defective	Refer to #2, 2, a.	Control PCB	5-5
	5.	Air valve	Remove connector P121, and measure resistance between pins 1 and 9 on valve. It should be approx. 300 ohms.	Air valve	

Problem	(De	Cause efective parts)	Check, repair, adjustment	Parts to be replaced	Ref. page
#5 Presser plate is not lowered when presser lifter pedal is depressed.	1.	Presser lifter pedal defective (2-stage switch defective)	If presser plate automatically lowers when power is turned off, but it is raised when power is turned on without any other operator action to machine, presser lifter pedal is defective. If presser plate once lowered by pressing presser lifter pedal is raised by releasing it, presser lifter pedal is defective.	Presser lifter pedal (Adjust 2- stage switch.)	
#6 Error number appears when presser plate is at its home	1.	Floppy disk is defective when error No. 3 or No. A appears.	If error No. 3 appears, floppy disk area is overloaded with sewing program. If error No. A appears, data is incomplete.		
starting pedal is depressed.	2.	Error C appears.	Needle bar is lowered.	Parts to be replaced Presser lifter pedal (Adjust 2- stage switch.) Pr g lit, s le. CB Starting pedal al if t for when ection me cEB rs CB rs Fuse F1 of Power supply unit rrox. Power supply unit Power supply un	
#7 Presser plate does not return to home position when starting pedal is depressed.	1.	Starting pedal or its cord defective	<ul> <li>a. Reinsert connector P17 on control PCB and connector P171 of starting pedal if presser plate does not move at all.</li> <li>b. Remove connector P17, and check it for continuity between pins 5 and 6. It should usually be ∞ ohms; 0 ohms when starting pedal is pressed.</li> </ul>	IstmentParts to be replaced/ lowers when aised when any other presser lifterPresser lifter pedal (Adjust 2- stage switch.)I by pressing py releasing it, ve.Presser lifter/ disk area is gram. s incomplete.Image: starting pedal starting pedal if ove at all. and check it for 5 and 6. It is; 0 ohms whenStarting pedal sensor PCBreverse direction ppears, home ct. or connectors sor.Home position sensor PCBS sensor PCBstarting pedal is is stopped.Servo drivers (X) and (Y)S sensor drivers (X) sensor presser (X) and (Y)S servo drivers (X) sensor presser (X) and (Y)S servo drivers (X) sensor presser (X) and (Y)fmachine is stopped.Floppy disk PCBS servo drivers (X) servo	
	2.	Home position signal error	<ul> <li>a. If presser plate moves in reverse direction and stops when error b appears, home position signal is incorrect.</li> <li>b. Reinsert connector P14 on control PCB and home position sensor connectors P141 to P147.</li> <li>c. Clean home position sensor.</li> </ul>	Home position sensor PCB	5-8
	3.	Fuse blown	(a) Remove fuse No. 1, and check it for continuity.	Fuse F1	5-1
	4.	Power supply unit defective	Measure voltage between pins 1 and 3 of connector CN1 or CN2. It should be approx. 270 V DC.	Power supply unit	
	5.	Servo driver defective	a*. Error No. 2 appears after starting pedal is depressed, and machine is stopped.	Servo drivers (X) and (Y)	5-5
#8 Presser plate does not move to sewing start position.	1.	Floppy disk defective	Insert another floppy disk. If machine functions normally with newly inserted floppy disk, old floppy disk is defective.	Floppy disk	
	2.	Control PCB defective	Replace control PCB with a new one.	Control PCB	5-5
Problem #5 Presser plate is not lowered when presser lifter pedal is depressed. #6 Error number appears when presser plate is at its home position after starting pedal is depressed. #7 Presser plate does not return to home position when starting pedal is depressed. #8 Presser plate does not move to sewing start position. #9 TEST lamp will not light when TEST switch is pressed.	1.	TEST switch or its cord defective	(a) Reinsert connector P9 of control PCB and connector P091 of operation panel PCB.	Operation panel PCB	5-5
	2.	TEST lamp and its cord defective	(a) Reinsert connector P9 of control PCB and connector P091 of operation panel PCB.	Operation panel PCB	5-5
	3.	Control PCB defective	Replace control PCB with a new one.	Control PCB	5-5

Problem	Cause (Defective parts)	Check, repair, adjustment	Parts to be replaced	Ref. page
#10 No feeding operation occurs during test sewing.		Refer to #7-1, 3 to 5.		
#11 Rapid feed can not be used during test sewing.	1. Presser lifter pedal or its cord defective	Refer to #4-3.		
#12 Machine does not operate as programmed	1. Feed mechanism not adjusted properly	Adjust feed mechanism by moving it by hand so that it operates smoothly.		
sewing.	2.	Refer to #7-1, 3 to 5.	Parts to be replacedImage: Parts to be repla	
Problem #10 No feeding operation occurs during test sewing. #11 Rapid feed can not be used during test sewing. #12 Machine does not operate as programmed during test sewing. #13 Machine does not operate for sewing. #14 Machine operates but presser plate does not. #15 Error No. 2 appears during sewing, and machine is stopped suddenly. #16 Machine will not trim thread.	1. Cord defective	Reinsert connectors P4, P041 to P044.		
	2. Control PCB defective	Control PCB is defective when error No. 2 does not appear.	Control PCB	5-5
	3. Servo driver defective	Error No. 2 appears.	Servo driver (Z)	5-5
#14 Machine operates but presser plate	1. Needle position sensor defective	NOTE: If machine is placed in this error status, test operation will be performed normally.	Synchronizing sensor	5-9
does not.	2. PCB defective	· · · · · · · · · · · · · · · · · · ·	Id Control PCB 5 Servo driver (Z) 5 Servo driver (Z) 5 Synchronizing 5 sensor 5 Control PCB 5 d Control PCB 5 d Servo drivers (X) 5 and (Y) 5 Needle up sensor 5 Control PCB 5 and (Y) 5 Servo drivers (X) 5 and (Y) 5 Needle up sensor 5 Thread trimmer air valve	5-5
operates but presser plate does not. #15 Error No. 2 appears during sewing, and machine is stopped suddenly.	1. Feed mechanism not adjusted properly	Adjust feed mechanism by moving it by hand so that it operates smoothly.		
	2. Servo driver defective		Servo drivers (X) and (Y)	5-5
#16 Machine will not trim thread.	1. Needle position sensor defective		Needle up sensor	5-9
	2. PCB defective		Control PCB	5-5
	3. Thread trimmer air valve defective	(a) Remove connector P122, and measure resistance between pins 1 and 7 of valve. It should be 300 ohms.	Thread trimmer air valve	

Problem	(De	Cause efective parts)	Check, repair, adjustment	Parts to be replaced	Ref. page
#17 Machine does not stop with needle at its	1.	Needle position sensor defective		Needle up sensor	5-9
after thread is trimmed.	2.	PCB defective		Control PCB	5-5
#18 Pattern can not be sewn as programmed.			Refer to #12.		
#19 Machine will not stop even if emergency stop switch is pressed.	1.	Emergency stop switch or its cord defective	Remove connector P16, and check it for continuity. Resistance between pins 1 and 2 should usually be 0 ohms; $\infty$ ohms when emergency stop switch is pressed. Resistance between pins 2 and 3 should usually be $\infty$ ohms; 0 ohms when emergency stop switch is pressed.	Emergency stop switch assembly	
#20 Thread trimmer does not operate even if emergency stop state is cancelled.			Refer to #16 and #17.		
#21 Step back switch is not inoperative.	1.	Step back switch or its cord defective	Refer to #9.	Operation panel PCB	5-5
#22 Sewing can not be resumed.			Refer to #12 and #13.		
emergency stop state is cancelled. #21 Step back switch is not inoperative. #22 Sewing can not be resumed. #23 Programming can not be performed.	1.	Connector or its cord defective	Reinsert connectors P011 and P1.		
performed.	2.	Programmer defective	Replace programmer with a new one.	Programmer	
	3.	Control PCB defective	Replace control PCB with a new one.	Control PCB	5-5
	4.	Power supply unit defective	a*. Remove connector P13 from control PCB. Turn on power, and measure voltage. Voltage between pins 2 and 3 should be + 12 V DC. Voltage between pins 4 and 3 should be -12 V DC.	AVR	5-2

# OPTION

# 1 Sub clamp



Be sure to remove tables (B) and (C), and the front cover.

#### <Attachment>

- 1) Attach the left and right sub presser units ① to the left and right X-movable plates ② and ③.
- 2) Attach the value  $\mathbf{\Theta}$  to the 2nd place of the air manifold  $\mathbf{\Theta}$  from the left, then insert the connector  $\mathbf{\Theta}$ .
- Remove the two screws Ø attached to the bottom of the air manifold ③, and attach the two half unions
   ③.
- 4) Insert the air tubes ⊕ into the half unions ⊕, attach the Y-4 unions ⊕ as shown in the above figure, and insert the air tubes ⊕ into the cylinders ⊕.

#### <Adjustment>

1) Adjust the speed for the cylinders ① and ② using the speed controllers ③, ③, ①, ①, and ③, so that the sub clamp ② and the presser plate ③ do not contact.

Adjusting the speeds of the sub clamp cylinder

Turn the speed controllers  $\oplus$  and  $\oplus$  counterclockwise to increase both the rising and the descending speeds of the sub clamp  $\oplus$ ; turn them clockwise to decrease them.

Adjusting the speeds of the presser plate cylinder

Turn the speed controllers **()** and **()** counterclockwise to increase both the rising and the descending speeds of the presser plate **()**; turn them clockwise to decrease them.

2) Loosen the screw <sup>(1)</sup> of the cloth clamp lever <sup>(2)</sup>. Move the cloth clamp lever <sup>(2)</sup> along the sub clamp shaft <sup>(2)</sup> in the direction of the arrow, and attach the sub presser <sup>(2)</sup>.

### 2 Beam sensor thread breakage detector



- 1) The thread breakage detector monitors the thread breakage detecting signal every stitch during sewing.
- 2) If the signal is not detected for three stitches, the detector deems that thread breakage has occurred, and the machine is stopped, the emergency buzzer sounds, and error No. 8 appears.
- 3) To release the emergency stoppage, press the EMERGENCY STOP button. Then the thread is cut and the needle moves to above the needle plate and stops.
- 4) Rethread the needle, then press the STEP BACK button to restart sewing.
- 5) To activate the thread breakage detector, set DIP switch A-8 to ON.

NOTE: When using the thread breakage detector (option), DIP switches B-5 and B-7 are deactivated.

<Thread breakage detector mechanism>

- 1) During sewing, the needle thread is tensed by the thread guide ② while the thread take-up ① moves up and down.
- 2) The thread breakage detector  $\Theta$ , which is a reflex non-contact fiber sensor, monitors the tensed thread to send a signal to the control circuit board.
- 3) When the needle thread has broken, it is not tensed while the thread take-up **1** moves up and down. Therefore, the sensor deems thread breakage.

#### <Assembly and adjustment>

- 1) Attach the amp unit set plate ④ using the screw ⑤.
- 2) Insert the amp unit ③.
- 4) While pressing the fiber unit 🛛 against the amp unit 🕲 lightly, press the button 🙂 so that it remains inserted, and secure the fiber unit 🖗.
- NOTE: When the power is turned on, the center of the fiber unit 🔊 should function as the flood lamp and the outer part of the unit should function as the sensor. If they do not, remove, invert, and insert the fiber unit again.
- 5) Secure the fiber unit 🛛 using the sensor set plate 😉 and the screw 🕕 so that the fiber unit 🕤 is perpendicular to the thread and so that the end of the fiber unit 🕤 is 2 mm away from the needle.



- 6) Attach the cord of the amp unit ③ with the left of the arm, and secure it.
- 7) Insert the three pins of amp unit ③ into the sockets of connector P111 @ of head sensor harness (B) ① with numbers 7 to 9 on the underside of the table on the arm rear side.
- 8) Remove the cover (1) attached to the amplifier. Slide the switch to the SET position to adjust the sensitivity of the amp unit (3). Without threading the needle, turn the sensitivity adjusting trimmer (1) clockwise until the lamp is lit. Then, turn the trimmer counterclockwise until the lamp is not lit, and turn it a further 180° counterclockwise.

Set the switch to "L·ON" position, and reattach the cover  $oldsymbol{ ilde{O}}$ .

- NOTE: Make sure that the red lamp lights when the needle is threaded, and goes out when the needle is not threaded.
- 9) The green lamp shows allowance for the voltage of the sensor and dust. It will be normally lit regardless of the red lamp setting.
- > <Disassembly>
- 1) Remove the screw  $\mathbf{0}$ , and the sensor set plate  $\mathbf{S}$ .
- 2) Press the button ③ on the amp unit ⑤ so it protrudes, then remove the fiber unit ⑦.
- 3) Remove the amp unit ③ by pulling the lever ④ in the direction of the arrow using a screwdriver.
- 4) Remove the screw (G), and the amp unit set plate (G).

# 3 Needle thread presser assembly



Be sure to remove the arm front cap, the arm motor cover, table (B), and the front cover.

#### <Attachment>

- 1) Attach the needle thread presser assembly  $oldsymbol{0}$  to the arm using the screw  $oldsymbol{2}$ .
- 2) Attach the value ③ to the 11th position of the air manifold ④ from the left. Insert it into connector 11
   ③.
- 3) Remove the screw ③ attached to the bottom of the air manifold ④, and attach the half union ④.
- 4) Insert the air tube ③ into the half union ④. Attach the air tube ③ to the table leg, and the left side of the arm, pass from the left through to the right of the arm, and then plug into the cylinder ⑤ of the needle thread presser assembly ●.

#### <Adjustment>

- 1) Extend the stroke of the cylinder (a) to the maximum. Adjust the position of the nut (b) so that the needle thread presser (b) touches the arm channel. Adjust the position of the cylinder (c) by moving it in the direction of the arrow.
- 2) Adjust the position of the needle thread presser assembly ① by moving it in the direction of the arrow so that the needle thread presser ① is positioned almost in the center of the arm channel.
- 3) Check the value  $\Theta$ : When the value  $\Theta$  is activated manually, the needle thread presser  $\oplus$  touches the bottom of the arm channel and hold the thread; when the value  $\Theta$  is deactivated manually, the needle thread presser  $\oplus$  is released from the bottom of the arm channel.

#### 6-4

## **4** Two-stage thread tension



Be sure to remove the arm front cap, the arm motor cover, table (B), and the front cover. When the thread breakage detector ① is attached, the two-stage thread tension can not be attached. In this case, remove the thread breakage detector ①, and attach the two-stage thread tension.

#### <Attachment>

- 1) Attach the two-stage thread tension assembly 2 to the arm using the screw S.
- 2) Attach the value 3 to the 4th place of the air manifold 3 from the left, then insert connector 4 3.
- 3) Remove the two screws @ attached to the bottom of the air manifold ③, and attach the two half unions ③.

#### <Adjustment>

- 1) Make sure that the tension disks  $\oplus$  open and there is no resistance on the needle thread when the twin rod cylinder  $\oplus$  does not operate.
- 2) If there is resistance on the needle thread, loosen the screw (2), and adjust the position of the split claw (2).
- 3) Make sure that the spring tension is applied to the tension disks  $\oplus$  and the resistance is applied to the needle thread when the twin rod cylinder  $\oplus$  operates.
- 4) If there is no resistance on the needle thread, loosen the screw (2), and adjust the position of the split claw (3).
- 5) Use the screw  $\oplus$  to adjust the needle thread tension when the twin rod cylinder  $\oplus$  operates.

## **5** Intermittent presser foot control mechanism



Be sure to remove the arm motor cover, table (B), and the front cover. <Attachment>

- 1) Remove the screw  $\mathbf{0}$ , and the intermittent cover  $\mathbf{O}$ .
- - 5) Secure the stopper  $\mathbf{0}$  to the stopper arm  $\mathbf{S}$  using the set screw  $\mathbf{0}$ .
  - 6) Loosen the set screw (2), and remove the set collar (2) from the intermittent support (3).
  - 7) Insert the stopper arm 
     into the shaft of the intermittent support 
     b, and set the intermittent support
     b horizontally. Tighten the bolt
     b so that the support
     0 contacts the highest surface on the
     underside of the presser foot control cam
     c.
  - 8) Attach the cam home position sensor (1) to the sensor set plate (1), and attach the sensor set plate (1) to the arm using the screw (1).



- 9) Adjust the position of the sensor (1) so that the distance between the sensor (1) and detecting part (2) of the presser plate control cam ② is approx. 1.5 mm.
- 10) Attach the connector 🐵 of the pulse motor 🗇 to pulse motor harness (B) 🐵. Attach pulse motor harness (B) (1) with the left of the arm, and secure it.
- 11) Attach pulse motor harness (B) 0 to pulse motor harness (A) 0 at the underside of the table in the rear of the arm.
- 12) Attach pulse motor harness (A) 0 to the table leg, and insert its plug into connector P7 on the control circuit board 🕲.
- 13) Insert the connector 0 of the sensor 0 into head sensor harness (C) 0, attach it with the left of the arm, and secure it.
- 14) Insert the three pins of head sensor harness (C) 🐵 into the sockets of connector P111 🕹 of head sensor harness (B) 🕲 with numbers 4 to 6 on the underside of the table on the arm rear side.

#### <Adjustment>

- 1) Turn on the power.
- 2) Make sure that the pulse motor ③ rotates and the lamp of the sensor ⑥ is turned off just after it is turned on. If the lamp of the sensor () does not light, adjust the distance between the detecting part (1) of the presser foot control cam (2) and the sensor (1).
- 3) Make sure that the bottom of the presser foot control cam  ${\bf G}$  does not touch the stopper  ${\bf \Phi}$  of the stopper arm 😉 while the pulse motor 🕲 rotates. If it does, loosen the bolt 🛈 of the stopper arm 😊 to adjust its position.

### **6** Jig pattern sensor



Be sure to remove the arm motor cover, table (B), and the front cover.

#### <Attachment>

- 1) Attach the mirror reflector sensor ② to the screw hole of the intermittent cover ① using the screw ③.
- 2) Attach the harness of the reflector sensor ② to the arm, and pass it from the rear of the arm through to the underside of the table.
- 3) Insert the connector ② for the mirror reflector sensor ② into reflector sensor harness (A) ③.
- 5) Pull out connector P11 ②, insert the pin of reflector sensor harness (A) ③ into the sockets of connector P11 ② with the numbers 10 to 13. Insert connector P11 ⑦ into the control circuit board ⑤.

#### <Adjustment>

- 1) Turn on the power.
- Set the tape ③ so as to cut into 3 by 3 cm squares directly under the mirror reflector sensor ④, and turn the sensitivity adjusting trimmer ⑤ clockwise to light the lamp ①. Remember that position.
   NOTE: If the lamp ① does not light, adjust the angle of the tape ⑤.
- 3) Set the sensitivity adjusting trimmer  $\Theta$  in the middle between the position found in step 2 and the max position.
- 4) Make sure that: when the tape ③ is set directly under the sensor ④, the lamp ① will light; other than that, the lamp ① will not light.

# TROUBLESHOOTING GUIDE

# Machine head mechanism

Problem	Cause	Check	Solution	Page
Wound bobbin thread volume is inappropriate.	Improper bobbin presser position	Bobbin thread volume	Adjust bobbin presser position.	
Needle has lost its thread.	Improper length and hardness of thread take-up spring	Length and hardness of thread take-up spring	Adjust thread take-up spring.	
	Needle thread end length	Thread tension of thread breakage detector	Adjust pretension.	
		Sub tension	Adjust sub tension.	
	Improper clearance of tension disk	Tension disk clearance	Adjust clearance.	
	Improper sewing rhythm	Needle location, presser foot, and material	Re-program needle location.	
Needle thread has broken.	Excessive needle thread tension	Needle thread tension	Adjust needle thread tension.	
	Needle improperly installed	Needle orientation	Install needle with longitudinal groove facing front.	
	Thread too thick for needle	Thread and needle	Replace thread with one matching needle.	
	Flaws or burrs on rotary hook, needle hole plate, and needle	Rotary hook, needle hole plate, and needle	Polish or replace faulty parts.	
	Heat generated in thread path	Thread end state	Use liquid (silicon) cooling device. Use needle cooler.	
Bobbin thread has broken.	Excessive bobbin thread tension	Bobbin thread tension	Adjust bobbin thread tension.	
	Flaws or burrs on edge of needle hole plate or bobbin case	Edge of needle hole plate or bobbin case	Polish or replace faulty parts.	
Bobbin thread cut	Flaws or burrs on movable knife	Movable knife	Polish or replace movable knife.	
	Excessive bobbin thread tension	Bobbin thread tension	Adjust bobbin thread tension.	

Problem	Cause	Check	Solution	Page
Stitches have skipped.	Too big a clearance between needle and rotary hook point	Clearance between needle and rotary hook point	Adjust clearance	4-2
	Improper contact of needle with rotary	Needle bar stroke	Adjust needle bar height.	4-1
	hook	Contact of needle and rotary hook point	Adjust timing.	4-1
	Needle bent	Needle	Replace needle with a new one.	
	Needle improperly installed	Needle orientation	Install needle with longitudinal groove facing operator.	
	Presser foot (intermittent) not activated	Presser foot height	Adjust presser foot height.	4-2
Needle has broken.	Needle interfering with rotary hook	Clearance between needle and rotary hook point	Adjust clearance between needle and rotary hook point.	4-2
		Needle bar stroke	Adjust needle bar height.	4-1
	Needle bent	Needle	Replace needle with a new one.	
	Sideways needle movement	Timing between needle and feeding operations	Adjust synchronizing sensor position.	4-10
	Improper needle location to presser	Positions of needle and presser foot	Adjust presser foot height.	4-2
	1001		Re-program needle location.	
Needle thread can not be cut.	Dull cutting edge of fixed knife and movable knife	Fixed knife and movable knife cutting edge	Sharpen or replace fixed knife and movable knife.	
	Movable knife does not catch needle thread.	Final stitch direction	Complete stitching in forward stitch direction.	
	Movable knife does not catch needle thread due to final stitch skipped.	Final stitch	Refer to "stitches have skipped." in problem item.	
	Movable knife and fixed knife do not overlap sufficiently.	Overlap between movable and fixed knives	Adjust fixed knife pressure.	4-7
	Lower thread finger is caught in between movable and fixed knives.	Attaching position and shape of lower thread finger	Adjust position and shape of lower thread finger.	
Problem	Cause	Check	Solution	Page
---	--	---	--	------
Poorly tightened thread	Insufficient needle thread tension	Needle thread tension	Adjust needle thread tension.	
	Insufficient bobbin thread tension	Bobbin thread tension	Adjust bobbin thread tension.	
	Improper length and hardness of thread take-up spring	Length and hardness of thread take-up spring	Adjust thread take-up spring.	
Thread breakage detector functions even though thread is not broken.	Unbalanced tensions of pretensions and thread take-up spring	Pretension of thread breakage detector	Set total tensions of both pretensions to lower than that of thread take-up spring.	
		Machine head pretension		
		Thread take-up spring		
	Thread breakage detector too sensitive	Thread breakage detection stitch margin setting	Change stitch margin to 14 stitches by changing DIP switch.	5-13
	Pulley of thread breakage detector does not rotate.	Pretension thread tension and threading of machine head pulley	Adjust tension. Pass thread through pulley.	
Thread breakage detector does not function if needle thread is broken.	Thread breakage detector switch is set to OFF.	DIP switch setting in operation panel	Set DIP switch to ON.	5-13
	Sensor of thread breakage detector is dirty.	Thread breakage detector pulley and sensor	Remove dust or oil from pulley or sensor.	

## ERROR CODE LIST

No.	Cause		
1	Emergency stop switch was pressed.		
2	Feed mechanism or pulley movement is stiff, or trouble with AC servo motor.		
3	Over-area		
4	Floppy disk is not inserted, cable is not properly connected or problem with floppy disk drive.		
5	Attempt was made to write data on write-protected floppy disk.		
6	Attempt was made to read sewing pattern data that is not stored on floppy disk.		
7	Error in program mode		
8	Needle thread breakage was detected.		
9	Air pressure is insufficient.		
A	Starting pedal was pressed even though usable pattern data was not read.		
b	Feed position is outside sewing area. Something wrong with sensor.		
с	Starting pedal was pressed even though needle bar was lowered.		



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