CHAPTER 14: TIMING CHARTS

Contents

Initialization Operations 14-2
1. Overall Initialization Operation 14-2
2. Individual Initialization Operations 14-2
[Thermal Print Head Initialization Operation] 14-2
[Master Compression Plate Initialization Operation] 14-3
[Clamp Unit Home Positioning Operation] 14-3
[Vertical Printing Position Initialization Operation] 14-4
[Pressure Initialization Operation] 14-4

Printing Operations 14-5
1. Normal Overall Printing Operation 14-5
2. Individual Printing Operations 14-6
[Print Start Operation] 14-6
[Print In Progress - End Operation] 14-8
[Three-Cycle No-Paper Pickup Operation] 14-9
3. Elevator Operations 14-10
[Elevator Raise Operation] 14-10
[Elevator Lower Operation] 14-11
[Elevator Servo Operation] 14-12
4. Print Drum Peripheral Operations 14-13
[Clamp Release] 14-13
[Master Clamp Operation] 14-13
[Inking Operation (No Ink Detection)] 14-14
[Inking Operation (Overflow Detection)] 14-14
[Print Drum Solenoid Lock Release] 14-15
5. Print Adjustment Operations 14-16
[Print Speed Change] 14-16
[Print Intensity Change] 14-16
[Vertical Print Positioning Operation] 14-17

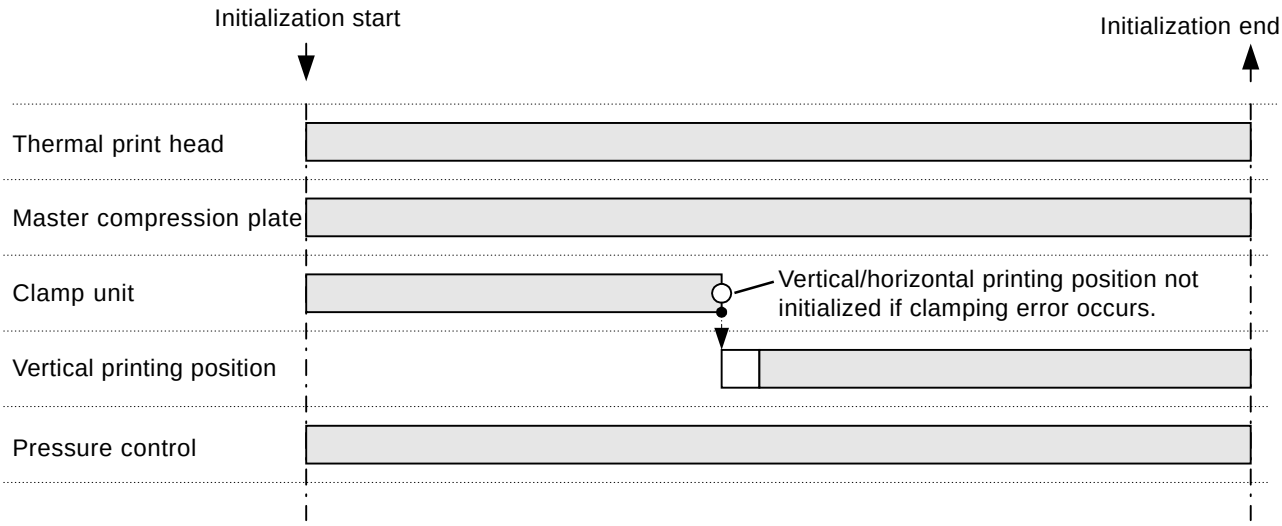
Master Removal Operations 14-18
1. Overall Timing for Normal Master Creation 14-18
2. Individual Master Removal Operations 14-19
[Removed Master Vertical Transport Operation] 14-19
[Disposed Master Compressing Operation] 14-20

Master Making Operation 14-21
1. Overall Timing for Normal Master Creation 14-21
2. Individual Master Making Operation 14-22
[Thermal Print Head Compression Operation] 14-22
[Thermal Print Head Release Operation] 14-22
[Master Positioning Operation] 14-23
[Master Cutting Operation] 14-24
[Master Making Operation] 14-25

Initialization Operations

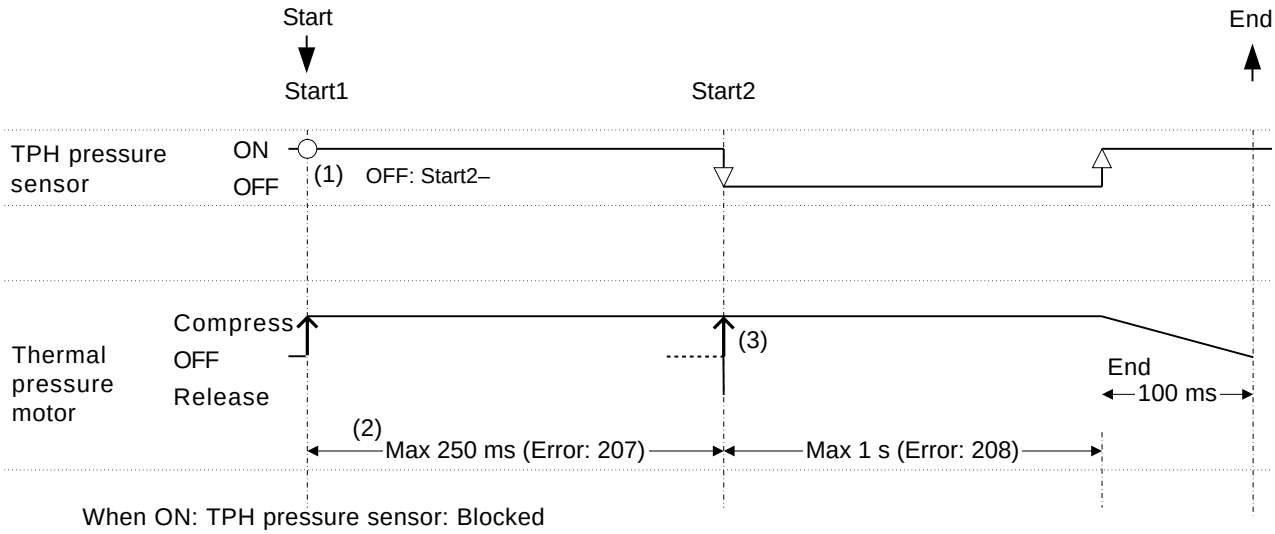
1. Overall Initialization Operation

Returns the following items to their home positions when the power is switched on or when everything is reset.



2. Individual Initialization Operations

[Thermal Print Head Initialization Operation]



When ON: TPH pressure sensor: Blocked

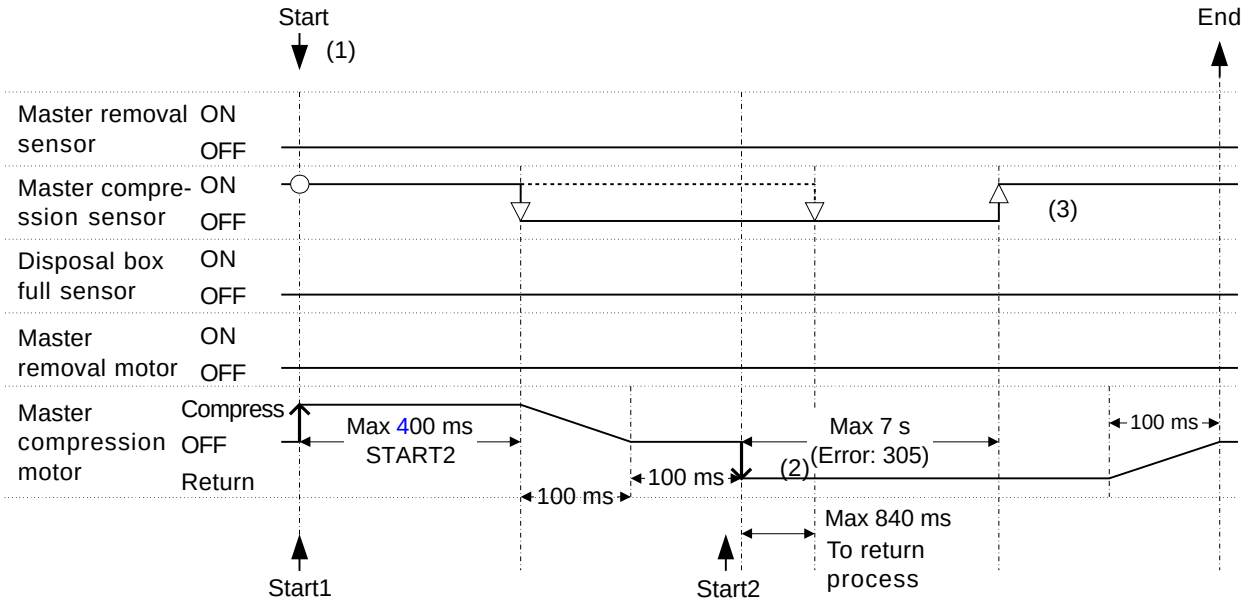
(1) The TPH pressure sensor is checked on starting, and the operation starts from Start 1 if it is ON, and from Start 2 if it is OFF. At Start 1, the thermal pressure motor operates in the compressing direction until the TPH pressure sensor goes OFF.

(2) A time-out occurs at 250 ms here, and error message [T19-207] is displayed.

(3) The thermal pressure motor operates in the release direction until the TPH pressure sensor goes ON.
A time-out occurs at 1 s here, and error message [T19-208] is displayed.

(4) Initialization ends once the TPH pressure sensor goes ON.

[Master Compression Plate Initialization Operation]

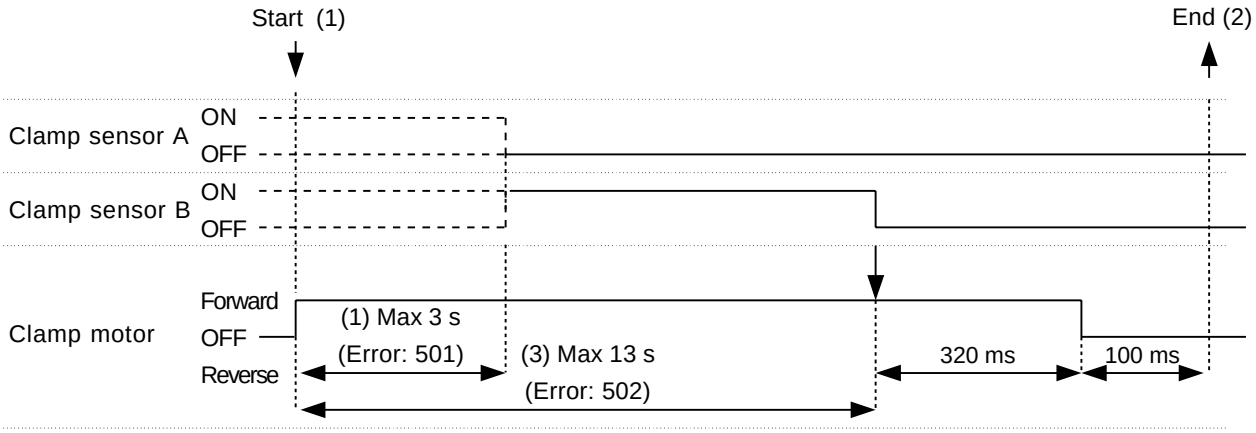


When ON: Master removal sensor: Open, Master compression sensor: Open, Disposal box full sensor: Open

(1) The master compression sensor is checked on starting, and the operation starts from Start 1 if it is ON, and from Start 2 if it is OFF. At Start 1, the master compression motor operates in the compressing direction until the master compression sensor goes OFF.
A time-out occurs at 400 ms here, and the process moves to Start 2.

(2) The master compression motor operates in the return direction until the master compression sensor goes ON.
A time-out occurs at 7 s here, and error message [T12-305] is displayed.

(3) Initialization ends once the master compression sensor goes ON and the master compression motor stops.



When ON: Clamp sensor A: Blocked, Clamp sensor B: Blocked

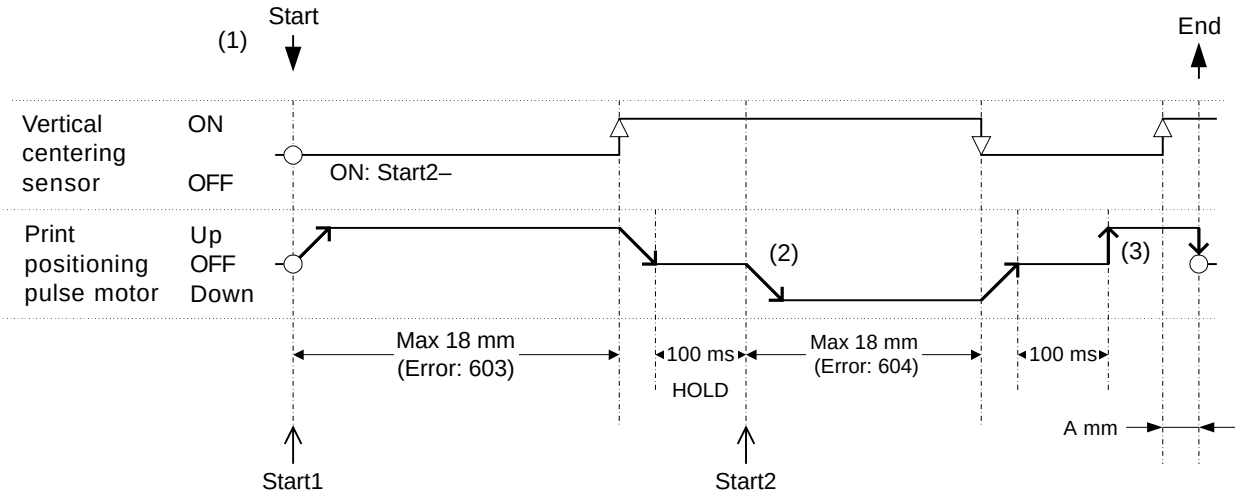
[Clamp Unit Home Positioning Operation]

(1) On starting, the system checks that clamp sensor A and clamp sensor B are both OFF. If either is ON, clamp initialization is performed.
If the clamp sensors do not change even after the clamp motor operates, a time-out occurs at 3 s, and the error message [T03-501] is displayed.

(2) Initialization ends once both clamp sensor A and clamp sensor B are OFF.

(3) A time-out occurs at 13 s if both the sensors do not go OFF after the clamp motor operates, and error message [T03-502] is displayed.

[Vertical Printing Position Initialization Operation]



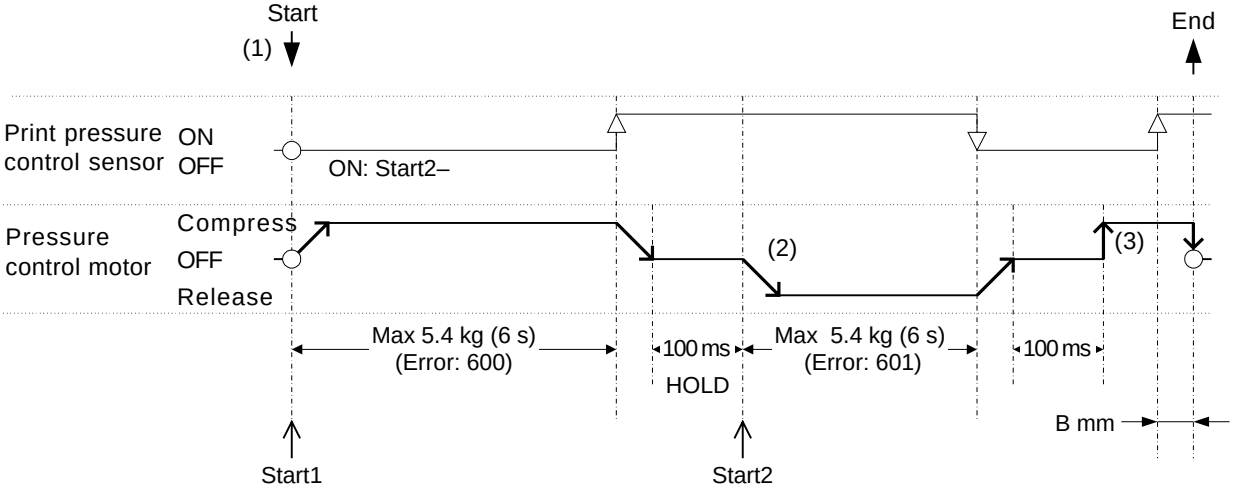
When ON: Vertical centering sensor: Blocked

(1) The vertical centering sensor is checked on starting, and the operation starts from Start 1 if it is OFF, and from Start 2 if it is ON. At Start 1, the print positioning pulse motor operates in the upward direction until the vertical centering sensor goes ON.
A time-out occurs at 18 mm here, and error message [T05-603] is displayed.

(2) The print positioning pulse motor operates in the downward direction until the vertical centering sensor goes OFF.
A time-out occurs at 18 mm here, and error message [T05-604] is displayed.

(3) The print positioning pulse motor operates in the upward direction once again, and then moves the equivalent of A mm after the vertical centering sensor goes ON, before stopping. (A = 0.25 mm + value set in Test mode No. 680)

[Pressure Initialization Operation]



When ON: Print pressure control sensor: Blocked

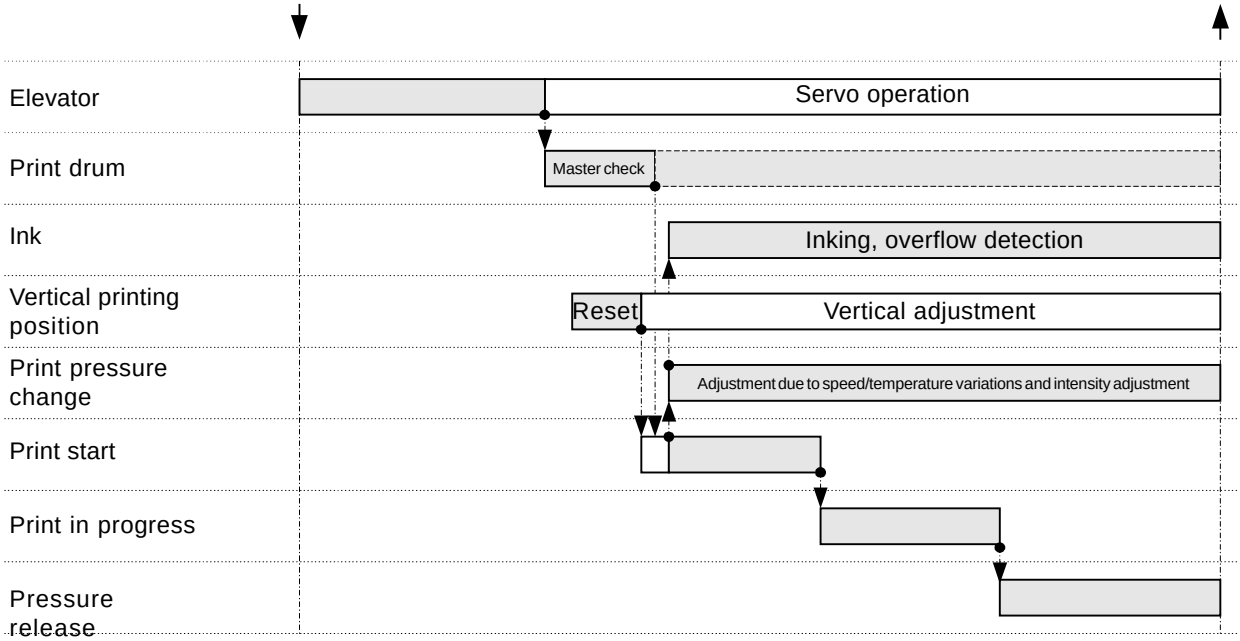
(1) The print pressure control sensor is checked on starting, and the operation starts from Start 1 if it is OFF, and from Start 2 if it is ON. At Start 1, the pressure control motor operates in the direction of compression until the print pressure control sensor goes ON.
A time-out occurs at 12 mm here, and error message [T11-600] is displayed.

(2) The pressure control motor operates in the release direction until the print pressure control sensor goes OFF.
A time-out occurs at 12 mm here, and error message [T11-601] is displayed.

(3) The pressure control motor operates in the direction of compression once again, and then moves the equivalent of B mm after the print pressure control sensor goes ON, before stopping. (B = 0.25 mm + value set in Test mode No. 682)

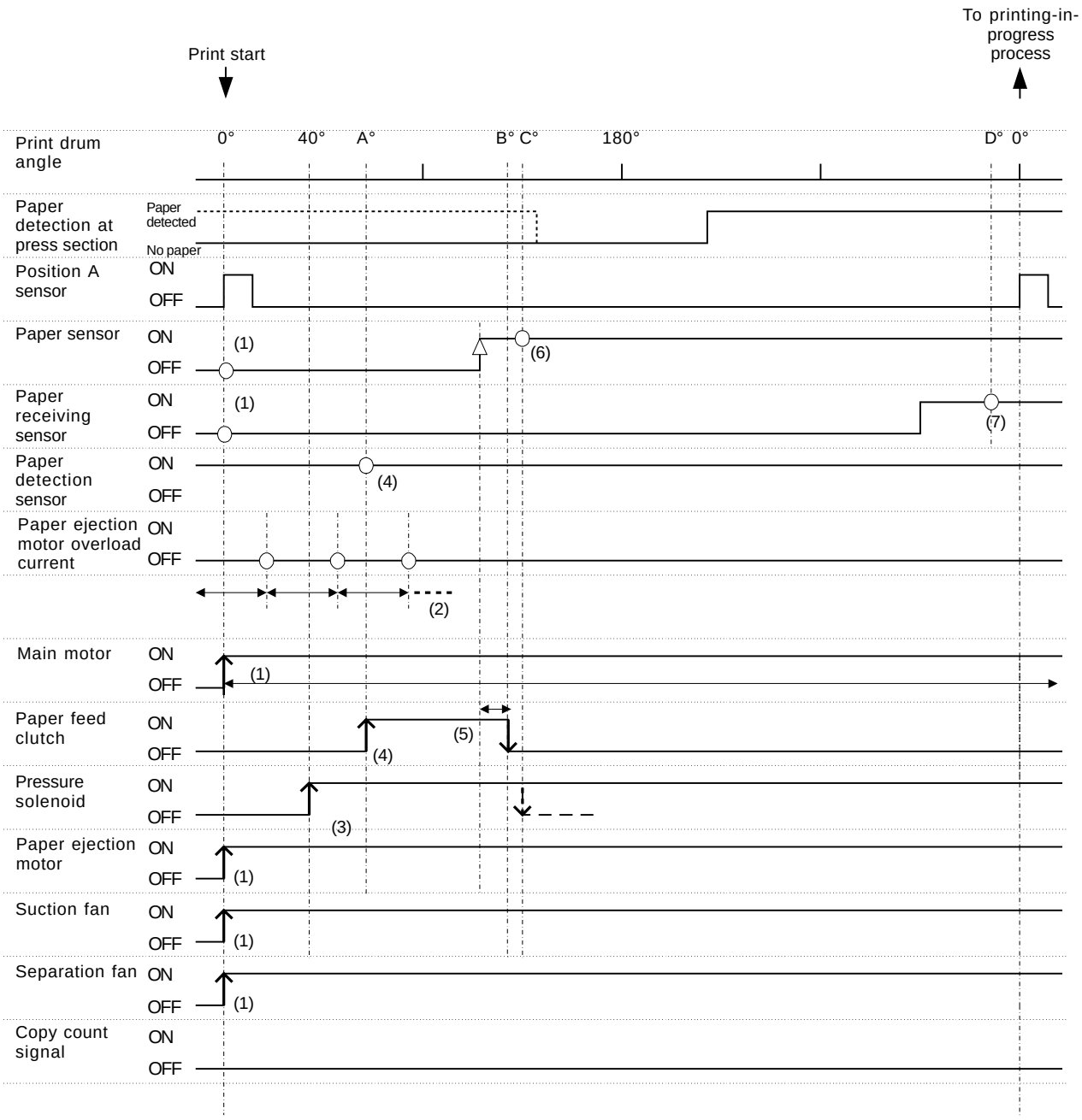
Printing Operations

1. Normal Overall Printing Operation



2. Individual Printing Operations

[Print Start Operation]



When ON: Position A sensor: Blocked, Paper sensor: Blocked, Paper receiving sensor: Open, Paper detection sensor: Open

(1) The paper receiving sensor is checked on starting printing, and error message [A09-417] is displayed if it is ON (paper jam from start).
The paper sensor is checked on starting printing, and error message [A07-418] is displayed if it is ON (paper jam from start).
On starting printing, the main motor, paper ejection motor, suction fan, and separation fan are switched ON.
The print drum initially rotates at speed 1 here, and increments by one speed level at the drum angle of 220° for each sheet printed.

(2) The paper ejection motor overload current is continually monitored at 100 ms intervals, and error message [T02-401] is given if is activated three times in succession.

(3) The pressure solenoid is activated at the drum angle of 40°, and subsequently remains ON until printing ends.

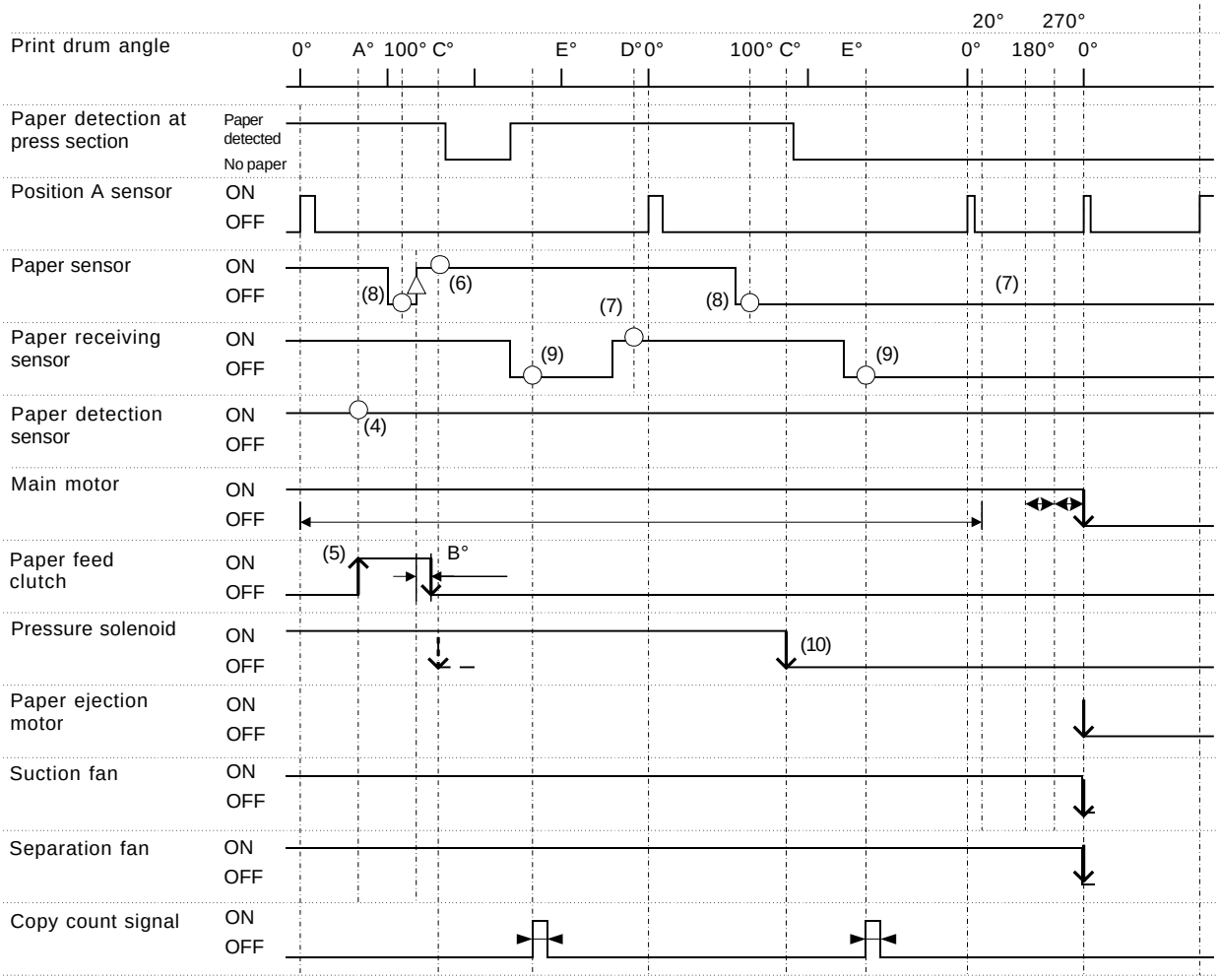
(4) The paper detection sensor is checked at the drum angle of A°, and the paper feed clutch is activated if paper is present.
Error message [C04-402] is displayed if no paper is present.
(A = 62° + value set in Test mode 481)

(5) The paper is transported, and the paper feed clutch is deactivated once the print drum has rotated B° from when the paper is detected by the paper sensor.
(B = 21° + value set in Test modes 482–485 + adjustment for print drum speed)

(6) If the paper sensor does not detect the paper by the time the print drum has rotated to angle C, it determines that no paper has been picked up, and moves to the three-cycle no-paper pickup operation.
(C = 135° + value set in Test mode 486 + value set in Test mode 481)

(7) If the paper receiving sensor does not detect the paper by the time the print drum has rotated to angle D, it determines that a paper jam has occurred, and moves to the print-end operation.
The paper sensor is checked at 180° before the print drum stops, error message [A07-409] is displayed if paper is present, and [A08-410] is displayed if there is no paper.
(D = 350° + value set in Test mode 487)

[Print In Progress - End Operation]



(4) The paper detection sensor is checked at the drum angle, A, and the paper feed clutch is activated if paper is present.
Error message [C04-402] is displayed if no paper is present. (A = 62° + value set in Test mode 481)

(5) The paper is transported, and the paper feed clutch is deactivated once the print drum has rotated B° from when the paper is detected by the paper sensor. (B = 21° + value set in Test modes 482–485 + adjustment for print drum speed)

(6) If the paper sensor does not detect the paper by the time the print drum has rotated to angle C, it determines that no paper has been picked up, and moves to the three-cycle no-paper pickup operation. (C = 135° + value set in Test mode 486 + value set in Test mode 481)

(7) If the paper receiving sensor does not detect the paper by the time the print drum has rotated to angle D, it determines that a paper jam has occurred, and moves to the print-end operation.
The paper sensor is checked at 180° before the print drum stops, error message [A07-409] is displayed if paper is present, and [A08-410] is displayed if there is no paper. (D = 350° + value set in Test mode 487)

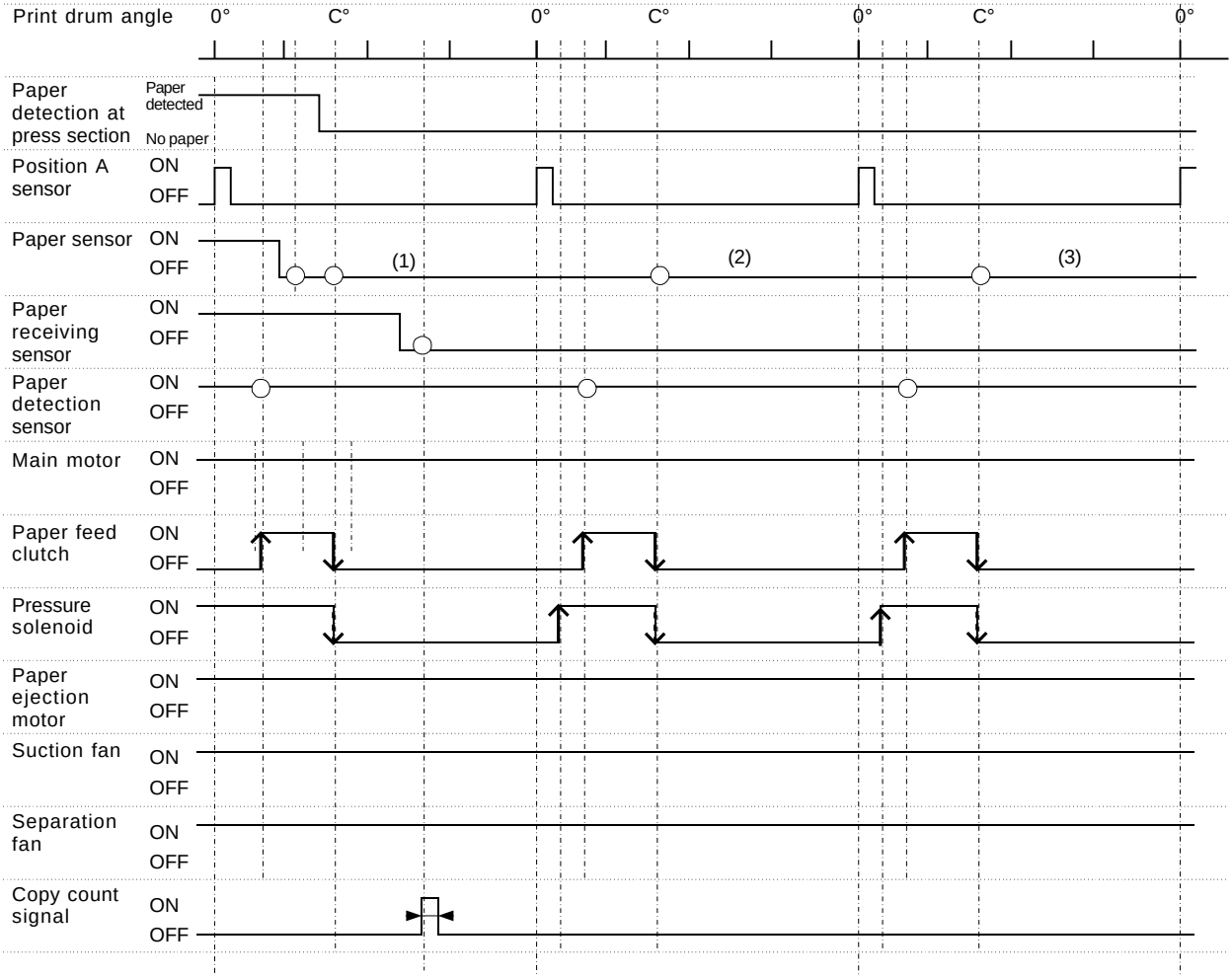
(8) If the paper does not pass beyond the paper sensor by the time the print drum has rotated to 100°, it determines that a paper jam has occurred, and moves to the print-end operation. Error message [A07-413] is displayed.

(9) The paper receiving sensor is checked at the drum angle, E. If the paper is still present, it determines that a paper jam has occurred, moves to the print-end operation, and error message [A09-411] is displayed. If normal, the copy count is incremented. (E = 250° + value set in Test mode 488)

(10) On completion of printing, the pressure solenoid is deactivated when the print drum has rotated to angle C.

(11) On the final revolution, the drum rotates at speed 1 at 20°, reducing to 30 rpm at 180° and 10 rpm at 270°. The main motor, paper receiving motor, suction fan, and separation fan stop once the print drum is detected at position A.

[Three-Cycle No-Paper Pickup Operation]



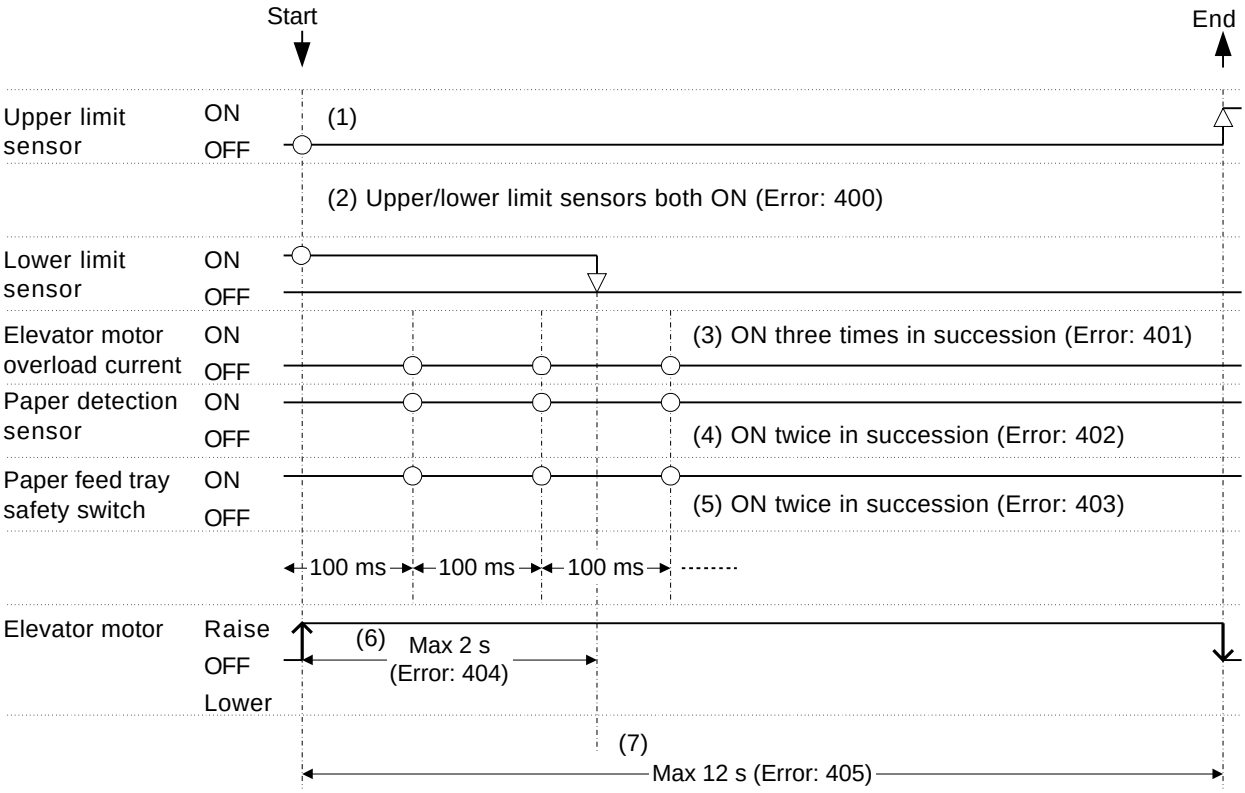
(1) If the paper sensor does not detect the paper by the time the print drum has rotated to angle C, it determines that no paper has been picked up, and moves to the three-cycle no-paper pickup operation.
(C = 135° + value set in Test mode 486 + value set in Test mode 481)

(2) The paper feed operation is performed a second time, and returns to the normal operation if the paper sensor detects the paper by the time the print drum has rotated to angle C.

(3) The paper feed operation is performed a third time, and returns to the normal operation if the paper sensor detects the paper by the time the print drum has rotated to angle C. If paper is not detected, it moves to the print-end operation, and error message [A07-412] is displayed.

3. Elevator Operations

[Elevator Raise Operation]



When ON: Upper limit sensor: Blocked, Lower limit sensor: Blocked, Paper detection sensor: Open

(1) The operation ends if the upper limit sensor is ON from the start.
If the upper limit sensor is OFF, the elevator operates until the upper limit sensor goes ON.

(2) Error message [T02-400] is displayed if both the upper and lower limit sensors are ON at the start.

(3) The elevator motor overload current is continually monitored at 100 ms intervals while the elevator is operating, and error message [T02-401] is displayed if an overload current is detected three times in succession.

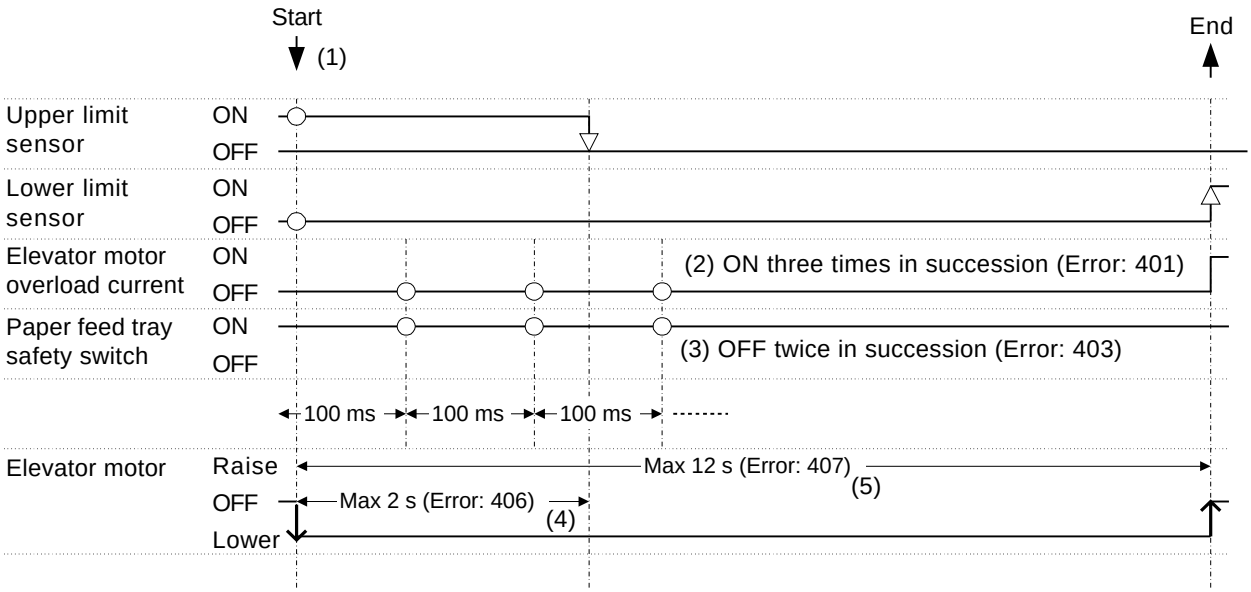
(4) The paper detection sensor is continually monitored at 100 ms intervals while the elevator is operating, and error message [C04-402] is displayed if no paper is detected twice in succession.

(5) The paper feed tray safety switch is continually monitored at 100 ms intervals while the elevator is operating, and error message [A06-403] is displayed if it is detected as OFF twice in succession.

(6) If the lower limit sensor takes more than 2 s to go OFF after the elevator starts, a time-out occurs, and error message [T02-404] is displayed.

(7) If the upper limit sensor takes more than 12 s to go ON after the elevator starts, a time-out occurs, and error message [T02-405] is displayed.

[Elevator Lower Operation]



When ON: Upper limit sensor: Blocked, Lower limit sensor: Blocked, Paper feed tray safety switch: Not depressed

(1) The operation ends if the lower limit sensor is ON from the start.
If the lower limit sensor is OFF, the elevator operates until the lower limit sensor goes ON.

(2) The elevator motor overload current is continually monitored at 100 ms intervals while the elevator is operating, and error message [T02-401] is displayed if an overload current is detected three times in succession.

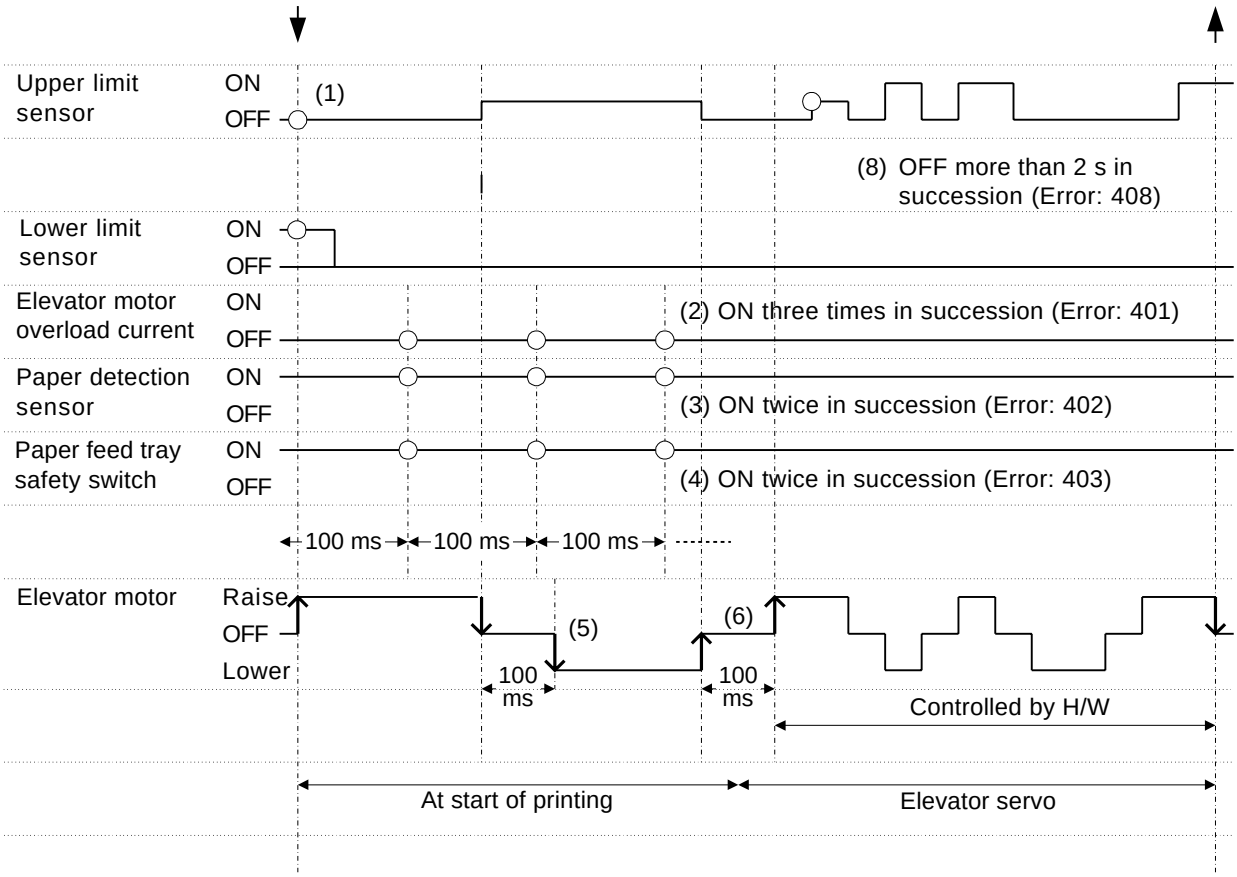
(3) The paper feed tray safety switch is continually monitored at 100 ms intervals while the elevator is operating, and error message [A06-403] is displayed if it is detected as OFF twice in succession.

(4) If the upper limit sensor takes more than 2 s to go OFF after the elevator starts, a time-out occurs, and error message [T02-406] is displayed.

(5) If the lower limit sensor takes more than 12 s to go ON after the elevator starts, a time-out occurs, and error message [T02-407] is displayed.

ELEVATOR OPERATIONS

[Elevator Servo Operation]



When ON: Upper limit sensor: Blocked, Lower limit sensor: Blocked, Paper detection sensor: Open, Paper feed tray safety switch: Depressed

(1) The operation ends if the upper limit sensor is ON from the start.
If the upper limit sensor is OFF, the elevator operates until the upper limit sensor goes ON.

(2) The elevator motor overload current is continually monitored at 100 ms intervals while the elevator is operating, and error message [T02-401] is displayed if an overload current is detected three times in succession.

(3) The paper detection sensor is continually monitored at 100 ms intervals while the elevator is operating, and error message [C04-402] is displayed if no paper is detected twice in succession.

(4) The paper feed tray safety switch is continually monitored at 100 ms intervals while the elevator is operating, and error message [A06-403] is displayed if it is detected as OFF twice in succession.

(5) If the upper limit sensor goes ON, the elevator briefly descends until the upper limit sensor goes OFF.

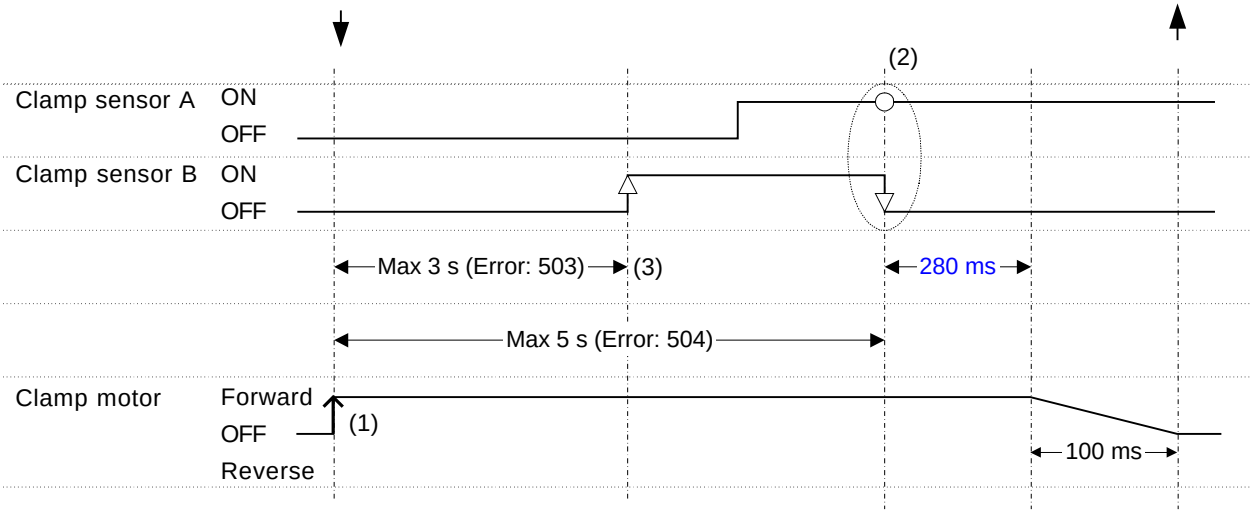
(6) The elevator then rises until the upper limit sensor goes ON again.

(7) The elevator servo operation is subsequently performed.

(8) If the upper limit sensor remains OFF for more than 2 s during the elevator servo operation, error message [T02-408] is displayed.

4. Print Drum Peripheral Operations

[Clamp Release]



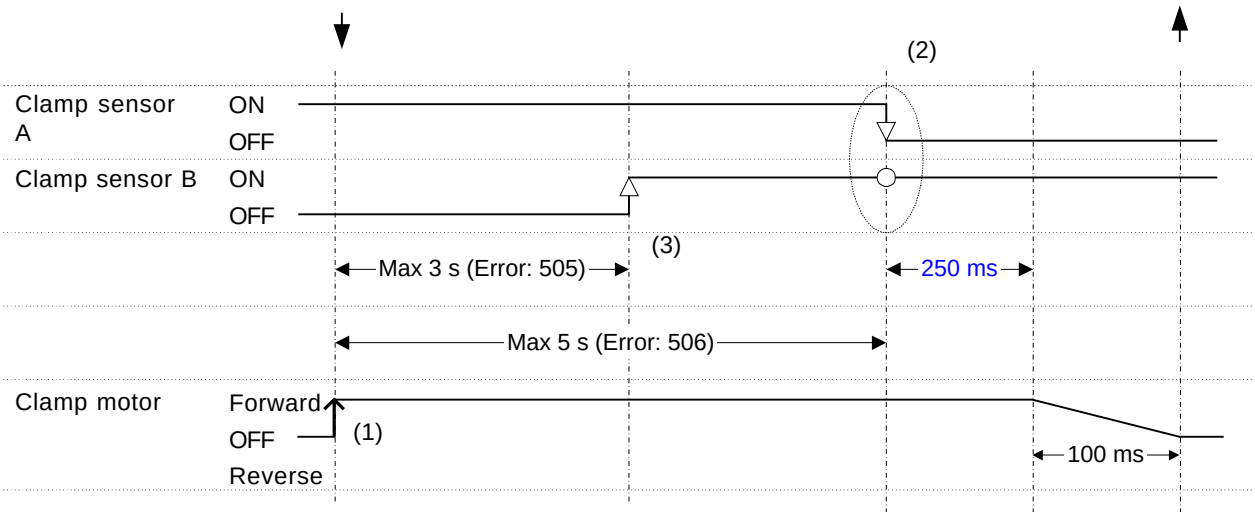
When ON: Clamp sensor A: Blocked, Clamp sensor B: Blocked

(1) The clamp motor operates in the forward direction on starting.

(2) When clamp sensor B goes OFF with clamp sensor A ON, the clamp motor operates for a further 280 ms before stopping.
A time-out occurs at 5 s after the clamp motor starts, and error message [T03-504] is displayed.

(3) A time-out occurs and error message [T03-503] is displayed if clamp sensor B does not go ON within 3 s of the clamp motor starting.

[Master Clamp Operation]

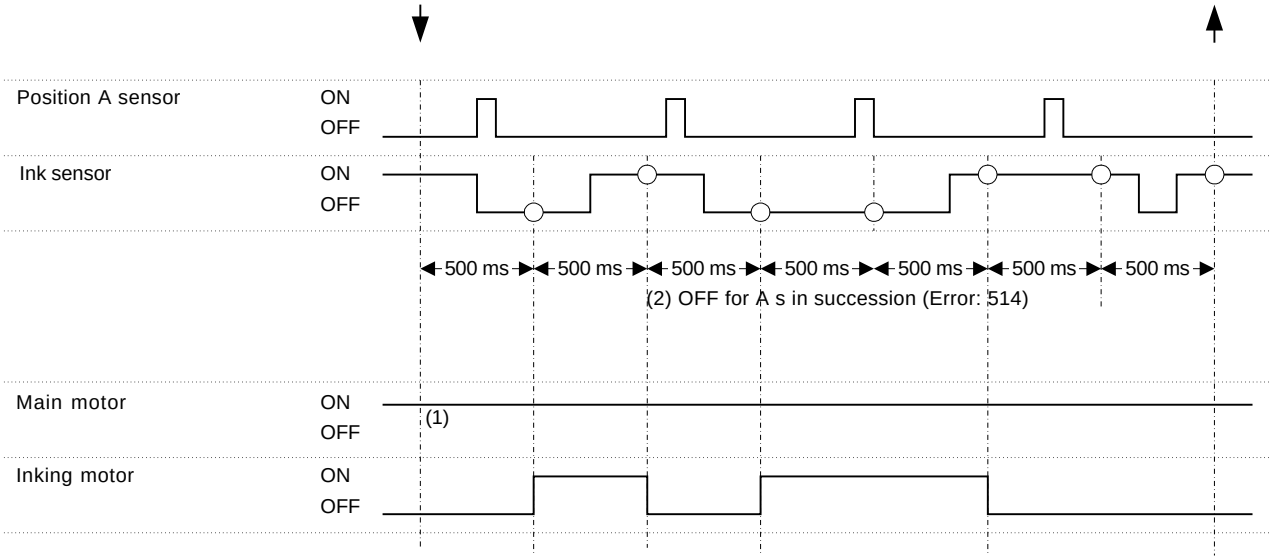


(1) The clamp motor operates in the forward direction on starting.

(2) When clamp sensor A goes OFF with clamp sensor B ON, the clamp motor operates for a further 250 ms before stopping.
A time-out occurs at 5 s after the clamp motor starts, and error message [T03-506] is displayed.

(3) A time-out occurs and error message [T03-505] is displayed if clamp sensor B does not go ON with 3 s of the clamp motor starting.

[Inking Operation (No Ink Detection)]

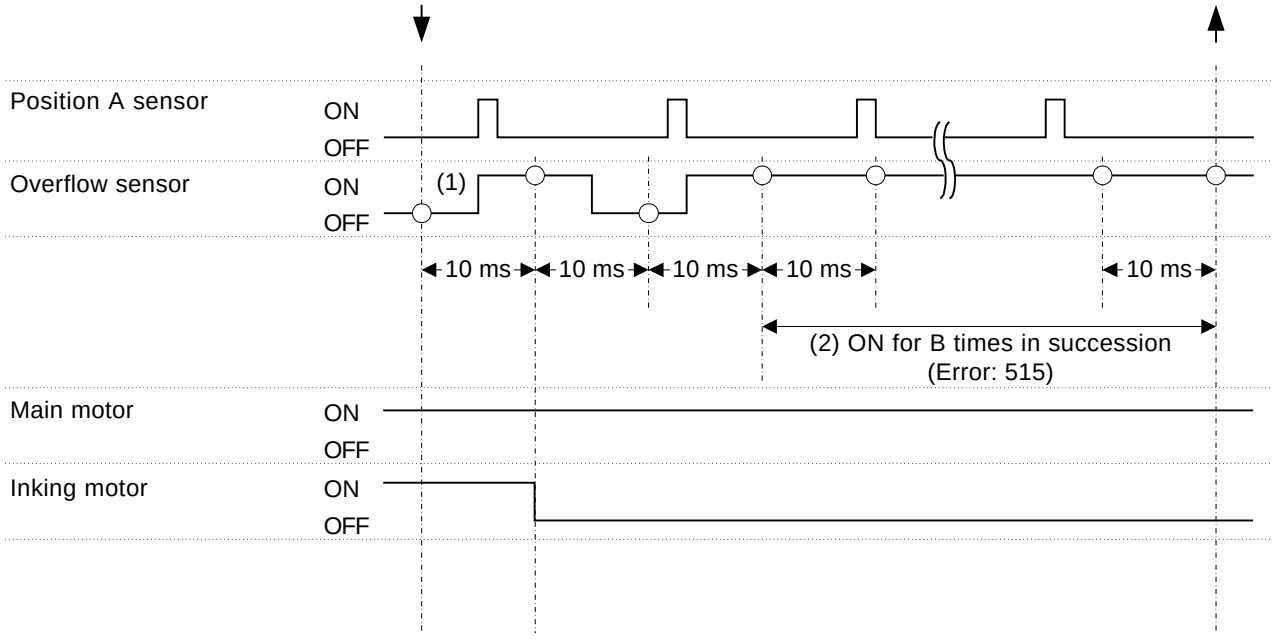


(1) Inking is performed with the main motor ON.

(2) The ink sensor is monitored at 500 ms intervals, and if it is detected as OFF, the inking motor is activated until the ink sensor goes ON. A time-out occurs at A s here, and the ink cartridge is determined as empty. Error message [C01-512] is displayed.

Normally: (A = Value set in Test mode No. 583 (initially 20 s))
After ink replacement: (A = Value set in Test mode No. 584 (initially 40 s))

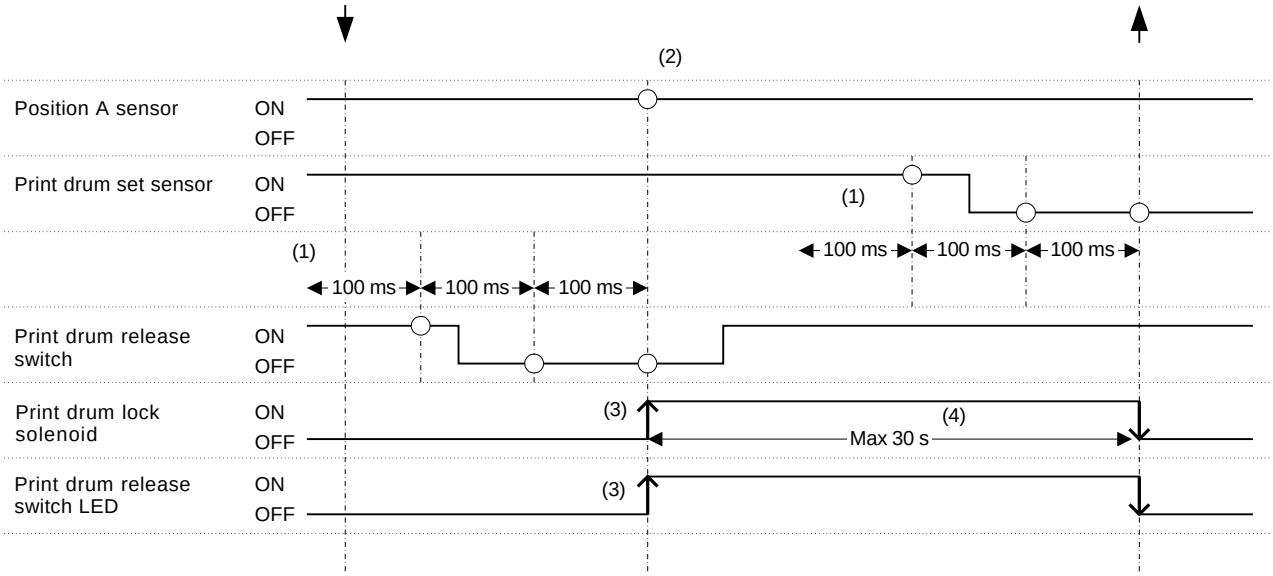
[Inking Operation (Overflow Detection)]



(1) The overflow sensor is monitored at 10 ms intervals, and if it is detected as ON, the inking motor is stopped for period (2) irrespective of the ink sensor status.

(2) If the overflow sensor is detected as ON B times in succession, an overflow is determined to have occurred, and error message [T04-513] is displayed.
(B = Value set in Test mode No. 585 (initially 50 times))

[Print Drum Solenoid Lock Release]



(1) The print drum set sensor and print drum release switch are monitored at 100 ms intervals.

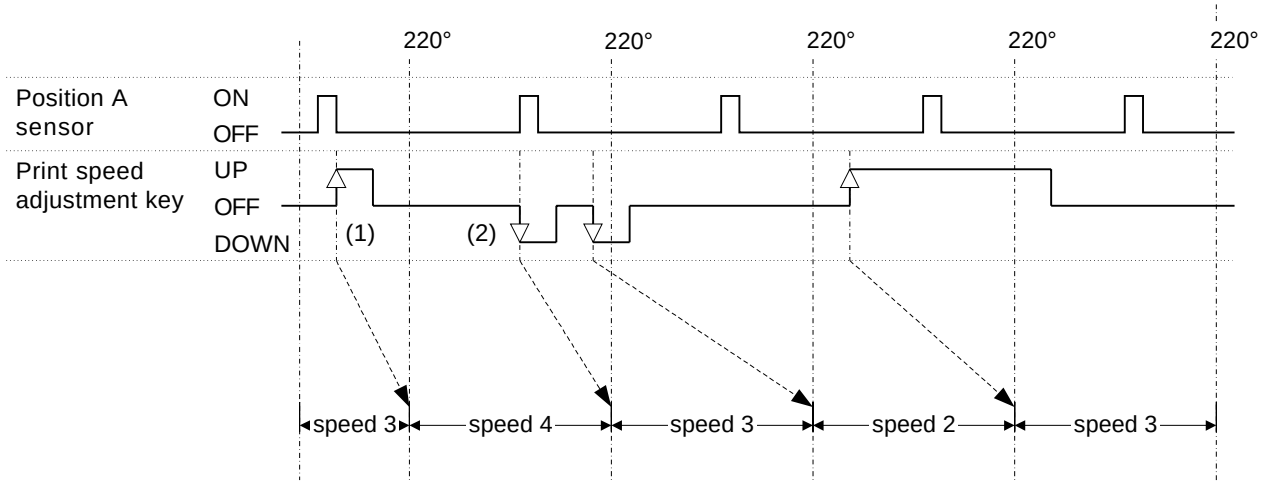
(2) If the print drum release switch is detected as having been depressed twice in succession, the position A sensor is checked, and the print drum rotates to position A if the position A sensor is OFF. (The print drum release switch LED blinks here.)

(3) The print drum lock solenoid and print drum release switch LED are switched ON until the print drum set sensor goes OFF (until the print drum is removed) to allow the print drum to be removed at position A.

(4) If the print drum is left at the removal position without being removed, a time-out occurs at 30 s, and the print drum lock solenoid and print drum release switch LED are switched OFF.

5. Print Adjustment Operations

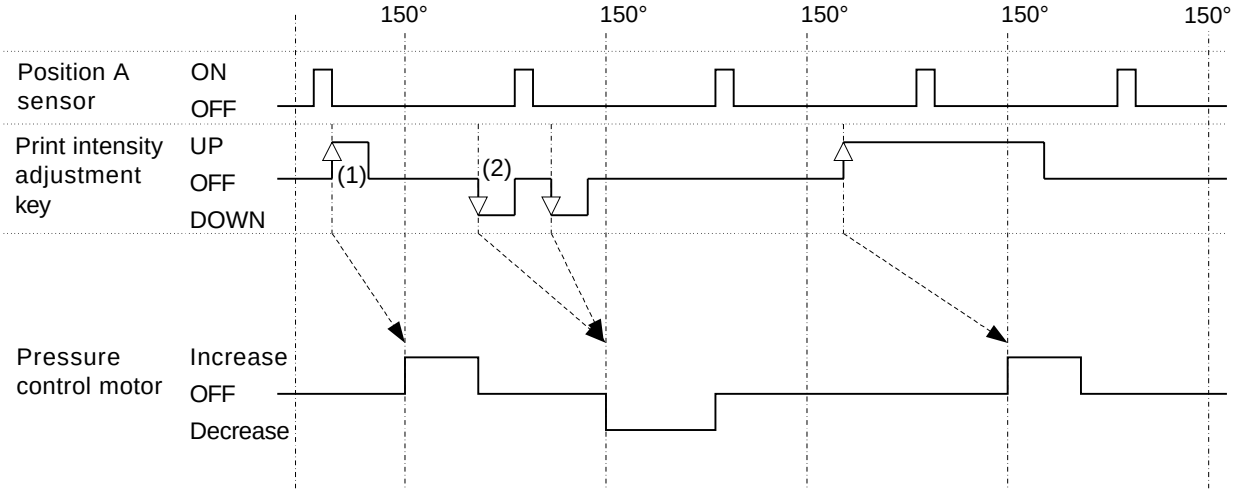
[Print Speed Change]



(1) If the print speed adjustment key is pressed, the speed does not change immediately, but rather at the next time the print drum reaches the 220° position.

(2) If the print speed adjustment key is pressed twice, the speed only changes by one level per revolution, and so two revolutions are required to reach the specified speed.

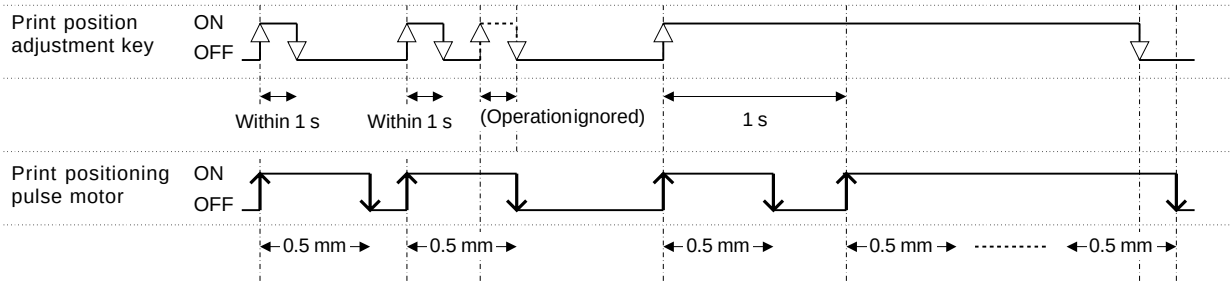
[Print Intensity Change]



(1) If the print intensity adjustment key is pressed, the print intensity does not change immediately, but rather at the next time the print drum reaches the 150° position.

(2) Likewise, when the print intensity adjustment key is pressed twice, the intensity changes as specified the next time the print drum reaches the 150° position.

[Vertical Print Positioning Operation]



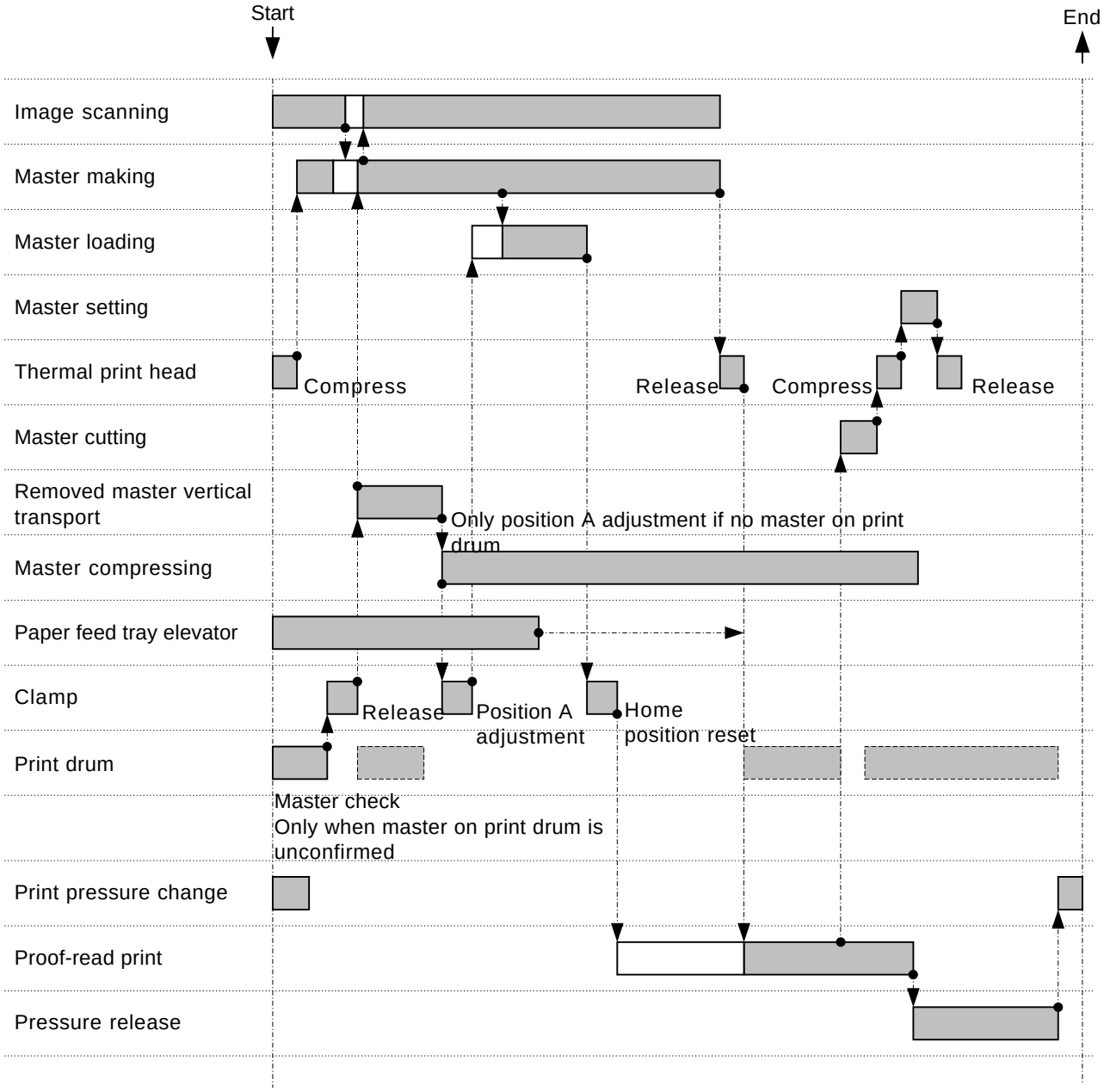
(1) If the print position adjustment key is pressed once (within 1 s), the position is immediately changed 0.5 mm.

(2) If the print position adjustment key is pressed twice (within 1 s), the second press is ignored if pressed while the position is being moved for the first press.

(3) If the print position adjustment key is pressed for more than 1 s, the position is moved 5 mm for the first 1 s pressed, and then continuously in 5 mm increments for as long as the key is pressed.

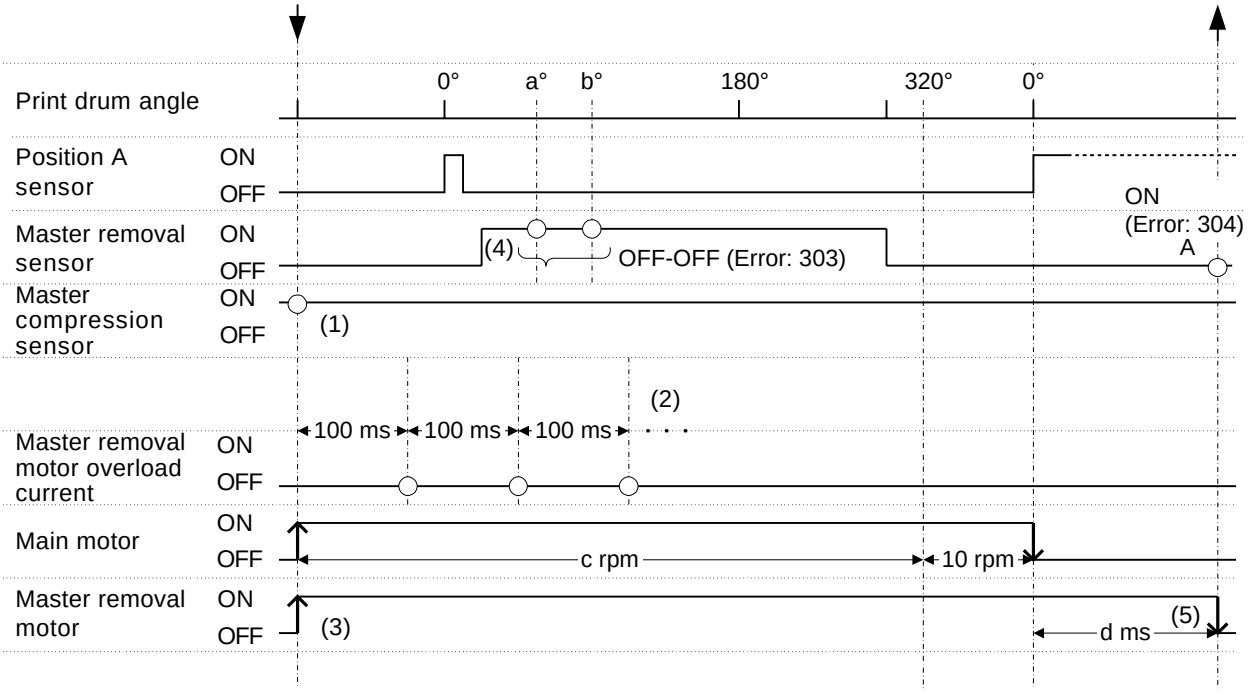
Master Removal Operations

1. Overall Timing for Normal Master Creation



2. Individual Master Removal Operations

[Removed Master Vertical Transport Operation]



When ON: Position A sensor: Blocked, Master removal sensor: Open, Master compression sensor: Open

The removed master vertical transport operation starts after the print drum clamp plate releasing operation ends.

(1) The master compression sensor is checked on starting, and the master compression plate is initialized if it is OFF.

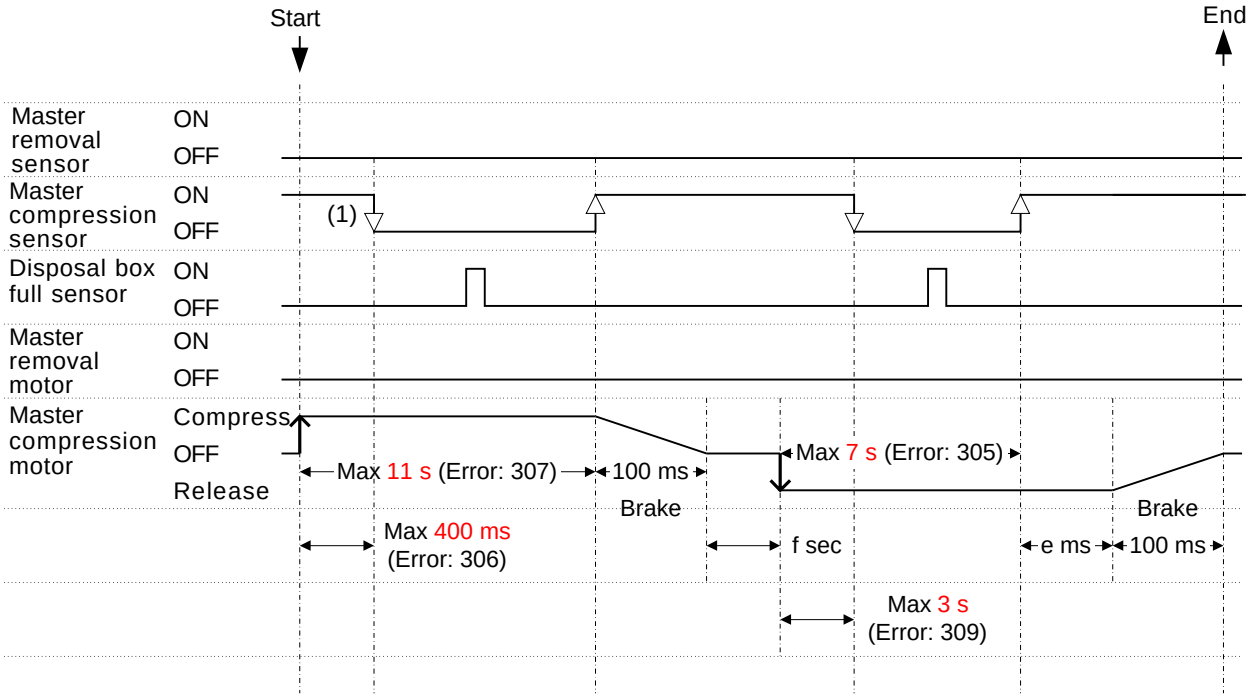
(2) The master removal motor overload current is monitored continually at 100 ms intervals during the Removed master vertical transport operation, and error message [T12-300] is displayed if an overload current is detected three times in succession.

(3) The main motor and master removal motor are operated to vertically transport the removed master while rotating the print drum.
The print drum speed here corresponds to the value set in Test mode No. 387 (initially 15 rpm).

(4) The progress of the removed master is checked twice by the master removal sensor at print drum angles a° and b°, and is judged to be normal if the sensor is ON at both points. If it is OFF at one point, error message [A04-303] is displayed.
(a = value set in Test mode No. 380 (initially 70°))
(b = value set in Test mode No. 381 (initially 90°))

(5) The print drum stops at position A, and the master removal motor stops after d ms. The master removal sensor is checked here, and error message [A04-304] is displayed if it is ON.
(d = value set in Test mode No. 382 (initially 0 s))

[Disposed Master Compressing Operation]



When ON: Master removal sensor: Open, Master compression sensor: Open, Disposal box full sensor: Open
The disposed master compressing operation starts after the removed master vertical transport operation ends.

(1) The master compression sensor is checked on starting, and the master compression plate is initialized if it is OFF.

(2) The master compression motor operates to start the master compression.

(3) The master compression sensor goes OFF. A time-out occurs here at 400 ms, and error message [T12-306] is displayed.

(4) The disposal box full sensor goes ON midway.

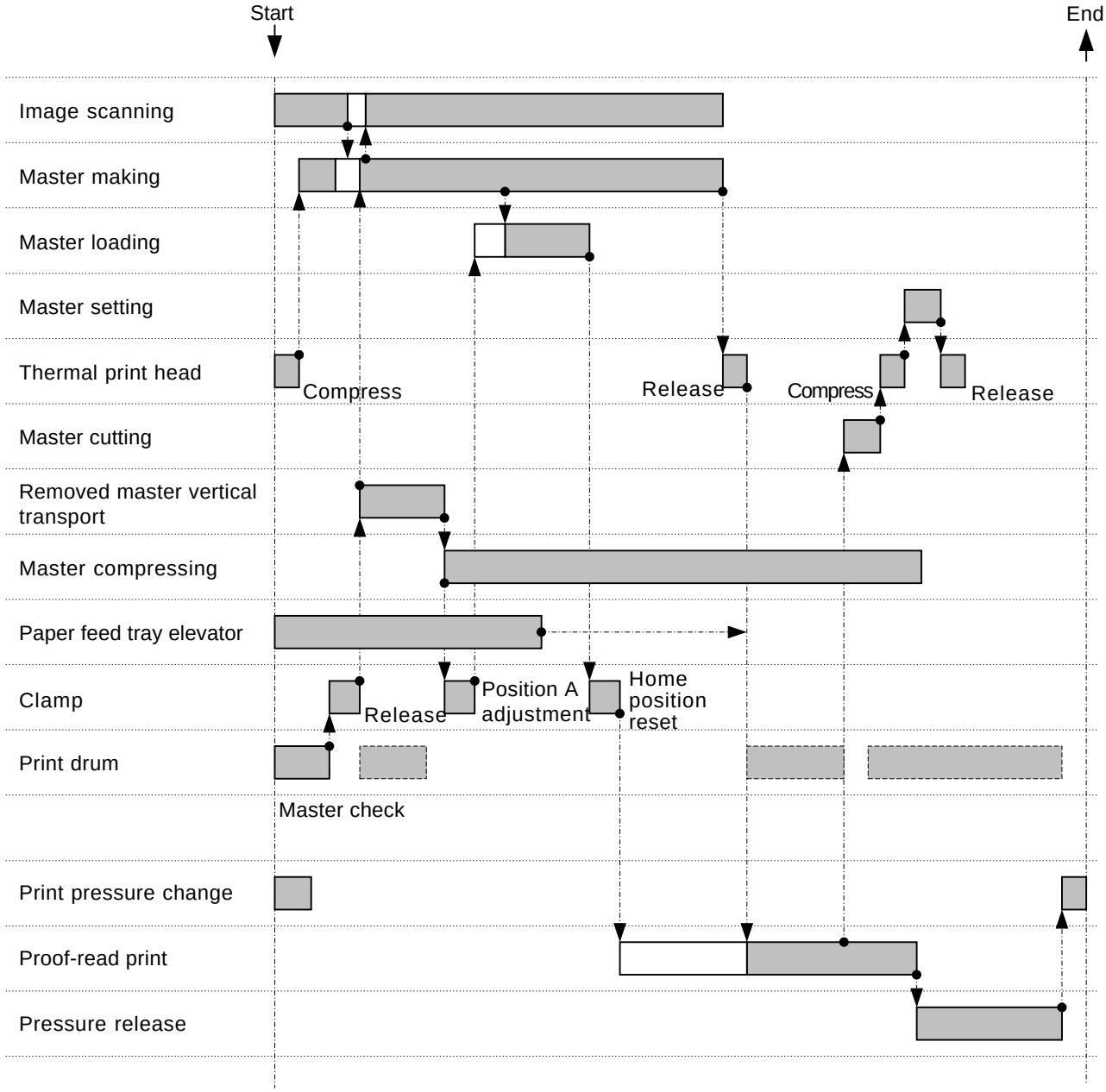
(5) The master compression motor stops once the master compression sensor goes back ON again.
A time-out occurs at 11 s after the start of master compression here, and error message [T12-307] is displayed.
Similarly, if (4) is not detected, the disposal box is judged to be full, and error message [C03-313] is displayed.

(6) The master compression motor reverses f s after the motor stops.
(f = value set in Test mode No. 384 (initially 1 s))
The master compression sensor goes OFF while the master compression motor operates in reverse.
A time-out occurs here at 3 s after reversing, and error message [T12-309] is displayed.

(7) The master compression motor stops once the master compression sensor goes back ON.
A time-out occurs here at 7 s after reversing, and error message [Error 305] is displayed.

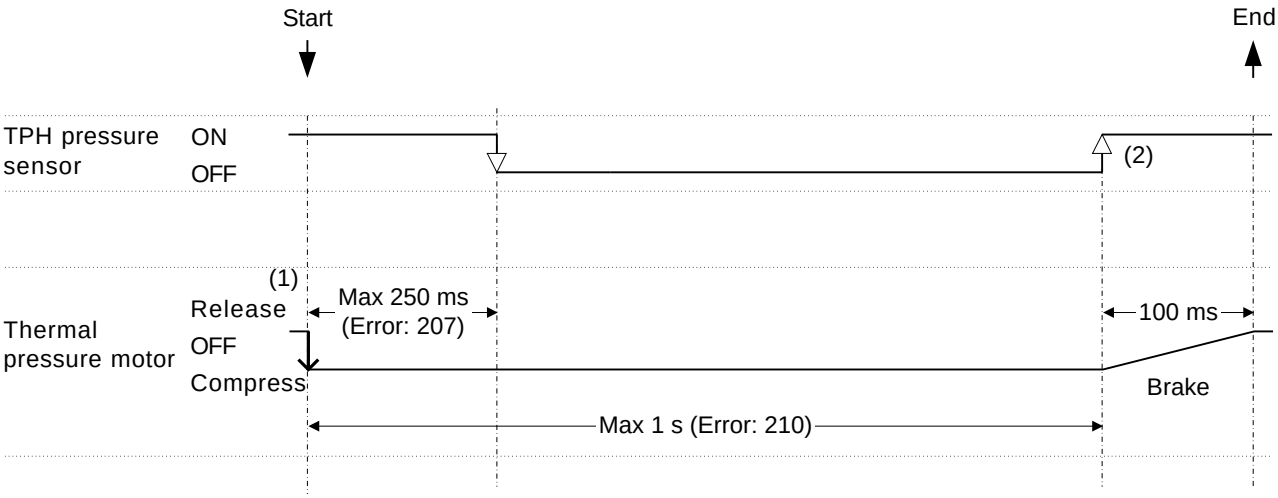
Master Making Operation

1. Overall Timing for Normal Master Creation



2. Individual Master Making Operation

[Thermal Print Head Compression Operation]

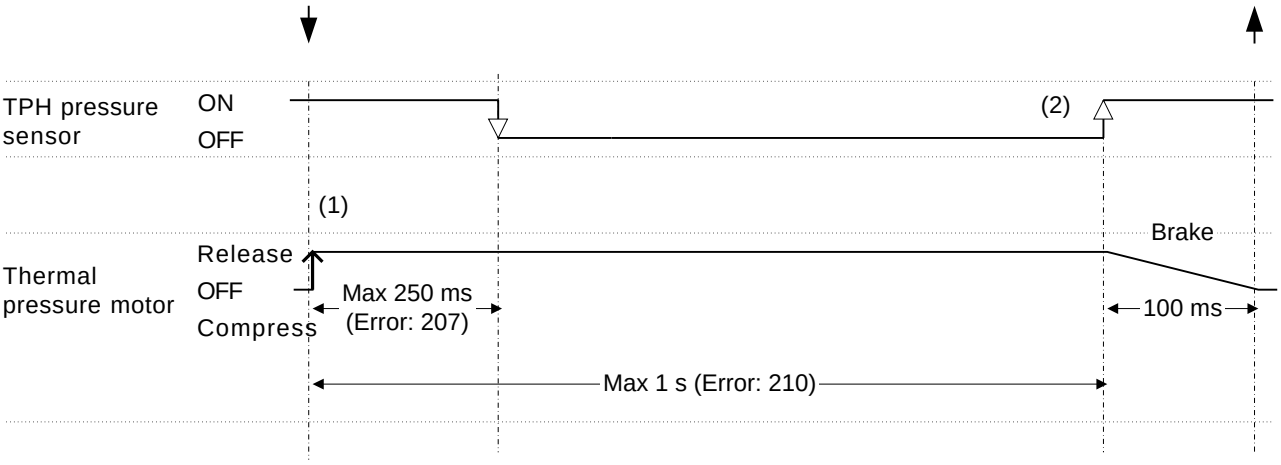


When ON: TPH pressure sensor: Blocked

(1) The thermal pressure motor operates in the direction of compression.

(2) The TPH pressure sensor goes OFF, and the thermal pressure motor stops when the sensor goes back ON again.
A time-out occurs at 250 ms when the TPH pressure sensor goes OFF, and error message [T19-207] is displayed. Likewise, a time-out occurs at 1 s when the TPH pressure sensor goes back on again, and error message [Error 208] is displayed.

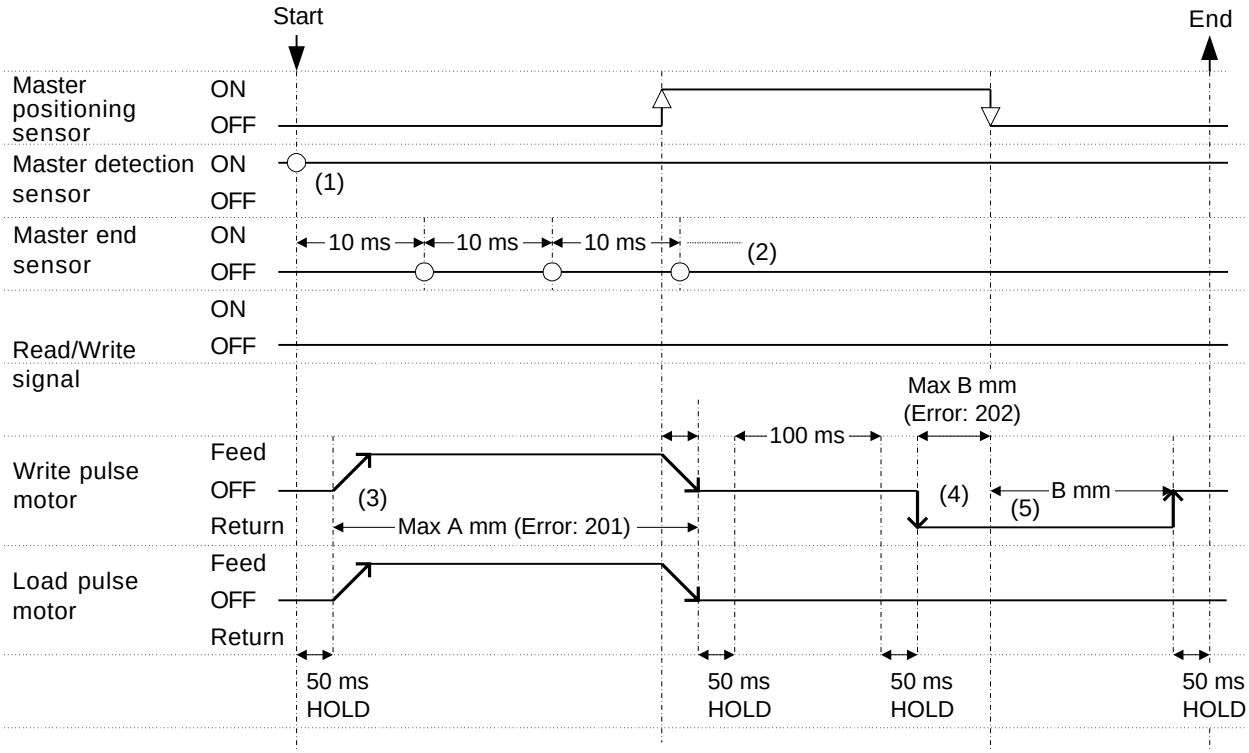
[Thermal Print Head Release Operation]



(1) The thermal pressure motor operates in the release direction.

(2) The TPH pressure sensor goes OFF, and the thermal pressure motor stops when the sensor goes back ON again.
A time-out occurs at 250 ms when the TPH pressure sensor goes OFF, and error message [T19-207] is displayed. Likewise, a time-out occurs at 1 s when the TPH pressure sensor goes back on again, and error message [T19-208] is displayed.

[Master Positioning Operation]



When ON: Master positioning sensor: Open, Master detection sensor: Open, Master end sensor: Blocked

The master positioning operation starts after master cutting is complete when setting the master loading unit and master creation.

(1) The master detection sensor detects whether a master is present on starting. If the master detection sensor is OFF, error message [D05-210] is displayed.

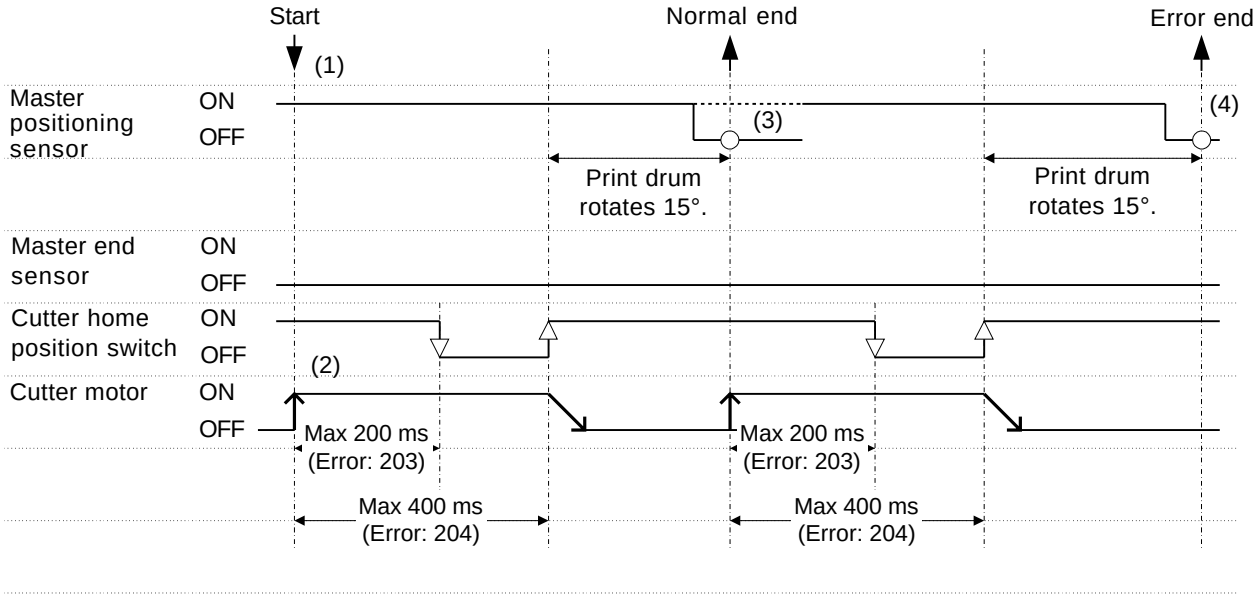
(2) The master end sensor is checked at 10 ms intervals, and if an end mark is detected twice in succession, error message [C02-200] is displayed.

(3) The write pulse motor and load pulse motor operate in the feed direction until the master positioning sensor goes ON. A time-out occurs here when it has fed 75 mm when setting the master loading unit and 25 mm when inching after cutting, and error message [A01-201] is displayed.

(4) The write pulse motor and load pulse motor operate in the return direction until the master positioning sensor goes OFF. A time-out occurs here when it has fed B mm, and error message [A01-202] is displayed. (B = 3 mm + value set in Test mode No. 280)

(5) The master is moved a further B mm in the return direction after the master positioning sensor goes OFF, and then motor then stops, ending the master positioning operation.

[Master Cutting Operation]



When ON: Master positioning sensor: Open, Master end sensor: Blocked

When the master making operation starts, the cutter home position switch is checked at the start of the master cutting operation. Error message [A17-209] is displayed if it is OFF.

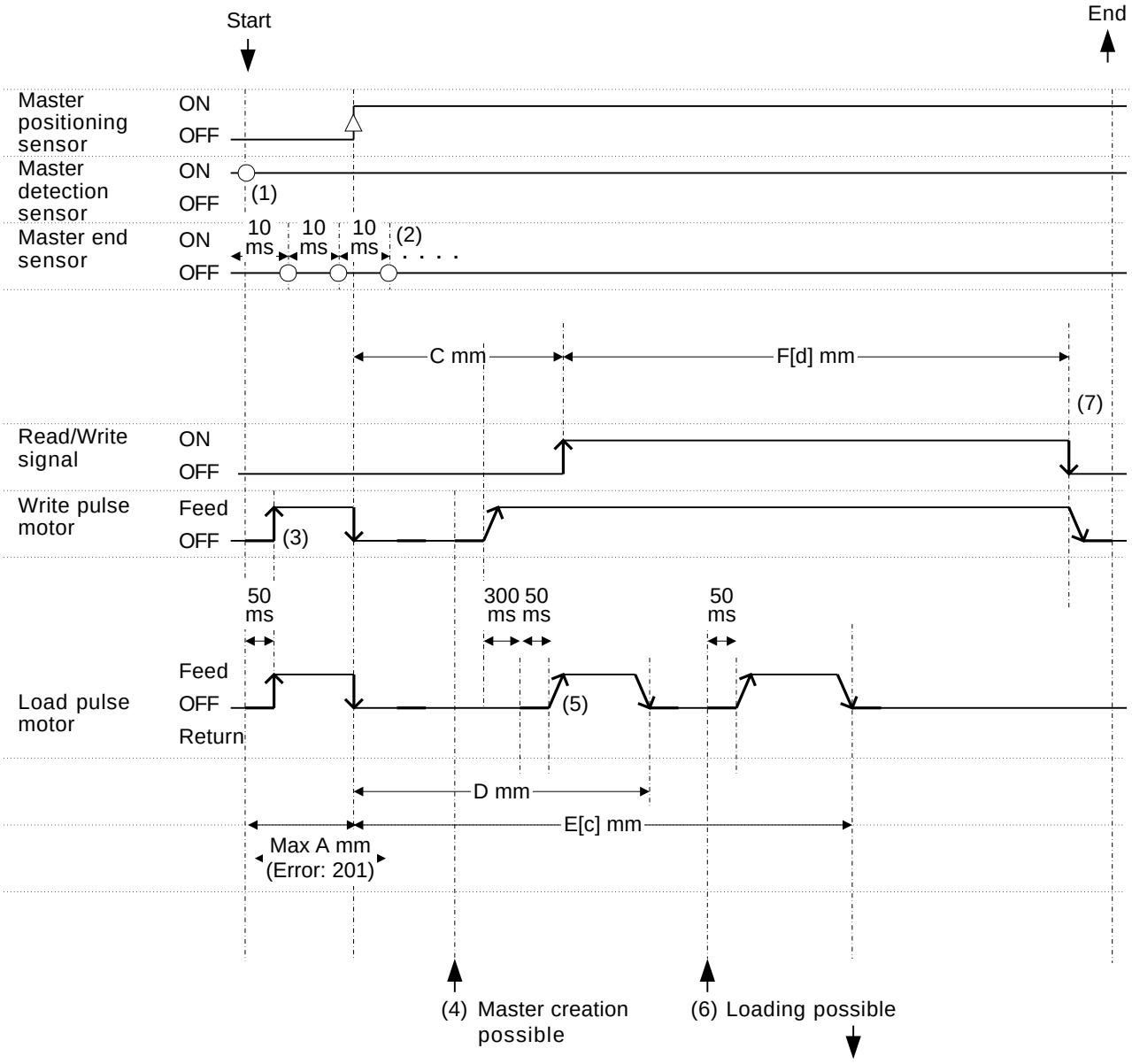
(1) The Master cutting operation starts after the print drum stops at angle A during master loading. (A = 220° + value set in Test mode No. 284)

(2) The cutter motor operates and stops after the cutter home position switch goes OFF and then back ON again.
A time-out occurs at 200 ms before the switch goes OFF, and error message [T13-203] is displayed.
Likewise, a time-out occurs at 400 ms before the switch goes back ON again, and error message [T13-204] is displayed.

(3) The print drum rotates, and the master positioning sensor is checked when the print drum reaches the 15° position.
If the master positioning sensor is OFF, the process is normal, and master cutting ends.
If the master positioning sensor is ON, master cutting is repeated.

(4) The print drum rotates, and the master positioning sensor is rechecked when the print drum reaches the 15° position.
If the master positioning sensor is OFF, error message [A03-206] is displayed.
If the master positioning sensor is ON, error message [T13-205] is displayed.

[Master Making Operation]



When ON: Master positioning sensor: Open, Master detection sensor: Open, Master end sensor: Blocked

The master loading and master making operation start once the thermal print head compressing is complete.

(1) The master detection sensor checks for the presence of a master on starting.

(2) The master end sensor is checked at 10 ms intervals during the master transport operation, and if the end mark is detected twice in succession, error message [C02-200] is displayed.

(3) The write pulse motor and load pulse motor operate in the feed direction until the master positioning sensor goes ON. A time-out occurs here when the master is fed A mm, and error message [A01-201] is displayed. (A = 3 mm + value set in Test mode No. 280)

(4) The write pulse motor operates once the clamp release operation ends for removing the master, and master creation starts after it has been transported to the position for the start of printing. (C = 6.5 mm + value set in Test mode No. 281)

(5) The load pulse motor operates to transport the leading edge of the master to the master loading position. (D = 95 mm)

(6) Once the removed master vertical transport ends and the print drum position A adjustment is complete, the load pulse motor operates to transport the leading edge of the master to the clamp position. (E = 136.1 mm + value set in Test mode No. 283)

(7) Master creation ends once master creation is complete for the effective printing area.