15. ABSOLUTE POSITION DETECTION SYSTEM

CAUTION

If an absolute position erase alarm (AL.25) has occurred, always perform home position setting again. Not doing so can cause runaway.

15. Outline

15.1 Features

For normal operation, as shown below, the encoder consists of a detector designed to detect a position within one revolution and a cumulative revolution counter designed to detect the number of revolutions. The absolute position detection system always detects the absolute position of the machine and keeps it battery-backed, independently of whether the general-purpose programming controller power is on or off. Therefore, once the home position is defined at the time of machine installation, home position return is not needed when power is switched on thereafter.

If a power failure or a fault occurs, restoration is easy.

Also, the absolute position data, which is battery-backed by the super capacitor in the encoder, can be retained within the specified period (cumulative revolution counter value retaining time) if the cable is unplugged or broken.

15.1.2 Restrictions

The absolute position detection system cannot be configured under the following conditions. Test operation cannot be performed in the absolute position detection system, either. To perform test operation, choose incremental in parameter No.1.

1. Speed control mode, torque control mode.
2. Control switch-over mode (position/speed, speed/torque, torque/speed).
3. Stroke-less coordinate system, e.g. rotary shaft, infinitely long positioning.
5. Use of alarm code output.
15. ABSOLUTE POSITION DETECTION SYSTEM

15.2 Specifications

(1) Specification list

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>System</td>
<td>Electronic battery backup system</td>
</tr>
<tr>
<td>Battery</td>
<td>1 piece of lithium battery (primary battery, nominal + 3.6V)</td>
</tr>
<tr>
<td></td>
<td>Type: MR-BAT or A6BAT</td>
</tr>
<tr>
<td>Maximum revolution range</td>
<td>Home position + 32767 rev.</td>
</tr>
<tr>
<td>(Note 1) Maximum speed at power failure</td>
<td>500r/min</td>
</tr>
<tr>
<td>(Note 2) Battery backup time</td>
<td>Approx. 10,000 hours (battery life with power off)</td>
</tr>
<tr>
<td>(Note 3) Data holding time during battery replacement</td>
<td>2 hours at delivery, 1 hour in 5 years after delivery</td>
</tr>
<tr>
<td>Battery storage period</td>
<td>5 years from date of manufacture</td>
</tr>
</tbody>
</table>

Note: 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like.
2. Time to hold data by a battery with power off. It is recommended to replace the battery in three years independently of whether power is kept on or off.
3. Period during which data can be held by the super capacitor in the encoder after power-off, with the battery voltage low or the battery removed, or during which data can be held with the encoder cable disconnected.
   Battery replacement should be finished within this period.

(2) Configuration

<table>
<thead>
<tr>
<th>Positioning module</th>
<th>I/O module</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD71 · AD71S2 · AD71S7</td>
<td>AX40 · 41 · 42</td>
</tr>
<tr>
<td>A1SD71S2 · A1SD71S7</td>
<td>AY40 · 41 · 42</td>
</tr>
<tr>
<td>AD75</td>
<td></td>
</tr>
<tr>
<td>A1SD75</td>
<td></td>
</tr>
<tr>
<td>FX-1PG · FX-1GM</td>
<td>FX2-32MT</td>
</tr>
<tr>
<td>FX(E)-20GM · FX-10GM</td>
<td></td>
</tr>
</tbody>
</table>

(3) Parameter setting

Set "1" in parameter No.1 to make the absolute position detection system valid.

Parameter No. 1

```
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

Selection of absolute position detection system
0: Incremental system
1: Absolute position detection system
15. ABSOLUTE POSITION DETECTION SYSTEM

15.3 Battery installation procedure

**WARNING**

- Before starting battery installation procedure, make sure that the charge lamp is off more than 10 minutes after power-off. Then, confirm that the voltage is safe in the tester or the like. Otherwise, you may get an electric shock.

**POINT**

The internal circuits of the servo amplifier may be damaged by static electricity. Always take the following precautions:

- Ground human body and work bench.
- Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.

(1) Open the operation window. (When the model used is the MR-J2S-200A • MR-J2S-350A or more, also remove the front cover.)
(2) Install the battery in the battery holder.
(3) Install the battery connector into CON1 until it clicks.
15.4 Standard connection diagram

Note: 1. Always install the emergency stop switch.
2. For operation, always short the forward/reverse rotation stroke end (LSN/LSP) with SG.
3. When using the torque limit signal (TL), set "□□□4" in parameter No.46 to assign TL to pin CN1B-7.
15. ABSOLUTE POSITION DETECTION SYSTEM

15.5 Signal explanation

When the absolute position data is transferred, the signals of connector CN1 change as described in this section. They return to the previous status on completion of data transfer. The other signals are as described in Section 3.3.2.

For the I/O interfaces (symbols in the I/O Category column in the table), refer to Section 3.6.

<table>
<thead>
<tr>
<th>Signal name</th>
<th>Code</th>
<th>Pin No.</th>
<th>Function/Application</th>
<th>I/O category</th>
<th>Control mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS transfer mode</td>
<td>ABSM</td>
<td>CN1B-8</td>
<td>While ABSM is shorted by connection to SG, the servo amplifier is in the ABS transfer mode, and the functions of ZSP, TLC, and D01 are as indicated in this table.</td>
<td>DI-1</td>
<td>P</td>
</tr>
<tr>
<td>ABS request</td>
<td>ABSR</td>
<td>CN1B-9</td>
<td>ABSR-SG are shorted to request the ABS data in the ABS transfer mode.</td>
<td>DI-1</td>
<td>P</td>
</tr>
<tr>
<td>ABS bit 0</td>
<td>D01</td>
<td>CN1B-4</td>
<td>Indicates the lower bit of the ABS data (2 bits) which is sent from the servo to the programmable controller in the ABS transfer mode. If there is a signal, the circuit between D01 and SG is closed.</td>
<td>DO-1</td>
<td>(Position control)</td>
</tr>
<tr>
<td>ABS bit 1</td>
<td>ZSP</td>
<td>CN1B-19</td>
<td>Indicates the upper bit of the ABS data (2 bits) which is sent from the servo to the programmable controller in the ABS transfer mode. If there is a signal, the circuit between ZSP and SG is closed.</td>
<td>DO-1</td>
<td>P</td>
</tr>
<tr>
<td>Send data ready</td>
<td>TLC</td>
<td>CN1B-6</td>
<td>Indicates that the data to be sent is being prepared in the ABS transfer mode. At the completion for the ready state, the circuit between TLC and SG is closed.</td>
<td>DO-1</td>
<td>P</td>
</tr>
<tr>
<td>Home position setting</td>
<td>CR</td>
<td>CN1A-8</td>
<td>When CR-SG are shorted, the position control counter is cleared and the home position data is stored into the non-volatile memory (backup memory).</td>
<td>DI-1</td>
<td>P</td>
</tr>
</tbody>
</table>

Note: When "Used in absolute position detection system" is selected in parameter No. 1, pin CN1B-8 acts as the ABS transfer mode (ABSM) signal and pin CN1B-9 as the ABS request (ABSR) signal. They do not return to the original signals if data transfer ends.
15. ABSOLUTE POSITION DETECTION SYSTEM

15.6 Startup procedure

(1) Battery installation.
   Refer to Section 15.3 installation of absolute position backup battery.

(2) Parameter setting
   Set "1 □□□□" in parameter No. 1 of the servo amplifier and switch power off, then on.

(3) Resetting of absolute position erase alarm (AL.25)
   After connecting the encoder cable, the absolute position erase alarm (AL.25) occurs at first power-on.
   Leave the alarm as it is for a few minutes, then switch power off, then on to reset the alarm.

(4) Confirmation of absolute position data transfer
   When the servo-on signal is turned on, the absolute position data is transferred to the programmable controller. When the ABS data is transferred properly:
   (a) The ready output (RD) turns on.
   (b) The programmable controller/ABS data ready contact (M3 for A1SD71, M99 for 1PG) turns on.
   (c) The servo configuration software ABS data display window (refer to Section 15.9) and programmable controller side ABS data registers (D3, D4 for A1SD71, D106, D107 for 1PG) show the same value (at the home position address of 0).
   If any warning such as ABS time-out warning (AL.E5) or programmable controller side transfer error occurs, refer to Section 15.10 or Chapter 10 and take corrective action.

(5) Home position setting
   The home position must be set if:
   (a) System setup is performed;
   (b) The servo amplifier has been changed;
   (c) The servo motor has been changed; or
   (d) The absolute position erase alarm (AL.25) occurred.

   In the absolute position system, the absolute position coordinates are made up by making home position setting at the time of system setup.
   The motor shaft may misoperate if positioning operation is performed without home position setting.
   Always make home position setting before starting operation.
   For the home position setting method and types, refer to Section 15.7.3.
15. Absolute position data transfer protocol

**POINT**
- After switching on the ABS transfer mode (ABSM), turn on the servo-on signal (SON). When the ABS transfer mode is off, turning on the servo-on signal (SON) does not switch on the base circuit.

15.7.1 Data transfer procedure

Each time the SON signal is turned ON (when the power is switched ON for example), the programmable controller reads the position data (present position) of the servo amplifier. Time-out monitoring is performed by the programmable controller.

![Diagram of data transfer procedure](image)
15.7.2 Transfer method

The sequence in which the base circuit is turned ON (servo-on) when it is in the OFF state due to the servo-on signal (SON) going OFF, an emergency stop, or alarm, is explained below. In the absolute position detection system, every time the servo-on (SON) signal is turned on, the ABS transfer mode (ABSM) signal should always be turned on to read the current position in the servo amplifier to the controller. The servo amplifier transmits to the controller the current position latched when the ABS transfer mode (ABSM) signal switches from OFF to ON. At the same time, this data is set as a position command value inside the servo amplifier. Unless the ABS transfer mode signal (ABSM) is turned ON, the base circuit cannot be turned ON.

(1) At power-on

(a) Timing chart

![Timing Chart](image)

Note: For details, refer to (1) (b) in this section.
1) The ready signal (RD) is turned ON when the ABS transfer mode signal (ABSM) is turned OFF after transmission of the ABS data.
While the ready signal (RD) is ON, the ABS transfer mode signal (ABSM) input is not accepted.
2) Even if the servo-on (SON) signal is turned ON before the ABS transfer mode signal (ABSM) is turned ON, the base circuit is not turned ON until the ABS transfer mode signal (ABSM) is turned ON.
If a servo alarm has occurred, the ABS transfer mode signal (ABSM) is not received.
The ABS transfer mode signal (ABSM) allows data transmission even while a servo warning is occurring.
3) If the ABS transfer mode signal (ABSM) is turned OFF during the ABS transfer mode, the ABS transfer mode is interrupted and the time-out error (AL.E5) occurs.
4) The functions of output signals such as ZSP, TLC, D01, and INP change depending on the ON/OFF state of the ABS transfer mode signal (ABSM).
Note that if the ABS transfer mode signal (ABSM) is turned ON for a purpose other than ABS data transmission, the output signals will be assigned the functions of ABS data transmission.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Pin No.</th>
<th>Output signal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ABS transfer mode (ABSM): OFF</td>
</tr>
<tr>
<td>(Note) D01</td>
<td>CN1B-4</td>
<td>Positioning completion</td>
</tr>
<tr>
<td>ZSP</td>
<td>CN1B-19</td>
<td>Zero speed</td>
</tr>
<tr>
<td>TLC</td>
<td>CN1B-6</td>
<td>During torque limit control</td>
</tr>
<tr>
<td>(Note) INP</td>
<td>CN1A-18</td>
<td>Positioning completion</td>
</tr>
</tbody>
</table>

Note: CN1B-4 and CN1A-18 output the same signals. (To enter the positioning completion signal into INPS of the AD75, connect CN1A-18.)
(b) Detailed description of absolute position data transfer

Note: If the servo-on signal (SON) is not turned ON within 1 second after the ABS transfer mode signal (ABSM) is turned ON, an SON time-out warning (AL.EA) occurs. This warning, however, does not interrupt data transmission. It is automatically cleared when the servo-on (SON) signal is turned ON.

1) The programmable controller turns ON the ABS transfer mode signal (ABSM) and servo-on signals (SON) at the leading edge of the internal servo-on signal.

2) In response to the ABS transfer mode signal, the servo detects and calculates the absolute position and turns ON the send data ready (TLC) signal to notify the programmable controller that the servo is ready for data transmission.

3) After acknowledging that the ready to send (TLC) signal has been turned ON, the programmable controller turns ABS request (ABSR) ON.

4) In response to ABS request (ABSR), the servo outputs the lower 2 bits of the ABS data and the ready to send (TLC) signal in the OFF state.

5) After acknowledging that the ready to send (TLC) signal has been turned OFF, which implies that 2 bits of the ABS data have been transmitted, the programmable controller reads the lower 2 bits of the ABS data and then turns OFF the ABS request (ABSR).

6) The servo turns ON the ready to send (TLC) so that it can respond to the next request.

Steps 3) to 6) are repeated until 32-bit data and the 6-bit check sum have been transmitted.

7) After receiving of the check sum, the programmable controller turns the ABS transfer mode signal (ABSM) OFF.

If the ABS transfer mode signal (ABSM) is turned OFF during data transmission, the ABS transfer mode is interrupted.
(c) Checksum
The check sum is the code which is used by the programmable controller to check for errors in the received ABS data. The 6-bit check sum is transmitted following the 32-bit ABS data.
At the programmable controller, calculate the sum of the received ABS data using the ladder program and compare it with the check sum code sent from the servo.
The method of calculating the check sum is shown. Every time the programmable controller receives 2 bits of ABS data, it adds the data to obtain the sum of the received data. The check sum is 6-bit data.
Negative data is available for the FX-1PG and unavailable for the A1SD71.

Example: ABS data: \(-10\) (FFFFFFF6H)

<table>
<thead>
<tr>
<th>Decimal</th>
<th>Hexadecimal</th>
<th>Binary</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>FFFF FFF6</td>
<td>1111 1111 1111 1111 1011</td>
</tr>
</tbody>
</table>

When the binary data of each 2 bits of the ABS data is added up, "10 1101" is obtained.

Therefore, the check sum of "\(-10\)" (ABS data) is "2Dh"
(2) Transmission error

(a) Time-out warning (AL.E5)

In the ABS transfer mode, the time-out processing shown below is executed at the servo. If a time-out error occurs, an ABS time-out warning (AL.E5) is output. The ABS time-out warning (AL.E5) is cleared when the ABS transfer mode (ABSM) changes from OFF to ON.

1) ABS request OFF-time time-out check (applied to 32-bit ABS data in 2-bit units + check sum)

If the ABS request signal is not turned ON by the programmable controller within 5s after the send data ready signal is turned ON, this is regarded as a transmission error and the ABS time-out warning (AL.E5) is output.

2) ABS request ON-time time-out check (applied to 32-bit ABS data in 2-bit units + check sum)

If the ABS request signal is not turned OFF by the programmable controller within 5s after the send data ready signal is turned OFF, this is regarded as the transmission error and the ABS time-out warning (AL.E5) is output.
3) ABS transfer mode finish-time time-out check
If the ABS transfer mode signal is not turned OFF within 5s after the last ready to send signal (19th signal for ABS data transmission) is turned ON, it is regarded as the transmission error and the ABS time-out warning (AL.E5) is output.

(b) Check sum error
If the check sum error occurs, the programmable controller should retry transmission of the ABS data.
Using the ladder check program, turn OFF the ABS transfer mode (ABSM) and servo-on (SON) signals once. Turn them ON again after an OFF time of longer than 20 ms.
If the ABS data transmission fails to end normally even after retry, regard this situation as an ABS check sum error and execute error processing.
The start command should be interlocked with the ABS data ready signal to disable positioning operation when an check sum error occurs.
(3) At the time of alarm reset

If an alarm occurs, turn OFF the servo-on (SON) signal by detecting the alarm output (ALM).
If an alarm has occurred, the ABS transfer mode signal (ABSM) cannot be accepted.
In the reset state, the ABS transfer mode signal (ABSM) can be input.
(4) At the time of emergency stop reset

(a) If the power is switched ON in the emergency stop state

The emergency stop state can be reset while the ABS data is being transferred. If the emergency stop state is reset while the ABS data is transmitted, the base circuit is turned ON 80[ms] after resetting. If the ABS transfer mode signal (ABSM) is OFF when the base circuit is turned ON, the ready signal (RD) is turned ON 20[ms] after the turning ON of the base circuit. If the ABS transfer mode signal (ABSM) is ON when the base circuit is turned ON, it is turned OFF and then the ready signal (RD) is turned ON. The ABS data can be transmitted after the emergency stop state is reset.

The current position in the servo amplifier is updated even during an emergency stop. When servo-on (SON) and ABS transfer mode (ABSM) are turned ON during an emergency stop as shown below, the servo amplifier transmits to the controller the current position latched when the ABS transfer mode (ABSM) switches from OFF to ON, and at the same time, the servo amplifier sets this data as a position command value. However, since the base circuit is OFF during an emergency stop, the servo-lock status is not encountered. Therefore, if the servo motor is rotated by external force or the like after the ABS transfer mode (ABSM) is turned ON, this travel is accumulated in the servo amplifier as droop pulses. If the emergency stop is cleared in this status, the base circuit turns ON and the motor returns to the original position rapidly to compensate for the droop pulses. To avoid this status, reread the ABS data before clearing the emergency stop.
(b) If emergency stop is activated during servo-on
The ABS transfer mode signal (ABSM) is permissible while in the emergency stop state. In this case, the base circuit and the ready signal (RD) are turned ON after the emergency stop state is reset.
15.7.3 Home position setting

(1) Dog type home position return

Preset a home position return creep speed at which the machine will not be given impact. On detection of a zero pulse, the home position setting signal (CR) is turned from off to on. At the same time, the servo amplifier clears the droop pulses, comes to a sudden stop, and stores the stop position into the non-volatile memory as the home position ABS data.

The home position setting signal should be turned on after it has been confirmed that the in-position (D01 or INP) is on. If this condition is not satisfied, the home position setting warning (AL.96) will occur, but that warning will be reset automatically by making home position return correctly.

The number of home position setting times is limited to 1,000,000 times.
(2) Data set type home position return

Move the machine to the position where the home position is to be set by performing manual operation such as jog operation to turn the motor shaft more than one revolution. When the home position setting signal (CR) is on for longer than 20ms, the stop position is stored into the non-volatile memory as the home position ABS data. The home position setting signal should be turned on after it has been confirmed that the in-position (D01 or INP) is on. If this condition is not satisfied, the home position setting warning (AL.96) will occur, but that warning will be reset automatically by making home position return correctly. The number of home position setting times is limited to 1,000,000 times.

![Diagram of home position setting process]

Servo Motor

- Manual feed (JOG, etc.)
  - (more than 1 revolution of the motor shaft)

Completion of positioning (D01 or INP)

- ON
- OFF

Home position setting (CR)

- ON
- OFF

Home position ABS data

- Update

20 [ms] or more
15.7.4 Use of servo motor with electromagnetic brake

The timing charts at power on/off and servo-on (SON) on/off are given below. Preset "☐ 1 ☐" in parameter No. 1 to make the electromagnetic brake interlock signal (MBR) usable. When the ABS transfer mode is ON, the electromagnetic brake interlock (MBR) is used as the ABS data bit 1. Hence, make up an external sequence which will cause the electromagnetic brake torque to be generated by the ABS mode (ABSM) and electromagnetic brake interlock signals.
15. ABSOLUTE POSITION DETECTION SYSTEM

15.7.5 How to process the absolute position data at detection of stroke end

The servo amplifier stops the acceptance of the command pulse when stroke end (LSP • LSN) is detected, clears the droop pulses to 0 at the same time, and stops the servo motor rapidly. At this time, the programmable controller keeps outputting the command pulse. Since this causes a discrepancy between the absolute position data of the servo amplifier and the programmable controller, a difference will occur between the position data of the servo amplifier and that of the programmable controller.

To prevent this difference in position data from occurring, do as described below. When the servo amplifier has detected the stroke end, perform jog operation or the like to clear the stroke end. After that, switch the servo-on signal off once, then on again, or switch the power off once, then on again. This causes the absolute position data of the servo amplifier to be transferred to the programmable controller, restoring the normal data.
15. ABSOLUTE POSITION DETECTION SYSTEM

15.8 Examples of use

15.8.1 MELSEC-A1S (A1SD71)

(1) Instructions

The absolute coordinate system (programmable controller coordinate system) of the A1SD71 (AD71) only covers the range in which the address increases (positive coordinate values) on moving away from the machine home position (the position reached in the home position return operation). Therefore, if the motor enters the range where the coordinate value is negative due to the load torque or a fall on a vertical axis when the power is turned ON/OFF at a point near the machine home position, the system fails to detect the absolute position. To prevent this problem, it is necessary to set the home position (operation home position) for positioning in addition to the machine home position.

(a) The home position should be set in the direction in which the position address of the programmable controller coordinate system increases on moving away from machine home position, as illustrated below. Note that the home position for positioning must be more than one revolution of the servo motor shaft from the machine home position.

If the address of the machine home position is changed to any value other than "0", the home position should be set in the direction in which the position address increases on moving away from the machine home position (machine home position after changing the home position address) and at a point removed from the machine home position by more than one revolution of the motor shaft.

(b) In the range where the address decreases on moving away from the machine home position, do not turn the power supply to the programmable controller or the servo amplifier, the servo-on pushbutton switch, or the PC-RESET switch, ON/OFF. If any of these operations are attempted, the ABS coordinate error (Y4B) is output since the absolute position cannot be detected.
If the address of the machine home position is changed to any coordinate value other than "0", the programmable controller coordinate system will be as illustrated below.

The power should be turned ON/OFF in the range in which the address increases on moving away from the home position.

(a) If revolution direction parameter (Pr. 14) = 0

(b) If revolution direction parameter (Pr. 14) = 1

(c) In a positioning program, the address of the positioning point should be determined by adding the home position address to the target position address.

Example) After home position return, execute positioning at 1) to 3).

1) Positioning at position address 80000
   (PC coordinate 140000)
2) Positioning at position address 130000
   (PC coordinate 190000)
3) Positioning at position address 0
   (PC coordinate 60000)
d) Slot arrangement

The sequence programs presented in this section show I/O numbers (X, Y) assuming the arrangement of modules on the main base unit is as illustrated below. A1SD71 is mounted at I/O slots 0 and 1, a 16-point input module at slot 2, and 16-point output module at slot 3. If the actual arrangement of the modules differs from this arrangement, change the X and Y numbers accordingly.

The numbers of the devices (M, D, T, etc.) used in the program can be changed as required.

\[\text{Example arrangement of modules}\]

\[\text{[Numbers used] X, X0-X, Y2F}\]

\[\text{16-point input module}\]
\[\text{16-point output module}\]

Therefore, the I/O number to be set with the FROM/TO instruction is head I/O number allocated to the A1SD71 + 010H.

3) By setting "0 point of vacant slot" for the first slot of the A1SD71 in the "I/O allocation" of the GPP function, the 16 points in the first slot can be saved.

In this case, the I/O number to be set with the FROM/TO instruction is the same number as the head I/O number allocated to the A1SD71.

Note: The program example given in (3) in this section is for 1-axis control. Slot allocations are as illustrated to the left. To use the system for 2-axis control, increase the number of I/O points.

(e) Points

1) The A1SD71 has 48 I/O points and occupies 2 slots. For I/O allocation using the GPP function, follow the instructions given below.

First slot: Vacant slot 16 points
Second slot: Special function module 32 points

2) To execute the FROM/TO instruction for the A1SD71, use the head I/O number of the second slot.

\[\text{X0 to X0F}\]
\[\text{Y0 to Y1F}\]

\[\text{I/O numbers to be set with FROM/TO instruction}\]

\[\text{Note: The program example given in (3) in this section is for 1-axis control. Slot allocations are as illustrated to the left. To use the system for 2-axis control, increase the number of I/O points.}\]
(2) Connection diagram

Note: 1. To be connected for dog type home position setting. The connection in Note 2 is not required.
2. To be connected for data set type home position setting. The connection in Note 1 is not required.
3. This circuit is for reference only.
4. The electromagnetic brake output should be controlled by connecting the programmable controller output to a relay.
3) Sequence program example
   (a) Conditions
   This sample program is an ABS sequence program example for a single axis (X axis).
   To transmit the ABS data using the OFF-to-ON change of the servo-on signal as the trigger.
   1) When the servo-ON signal and the GND of the power supply are shorted, the ABS data is
      transmitted when the power to the servo amplifier power is turned ON, or at the leading edge
      of the RUN signal after a PC reset operation (PC-RESET). The ABS data is also transmitted when
      an alarm is reset, or when the emergency stop state is reset.
   2) If a check sum discrepancy is detected in the transmitted data, ABS data transmission is retried
      up to three times. If the check sum discrepancy is still detected after retrying, the ABS check
      sum error is generated (Y4A ON).
   3) The following time periods are measured and if the ON/OFF state does not change within the
      specified time, the ABS communication error is generated (Y4A ON).
      ON period of ABS transfer mode (Y41)
      ON period of ABS request (Y42)
      OFF period of ready to send ABS data (X32).
   4) If the relationship between the polarity (\(\uparrow\)) of the received ABS data and the setting value for
      parameter No. 14 (rotating direction) of A1SD71 (AD71) involves negative coordinate values,
      which cannot be handled by the A1SD71 (AD71), the ABS coordinate error is generated (Y4B
      ON).

   (b) Device list

<table>
<thead>
<tr>
<th>X input contact</th>
<th>Y output contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>X30 ABS bit 0 / completion of positioning</td>
<td>Y40 Servo-on</td>
</tr>
<tr>
<td>X31 ABS bit 1 / zero speed</td>
<td>Y41 ABS transfer mode</td>
</tr>
<tr>
<td>X32 Send ABS data ready / torque limit control</td>
<td>Y42 ABS request</td>
</tr>
<tr>
<td>X33 Servo alarm</td>
<td>Y43 Alarm reset</td>
</tr>
<tr>
<td>X34 Error reset</td>
<td>X44 (Note 2) Electromagnetic brake output</td>
</tr>
<tr>
<td>X35 Servo emergency stop</td>
<td>Y46 (Note 2)</td>
</tr>
<tr>
<td>X36 Servo-on</td>
<td>Y47 Servo alarm</td>
</tr>
<tr>
<td>X37 Home position return start</td>
<td>Y48 ABS communication error</td>
</tr>
<tr>
<td>X38 Operation mode I</td>
<td>Y49 ABS check sum error</td>
</tr>
<tr>
<td>X39 Operation mode II</td>
<td>Y4A ABS check sum error</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D register M contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>D0 ABS data transmission counter</td>
</tr>
<tr>
<td>D1 Check sum transmission counter</td>
</tr>
<tr>
<td>D2 Check sum addition counter</td>
</tr>
<tr>
<td>D3 ABS data: Lower 16 bits</td>
</tr>
<tr>
<td>D4 ABS data: Upper 16 bits</td>
</tr>
<tr>
<td>D5 ABS data 2-bit receiving buffer</td>
</tr>
<tr>
<td>D6 Check data in case of check sum error</td>
</tr>
<tr>
<td>D7 Retry frequency</td>
</tr>
<tr>
<td>D8 Forward rotation direction</td>
</tr>
<tr>
<td>D9 Home position address: Lower 16 bits</td>
</tr>
<tr>
<td>D10 Home position address: Upper 16 bits</td>
</tr>
<tr>
<td>D100 Received shift data: Lower 16 bits</td>
</tr>
<tr>
<td>D101 Received shift data: Upper 16 bits</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T timer M13 PLC processing command</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0 ABS transfer mode timer</td>
</tr>
<tr>
<td>T1 ABS request response timer</td>
</tr>
<tr>
<td>T2 Retry wait timer</td>
</tr>
<tr>
<td>T3 Ready to send response timer</td>
</tr>
<tr>
<td>T10 (Note 3) Clear signal ON timer</td>
</tr>
<tr>
<td>T200 Transmitted data read 10ms delay timer</td>
</tr>
</tbody>
</table>

   Note 1: Necessary when data set type home position return is executed.
   Note 2: Necessary in the event of electromagnetic brake output.
15. ABSOLUTE POSITION DETECTION SYSTEM

(c) ABS data transfer program for X axis

This sequence program example assumes the following conditions:
- Parameters of the A1SD71-S2 (AD71) positioning module
  1) Unit setting : 3 = pulse (PLS)
  2) Travel per pulse : 1 = 1 pulse

To select the unit other than the pulse, conversion into the unit of the feed command value per pulse is required. Hence, add the following program to the area marked Note in the sequence program.

<Additional program>

<table>
<thead>
<tr>
<th>Item</th>
<th>mm</th>
<th>inch</th>
<th>degree</th>
<th>pulse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit setting</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Travel per pulse</td>
<td>0.1 to 1.0 to 10.0</td>
<td>0.00001 to 0.0001 to 0.001</td>
<td>0.00001 to 0.0001 to 0.001</td>
<td>0.00001 to 0.0001 to 0.001</td>
</tr>
<tr>
<td>Unit of travel</td>
<td>um/PLS</td>
<td>inch/PLS</td>
<td>degree/PLS</td>
<td>PLS</td>
</tr>
<tr>
<td>Constant K for conversion</td>
<td>1 to 10 to 100</td>
<td>1 to 10 to 100</td>
<td>1 to 10 to 100</td>
<td>None</td>
</tr>
<tr>
<td>unit of travel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reference
- For 1μm/PLS, set constant K to 10
- For 5μm/PLS, set constant K to 50
- When the unit setting is pulse, the additional program is not required.
15. ABSOLUTE POSITION DETECTION SYSTEM

(Continued from preceding page)

M8
Servo-on request
M12
Retry flag reset request
X34
M9
Error reset
PB
Y43
Alarm reset
X35
Emergency stop PB
X33
Servo alarm
M0
ABS data transfer start
MOV K16 D0
MOV K3 D1
MOV K0 D2
MOV K0 D5
DMOV K0 D9
DMOV K0 A0
RST Y48
RST C0
RST C1
Y41
ABS data transmission retry control
Setting retry flag
Resetting retry counter
Alarm reset output
Error flag output
Servo alarm detection, alarm reset control
Resetting ready to send
Resetting servo-on request
Servo alarm
Initializing ABS data transfer counter
Initializing check sum transfer counter
Initializing check sum register
Initializing ABS data register
ABS transfer mode Initial setting
Resetting error for ABS coordinate
Resetting ABS transfer counter
Resetting check sum transfer counter
ABS transfer mode
ABS transfer mode control

(To be continued)
15. ABSOLUTE POSITION DETECTION SYSTEM

(Continued from preceding page)

To be continued...
15. ABSOLUTE POSITION DETECTION SYSTEM

Continued from preceding page

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOV K1*X30 D5</td>
<td>Reading 4 bits</td>
</tr>
<tr>
<td>NOR D6 A0</td>
<td>Masking 2 bits</td>
</tr>
<tr>
<td>ADD D5 D2 D2</td>
<td>Adding 2 bits</td>
</tr>
<tr>
<td>D5+ &amp; D2 D2</td>
<td>Right rotation of A0 2 bits</td>
</tr>
<tr>
<td>ADD</td>
<td>Adding check sum</td>
</tr>
<tr>
<td>D0 C0</td>
<td>Counting frequency of ABS data reception</td>
</tr>
<tr>
<td>PLS M6</td>
<td>Completion of reading: 2 bits of ABS data</td>
</tr>
<tr>
<td>D2 A0</td>
<td>Right rotation of A0 10 bits</td>
</tr>
<tr>
<td>NOR H0003 F A0</td>
<td>Masking check sum</td>
</tr>
<tr>
<td>M1</td>
<td>Sum check OK</td>
</tr>
<tr>
<td>M2</td>
<td>Sum check NG</td>
</tr>
<tr>
<td>MOV A0 D6</td>
<td>Sum check memory</td>
</tr>
<tr>
<td>Y4A</td>
<td>ABS check sum error</td>
</tr>
<tr>
<td>Y41 X32</td>
<td>Resetting ABS request</td>
</tr>
<tr>
<td>M7</td>
<td>ABS 2 bits request</td>
</tr>
<tr>
<td>Y42 SET Y42</td>
<td>Setting ABS request</td>
</tr>
<tr>
<td>K1 T200</td>
<td>10ms delay timer</td>
</tr>
<tr>
<td>M4</td>
<td>Transmission data read enabled</td>
</tr>
</tbody>
</table>

(To be continued)
Note: When the unit setting parameter value of the AD71 positioning module is changed from "3" (pulse) to "0" (mm), the unit is $0.1\mu$m for the input value. To change the unit to $1\mu$m, and this program to multiple the feed value by 10.
When absolute position data is received at power ON, for example, if a negative coordinate position which cannot be handled by the A1SD71 is detected, the ABS coordinate error (Y4B ON) is generated. If this error is generated, move the axis into the positive coordinate zone in JOG operation. Then, turn OFF the servo-on pushbutton switch and turn it ON again.
(d) X-axis control program
This precludes execution of the X-axis start program while M3 (ready to send the ABS data) is OFF.

(e) Dog type home position return
For an example of a program for the dog type home position return operation, refer to the home position return program presented in the User's Manual for A1SD71.

(f) Data set type home position return
After jogging the machine to the position where the home position (e.g. 500) is to be set, choose the home position return mode set the home position with the home position return start (PB ON).
After switching power on, rotate the servo motor more than 1 revolution before starting home position return.
Do not turn ON the clear signal (Y45) for an operation other than home position return. Turning it ON in other circumstances will cause position shift.

(Note 1)
1: Changing X-axis home position address
2: Contrary to Note 1 above, if the home position address is written in the home position address parameter, the circuit indicated by Note 3 is necessary and the circuits indicated by Note 1 are not necessary.
(g) Electromagnetic brake output
During ABS data transfer (for several seconds after the servo-on signal is turned on), the servo motor must be at a stop.
Set "1 1 1" in parameter No. 1 of the servo amplifier to choose the electromagnetic brake interlock signal.

(h) Positioning completion
To create the status information for servo positioning completion.
During ABS data transfer (for several seconds after the servo-on signal is turned on), the servo motor must be at a stop.

(i) Zero speed
To create the status information for servo zero speed
During ABS data transfer (for several seconds after the servo-on signal is turned on), the servo motor must be at a stop.

(j) Torque limiting
To create the status information for the servo torque limiting mode
During ABS data transfer (for several seconds after the servo-on signal is turned on), the torque limiting must be off.
(4) Sequence program - 2-axis control

The following program is a reference example for creation of an ABS sequence program for the second axis (Y axis) using a single A1SD71 module. Create a program for the third axis in a similar manner.

(a) Y-axis program

Refer to the X-axis ABS sequence program and create the Y-axis program.

Assign the X inputs, Y outputs, D registers, M contacts, T timers and C counters of the Y axis so that they do not overlap those of the X axis.

The buffer memory addresses of the A1SD71 differ between the X and Y axes. The instructions marked *1 in the program of Section 15.8.1 (3), (c) should be changed as indicated below for use with the Y axis:

\[
\begin{align*}
\text{X-axis ABS sequence program} & \rightarrow \text{Y-axis ABS sequence program} \\
\text{Program in Section 15.8.1 (3), (f)} & \rightarrow \\
\text{Refer to the X-axis program and write the Y-axis program}
\end{align*}
\]

(b) Data set type home position return

Arrange the data set type home position return programs given in Section 15.8.1 (3), (f) in series to control two axes.

Refer to the X-axis data set type home position return program and create the Y-axis program.

Assign the X inputs, Y outputs, D registers, M contacts and T timers of the Y axis so that they do not overlap those of the X axis.

The buffer memory addresses of the A1SD75 differ between the X and Y axes. The instructions marked *1 in the program of Section 15.8.1 (3), (f) should be changed as indicated below for use with the Y axis:

\[
\begin{align*}
\text{X-axis data set type home position return program} & \rightarrow \text{Y-axis data set type home position return program} \\
\text{Program in Section 15.8.1 (3), (f)} & \rightarrow \\
\text{Refer to the X-axis program and write the Y-axis program}
\end{align*}
\]
15. ABSOLUTE POSITION DETECTION SYSTEM

15.8.2 MELSEC FX(2N)-32MT (FX(2N)-1PG)

(1) Connection diagram
   (a) FX-32MT (FX-1PG)

Note 1: To be connected for the dog type home position setting. At this time, do not connect the portions marked (Note 2).

2: To be connected for the data set type home position setting. At this time, do not connect the portions marked (Note 1).

3: The electromagnetic brake interlock signal should be controlled by connecting the programmable controller output to a relay.
15. ABSOLUTE POSITION DETECTION SYSTEM

(b) FX2N-32MT (FX2N-1PG)

Note 1: To be connected for the dog type home position setting. At this time, do not connect the portions marked (Note 2).
2: To be connected for the data set type home position setting. At this time, do not connect the portions marked (Note 1).
3: The electromagnetic brake interlock signal should be controlled by connecting the programmable controller output to a relay.
(2) Sequence program example
(a) Conditions
1) Operation pattern
ABS data transfer is made as soon as the servo-on pushbutton is turned on. After that, positioning operation is performed as shown below:

![Diagram showing ABS data transfer and positioning operation]

After the completion of ABS data transmission, JOG operation is possible using the JOG+ or JOG- pushbutton switch.

After the completion of ABS data transmission, dog type home position return is possible using the home position return pushbutton switch.

2) Buffer memory assignment
For BFM#26 and later, refer to the FX2N-1PG User's Manual.

<table>
<thead>
<tr>
<th>BMF No.</th>
<th>Upper 16 bits</th>
<th>Lower 16 bits</th>
<th>Name and symbol</th>
<th>Set value</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>#0</td>
<td></td>
<td>Pulse rate</td>
<td>A</td>
<td>2000</td>
</tr>
<tr>
<td>#2</td>
<td>#1</td>
<td></td>
<td>Feed rate</td>
<td>B</td>
<td>1000</td>
</tr>
<tr>
<td>-</td>
<td>#3</td>
<td></td>
<td>Parameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#5</td>
<td>#4</td>
<td></td>
<td>Max. speed</td>
<td>Vmax</td>
<td>100000PPS</td>
</tr>
<tr>
<td>-</td>
<td>#6</td>
<td></td>
<td>Bias speed</td>
<td>Vbia</td>
<td>0PPS</td>
</tr>
<tr>
<td>#8</td>
<td>#7</td>
<td></td>
<td>JOG operation</td>
<td>Vjog</td>
<td>10000PPS</td>
</tr>
<tr>
<td>#10</td>
<td>#9</td>
<td></td>
<td>Home position return speed (high speed)</td>
<td>Verr</td>
<td>50000PPS</td>
</tr>
<tr>
<td>-</td>
<td>#11</td>
<td></td>
<td>Home position return speed (creep)</td>
<td>Vcl</td>
<td>10000PPS</td>
</tr>
<tr>
<td>-</td>
<td>#12</td>
<td></td>
<td>Home position return zero-point signal count</td>
<td>N</td>
<td>2 pulses</td>
</tr>
<tr>
<td>#14</td>
<td>#13</td>
<td></td>
<td>Home position address</td>
<td>HP</td>
<td>0</td>
</tr>
<tr>
<td>-</td>
<td>#15</td>
<td></td>
<td>Acceleration/deceleration time</td>
<td>Ta</td>
<td>200ms</td>
</tr>
<tr>
<td>-</td>
<td>#16</td>
<td></td>
<td>Not usable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#18</td>
<td>#17</td>
<td></td>
<td>Target address (I)</td>
<td>P(I)</td>
<td>0</td>
</tr>
<tr>
<td>#20</td>
<td>#19</td>
<td></td>
<td>Operation speed (I)</td>
<td>V(I)</td>
<td>100000</td>
</tr>
<tr>
<td>#22</td>
<td>#21</td>
<td></td>
<td>Target address (II)</td>
<td>P(II)</td>
<td>0</td>
</tr>
<tr>
<td>#24</td>
<td>#23</td>
<td></td>
<td>Operation speed (II)</td>
<td>V(II)</td>
<td>10</td>
</tr>
<tr>
<td>-</td>
<td>#25</td>
<td></td>
<td>Operation command</td>
<td></td>
<td>H0000</td>
</tr>
</tbody>
</table>

3) Instructions
When the servo-on pushbutton switch and the GND of the power supply are shorted, the ABS data is transmitted when the servo amplifier power is turned ON, or at the leading edge of the RUN signal after a PC reset operation (PC-RESET). The ABS data is also transmitted when an alarm is reset, or when the emergency stop state is reset.

If check sum discrepancy is detected in the transmitted data, the ABS data transmission is retried up to three times. If the check sum discrepancy is still detected after retrying, the ABS check sum error is generated (Y12 ON).

The following time periods are measured and if the ON/OFF state does not change within the specified time, the ABS communication error is generated (Y11 ON).

ON period of ABS transfer mode (Y1)
ON period of ABS request (Y2)
OFF period of ready to send the ABS data (X2).
## 15. ABSOLUTE POSITION DETECTION SYSTEM

### (b) Device list

<table>
<thead>
<tr>
<th>X input contact</th>
<th>Y output contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>X0</td>
<td>Y0</td>
</tr>
<tr>
<td>X1</td>
<td>Y1</td>
</tr>
<tr>
<td>X2</td>
<td>Y2</td>
</tr>
<tr>
<td>X3</td>
<td>Y3</td>
</tr>
<tr>
<td>X4</td>
<td>Y4 (Note 2)</td>
</tr>
<tr>
<td>X5</td>
<td>Y5 (Note 1)</td>
</tr>
<tr>
<td>X6</td>
<td>Y10</td>
</tr>
<tr>
<td>X7</td>
<td>Y11</td>
</tr>
<tr>
<td>X8</td>
<td>Y12</td>
</tr>
<tr>
<td>X9</td>
<td></td>
</tr>
<tr>
<td>X10</td>
<td></td>
</tr>
<tr>
<td>X11</td>
<td></td>
</tr>
<tr>
<td>X12</td>
<td></td>
</tr>
<tr>
<td>X13</td>
<td></td>
</tr>
<tr>
<td>X14</td>
<td></td>
</tr>
<tr>
<td>X15</td>
<td></td>
</tr>
</tbody>
</table>

### D register

| D0 | ABS data: Lower 16 bits |
| D1 | ABS data: Upper 16 bits |
| D2 | Check sum addition counter |
| D3 | Check data in case of check sum error |
| D4 | Transmission retry count in check sum discrepancy |
| D24 | Home position address: Lower 16 bits |
| D25 | Home position address: Upper 16 bits |
| D106 | 1PG present position address: Lower 16 bits |
| D107 | 1PG present position address: Upper 16 bits |

### M contact

| M0 | Error flag |
| M1 | ABS data transmission start |
| M2 | Retry command |
| M3 | ABS data read |
| M4 | Spare |
| M5 | Servo on request |
| M6 | Retry flag |
| M10 | ABS data 2 bit receiving buffer |
| M11 | ABS data 32 bit buffer |
| M20 | Check sum 6 bit buffer |
| M51 | \( \downarrow \) Check sum 6 bit buffer |
| M52 | \( \uparrow \) Check sum 6 bit buffer |
| M57 | \( \downarrow \) Check sum 6 bit buffer |
| M58 | \( \uparrow \) Check sum 6 bit buffer |
| M59 | For checksum comparison |
| M62 | Sum check discrepancy (greater) > |
| M63 | Sum check discrepancy ≥ |
| M64 | Sum check discrepancy (less) > |
| M70 (Note 1) | Clear signal ON timer request |
| M71 (Note 1) | Data set type home position return request |
| M99 | ABS data ready |

### T timer

| T200 | Retry wait timer |
| T201 | ABS transfer mode timer |
| T202 | ABS request response timer |
| T203 | Ready to send response timer |
| T204 | ABS data waiting timer |
| T210 (Note 1) | Clear signal ON timer |

### C counter

| C0 | All data reception frequency counter (19 times) |
| C1 | Check sum reception frequency counter |
| C2 | ABS data reception frequency counter (16 times) |

Note 1: Necessary when data set type home position return is executed.

2: Necessary in the event of electromagnetic brake output.
15. ABSOLUTE POSITION DETECTION SYSTEM

(c) ABS data transfer program for X-axis

<table>
<thead>
<tr>
<th>M8002</th>
<th>Initial pulse</th>
<th>Initial setting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DMOV K0 D24</td>
<td>Setting home position address to 0</td>
</tr>
<tr>
<td></td>
<td>TO K0 K3 K0 K1</td>
<td>Setting 1PG pulse command unit</td>
</tr>
<tr>
<td></td>
<td>DTO K0 K4 K10000 K1</td>
<td>1PG max. speed: 100 kpps</td>
</tr>
<tr>
<td></td>
<td>DTO K0 K7 K10000 K1</td>
<td>1PG Jog speed: 10 kpps</td>
</tr>
<tr>
<td></td>
<td>DTO K0 K9 K50000 K1</td>
<td>1PG home position return speed: 50 kpps</td>
</tr>
<tr>
<td></td>
<td>TO K0 K11 K1000 K1</td>
<td>1PG creep speed: 1 kpps</td>
</tr>
<tr>
<td></td>
<td>TO K0 K12 K2 K1</td>
<td>1PG home position return zero-point count: twice</td>
</tr>
<tr>
<td></td>
<td>DTO K0 K13 D24 K1</td>
<td>1PG home position address setting</td>
</tr>
<tr>
<td></td>
<td>TO K0 K15 K200 K1</td>
<td>1PG acceleration/deceleration time: 200ms</td>
</tr>
<tr>
<td></td>
<td>DTO K0 K19 K10000 K1</td>
<td>1PG operation speed: 100kpps</td>
</tr>
<tr>
<td></td>
<td>DMOV K300000 D100</td>
<td>Position move account 1: 300000 pulses</td>
</tr>
<tr>
<td></td>
<td>DMOV K-250000 D102</td>
<td>Position move account 2: -250000 pulses</td>
</tr>
<tr>
<td></td>
<td>DMOV K0 D104</td>
<td>Position move account 3: 0 pulses</td>
</tr>
<tr>
<td></td>
<td>DMOV K0 Z</td>
<td>Clearing index registers V, Z</td>
</tr>
<tr>
<td></td>
<td>DMOV K4 D4</td>
<td>Setting &quot;4 times&quot; for check sum error transmission frequency</td>
</tr>
</tbody>
</table>

(To be continued)
15. ABSOLUTE POSITION DETECTION SYSTEM

(Continued from preceding page)

Servo-on request

Servo-on output

ABS data transmission start

Clearing retry counter

Resetting ready to send ABS data

Resetting servo-on request

Resetting ABS transfer mode

Resetting ABS request

Resetting retry flag

Resetting check sum judgement

Resetting communication counter

(To be continued)
15. ABSOLUTE POSITION DETECTION SYSTEM

(Continued from preceding page)

2

X4
Alarm reset PB
M0
Alarm reset
Y3
Error flag
RST C1
Alarm reset output
C0
Clearing retry counter
M64
Clearing ABS data receiving area
D3
Clearing ABS receive data buffer
C2
Resetting ABS data reception counter
C0
Resetting all data reception counter

X5
Emergency stop PB
Y3
Servo alarm
M0
Error flag output
RST Y1
Servo alarm output
RST Y2
Resetting ABS transfer mode
RST M98
Resetting ABS request
M5
Resetting ready to send
M5
Resetting servo-on request
M6
Resetting retry flag

M1
ABS data transmission start
RST M10
ABS transfer mode ON
M64
Clearing ABS data reception area
D2
Clearing ABS receiver data buffer
C2
Resetting ABS data reception counter
C0
Resetting all data reception counter

(To be continued)
15. ABSOLUTE POSITION DETECTION SYSTEM

(Continued from preceding page)

ABS data waiting timer

ABS data waiting timer 10ms

ABS data 32 bits
(2 bits × 16 times)

ABS request ON

Check sum 6 bits
(2 bits × 3 times)

Detection of ABS check sum error, retry control

(To be continued)
Writing absolute position data to 1PG

Detecting ABS communication error

Counting retry frequency

Setting servo-on request
Note: Program example for the dog type home position return. For the data set type home position return, refer to the program example in (2), (d) in this section.
(d) Data set type home position return

After jogging the machine to the position where the home position (e.g., 500) is to be set, choose the home position return mode set the home position with the home position return start (PBON).

After switching power on, rotate the servo motor more than 1 revolution before starting home position return.

Do not turn ON the clear signal (Y5) for an operation other than home position return. Turning it ON in other circumstances will cause position shift.

- Clear signal ON timer request
- Clear signal 100ms ON timer
- Setting data set type home position return request
- Resetting data set type home position return request
- Setting X-axis home position address "500" in the data register
- Changing X-axis home position address
- Changing X-axis present position data
(e) Electromagnetic brake output

During ABS data transfer (for several seconds after the servo-on signal is turned on), the servo motor must be at a stop.

Set "1 1" in parameter No. 1 of the servo amplifier to choose the electromagnetic brake interlock signal.

(f) Positioning completion

To create the status information for servo positioning completion.

During ABS data transfer (for several seconds after the servo-on signal is turned on), the servo motor must be at a stop.

(g) Zero speed

To create the status information for servo zero speed.

During ABS data transfer (for several seconds after the servo-on signal is turned on), the servo motor must be at a stop.

(h) Torque limiting

To create the status information for the servo torque limiting mode.

During ABS data transfer (for several seconds after the servo-on signal is turned on), the torque limiting must be off.
15. ABSOLUTE POSITION DETECTION SYSTEM

15.8.3 MELSEC A1SD75(AD75)

(1) Connection diagram
15. ABSOLUTE POSITION DETECTION SYSTEM

Note 1: For the dog type home position return. Need not be connected for the data set type home position return.

2: If the servo motor provided with the zero point signal is started, the A1SD75(AD75) will output the deviation counter clear signal. Therefore, do not connect the clear signal of the MR-J2-A to the A1SD75(AD75) but connect it to the output module of the programmable controller.

3: This circuit is provided for your reference.

4: The electromagnetic brake output should be controlled via a relay connected to the programmable controller output.

5: Use the differential line driver system for pulse input. Do not use the open collector system.

6: To reinforce noise suppression, connect LG and pulse output COM.
15. ABSOLUTE POSITION DETECTION SYSTEM

(2) Sequence program example

(a) Conditions

1) When the servo-on signal and power supply GND are shorted, the ABS data is transmitted at power-on of the servo amplifier or on the leading edge of the RUN signal after a PC reset operation (PC-RESET). The ABS data is also transmitted when an alarm is reset or when an emergency stop is reset.

2) If a checksum mismatch is detected in the transmitted data, data transmission is retried up to three times. If the checksum mismatch still persists after the retries, the ABS checksum error occurs (Y3A ON).

3) The following time periods are measured. If the ON/OFF state does not change within the specified time, the ABS communication error occurs change within the specified time, the ABS communication error occurs (Y3A ON):

- ON period of ABS transfer mode (Y31)
- ON period of ABS request (Y32)
- OFF period of reading to send ABS data (X22)

(b) Device list

<table>
<thead>
<tr>
<th>X input contact</th>
<th>Y output contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>X20 ABS bit 0 / positioning completion</td>
<td>Y30 Servo-on</td>
</tr>
<tr>
<td>X21 ABS bit 1 / zero speed</td>
<td>Y31 ABS transfer mode</td>
</tr>
<tr>
<td>X22 Reading to send ABS data / limiting torque</td>
<td>Y32 ABS request</td>
</tr>
<tr>
<td>X23 Servo alarm</td>
<td>Y33 Alarm reset</td>
</tr>
<tr>
<td>X24 Alarm reset</td>
<td>X34 (Note 2) Electromagnetic brake output</td>
</tr>
<tr>
<td>X25 Servo emergency stop</td>
<td>Y35 (Note 1) Clear</td>
</tr>
<tr>
<td>X26 Servo-on</td>
<td>Y36 Servo alarm</td>
</tr>
<tr>
<td>X27 Home position return start</td>
<td>X37 ABS communication error</td>
</tr>
<tr>
<td>X28 Operation mode I</td>
<td>Y38 ABS checksum error</td>
</tr>
<tr>
<td>X29 Operation mode II</td>
<td></td>
</tr>
</tbody>
</table>

D register

<table>
<thead>
<tr>
<th>M contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>D0 ABS data transmission counter</td>
</tr>
<tr>
<td>D1 Checksum transmission counter</td>
</tr>
<tr>
<td>D2 Checksum addition register</td>
</tr>
<tr>
<td>D3 ABS data: Lower 16 bits</td>
</tr>
<tr>
<td>D4 ABS data: Upper 16 bits</td>
</tr>
<tr>
<td>D5 ABS data 2-bit receiving buffer</td>
</tr>
<tr>
<td>D6 Check data in case of checksum error</td>
</tr>
<tr>
<td>D7 Number of retries</td>
</tr>
<tr>
<td>D8 Forward rotation direction</td>
</tr>
<tr>
<td>D9 Home position address: Lower 16 bits</td>
</tr>
<tr>
<td>D10 Home position address: Upper 16 bits</td>
</tr>
<tr>
<td>D11 Drive unit ready data</td>
</tr>
<tr>
<td>D12 Home position return completion data</td>
</tr>
<tr>
<td>D110 Received shift data: Lower 16 bits</td>
</tr>
<tr>
<td>D111 Received shift data: Upper 16 bits</td>
</tr>
</tbody>
</table>

M20 (Note 1) Clear signal ON timer request

T timer

<table>
<thead>
<tr>
<th>C counter</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0 ABS transmission mode timer</td>
</tr>
<tr>
<td>T1 ABS request response timer</td>
</tr>
<tr>
<td>T2 Retry wait timer</td>
</tr>
<tr>
<td>T3 ABS data send reading response timer</td>
</tr>
<tr>
<td>T10 (Note 1) Clear signal ON timer</td>
</tr>
<tr>
<td>T200 Transmitted data read 10ms delay timer</td>
</tr>
</tbody>
</table>

Note:
1. Required for data set type home position return.
2. Required for electromagnetic brake output.
15. ABSOLUTE POSITION DETECTION SYSTEM

(c) ABS data transfer program for X axis

This sequence program example assumes the following conditions:

- Parameters of the A1SD75-P1 (AD75-P1) positioning module
  1) Unit setting : \(3 = \text{pulse (PLS)}\)
  2) Travel per pulse : \(1 = 1 \text{ pulse}\)

To select the unit other than the pulse, conversion into the unit of the feed value per pulse is required. Hence, add the following program to the area marked (Note) in the sequence program:

<Additional program>

<table>
<thead>
<tr>
<th>Item</th>
<th>(\text{mm} )</th>
<th>(\text{inch} )</th>
<th>(\text{degree} )</th>
<th>(\text{pulse} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit setting</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Travel per pulse</td>
<td>0.1 to 1 to 10 to 100</td>
<td>0.00001 to 0.001 to 0.01 to 0.001 to 0.01 to 0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit of travel</td>
<td>(\mu\text{m/PLS} )</td>
<td>inch/PLS</td>
<td>degree/PLS</td>
<td>PLS</td>
</tr>
<tr>
<td>Constant K for conversion into unit of travel</td>
<td>1 to 10 to 100 to 1000</td>
<td>1 to 10 to 100 to 1000</td>
<td>1 to 10 to 100 to 1000</td>
<td>None</td>
</tr>
</tbody>
</table>

Reference

- For \(1 \mu\text{m/PLS}\), set constant K to 10
- For \(5 \mu\text{m/PLS}\), set constant K to 50
- The additional program is not required for the unit setting is PLS.

M101

Output signal reset

TO H0000 K1151 K1 K1

A1SD75 error reset

MOV K3 D7

Setting the number of retries (to 3 times)

SET M101

Error reset completion flag

DMOV D110 A0

Loading received shift data

(Move to be continued)
15. ABSOLUTE POSITION DETECTION SYSTEM

(Continued from preceding page)

Servo-on request

Reading A1SD75 1-axis RDY signal

Masking RDY signal

Current position change processing instruction

Servo-on PB

Processing instruction RDY signal ON judgment

Servo-on request

Error flag

Retry flag

Servo-on request

Error flag

Retry flag

Servo alarm

Servo alarm

Alarm reset output

Error flag output

Servo alarm
detection, alarm reset control

Emergency stop PB

Servo alarm

Servo-on request

Resetting servo-on request
15. ABSOLUTE POSITION DETECTION SYSTEM

(Continued from preceding page)

ABS transfer mode initial setting

ABS transfer mode control

Saving ABS 32-bit data

Clearing register

Absolute position polarity, A1SD75 rotation direction setting detection

PLS processing command

Reversing polarity of upper 16 bits

Decrementing upper 16 bits by 1

Reversing polarity of lower 16 bits

Lower 16 bits: 0 → D4 + 1 ± D4

(To be continued)
15. ABSOLUTE POSITION DETECTION SYSTEM

(Continued from preceding page)

Reading checksum
6 bits
(2 bits × 3 times)

Reading ABS data
32 bits
(2 bits × 16 times)

Detection of ABS checksum error
Note: When the unit setting parameter value of the AD75 positioning module is changed from "3" (pulse) to "0" (mm), the unit is $0.1 \mu m$ for the input value. To set the unit to $1 \mu m$, add this program to multiple the feed value by 10.
15. ABSOLUTE POSITION DETECTION SYSTEM

Y39 X26
ABS communication error

Y31
ABS transfer mode

Y31 X32
ABS request

Y31 X22
Ready to send ABS data

T0

ABS transfer NG

T1
ABS request NG

T3

Detecting ABS communication error

M7
Sum check NG

M15
ABS transfer retry start pulse

C2
Retry start

Set M16
Retry counter

D7

M16
Retry flag set

X1
Retry waiting timer (100ms)

T2
Resetting retry flag

M9039
Saved received shift data

PC RUN

(Continued from preceding page)
(d) X-axis program

Do not execute the X-axis program while the ABS ready (M8) is off.

When "M8" (ready to send ABS data) switches on, the X-axis start program is executed by the X-axis start command.

(e) Dog type home position return

Refer to the home position return program in the A1SD75 User’s Manual.

Note that this program requires a program which outputs the clear signal (Y35) after completion of home position return.

Add the following program:
15. ABSOLUTE POSITION DETECTION SYSTEM

(f) Data set type home position return

After jogging the machine to the position where the home position (e.g., 500) is to be set, choose the home position return mode and set the home position with the home position return start (PBON).

After switching power on, rotate the servo motor more than 1 revolution before starting home position return.

Do not turn ON the clear signal (Y35) for an operation other than home position return. Turning it on in other circumstances will cause position shift.

Note 1: If the data of the home position address parameter is not written from the A7PHP programming tool or the like before starting the data set type home position return program, this sequence circuit (Note 1) is required and the sequence circuit (Note 2) is not required.

2: Contrary to above 2, if the home position address is written in the home position address parameter, the sequence circuit (Note 1) is not required but this sequence circuit (Note 1) is required.

---

Diagram with labels:
- Y10
- X1
- X4
- BUSY
- X10
- X20
- X27
- PLS
- M20
- M21
- Y35
- T10
- M9039
- PC RUN
- Home position return mode
- Y31
- ABS transfer mode
- X20
- X27
- Positioning completion
- Home position return start PB
- M20
- Clear signal ON timer request
- M21
- Data set type home position return request
- T10
- Clear signal 100ms ON timer
- M21
- Data set type home position return request
- (Note 1)
- DMOV K500 D9
- (Note 2)
- DTOP H000 K72 D9 K1
- DTOP H000 K1154 D9 K1
- TO H000 K1150 K9003 K1
- SET Y10
- SET M21
- START
- Y10
- BUSY

Programmable controller ready
Clear signal ON timer request
Clear signal 100ms ON timer
Setting data set type home position return request
Resetting data set type home position return request
Switch clear signal on
Setting X-axis home position address 500 in data register
*1: Changing X-axis home position address
*1: Changing X-axis current value
*1: Writing positioning data No. 9003
Starting positioning
Switching BUSY signal off to switch start signal off.
(g) Electromagnetic brake output
During ABS data transfer (for several seconds after the servo-on signal is turned on), the servo motor must be at a stop.
Set "1 □  1 □" in parameter No. 1 of the servo amplifier to choose the electromagnetic brake interlock signal.

(h) Positioning completion
To create the status information for servo positioning completion.
During ABS data transfer (for several seconds after the servo-on signal is turned on), the servo motor must be at a stop.

(i) Zero speed
To create the status information for servo zero speed.
During ABS data transfer (for several seconds after the servo-on signal is turned on), the servo motor must be at a stop.

(j) Torque limiting
To create the status information for the servo torque limiting mode.
During ABS data transfer (for several seconds after the servo-on signal is turned on), the torque limiting must be off.
(3) Sequence program - 2-axis control

The following program is a reference example for creation of an ABS sequence program for the second axis (Y axis) using a single A1SD75 module. Create a program for the third axis in a similar manner.

(a) Y-axis program

Refer to the X-axis ABS sequence program and create the Y-axis program.
Assign the X inputs, Y outputs, D registers, M contacts, T timers and C counters of the Y axis so that they do not overlap those of the X axis.
The buffer memory addresses of the A1SD75 differ between the X and Y axes. The instructions marked *1 in the program of Section 15.8.3 (2), (c) should be changed as indicated below for use with the Y axis:

<table>
<thead>
<tr>
<th>X-axis program</th>
<th>Y-axis program</th>
</tr>
</thead>
<tbody>
<tr>
<td>[FROMP H0000 K5  D8  K1] → [FROMP H0000 K155 D8 K1]</td>
<td>[FROMP H0000 K155 D8 K1] → [FROMP H0000 K155 D8 K1]</td>
</tr>
<tr>
<td>[DFROP H0000 K0072 D9 K1] → [DFROP H0000 K222 D9 K1]</td>
<td>[DFROP H0000 K222 D9 K1] → [DFROP H0000 K222 D9 K1]</td>
</tr>
<tr>
<td>[DTOP H0000 K1154 D3 K1] → [DTOP H0000 K1204 D3 K1]</td>
<td>[DTOP H0000 K1204 D3 K1] → [DTOP H0000 K1204 D3 K1]</td>
</tr>
<tr>
<td>[TO  H0000 K1150 K9003 K1] → [TO  H0000 K1200 K9003 K1]</td>
<td>[TO  H0000 K1200 K9003 K1] → [TO  H0000 K1200 K9003 K1]</td>
</tr>
</tbody>
</table>

(b) Data set type home position return

Arrange the data set type home position return programs given in Section 15.8.3 (2), (f) in series to control two axes.
Refer to the X-axis data set type home position return program and create the Y-axis program.
Assign the X inputs, Y outputs, D registers, M contacts and T timers of the Y axis so that they do not overlap those of the X axis.
The buffer memory addresses of the A1SD75 differ between the X and Y axes. The instructions marked *1 in the program of Section 15.8.3 (2), (f) should be changed as indicated below for use with the Y axis:

<table>
<thead>
<tr>
<th>X-axis program</th>
<th>Y-axis program</th>
</tr>
</thead>
<tbody>
<tr>
<td>[DTOP H0000 K72  D9  K1] → [DTOP H0000 K222 D9 K1]</td>
<td>[DTOP H0000 K222 D9 K1] → [DTOP H0000 K222 D9 K1]</td>
</tr>
<tr>
<td>[DTOP H0000 K1154 D9 K1] → [DTOP H0000 K1204 D9 K1]</td>
<td>[DTOP H0000 K1204 D9 K1] → [DTOP H0000 K1204 D9 K1]</td>
</tr>
<tr>
<td>[TO  H0000 K1150 K9003 K1] → [TO  H0000 K1200 K9003 K1]</td>
<td>[TO  H0000 K1200 K9003 K1] → [TO  H0000 K1200 K9003 K1]</td>
</tr>
</tbody>
</table>
15. ABSOLUTE POSITION DETECTION SYSTEM

(4) Differences between A1SD75 (AD75) and A1SD71 (AD71)

The sequence programs shown in (2) of this section differ from those for the A1SD71 (AD71) in the following portions. 1) to 20) in the following sentences indicate the numbers in the programs given in (2) of this section.

(a) Devices used

Since the A1SD75 (AD75) is a one-slot module which occupies 32 I/O points, the I/O devices are different, as indicated by 1) and 2), from those of the two-slot A1SD71 which occupies 48 point. The A1SD75 (AD75) uses the devices indicated in the following table, and its D registers and M contacts are different as indicated by 3) and 4).

<table>
<thead>
<tr>
<th>Device name</th>
<th>Devices</th>
<th>Axis 1</th>
<th>Axis 2</th>
<th>Axis 3</th>
<th>Application</th>
<th>Bit device</th>
<th>:Data at ON</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Data register</td>
<td>Data register</td>
</tr>
<tr>
<td>Input</td>
<td>X0</td>
<td>AD75 ready</td>
<td></td>
<td></td>
<td>Not ready/ WDT error</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X4</td>
<td>X5</td>
<td>X6</td>
<td></td>
<td>BUSY</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>XA</td>
<td>XB</td>
<td>XC</td>
<td></td>
<td>Error detection</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y10</td>
<td>Y11</td>
<td>Y12</td>
<td></td>
<td>Positioning start</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y13</td>
<td>Y14</td>
<td>Y1C</td>
<td></td>
<td>Start being requested</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y16</td>
<td>Y18</td>
<td>Y1A</td>
<td></td>
<td>Forward rotation jog start</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y17</td>
<td>Y19</td>
<td>Y1B</td>
<td></td>
<td>Reverse rotation jog start</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y1D</td>
<td></td>
<td></td>
<td></td>
<td>Programmable controller ready</td>
<td>Programmable controller CPU normal</td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>M0</td>
<td></td>
<td></td>
<td></td>
<td>Parameter setting completion flag</td>
<td>Setting complete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M1</td>
<td></td>
<td></td>
<td></td>
<td>Flash ROM registration processing flag</td>
<td>Processing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M2</td>
<td>M3</td>
<td>M4</td>
<td></td>
<td>Axis error reset requesting flag</td>
<td>Requesting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M100</td>
<td></td>
<td></td>
<td></td>
<td>AD75 normal flag</td>
<td>AD75 normal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M101</td>
<td></td>
<td></td>
<td></td>
<td>Initial error reset completion flag</td>
<td>Error reset complete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M102</td>
<td></td>
<td></td>
<td></td>
<td>All BUSY signal OFF flag</td>
<td>All BUSY signal OFF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M103</td>
<td></td>
<td></td>
<td></td>
<td>AD75 operable flag</td>
<td>Operable</td>
<td></td>
</tr>
<tr>
<td>internal relay</td>
<td>D100</td>
<td></td>
<td></td>
<td></td>
<td>Flash ROM registration results</td>
<td>Registration results</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D101</td>
<td>D102</td>
<td>D103</td>
<td></td>
<td>Axis error code</td>
<td>Error code</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D104</td>
<td>D105</td>
<td>D106</td>
<td></td>
<td>Axis warning code</td>
<td>Warning code</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D107</td>
<td>D108</td>
<td>D109</td>
<td></td>
<td>Axis error reset results</td>
<td>Axis error reset results</td>
<td></td>
</tr>
<tr>
<td>Data register</td>
<td>D100</td>
<td></td>
<td></td>
<td></td>
<td>Flash ROM register processing flag</td>
<td>Processing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D101</td>
<td>D102</td>
<td>D103</td>
<td></td>
<td>Axis error code</td>
<td>Error code</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D104</td>
<td>D105</td>
<td>D106</td>
<td></td>
<td>Axis warning code</td>
<td>Warning code</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D107</td>
<td>D108</td>
<td>D109</td>
<td></td>
<td>Axis error reset results</td>
<td>Axis error reset results</td>
<td></td>
</tr>
</tbody>
</table>

(b) ABS sequence program example

1) Initial setting

To reset the error of the A1SD75, the program 5) is added to reset all output signals at start-up. The axis error reset buffer memory address is changed from 201 to 1154 (axis 1) and the slot number from H0001 (slot number 1) to H0000 (slot number 2) 6).

2) Absolute position polarity, A1SD75 rotation direction setting detection

The slot number and buffer memory of the X-axis rotation direction parameter reading area are changed from [FROMP H0001 K7872 D8 K1] to [FROMP H0000 K5 D8 K1] 8).

The rotation direction parameter masking area is changed from [WAND H0004 D8] to [WAND H0001 D8] 9).

3) Reversing absolute position polarity

The rotation direction judging area is changed from [= D8 K4] to [= D8 K1] 10).

4) Reading checksum 6 bits, reading ABS data 32 bits

The 4 bits reading area is changed from [MOV K1 X30D5] to [MOV K1X20 D5] 11).

5) Restoring absolute position data

The slot number and buffer address of the A1SD75 home position address reading area are changed from [DFROP H0001 K7912 D9 K1] to [DFROP H0000 K72 D9 K1] 12)
6) Writing absolute position data to A1SD75
   The slot number and buffer address of the X-axis current value changing area are changed from
   [DTOP H0001 K41 D3 K1] to [DTOP H0000 K1154 D3 K1] 14). When the current value is changed
   in the A1SD75, the current feed value is changed at the start of positioning data No.9003.
   Therefore, the starting program for positioning data No.9003 15) is added.

7) X-axis data set type home position return program
   The slot numbers and buffer addresses of the X-axis home position address changing area are
   changed from [DTOP H0001 K7912 D9 K1] to [DTOP H0000 K72 D9 K1] and from [DFROP
   H0001 K7912 D9 K1] to [DFROP H0000 K72 D9 K1] 17). The slot number and buffer address of the X-axis current value changing area are changed from
   [DTOP H0001 K41 D3 K1] to [DTOP H0000 K1154 D3 K1] 18). When the current value is changed
   in the A1SD75, the current feed value is changed at the start of positioning data No.9003.
   Therefore, the starting program for positioning data No.9003 19) is added.

8) Y-axis sequence program, Y-axis data set type home position return program.
   The slot numbers and buffer addresses are changed as indicated by 20).

9) Writing absolute position data to AD75
   The A1SD75 (AD75) allows the current position to be changed only when the ready signal of the
   Servo amplifier is on. Therefore, if the CPU scan is fast, the program for A1SD71 may change
   the current position before the ready signal switches on. 7) is added because the current position
   must be changed after it has been confirmed that the drive unit ready signal of the A1SD75
   (D75) has switched on/off.

10) ABS coordinate error detection
    As the A1SD75 (AD75) can handle the negative-polarity coordinate position that the A1SD71
    could not handle, the program for ABS coordinate error detection is deleted. 13)

11) Dog type home position return program
    Due to the changes in wiring described in (4), (a), 4) of this section, the program for
    outputting the clear signal (Y35) after completion of a home position return is required. 16)
15. ABSOLUTE POSITION DETECTION SYSTEM

15.9 Confirmation of absolute position detection data

You can confirm the absolute position data with servo configuration software (MRZJW3-SETUP121E). Choose "Diagnostics" and "Absolute Encoder Data" to open the absolute position data display screen.

(1) Choosing "Diagnostics" in the menu opens the sub-menu as shown below:

![Menu Image]

(2) By choosing "Absolute Encoder Data" in the sub-menu, the absolute encoder data display window appears.

![Data Display Image]

(3) Press the "Close" button to close the absolute encoder data display window.
15.10 Absolute position data transfer errors

15.10.1 Corrective actions

(1) Error list

The number within parentheses in the table indicates the output coil or input contact number of the A1SD71 (AD71).

<table>
<thead>
<tr>
<th>Name</th>
<th>Output coil</th>
<th>Description</th>
<th>Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Note) ABS communication error</td>
<td>Y49 Y11</td>
<td>1. The ABS data transfer mode signal (Y41) is not completed within 5s.</td>
<td>1. Wiring for ABS transfer mode signal, ABS data request signal, or ready to send signal is disconnected or connected to the SG terminal.</td>
<td>Correct the wiring.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. The ready to send signal (X32) is not turned OFF within 1s after the ABS data request signal (Y42) is turned ON.</td>
<td>2. PC ladder program wrong.</td>
<td>Correct the ladder.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. The ready to send signal (X32) remains OFF for longer than 1s.</td>
<td>3. Faulty PLC output or input module.</td>
<td>Change the input or output module.</td>
</tr>
<tr>
<td>ABS data check sum error</td>
<td>Y4A Y12</td>
<td>· ABS data sumcheck resulted in mismatch four times consecutively.</td>
<td>4. Faulty printed board in the servo amplifier.</td>
<td>Change the amplifier.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5. Power supply to the servo amplifier is OFF.</td>
<td>Turn on the power to the servo amplifier.</td>
</tr>
<tr>
<td>ABS coordinate error</td>
<td>Y4B</td>
<td>· The motor position is in the negative coordinate value range when the servo is turned ON or when power supply is turned ON.</td>
<td>1. The servo is turned ON or the power supply is turned ON near the machine home position or in the zone in which addresses decrease.</td>
<td>Change the amplifier.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. The machine falls on a vertical axis when the servo signal is turned ON/OFF.</td>
<td>Change the electromagnetic brake operation sequence.</td>
</tr>
<tr>
<td>Servo alarm</td>
<td>Y48 Y10</td>
<td>· Alarm occurred in the servo amplifier.</td>
<td>1. Emergency stop (EMG) of the servo amplifier was turned off.</td>
<td>After ensuring safety, turn EMG on.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Trouble (ALM) of the servo amplifier was turned on.</td>
<td>Refer to Section 10.2.2 and take action.</td>
</tr>
</tbody>
</table>

Note: Refer to (2) in this section for details of error occurrence definitions.
(2) ABS communication error

(a) The OFF period of the send data ready signal output from the servo amplifier is checked.

If the OFF period is 1s or longer, this is regarded as a transfer fault and the ABS communication error is generated.

The ABS communication error occurs if the ABS time-out warning (AL.E5) is generated at the servo amplifier due to an ABS request ON time time-out.

(b) The time required for the ABS transfer mode signal to go OFF after it has been turned ON (ABS transfer time) is checked.

If the ABS transfer time is longer than 5s, this is communication error occurs if the ABS time-out warning (AL.E5) is generated at the servo amplifier due to an ABS transfer mode completion time time-out.
(c) To detect the ABS time-out warning (AL.E5) at the servo amplifier, the time required for the ABS request signal to go OFF after it has been turned ON (ABS request time) is checked. If the ABS request remains ON for longer than 1s, it is regarded that an fault relating to the ABS request signal or the send data ready signal has occurred, and the ABS communication error is generated. The ABS communication error occurs if the ABS time-out warning (AL.E5) is generated at the servo amplifier due to an ABS request OFF time-out.

15.10.2 Error resetting conditions

Always remove the cause of the error before resetting the error.

<table>
<thead>
<tr>
<th>Name</th>
<th>Output coil</th>
<th>Servo status</th>
<th>Resetting condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AD71 1PG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABS communication error</td>
<td>Y49 Y11</td>
<td>Ready (RD) signal off</td>
<td>Reset when servo-on PB (X36) signal turns off.</td>
</tr>
<tr>
<td>ABS checksum error</td>
<td>Y4A Y12</td>
<td>Ready (RD) signal on</td>
<td>For AD71 Reset when servo-on PB (X36) signal turns from off to on.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>For FX-1PG Reset when servo-on PB (X36) signal turns off.</td>
</tr>
<tr>
<td>ABS coordinate error</td>
<td>Y4B</td>
<td>Ready (RD) signal on</td>
<td>Reset when servo-on PB (X36) signal turns from off to on after a motion to (0) coordinate is made by jog operation.</td>
</tr>
<tr>
<td>Servo alarm</td>
<td>Y48 Y10</td>
<td>Ready (RD) signal on</td>
<td>Reset when alarm reset PB turns on or power switches from off to on.</td>
</tr>
</tbody>
</table>