3.2 SERVO AMPLIFIER MODULE

3.2.1 Abnormal Current Alarms (8, 9, A, b, C, d, and E in the LED display)

(1) Make sure that the following parameters are set to the standard values. If they are not, abnormal current control is performed.

No. 1809	
No. 2004	No. 8X04

No. 1884	
No. 2006	No. 8X06

No. 1954(15-A),1955(15-B)	
No. 2011	No. 8X10

No. 1852	
No. 2040	No. 8X40

No. 1853	
No. 2041	No. 8X41

No. 1967	
No. 2074	No. 8X74

No. 1991	
No. 2098	No. 8X98

(2) Remove the power line wires from the amplifier terminals, and release an emergency stop state.
→ If an abnormal current alarm is issued, the servo amplifier module needs to be replaced.
→ If not, go to (3).

(3) Check for insulation between PE and each of the removed power wires U, V, and W. If insulation is perfect, go to (4). If not, disconnect the power wires from the motor connector. Then check for insulation between PE and each of the U, V, and W terminals on the motor.
→ If there is a short-circuit between PE and U, V, or W of the motor, replace the motor.
→ If insulation is perfect, replace the power wires.

(4) Connect the power wires. Attach the check board (A06B-6071-K290) to connector JX5 to measure the waveform of the actual current (IR and IS) in the servo amplifier module. Accelerate or decelerate the motor, and measure the actual current (IR and IS) of the amplifier.
→ If an abnormal current alarm occurs right after an emergency stop state is released, go to (5).

Release an emergency stop state, and start the motor.
Check whether the waveform of the actual current (IR and IS) is a normal sine wave.
→ If normal, go to (5).
→ If not, replace the amplifier.

(5) Check whether there is noise on the actual current (IR and IS) waveform.
→ If there is no noise, replace the amplifier.
→ If there is noise, use a shielding wire, and ground the shielding, or take other countermeasures as required.

(6) If still there is noise, a probable cause is a defective command cable or a hardware failure in the CNC.

3.2.2 IPM Alarms (8., 9., A., b., C., d., and E in the LED display; note these codes are displayed simultaneously with a period.)

(1) Wait for about 10 minutes. Then release the emergency stop state. If an IPM alarm still occurs, go to (2).
If the cause is IPM overheat, the IPM alarm will not recur. IPM overheat can occur if the ambient temperature is high or the motor is overloaded. Check the operating condition.

(2) Remove the power wires from the amplifier terminals, and release an emergency stop state.
If the IPM alarm does not recur, go to (3).

If the IPM alarm recurs, the probable cause is the operation of the IPM protective function (for overcurrent or power failure). Replace the amplifier and see.
→ If the IPM does not recur, go to (3).

(3) Check for insulation between PE and each of the removed power wires U, V, and W. If insulation is perfect, go to (4). If not, disconnect the power wires from the motor connector. Then check for insulation between PE and each of the U, V, and W terminals on the motor.
→ If there is a short-circuit between PE and U, V, or W of the motor, replace the motor.
→ If insulation is perfect, replace the power wires.

(4) Connect the power wires. Attach the check board (A06B-6071-K290) to connector JX5 to measure the waveform of the actual current (IR and IS) in the servo amplifier module. Accelerate or decelerate the motor, and measure the actual current (IR and IS) of the amplifier.
If an overcurrent alarm occurs right after an emergency stop state is released, go to (5).
Release an emergency stop state, and start the motor.
Check whether the waveform of the actual current (IR and IS) is a normal sine wave.
→ If normal, go to (5).
→ If not, replace the amplifier.

(5) Check whether there is noise on the actual current (IR and IS) waveform.
→ If there is no noise, replace the amplifier.
→ If there is noise, use a shielding wire, and ground the shielding, or take other countermeasures as required.

(6) If still there is noise, a probable cause is a defective command cable or a hardware failure in the CNC.

3.2.3 Control Power Supply Undervoltage Alarm (2 in the LED display)

(1) Check the three-phase input voltage to the amplifier.
→ If the voltage is below 0.85 times the rating, adjust it to the rated value.

(2) Replace the servo amplifier.

3.2.4 DC Link Undervoltage Alarm (5 in the LED display)

(1) Check the three-phase input voltage to the power supply module.
→ If the voltage is below 0.85 times the rating, adjust it to the rated value.

(2) Replace the servo amplifier module.

3.2.5 Fan Stopped Alarm (1 in the LED display)

(1) Make sure that the fan is not clogged up.

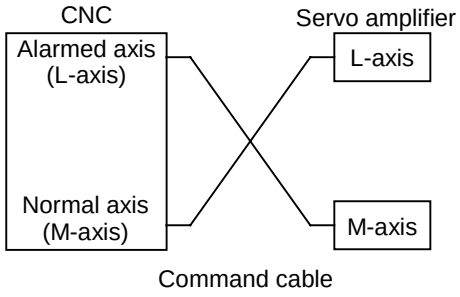
(2) Replace the servo amplifier module. Alternatively, replace the cooling fan inside the servo amplifier module according to Chapter 4.

3.2.6 Current Conversion Error Alarm

(1) Exchange the command cable with the cable for the axis on which no alarm has occurred.
→ If the alarm occurs on the same axis, go to (3).
→ If the alarm occurs on the new axis, go to (2).

(2) The command cable is defective. Replace it.

(3) Exchange the command cables according to the diagram here. When switching the CNC on, do so in an emergency stop state.
→ If the alarm recurs on the same axis, go to (5).
→ If the alarm occurs on the other axis, go to (4).



(4) The servo amplifier is defective.

(5) The module for current conversion in the CNC is defective.

3.3 SERVO SOFTWARE

If a servo alarm is issued, an alarm message is output, and details of the alarm are also displayed on the servo adjustment screen or the diagnosis screen. Using the alarm identification table given in this section, determine the alarm, and take a proper action. With a CNC of the *i* series, detailed alarm messages are displayed. So, from the information in the alarm identification table, select a proper action.

3.3.1 Servo Adjustment Screen

- **Series 0-C**

Press the PARAM key several times to display the servo setting screen.

Pressing the PAGE ↑ PAGE ↓ keys displays the servo screen.

If the servo setting screen does not appear, specify the following parameter, then switch the CNC off and on again:

	#7	#6	#5	#4	#3	#2	#1	#0
0389								SVS

SVS (#0)=0 (to display the servo setting screen)

- **Series 15-A/B, 15*i***

Press the SERVICE key several times to cause the servo setting screen to appear. Then press the ↓ key, and the servo adjustment screen will appear.

- **Series 16, 18, 20, 21**

SYSTEM → [SYSTEM] → [▷] → [SV-PRM] → [SV-TUN]

If the servo setting screen does not appear, specify the following parameter, then switch the CNC off and on again.

	#7	#6	#5	#4	#3	#2	#1	#0
3111								SVS

SVS (#0)=1 (to display the servo setting screen)

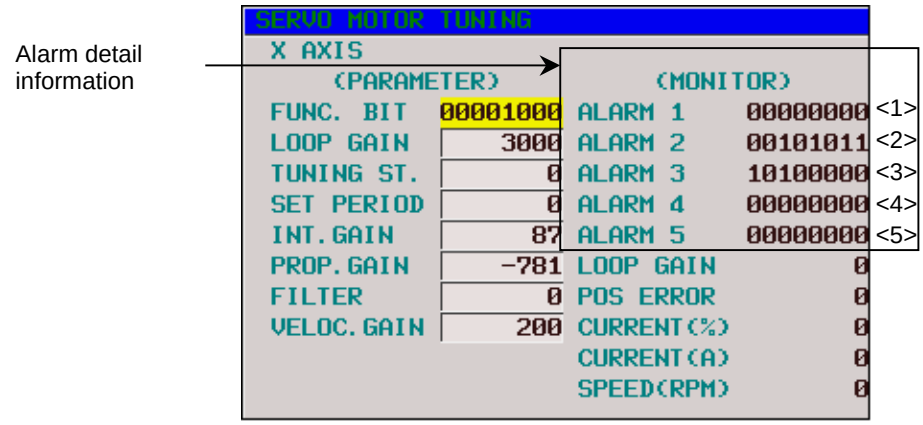


Fig. 3.3.1(a) Servo adjustment screen

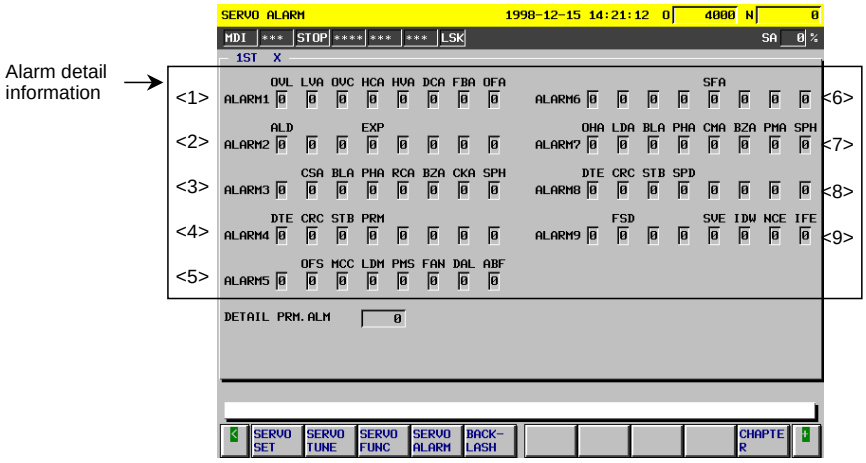


Fig. 3.3.1(b) Series 15*i* servo alarm screen

The table below indicates the names of the alarm bits.

Table 3.3.1 List of alarm bit names

	#7	#6	#5	#4	#3	#2	#1	#0
<1> Alarm 1	OVL	LVA	OVC	HCA	HVA	DCA	FBA	OFA
<2> Alarm 2	ALD			EXP				
<3> Alarm 3		CSA	BLA	PHA	RCA	BZA	CKA	SPH
<4> Alarm 4	DTE	CRC	STB	PRM				
<5> Alarm 5		OFS	MCC	LDM	PMS	FAN	DAL	ABF
<6> Alarm 6					SFA			
<7> Alarm 7	OHA	LDA	BLA	PHA	CMA	BZA	PMA	SPH
<8> Alarm 8	DTE	CRC	STB	SPD				
<9> Alarm 9		FSD			SVE	IDW	NCE	IFE

NOTE
The empty fields do not represent alarm codes.

3.3.2 Diagnosis Screen

The alarm items of the servo adjustment screen correspond to the diagnosis screen numbers indicated in the table below.

Table 3.3.2 Correspondence between the servo adjustment screen and diagnosis screen

Alarm No.	Series 0-C	Series 15-A, B, 15*i*	Series 16, 18, 20, 21	PowerMate-E
<1> Alarm 1	No 720 to 723	No 3014 + 20(X-1)	No 200	No 2711
<2> Alarm 2	730 to 733	3015 + 20(X-1)	201	2710
<3> Alarm 3	760 to 763	3016 + 20(X-1)	202	2713
<4> Alarm 4	770 to 773	3017 + 20(X-1)	203	2712
<5> Alarm 5	————	————	204	2714
<6> Alarm 6	————	————	———	———
<7> Alarm 7	————	————	205	———
<8> Alarm 8	————	————	206	———
<9> Alarm 9	————	————	———	———

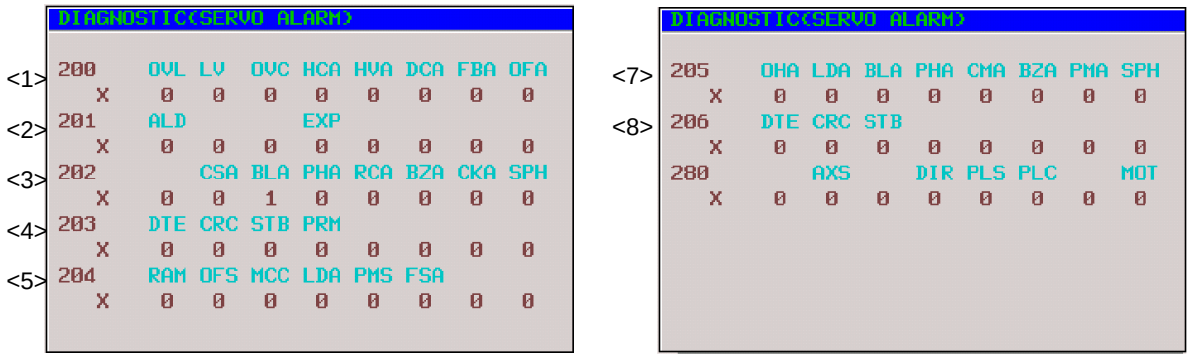


Fig. 3.3.2 Series 16*i* diagnosis screen

3.3.3 Overload Alarm (Soft Thermal, OVC)

(Alarm identification method)

	#7	#6	#5	#4	#3	#2	#1	#0
<1> Alarm 1	OVL	LVA	OVC	HCA	HVA	DCA	FBA	OFA

(Action)

(1) Make sure that the motor is not vibrating.
⇒ If a motor vibrates, the current flowing in it becomes more than necessary, resulting in an alarm.

(2) Make sure that the power line to the motor is connected correctly.
⇒ If the connection is incorrect, an abnormal current flows in the motor, resulting in an alarm.

(3) Make sure that the following parameters are set correctly.
⇒ An overload alarm is issued based on the result of calculation of these parameters. Be sure to set them to the standard values. For details of the standard values, refer to the parameter manual (B-65150E).

1877	8x62	Overload protection coefficient (OVC1)
2062	1062	

1878	8x63	Overload protection coefficient (OVC2)
2063	1063	

1893	8x65	Overload protection coefficient (OVCLMT)
2065	1065	

(4) Attach the check board (A06B-6071-K290) to connector JX5 to measure the waveform of the actual current (IR and IS) of the servo amplifier module. Start the motor and measure the actual current (IR and IS).
⇒ If the actual current exceeds 1.4 times the rated current, the constant for the acceleration/deceleration duration is too small, or the load on the machine is too heavy for the capacity of the motor.
⇒ If the actual current exceeds 1.4 times the rated current during normal operation, the load on the machine is too heavy for the capacity of the motor.

3.3.4 Feedback Disconnected Alarm

(Alarm identification method)

	#7	#6	#5	#4	#3	#2	#1	#0
<1> Alarm 1	OVL	LVA	OVC	HCA	HVA	DCA	FBA	OFA
<2> Alarm 2	ALD			EXP				
<6> Alarm 6					SFA			

FBA	ALD	EXP	SFA	Alarm description	Action
1	1	1	0	Hard disconnection (separate phase A/B)	1
1	0	0	0	Soft disconnection (closed loop)	2
1	0	0	1	Soft disconnection (α pulse coder)	3

(Action)

Action 1: This alarm is issued when a separate phase A/B scale is used. Check if the phase A/B detector is connected correctly.

Action 2: This alarm is issued when the position feedback pulse variation is small relative to the velocity feedback pulse variation. This means that this alarm is not issued when a semi-full is used. Check if the separate detector outputs position feedback pulses correctly. If position feedback pulses are output correctly, it is considered that the motor alone is rotating in the reverse direction at the start of machine operation because of a large backlash between the motor position and scale position.

		#7	#6	#5	#4	#3	#2	#1	#0
1808	8X03							TGAL	
2003	1003								

TGAL (#1) 1: Uses the parameter for the soft disconnection alarm detection level.

		Soft disconnection alarm level
1892	8X64	
2064	1064	

Standard setting 4: Alarm issued for a 1/8 rotation of the motor. Increase this value.

Action 3: This alarm is issued when synchronization between the absolute position data sent from the built-in pulse coder and phase data is lost. Turn off the power to the CNC, then detach the pulse coder cable then attach it again. If this alarm is still issued, replace the pulse coder.

3.3.5 Overheat Alarm

(Alarm identification method)

	#7	#6	#5	#4	#3	#2	#1	#0
<1> Alarm 1	OVL	LVA	OVC	HCA	HVA	DCA	FBA	OFA
<2> Alarm 2	ALD			EXP				

OVL	ALD	EXP	Alarm description	Action
1	1	0	Motor overheat	1
1	0	0	Amplifier overheat	1

(Action)

Action 1: If this alarm is issued after a long-time of continuous operation, it is considered that the motor and amplifier are overheated. Stop operation for a while, then make a check. If this alarm is still issued after the power is off for about 10 minutes then is turned on again, the thermostat is considered to be faulty. If this alarm is issued intermittently, increase the time constant or increase stop time in the program to suppress the rise in temperature.

3.3.6 Invalid Servo Parameter Setting Alarm

The invalid servo parameter setting alarm is issued when a setting out of the specifiable range is specified, or an overflow has occurred in an internal calculation. When an invalid parameter is detected on the servo side, alarm 4 #4 (PRM) = 1 results.
(Alarm identification method)

	#7	#6	#5	#4	#3	#2	#1	#0
<4> Alarm 4	DTE	CRC	STB	PRM				

For details and action required when the invalid servo parameter setting alarm is issued on the servo side, refer to the parameter manual (B-65150E) edition 4 and up.

(Reference information)

Method of checking details of an invalid parameter detected on the servo side

(For Series 15*i*)

A number is indicated in the item "Details of invalid parameter" on the servo alarm screen (Fig. 3.3.1(b)).

(For Series 16*i*, 18*i*, 21*i*, and Power Mate *i*)

A number is indicated in No. 352 of the diagnosis screen.

3.3.7 Alarms Related to Pulse Coder and Separate Serial Detector

(Bits for alarm identification)

	#7	#6	#5	#4	#3	#2	#1	#0
<1> Alarm 1	OVL	LVA	OVC	HCA	HVA	DCA	FBA	OFA
<2> Alarm 2	ALD			EXP				
<3> Alarm 3		CSA	BLA	PHA	RCA	BZA	CKA	SPH
<4> Alarm 4	DTE	CRC	STB	PRM				
<5> Alarm 5		OFS	MCC	LDM	PMS	FAN	DAL	ABF
<6> Alarm 6					SFA			
<7> Alarm 7	OHA	LDA	BLA	PHA	CMA	BZA	PMA	SPH
<8> Alarm 8	DTE	CRC	STB	SPD				
<9> Alarm 9		FSD			SVE	IDW	NCE	IFE

(1) For a built-in pulse coder
An alarm is determined from the bits of alarms 1, 2, 3, and 5. The table below indicates the meaning of each bit.

Alarm 3							Alarm 5		1	Alarm 2		Alarm description	Action
CSA	BLA	PHA	RCA	BZA	CKA	SPH	LDM	PMA	FBA	ALD	EXP		
						1						Soft phase alarm	2
					1							Clock alarm (serial A)	
				1								Zero battery voltage	1
			1						0	0	0	Speed error (serial A)	
			1						1	1	0	Count error alarm (α pulse coder)	2
		1										Phase alarm (serial A)	2
	1											Battery voltage decrease (warning)	1
1												Checksum alarm (serial A)	
								1				Pulse error alarm (α pulse coder)	
							1					LED error alarm (α pulse coder)	

NOTE
An alarm for which no action number is given is considered to be caused by a pulse coder failure. Replace the pulse coder.

(2) For a separate serial detector
An alarm is determined from the bits of alarm 7. The table below indicates the meaning of each bit.

Alarm 7								Alarm description	Action
OHA	LDA	BLA	PHA	CMA	BZA	PMA	SPH		
							1	Soft phase alarm	2
						1		Pulse error alarm	
					1			Zero battery voltage	1
				1				Count error alarm	2
			1					Phase alarm	2
		1						Battery voltage decrease (warning)	1
	1							LED error alarm	
1								Separate detector alarm	

NOTE
An alarm for which no action number is given is considered to be caused by a detector failure. Replace the detector.

(Action)

Action 1: Battery-related alarms
Check if a battery is connected. When the power is turned on for the first time after a battery is connected, the zero battery voltage alarm is issued. In such a case, turn off the power, then turn on the power again. If the alarm is still issued, check the battery voltage. If the battery voltage decrease alarm is issued, check the voltage, and replace the battery as required.

Action 2: Alarms that may be issued for noise
If an alarm is issued intermittently or after emergency stop cancellation, noise is probably the cause. So, provide noise protection. If the same alarm is still issued after noise protection is provided, replace the detector.

(3) Alarms related to serial communication
An alarm is determined from the bits of alarms 4 and 8.

Alarm 4			Alarm 8			Alarm description
DTE	CRC	STB	DTE	CRC	STB	
1						Serial pulse coder communication alarm
	1					
		1				
			1			Separate serial pulse coder communication alarm
				1		
					1	

Action: Serial communication is not performed correctly. Check if the cable is connected correctly and is not broken. If CRC or STB is issued, noise may be the cause. So, provide noise protection. If CRC or STB is always issued after the power is turned on, the pulse coder or amplifier control board (*i* series) or the pulse module (*i* series) may be faulty.

3.3.8 Other Alarms

(Alarm identification method)

	#7	#6	#5	#4	#3	#2	#1	#0
<5> Alarm 5		OFS	MCC	LDM	PMS	FAN	DAL	ABF

OFS	DAL	ABF	Alarm description	Action
		1	Feedback mismatch alarm	1
	1		Excessive semi-full error alarm	2
1			Current offset error alarm	3

(Action)

Action 1: This alarm is issued when the move direction of the position detector is opposite to the move direction of the speed detector. Check the rotation direction of the separate detector. If the rotation direction of the separate detector is opposite to the rotation direction of the motor, take the following action:

For a phase A/B detector: Reverse the connections of A and $\overline{A}$.

For a serial detector: Reverse the setting of the signal direction of the separate detector.

		#7	#6	#5	#4	#3	#2	#1	#0
1960	-								RVRSE
2018	-								

RVRSE (#0) Reverses the signal direction of the separate detector.

0: Does not reverse the signal direction of the separate detector.

1: Reverses the signal direction of the separate detector.

If a large distortion exists between the motor and separate detector, this alarm may be issued in the case of abrupt acceleration/ deceleration. In such a case, modify the detection level.

		#7	#6	#5	#4	#3	#2	#1	#0
1741	-							RNLV	
2201	-								

RNLV (#1) Modifies the feedback mismatch alarm detection level.

1: Detected with 1000 min^{-1} or more

0: Detected with 600 min^{-1} or more

Action 2: This alarm is issued when the difference between the motor position and separate detector position exceeds the excessive semi-full error level. Check if the conversion efficient for dual position feedback is set correctly. If the conversion efficient is set correctly, increase the alarm level. If this alarm is still issued after the level is modified, check the connection direction of the scale.

1971	**-**	**Dual position feedback conversion coefficient (numerator)**
2078	**-**	

1972	**-**	**Dual position feedback conversion coefficient (denominator)**
2079	**-**	

$$\text{Conversion coefficient} = \frac{\left(\begin{array}{l}\text{Number of feedback pulses per motor}\\ \text{revolution (detection unit)}\end{array}\right)}{1{,}000{,}000}$$

1729	**-**	**Dual position feedback semi-full error level**
2118	**-**	

[Setting] Detection unit. When 0 is set, no detection is made.

Action 3: The current offset value of the current detector (equivalent to the current value in the emergency stop state) is abnormally high. If this alarm is still issued after the power is turned off then back on, the current detector is faulty. For the *i* series, replace the control board of the amplifier. For series other than the *i* series, replace the servo-related modules on the CNC.