Brushless Motor Troubleshooting: An alarm occurs

Notes

(1) In order to ensure a safe use of the system, please refer to the operating manuals and operating instructions for each device such as "Safety Precautions" and "Safety Essentials". Please check the contents before use.

(3) The information contained in this document is as of August 2021.
The information in this document is subject to change without notice.

(4) This document describes the malfunction of the equipment and does not cover the individual operation, installation or wiring methods. For further information, other than the malfunction of the equipment, please refer to the operating manual of the product or contact the manufacturer for more information.

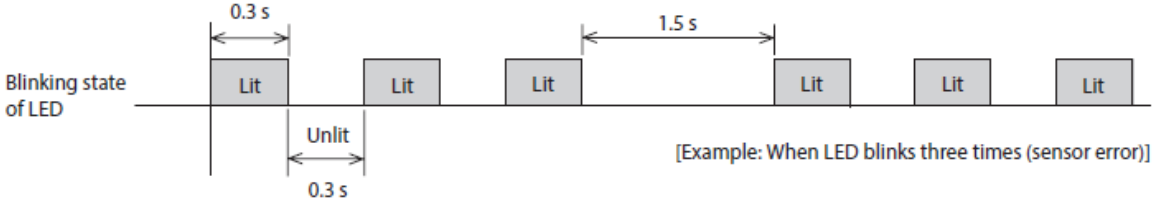
Problem: An alarm occurs

The driver is equipped with an alarm function to protect the driver from various troubles. When an alarm occurs, the motor and driver are in the following states. Please refer to the operating manual of each series for details.

ALM output
ALM output and ALM-B output are OFF and ALM-A output is ON*.

Motor running
The motor excitation is cut off and the motor stops spontaneously (except for some alarms). Motor excitation by the load hold function (simple hold function) is also cut off.

PWR/ALM LED
Blinks in red. You can check the contents of the alarm from the number of blinks.



Electromagnetic brake
For products equipped with an automatic electromagnetic brake control function, the brake is automatically held**.

* The driver's output signal is a transistor or photocoupler open collector output. The signal status does not indicate the voltage level of the signal, but rather the "ON: energized" and "OFF: de-energized" of the internal elements.
** When the electromagnetic brake operation parameter at the time of alarm is changed, the holding timing at the time of alarm will change.

Problem: An alarm occurs

When clearing an alarm, check the details of the alarm that is occurring and remove the cause before clearing it. You can disable the alarm in the following ways. Some series may not be compatible with this product, so please check the operating manual.

- Turn the ALM-RST input from OFF to ON (valid on the ON edge*) .
- Turn the power back on.
- Perform an alarm reset on MEXE02.
- Execute the maintenance command Alarm Reset via communication.

* The effective edge may differ depending on the product.

CAUTION

- Some types of alarms can only be cleared by turning the power back on.
- To clear the alarm, turn the operation input signal OFF and execute it. When the operation input signal is ON, the alarm reset is not accepted.

If you are unable to reset (cancel) the alarm even after taking the necessary measures, please contact the Customer Service Center.

How to check the alarm content

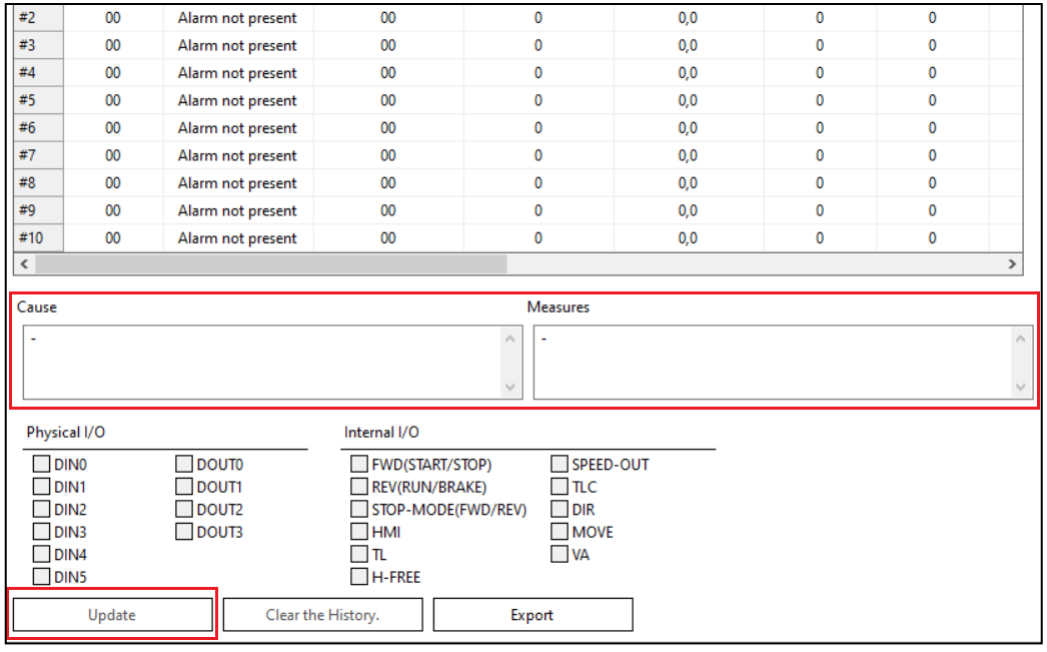
If there is an alarm, first check the contents of the alarm that is occurring.
The following methods can be used to check the content of an alarm that is occurring.
The method of confirmation differs depending on the series, so please refer to the operating manual for details.

	BMU	BLE2	BLH			BLV
			Analogue	Digital	RS-485	
Number of LED Blinking	-	-	●	●	●	●
Control Panel	●	●	-	-	-	-
MEXE02 Support Software	-	● (USB-mini-B)	-	● (USB-mini-B)	● (USB-mini-B)	● (special cable)
OPX-2A Data Setting Device	-	-	-	-	-	●
Via Network	-	-	-	-	●	●

Dedicated communication cable: CC05IF-USB.

You can check the currently occurring alarms on the "Alarm Monitor" of MEXE02 (except for some products).
You can also check the cause of the alarm and the action taken for the alarm that occurred by pressing the Update button on the alarm monitor.
Please refer to the contents of this manual and the operating manual to deal with the alarm.
Reset (clear) the alarm.

Example: BLH Series Digital Setting Type (Confirmation screen for MEXE02)



The items that can be checked differ depending on the series. Please refer to the operating manual for the items that can be checked.

Alarm for each series (AC-input)

Alarm Name (Code)	Explained in this document	LED Blinking	BMU	BLE2
Overcurrent (20)	Yes	7 times	● (reset not possible)	● (reset not possible)
Main circuit overheat (21)	-	9 times	●	●
Overvoltage (22)	Yes	4 times	●	●
Undervoltage (25)	Yes	5 times	●	●
Main circuit output error (2D)	-	14 times	-	●
Sensor error (28)	Yes	3 times	●	●
Overload (30)	Yes	2 times	●	●
Overspeed (31)	Yes	6 times	●	●
EEPROM error (41)	-	8 times	● (reset not possible)	● (reset not possible)
Sensor error at power on (42)	Yes	3 times	●	●
Prevention of operation at power-on (46)	Yes	11 times	●	●
Regeneration resistor overheat (51)	Yes	9 times	-	●
External stop (6E)	-	10 times	●	●

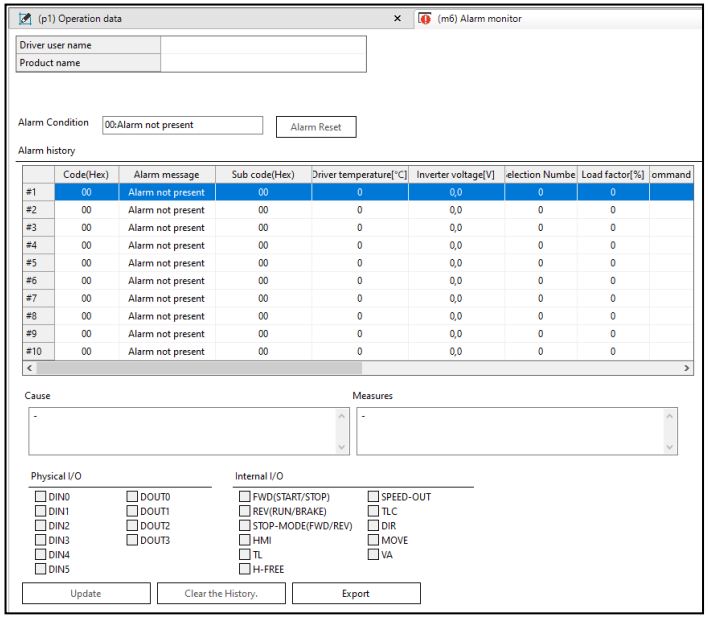
Alarm for each series (DC-input)

Alarm Name (Code)	Explained in this document	LED Blinking	BLH			
			Analogue	Analogue 100 W	Digital	RS-485
Overcurrent (20)	Yes	7 times	● (reset not possible)	-	● (reset not possible)	● (reset not possible)
Main circuit overheat (21)	-	9 times	●	-	●	●
Overvoltage (22)	Yes	4 times	●	●	●	●
Undervoltage (25)	Yes	5 times	●	●	●	●
Main circuit output error (2D)	-	14 times	-	-	-	-
Sensor error (28)	Yes	3 times	●	●	●	●
Overload (30)	Yes	2 times	●	●	●	●
Overspeed (31)	Yes	6 times	●	●	●	●
EEPROM error (41)	-	8 times	● (reset not possible)	-	● (reset not possible)	● (reset not possible)
Sensor error at power on (42)	Yes	3 times	●	-	●	●
Prevention of operation at power-on (46)	Yes	11 times	-	-	●	●
Regeneration resistor overheat (51)	Yes	9 times	-	-	-	-
External stop (6E)	-	10 times	-	-	●	●
RS-485 communication error (84)	-	12 times	-	-	-	●
RS-485 communication timeout (85)	-	12 times	-	-	-	●

About the alarm history function

The driver is also equipped with an alarm history function that stores the contents of the last 10 alarms (excluding some products).
This function allows you to check the alarms that have occurred even after they have been cleared.
In addition, in the BLE2 and BLH Series (digital setting, RS-485), this function was executed when an alarm occurred. You can also check the driver status such as operation data No. and I/O signal status (alarm history detail function).

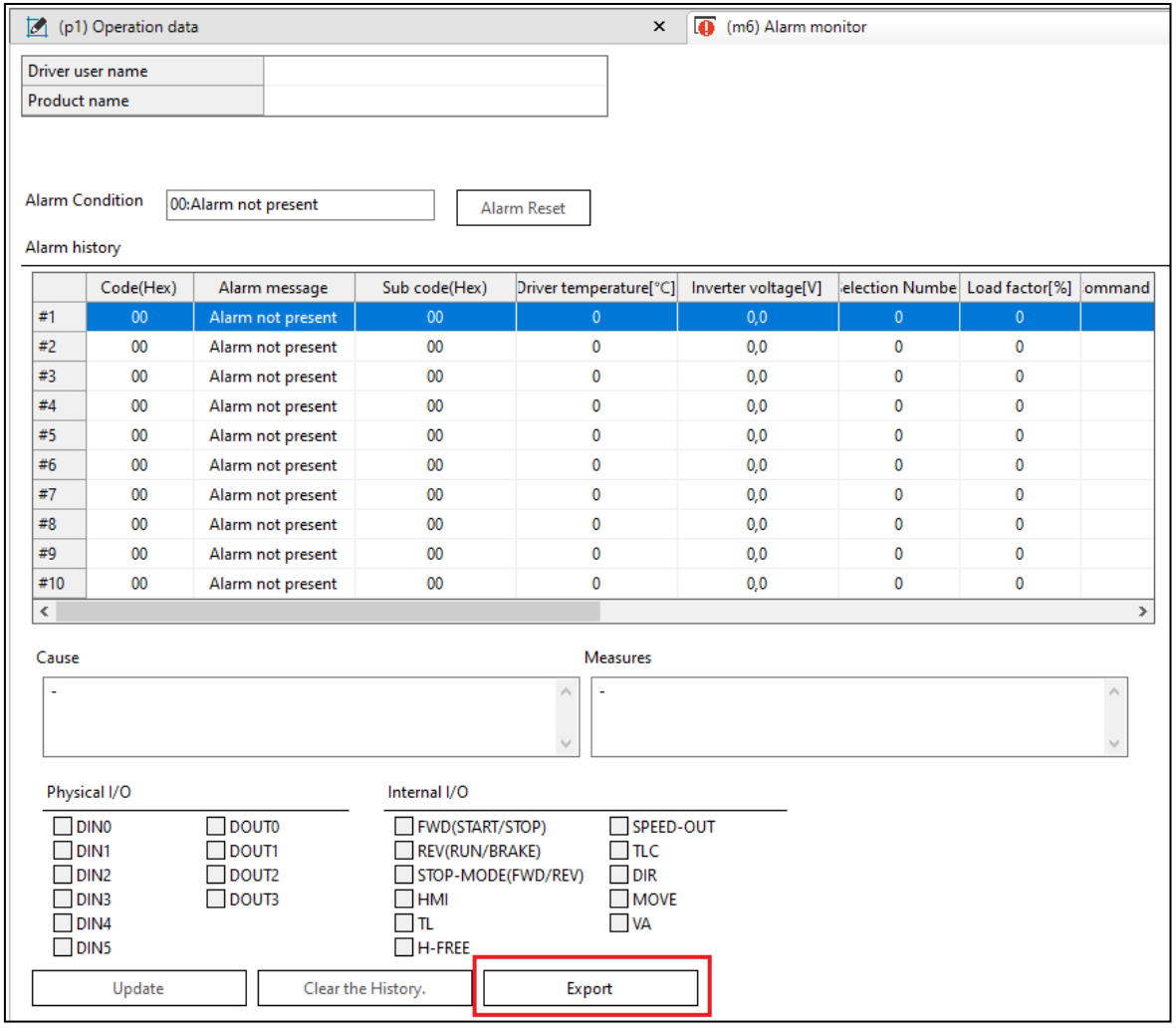
Example: BLH Series Digital Setting Type (Confirmation screen for MEXE02)



The items that can be checked differ depending on the series. Please refer to the operating manual for the items that can be checked.

About the alarm history function

You can also export the alarm history to CSV format by running "Export".



Check the contents of the alarm that is occurring. The number in parentheses ( ) is the alarm code.

- Overload (30)
- Overvoltage (22)
- Sensor error (28)
- Initial sensor error (42)
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Cause

This alarm occurs when the motor load factor exceeds the alarm threshold for a specified period of time. The alarm threshold and specified time vary depending on the series. Please refer to the operating manual of each series.

Checklist

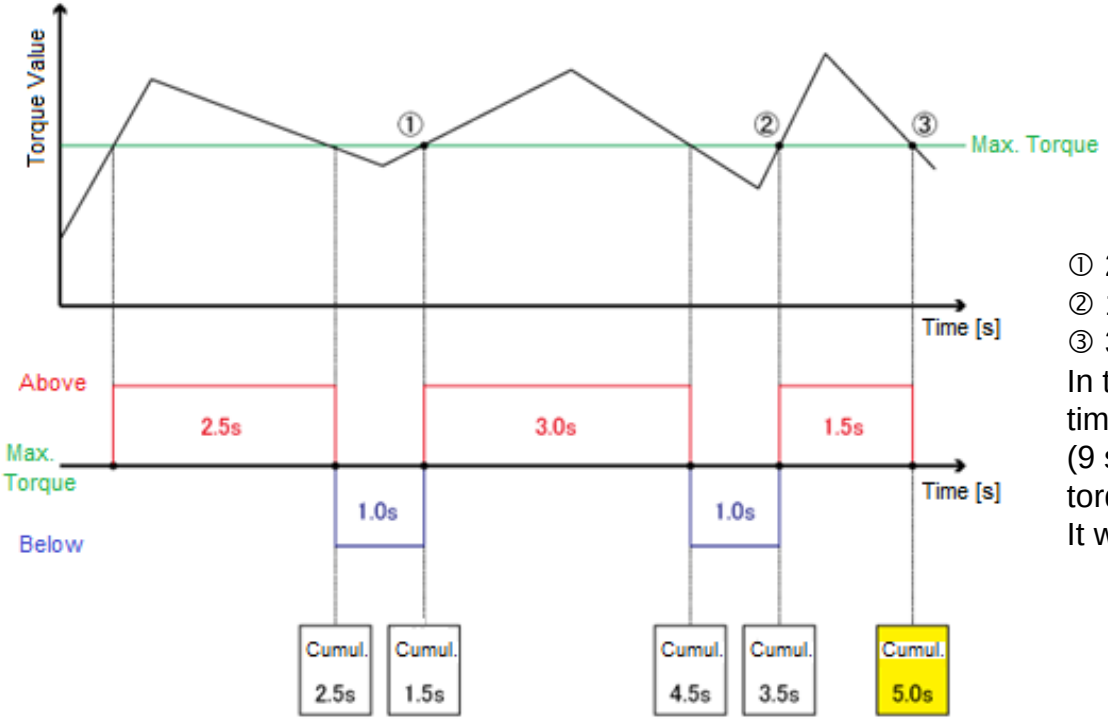
(1) If the problem occurs a short time after startup, please check the following.
- (1) Has the workpiece become heavy with age?
- (2) Is the power line (motor line) or electromagnetic brake line broken (check continuity between cables)?

(2) If the problem occurs during start-up, please check the following.
- (1) Are there any problems with the cable (e.g., forgotten connection of the electromagnetic brake wire, extension beyond specifications, poor contact at the connector, etc.)?
- (2) Review the load environment and operating conditions to see if they can be improved, and recalculate the required torque to see if it is insufficient.
- (3) Does the combination of the driver and motor match?
(If there is an abnormality in the combination, the torque will not be output normally and an alarm may occur.)

Overload alarm (30)

About the overload time

The detection time of overload is cumulative time. Cumulative time is the time from the "total time that the condition is reached" at a certain point. This is the time that is subtracted from the "total time that has not met the requirements.“
(The time deducted is counted from the point where the condition is reached for the first time.)
Assume that the relationship between torque change and elapsed time during operation is as shown in the graph below.
The green line is the overload detection line and is divided into two areas: above and below the line.
The relationship between the elapsed time and the overload detection line is organized on the time axis, with red for when the line is above the overload detection line and blue for when it is below the line.
The cumulative time at three points (1), (2), and (3) is obtained as follows.



① 2.5 - 1.0 = 1.5s
② 1.5 + 3.0 - 1.0 = 3.5s
③ 3.5 + 1.5 = 5.0s
In this example, the alarm is triggered at the timing of ③.
(9 seconds after reaching the overload detection torque for the first time)
It will never be less than 0s by subtraction.

About load monitoring

The torque applied to the motor can be checked as the load factor by the following method. The load factor is calculated by converting the motor shaft with the rated torque as 100%.

	BMU	BLE2	BLH			BLV
			Analogue	Digital	RS-485	
Control Panel	●	●	-	-	-	-
MEXE02 Support Software	-	● (USB-mini-B)	-	● (USB-mini-B)	● (USB-mini-B)	● (special cable)
OPX-2A Data Setting Device	-	-	-	-	-	●
Via Network	-	-	-	-	●	●

You can check the average value of the load factor, but the filter is weighted to make it easier to check.
It is not suitable for checking instantaneous fluctuations.
If you want to check the instantaneous fluctuation, please use "Detected torque" in the waveform monitor of "MEXE02".

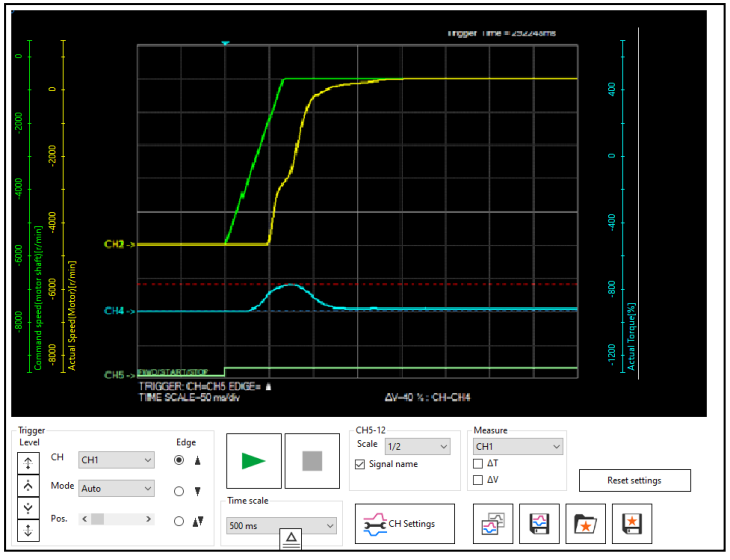
Overload alarm (30)

Example: BLE2 Series

Status monitor

1-1	Command speed(motor shaft)	0 [r/min]
1-2	Command speed(gearhead shaft)	0 [r/min]
1-3	Actual Speed(Motor)	0 [r/min]
1-4	Actual Speed(Gear)	0 [r/min]
1-5	Inverter voltage	0,0 [V]
1-6	Elapsed time from boot	0 [ms]
1-7	Load Factor	5 [%]
1-8	Driver Temperature	0,0 [°C]

Waveform monitor



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- Overload (30)
- Overvoltage (22)
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- Overspeed (31)
- Regenerative resistance overheat (51)
- Initial operation prohibited (46)
- Overcurrent (20)

Cause

This alarm occurs when the internal voltage value detected by the driver exceeds the threshold value. The cause may be that the input voltage value exceeds the specification range or the internal voltage rises due to regenerative power.

Checklist

(1) Is the input voltage within the specification range?
(2) Improve by extending the acceleration/deceleration time?
3) Reduce inertia load to improve?
(4) Lower the operation speed to see if it improves.
(5) If you are using it to turn the output shaft from the outside, review the usage itself.
(6) Attach a regenerative resistor (available only for compatible series)*.

* Connect a regenerative resistor when regenerating continuously, such as in lifting and lowering operations or winding applications.

Checking the internal voltage with MEXE02

If the following series can be connected to the MEXE02 the internal voltage value of the driver can be checked from the status monitor or waveform monitor. (The internal voltage monitor name differs depending on the series. Please confirm it in the operating manual.)

BLE2 Series, BLH Series digital setting type, BLH Series RS-485 communication, BLV Series

Internal voltage of AC input (standard)

The internal voltage of the AC input type driver is calculated by the following method based on the power supply input voltage.

For 100 V type: Power input x 2 x $\sqrt{2}$

For 200 V type: Power input x $\sqrt{2}$

Example: The internal voltage value when the rated voltage is input to 100 V and 200 V types respectively is as follows.

For 100 V type: 100 x 2 x $\sqrt{2}$ = ca. 283 V

For 200 V type: 200 x $\sqrt{2}$ = ca. 283 V

When checking the voltage change due to regeneration, it is recommended to use a waveform monitor that can be checked in time.

Check the contents of the alarm that is occurring. The number in parentheses ( ) is the alarm code.

- Overload (30)
- Overvoltage (22)
- Sensor error (28)
- Initial sensor error (42)
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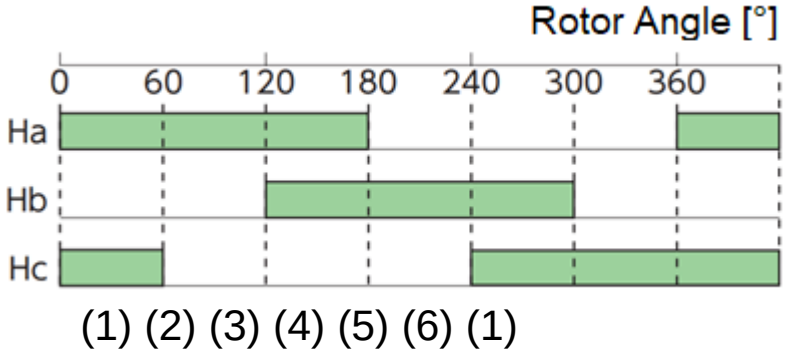
- Regenerative resistance overheat (51)
- Initial operation prohibited (46)
- Overcurrent (20)

Cause

This error occurs when the feedback information of the Hall IC is in an abnormal state. (Abnormal state: Hall IC HA, HB and HC are all ON or all OFF)
If the Hall IC is normal, one of the following six patterns will occur depending on the position of the rotor. (There is no section where all Hall ICs are either all ON or all OFF.)



The cause of all Hall ICs being turned ON or OFF is assumed to be the following.

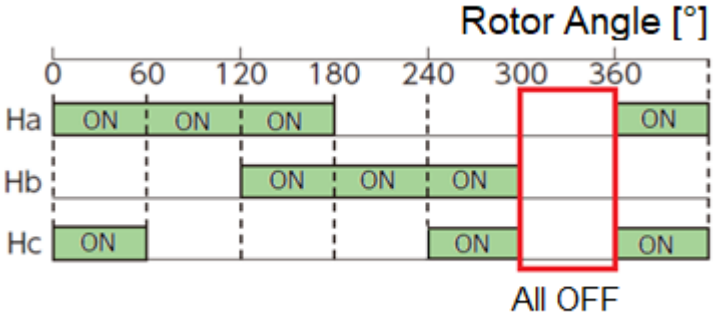
- Malfunction of Hall IC by noise
- Pseudo disconnection of sensor cable
- Disconnection of sensor cable
- Damage to Hall IC

Checklist

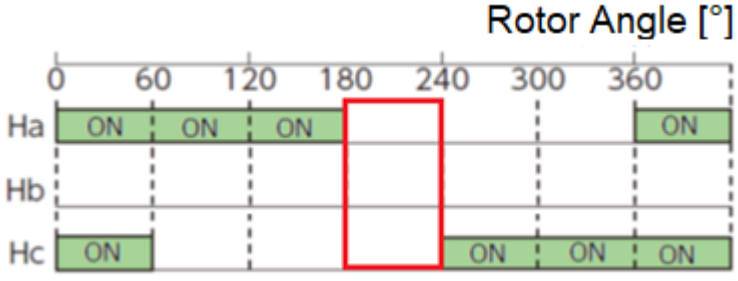
(1) Replace the cable to see if it improves (sensor line is not pseudo broken).
(2) If the extension distance is long, will it improve if it is shortened?
(If it improves, the cable may be pseudo-interrupted in the middle or malfunctioning due to noise.)
(3) If you made the cable yourself, are there any problems with the wiring (such as misplaced wires)?

Examples of Hall IC at abnormal condition

Example: When the cable is pseudo-interrupted

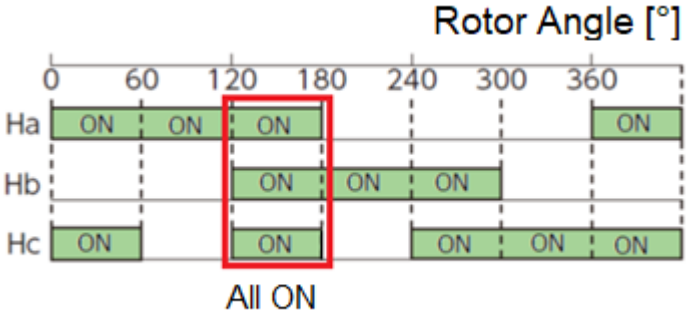


Example: Hall IC failure, cable disconnetcion, etc.

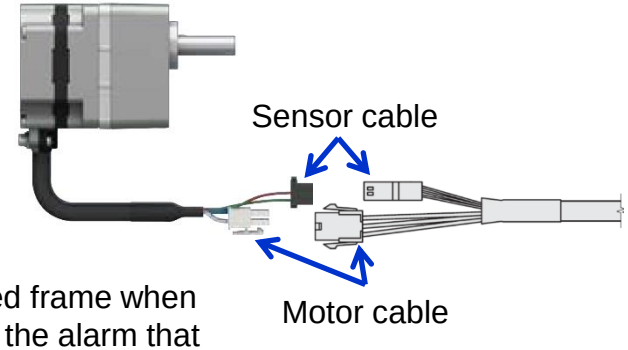


HB is always OFF. Also, there is a possibility of abnormalities in movement outside the red frame.

Example: Malfunction due to noice, etc.



Example: In the case of BLM motors (cable type)



If the sensor is in the red frame when the power is turned on, the alarm that occurs is an initial sensor error.

Check the contents of the alarm that is occurring. The number in parentheses ( ) is the alarm code.

- Overload (30)
- Overvoltage (22)
- Sensor error (28)
- Initial sensor error (42)
- Overspeed (31)
- Regenerative resistance overheat (51)
- Initial operation prohibited (46)
- Overcurrent (20)

Cause

This alarm occurs when the hall IC is in an abnormal state when the driver power is turned ON.
(Abnormal state: Hall IC HA, HB and HC are all ON or all OFF)
The cause of all Hall ICs being turned ON or OFF is assumed to be the following.
- Forgetting to connect the sensor cable
- Pseudo disconnection of sensor cable
- Disconnection of sensor cable
- Damage to Hall IC

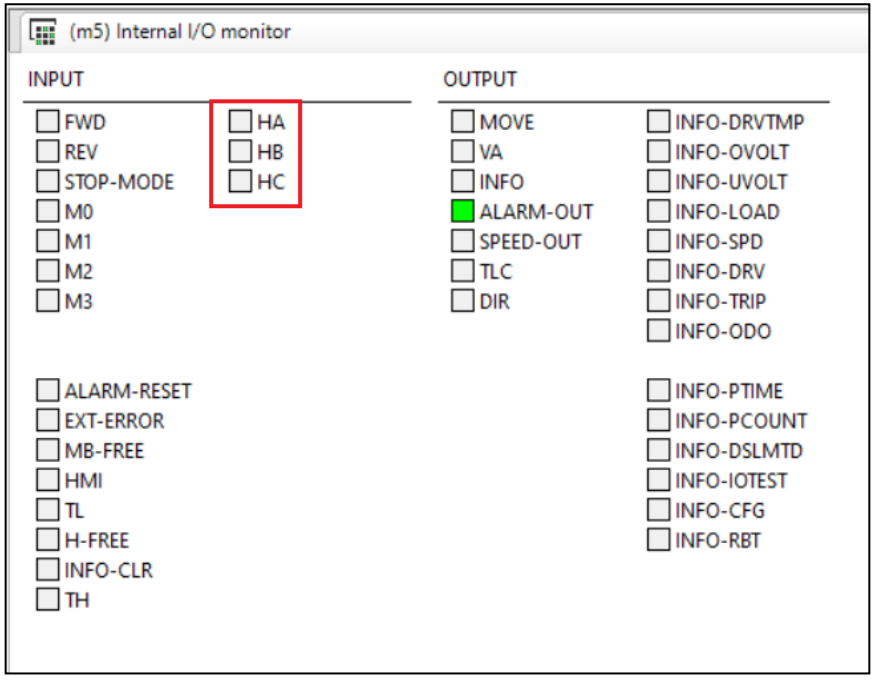
Checklist

(1) Are the sensor cables connected to the driver and motor respectively?
(2) Check the sensor cable for disconnection (check the resistance values at both ends of the cable with a tester, and confirm that there is continuity).
(3) Does the problem improve when the extension cable is shortened? (If the problem improves, the cable may be broken in the middle.
(4) If you made the cable yourself, are there any problems with the wiring (are there any misplaced wires, etc.)?

Checking the Hall IC status with MEXE02

You can check the status of each Hall IC (HA, HB, HC) with the internal I/O monitor of MEXE02 in the following series: BLE2 Series, BLH Series digital setting type, BLH Series RS-485 communication type, BLV Series.

Example: BLE2 Series



Display in green colour: active status
Display in white colour: inactive status

Confirmation of abnormal line

Check the Hall IC status by turning the motor shaft one revolution from the outside. If there is a Hall IC that does not light up even once during one rotation of the motor, then the line is most likely damaged (cable or motor).

When checking, please turn as slowly as possible.
If the speed of rotation is too fast, it is easy to miss the light (especially if the geared type is used).

Please note that the above method is only for identifying the damaged part, so there is no need to force it.
In the case of a cable, it is possible to fix it by repairing the broken part, but if the Hall IC inside the motor is damaged, it cannot be repaired by the customer.

Check the contents of the alarm that is occurring. The number in parentheses ( ) is the alarm code.

- Overload (30)
- Overvoltage (22)
- Sensor error (28)
- Initial sensor error (42)
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- Regenerative resistance overheat (51)
- Initial operation prohibited (46)
- Overcurrent (20)

Cause

The alarm occurs when the detection speed exceeds the alarm threshold (threshold varies by series). Some of the causes of exceeding the threshold are as follows:

- Abnormal sensor line
- It's being forced around by external forces
- Started with a large inertial load attached (overshoot)

Checklist

(1) Checking the sensor line

The brushless motor detects the speed based on the feedback information from the Hall IC. Therefore, if noise is introduced into the Hall IC feedback signal or the cable is about to be disconnected, the speed information can go wrong and be misinterpreted as faster than it actually is. Please refer to the next page for details of the confirmation.

(2) Confirmation of the timing of occurrence

Check when the alarm is triggered. Does it occur when the workpiece is manually pushed or when it is lowered by vertical movement, or does it occur during acceleration?

(1) Checking the sensor line

1) Does it improve by replacing the cable?
If the cable is completely disconnected, a sensor error system will occur. If it improves, there is most likely a problem with the cable.

2) If the extension distance is long, can it be improved by shortening the cable?
If the problem is improved by shortening the cable, it may be either a problem with the cable itself or a malfunction caused by noise.

3) Noise suppression and improvement?
It is the influence by the noise when it is improved by the noise countermeasure.
(Move the sensor line away from the power line, add a ferrite core to the sensor/power line, install an FG line, etc.)

(2) Confirmation of the timing of occurrence

1) When the alarm occurs when the workpiece is manually pushed or when the workpiece is lowered in vertical motion.

There are no measures that can be taken by the driver alone. It may be improved by lowering the deceleration ratio, but basically you should review the way you use the driver.

When pushing the driver by hand in an emergency, disconnect both the power wire and sensor wire while shutting off the driver's power supply.

2) When it occurs at the start of operation

This may be caused by overshooting at startup. Change the operating conditions and see if the problem improves.

(Increase acceleration time, reduce inertia, etc.)

It may also be improved by increasing the gear reduction ratio or output.

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- Overspeed (31)
- Regenerative resistance overheat (51)
- Initial operation prohibited (46)
- Overcurrent (20)

Cause

It occurs when the thermostat output (TH input) of the regenerative resistor is in the OFF state. The thermostat output turns OFF when the regenerative resistance reaches the specified temperature. Other than that, it may also be caused by wiring error of thermostat output or timing of power on.

Checklist

Use one of the following methods to check the status of the TH input. For details on the confirmation method, refer to the operating manual.

- Operation panel monitor screen
- Operation panel test screen
- D-I/O monitor of MEXE02
- Internal I/O monitor of MEXE02

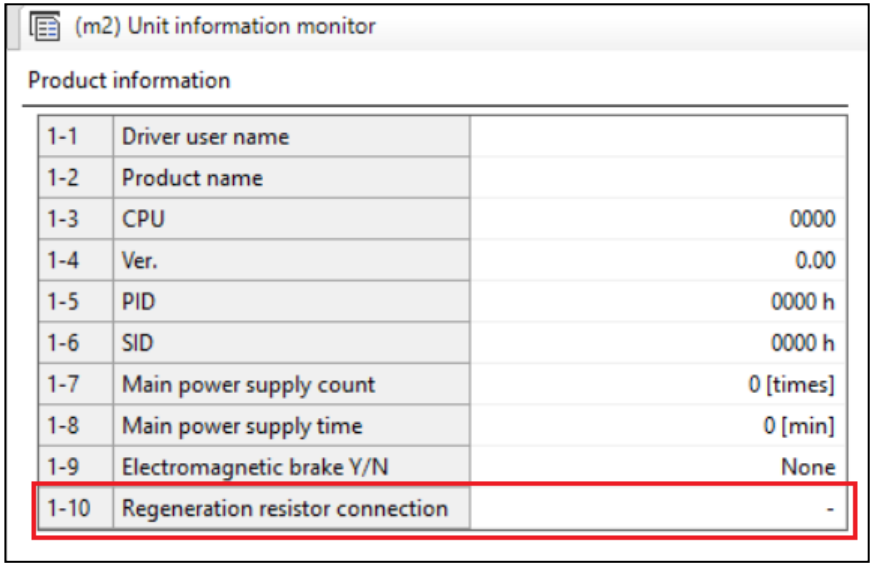
If the TH input is turned OFF, the regenerative resistor may be generating heat abnormally. In that case, review the operating conditions, load conditions, heat sink size, etc. The thermostat output returns when the temperature of the regenerative resistor drops to the specified temperature or below. If the problem is not caused by the heat generated by the regenerative resistor, check the contents on the next and subsequent pages.

(1) When the regenerative resistor is not used

1) Check that pins 10-11 of the input/output signal connector (CN5) are in the released state.

2) Perform initialization (reset to the factory default settings) from the operation panel or MEXE02.

If Pin 10-11 of CN5 is short-circuited by mistake, it enters the regenerative resistor use mode. The mode can be checked from the unit information monitor of MEXE02.



(2) When using the regenerative resistor

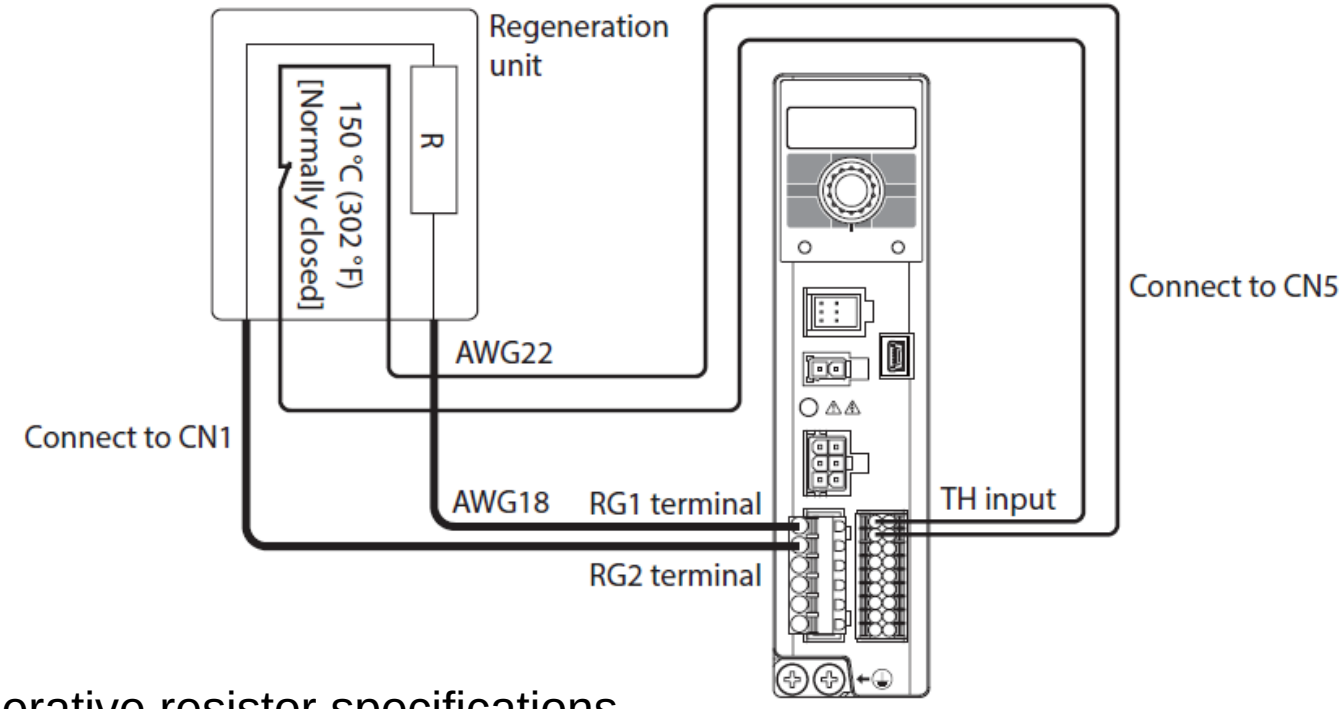
Short-circuit pins 10-11 of the I/O signal connector (CN5) with a lead wire or the like and turn on the driver power.

If improved: The thermostat output cable may be disconnected or poorly connected.

If there is no improvement: The driver may be corrupted. Please contact our Customer Service Center.

Wiring the regenerative resistor

In the BLE2 Series, regardless of the connection method, connect the thermostat outputs to pins 10-11 of CN5 respectively.



Regenerative resistor specifications

Model	Continuous regenerative power	Instantaneous regenerative power	Resistance value	Thermostat operating temperature
RGB100	70 W	720 W	150 Ω	Operation: Opens at 150±7 °C (302±13 °F) Reset: Closes at 145±12 °C (293±22 °F) [normally closed]

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- Regenerative resistance overheat (51)
- Initial operation prohibited (46)
- Overcurrent (20)

Initial operation prohibited alarm (46)

Cause
This alarm occurs when the power is turned on while the operation input signal is ON

Checklist
Check when the alarm is triggered.
Check if the alarm occurs when the power is turned on or during operation.

(1) When the alarm occurs at power-on

1) There is a possibility that the operation signal is turned ON when the power is turned ON.
Check the upper program (ladder, etc.) and consider delaying the timing for turning the operation signal ON.

2) There is a possibility that the operation signal is always in the ON state.
Check the wiring of the operation signal again.

3) You want to drive the motor when the power is turned on.
Change the parameters so that the initial operation prohibited alarm is disabled.
Please refer to the operating manual of each series for the change method.

(2) When it occurs during operation

The power supply may have been momentarily turned off due to insufficient power supply capacity or regenerative power.
This may occur especially in the case of DC input products.
Check the capacity of the power supply or breaker and the input current of the driver being used.

Check the contents of the alarm that is occurring. The number in parentheses ( ) is the alarm code.

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- Overcurrent (20)

Cause

This occurs when an excessive current flows. The probable causes are as follows.

- The motor, driver or connecting cable is damaged (short circuit, ground fault)
- Hit-and-run operation
- Effect of external noise

Checklist

Because once an overcurrent alarm occurs, it may break other parts of the system.
It is recommended that all motors, drivers and complete sets of connecting cables be inspected and replaced.

When checking a damaged part, shut off the power supply and check it with sufficient attention to safety.
Please refer to the next page for confirmation details.

1) Is the cable broken internally and is there a short circuit?
Check the resistance between the lines of U-V-W respectively, and make sure that there is no short circuit (purple-gray, blue-gray, purple-blue).
If the cable is broken, please review the usage and fixing method, and consider adopting a flexible cable.

2) Is the motor damaged?
Check the resistance between the phases of U-V-W respectively and make sure that there is no short circuit (purple-gray, blue-gray, purple-blue).

3) Is there any continuity between the motor wire and FG wire, or between the motor wire and the motor surface?
If there is continuity, it is an abnormal condition, so please try to replace it and identify the relevant part.

4) Check the surrounding environment (i.e., is it not an environment subject to splashing water or oil, dust, steam, chemicals, etc.)
If the problem is caused by the surrounding environment, it may occur again even after replacement. Please take measures such as installation environment and cover to prevent water from splashing.

5) If you have made or modified the cable yourself, check that there is no mistake in the connection point.

6) If the cable extension distance is long, improve it by shortening the extension distance or

7) If you are hitting the target, review your usage.

8) If FG or PE processing is not used, ground it or take noise countermeasures to improve it.

In the case of DC input products, since the resistance of the motor is low and it is difficult to measure and judge abnormality, please check the continuity of the cable only.

Contact us

Please feel free to contact us with any questions you may have about motors, how to select a product, delivery times, prices, orders, etc.

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