LXM32

Explanation for detected error
E 733F

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications.

It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein.

If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed. Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results. Failure to observe this information can result in injury or equipment damage.

Table of Contents

Introduction

1

Overview

This chapter gives the introduction and provides important safety information. The present document is not a substitute for the product documentation, but is instead intended to provide a more detailed explanation of certain aspects of the product concerned.

Contents of this chapter

This chapter contains the following topics:

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material. A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved. Failure to observe this information can result in injury or equipment damage.

Before You Begin

General

The products specified in this document have been tested under actual service conditions. Of course, your specific application requirements may be different from those assumed for this and any related examples described herein. In that case, you will have to adapt the information provided in this and other related documents to your particular needs. To do so, you will need to consult the specific product documentation of the hardware and/or software components that you may add or substitute for any examples specified in this documentation. Pay particular attention and conform to any safety information, different electrical requirements and normative standards that would apply to your adaptation.

⚠ WARNING

REGULATORY INCOMPATIBILITY

Be sure that all equipment applied and systems designed comply with all applicable local, regional and national regulations and standards

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The use and application of the information contained herein require expertise in the design and programming of automated control systems. Only the user or integrator can be aware of all the conditions and factors present during installation and setup, operation, and maintenance of the machine or process, and can therefore determine the automation and associated equipment and the related safeties and interlocks which can be effectively and properly used. When selecting automation and control equipment, and any other related equipment or software, for a particular application, the user or integrator must also consider any applicable local, regional or national standards and/or regulations.

Some of the major software functions and/or hardware components used in the proposed architectures and examples described in this document cannot be substituted without significantly compromising the performance of your application. Further, any such substitutions or alterations may completely invalidate any proposed architectures, descriptions, examples, instructions, wiring diagrams and/or compatibilities between the various hardware components and software functions specified herein and in related documentation. You must be aware of the consequences of any modifications, additions or substitutions.

A residual risk, as defined by EN/ISO 12100-1, Article 5, will remain if
- it is necessary to modify the recommended logic and if the added or modified components are not properly integrated in the control circuit.
- you do not follow the required standards applicable to the operation of the machine, or if the adjustments to and the maintenance of the machine are not properly made (it is essential to strictly follow the prescribed machine maintenance schedule).
- the devices connected to any safety outputs do not have mechanically-linked contacts.

⚠ CAUTION

EQUIPMENT INCOMPATIBILITY

Read and thoroughly understand all device and software documentation before attempting any component substitutions or other changes related to the application examples provided in the document

Failure to follow these instructions can result in injury, or equipment damage.

Start-Up and Test

Before using electrical control and automation equipment after design and installation, the application and associated functional safety system must be subjected to a start-up test by qualified personnel to verify correct operation of the equipment. It is important that arrangements for such testing be made and that enough time is allowed to perform complete and satisfactory testing.

⚠ CAUTION

EQUIPMENT OPERATION HAZARD

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices
- Remove tools, meters, and debris from equipment.

Failure to follow these instructions can result in injury, or equipment damage.

Verify that the completed system, including the functional safety system, is free from all short circuits and grounds, except those grounds installed according to local regulations. If high-potential voltage testing is necessary, follow the recommendations in equipment documentation to help prevent injury or equipment damage.

Operations and Adjustments

General

Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly installed and operated.
In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the hands and other parts of the body are free to enter the pinch points or other hazardous areas where serious injury can occur. Software products alone cannot protect an operator from injury. For this reason, the software cannot be substituted for or take the place of point-of-operation protection.

⚠ WARNING

UNGUARDED MACHINERY CAN CAUSE SERIOUS INJURY

- Do not use this software and related automation equipment on equipment which does not have point-of -operation protection.
- Do not reach into machinery during operation.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Ensure that appropriate safeties and mechanical/electrical interlocks related to point-of-operation protection have been installed and are operational before placing the equipment into service. All interlocks and safeties related to point-of-operation protection must be coordinated with the related automation equipment and software programming.

NOTE: Coordination of safeties and mechanical/electrical interlocks for point-ofoperation protection is outside the scope of the examples and implementations suggested herein. It is sometimes possible to adjust the equipment incorrectly and this produce unsatisfactory or unsafe operation. Always use the manufacturer instructions as a guide to functional adjustments. Personnel who have access to these adjustments must be familiar with the equipment manufacturer instructions and the machinery used with the electrical equipment. Only those operational adjustments actually required by the machine operator should be accessible to the operator. Access to other controls should be restricted to help prevent unauthorized changes in operating characteristics.

Lexium 32: Explanation for detected error E 733F

2

There are many questions around the error E 733F coming to the Expert support department. This present document attempts to explain the detected error and suggests what can be done to find the external root cause.

General explanation

E 733F	3	Amplitude of encoder analog signals too low Parameter `_SigLatched` Bit 16	Incorrect encoder wiring. Encoder not connected. Encoder signals subject to EMC interference (shield connection, cabling, etc.).	

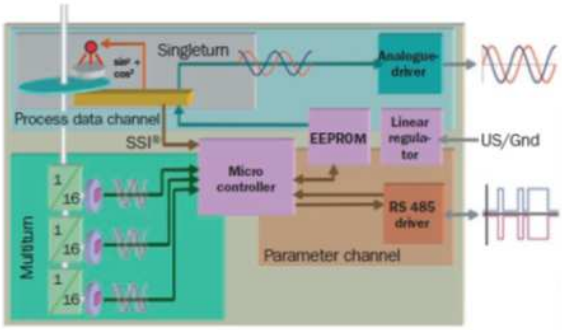
Hiperface® encoder

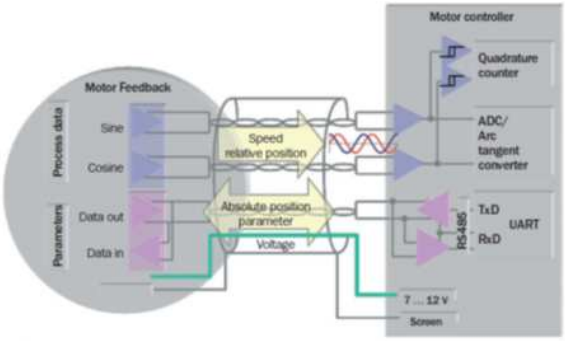
BSH and BMH motors are using Hiperface® encoders. This encoder technology uses digital and analogue signals. For the detection of Speed and relative position an analogue signal is used.

Motor technologies

Servo motors - Hiperface® encoder

- Developed from SICK STEGMANN
- Mixture of incremental and absolute encoder
- Speed and Relative position by analogue signal
- Absolute position and parameter exchange via RS485
- Electronic type plate in EEPROM
- 8 wires
- Used in Lexium32





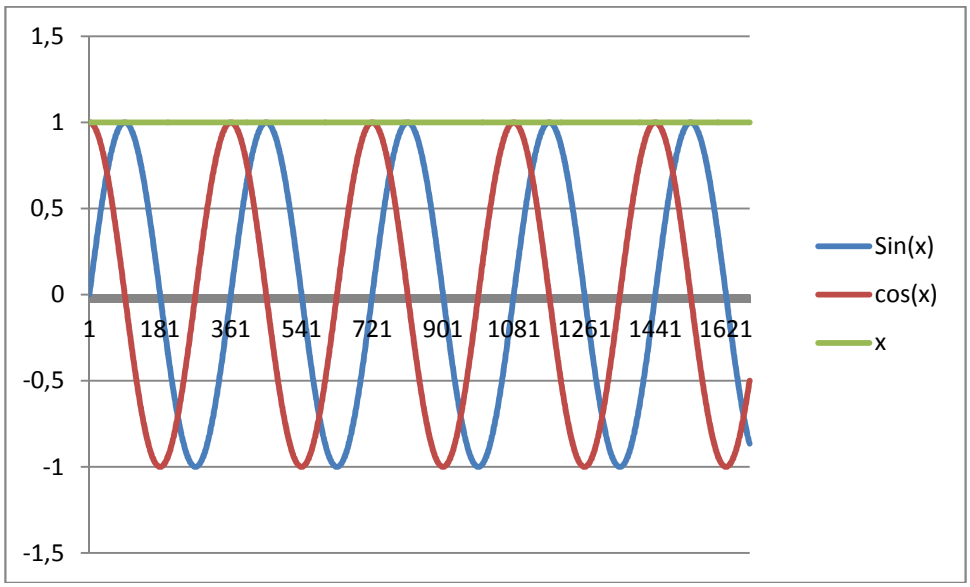
The analogue signal is comprised of a sine and cosine waves. The speed can be calculated by the frequency of the oscillation. The single-turn position (angle) can be calculated by the arctangents of sine and cosine waves.

Algorithm for detected error E 733F

The analogue signals are measured in the 62.5 µs – Task in Lexium32. The monitoring of E 733F is handled in the 1ms – task. Therefore, each 16th period is taken into account ($16 \cdot 62{,}5$ µs = 1 ms). The Lexium32 makes its calculation based on the following formula:

$$x = \sqrt{\sin^2(u) + cos^2(u)} \qquad (1)$$

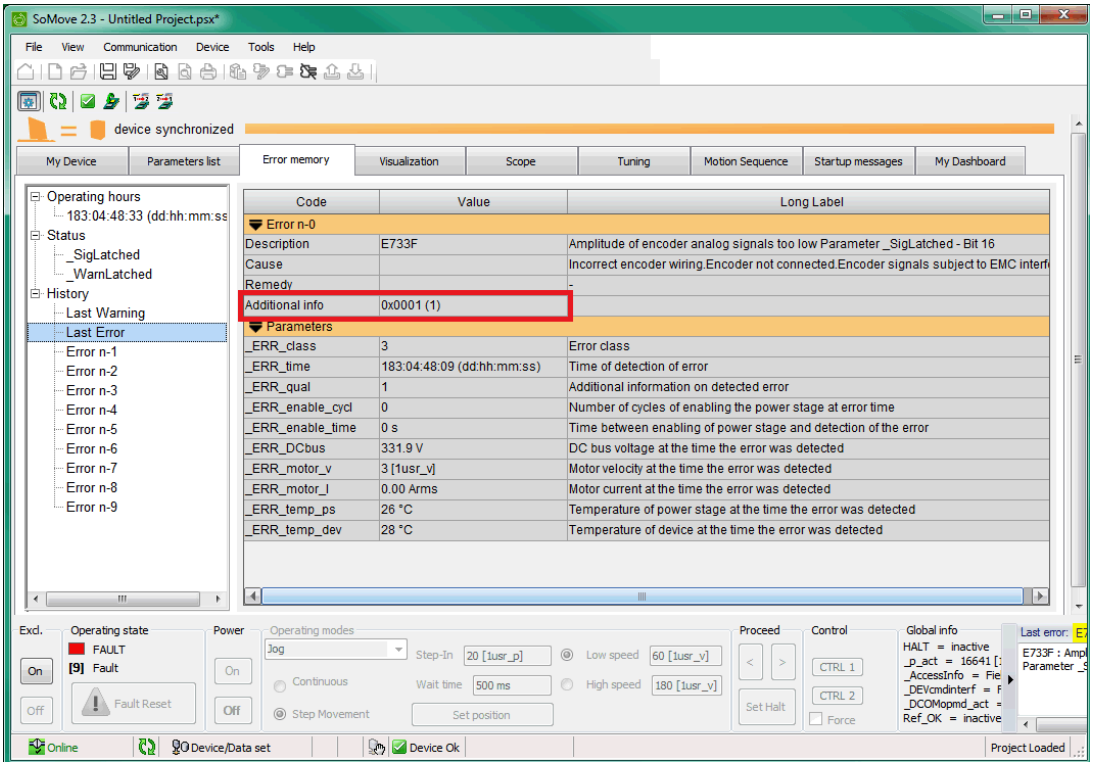
If both sine and cosine are correct, the amplitude of x is equal 1.



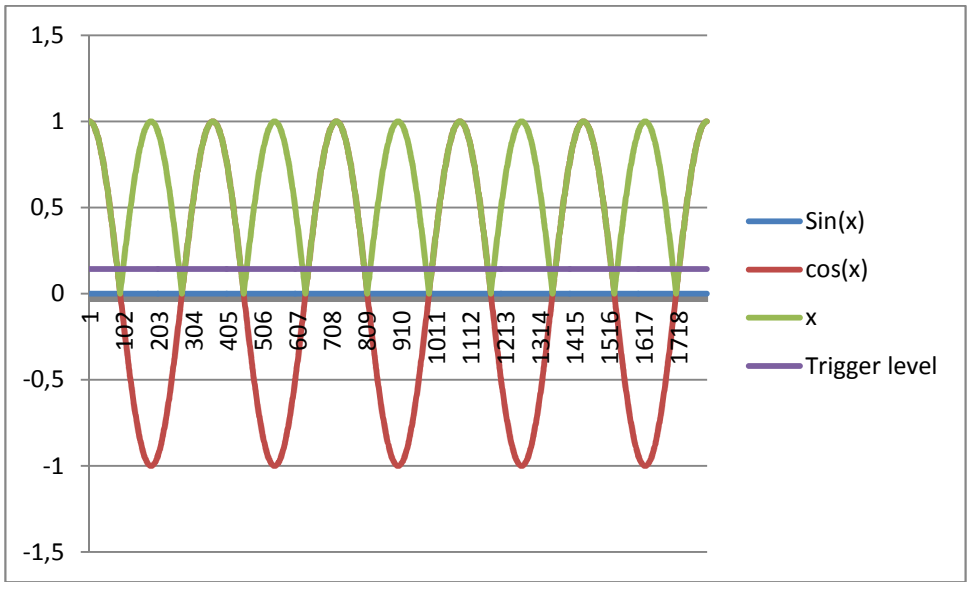
The error E 733F is detected if one of the following two conditions is true:

1. The amplitude x is below 1/7 of the nominal value of 1 V, or approximately 143 mV.
2. For 4 cycles (4 ms) the Amplitude is below ¼ of the nominal value of 1 V or 250 mV.

Therefore, the detection is only active when the motor is turning.

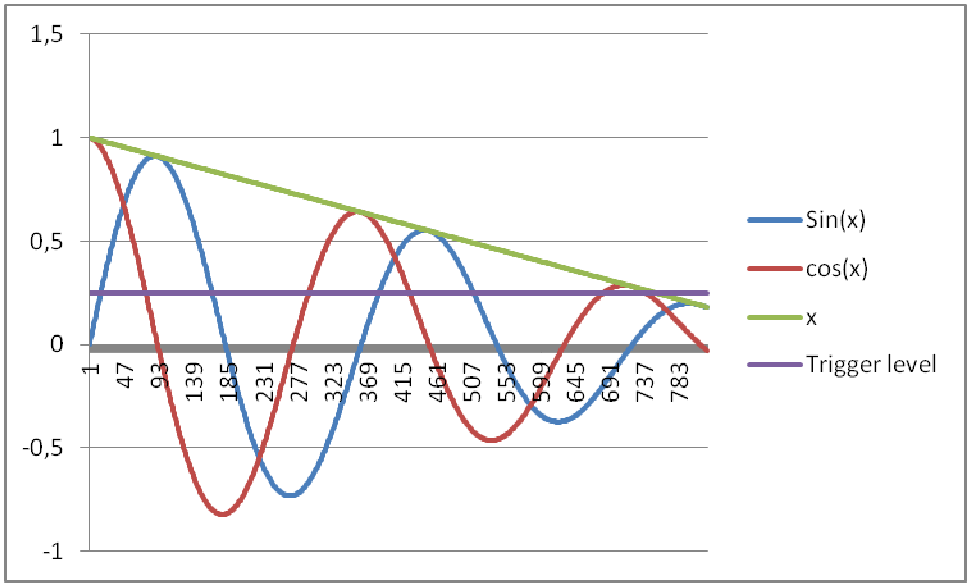


Example 1: sinus wave is missing (broken wire)



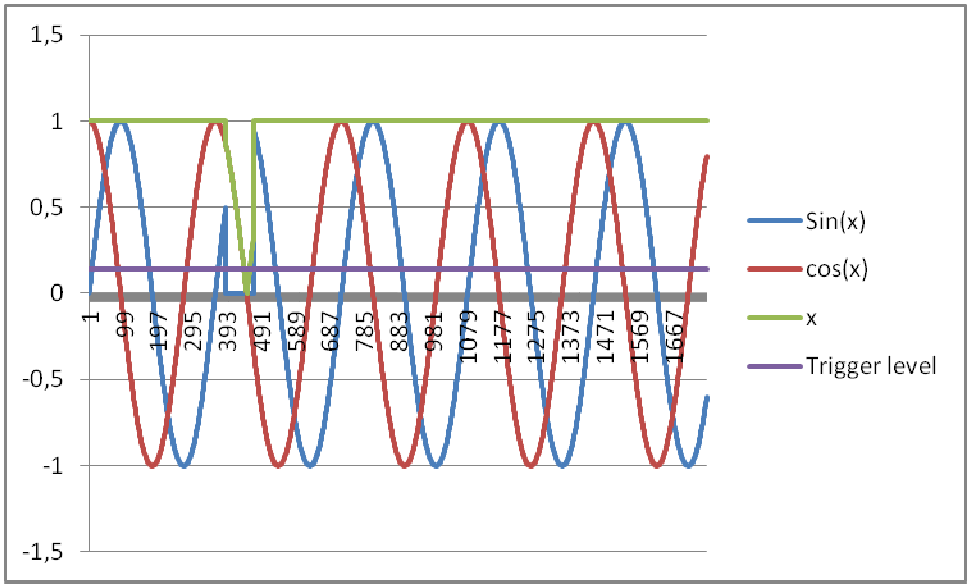
In the case above, error E 733F with additional info 1 is detected when x is less than 143 mV.

Example 2: floating signals



In the case above, error E 733F with additional info 2 is detected when x is less than 250 mV for 4 cycles.

Example 3: EMC disturbance



In the case above, error E 733F with additional info 1 detected when x is less than 143 mV in the on-going cycle.

Typical issues that provoke the detection of E 733F

The first question to answer is how frequent is the error as an indication of the possible cause. It is important to determine if the detection is constant and frequent, or whether the detection is sporadic.

If it is a frequent, consistent error, it is likely linked to a hardware problem. In that case, the strategy is to trouble-shoot the different components (cable, motor, LXM32).

Also very important is to verify whether there are other errors possibly associated with the detection of E 733F by analyzing the error memory in LXM32. There may be other encoder errors around, e.g., E5200 or error numbers E 73xx (see below). These additional detected errors (with additional information) can help you to find the root cause of the problem.

If, for example, the data lines are interrupted after applying power, there will be E7331 and E5200:

Last Error	E7331 : System error detected: Motor encoder initialization
Error n-1	E5200 : Error detected at connection to motor encoder

If the data lines are interrupted when drive is in RDY or RUN there is error E73211:

Error n-0		
Description	E7321	Timeout reading the absolute position from the encoder
Cause		Communication channel (Hiperface) to encoder is subject to interference or motor encoder is inoperative.
Remedy		Verify wiring and shield connection of encoder cable or replace motor.

Also there can be advisories or alerts around the errors.
NOTE: Advisories and alerts are not saved in the error memory.

Last warning		
Description	E7343	Absolute position is different from incremental position
Cause		- Encoder is subject to EMC interference.- Motor encoder is inoperative.
Remedy		Verify wiring and shield connection of encoder cable, replace motor.

Error number	Error class	Description	Cause	Correctives
E 7320	4	System error: Invalid encoder parameter Parameter _SigLatched Bit 16	Communication channel (Hiperface) to encoder is subject to interference, motor encoder has not been factory-parameterized.	Contact Technical Support.
E 7321	3	Timeout reading the absolute position from the encoder Parameter _SigLatched Bit 16	Communication channel (Hiperface) to encoder is subject to interference or motor encoder is inoperative.	Check wiring and shield connection of encoder cable or replace motor.
E 7327	0	Error bit set in Hiperface answer Parameter _WarnLatched Bit 16	EMC problems.	Check wiring (shield).
E 7328	4	Motor encoder: Position evaluation error Parameter _SigLatched Bit 16	Position evaluation problem detected by encoder.	Contact Technical Support or replace the motor.
E 7329	0	Motor encoder: Warning Parameter _WarnLatched Bit 16	EMC, encoder signals internal warning.	Contact Technical Support or replace the motor.
E 7330	4	System error: Motor encoder (Hiperface) Parameter _SigLatched Bit 16		Check wiring and shield connection of encoder cable. Contact Technical Support.
E 7331	4	System error: Motor encoder initialization Parameter _SigLatched Bit 30		Check wiring and shield connection of encoder cable. Contact Technical Support.
E 7335	0	Communication with motor encoder active Parameter _WarnLatched Bit 16	Command is being processed or communication may be disturbed by EMC problems.	Check shield connection of encoder cable. Contact Technical Support.
E 733F	3	Amplitude of encoder analog signals too low Parameter _SigLatched Bit 16	Incorrect encoder wiring. Encoder not connected. Encoder signals subject to EMC interference (shield connection, cabling, etc.).	
E 7340	3	Reading of absolute position aborted, number of unsuccessful consecutive attempts too great Parameter _SigLatched Bit 16	Communication channel (Hiperface) to encoder is subject to interference. Encoder (in motor) is inoperative.	Check wiring and shield connection of encoder cable, replace motor.
E 7341	0	Encoder temperature warning level reached Parameter _WarnLatched Bit 16	The maximum permissible duty cycle is exceeded. The motor was not mounted properly, for example, it is thermally isolated. The motor is blocked or damaged so that more current is used than under normal conditions. The ambient temperature is too high.	Reduce the duty cycle, for example, reduce acceleration. Supply additional cooling, for example, use a fan. Mount the motor in such a way as to increase thermal conductivity. Use a differently rated drive or motor. Replace the motor if it is damaged.

Error number	Error class	Description	Cause	Correctives
E 7342	2	Encoder temperature limit reached Parameter _SigLatched Bit 16	The maximum permissible duty cycle is exceeded. The motor was not mounted properly, for example, it is thermally isolated. The motor is blocked or damaged so that more current is used than under normal conditions. The ambient temperature is too high.	Reduce the duty cycle, for example, reduce acceleration. Supply additional cooling, for example, use a fan. Mount the motor in such a way as to increase thermal conductivity. Use a differently rated drive or motor. Replace the motor if it is damaged.
E 7343	0	Warning: Absolute position is different from incremental position Parameter _WarnLatched Bit 16	- Encoder is subject to EMC interference. - Motor encoder is inoperative.	Check wiring and shield connection of encoder cable, replace motor.
E 7344	3	Absolute position is different from incremental position Parameter _SigLatched Bit 16	- Encoder is subject to EMC interference. - Motor encoder is inoperative.	Check wiring and shield connection of encoder cable, replace motor.
E 7345	0	Amplitude of analog signals too high, limit of AD conversion exceeded	Encoder signals subject to EMC interference (shield connection, cabling, etc.). Encoder inoperative.	Check cabling and shield connection. Replace encoder.
E 7346	4	System error: Encoder not ready Parameter _SigLatched Bit 16		Check wiring and shield connection of encoder cable. Contact Technical Support.
E 7347	0	System error: Position initialization not possible	Analog and digital encoder signals subject to massive interference.	Reduce encoder signal interference, check shield connection, etc. Contact Technical Support.
E 7348	3	Timeout reading encoder temperature Parameter _SigLatched Bit 16	Encoder without temperature sensor	Check wiring and shield connection of encoder cable. Contact Technical Support.
E 7349	0	Discrepancy between absolute and analog encoder phases	Analog encoder signals are subject to interference. Encoder inoperative.	Check wiring and shield connection of encoder cable. Replace motor. Contact Technical Support.
E 734A	3	Amplitude of analog signals from encoder too high, signals are clipped Parameter _SigLatched Bit 16	Incorrect encoder wiring. Encoder hardware interface inoperative.	
E 734B	0	Signal position evaluation of analog encoder inoperative Parameter _WarnLatched Bit 16	Incorrect encoder wiring. Encoder hardware interface inoperative.	
E 734C	3	Error with quasi absolute position Parameter _SigLatched Bit 16	The motor shaft may have been moved while the drive was shut down. A quasi absolute position has been detected that is not within the permissible motor shaft deviation range.	If the quasi absolute function is active, only shut down the drive if the motor is at a standstill and do not move the motor shaft when the drive is off.
E 734D	0	Index pulse is not available for the encoder Parameter _WarnLatched Bit 16		

Encoder not connected correctly

Issue: The lock of the encoder connector is not fixed.

Action: Verify if the encoder connector is fixed correctly.

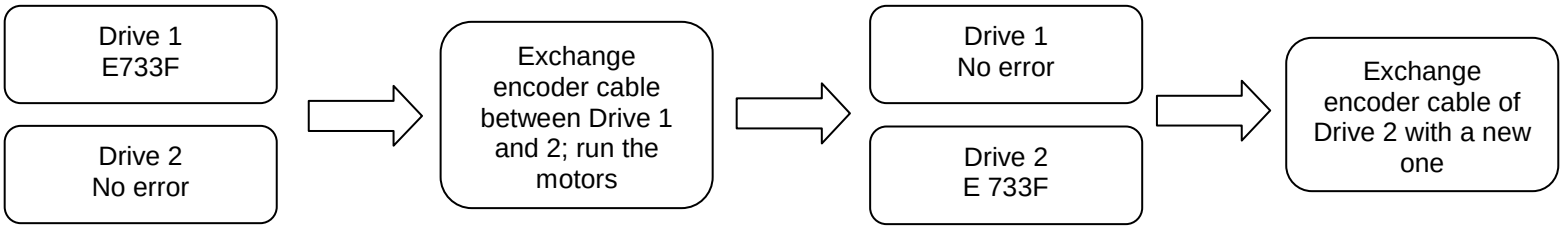
Connecting the motor encoder

- Verify that wiring, cables and connected interface meet the PELV requirements.
- Note the EMC requirements for encoder cables, page 62. Use equipotential bonding conductors for equipotential bonding.
- Connect the connector to CN3 Encoder-1.
- Verify that the connector locks snap in properly at the housing.

Broken wires

Issue: Some wires inside the encoder cable are broken and possibly making intermittent contact.
Typically, E 733F with additional info 1 is detected.

Action: Verify if the cable shows any visible signs of damage.
If possible do a crosscheck (see below). Take care that the motor shaft has to be turned (either in RUN automatically or in DIS manually)!



Determine if the bending radius of encoder cable is according the specification:

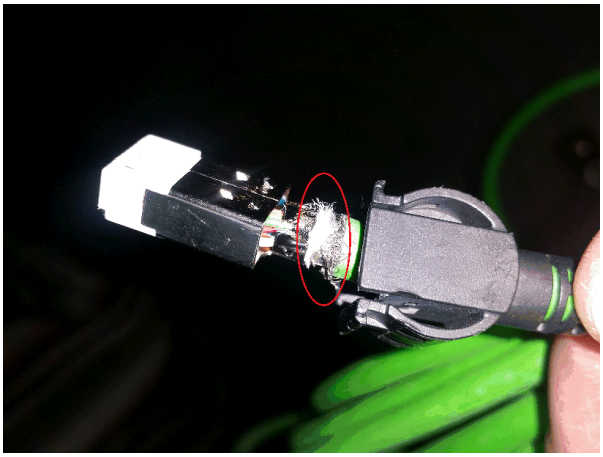
Motor cable and encoder cable

Motor cables		Style 20234
Motor cable outside diameter	mm	VW3M5•01: 12 ±0.2 VW3M5•02: 14 ±0.3 VW3M5•03: 16.3 ±0.3 VW3M5•05: 19 ±0.3 VW3M5•04: 23.5 ±0.3
Permissible voltage motor cable	Vac	600 (UL and CSA)
Encoder cables		Style 20233
Encoder cable outside diameter	mm	VW3M8••2: 6.8 ±0.2
Temperature range	°C	-40 ... 90 (fixed) -20 ... 80 (moving)
Permissible bend radius		4 x diameter (fixed) 7.5 x diameter (moving)
Cable jacket		Oil-resistant PUR
Shielding		Shield braiding
Shield braiding coverage	%	≥85

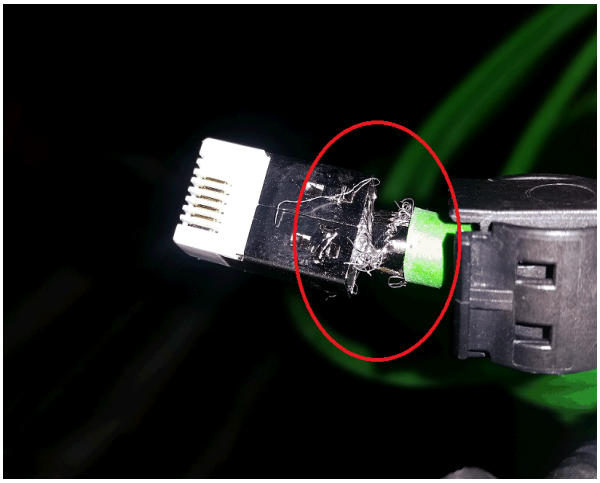
The motor cables and encoder cables are suitable for drag chain applications; they are available in various lengths. See page 657 for the versions available as accessories.

Damaged encoder connector drive side

Issue: Cable shield was not connected to RJ 45 connector. In case the shield is not, or is incorrectly, connected, the black housing can easily be moved.



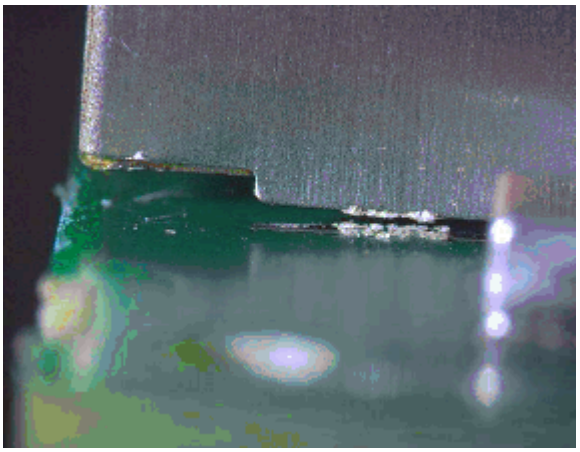
Shield not connected



Shield connected

Action: Damaged or inadequate cables need to be replaced.

Issue: The encoder connector CN3 has been broken internally.



Action: To avoid this type of issue it is very important that there are no external forces or vibrations on the encoder cable and connector in the cabinet. RJ45 must be handled carefully during the wiring of the machine.

NOTE: With few exceptions, there are no other user-serviceable parts within the Lexium 32. Either replace the component or contact Schneider Electric.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not attempt to repair this equipment outside of authorized Schneider Electric service centers.
- Only use software and hardware components approved by Schneider Electric for use with this equipment.
- Update your application program every time you change the physical hardware configuration.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Route the cables from the motor and the encoder to the device (start at the motor). Due to the pre-assembled connectors, this direction is often faster and easier.

Damaged encoder connector motor side

Issue: Some pins of the encoder connector have been pushed in. This can happen if the encoder connector is not mounted correctly. Typical scenario is if the connector is not oriented correctly and forcefully screwed down.

Action: Verify alignment of the connectors. Hand tighten the connectors; do not use tools. Check if the pins are still in place on the motor connector.

Shock

Issue: High mechanical shocks can also provoke detection of the E 733F error. The maximum values for shock are provided in the manual:

Vibration and shock BMH070 ... 190

Vibration, sinusoidal	Type test with 10 runs as per IEC 60068-2-6 0.15 mm (von 10 Hz ... 60 Hz) 20 m/s² (from 60 Hz ... 500 Hz)
Shock, semi-sinusoidal	Type test with 3 shocks in each direction as per IEC 60068-2-27 150 m/s² (11 ms)

Vibration and shock BMH205

Vibration, sinusoidal	Type test with 10 runs as per IEC 60068-2-6 0.35 mm (von 10 Hz ... 60 Hz) 50 m/s² (from 60 Hz ... 150 Hz)
Shock, semi-sinusoidal	Type test with 3 shocks in each direction as per IEC 60068-2-27 200 m/s² (6 ms)

Vibration and shock BSH055 ... 140

Vibration, sinusoidal	Type test with 10 runs as per IEC 60068-2-6 0.15 mm (von 10 Hz ... 60 Hz) 20 m/s² (from 60 Hz ... 500 Hz)
Shock, semi-sinusoidal	Type test with 3 shocks in each direction as per IEC 60068-2-27 150 m/s² (11 ms)

Vibration and shock BSH205

Vibration, sinusoidal	Type test with 10 runs as per IEC 60068-2-6 0.35 mm (von 10 Hz ... 60 Hz) 50 m/s² (from 60 Hz ... 150 Hz)
Continuous shock	Type test with 3 shocks in each direction as per IEC 60068-2-29 200 m/s² (6 ms)

Action: Verify that any mechanical shocks are within tolerances.

Electromagnetic Compatibility

Issue: Error E 733F is detected sporadically.

Action: In general, it is very difficult to detect if EMC disturbances are the root cause for error E 733F. However, you can reduce the risk of disturbances by validating whether the motor and drive is wired according to the Wiring Best Practices detailed in the product manuals.

From BSH manual:

4.2 Electromagnetic compatibility, EMC

⚠ WARNING

SIGNAL AND DEVICE INTERFERENCE

Signal interference can cause unexpected responses of the device.

- Install the wiring in accordance with the EMC requirements.
- Verify compliance with the EMC requirements.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Pre-assembled motor cables and encoder cables in many different lengths are available for the drive solutions. Contact your local sales office.

EMC requirement: Route motor cable separately

When planning the wiring, take into account the fact that the motor cable must be routed separately. The motor cable must be separate from the mains cable or the signal wires.

Motor and encoder cables

Motor and encoder cables are especially critical in terms of EMC. Use only pre-assembled cables or cables that comply with the specifications and implement the EMC measures described below.

EMC measures	Effect
Keep cables as short as possible. Do not install unnecessary cable loops, use short cables from the central grounding point in the control cabinet to the external ground connection.	Reduces capacitive and inductive interference.
Ground the product via the motor flange or with a ground strap to the ground connection at the cover of the connector housing.	Reduces emissions, increases immunity.
Connect large surface areas of cable shields, use cable clamps and ground straps.	Reduces emissions.
Do not install switching elements in motor cables or encoder cables.	Reduces interference.
Route the motor cable at a distance of at least 20 cm from the signal cable or use shielding plates between the motor cable and signal cable.	Reduces mutual interference
Route the motor cable and encoder cable without cutting them. [1]	Reduces emission.

1) If a cable is cut for the installation, take appropriate measures for uninterrupted shielding (such as a metal housing) at the point of the cut. Connect a large area of the cable shield to the metal housing at both ends of the cut.

Pre-assembled connection cables (accessories)

Use pre-assembled cables to reduce the risk of wiring errors, see chapter "7 Accessories and spare parts".

Place the female connector of the motor cable onto the male connector and tighten the union nut. Proceed in the same manner with the connection cable of the encoder system. Connect the motor cable and the encoder cable to the drive according to the wiring diagram of the drive.

Equipotential bonding conductors

Potential differences can result in excessive currents on the cable shields. Use equipotential bonding conductors to reduce currents on the cable shields.

The equipotential bonding conductor must be rated for the maximum current flowing. Practical experience has shown that the following conductor cross sections can be used:

- 16 mm² (AWG 4) for equipotential bonding conductors up to a length of 200 m
- 20 mm² (AWG 4) for equipotential bonding conductors with a length of more than 200 m

From LXM32 manual:

Overview: EMC-compliant wiring

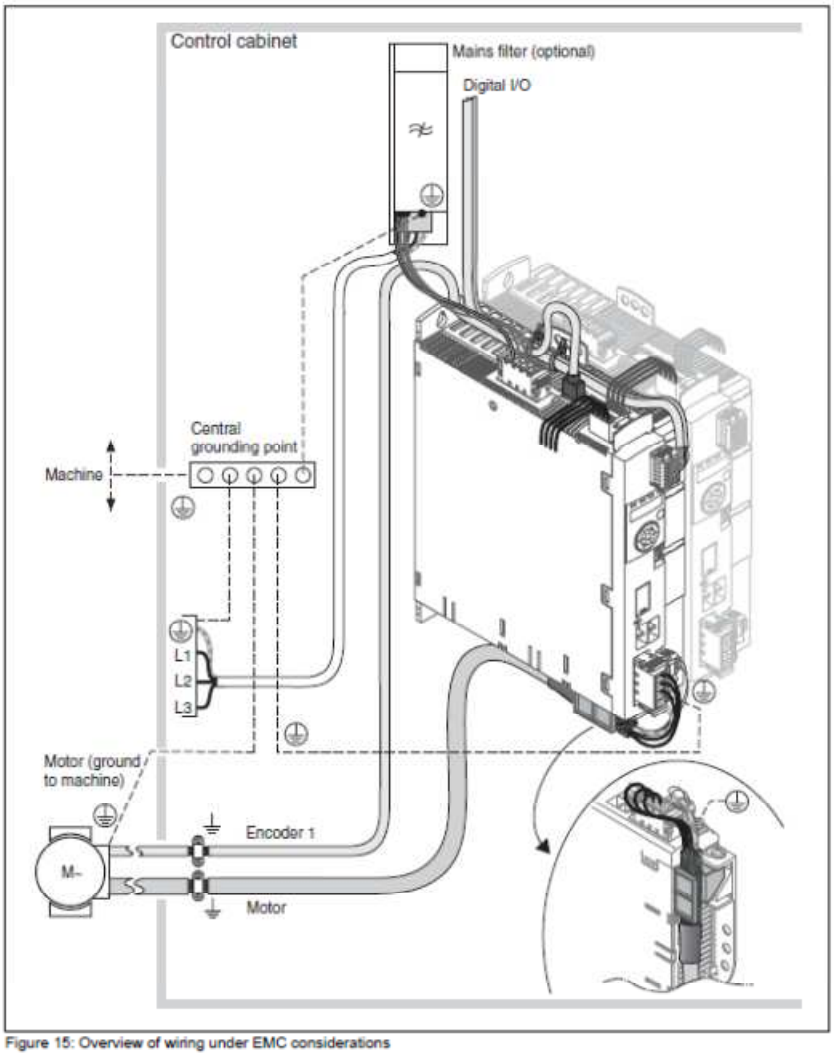


Figure 15: Overview of wiring under EMC considerations

EMC requirements for the control cabinet

EMC measures	Objective
Use mounting plates with good electrical conductivity, connect large surface areas of metal parts, remove paint from contact areas.	Good conductivity due to large surface contact.
Ground the control cabinet, the control cabinet door and the mounting plate with ground straps or ground wires. The conductor cross section must be at least 10 mm² (AWG 6).	Reduces emissions.
Install switching devices such as power contactors, relays or solenoid valves with interference suppression units or arc suppressors (for example, diodes, varistors, RC circuits).	Reduces mutual interference
Do not install power components and control components adjacent to one another.	Reduces mutual interference

Shielded cables

EMC measures	Objective
Connect large surface areas of cable shields, use cable clamps and ground straps.	Reduces emissions.
Use cable clamps to connect a large surface area of the shields of all shielded cables to the mounting plate at the control cabinet entry.	Reduces emissions.
Ground shields of digital signal wires at both ends by connecting them to a large surface area or via conductive connector housings.	Reduces interference affecting the signal wires, reduces emissions
Ground the shields of analog signal wires directly at the device (signal input); insulate the shield at the other cable end or ground it via a capacitor (for example, 10 nF).	Reduces ground loops due to low-frequency interference.
Use only shielded motor cables with copper braid and a coverage of at least 85%, ground a large surface area of the shield at both ends.	Diverts interference currents in a controlled way, reduces emissions.

Cable installation

EMC measures	Objective
Do not route fieldbus cables and signal wires in a single cable duct together with lines with DC and AC voltages of more than 60 V. (Fieldbus cables, signal lines and analog lines may be in the same cable duct) Recommendation: Use separate cable ducts at least 20 cm apart.	Reduces mutual interference
Keep cables as short as possible. Do not install unnecessary cable loops, use short cables from the central grounding point in the control cabinet to the external ground connection.	Reduces capacitive and inductive interference.
Use equipotential bonding conductors in the following cases: wide-area installations, different voltage supplies and installation across several buildings.	Reduces current in the cable shield, reduces emissions.
Use fine stranded equipotential bonding conductors.	Diverts high-frequency interference currents.
If motor and machine are not conductively connected, for example by an insulated flange or a connection without surface contact, you must ground the motor with a ground strap or a ground wire. The conductor cross section must be at least 10 mm^2 (AWG 6).	Reduces emissions, increases immunity.
Use twisted pair for the DC supply.	Reduces interference affecting the signal cables, reduces emissions.

Power supply

EMC measures	Objective
Operate product on mains with grounded neutral point.	Enables effectiveness of mains filter.
Surge arrester if there is a risk of overvoltage.	Reduces the risk of damage caused by overvoltage.

Motor and encoder cables

Motor and encoder cables are especially critical in terms of EMC. Use only pre-assembled cables (see chapter "11 Accessories and spare parts") or cables that comply with the specifications (see chapter "4.2 Cables", page 68) and implement the EMC measures described below.

EMC measures	Objective
Do not install switching elements in motor cables or encoder cables.	Reduces interference.
Route the motor cable at a distance of at least 20 cm from the signal cable or use shielding plates between the motor cable and signal cable.	Reduces mutual interference
For long lines, use equipotential bonding conductors.	Reduces current in the cable shield.
Route the motor cable and encoder cable without cutting them. [1]	Reduces emission.

1) If a cable has to be cut for the installation, it has to be connected with shield connections and a metal housing at the point of the cut.

Additional measures for EMC improvement

Depending on the application, the following measures can improve the EMC-dependent values:

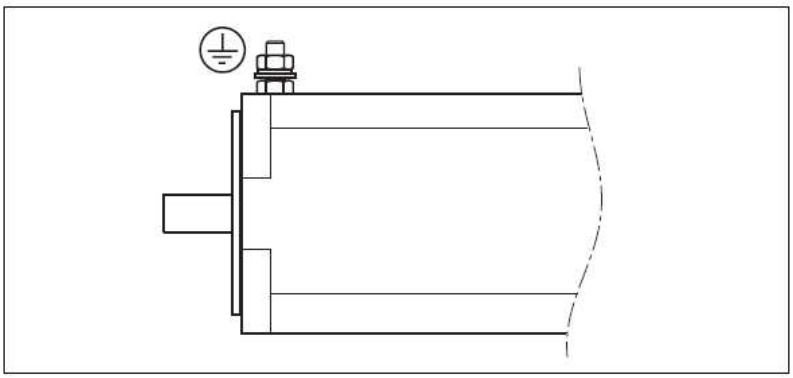
EMC measures	Objective
Use mains reactors	Reduces mains harmonics, prolongs product service life.
Use external mains filters	Improves the EMC limit values.
Additional EMC measures, for example mounting in a closed control cabinet with 15 dB shielding attenuation of radiated interference	Improves the EMC limit values.

Concerning grounding the motor:

Ground the product via the motor flange or with a ground strap to the ground connection at the cover of the connector housing.	Reduces emissions, increases immunity.

Take care if the motor is only grounded via the motor flange. If there are anodized surfaces, e.g., when the motor is mounted to a gear box, ground connection continuity may be infringed or lost. In that case, use a ground strap to connect the motor with the machine.

Protective ground conductor connection



- Ground the motor via a grounding screw if grounding via the flange and the protective ground conductor of the motor cable is not sufficient. Use parts with suitable corrosion protection. Note the required tightening torque and the property class of the grounding screw, see Table 1 in chapter 21.

Actions for grounding the machine:
Take care that the machine is well grounded, e.g., if the machine is standing on plastic feet or other isolating material.

Equipotential bonding conductors

Potential differences can result in excessive currents on the cable shields. Use equipotential bonding conductors to reduce currents on the cable shields.

The equipotential bonding conductor must be rated for the maximum current flowing. Practical experience has shown that the following conductor cross sections can be used:

- 16 mm² (AWG 4) for equipotential bonding conductors up to a length of 200 m (656 ft)
- 20 mm² (AWG 4) for equipotential bonding conductors with a length of more than 200 m (656 ft)

For smaller cross sections a second ground connection should be connected. Respect your local regulations.

Damaged encoder

Issue: The encoder of the motor has been damaged.

Action: If none of the topics above resolves the issue and only the replacement of the motor solves the issue, then the problem is linked to the motor. In that case replace it and send the suspect motor back for analysis.