




Types of Motor Cables

Cable Type	Description
	Symmetrically shielded cable with 3 phase conductors, symmetrically arranged PE conductor and a shield. NOTE: Verify that the PE conductor complies with the requirements according to IEC 61439-1. Example: 2YSLCY-JB
	Symmetrically shielded cable with 3 phase conductors and a concentric PE conductor as shield. NOTE: Verify that the PE conductor complies with the requirements according to IEC 61439-1. Example: NYCY / NYCWY
	Three-phase cable with round conductors and reduced protective conductor. NOTE: A separate PE conductor is required if the shield does not fulfill the requirements according to IEC 61439-1.

Cable Length Instructions

Long Cable Lengths Consequences

When drives are used with motors, a combination of fast switching transistors and long motor cables can even cause peak voltages up to twice the DC link voltage. This high peak voltage can cause premature aging of motor winding insulation which leads to motor breakdown.

The overvoltage limitation function will enable to increase the cable length while decreasing the torque performances.

Length Of Motor Cables

Because of the permitted mains disturbances, the allowed overvoltages at the motor, the occurring bearing currents and the permitted heat losses the distance between inverter and motor(s) is limited.

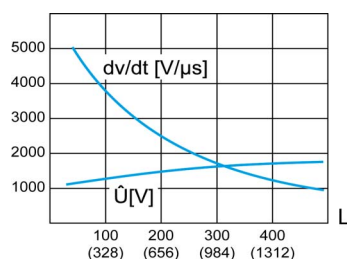
The maximum distance heavily depends on the used motors (insulation material), the type of motor cable used (shielded/unshielded), the cable laying (cable channel, underground installation...) as well as from the used options.

Dynamic Voltage Load Of The Motor

Overvoltages at the motor terminals result from reflection in the motor cable. Basically the motors are stressed with measurable higher voltage peaks from a motor cable length of 10 m. With the length of the motor cable also the value of overvoltage increases.

The steep edges of the switching impulses at the output side of the frequency inverter lead to a further load of the motors. The slew rate of the voltage is typically over 5 kV/μs but it decreases with the length of the motor cable

Load of the motor with overvoltage and slew rate when using conventional drive



L Length of motor cables in meters (feet)

Corrective Actions Overview

A number of simple measures can be taken to help enhance the motor life time:

- Specification of a motor designed for speed drive applications (IEC60034-25 B or NEMA MG1 Part 31 should be prescribed).
- Specification of drives that integrate voltage reflection superimposition software suppression. Refer to **[Volt surge limit. opt] 5 ▢ P** parameter in the Programming manual ([see page 9](#)).
- Reduce to a minimum the distance between motor and drive.
- Use unshielded cables.
- Reduce the drive switching frequency (a reduction to 2.5 kHz is advisable.)

Preventive Measures Suitable for Wall Mounting Drives According to IEC60034-25

The preventive measures will depend on motor characteristics and cable length.

Motor cable length (unshielded cable)	Motor conforming to IEC60034-25	Motor NOT-conforming to IEC60034-25
1 m (3 ft) < L < 50 m (164 ft)	Filter not required	dV/dt filter
50 m (164 ft) < L < 100 m (328 ft)	Filter not required	Sinus filter
100 m (328 ft) < L < 300 m (984 ft)	Filter not required	Sinus filter
300 m (984 ft) < L < 500 m (1640 ft)	dV/dt filter	Sinus filter
500 m (1640 ft) < L < 1000 m (3281 ft)	Sinus filter	Sinus filter

NOTE: When calculating cable lengths for the purpose of guarding against these overvoltage situations, a shielded cable should count as twice the length of an unshielded cable. For example, if a shielded cable is 100 m (328 ft) in actual length, it should be considered to be equal to a 200 m (656 ft) length standard cable in the calculation.

NOTE: The FS drive is delivered with standard output filters. For motor cable lengths beyond 300 m (984 ft), refer to the ATV660 drive range ([see page 9](#)).

Additional Information

Further detailed technical information is available in the following white paper *An Improved Approach for Connecting VSD and Electric Motors* ([998-2095-10-17-13AR0 EN](#)) available on www.schneider-electric.com.