

Lexium 15 LP Servo Drive

Installation Manual

**LXM15LD13M3/LXM15LD21M3/
LXM15LD28M3 / 200-240 V**

30072- 452- 51

**LXM15LU60N4/LXM15LD10N4
LXM15LD17N4/ 208-480 V**



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Important information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instruction are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result** in death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result** in death, serious injury, or equipment damage.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result** in injury or equipment damage.

PLEASE NOTE

Electrical equipment should be serviced only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material. This document is not intended as an instruction manual for untrained persons. © 2008 Schneider Electric. All Rights Reserved.

Before you begin

Read and follow these precautions before beginning any procedure with this servo drive.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Read and understand this manual before installing or operating the Lexium 15 servo drive. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
- The user is responsible for compliance with all international and national electrical code requirements with respect to grounding of all equipment.
- Many parts of this servo drive, including printed circuit boards, operate at line voltage. **DO NOT TOUCH.** Use only electrically insulated tools.
- **DO NOT** touch unshielded components or terminal strip screw connections with voltage present
- **DO NOT** short across terminals PA/+ and PC/- or across the DC bus capacitors.
- The servo motor generates voltage when the shaft is rotating. Lock the shaft of the servo motor to prevent rotation before starting work on the servo drive system.
- Before working on the servo drive system:
 - Disconnect all power, including external control power that may be present.
 - Place a "DO NOT TURN ON" label on all power disconnects.
 - Lock all power disconnects in the open position.
 - **WAIT 5 MINUTES** to allow the DC bus capacitors to discharge . Measure the DC bus voltage between the PC/- and PA/+ terminals to verify that the DC voltage is less than 40V. The drive LED is not indicator of the absence of DC bus voltage.
- Install and close all covers before applying power or starting and stopping the servo drive.

Failure to follow these instructions will result in death or serious injury.

CAUTION

IMPROPER DRIVE OPERATION

- If the servo drive is not turned on for a long period, the performance of its electrolytic capacitors will be reduced.
- If the servo drive has been stored for more than 1 year, it will be necessary to re-form the capacitors in the DC bus link circuit. To do this, disconnect all electrical connections and apply single-phase ≈ 230 V to terminals R/L1 and S/L2 of the servo drive for about 30 minutes. This will re-form the capacitors.

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

WARNING

UNINTENDED EQUIPMENT OPERATION

The servo drive may execute unexpected movements because of incorrect wiring, incorrect settings, incorrect data or others errors. Electromagnetic Interference (EMI) may cause unpredictable responses in the system.

- Wire the servo drive carefully in accordance with the accompanying documentation.
- Disable the inputs PWR (status 0) to prevent unexpected movements before switching and configuring the servo drive system.
- Do not operate a servo drive system with unknown settings or data.
- Carry out a comprehensive commissioning test.

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

1 Take delivery of the servo drive

- Check that the catalog number printed on the label is the same as that on the purchase order
- Remove the Lexium 15 LP from its packaging and check that it has not been damaged in transit

2 Check the line voltage

- Check that the line voltage is compatible with the voltage range of the device (See “” on page 5)

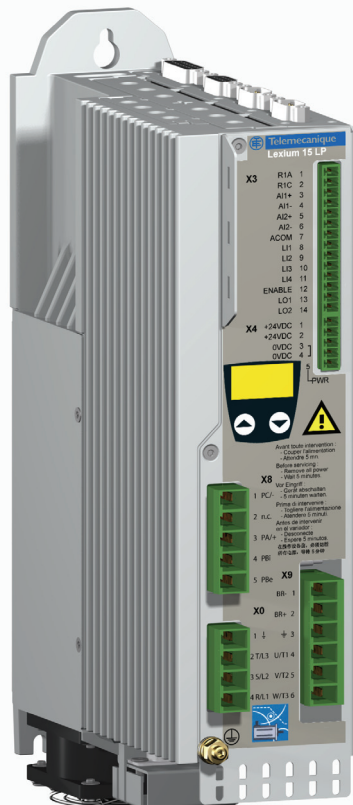
Steps 1 to 4 must be performed with the power disconnected

3 Install the product

- Check that the specified installation clearances correspond to the operating conditions
- Fasten the device in place in accordance with the EMC specifications and recommendations included in this document

4 Wire the servo drive

- Connect the power supply, the servo motor and any external components (e.g. braking resistor)
- Connect the signal lines and the controller supply voltage



PROGRAMMING

Please refer to the Lexium 15 LP programming manual

Preliminary recommendations

Equipment supplied

The package contains the following elements :

- The servo drive
- A simplified manual
- Mating connectors X0, X3, X4, X8, X9
- A shielding clamp

Handling and storage

To protect the servo drive prior to installation, handle and store the device in its packaging. Ensure that the ambient conditions are acceptable.

CAUTION

DAMAGED PACKAGING

If the packaging appears damaged, it can be dangerous to open it or handle it. Take precautions against all risks when performing this operation.

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

CAUTION

DAMAGED EQUIPMENT

Do not operate or install any servo drive that appears damaged.

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

CAUTION

RISK OF MECHANICAL DAMAGE

Protect the servo drive from impermissible stresses. In particular, do not let any component become bent or any insulation distances altered during transport and handling.

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

Installing the servo drive

Mount the servo drive on a wall or the back of the enclosure in accordance with the recommendations described in this document.

CAUTION

INCOMPATIBLE LINE VOLTAGE

Before turning on and configuring the servo drive, ensure that the line voltage is compatible with the supply voltage range shown in our catalogs. The servo drive may be damaged if the line voltage is not compatible.

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

CAUTION

RISK OF EQUIPMENT DAMAGE

Always use an isolating transformer for 400...480 V networks which are asymmetrically grounded or not grounded.

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

DANGER

UNINTENDED EQUIPMENT OPERATION

- During power up only it is recommended to keep the voltage between PWRI+ and PWRI- as 0 Volts to avoid any undesirable movement while the drive is powering up
- After the power up has completed 24 V DC needs to be present between PWRI+ and PWRI- to be able to activate the drive.

Failure to follow these instructions will result in death or serious injury.

Servo drive rating

The tables below describe the servo drive rating for the Lexium 15 LP

Single phase power supply voltage : 200...240 V 50/60 HZ									
Servo drive (output)					Line supply (input)			Lexium 15 LP	
Nominal current In	Max. transient current for 2 s I _{max}	Peak transient current	Nominal output power	Power loss	Max. line current		Apparent power	Primary fuse	References
					at 200 V	at 240 V			
A _{rms}	A _{rms}	A _{pk}	kW	W	A	A	kVA	A	
3	9	13	0.9	35	7.7	7.6	1.1	10 class CC	LXM15LD13M3
4	9	13	1.2	60	10.1	9.9	2.4	15 class CC	LXM15LD21M3
4	9	13	1.2	90	10.4	10.1	4	15 class CC	LXM15LD28M3

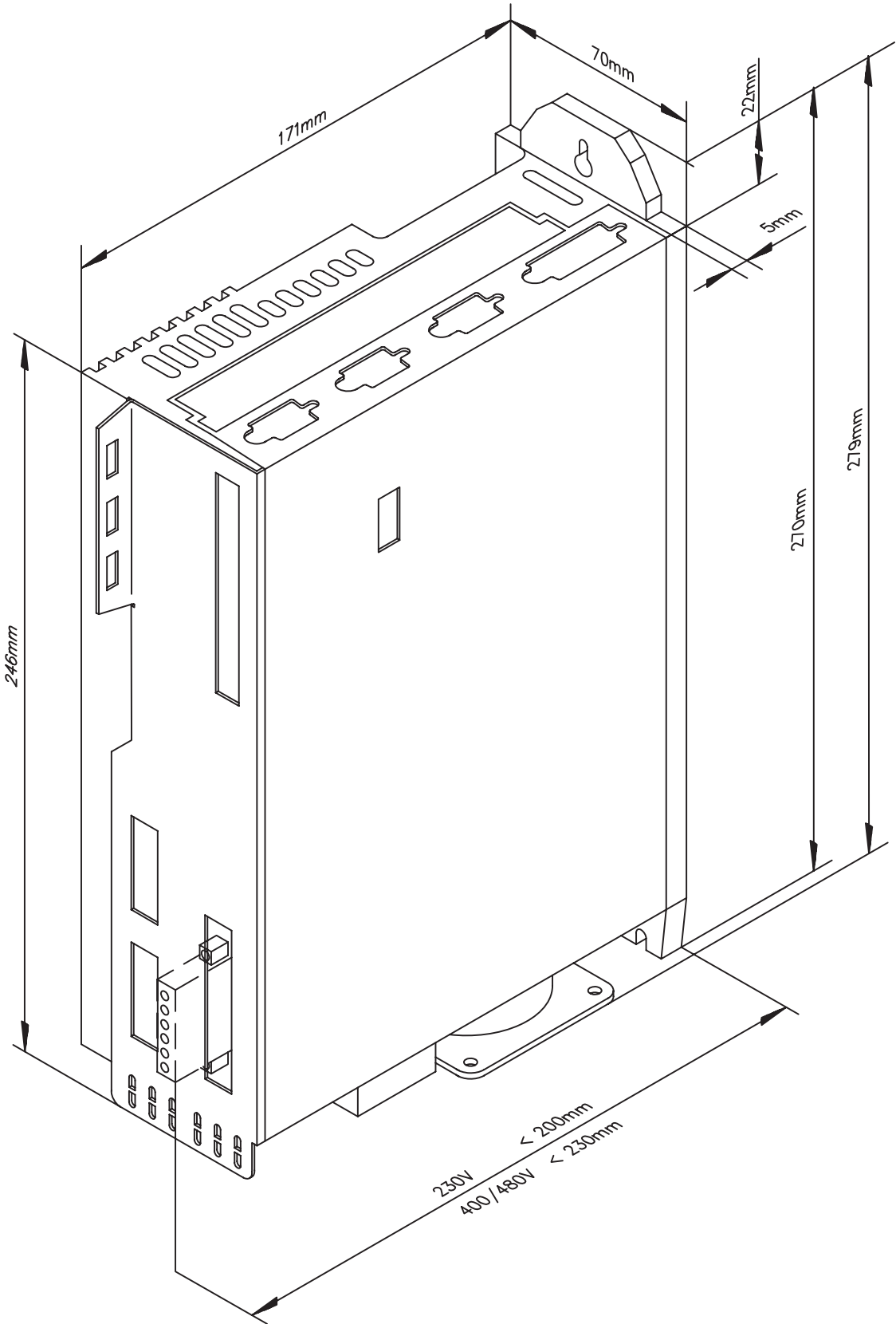
Three phase power supply voltage : 200...240 V 50/60 HZ									
Servo drive (output)					Line supply (input)			Lexium 15 LP	
Nominal current In	Max. transient current for 2 s I _{max}	Peak transient current	Nominal output power	Power loss	Max. line current		Apparent power	Primary fuse	References
					at 200 V	at 240 V			
A _{rms}	A _{rms}	A _{pk}	kW	W	A	A	kVA	A	
3	9	13	1	35	4.7	4.6	1.1	6 class CC	LXM15LD13M3
6	15	21	2.1	60	8.8	8.6	2.4	10 class CC	LXM15LD21M3
10	20	28	3.4	90	14	13.7	4	15 class CC	LXM15LD28M3

Three phase power supply voltage : 208...480 V 50/60 HZ									
Servo drive(output)					Line supply (input)			Lexium 15 LP	
Nominal current In	Max. transient current for 2 s I _{max}	Peak transient current	Nominal output power	Power loss	Max. line current		Apparent power	Primary fuse	References
					at 208 V	at 480 V			
A _{rms}	A _{rms}	A _{pk}	kW	W	A	A	kVA	A	
1.5	4.5	6	1.1	40	2.8	2.5	1.2	6 class CC	LXM15LU60N4
3	7.5	10	2.1	60	3.9	4.5	2.5	6 class CC	LXM15LD10N4
6	12	17	4.3	90	6.9	8.2	5	10 class CC	LXM15LD17N4

Dimensions and weights

Lexium 15 LP height, width and depth dimensions

The following diagram shows height, width and depth dimensions for the Lexium 15 LP servo drive.



Mounting and temperature conditions

Lexium 15 LP servo drive and mounting area dimensions

Install the servo drive vertically at $\pm 10^\circ$.

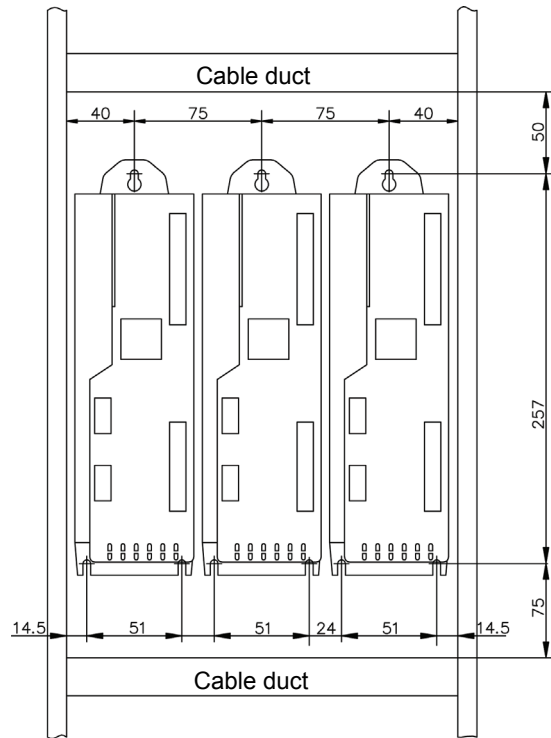
Do not place it close to heating elements.

Leave sufficient free space around the drive controller to ensure that the air can circulate from the bottom to the top of the unit. (see figure below).

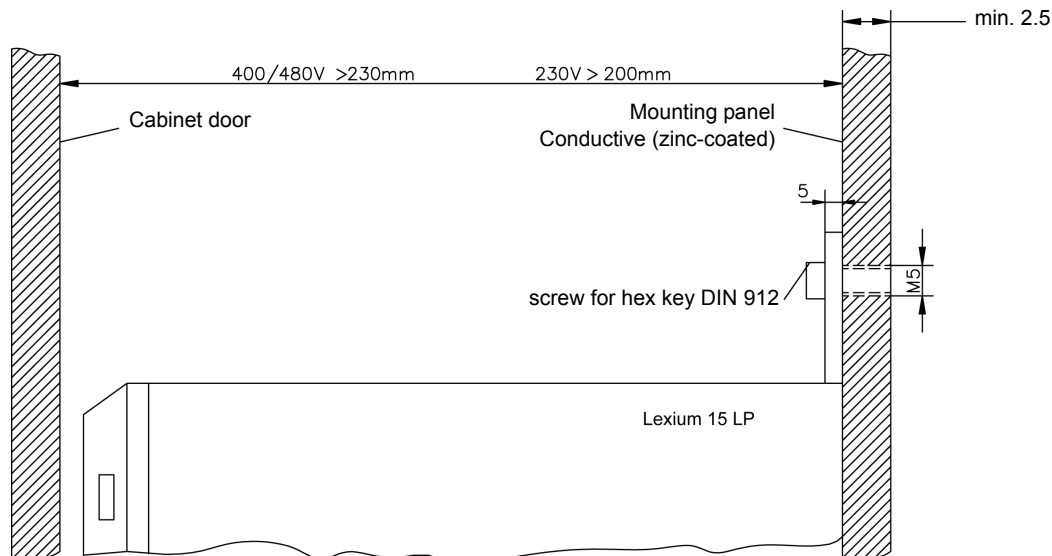
Servo drive mounting

The following diagrams show depth dimensions and mounting area requirements for the Lexium 15 LP servo drive.

You will need a 4 mm Allen key and material is 3 x M5 hexagon socket screws to DIN 912.



Note: All dimensions are given in millimeters



⚠ CAUTION

CONTAMINATION AND THERMAL HAZARD

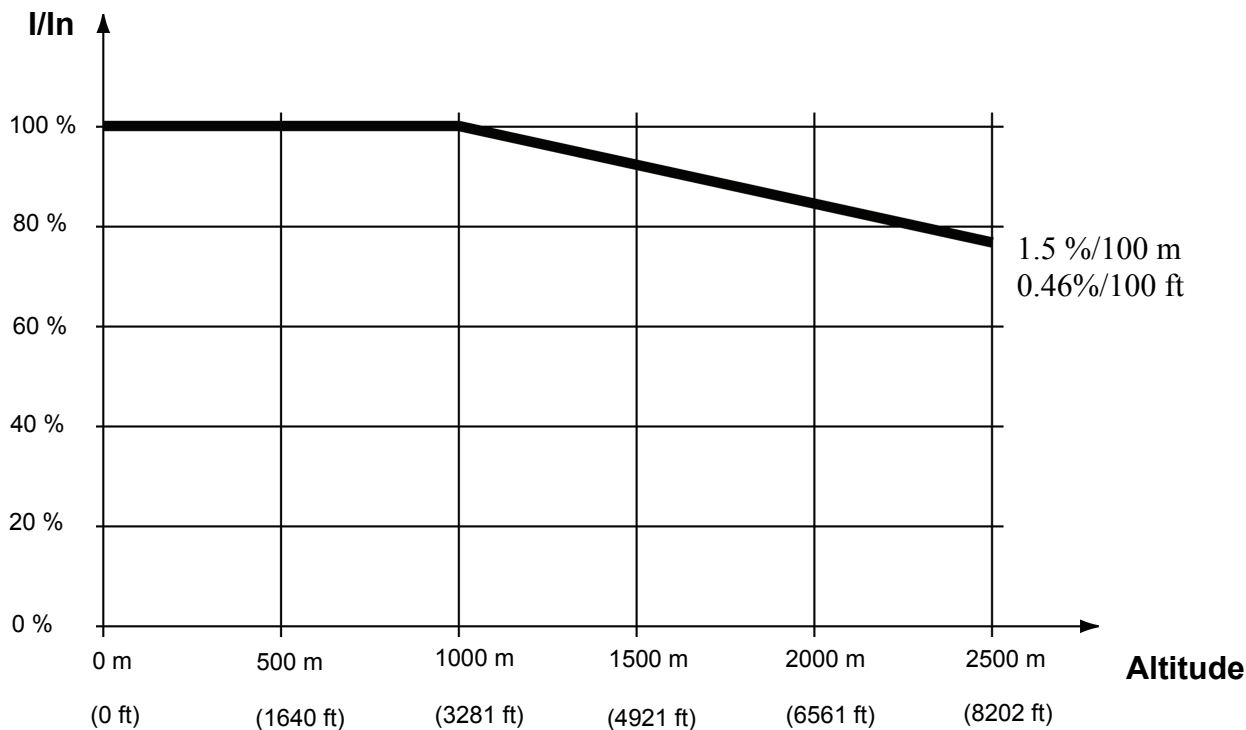
Ensure the Lexium 15 LP servo drive is mounted within a closed control cabinet. The site must be free from conductive or corrosive materials. Keep the required space clear above and below the servo drive. (See for more information).

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

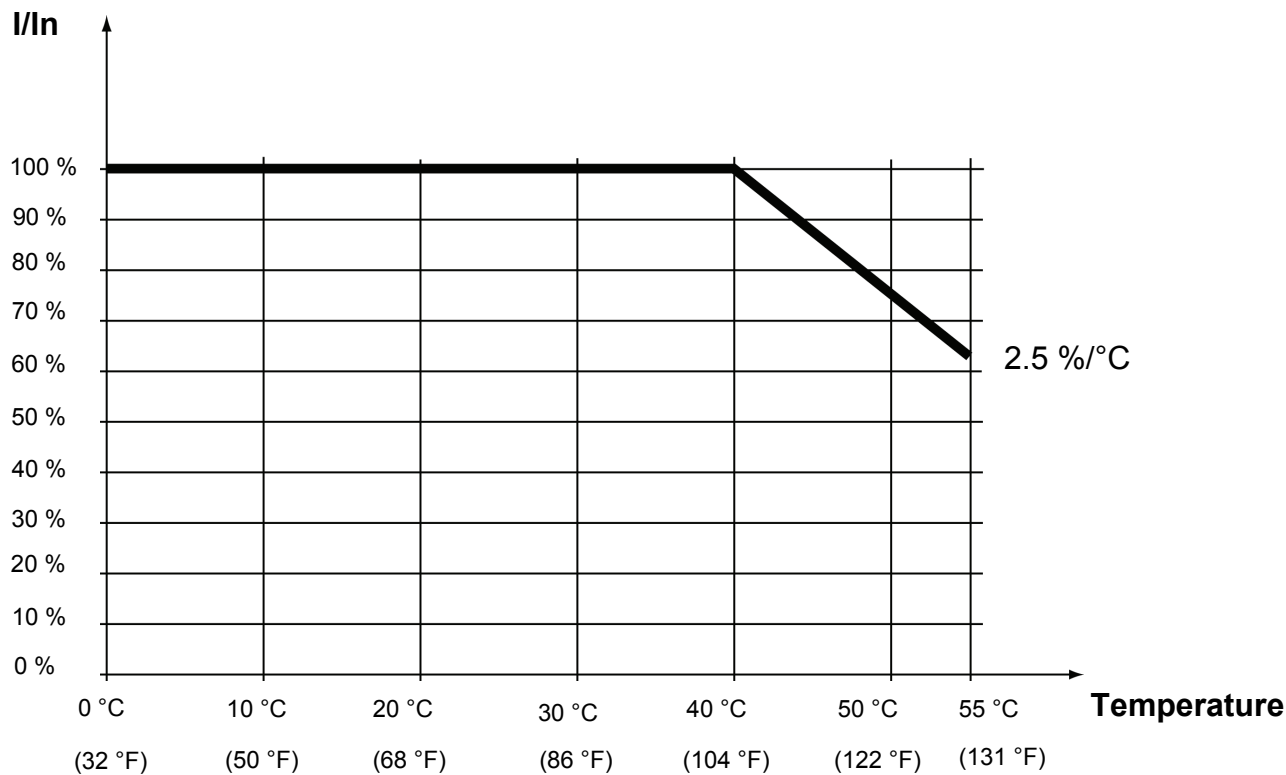
Mounting and temperature conditions

Derating curves

The following diagram describes the derating curve of the servo drive Current (In) as a function of the Altitude



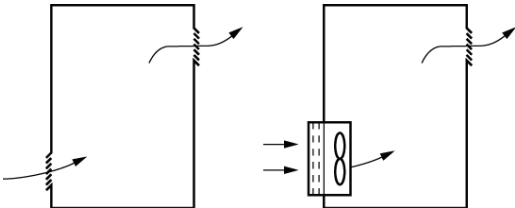
The following diagram describes the derating curve of the servo drive Current (In) as a function of the Temperature



Mounting in a wall-mounted or floor-standing enclosure

Observe the mounting recommendations on the previous pages.
To ensure proper air circulation in the servo drive:

- Fit ventilation grilles
- Ensure that the ventilation is adequate: if not, install forced ventilation with a filter



Mounting the servo drive in the enclosure

Power dissipated

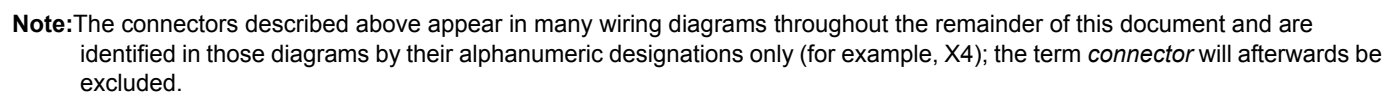
These power ratings are given for operation at nominal load and for the factory-set switching frequency:

LXM15L	Power loss
D13M3	35
D21M3	60
D28M3	90
U60N4	40
D10N4	60
D17N4	90

The diagram below shows the wiring connections and the pin assignments for the Lexium 15 LP drive.

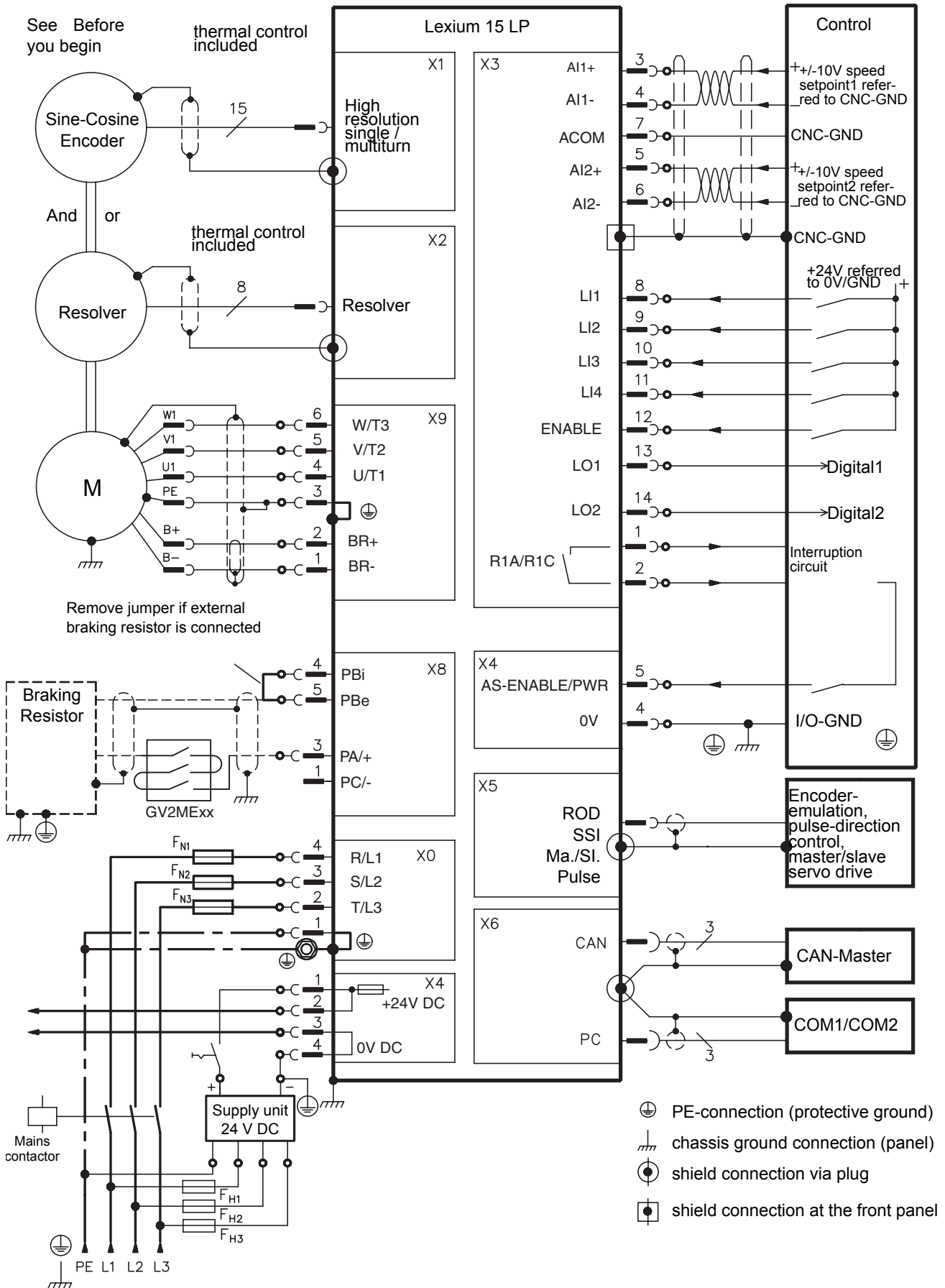
Do not connect a Modbus serial port to the X6 connector! Pin1 carries + 8 V DC which would be shorted out by a Modbus cable. Instead, use a 3-core cable (not a null-modem link cable) with only pins 2, 3 and 5 wired.

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



Wiring diagram overview

The following diagram shows the different connections for the Lexium 15 LP



Wiring recommendations

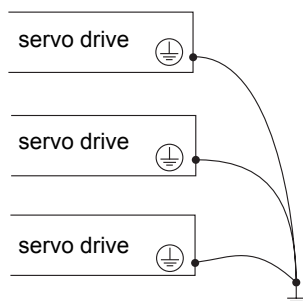
The drive must be connected to the protective ground. To comply with current regulations concerning high leakage currents, use at least a 10 mm² (AWG 6) protective conductor or 2 protective conductors with the same cross-section as the power supply conductors.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Ground equipment using the provided ground connecting point as shown in the figure below. The drive panel must be properly grounded before power is applied.

Failure to follow these instructions will result in death or serious injury.



Check whether the resistance to the protective ground is 1 ohm or less. Connect a number of servo drives to the protective ground, as shown in the diagram (see left). Do not lay protective grounding cables in a loop or in series.

Ensure the drive mounting plate, servo motor housing and ACOM for the controls are connected to common panel earth ground point.

⚠ WARNING

IMPROPER WIRING PRACTICES

- Follow the wiring practices described in the accompanying documentation, in addition to those already by the National Electrical Code and local electrical codes.
- Do not apply input line voltage to the output terminals (U/T1,V/T2,W/T3).
- Check the power connections before energizing the Lexium 15 LP servo drive.
- If replacing another servo drive, verify that all wiring connections to the Lexium 15 LP servo drive comply with all wiring instructions in this manual.

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

⚠ WARNING

INADEQUATE OVERCURRENT PROTECTION

- Overcurrent protective devices must be properly coordinated.
- The Canadian Electricity Code and the National Electrical Code require branch circuit protection. Use the fuses recommended in this manual (See AC power supply wire specifications) to achieve published short-circuit current ratings.
- Do not connect the drive controller to a power feeder whose short-circuit capacity exceeds the servo drive short-circuit current rating listed on the servo drive nameplate or in the Simplified Manual for this product

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

Keep the power cables separate from circuits in the installation with low-level signals (detectors, PLCs, measuring apparatus, video, telephone).

⚠ CAUTION

IMPROPER USE OF A BRAKING RESISTOR

Only use the braking resistors recommended in our catalogs.

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

Control: In order to improve the interference immunity required by EMC regulations, route power and control cables separately. We recommend a separation of at least 20 cm.

Wiring recommendations

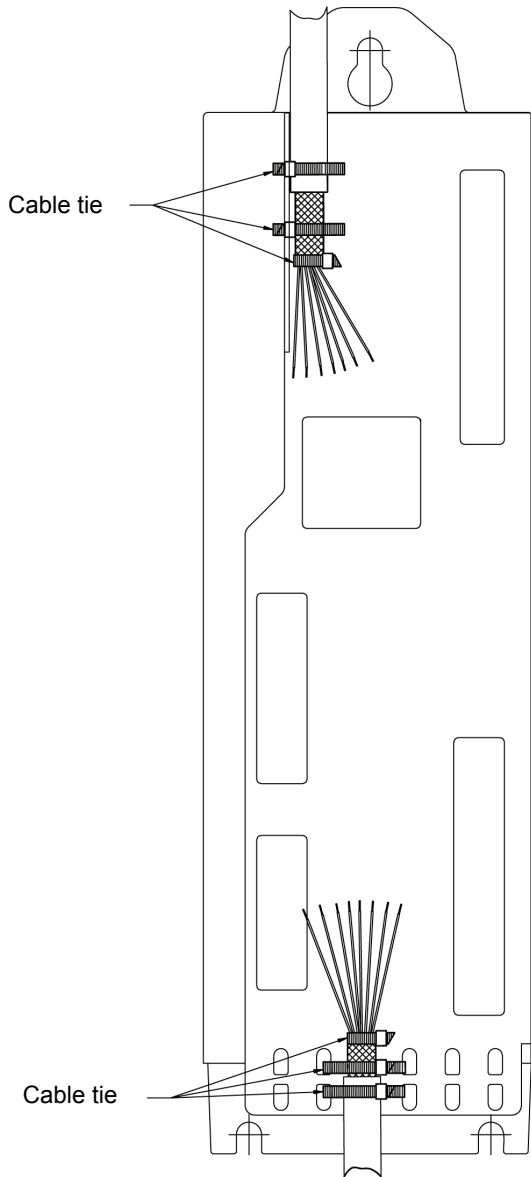
Connecting cable shields to the front panel

The following procedure and associated diagram describe how to connect cable shields to the front panel of the Lexium 15 LP servo drive:

Step	Action
1	Remove a length of the cable's outer covering and braided shield sufficient to expose the required length of wires.
2	Secure the exposed wires with a cable tie.
3	Remove approximately 30 mm of the cable's outer covering while ensuring the braided shield is not damaged during the process.
4	At the front panel of the servo drive, insert a cable tie into a slot in the shielding rail.
5	Use the previously inserted cable tie to secure the exposed braided shield of the cable firmly against the shielding rail.

Cable shield connection diagram

The following diagram shows the cable shield connections at the front of the Lexium 15 LP servo drive.



Remove the outside shroud of the cable and the shielded braid on the desired core length. Secure the cores with a cable tie.

Remove the outside shroud of the line on a length from, for instance, 30 mm without damaging the shielding braid.

Pull a cable tie by the slot in the shielding rail on the front panel of the servo drive.

Press the shielding of the cable firmly against the front panel with the cable tie

Note:For motor power output connection, use the shielding clamp provided in the package to ground the cable shielding.

Power wiring

AC power supply wire specifications

The following table describes the recommended wire specifications. Use only copper wire with insulation rated at 75 °C or greater, unless otherwise specified.

Servo drive model no.	Recommended wire size		Notes	Recommended tightening torque Nm (lbf.in)	Primary fuse (A)		
	mm ²	AWG			Single phase 200...240 V	Three phase 200...240 V	Three phase 208...480 V
LXM15LD13M3	1.5	14	600 V, 105 °C	0.5...0.6 (4.4...5.3)	10 A, class CC	6 A, class CC	
LXM15LD21M3					15 A, class CC	10 A, class CC	
LXM15LD28M3					15 A, class CC	15 A, class CC	
LXM15LU60N4							6 A, class CC
LXM15LD10N4							6 A, class CC
LXM15LD17N4							10 A, class CC

AC power supply connection

The following diagrams show the connections for the AC power supply input to the Lexium 15 LP servo drive.

Three phase

The three phase power supply EMC filter is integrated.

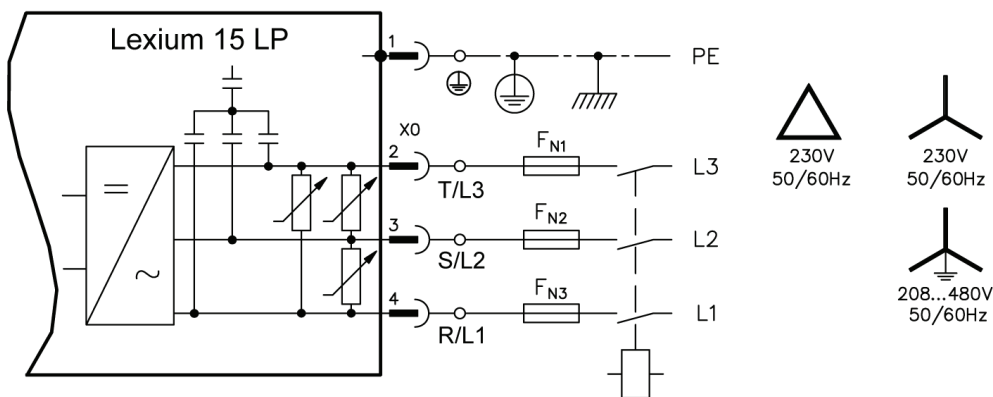
⚠ WARNING

INADEQUATE OVERCURRENT PROTECTION

- Overcurrent protective devices must be properly coordinated.
- The National Electrical Code and the Canadian Electricity Code require branch circuit protection. Use the fuses recommended in this manual (See AC power supply wire specifications) to achieve published short-circuit current ratings.
- Do not connect the drive controller to a power feeder whose short-circuit capacity exceeds the servo drive short-circuit current rating listed on the servo drive nameplate or in Table above.

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

The following diagram shows the connection for a 3-phase power supply.



⚠ CAUTION

RISK OF EQUIPMENT DAMAGE

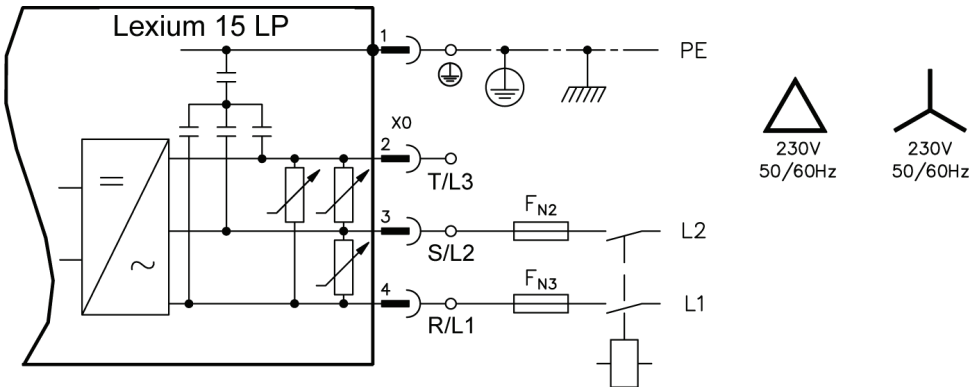
Always use an isolating transformer for 400...480 V networks which are asymmetrically grounded or not grounded.

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

Power wiring

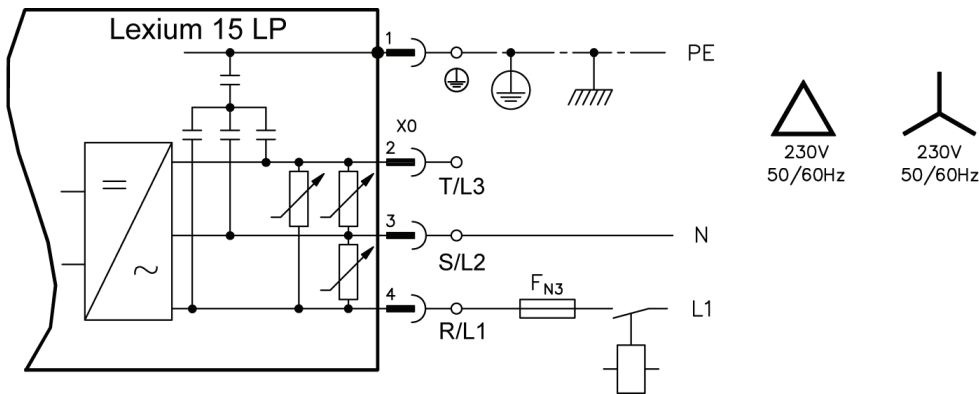
Single phase without neutral

The following diagram shows the connection for a single phase without neutral power supply.



Single phase with neutral

The following diagram shows the connection for a single phase with neutral power supply.



Power wiring

24 V DC external control power supply connection

The 24 V DC external control power supply is required to operate the Lexium 15 LP drive.

24 V DC external control power supply wire specifications

The following table describes the recommended wire specifications. Use only copper wire with insulation rated at 75 °C or greater, unless otherwise specified.

LXM15L	Wire size	Fuse(A)
D13M3, D21M3, D28M3 U60N4, D10N4, D17N4	2.5 mm ² or 14 AWG	Max. 8 A

24 V DC external control power supply terminal (X4)

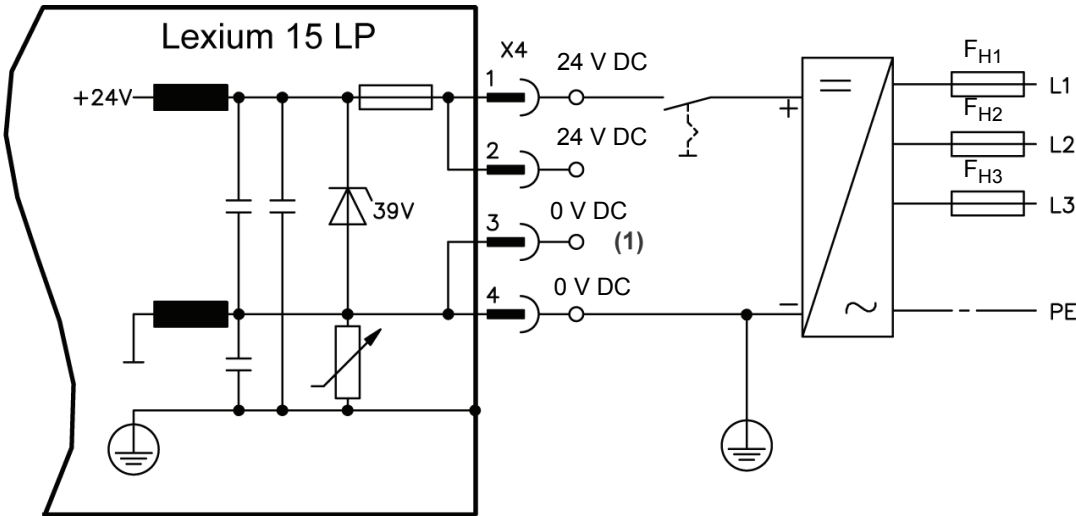
The table below describes the 24 V DC external control power supply specifications

Model	Servo motor brake present	External control power supply input	Value
LXM15LD13M3 LXM15LU60N4	No	Voltage	20-30 V
		Current	1 A
	Yes	Voltage	24 V DC-0 % +15 %
		Current	2.5
LXM15LD21M3 LXM15LD28M3 LXM15LD10N4 LXM15LD17N4	Yes	Voltage	24 V DC-0 % +15 %
		Current	2.5

The external control 24 V DC power supply has to be electrically isolated, e.g. via an isolating transformer. An EMC filter for the 24 V DC external control power supply is integrated.

The following diagram shows the required wiring for the 24 V DC external control power supply terminal.

Use appropriate fuses as required by the power supply manufacturer.



CAUTION

SERVO DRIVE CONTROLLER DAMAGE

- A fuse must be used between the terminal of the power supply and the +24 V DC input (X4-1 and 2) pins.
- The power supply may serve several devices in an installation, but in no event may the fuse serving a Lexium drive exceed 10A.

Failure to follow these instructions can result in equipment damage.

Power wiring

DC bus link (X8) wire specifications

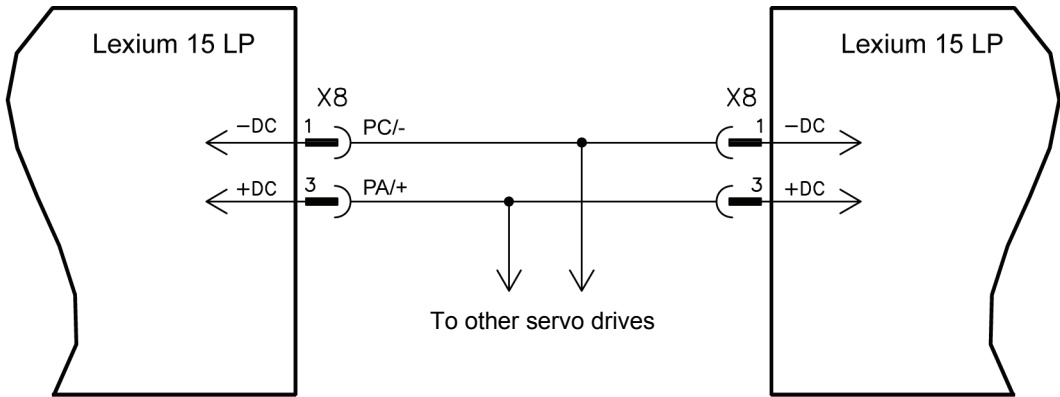
The following table describes the recommended wire specifications. Use only copper wire with insulation rated at 75 °C or greater, unless otherwise specified.

LXML15L	Wire Size	Recommended tightening torque Nm (lbf.in)	Notes
D13M3, D21M3, D28M3 U60N4, D10N4, D17N4	1.5 mm ² or 14 AWG	0.5...0.6 (4.4...5.3)	Shielded for lengths greater than 20 cm 1000 V, 75 °C

DC bus link (X8) connection

Terminals X8/1 (PC/-) and X8/3 (PA/+) can be connected in parallel, whereby the braking power is divided between all the servo drives that are connected to the same DC bus link circuit.

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Categories relating to safety according to EN 954-1

The 5 categories of standard EN 954-1 are used to define the necessary system performance to meet safety requirements.

Categories	Basic safety principle	Control system requirements	Behaviour in the event of a fault
B	Selection of components that comply with the relevant standards	Control according to good engineering practice	Possible loss of the safety function
1	Selection of components and safety principles	Use of tried and tested components and proven safety principles	Possible loss of the safety function with a lower probability than in B
2	Selection of components and safety principles	Test per cycle. The intervals between tests must be appropriate to both the machine and its application	Fault detected on each test
3	Structure of the safety circuits	A single fault must not result in loss of the safety function. The fault must be detected if this is reasonably possible	Safety function ensured, except in the event of an accumulation of faults
4	Structure of the safety circuits	A single fault must not result in loss of the safety function. The fault must be detected when or before the safety function is next invoked. An accumulation of faults must not result in loss of the safety function.	Safety function always assured

⚠ The machine manufacturer is responsible for selecting the safety category. The category depends on the level of risk factors given in standard EN 954-1.

Lexium 15 servo drives and standard EN 954-1

The table below shows the safety level obtained according to the type of servo drive, with the integrated "Power Removal" safety function and associated equipment (Preventa monitoring module, contactor, etc)

Safety level	Devices required	For Lexium 15 servo drives	Equipment to be added	Recommended wiring diagram, see page
Category B	–	All ratings	–	–
Category 1	1 breaking	All ratings	–	20
Category 2	1 breaking and 1 monitoring	All ratings	1 breaking device per PWR function with 1 Preventa monitoring module (1)	21
Category 3	2 breaking (2)	All ratings	1 breaking device per PWR function, 1 breaking device per contactor and 1 Preventa monitoring module (1)	22
Category 4	2 breaking and 1 monitoring (2)	All ratings	1 breaking device per PWR function, 1 breaking device per contactor and 1 Preventa monitoring module (1)	23

"Power Removal" safety function

The "Power Removal" (PWR) safety function makes it easier to achieve the safety levels defined above.

The "Power Removal" safety function integrated in Lexium 15 LP servo drives consists of a PWR logic input, accessed on the X4 connector. Deactivation of this input in particular initiates locking of the power stage of the servo drive supplying the servo motor, thus depriving the servo motor of energy (3).

This function is used primarily when the servo motor has to be kept stationary, for example when personnel need to have frequent access to protected areas in which machinery is running, for brief periods of time.

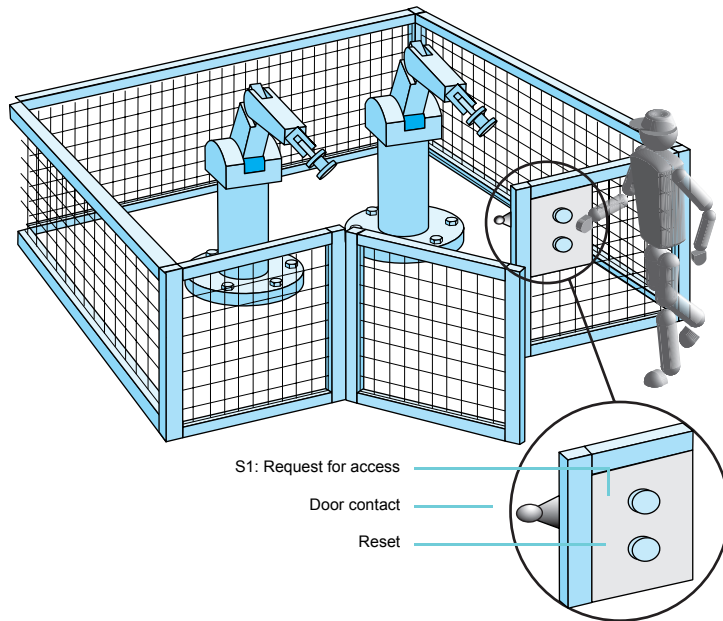
Note: The use of Lexium 15 servo drives with the integral "Power Removal" safety function simplifies the connection diagrams required to comply with standard EN 954-1.

(1) The category of the Preventa safety module must be u the required safety category.

(2) Where there are 2 breaking devices, see also the sections relating to Categories 3 and 4 on pages 22 and 23.

(3) Vertical axis immobilization can only be obtained by installing a mechanical locking system (holding brake) on the axes.

Application with requirement for access to a hazardous area



Presentation

The recommended wiring diagrams on pages 20 to 23 give an example of an application where access to a hazardous area needs to be protected (space inside and/or around a machine in which an operator is exposed to a hazard). These diagrams apply to Lexium 15 LP servo drives with integrated "Power Removal" safety function.

Description of the application

Pressing the "Request for access to protected area" spring return pushbutton **S1** causes the axes to slow down and stop, and also opens the access door to the protected area (activation of the latch electromagnet).

Depending on the safety level, if all the safety conditions are not met:

- Either the line contactor drops out
- Or the access door to the area remains locked

After operator intervention, the door closes and pressing the "Reset" spring return pushbutton enables the axes to operate again.

Selection criteria for the positions of the breaking contactors

Note: A contactor can be used to break the power either upstream or downstream of the Lexium 15 servo drive, without compromising safety. Mixed breaking, upstream and downstream, is also possible.

The positions of the contactors should be selected according to how often access to the hazardous area is required.

Occasional access requests

Breaking via a contactor upstream of the servo drive is recommended.

This type of breaking eliminates any risk of disconnection of the servo drive/servo motor assembly, which can cause overvoltages (only in the event of malfunction of the "Enable control system" input).

Frequent access requests

Breaking via a contactor downstream of the servo drive is preferable.

This type of breaking allows the servo drive input power bridge to remain energized, which enhances the longevity of the servo drive rectifier-filtering stage.

The recommended wiring diagrams on the following pages illustrate the most severe case corresponding to **frequent access requests**.

Note: As a general rule, the breaking command for upstream KM contactors is instantaneous. The command for downstream KM contactors is delayed to allow the axis to come to a controlled stop (in accordance with parameter "StopMode = 1").

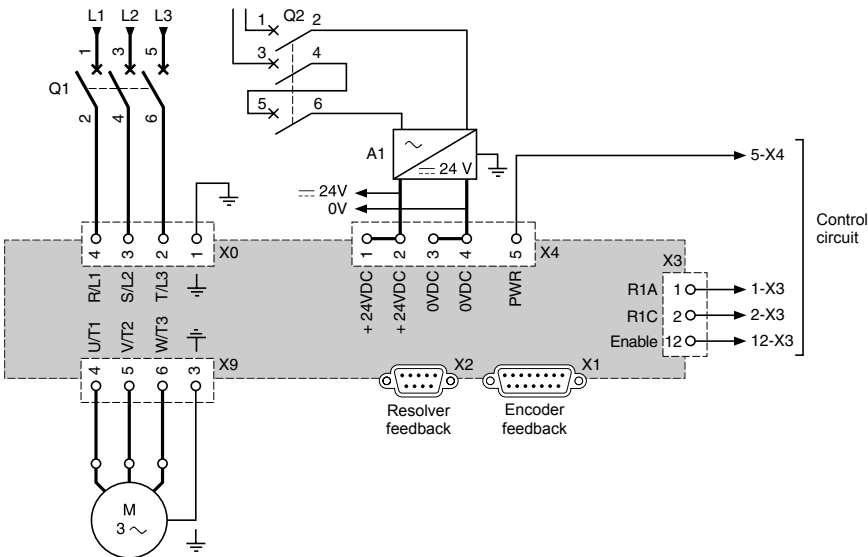
Categories 3 and 4

The diagrams for categories 3 and 4 on pages 22 and 23 take account of the widest requirements and thus incorporate **double breaking** of the control circuit **and the power circuit**.

Following specific analysis of machine risks, this redundancy can be limited to the control circuit alone, and thus can be restricted to simply breaking the power circuit.

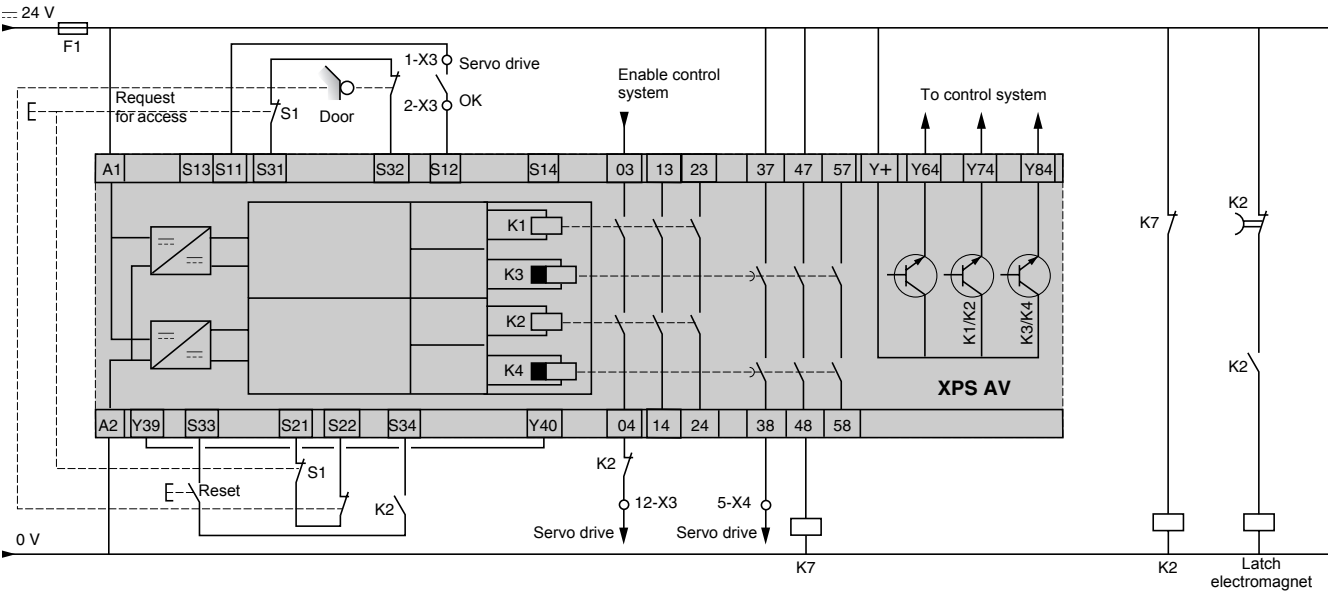
Category 2 safety level in accordance with EN 954-1

Power circuit of LXM 15L**** servo drives



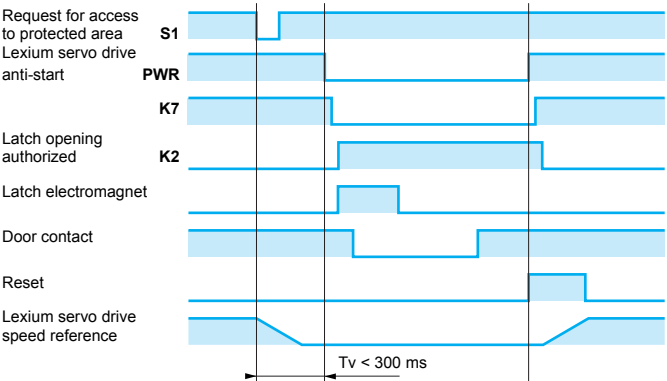
Q1: magnetic circuit breaker

Control circuit of LXM 15L**** servo drives



XPS AV: Preventa safety module, please consult our "Safety solutions using Preventa" specialist catalogue

Timing diagram

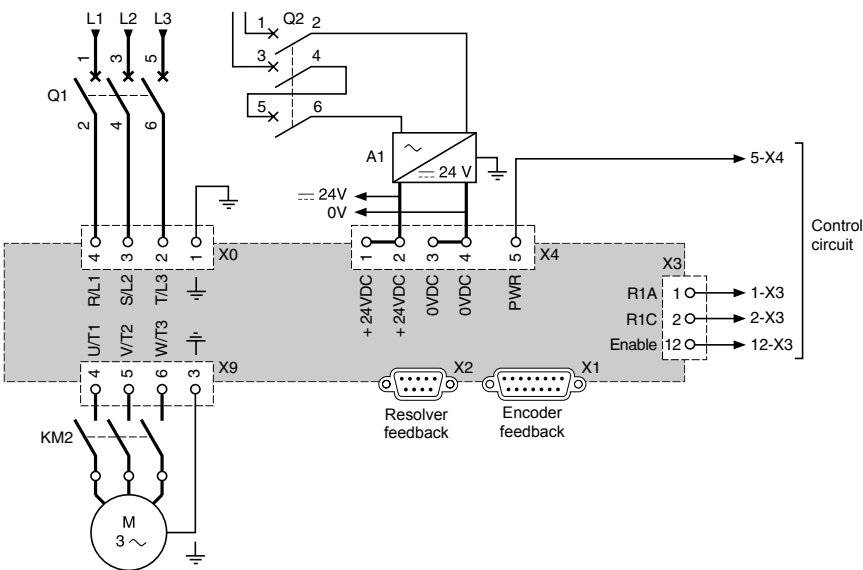


Comments

- Time delay Tv on the XPS AV monitoring module must be long enough for the axis to come to a controlled stop.
- Lexium 15 LP servo drive parameters:
 - StopMode = 0: Axis performs a freewheel stop
 - StopMode = 1: Axis comes to a controlled stop according to the emergency deceleration ramp

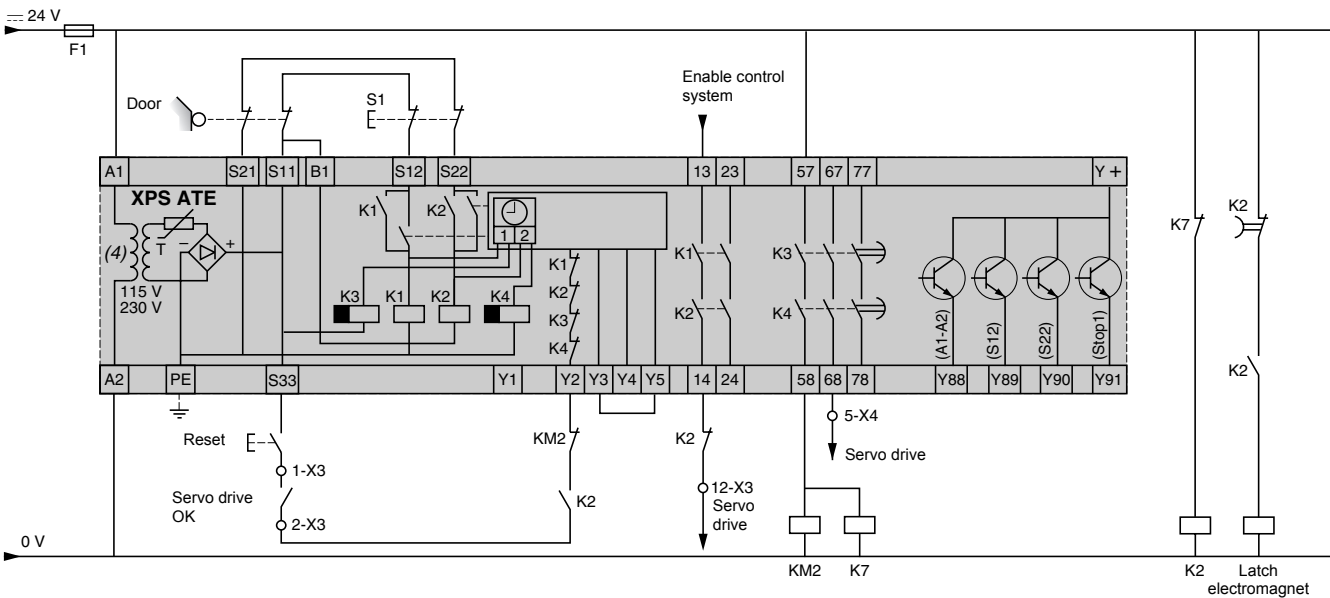
Category 3 safety level in accordance with EN 954-1

Power circuit of LXM 15L ***** servo drives



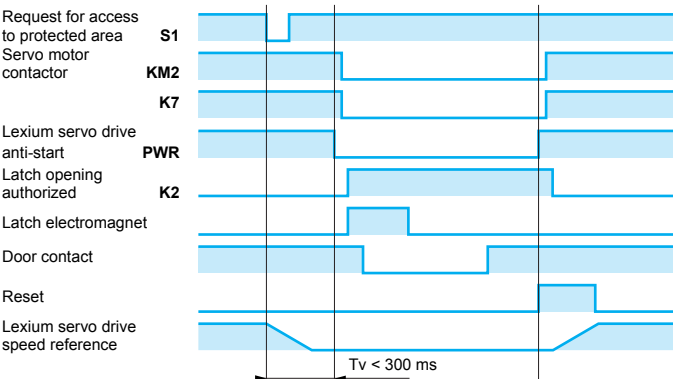
Q1: magnetic circuit breaker

Control circuit of LXM 15L ***** servo drives



XPS ATE: Preventa™ safety module, please consult our "Safety solutions using Preventa" specialist catalogue

Timing diagram

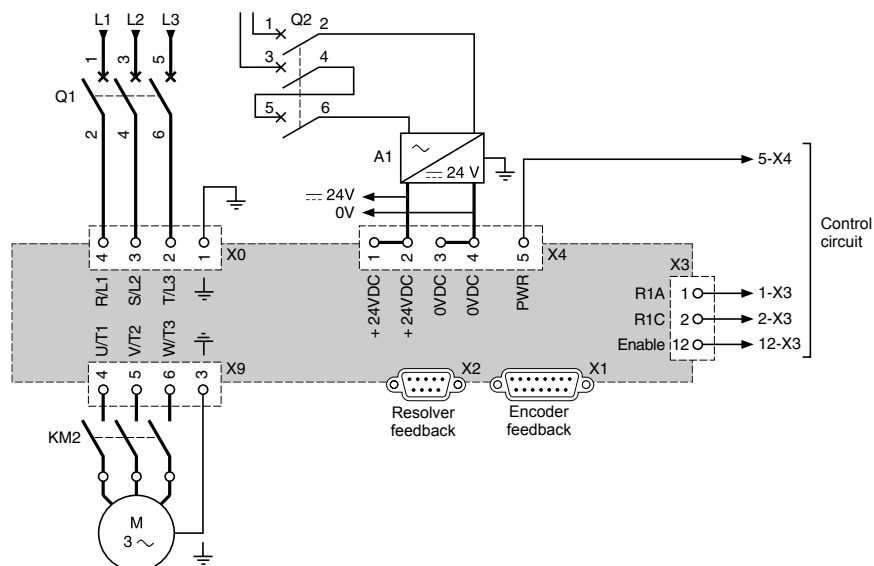


Comments

- Time delay Tv on the XPS ATE monitoring module must be long enough for the axis to come to a controlled stop.
- Lexium 15 LP servo drive parameters:
 - StopMode = 0: Axis performs a freewheel stop
 - StopMode = 1: Axis comes to a controlled stop according to the emergency deceleration ramp

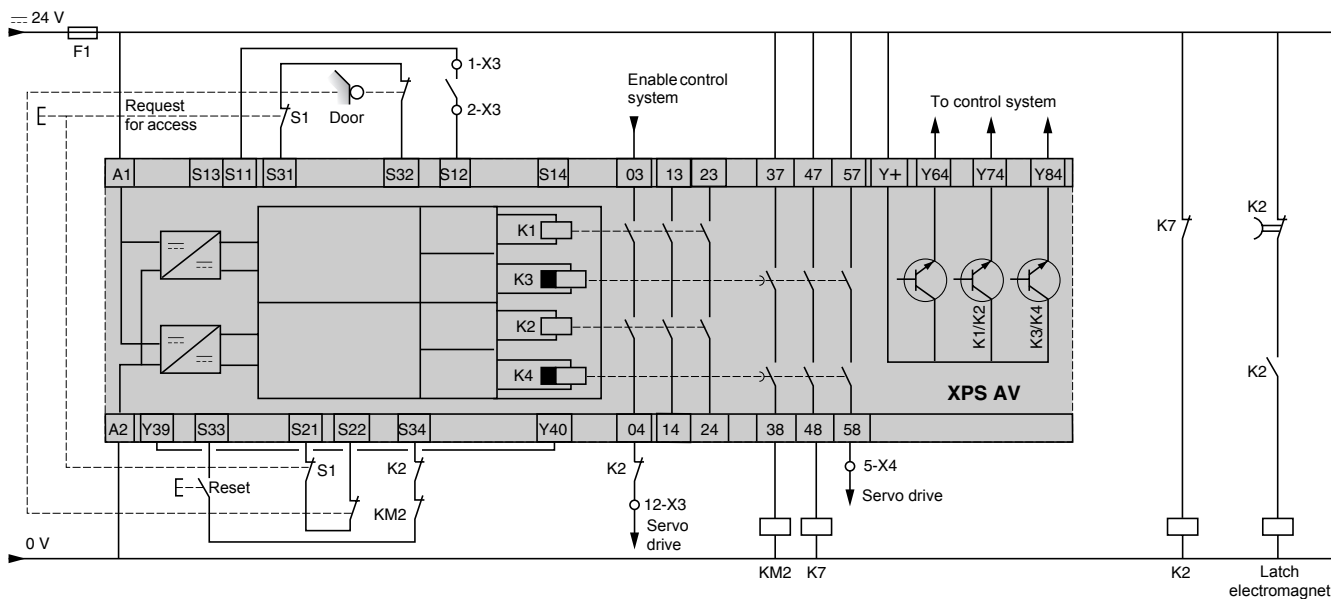
Category 4 safety level in accordance with EN 954-1

Power circuit of LXM 15L ***** servo drives



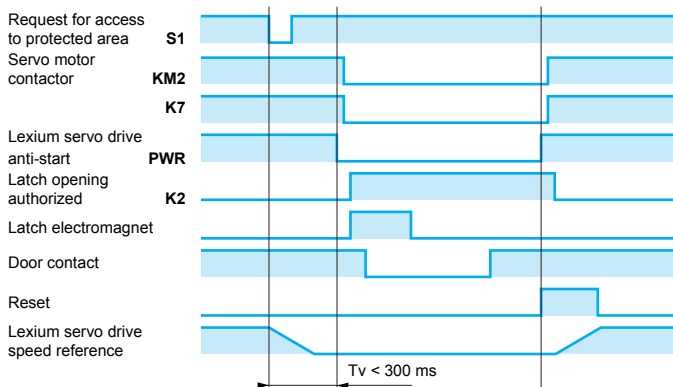
Q1: magnetic circuit breaker

Control circuit of LXM 15L ***** servo drives



XPS AV: Preventa™ safety module, please consult our "Safety solutions using Preventa" specialist catalogue

Timing diagram



Comments

- Time delay T_v on the XPS AV monitoring module must be long enough for the axis to come to a controlled stop.
- Lexium 15 LP servo drive parameters:
 - StopMode = 0: Axis performs a freewheel stop
 - StopMode = 1: Axis comes to a controlled stop according to the emergency deceleration ramp

Braking circuit specifications

The following table provides technical data on the braking circuit.

Braking circuit: technical data			Supply voltage		
	Rated data	Dim.	230 V	400 V	480 V
LXM15LD13M3	Switch-on (upper) threshold of braking circuit	V	400	—	
	Overvoltage F02	V	455		
	Braking resistor (internal)	Ohm	66		
	Continuous power in braking circuit (PBi)	W	20		
	Pulse power in braking circuit (PBi max. 1s)	kW	3		
	Braking resistor (external)*	Ohm	66		
	Continuous power in braking circuit (PA/+) max.	kW	0,3		
	Pulse power in braking circuit (PA/+ max. 1s)	kW	3		
LXM15LD21M3/28M3	Switch-on (upper) threshold of braking circuit	V	400	—	
	Overvoltage F02	V	455		
	Braking resistor (internal)	Ohm	66		
	Continuous power in braking circuit (PBi)	W	50		
	Pulse power in braking circuit (PBi max. 1s)	kW	3		
	Braking resistor (external)*	Ohm	66		
	Continuous power in braking circuit (PA/+) max.	kW	1		
	Pulse power in braking circuit (PA/+ max. 1s)	kW	3		
LXM15LU60N4	Switch-on (upper) threshold of braking circuit	V	400	720	840
	Overvoltage F02	V	455	800	900
	Braking resistor (internal)	Ohm	91	91	91
	Continuous power in braking circuit (PBi)	W	20	20	20
	Pulse power in braking circuit (PBi max. 1s)	kW	2.1	7	9
	Braking resistor (external)*	Ohm	91	91	91
	Continuous power in braking circuit (PA/+) max.	kW	0.3	0.3	0.3
	Pulse power in braking circuit (PA/+ max. 1s)	kW	2.1	7	9
LXM15LD10N4/17N4	Switch-on (upper) threshold of braking circuit	V	400	720	840
	Overvoltage F02	V	455	800	900
	Braking resistor (internal)	Ohm	91	91	91
	Continuous power in braking circuit (PBi)	W	50	50	50
	Pulse power in braking circuit (PBi max. 1s)	kW	2.1	7	9
	Braking resistor (external)*	Ohm	91	91	91
	Continuous power in braking circuit (PA/+) max.	kW	1.0	1.0	1.0
	Pulse power in braking circuit (PA/+ max. 1s)	kW	2.1	7	9

*Other resistance values are possible. Please ask our applications department.

Braking circuit wiring overview

External braking resistor wire specifications

The following table describes the recommended wire specifications. Use only copper wire with insulation rated at 75 °C or greater, unless otherwise specified

LXM15L	Wire Size	Recommended tightening torque Nm (lbf.in)	Notes	Protective device
D13M3, D21M3, D28M3 U60N4, D10N4, D17N4	1.5 mm ² or 14 AWG	0.5...0.6 (4.4...5.3)	High temperature insulation 1000 V, 105 °C or greater	GV2MExx or equivalent.

External braking resistor connection

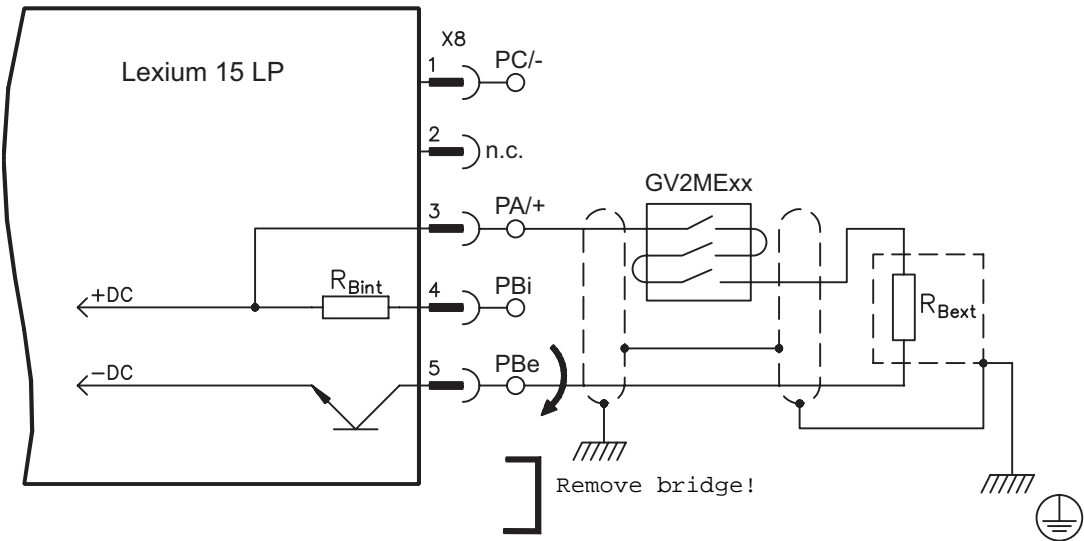
The following diagram shows the connections between the external braking resistor and the Lexium 15 LP servo drive. The servo drive is shipped with a jumper installed on connector X8, terminals PBe and PBi. If you are going to use an external braking resistor, then remove the jumper between PBe and PBi to disconnect (and thus disable) the internal braking resistor.

⚠ DANGER

FIRE HAZARD

- Connect the resistor to a protective device such as a Telemecanique GV2MExx circuit protector.
- Place the circuit protector between the resistor and the PA/+ terminal of the controller. The three contacts on the GV2ME must be wired in series.
- Consult Schneider Motion engineering for selection of the appropriate GV2MExx protective devices and the recommended settings.
- If fuses are used, two must be installed, one each resistor connection. Fuses must be rated for direct current (DC) application at the highest DC Link Voltage.

Failure to follow these instructions will result in death or serious injury.



⚠ CAUTION

IMPROPER USE OF A BRAKING RESISTOR

Only use the braking resistors recommended in our catalogs.

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

Power wiring

Servo motor wire specifications

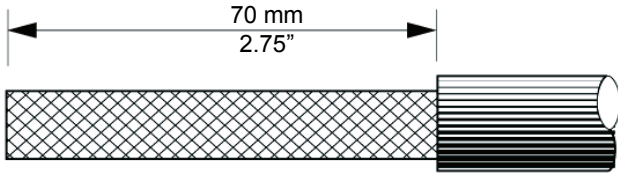
The following table describes the recommended wire specifications. Use only copper wire with insulation rated at 75 °C or greater, unless otherwise specified

LXM15L	Item	Wire Size	Notes
D13M3, D21M3, D28M3 U60N4, D10N4, D17N4	Power	Depends on the servo motor model. Please see the Lexium 15 servo drive catalog	-
	Brake	1.0 mm ² or 16 AWG minimum	Shielded

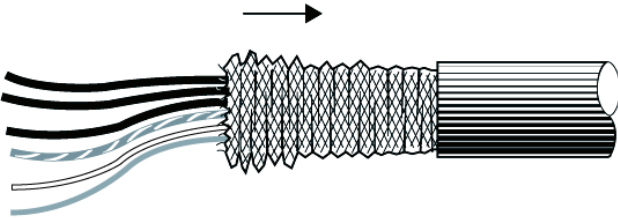
Servo motor wire recommendations

The following diagram and assoicated table explain how to prepare the motor cable

1

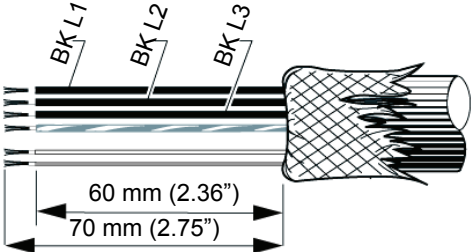


2



BK L1
BK L2
BK L3
GN/YE
WH
GR

3



Step	Action
1	Strip the motor cable to 70 mm (2.75")
2	Slide the shield braiding back over the cable sheath. During mounting it must be spread over the EMC plate.
3	Strip each segment cable to 10 mm

The table below describes the servo motor power cables specifications

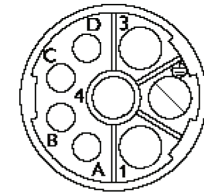
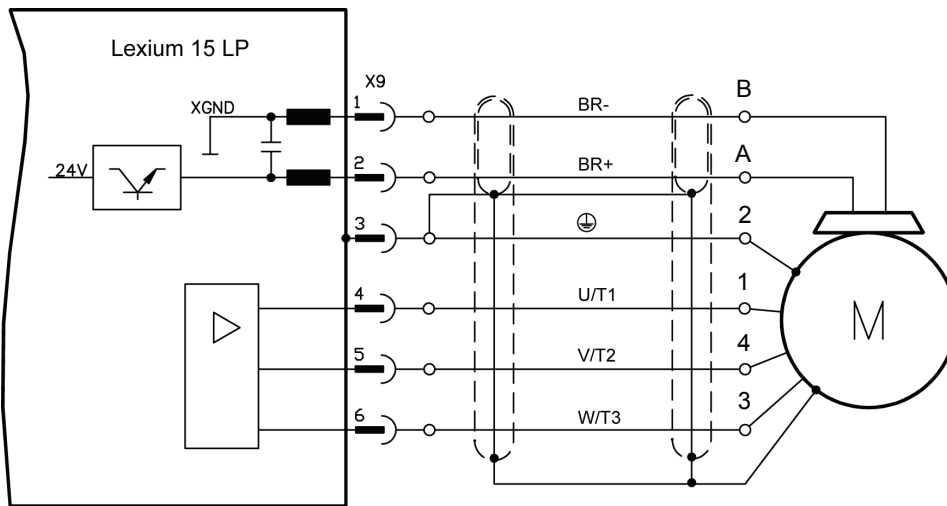
Servo motor cable	Description	Color
U/T1	Motor phase	BK L1
V/T2	Motor phase	BK L2
W/T3	Motor phase	BK L3
⏏	Protective conductor	Green/Yellow
BR+	Brake +	White
BR-	Brake -	Gray

Power wiring

Servo motor power connection

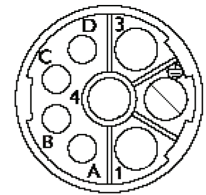
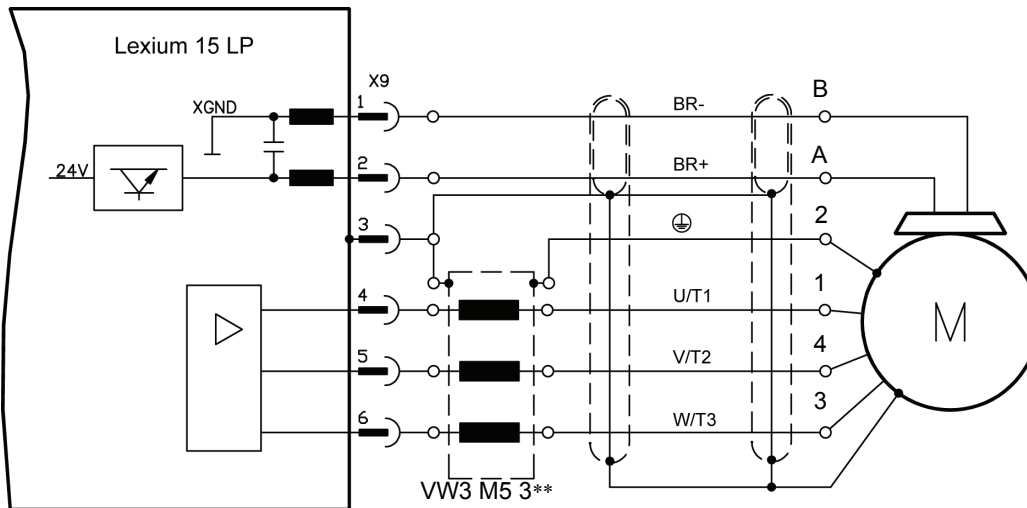
The following diagrams show the connections between a BDH or BSH servo motor and the Lexium 15 LP servo drive. When the interface cable length exceeds 25 m, a servo motor choke must be installed as shown and at a distance of one meter or less from the servo drive.

Connection between servo motor and servo drive when interface cable length is 25 m or less:



Servo motor power connector

Connection between servo motor and servo drive when interface cable length exceeds 25 m:



Servo motor power connector

If a servo motor power cable is used that includes cores for brake control, the brake control cores must be separately shielded. Ground the shielding at both ends.

⚠ CAUTION

RISK OF IMPROPER SERVO MOTOR OPERATION

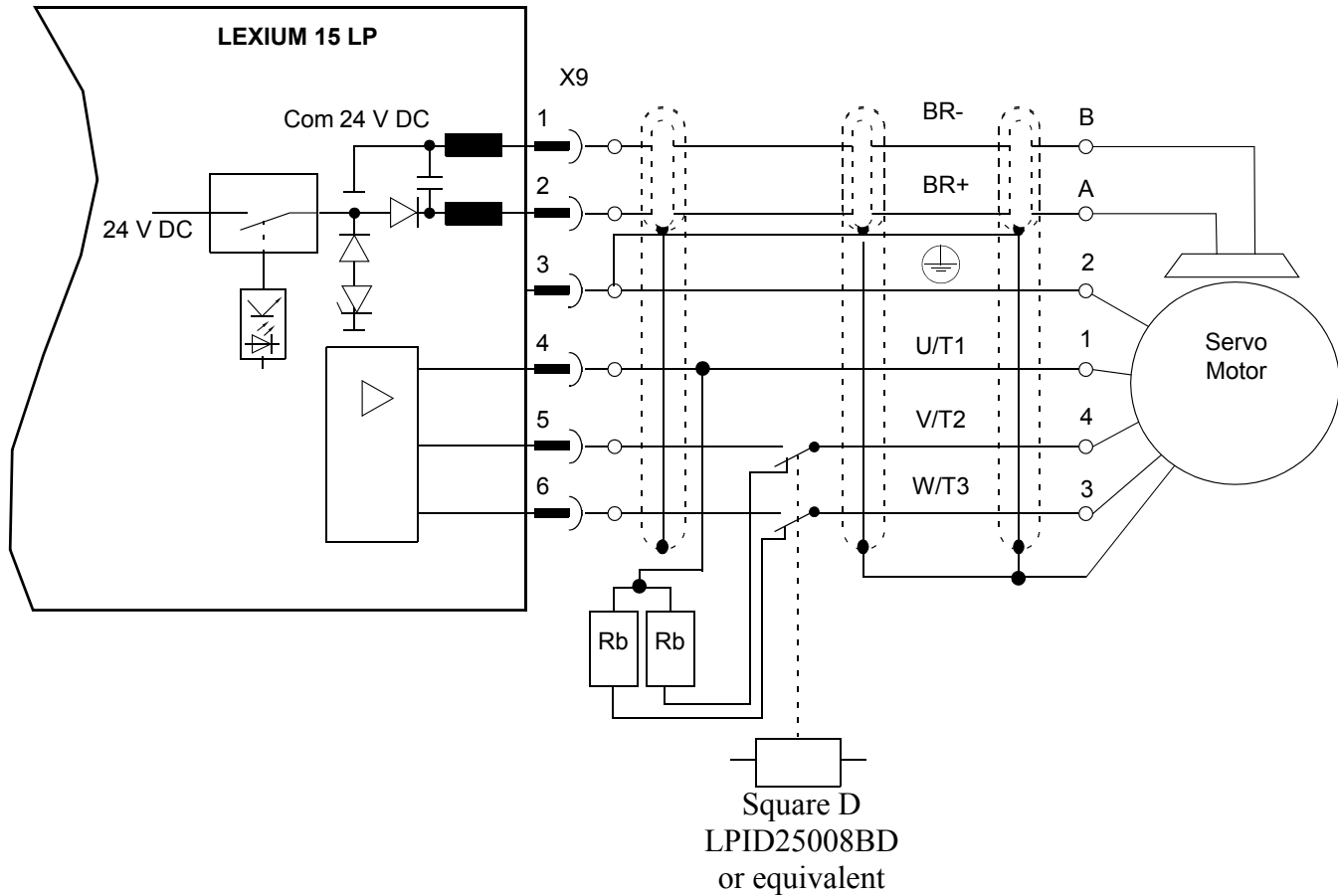
The servo motor output cable must be properly grounded using the provided shielding clamp.

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

Power wiring

Servo motor (with optional dynamic brake resistors and contactor) connection

The following diagram shows the connections between a servo motor and the Lexium 15 LP servo drive when the optional dynamic brake resistors and associated contactor are incorporated.



Note: If possible, disable the servo drive before opening relay

Braking resistors value

To determine the values of the braking resistors, use these formulas:

MINIMUM RESISTANCE (Rdb)

$$Rb = \frac{\left(\frac{\text{Maxspeed}}{1000} \right) * BEMF}{I_{\max} * 0.8}$$

RESISTOR POWER RATING (Pb)

$$Pb = \frac{(I_{\max} * 0.8)^2 * Rb}{10}$$

where : **Maxspeed** is the maximum speed of the servo motor in RPM*

BEMF is the back electromotive force of the servo motors in V/KRPM*

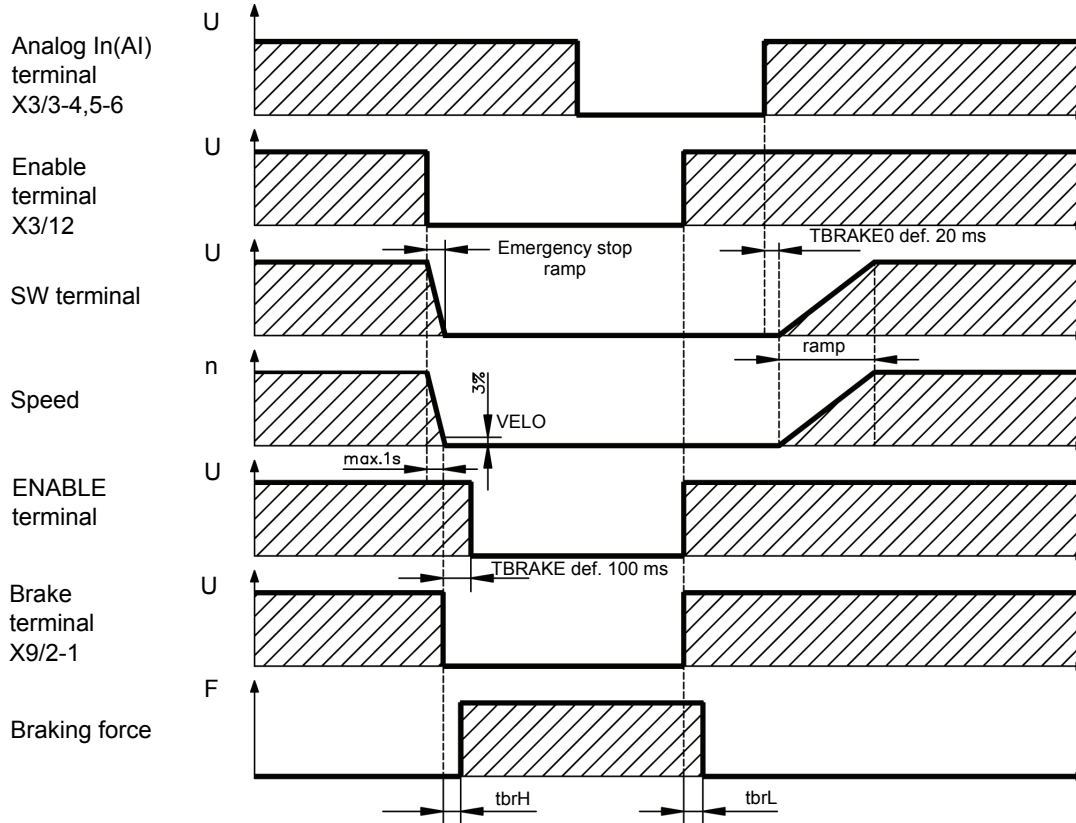
I_{max} is the maximum current of the servo motor in Amps RMS*

*These values are provided in the servo motor specification sheet

Holding brake control

Servo motor holding-brake control functional description

A 24 V / max.1.5 A holding brake in the servo motor can be controlled directly by the servo drive. The brake function must be enabled through the BRAKE parameter (See Lexium 15 LP programming manual). In the diagram below you can see the timing and functional relationships between the ENABLE signal, speed setpoint, speed and braking force



During the internal ENABLE delay time of 100 ms, the speed setpoint of the servo drive is internally driven down an adjustable ramp to 0 V. The output for the brake is switched on when the speed has fallen to 3 % of the preset final speed, at the latest after 1 second. The connection and separation time of the holding brake that is built into the servo motor are different for the various types of servo motor. For a description of the interface see the Lexium 15 LP programming manual.

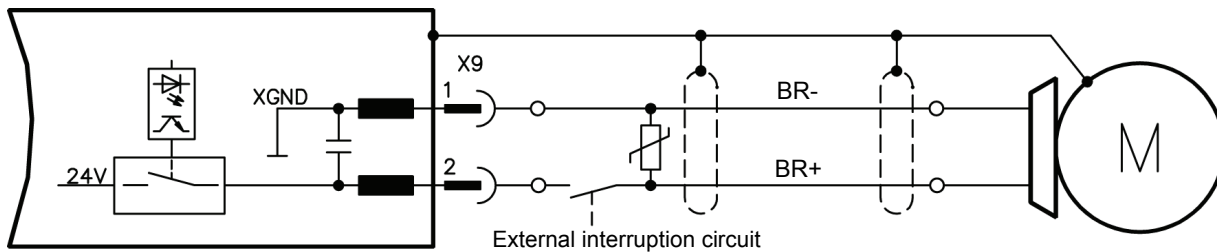
⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Ensure that when the brake is operated as a safety device, there is an additional "make" contact in the brake circuit, and a suppressor device, such as a varistor, for the brake circuit.

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

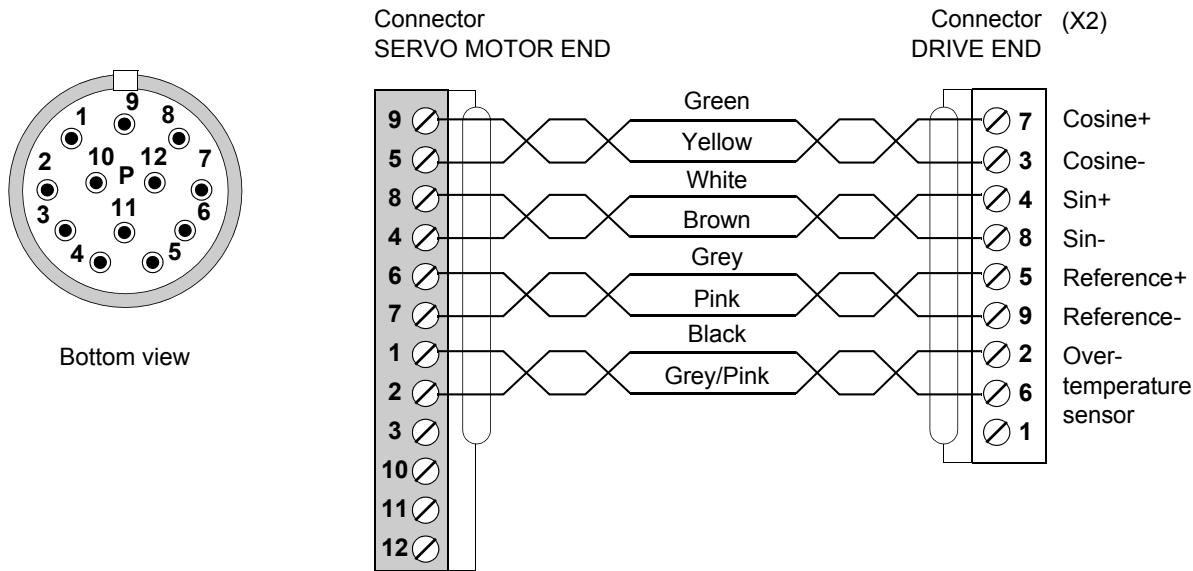
The recommended circuit is as follow :



Resolver connection

BDH servo motor resolver connection

The following diagram shows the connections between the resolver and the Lexium 15 LP servo drive.



Resolver input specifications table

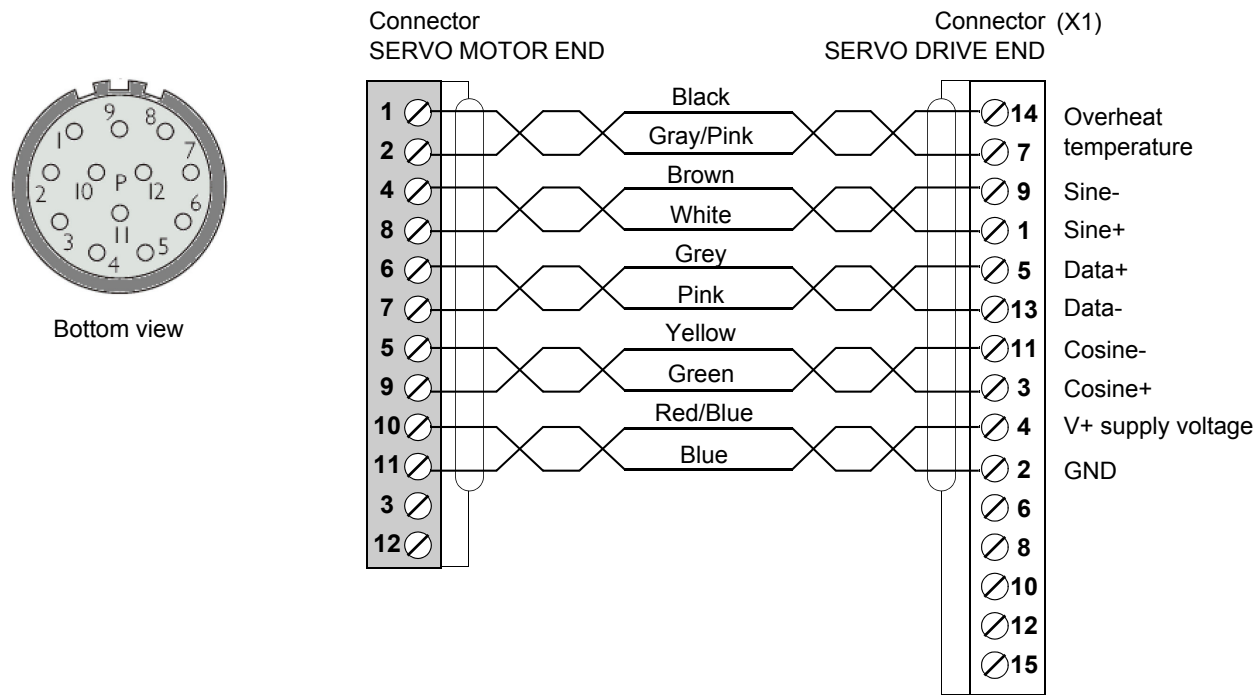
The following table provides resolver input specifications.

RESOLVER	
Reference	1 kHz ± 0.5 %
Servo drive capability	35 mA RMS max.
Amplitude	7 V ± 10 % RMS
Pair of poles	1 (default)
Accuracy	< 30 arc minutes
Resolver transformation ratio	0.5 ± 10 %
Loss of feedback	Detection circuit included
Maximum cable length	75 m
Maximum cable capacitance (signal connector to shield)	120 pF/m

Encoder connection

Servo motor encoder connection

The following diagram shows the encoder input connections between the encoder and the Lexium 15 LP servo drive.



Note:The servo motors can be optionally fitted with a single-turn or multi-turn sine-cosine encoder, which is used by the Lexium 15 LP positioning or extremely smooth running. In addition, the thermistor contact in the servo motor is connected via the encoder cable to the Lexium 15 LP servo drive.

Encoder Input Specifications Table

The following table provides Lexium 15 LP encoder input specifications

ENCODER INPUT			
Internal power supply	Voltage	7 V...12 V RMS	
	Current (maximum)	60 mA	
Input Signal	Sin-Cos encoder (cyclic absolute)	Absolute accuracy	± 5.3 arc minutes
		Resolution	± 1.3 arc minutes
	Sin-Cos encoder (multi-turn absolute)	Turn counter	12 bits
		Absolute accuracy within one turn	± 5.3 arc minutes
		Resolution within one turn	± 1.3 arc minutes

Encoder emulation

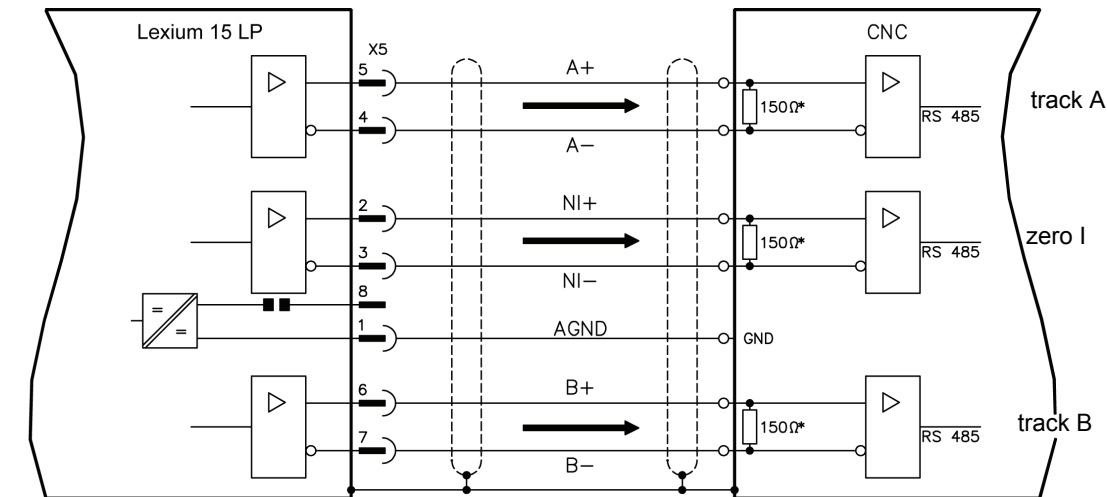
Incremental encoder output (X5)

The incremental-encoder interface is part of the package supplied. Select encoder function ROD (“Encoder” screen page). The servo drive calculates the servo motor shaft position from the cyclic-absolute signals of the resolver or encoder, generating incremental-encoder compatible pulses from this information. Pulse outputs on the SubD connector X5 are 2 signals, A and B, with 90 ° phase difference (i.e. in quadrature, hence the alternative term “A quad B” output), with a zero pulse. The resolution (before multiplication) can be set by the RESOLUTION function:

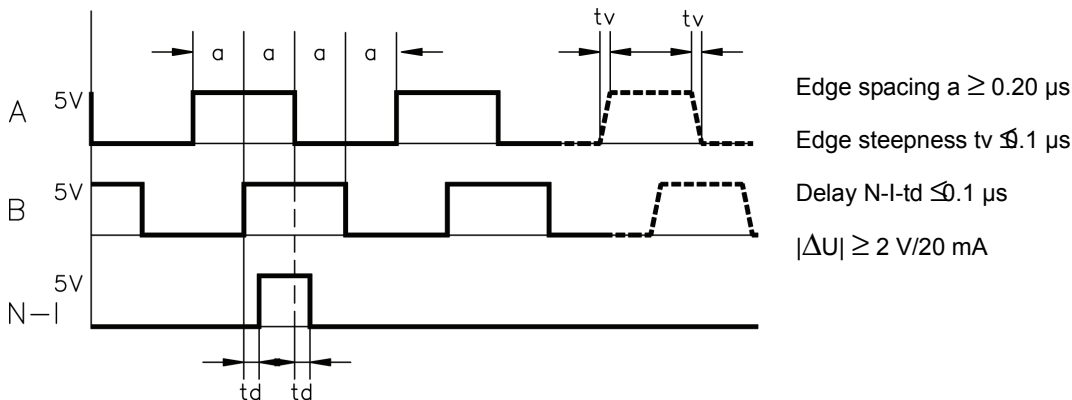
Enc. function (ENCMODE)	Feedback system	Resolution (lines)	Zero pulse (NI)
ROD	Resolver	16 ... 1024	once per turn (only at A=B=1)
	EnDat / HIPERFACE	16 ... 4096 and 8192 ... 524288 (2 n)	once per turn (only at A=B=1)
ROD interpolation	Incremental encoder without data channel	$2^2 \dots 2^7$ (multiplication) TTL line x encoder resolution	encoder signal passed through from X1 to X5

Use the NI-OFFSET parameter to adjust + save the zero pulse position within one mechanical turn. The maximum permissible cable length is 100 meters.

Connections and signals for the incremental encoder interface are as follows:



***Terminating impedance is required for operation of the communication bus.**



Encoder emulation

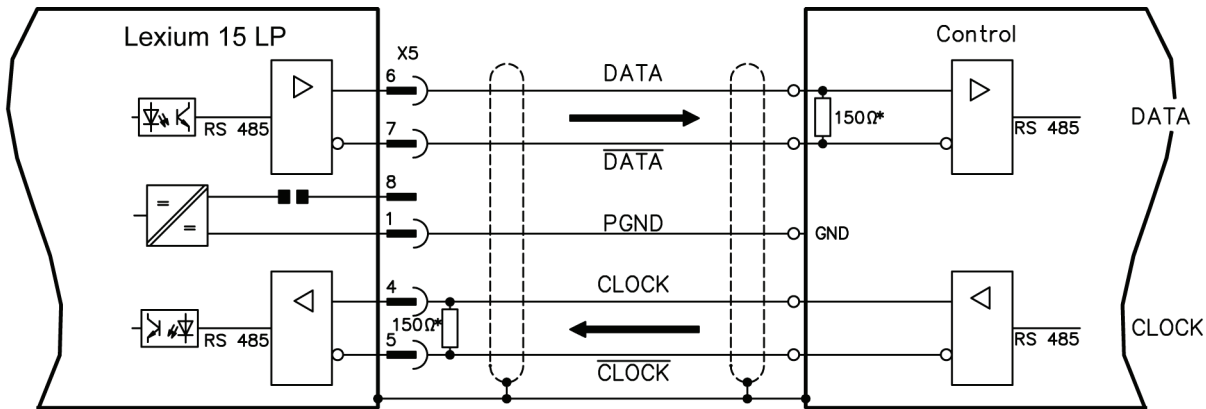
SSI output (X5)

The SSI interface (synchronous serial absolute-encoder emulation) is part of the package supplied. Select encoder function ROD (“Encoder” screen page). The servo drive calculates the servo motor shaft position from the cyclic-absolute signals of the resolver or encoder. From this information a SSI date (after Stegmann patent specification DE 3445617C2) is provided. Max 32 bits are transferred. The leading data bit contains the number of revolutions and are selectable from 12 to 16 bits. The following max. 16 bits contain the resolution and are not variable. The following table shows the allocation of the SSI date depending upon selected number of revolutions:

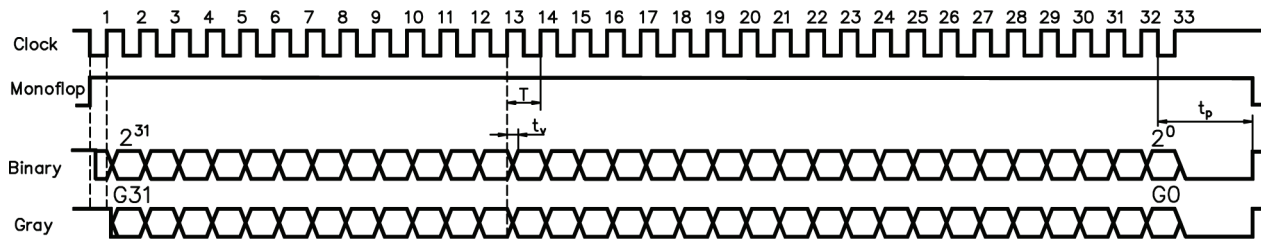
Revolution																Resolution (variable)															
SSIREVOL																															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0															
	14		13	12	11	10	9	8	7	6	5	4	3	2	1	0															
	13			12	11	10	9	8	7	6	5	4	3	2	1	0	15	14	13	12	11	10	9	8	7	6	5	4			
	12				11	10	9	8	7	6	5	4	3	2	1	0															
	11					10	9	8	7	6	5	4	3	2	1	0															

The signal sequence can be output in Gray code or in Binary (standard) code (parameter SSI-CODE). The servo drive can be adjusted to the clock frequency of your SSI-evaluation through the SSI-TIMEOUT parameter (1,3 µs or 10 µs).

Connection and signals for the SSI interface are described below:



*Terminating impedance is required for operation of the communication bus.



Switch over time Data t_v ≤ 300 ns

Output |ΔU| ≥ 2 V/20 mA

Period T = 600 ns

Input |ΔU| ≥ 0.3 V

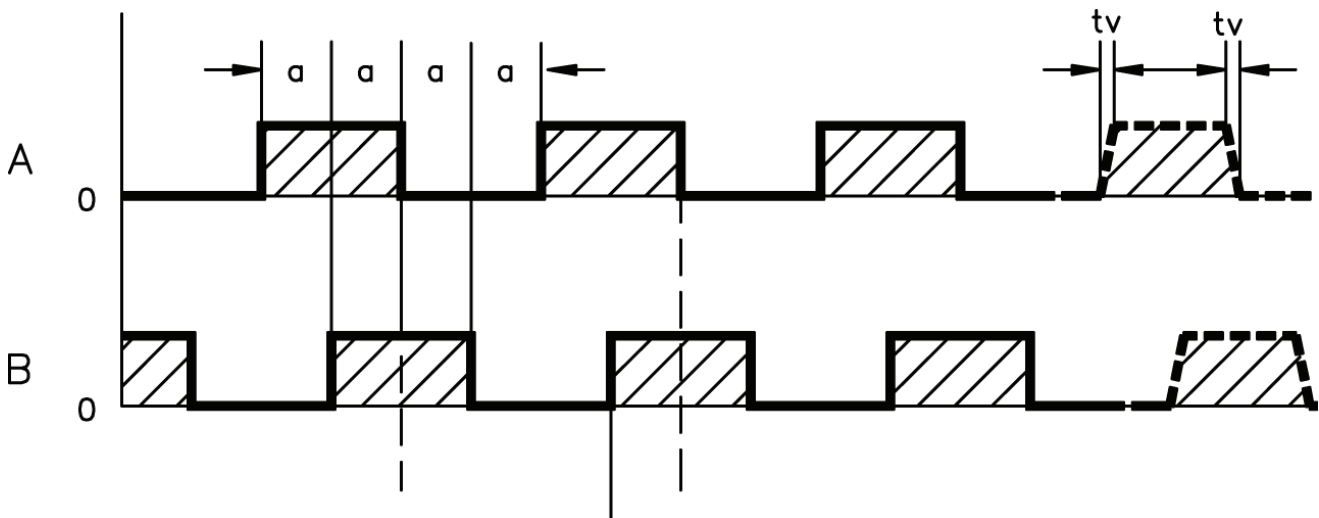
Time out t_p = 1.3 µs/10 µs (SSITOUT)

Note: The count direction for the SSI interface is UP when the servo motor shaft is rotating clockwise (looking at the end of the servo motor shaft).

Master/Slave connection

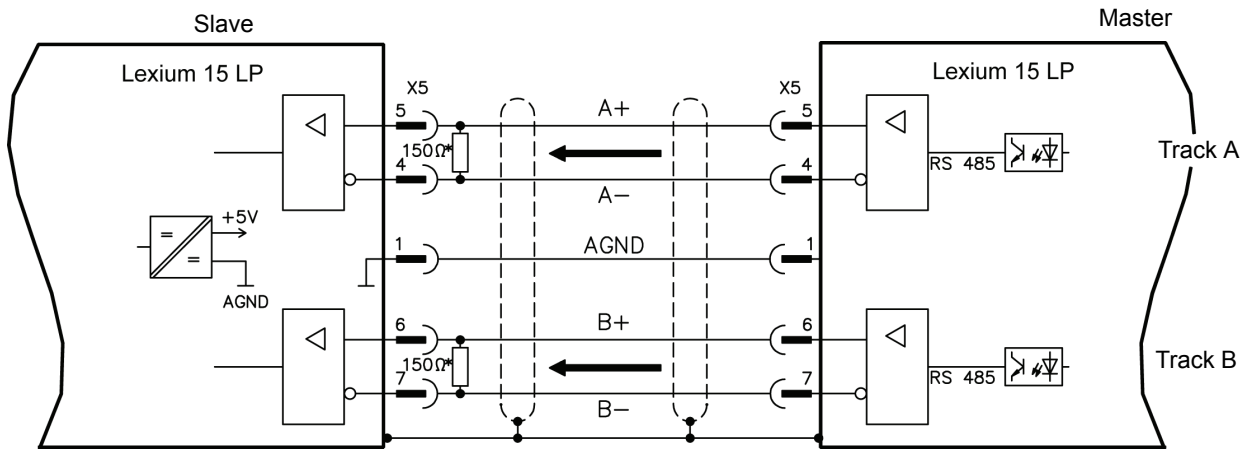
This interface can be used to link several Lexium 15 LP servo drives together in master-slave operation. Parameter setting for the slave servo drive is carried out with the aid of the setup software (electrical gearing). The resolution (no. of pulses/turn) can be adjusted, and the analog setpoint inputs are out of action.

Signal diagram (for encoders with RS422 or 24 V output) is as follow:



Connection to a LEXIUM master, 5 V signal level (X5)

This interface can be used to link several Lexium 15 LP servo drives together in master-slave operation as shown in the following diagram. Up to 16 slave servo drives can be controlled by the master, via the encoder output. The SubD connector X5 is used for this purpose.



*Terminating impedance is required for operation of the communication bus.

Encoder input (slave) specifications table

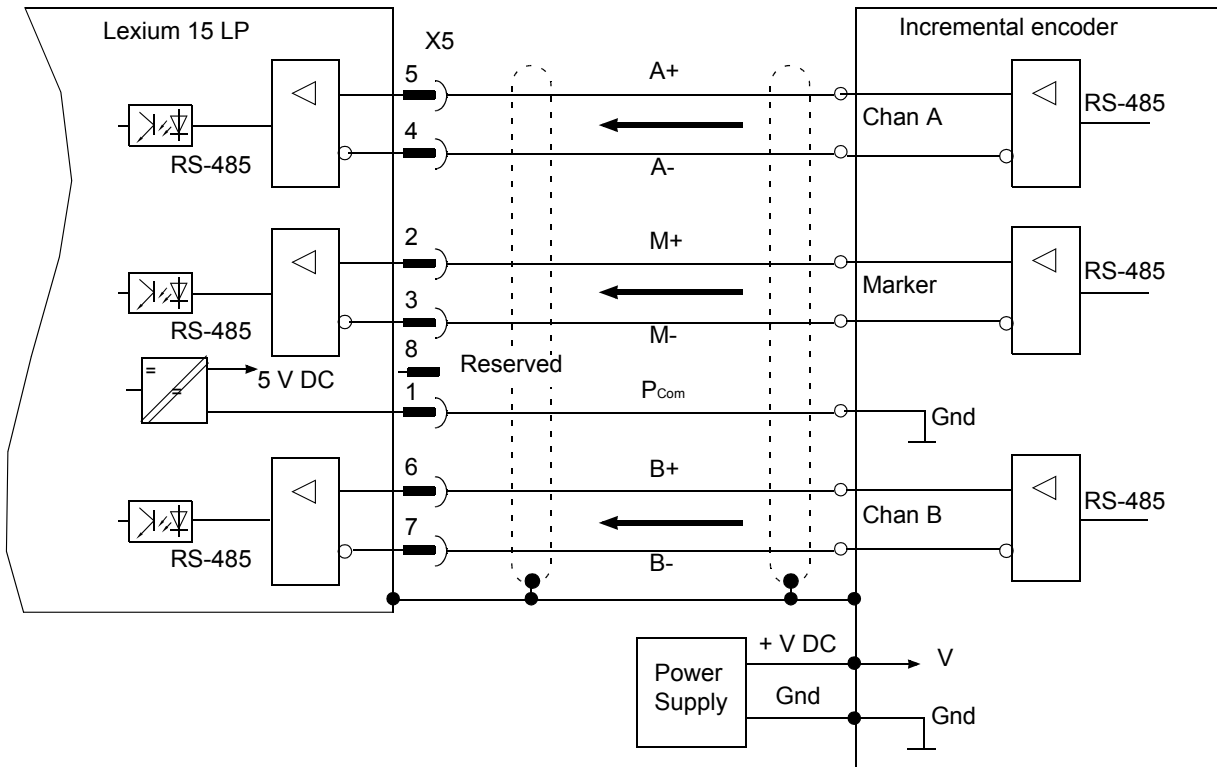
The following table provides Lexium 15 LP encoder input (slave) specifications.

ENCODER INPUT (SLAVE)	
Channels	A and B
Type	Differential, RS-485 compliant
Voltage	8 V nominal
Current	200 mA (maximum)
Maximum frequency	1.5 MHz
Rise time	≤ 0.1 ms
Fall time	≤ 0.1 ms

External encoder emulation

External incremental encoder connection

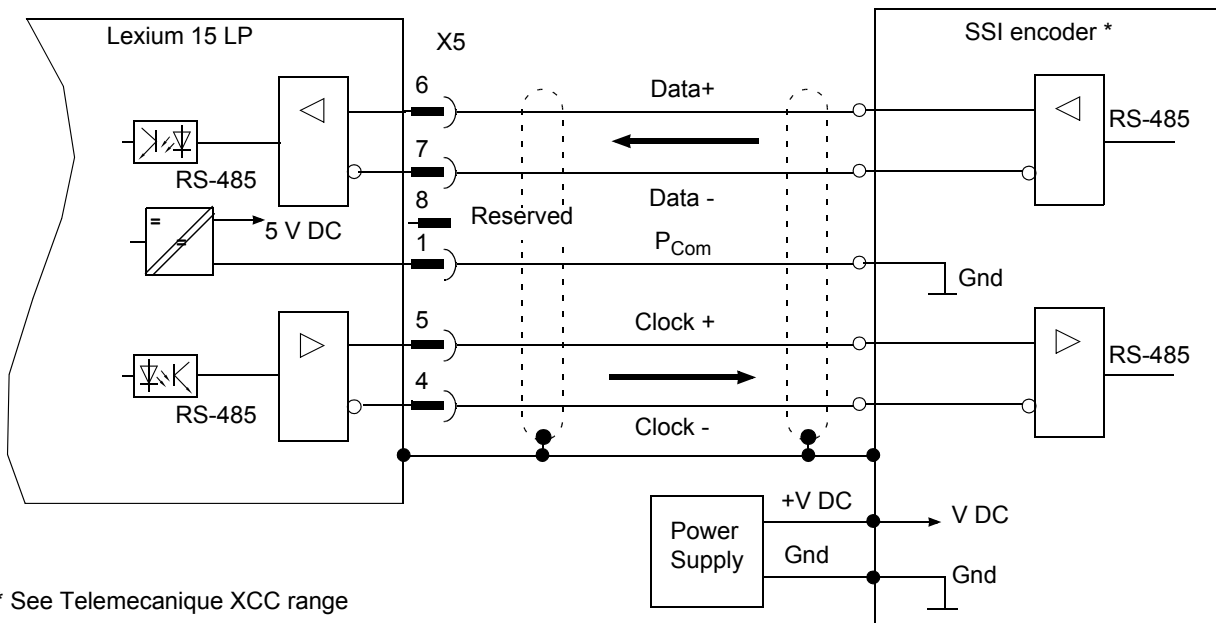
The following diagram shows the incremental encoder input connections between the Lexium 15 LP servo drive and an external incremental encoder.



Note: The receivers are supplied with an internal supply voltage.
P_{Com} must always be connected to the encoder ground.
Incremental encoder is powered by an external control power supply.

External SSI encoder connection

The following diagram shows the connections between an external SSI encoder and the Lexium 15 LP servo drive.



* See Telemecanique XCC range

Note: The drivers are supplied with an internal supply voltage.
P_{Com} must always be connected to the encoder ground.
SSI encoder is powered by an external control power supply

⚠ CAUTION

RISK OF EQUIPMENT DAMAGE

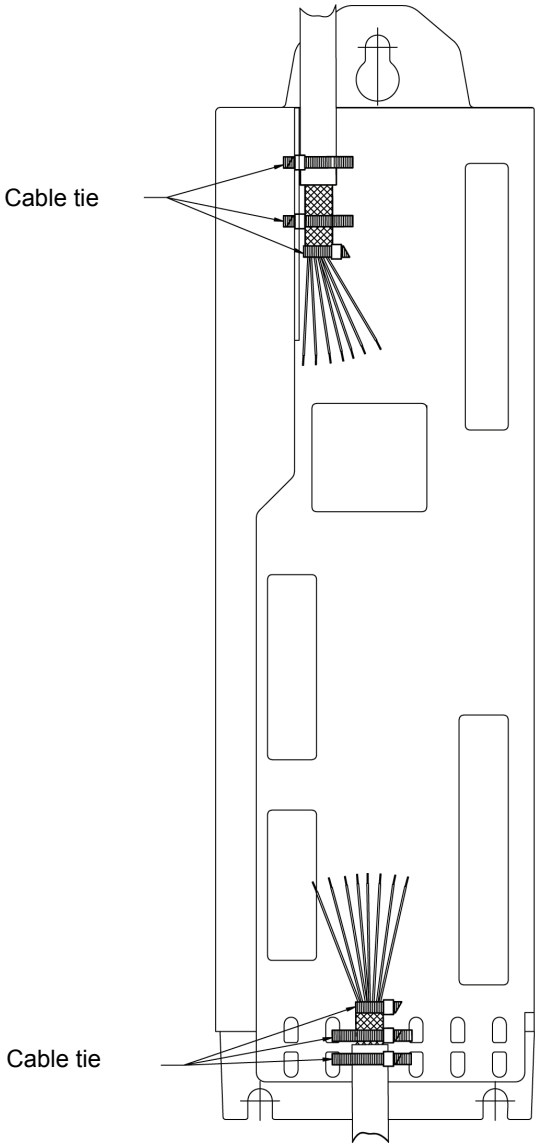
AGND is the ground for analog inputs, internal analog ground, encoder emulation, RS232 and CAN.
DGND is the ground for digital inputs/outputs and the external control power supply, optically isolated.
Ensure that all elements are correctly grounded and that the two grounds are connected at only one common point.

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

Connecting cable shields to the front panel

The following procedure and associated diagram describe how to connect cable shields to the front panel of the Lexium 15 LP servo drive:

Step	Action
1	Remove a length of the cable's outer covering and braided shield sufficient to expose the required length of wires.
2	Secure the exposed wires with a cable tie.
3	Remove approximately 30 mm of the cable's outer covering while ensuring the braided shield is not damaged during the process.
4	At the front panel of the servo drive, insert a cable tie into a slot in the shielding rail.
5	Use the previously inserted cable tie to secure the exposed braided shield of the cable firmly against the shielding rail.



Remove the outside shroud of the cable and the shielded braid on the desired core length. Secure the cores with a cable tie.

Remove the outside shroud of the line on a length from, for instance, 30 mm without damaging the shielding braid.

Pull a cable tie by the slot in the shielding rail on the front panel of the servo drive.

Press the shielding of the cable firmly against the front panel with the cable tie

Analog I/O connection

Analog I/O wire specifications

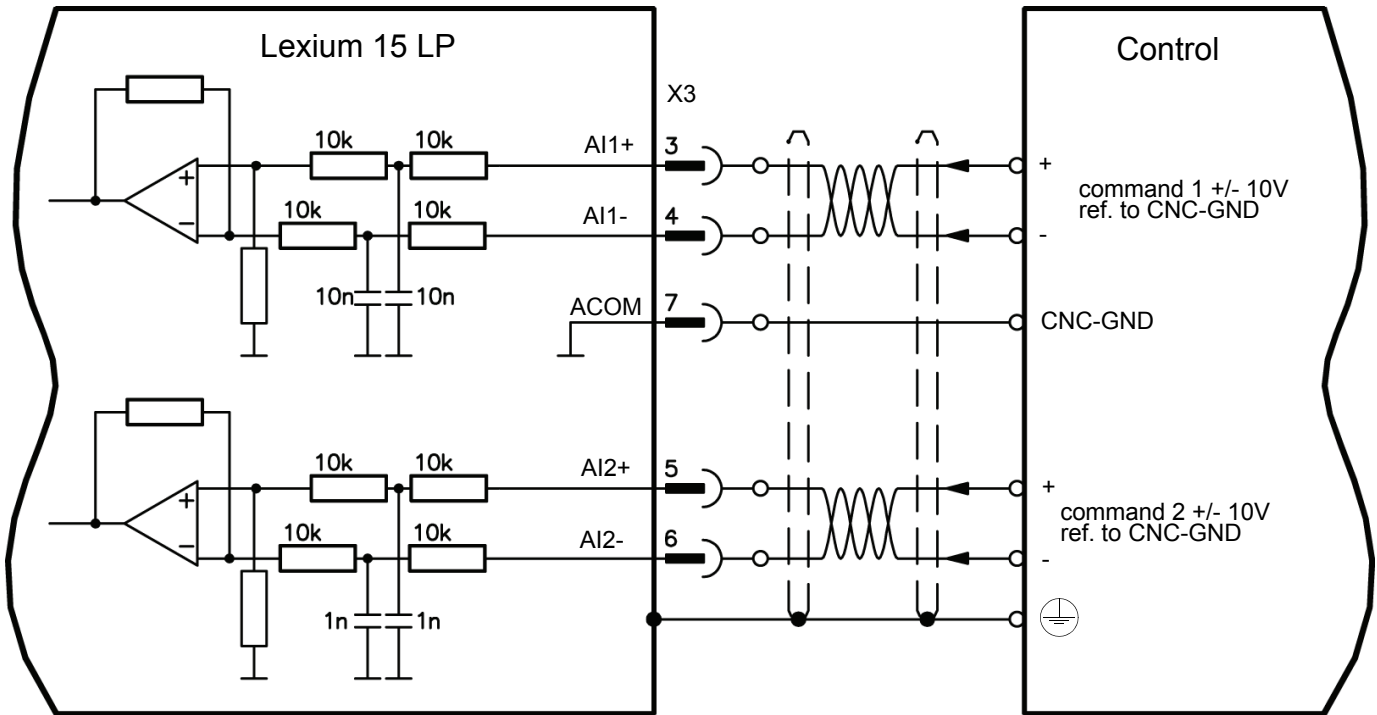
The following table describes the recommended wire specifications. Use only copper wire with insulation rated at 75 °C or greater, unless otherwise specified

LXM15L	Wire Size	Notes
D13M3, D21M3, D28M3, U60N4, D10N4, D17N4	0.25 mm ² or 22 AWG minimum	Twisted pairs, shielded

Analog inputs (X3)

The servo drive is fitted with two programmable differential inputs for analog setpoints. ACOM (X3/7) must always be joined to the GND of the controls as a ground reference.

The following diagram shows the connections between the two fully programmable, differential analog inputs on the Lexium 15 LP servo drive and a user device.



The list below describes the technical characteristics for the analog inputs (X3):

- Ground reference : ACOM, terminal X3/7
- Input resistance 20 kΩ

Analog I/O connection

The table below describes terminals X3/3-4 (AI1+/AI2-) and X3/5-6 (AI2+/AI2-) characteristics:

Terminals	Characteristics	Application examples for setpoint input
Analog-In 1 input (terminals X3/3-4)	Differential input voltage max. ± 10 V Resolution 14-bit Scalable Standard setting: speed setpoint	-
Analog-In 2 input (terminals X3/5-6)	Differential input voltage max. ± 10 V Resolution 12-bit Scalable Standard setting: torque setpoint	Adjustable external current limit Reduced-sensitivity input for setting-up/jog operation Pre-control / override

Defining the direction of rotation

The standard setting is a clockwise rotation of the servo motor shaft (looking at the shaft end):

- Positive voltage between terminal X3/3 (+) and terminal X3/4 (-) or
- Positive voltage between terminal X3/5 (+) and terminal X3/6 (-)

To reverse the direction of rotation, swap the connections to terminals X3/3-4 or X3/5-6 respectively, or change the ROTATION DIRECTION parameter in the "Speed controller" screen page.

Digital I/O connection

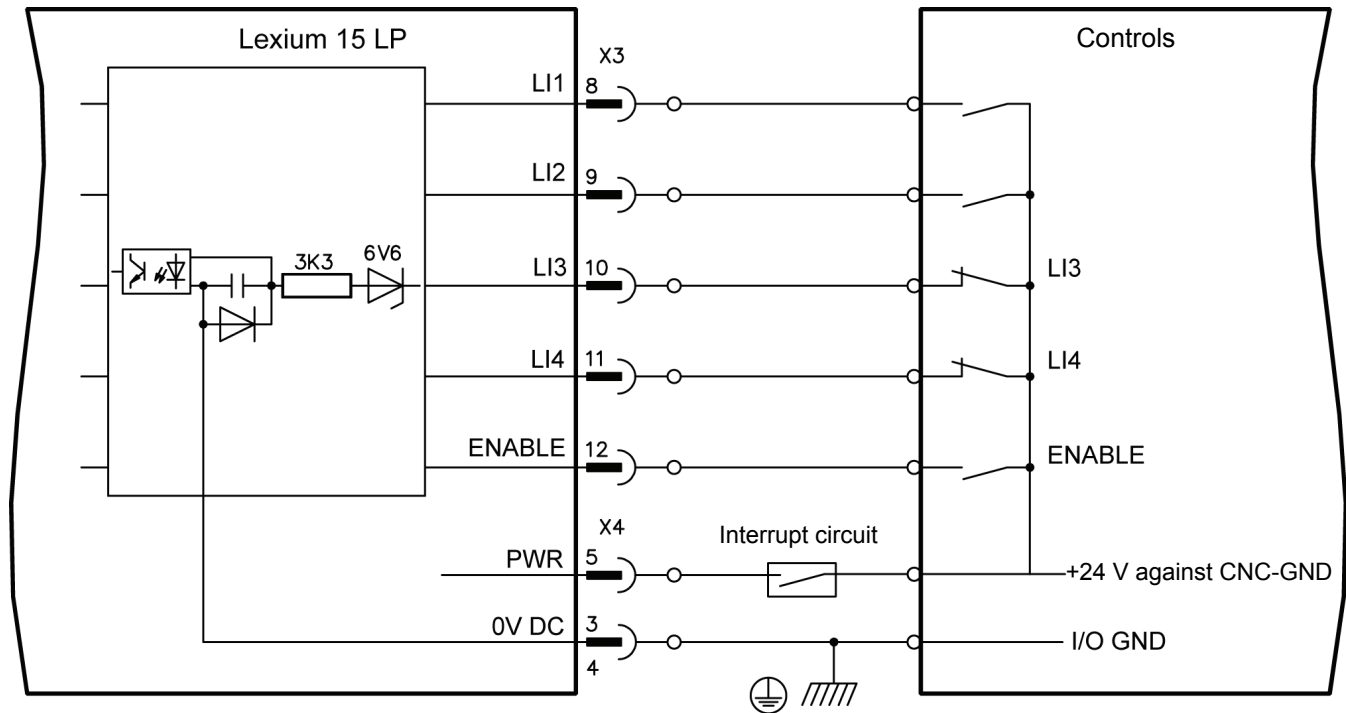
Digital I/O wire specifications

The following table describes the recommended wire specifications. Use only copper wire with insulation rated at 75 °C or greater, unless otherwise specified

LXM15L	Wire Size
D13M3, D21M3, D28M3 U60N4, D10N4, D17N4	0.5 mm ² or 20 AWG minimum

Digital control inputs(X3/X4)

All digital inputs are electrically isolated via optocouplers.



⚠ DANGER

UNEXPECTED MOVEMENT

The power removal function input (PWR) must be properly wired using an interrupt circuit as recommended herein.

Failure to follow these instructions will result in death or serious injury.

Discrete Input Specifications Table

The following table provides Lexium 15 LP discrete input specifications.

DISCRETE INPUT	
Channels	Five (four programmable and one dedicated for enable)
Type	Solid state, optically isolated, compatible IEC61131-2 type1.
Transient isolation voltage	250 V AC (channel to chassis)
V _{IN} maximum	30 V DC
I _{IN} @ V _{IN} = 24 V	11 mA
V _{IH} minimum	11 V (minimum input voltage to be recognized as high – true)
V _{IL} maximum	5 V (maximum input voltage to be recognized as low – false)
Scan time:	250 μs

Digital I/O connection

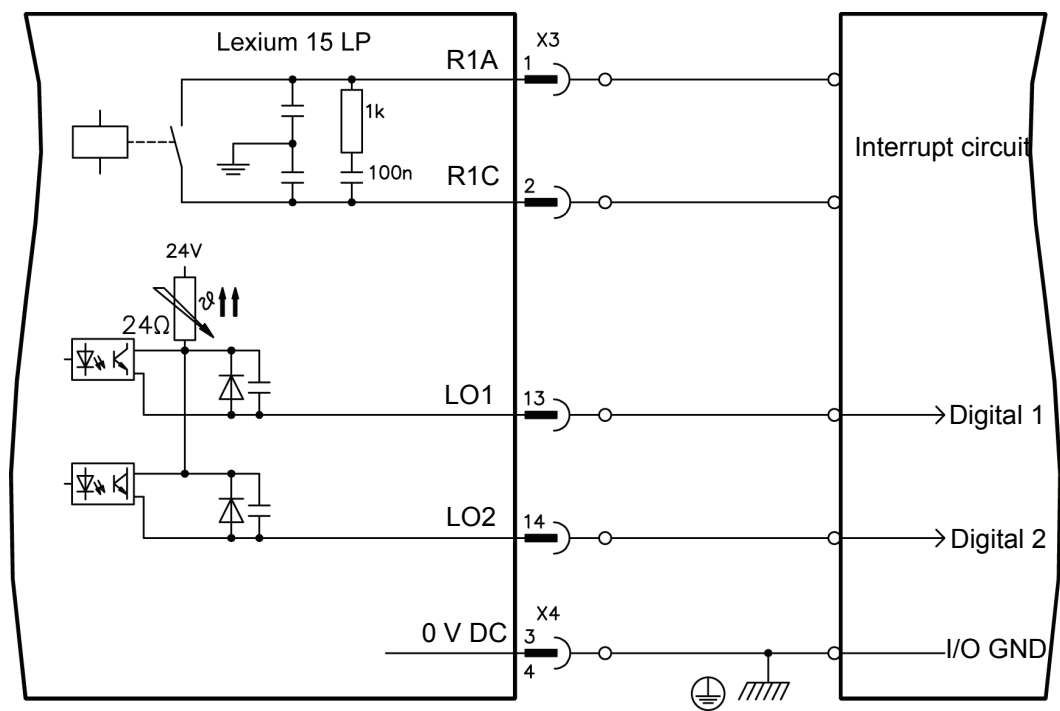
Digital I/O wire specifications

The following table describes the recommended wire specifications. Use only copper wire with insulation rated at 75 °C or greater, unless otherwise specified

LXM15L	Wire Size
D13M3, D21M3, D28M3 U60N4, D10N4, D17N4	0.5 mm ² or 20 AWG minimum

Digital control outputs(X3)

The following diagram shows the different control outputs :



Discrete Output Specifications Table

The following table provides Lexium 15 LP discrete output specifications.

DISCRETE OUTPUT	
Channels	Two
Type	Solid state: open emitter 30 V DC max., optically isolated
Transient isolation voltage	250 V AC (channel to chassis)
Sense	True low, sinking
I _{OUT}	10 mA maximum
Protection	Yes (PTC resistor 25 Ohm)
Scan time	250 μs

R1A/R1C Relay Output Specifications Table

The following table provides Lexium 15 LP R1A/R1C relay output specifications.

R1A/R1C RELAY OUTPUT	
Type	Relay contact
Sense	True (open)
V _{MAX}	30 V DC; 42 V AC
I _{OUT}	500 mA resistive

Pulse-direction control interface connection

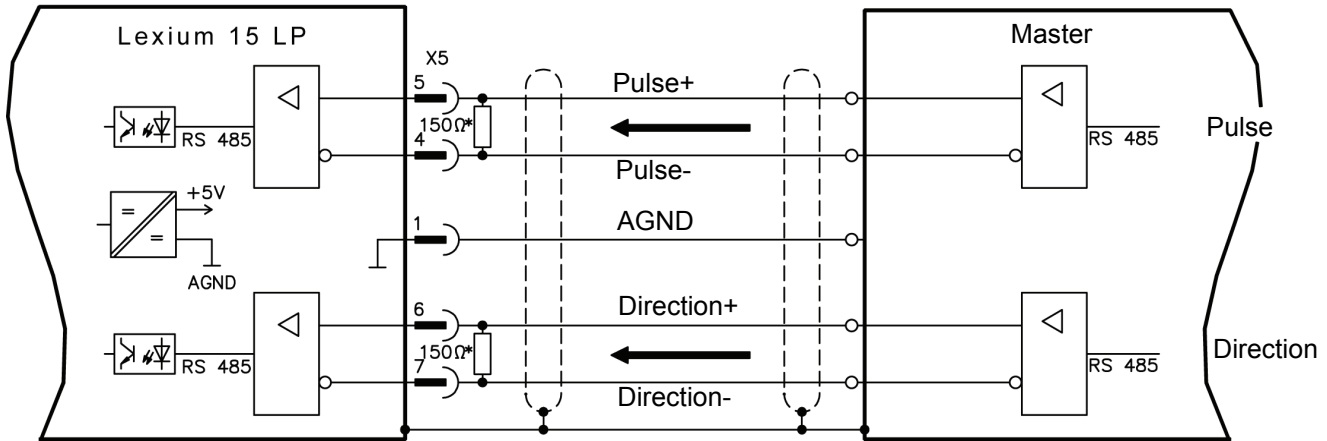
Pulse-direction control interface connection functional description

This interface can be used to connect the servo drive to a third-party pulse-direction controller. The parameters for the servo drives are set using the UniLink software and the number of steps are adjustable to allow the servo drive to correlate to the step-direction signals of any pulse-direction controller. In this configuration, the analog inputs are disabled and the servo drive can provide various monitoring signals.

Connection to a pulse-direction controller with 5 V signal level (X5)

This interface can be used to connect the servo drive to a pulse-direction controller with a 5 V signal level.

Frequency limit: 1.5 MHz

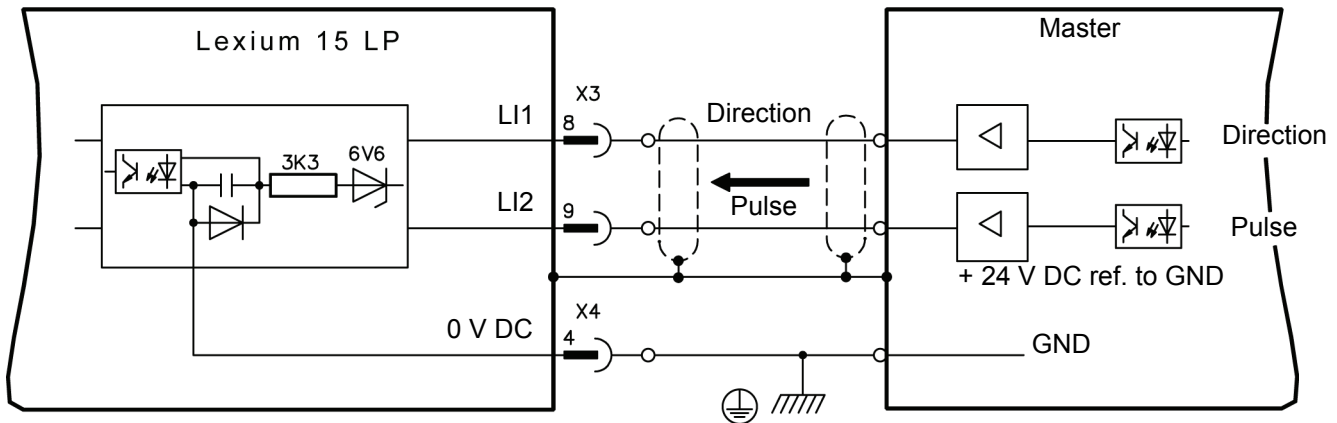


*Terminating impedance is required for operation of the communication bus.

Connection to a pulse-direction controller with 24 V DC signal level (X3)

This interface can be used to connect the servo drive to a pulse-direction controller with a 24 V signal level.

Frequency limit: 100 kHz



Serial communications connection (X6)

CAUTION

RISK OF EQUIPMENT DAMAGE

Do not connect a Modbus serial port to the X6 connector! Pin1 carries + 8 V DC which would be shorted out by a Modbus cable. Instead, use a 3-core cable (not a null-modem link cable) with only pins 2, 3 and 5 wired.

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

Serial communications connection diagram

Operating, position control, and motion-block parameters can be set up by using the setup software on an ordinary commercial PC.

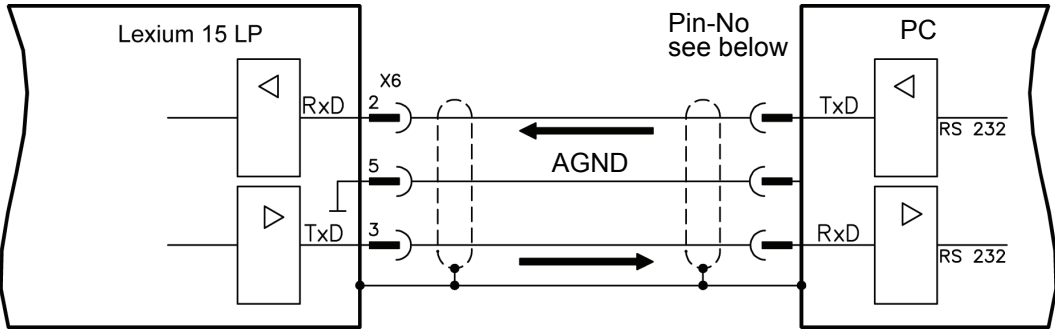
Connect the PC interface (X6) of the servo drive to a serial interface on the PC via a null-modem cable, while the supply to the equipment is switched off.

Do not use a null-modem power link cable!

This interface has the same electrical potential as the CANopen interface.

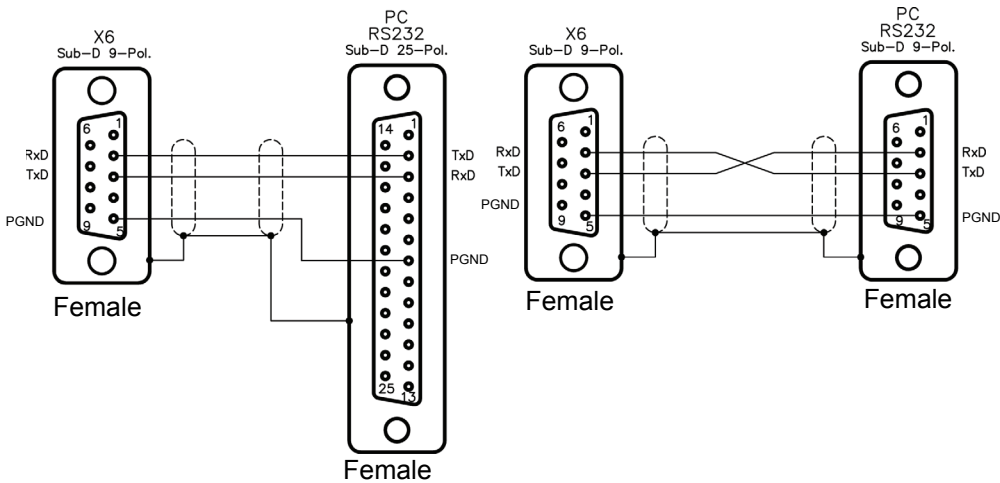
The interface is selected and set up in the setup software.

With the optional -2CAN- expansion card, the two interfaces for RS232 and CAN, which would otherwise use the same connector X6, are separated out onto three connectors.



The following diagram shows the interface cable between the PC and servo drives of the Lexium 15 LP series:

(View : looking at the solder side of the SubD sockets on the cable)



Serial communications specifications table

The following table lists the serial communications specifications.

SERIAL I/O	
Data bits	Eight
Stop bits	One
Parity	None
Baud rate	9600

CANopen interface (X6)

⚠ CAUTION

RISK OF EQUIPMENT DAMAGE

Do not connect a Modbus serial port to the X6 connector! Pin1 carries +8 V DC which would be shorted out by a Modbus cable. Instead, use a 3-core cable (not a null-modem link cable) with only pins 2, 3 and 5 wired.

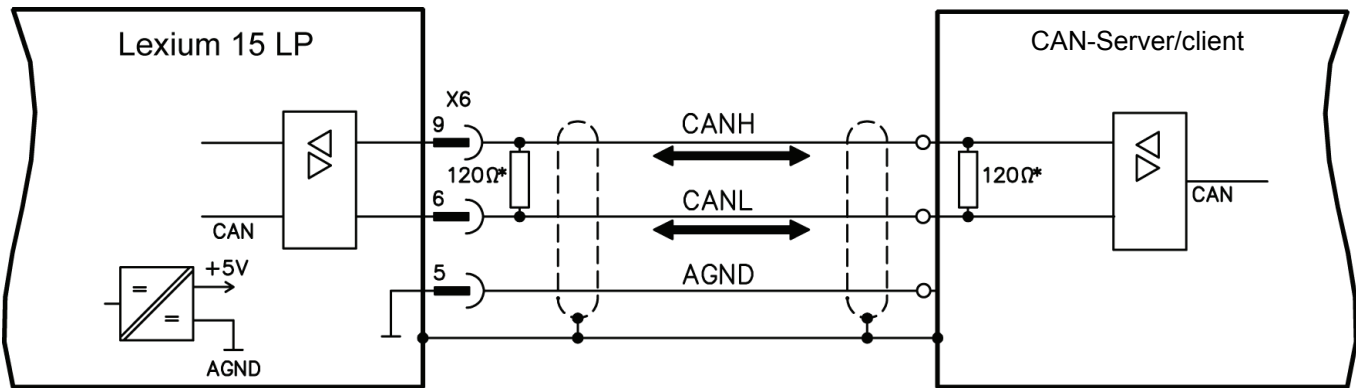
Failure to follow these instructions can result in injury or equipment damage.

The interface for connection to the CAN bus (default 500 kBaud). The integrated profile is based on the communication profile CANopen DS301 and the servo drive profile DSP402.

The following functions are available in connection with the integrated position controller:

- Jogging with variable speed
- reference traverse (zeroing)
- start motion task
- start direct task
- digital setpoint provision
- data transmission functions
- many others.

Detailed information can be found in the CANopen manual. The interface is electrically isolated by optocouplers, and is at the same potential as the RS232 interface. The analog setpoint inputs can still be used.



***Terminating impedance is required for operation of the communication bus.**

CAN ref. to ISO 11898

CANopen interface (X6)

CAN bus cable

To meet ISO 11898 you should use a bus cable with a characteristic impedance of 120 Ω. The maximum usable cable length for reliable communication decreases with increasing transmission speed. As a guide, you can use the following values which we have measured, but they are not to be taken as assured limits:

The following table lists the different cable data

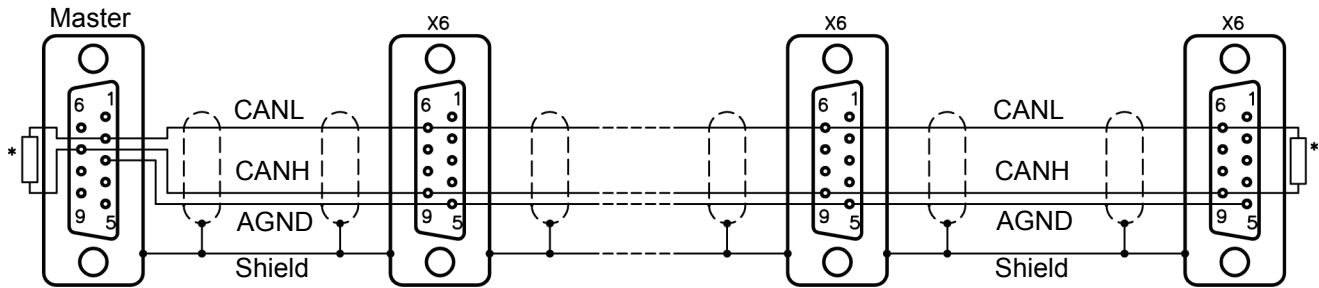
Cable characteristics	Value
Characteristic impedance	100-120 Ω
Cable capacitance	max. 60 nF/km
Lead resistance (loop)	159.8 Ω/km

The following table shows cable length, depending on the transmission rate

Transmission rate (kBauds)	max. cable length (m)
1000	20
500	70
250	115

For EMC reasons, the SubD connector housing must fulfill the following conditions:

- metal or metallized housing
- shield connection to housing.

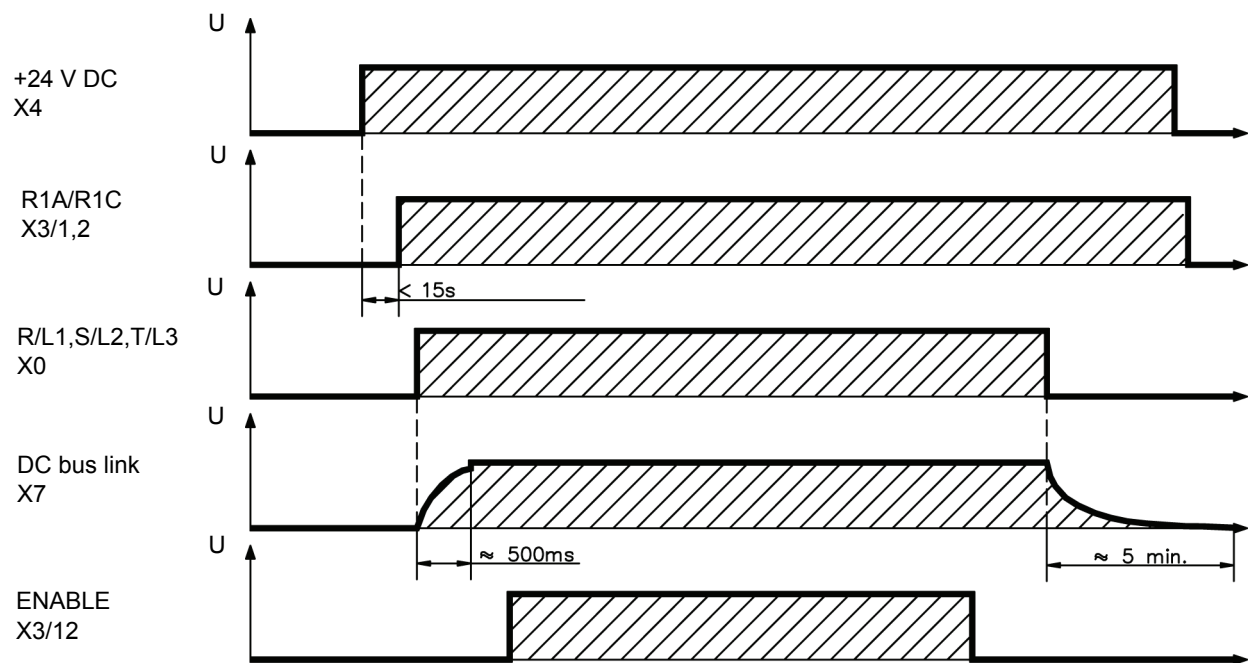


***Terminating impedance is required for operation of the communication bus.**

Powering up and powering down the system

Power-on and power-off characteristics

The following diagram illustrates the functional sequence that occurs when the servo drive is turned on and off.



Procedure for verifying system operation

Overview

The following procedure and associated information verifies operation of the system without creating a hazard to personnel or jeopardizing the equipment. This procedure presumes the servo drive has been configured with UniLink software in OpMode 1 as a speed controller with analog input command. An exact description of all parameters and the possibilities for optimizing the control loop characteristics can be found in the Lexium 15 LP programming manual.

Note: Default parameters for BDH or BSH servo motor series are loaded into your servo drive at the factory and contain valid and typical values for the current and speed controllers. A database for the servo motor parameters is stored in the servo drive. During commissioning, you must select the data set for the connected servo motor and store it in the servo drive. For most applications, these settings will provide good servo loop efficiency. For a description of all parameters and servo motor tuning, see the UniLink online help.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Ensure that all wiring is complete and verified.

Failure to follow these instructions will result in death or serious injury.

WARNING

UNINTENDED EQUIPMENT OPERATION

When the servo drive is operated for the first time, there is a high risk of unexpected motion because of possible wiring errors or unsuitable parameters.



- If possible, run the first test movement without coupled loads.
- Make sure that a functioning button for EMERGENCY STOP is within reach.
- Also anticipate a movement in the incorrect direction or oscillation of the servo drive.
- Make sure that the system is free and ready for the motion before starting the function.
- Keep personnel and equipment clear of all moving parts.
- Make sure all safety interlocks are engaged.

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

Procedure for verifying system operation

Quick Tuning Procedure

This procedure will enable you to rapidly assess the operational readiness of the system.

Step	Action	Description	
1	Check installation	See safety precautions on previous page	
2	Block the Enable signals	Apply 0 V DC to terminal X3/12 (Enable) and to terminal X4/5 (PWR)	
3	Switch on 24 V DC external control power supply	Apply 24 V DC to terminal X4/1(+ 24 V DC), ground terminal X4/3 (0 V DC). After the initialization procedure (about 0.5 sec.) the status will be shown in the LED display.	
4	Switch on PC, start setup software	Select the interface to which the servo drive is connected. The parameters which are stored in the SRAM of the servo drive are then transferred to the PC.	
5	Check the displayed parameters, and correct if necessary	<div><div> DANGER</div><div>UNINTENDED EQUIPMENT OPERATION It is VERY important to check the displayed parameters and to correct them if necessary. Please refer to the Lexium 15 LP programming manual. Failure to follow these instructions will result in death or serious injury.</div></div>	
		Supply voltage	Set to the actual electrical supply voltage.
		Rated servo motor voltage	At least as high as the DC bus link voltage of the servo drive.
		Servo motor pole-no.	Must match the servo motor (see servo motor manual).
		Feedback	Must match the feedback device in the servo motor.
		IRMS	Maximum is the servo motor standstill current I0 (on: nameplate).
		IPEAK	Maximum is 4 x servo motor standstill current I0.
		Limit speed	Maximum is the rated servo motor speed (on nameplate).
		Braking power	Maximum is the permitted braking resistor dissipation.
Station address	Unique address (See the Lexium 15 LP programming manual).		
6	Check interrupt devices	<div><div> DANGER</div><div>IMPACT HAZARD Make sure that any unintended movement of the servo drive cannot cause any danger to personnel or machinery Failure to follow these instructions will result in death or serious injury.</div></div>	
7	Switch on supply power	Use the ON/OFF button of the contactor controls.	
8	Apply 0 V command	Apply 0 V to terminals X3/3-4 (AI1+/AI1-) or X3/5-6 (AI2+/AI2-) respectively.	
9	Enable	Apply 24 V DC (500 ms after switching on the supply power) to terminal X3/12 (ENABLE), servo motor stands with standstill torque M0.	

10	Setpoint	Apply a small analog setpoint (about 0.5 V is recommended) to terminals X3/3-4 (AI1+/AI1-) or X3/5-6 (AI2+/AI2-) respectively.
		<div style="border: 1px solid black; padding: 10px; text-align: center;"> <h2 style="margin: 0;">CAUTION</h2> <p>SERVO MOTOR DAMAGE</p> <p>If the servo motor oscillates, the parameter Kp on the menu page "Speed controller" must be reduced, the servo motor may be permanently damaged!</p> <p>Failure to follow these instructions can result in equipment damage.</p> </div>
11	Optimization	Optimize speed, current and position controllers (see the Lexium 15 LP programming manual).
12	Set up the expansion card	See setup instructions in the corresponding manual on the CD-ROM.

Procedure for verifying system operation

Keypad operation / LED display

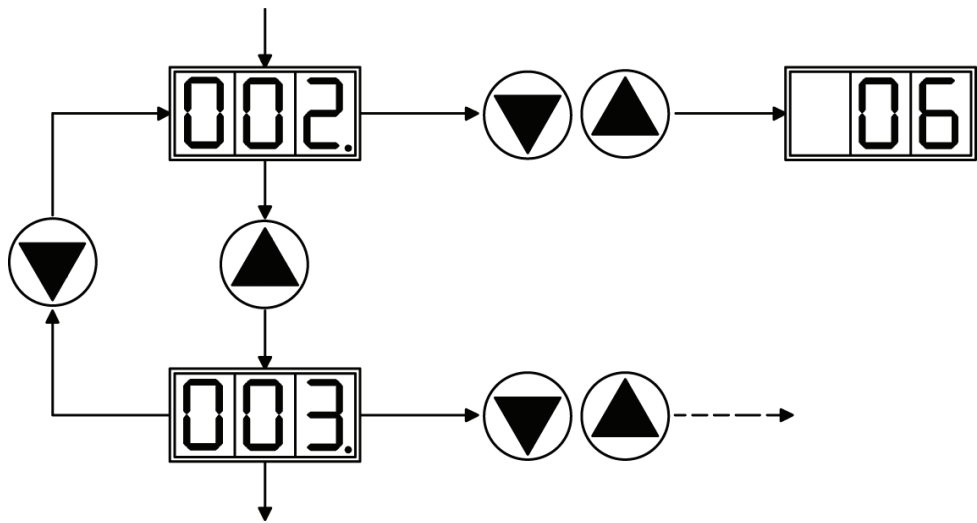
This section illustrates the two possible operating menus and the use of the keys on the front panel.

Normally, the Lexium 15 LP only presents the standard menu for your use. If you want to operate the servo drive via the detailed menu, you must keep the right key pressed while switching on the external control power supply.

Keypad operation

The two keys can be used to perform the following functions:

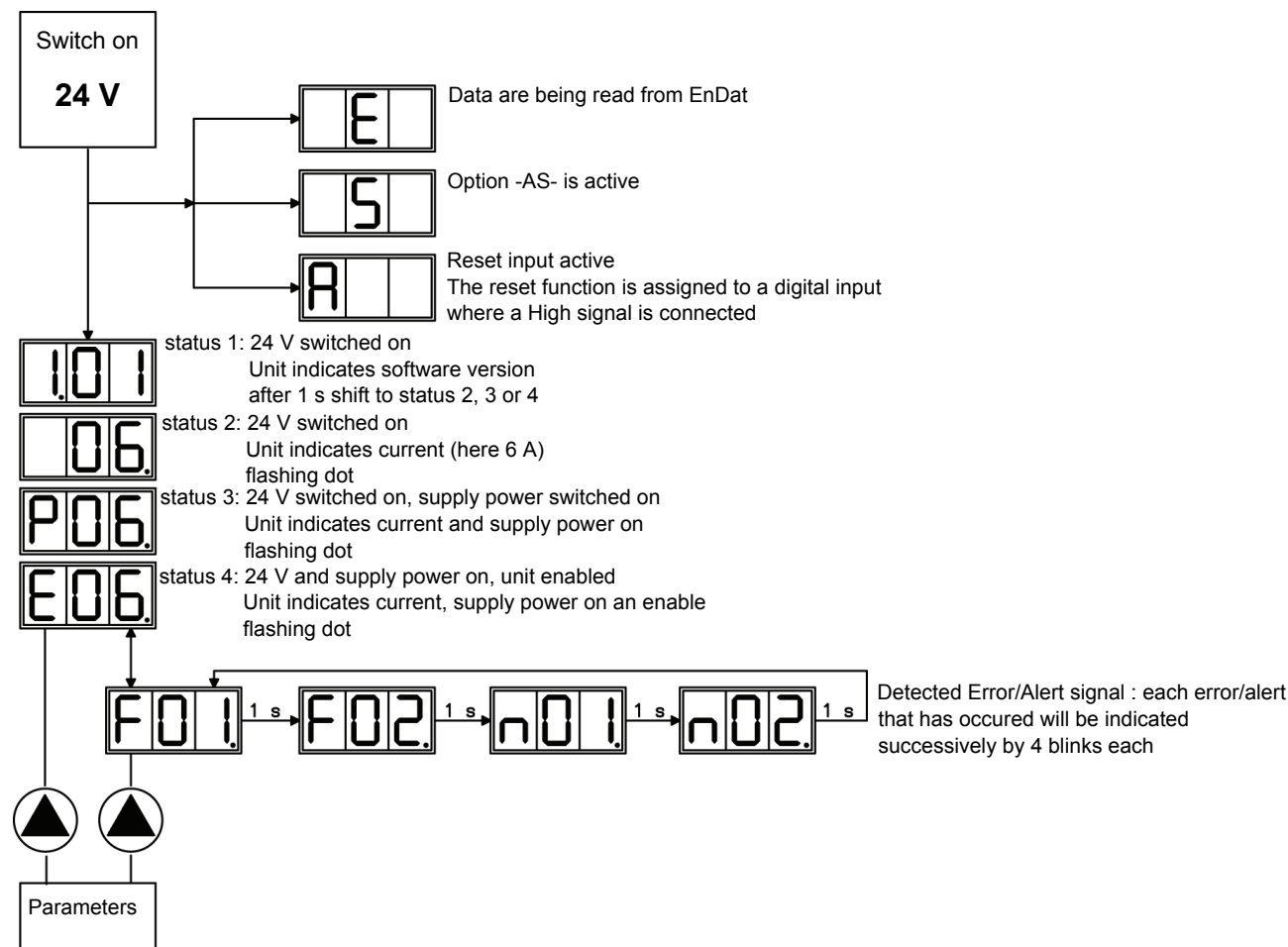
Key symbol	Functions
▲	Press once: move up to next menu or increase number by one Press twice in rapid succession: increase number by ten
▼	Press once: move down to previous menu or decrease number by one Press twice in rapid succession: decrease number by ten
▲ ▼	Hold right key pressed, and then press left key as well: this action enables you to enter a number, or to serve as a "Return" function



Front panel controls and indicators

Status display

The alphanumeric display indicates servo drive power status conditions, error codes and alert codes. The power status conditions are shown below; error and alert codes are described further in the document



Standard menu

The following diagram describes the standard menu



Alert messages

Alert identification and description

Detected errors which occur, but which do not cause a switch-off of the servo drive output stage (R1A/R1C contact remains closed), are indicated in the LED display on the front panel by a coded alert number.

Number	Designation	Explanation
n01	I ² t	I ² t threshold exceeded
n02	braking power	reached preset braking power limit
n03*	S_fault	exceeded preset contouring error limit
n04*	response monitoring	response monitoring (fieldbus) has been activated
n05	supply phase	power supply phase missing
n06*	Sw limit switch 1	passed software limit switch 1
n07*	Sw limit switch 2	passed software limit switch 2
n08	motion task error	incorrect motion task was started
n09	no reference point	no reference point (Home) set at start of motion task
n10*	PSTOP	PSTOP limit-switch activated
n11*	NSTOP	NSTOP limit-switch activated
n12	servo motor default values loaded	only for ENDAT or HIPERFACE® : discrepancy between servo motor number saved in the encoder and the servo motor default values loaded
n13*	expansion card	expansion card not operating correctly
n14	SinCos feedback	SinCos commutation (wake & shake) not completed will be canceled when servo drive is enabled and wake & shake carried out
n15	table error	detected error according to speed/current table INXMODE 35
n16	summarized warning	summarized alert for n17 to n31
n17	CAN-Sync	CAN-Sync is not logged in
n18	multiturn overflow	max. number of turns exceeded
n19-n31	reserved	reserved
n32	firmware beta version	firmware is an unreleased beta version
A	reset	RESET is present on input DIGITAL INx

*** = these alert messages result in a controlled shut-down of the servo drive (braking by emergency stop ramp)**

Error messages

Error identification and description

Any errors that occur are displayed as coded into an error number on the front panel, in the LED display.

All error messages result in:

- the R1A/R1C contact being opened,
- the output stage of the servo drive being switched off (servo motor loses all torque), and
- the servo motor-holding brake being activated.

Number	Designation	Explanation
F01*	heat sink temperature	heat sink temperature too high limit is set by manufacturer to 80 °C
F02*	overvoltage	overvoltage in DC bus link limit depends on the electrical supply voltage
F03*	contouring error	message from the position controller
F04	feedback	cable break, short-circuit, short to ground
F05*	undervoltage	undervoltage in DC bus link limit is set by manufacturer to 100 V
F06	servo motor temperature	servo motor temperature too high or temp. sensor defect limit is set by manufacturer to 145 °C
F07	reserved	reserved
F08*	overspeed	servo motor runs away, speed is too high
F09	EEPROM	checksum error
F10	flash-EPROM	checksum error
F11	brake	cable break, short-circuit, short to ground
F12	servo motor phase	servo motor phase missing (cable break or similar)
F13*	internal temperature	internal temperature too high
F14	output stage	detected error in the power output stage
F15	I ² t max.	I ² t maximum value exceeded
F16*	supply BTB/RTO	2 or 3 phases missing in the power supply feed
F17	A/D converter	error in the analog-digital conversion, normally caused by extreme electromagnetic interference
F18	braking	braking circuit inoperative or incorrect setting
F19*	supply phase	a phase is missing in the power supply power feed (can be switched off for 2-phase operation)
F20	slot fault	slot error (hardware detected error on expansion card)
F21	handling error	software error on the expansion card
F22	"reserved "	reserved
F23	"CAN-bus off "	severe CAN bus communication error
F24	alert	alert is displayed as detected error
F25	commutation error	commutation error
F26	limit switch	homing error (machine has driven onto hardware limit switch)
F27	PWR option	operational error with PWR option (control signal for PWR option appears simultaneously with the ENABLE signal)
F28	reserved	reserved
F29	Field bus error	Field bus option card operation issue
F30	emergency timeout	timeout emergency stop
F31	reserve	reserve
F32	system error	system software not responding correctly

* = these error messages can be cleared without a reset, by using the ASCII command CLRFAULT.

If only one of these errors is present and the RESET button or the I/O RESET function is used, only the CLRFAULT command will be executed

Error messages

Finding and removing detected errors

The table below should be regarded as a “First-aid” box. There may be a wide variety of reasons for the detected error, depending on the conditions in your installation. In multi-axis systems there may be further hidden causes of a detected error.

Our customer service can give you further assistance with troubleshooting.

Detected Error	Possible causes	Measures to remove the cause of the detected error
F01 message: Heat sink temperature	Permissible heat sink temperature exceeded.	Improve ventilation.
F02 message: Overvoltage	Braking power is insufficient. Braking power limit was reached and the braking resistor was switched off. This causes excessive voltage in the DC bus link circuit.	Reduce the RAMP braking time. Use an external braking resistor with a higher power rating and adjust the braking power parameter.
	Supply voltage too high.	Use a supply transformer.
F04 message: Feedback Unit	Feedback connector not properly inserted.	Check connectors.
	Feedback cable is broken, crushed, or otherwise damaged.	Check cables.
	Feedback unit is damaged or wrongly configured.	Check feedback unit and settings.
F05 message: Undervoltage	Supply voltage is not present, or too low when the servo drive is enabled.	Only ENABLE the servo drive when the electrical supply voltage has been switched on delay > 500 ms.
F06 message: Servo motor temperature	Servo motor thermostat has been activated.	Wait until servo motor has cooled down, then check for possible reasons for overheating.
	Feedback connector is loose, or a break in the feedback cable.	Tighten connector screw, or use new feedback cable.
F07 message: Aux. voltage	The aux. voltage produced by the servo drive is incorrect.	Return the servo drive to the manufacturer for servicing.
F08 message: Overspeed	Servo motor phases swapped.	Correct servo motor phase sequence.
	Feedback device set up incorrectly.	Set up correct offset angle.
F11 message: Brake	Short-circuit in the supply cable for the servo motor-holding brake.	Remove the short-circuit.
	Servo motor-holding brake is inoperative.	Replace servo motor.
	Detected error in brake cable.	Check shielding of brake cable.
	No brake connected, although the brake parameter is set to WITH.	Set brake parameter to WITHOUT.
F13 message: Internal temp.	Permissible internal temperature has been exceeded.	Improve ventilation.
F14 message: Output stage detected error	Servo motor has short-circuit or earth/ground short.	Replace servo motor.
	Servo motor cable has a short-circuit or earth/ground short.	Replace cable.
	Output module is overheated.	Improve ventilation.
	Output stage is inoperative.	Return the servo drive to the manufacturer for repair.
	Short-circuit or short to ground in the external braking resistor.	Remove short-circuit / ground short.
F16 message: Mains BTB/ RTO	Enable was applied, although the supply voltage was not present.	Only ENABLE the servo drive when the electrical supply voltage has been switched on.
	At least 2 supply phases are missing.	Check the electrical supply.
F17 message: A/D converter	Error in the analog-digital conversion, usually caused by EMC interference.	Reduce EMC interference check shielding and grounding.

Error messages

Finding and removing detected errors

Detected Error	Possible causes	Measures to remove the cause of the detected error
F25 message:	Wrong cable used.	Check cable.
Commutation error	Offset is too large.	Check resolver pole number (RESPOLES), servo motor pole number (MPOLES) and offset (MPHASE).
	Wake & shake missed.	Execute wake & shake.
F27 message: error PWR function	Power digital input AND hardware enable AND software enable are active.	Check programming and wiring of the PLC / control system.
Servo motor does not rotate	Servo drive not enabled.	Apply ENABLE signal.
	Software enable not set.	Set software enable.
	Break in setpoint cable.	Check setpoint cable.
	Servo motor phases swapped.	Correct servo motor phase sequence.
	Brake not released.	Check brake control.
	Servo drive is mechanically blocked.	Check mechanism.
	Servo motor pole no. set incorrectly.	Set servo motor pole no.
	Feedback set up incorrectly.	Set up feedback correctly.
Servo motor oscillates	Gain is too high (speed controller).	Reduce Kp (speed controller).
	Shielding in feedback cable has a break.	Replace feedback cable.
	AGND not wired up.	Join AGND to CNC-GND.
Servo drive reports following error	Irms or Ipeak set too low.	Increase Irms or Ipeak (keep within servo motor ratings!).
	Accel/decel ramp is too long.	Shorten ramp +/-.
Servo motor overheating	Irms/Ipeak is set too high.	Reduce Irms/Ipeak.
Servo drive too soft	Kp (speed controller) too low.	Increase Kp (speed controller).
	Tn (speed controller) too high.	Use servo motor default value for Tn (speed controller).
	ARLPF / ARHPF too high.	Reduce ARLPF / ARHPF.
	ARLP2 too high.	Reduce ARLP2.
Servo drive runs roughly	Kp (speed controller) too high.	Reduce Kp (speed controller).
	Tn (speed controller) too low.	Use servo motor default value for Tn (speed controller).
	ARLPF / ARHPF too low.	Increase ARLPF / ARHPF.
	ARLP2 too low.	Increase ARLP2.
Axis drifts at setpoint = 0 V	Offset not correctly adjusted for analog setpoint provision.	Adjust offset (analog I/O).
	AGND not joined to the controller-GND of the controls.	Join AGND and controller-GND.
n12 message: Servo motor default values loaded	Servo motor numbers stored in the encoder and servo drive do not match the parameters that have been set.	Default values for the servo motor have been loaded, SAVE automatically stores the servo motor number in the EEPROM.
n14 message: SinCos feedback	SinCos commutation (wake & shake) not completed.	ENABLE the servo drive.

