Lexium 15 MP Servo Drive

Installation Manual

LXM15MD28N4/LXM15MD40N4
LXM15MD56N4/ 208-480 V

30072- 452- 53

Telemecanique

Contents

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 personnal 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

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 the printed circuit boards, operate at the line voltage. DO NOT TOUCH. Use only electrically insulated tools.
- DO NOT touch unshielded components or terminal strip screw connections with voltage present. Control and power connection may be live even if the servo motor is not rotating.
- 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 servicing the servo drive:
  - 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 40 V. The drive LED is not an 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 AC 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.
- Ensure that 24 V DC is applied between the 2 analog inputs PWRI-/PWRI+.
- 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.

Steps for setting up the servo drive

Steps 1 to 4 must be performed with the power disconnected

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 MP 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)

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 MP programming manual

Preliminary recommendations

Equipment supplied

The package contains the following elements :

- The servo drive
- A simplified manual
- Mating connectors X0A, X0B, X3, X4, X7, X8, X10

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 specified supply voltage range. 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 table below describes the servo drive rating for the Lexium 15 MP

Three phase power supply voltage : 208…480 V 50/60 HZ									
Servo drive(output)					Line supply (input)				Lexium 15 MP
Nominal current In	Max. transient current for 2 s Imax	Peak transient current	Nominal output power	Power loss	Max. line current		Apparent power	Primary fuse (A)	References
					at 208 V	at 480 V			
A_{rms}	A_{rms}	A_{pk}	kW	W	A	A	kVA	A	
10	20	28	5.7	90	9.7	12.6	7	15 class CC	LXM15MD28N4
14	28	40	7.9	160	15.5	17.7	10	20 class CC	LXM15MD40N4
20	40	56	11.4	200	20	24.4	14	25 class CC	LXM15MD56N4

Dimensions and weights

Lexium 15 MP height, width and depth dimensions

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

LXM15MD28N4

265 mm (with connector 273 mm)
10.5" (with connector 10.8")

275 mm 10,9"

325 mm 12,8"

70mm
2,8"

LXM15MD40N4

265 mm (with connector 273 mm)
10.5" (with connector 10.8")

275 mm 10,9"

325 mm 12,8"

100 mm
4"

265 mm (with connector 273 mm)
10.5" (with connector 10.8")

275 mm 10,9"

325 mm 12,9"

LXM15MD56N4

120mm
4,8"
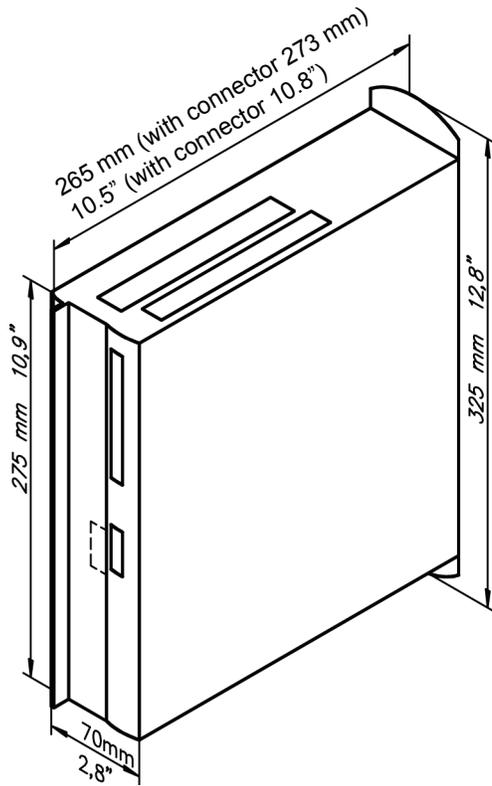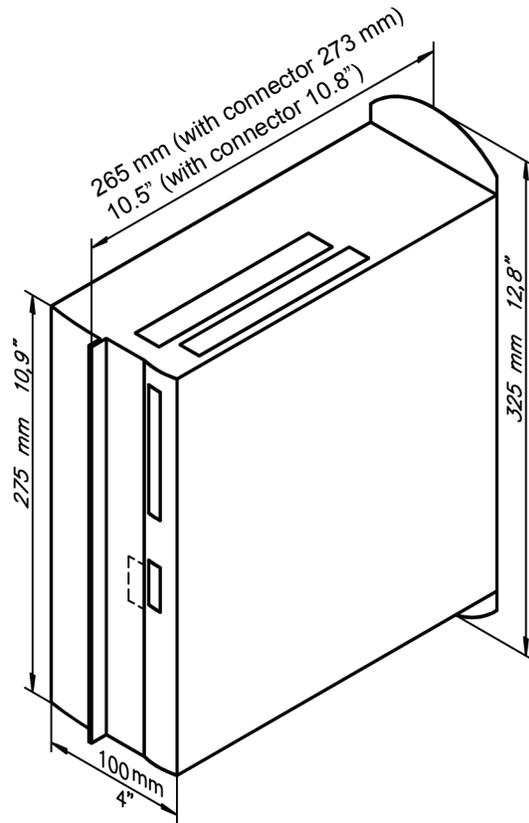
Mounting and temperature conditions

Lexium 15 MP servo drive and mounting area dimensions

Install the servo drive vertically at ± 10°.

Do not place it close to heating elements.

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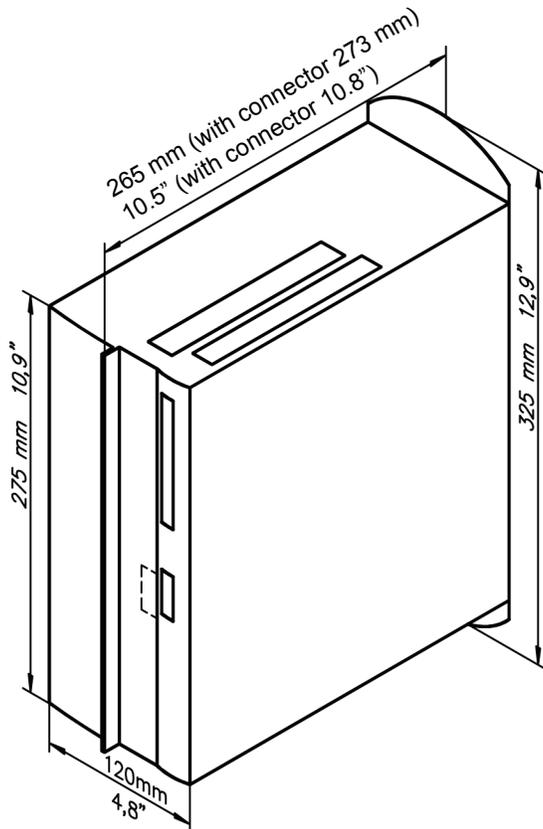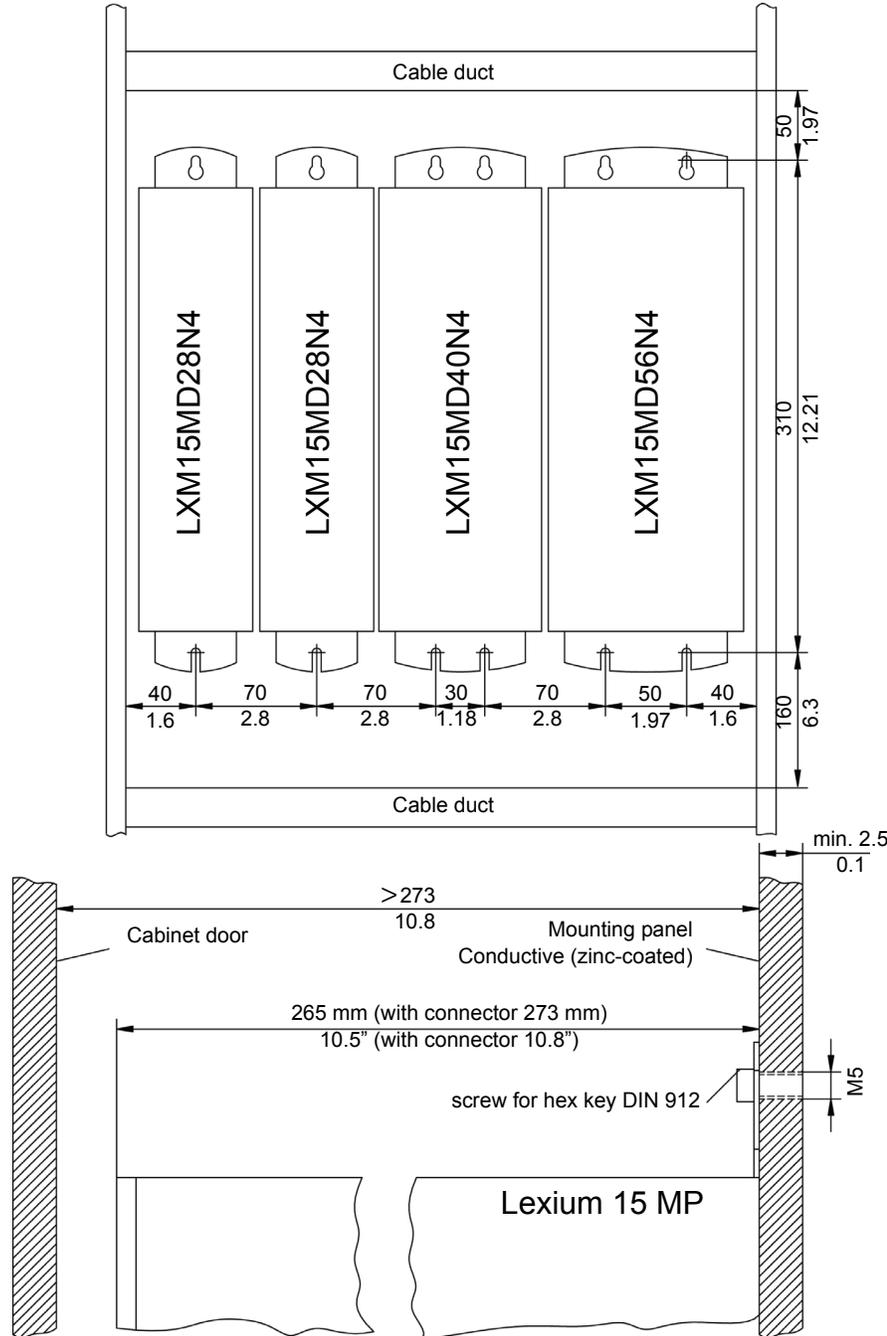
Servo drive mounting

The following diagrams show depth dimensions and mounting area requirements for the Lexium 15 MP 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 as follows mm/inch(")

⚠ CAUTION

CONTAMINATION AND THERMAL HAZARD

Ensure the Lexium 15 MP 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 Mounting in a wall-mounted or floor-standing enclosure 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
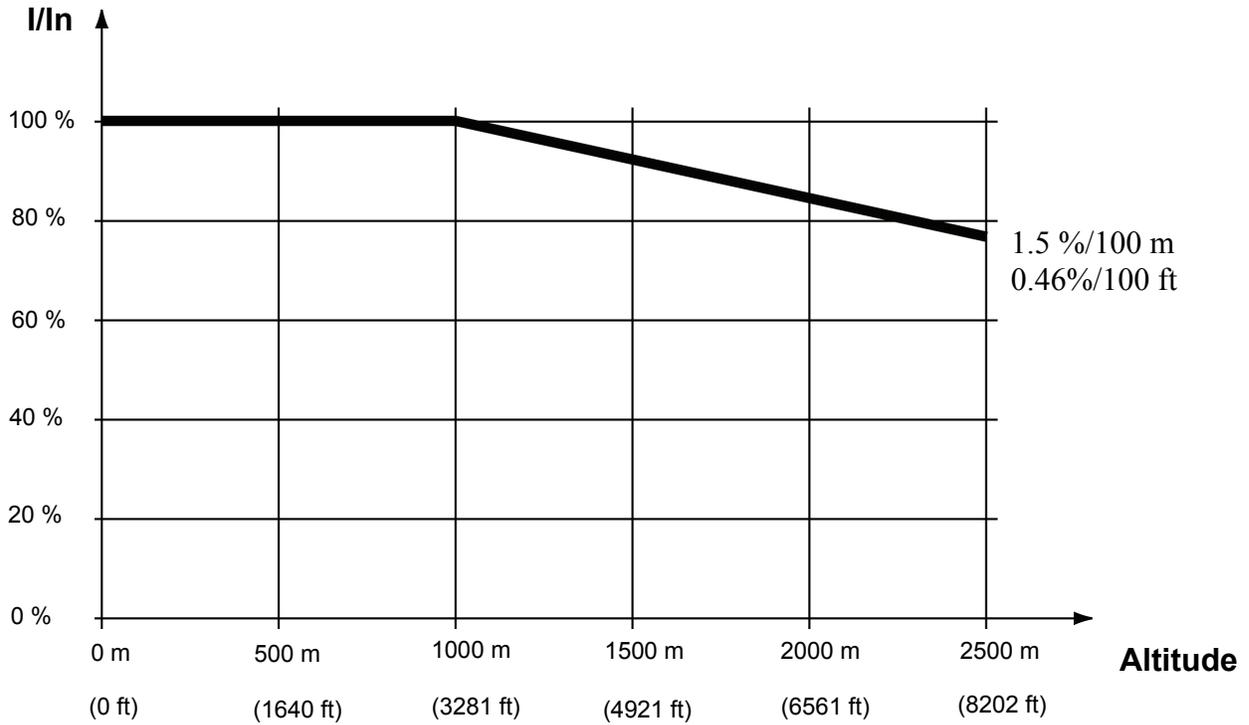
1.5 %/100 m
0.46%/100 ft

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

2.5 %/°C
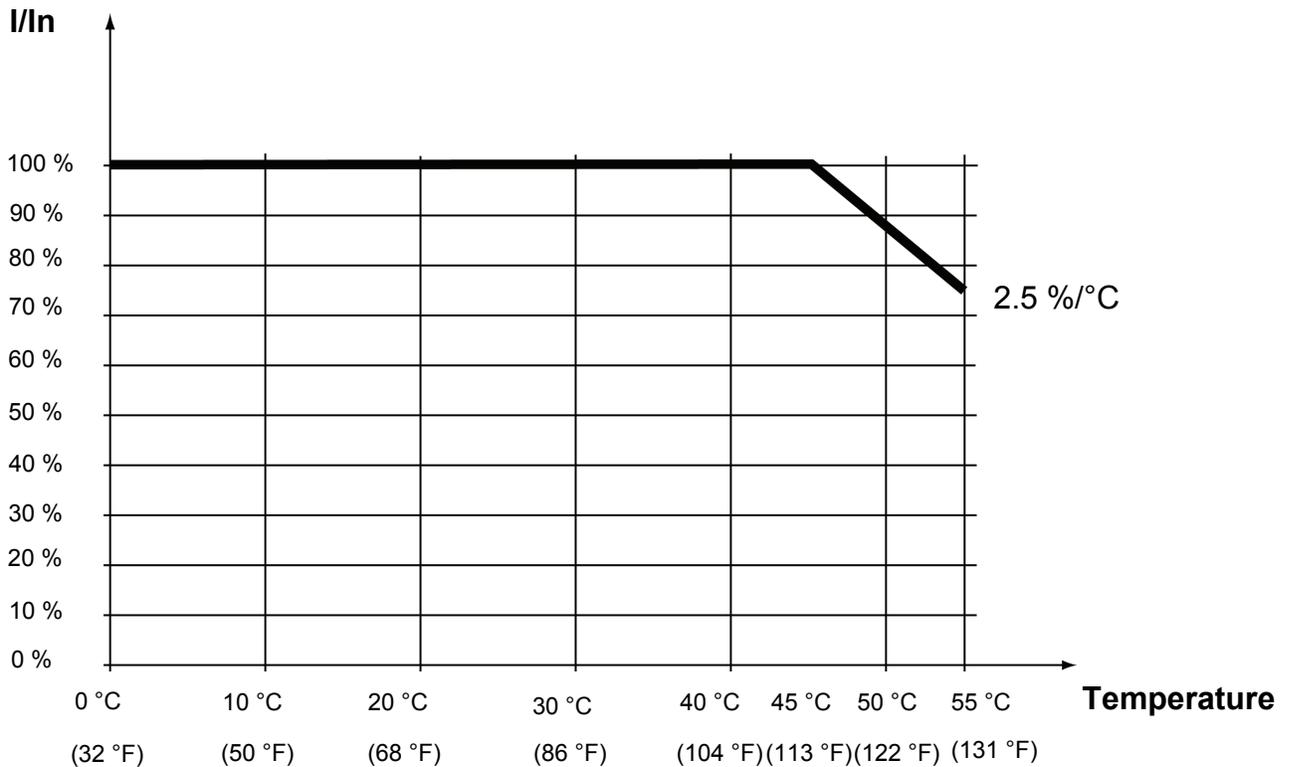
Mounting in a wall-mounted or floor-standing enclosure

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

- Fit ventilation grilles
- Ensure that the ventilation is adequate: if not, install forced ventilation with a filter
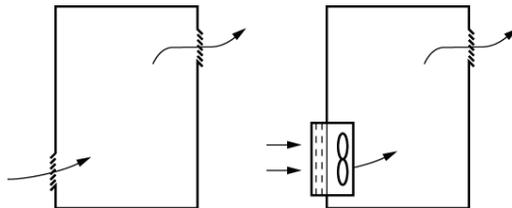
Mounting the servo drive in the enclosure

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

LXM15M	Power loss
D28N4	90
D40N4	160
D56N4	200

Wiring diagram overview

Overview of Lexium 15 MP wiring connections

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

⚠ 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.
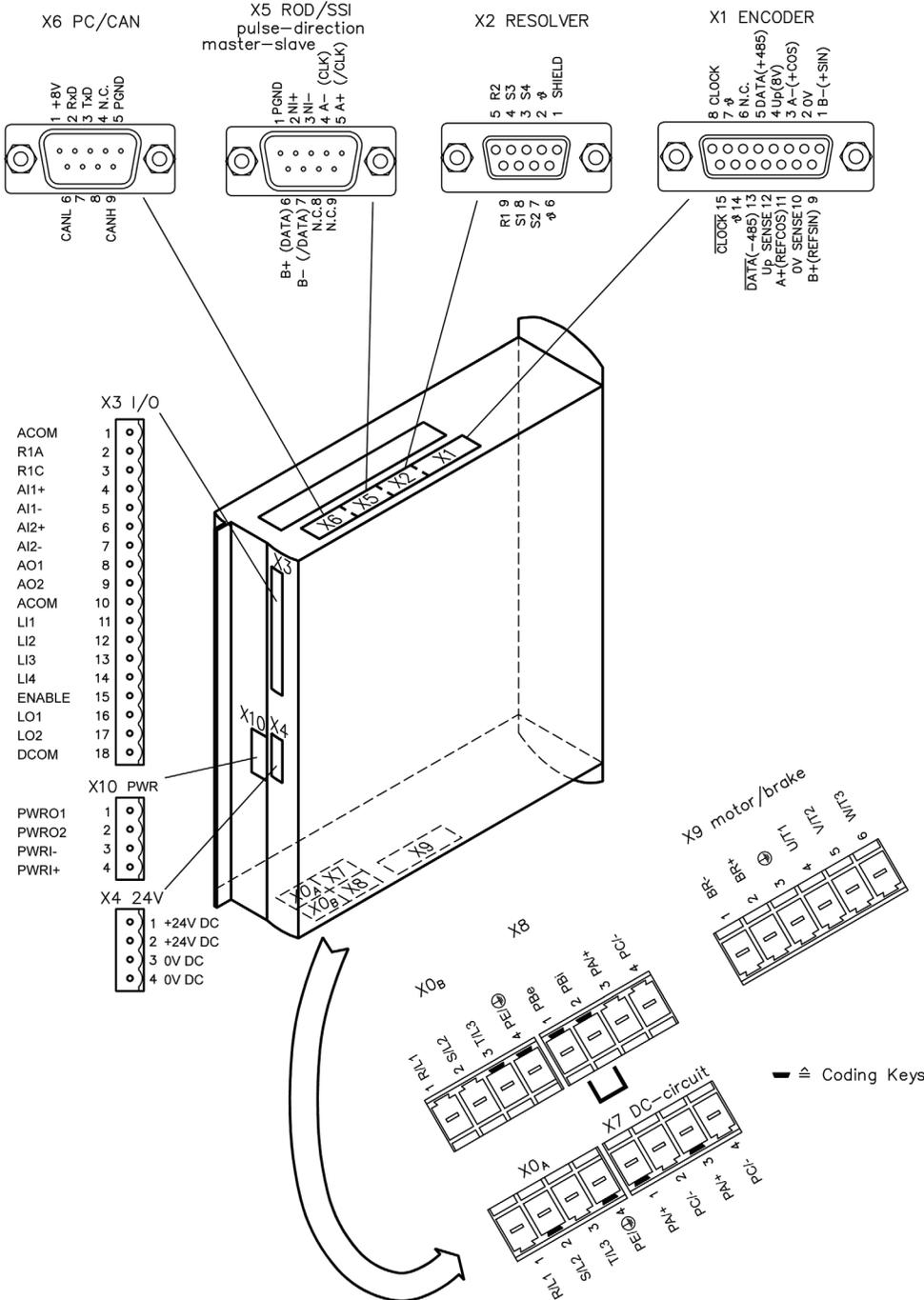
Note: The connectors described above appear in many wiring diagrams throughout the remainder of this document and are identified in those diagrams by their alphanumeric designations only (for example, X4); the term *connector* will afterwards be excluded.

Wiring diagram overview

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

See Before you begin

thermal control included

Lexium 15 MP

Control

Sine-Cosine Encoder

X1 — High resolution single / multiturn — 15

And / or

thermal control included

Resolver

X2 — Resolver — 8

M

X9
- 6 W/T3
- 5 V/T2
- 4 U/T1
- 3
- 2 BR+
- 1 BR-

Remove jumper if external braking resistor is connected

Braking Resistor

X8
- 2 PBi
- 1 PBe
- 3 PA/+
- 4 PC/-

GV2MExx

F_{N1} — 1 R/L1 — X0A
F_{N2} — 2 S/L2
F_{N3} — 3 T/L3
4 PE

X4
- 1
- 2 +24V DC
- 3
- 4 0V DC

Mains contactor
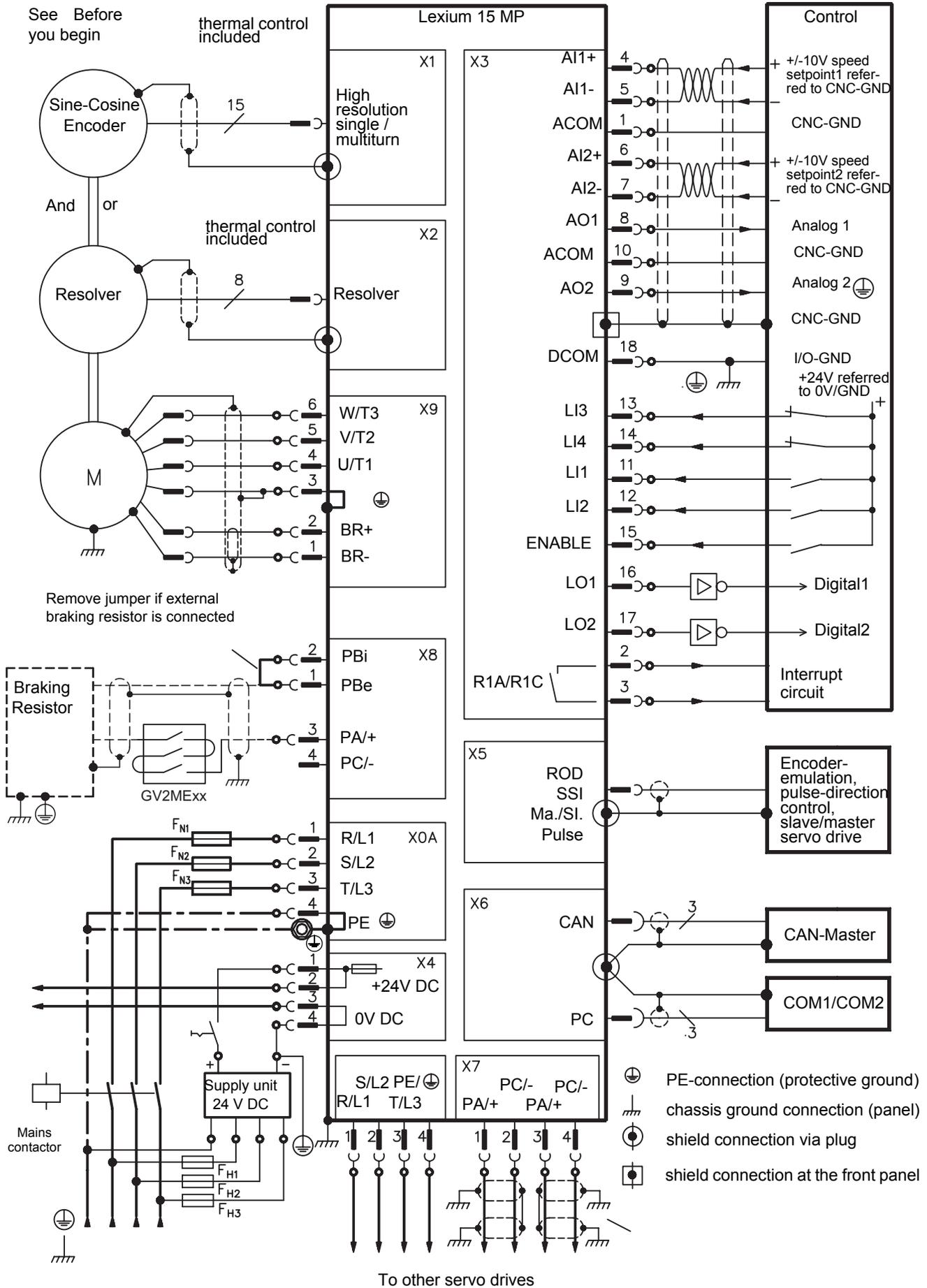
Supply unit 24 V DC

X3
AI1+	4	+/-10V speed setpoint1 referred to CNC-GND +
AI1-	5	−
ACOM	1	CNC-GND
AI2+	6	+/-10V speed setpoint2 referred to CNC-GND +
AI2-	7	−
AO1	8	Analog 1
ACOM	10	CNC-GND
AO2	9	Analog 2
		CNC-GND
DCOM	18	I/O-GND

+24V referred to 0V/GND

- LI3 — 13
- LI4 — 14
- LI1 — 11
- LI2 — 12
- ENABLE — 15
- LO1 — 16 — Digital1
- LO2 — 17 — Digital2
- R1A/R1C — 2 / 3 — Interrupt circuit

X5
ROD SSI Ma./SI. Pulse — Encoder-emulation, pulse-direction control, slave/master servo drive

X6
CAN — 3 — CAN-Master
— COM1/COM2
PC — 3

Supply unit legend / X7:

S/L2 PE/⏚
R/L1 T/L3 — 1 2 3 4

X7
PC/- PC/-
PA/+ PA/+ — 1 2 3 4

F_{H1}
F_{H2}
F_{H3}

To other servo drives

⏚ PE-connection (protective ground)
chassis ground connection (panel)
shield connection via plug
shield connection at the front panel

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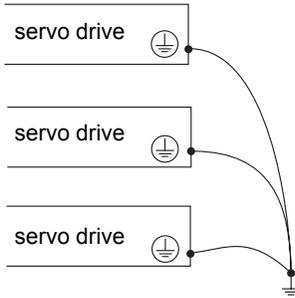
Check whether the resistance to the protective ground is 1 ohm or less. Connect a number of servo drives to the protective ground, as shown in the diagram (see left). Do not lay protective grounding cables in a loop or in series.

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 this document in addition to those already required 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 MP servo drive.
- If replacing another servo drive, verify that all wiring connections to the Lexium 15 MP 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 this Installation Manual. Refer to pages 27 through 30.

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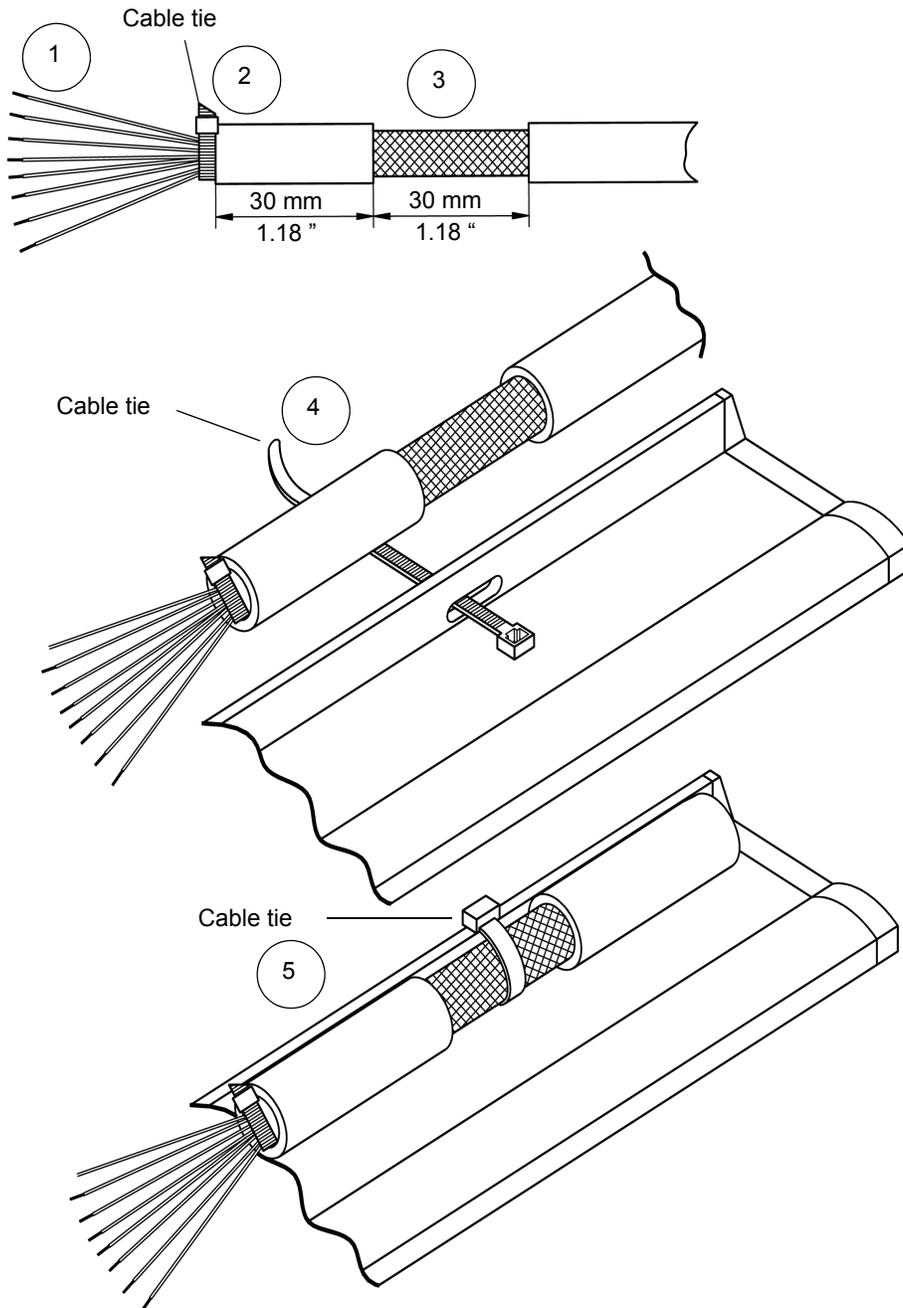
Remove the outside shroud of the cable and the shielded braid on the desired core length. Secure the cores with a cable tie.

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

Advice on use in accordance with the machinery safety directive

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	–	16
Category 2	1 breaking and 1 monitoring	All ratings	1 breaking device per PWR function with 1 Preventa™ monitoring module (1)	17
Category 3	2 breaking (2)	All ratings	1 breaking device per PWR function, 1 breaking device per contactor and 1 Preventa™ monitoring module (1)	18
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)	19

"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 MP and Lexium 15 HP servo drives consists principally of an auxiliary relay that is accessed on the PWRI+ and PWRI- terminals of the X10 connector. When the relay coil is activated by the control system, this locks the servo drive power stage that supplies power to the servo motor, thus depriving the servo motor of energy (3).
The anti-start relay contact, accessed on the PWRO1 and PWRO2 terminals on the X10 connector, enables the application to check the locking command. The state of the relay contact is monitored constantly by the control system, to check that the system is working correctly and ensure strict compliance with the machine stop and locking procedures.

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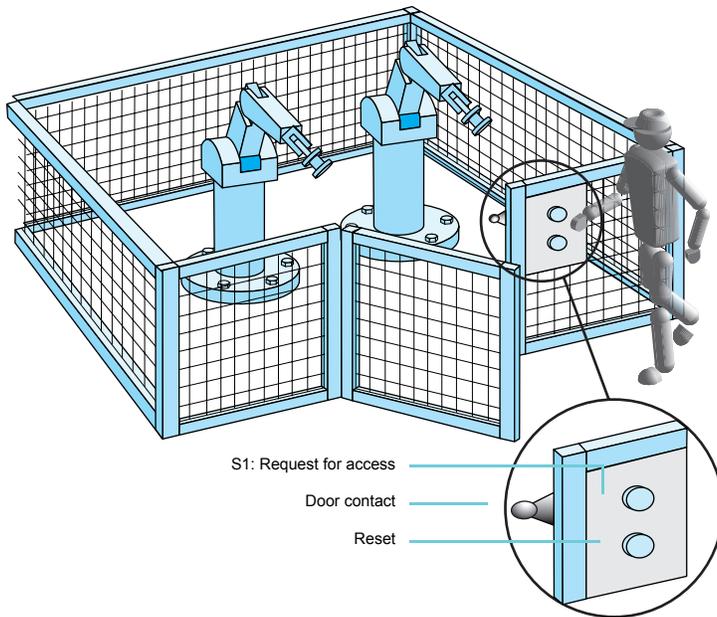
Note: The use of Lexium 15 servo drives with the integral "Power Removal" safety function simplifies the connection diagrams required to comply with standard EN 954-1.

(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 18 and 19.
(3) Vertical axis immobilization can only be obtained by installing a mechanical locking system (holding brake) on the axes.

Recommended wiring diagrams complying with standard EN 954-1

Application with requirement for access to a hazardous area

S1: Request for access
Door contact
Reset

Presentation

The recommended wiring diagrams on pages 16 to 19 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 MP and 15 HP 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").
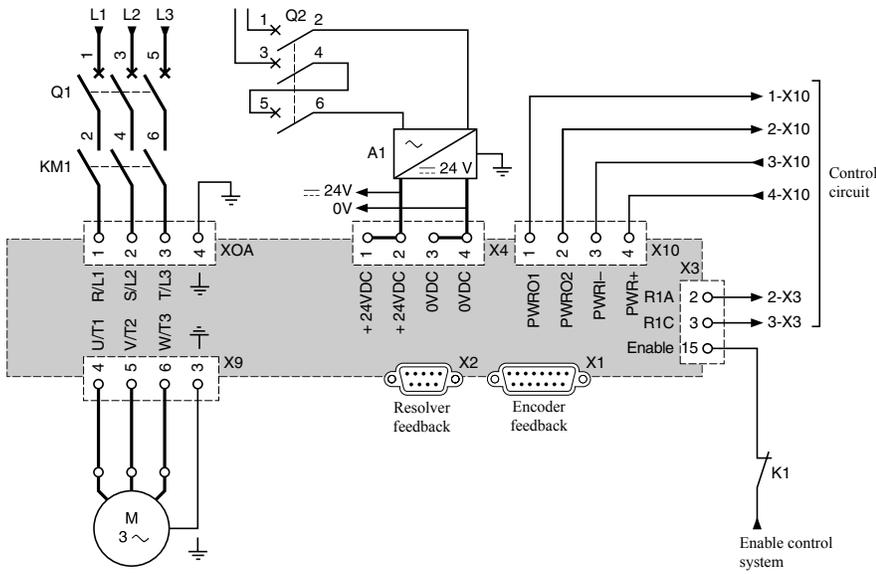
Categories 3 and 4

The diagrams for categories 3 and 4 on pages 18 and 19 take account of the widest requirements and thus incorporate **double breaking** of the control circuit **and the power circuit**.

Note: 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.
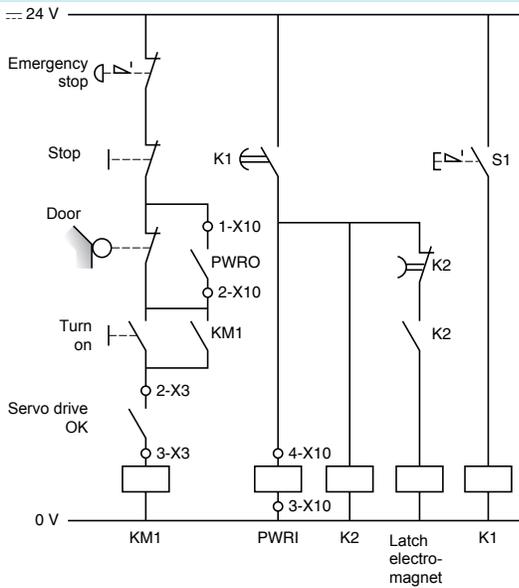
Recommended wiring diagrams complying with standard EN 954-1

Category 1 safety level in accordance with EN 954-1

Power circuit of LXM 15MD**N4, LXM 15HC**N4X servo drives

L1 L2 L3
Q2
Q1
KM1
A1
~ 24 V
24V
0V
1-X10
2-X10
3-X10
4-X10
Control circuit

XOA
R/L1 S/L2 T/L3
U/T1 V/T2 W/T3 X9
+24VDC +24VDC 0VDC 0VDC X4
PWRO1 PWRO2 PWRI– PWR+ X10
X3
R1A 2 — 2-X3
R1C 3 — 3-X3
Enable 15

Resolver feedback X2
Encoder feedback X1

M 3 ~

K1

Enable control system

Q1: magnetic circuit breaker
KM1: contactor

Control circuit of LXM 15MD**N4, LXM 15HC**N4X servo drives

24 V
Emergency stop
Stop
K1
S1
Door
1-X10
PWRO
2-X10
K2
Turn on
KM1
K2
2-X3
Servo drive OK
3-X3
4-X10
3-X10
0 V
KM1   PWRI   K2   Latch electro-magnet   K1

Timing diagram

|		
Request for access to protected area	S1	
Servo motor contactor	KM2	
Lexium servo drive anti-start	PWRI	
Latch opening authorized	K2	
Latch electromagnet		
Door contact		
Reset		
Lexium servo drive speed reference		

T1 < 300 ms
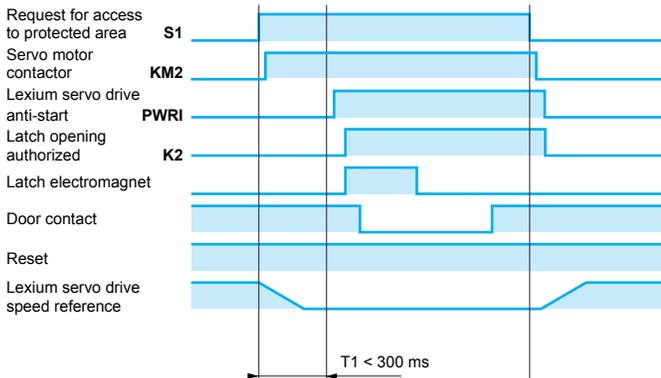
Comments

- Time delay T1 on the K1 relay must be long enough for the axis to come to a controlled stop.
- Lexium 15 MP and 15 HP servo drive parameters:
  - StopMode = 0: Axis performs a freewheel stop
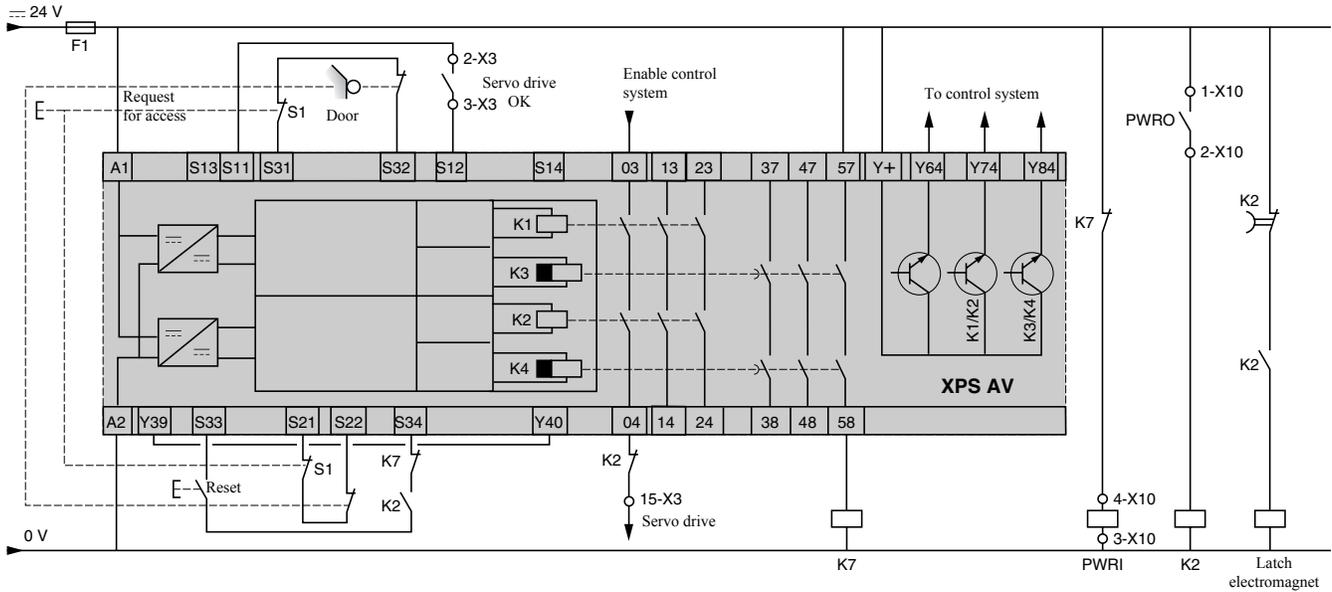 - StopMode = 1: Axis comes to a controlled stop according to the emergency deceleration ramp

Recommended wiring diagrams complying with standard EN 954-1

Category 2 safety level in accordance with EN 954-1

Power circuit of LXM 15MD**N4, LXM 15HC**N4X servo drives
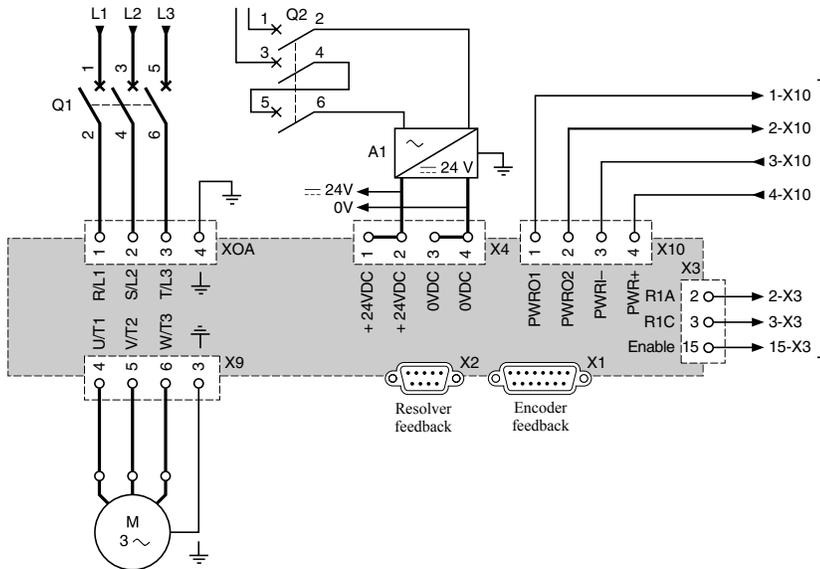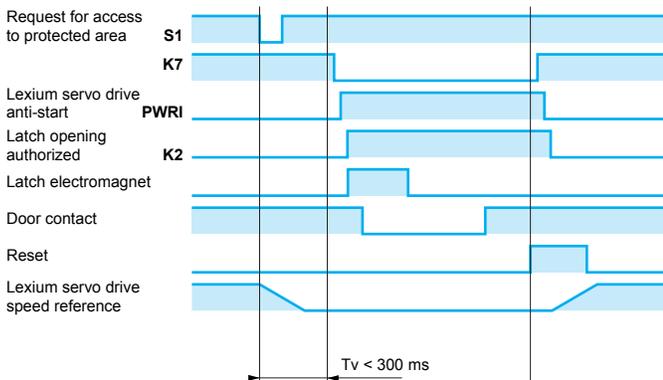

Q1: magnetic circuit breaker

Control circuit of LXM 15MD**N4, LXM 15HC**N4X servo drives

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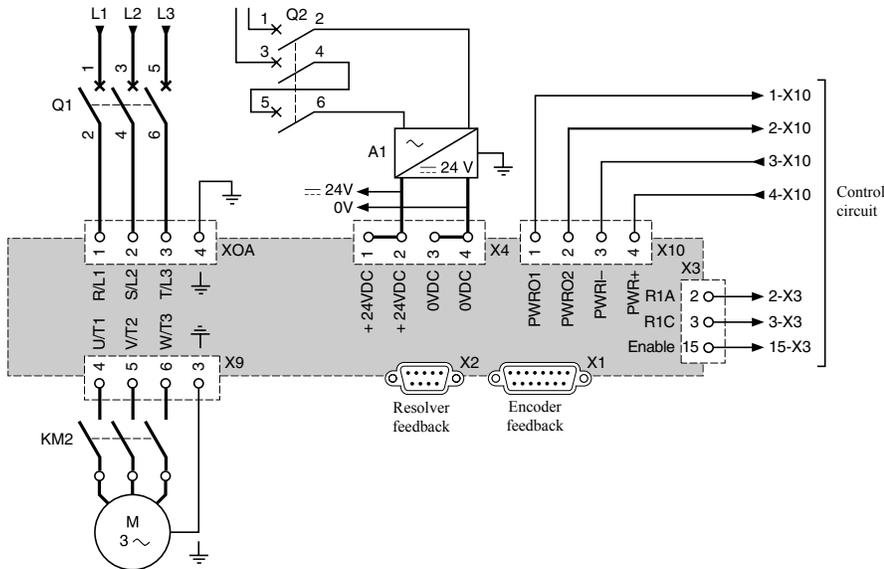
Timing diagram

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 MP and 15 HP servo drive parameters:
  - StopMode = 0: Axis performs a freewheel stop
  - StopMode = 1: Axis comes to a controlled stop according to the emergency deceleration ramp
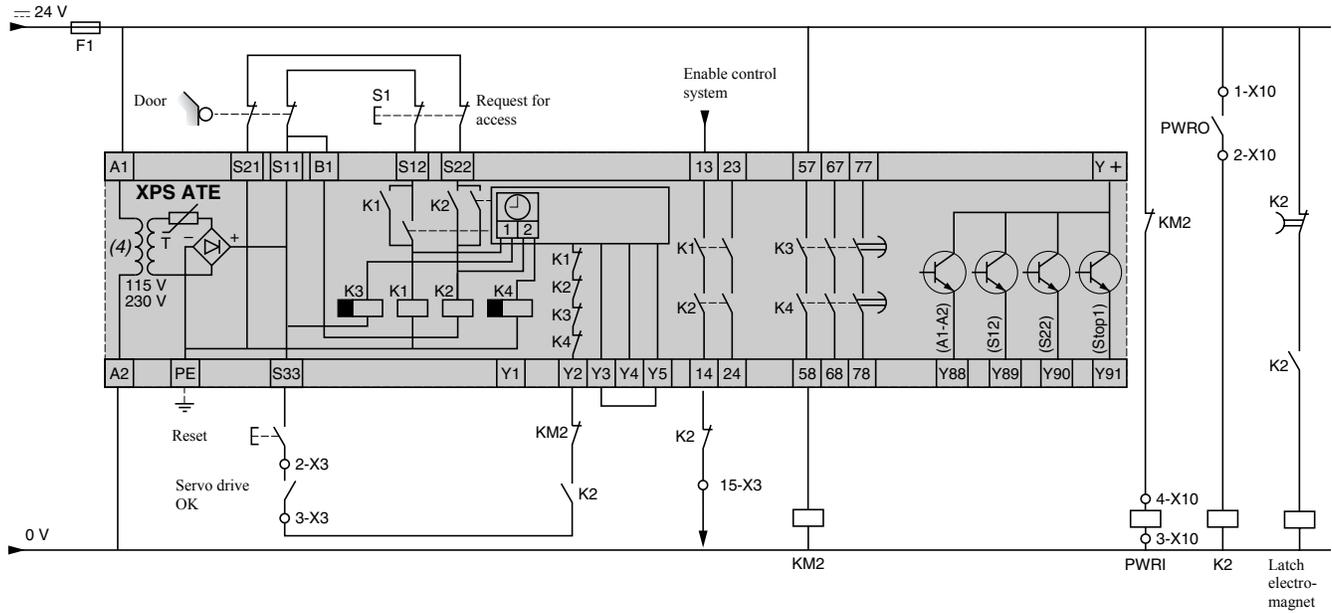
Recommended wiring diagrams complying with standard EN 954-1

Category 3 safety level in accordance with EN 954-1

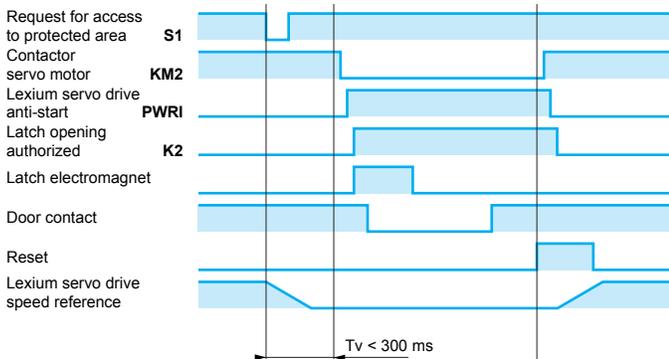### Power circuit of LXM 15MD**N4, LXM 15HC**N4X servo drives

Q1: magnetic circuit breaker

Control circuit of LXM 15MD**N4, LXM 15HC**N4X servo drives

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

Timing diagram

Request for access to protected area	**S1**	
Contactor servo motor	**KM2**	
Lexium servo drive anti-start	**PWRI**	
Latch opening authorized	**K2**	
Latch electromagnet		
Door contact		
Reset		
Lexium servo drive speed reference		

Tv < 300 ms

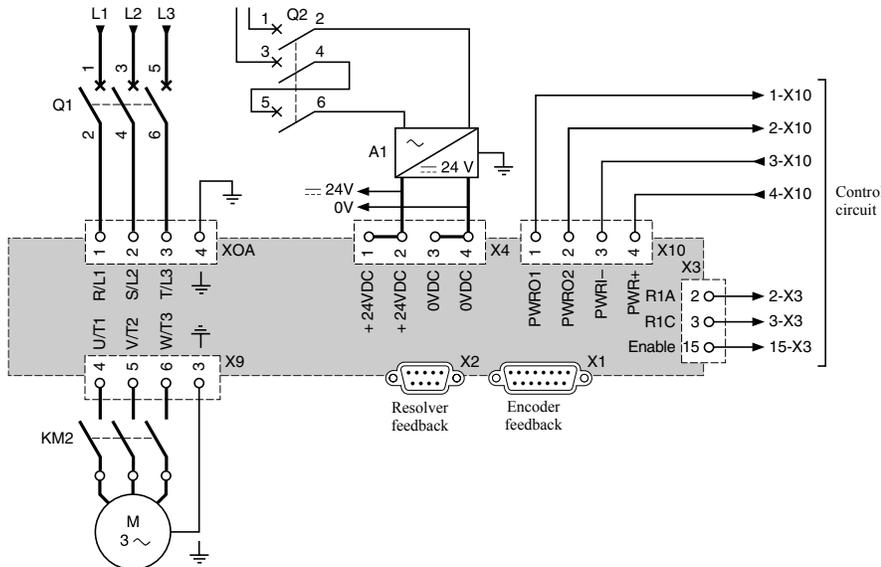### Comments

- Time delay Tv on the XPS ATE monitoring module must be long enough for the axis to come to a controlled stop.
- Lexium 15 MP and 15 HP servo drive parameters:
  - StopMode = 0: Axis performs a freewheel stop
  - StopMode = 1: Axis comes to a controlled stop according to the emergency deceleration ramp
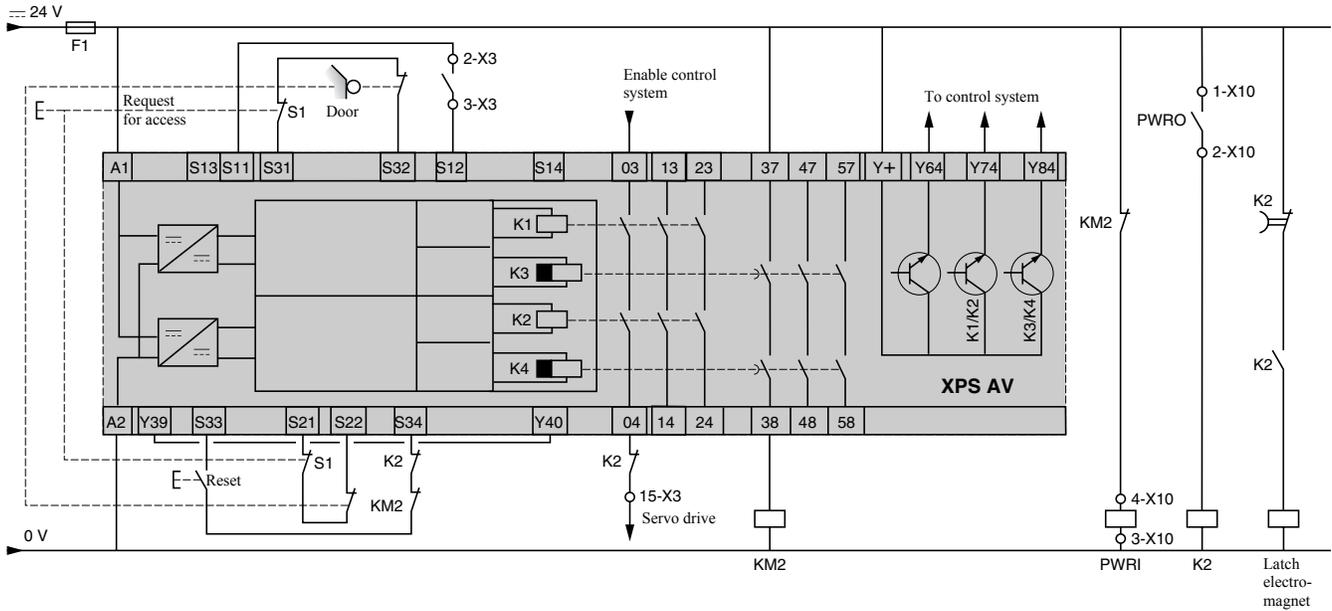
Category 4 safety level in accordance with EN 954-1

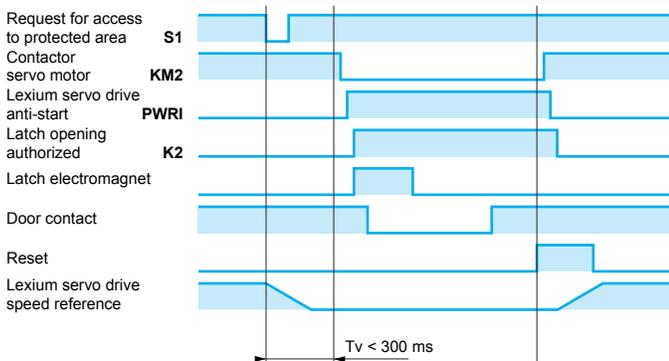### Power circuit of LXM 15MD**N4, LXM 15HC**N4X servo drives

Q1: magnetic circuit breaker

Control circuit of LXM 15MD**N4, LXM 15HC**N4X servo drives

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

Timing diagram

Request for access to protected area	**S1**
Contactor servo motor	**KM2**
Lexium servo drive anti-start	**PWRI**
Latch opening authorized	**K2**
Latch electromagnet	
Door contact	
Reset	
Lexium servo drive speed reference	

Tv < 300 ms

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 MP and 15 HP servo drive parameters:
  - StopMode = 0: Axis performs a freewheel stop
  - StopMode = 1: Axis comes to a controlled stop according to the emergency deceleration ramp

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.

| LXM15M | Recommended wire size | | Notes | Tightening torque Nm (lbf.in) | Primary fuse (A) |
	mm²	AWG			Three phase 208…480 V
D28N4	2.5	12	600 V, 75° C (221° F), twisted	0.5...0.6 (4.4...5.3)	15 A, class CC
D40N4	4	10			20 A, class CC
D56N4					25 A, class CC

AC power supply connection

The following diagrams show the connections for the AC power supply input to the Lexium 15 MP 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 the Simplified Manual for this product.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

The following diagram show the connection for a 3-phase power supply.
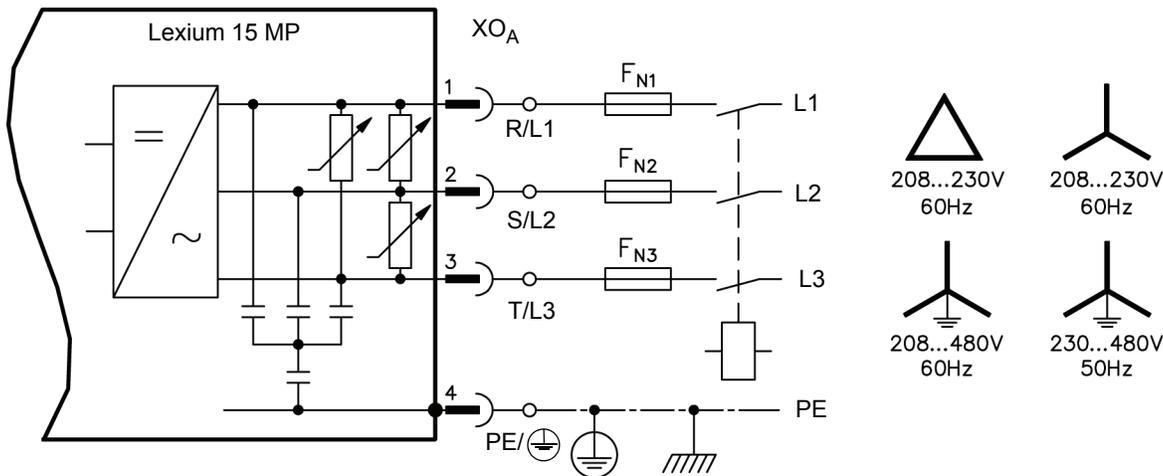
⚠ CAUTION
RISK OF EQUIPMENT DAMAGE
Always use an isolating transformer for 400...480 V networks which are asymmetrically grounded or not grounded.
Failure to follow these instructions can result in injury or equipment damage.

Power wiring

24 V DC external control power supply connection
The 24 V **DC** external control power supply is required to operate the Lexium 15 MP 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.

| LXM15M	Wire size	Tightening torque Nm (lbf.in)	Fuse (A)	Notes
D28N4, D40N4, D56N4	2.5 mm^2 or 14 AWG	0.5...0.6 (4.4...5.3)	10 A	Check voltage drop

24 V DC external control power supply terminal (X4)
The table below describes the 24 V **DC** external control power supply specifications

LXM15M	Servo motor brake present	External control power supply input	Value
D56N4	No	Voltage	24 V DC -0 % +15 %
		Current	1 A
D40N4	Yes	Voltage	24 V DC -0 % +15 %
D56N4		Current	3 A

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.
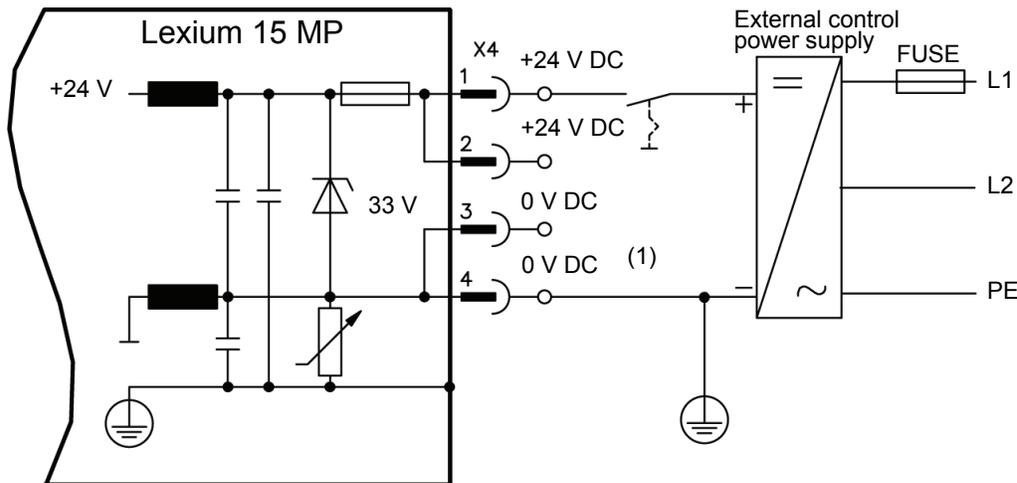
Use appropriate fuses as required by the power supply manufacturer.

CAUTION

SERVO DRIVE CONTROLLER DAMAGE

- A fuse must be used between the terminal of the power supply and the +24V DC input (X4-1and 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.

Braking circuit specifications

The following table provides technical data on the braking circuit.

Braking circuit: technical data			LXM15M
Supply voltage	**Rated data**	**Dim.**	**D28N4, D40N4, D56N4**
3 X 230 V	Upper switch-on level of braking circuit	V	400 - 430
	Switch-off level of braking circuit	V	380 - 410
	Overvoltage F02	V	450
	Continuous power of braking circuit (PC/-)	W	200
	Continuous power of braking circuit (PA/+) max.	kW	0.75
	Pulse power, internal (PC/- max. 1s)	kW	5
	Pulse power, external (PA/+ max. 1s)	kW	5
	External braking resistor	See Braking Resistors section, page 30.	
	Internal braking resistor	Ohm	33
3 X 400 V	Upper switch-on level of braking circuit	V	720 - 750
	Switch-off level of braking circuit	V	680 - 710
	Overvoltage F02	V	800
	Continuous power of braking circuit (PC/-)	W	200
	Continuous power of braking circuit (PA/+) max.	kW	1.2
	Pulse power, internal (PC/- max. 1s)	kW	16
	Pulse power, external (PA/+ max. 1s)	kW	16
	External braking resistor	See Braking Resistors section, page 30.	
	Internal braking resistor	Ohm	33
3 X 480 V	Upper switch-on level of braking circuit	V	840 - 870
	Switch-off level of braking circuit	V	800 - 830
	Overvoltage F02	V	900
	Continuous power of braking circuit (PC/-)	W	200
	Continuous power of braking circuit (PA/+) max.	kW	1.5
	Pulse power, internal (PC/- max. 1s)	kW	21
	Pulse power, external (PA/+ max. 1s)	kW	21
	External braking resistor	See Braking Resistors section, page 30.	
	Internal braking resistor	Ohm	33

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

| LXM15M	Wire Size	Tightening torque Nm (lbf.in)	Notes	Protective device
D28N4, D40N4, D56N4	2.5 mm^2 or 14 AWG	0.5...0.6 (4.4...5.3)	High temperature insulation 1000 V, 105 °C (221 °F) or greater	GV2MExx or equivalent

External braking resistor connection

The following diagram shows the connections between the external braking resistor and the Lexium 15 MP 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.

⚠ CAUTION
RISK OF EQUIPMENT DAMAGE
A protective device must be used with the external braking resistor. Refer to the instructions with the resistor for recommended devices.
Failure to follow these instructions can result in injury or equipment damage.
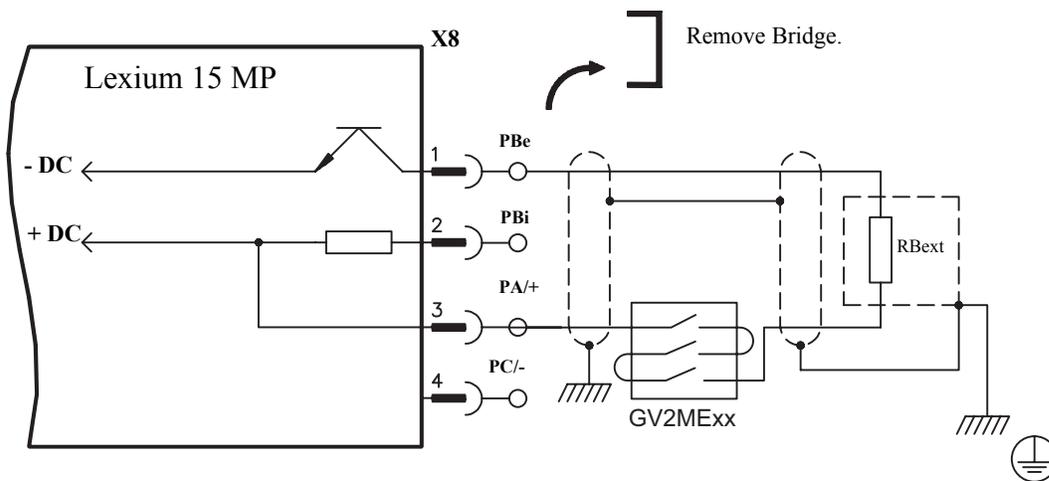
⚠ CAUTION
IMPROPER USE OF A BRAKING RESISTOR
Only use the braking resistors recommended in this Installation Manual. Refer to pages 27 through 30.
Failure to follow these instructions can result in injury or equipment damage.

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

| LXM15M	Item	Wire Size	Notes
D28N4, D40N4, D56N4	Power	Depends on the servo motor model. Please see the Lexium 15 servo drive catalog	-
	Brake	Min. 0.75 mm² (18 AWG)	600 V, 105 °C (221°F) shielded, check voltage drop

Servo motor power connection

The following diagrams show the connections between a BDH or BSH servo motor and the Lexium 15 MP 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:
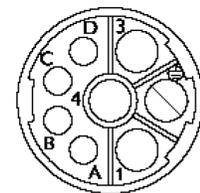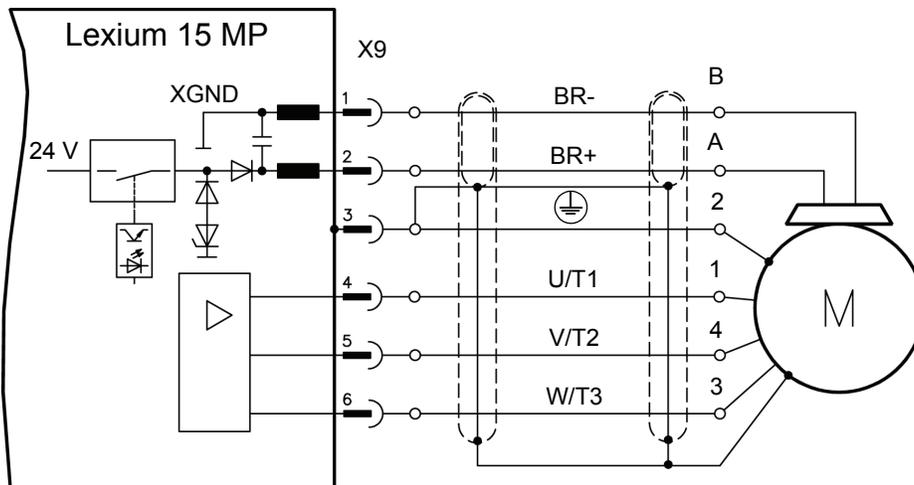
Servo motor power connector

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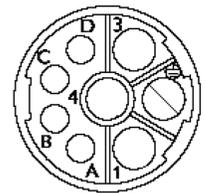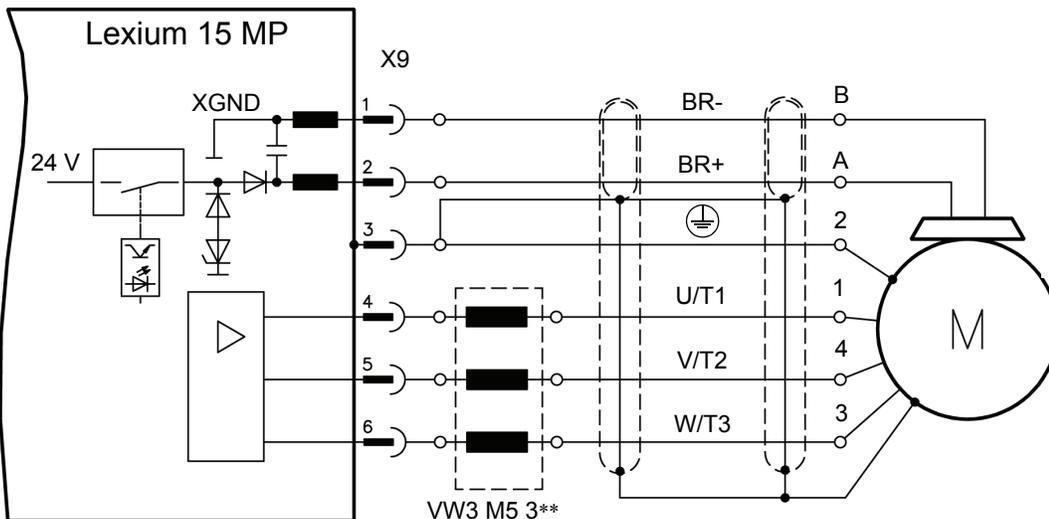
Servo motor power connector

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.

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 MP servo drive when the optional dynamic brake resistors and associated contactor are incorporated.

Square D
LPID25008BD
or equivalent
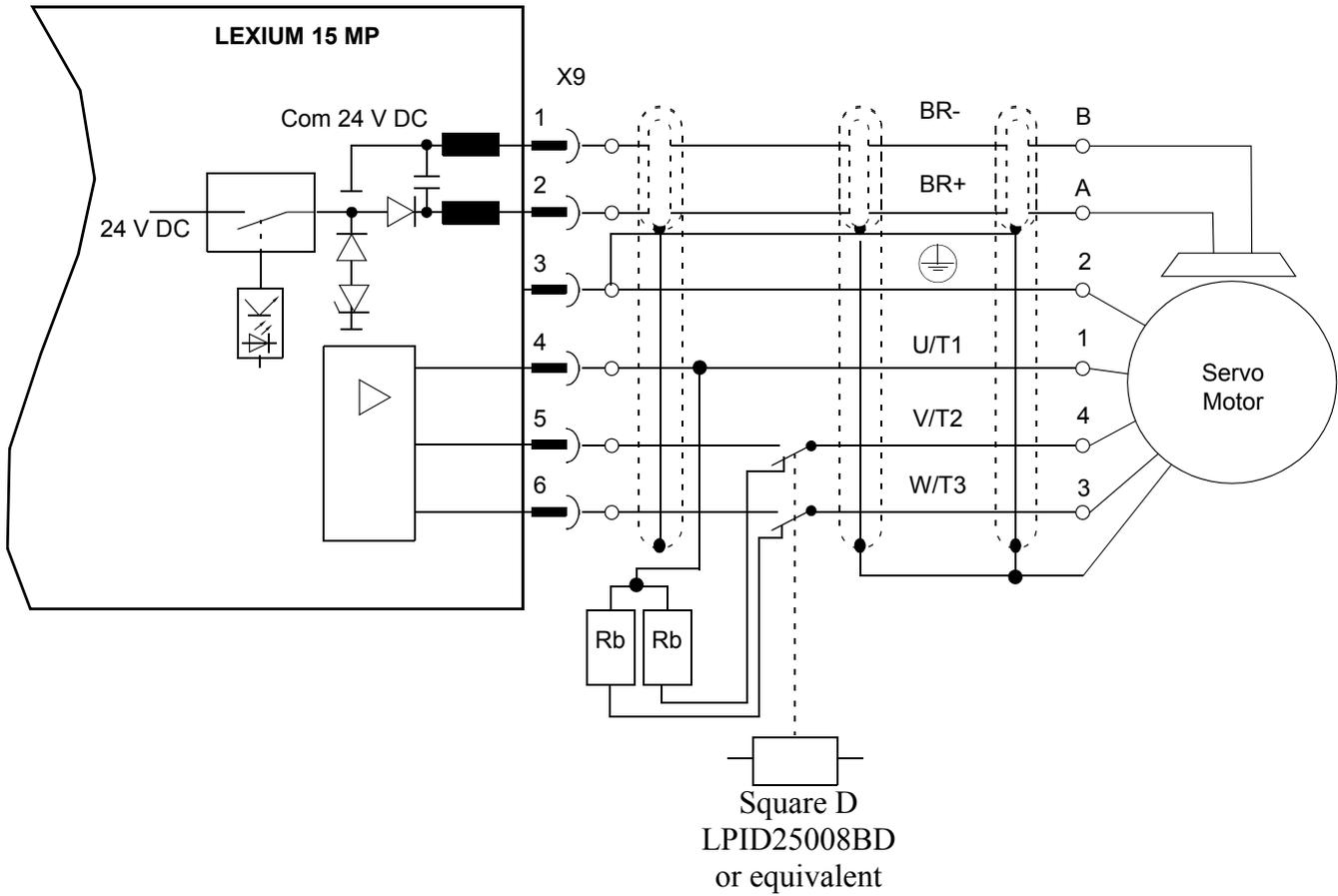
Note: If possible, disable the servo drive before opening relay

Braking resistors value

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

MINIMUM RESISTANCE (Rdb)

RESISTOR POWER RATING (Pb)

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

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

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 MP programming manual). In the diagram below you can see the timing and functional relationships between the ENABLE signal, speed setpoint, speed and braking force
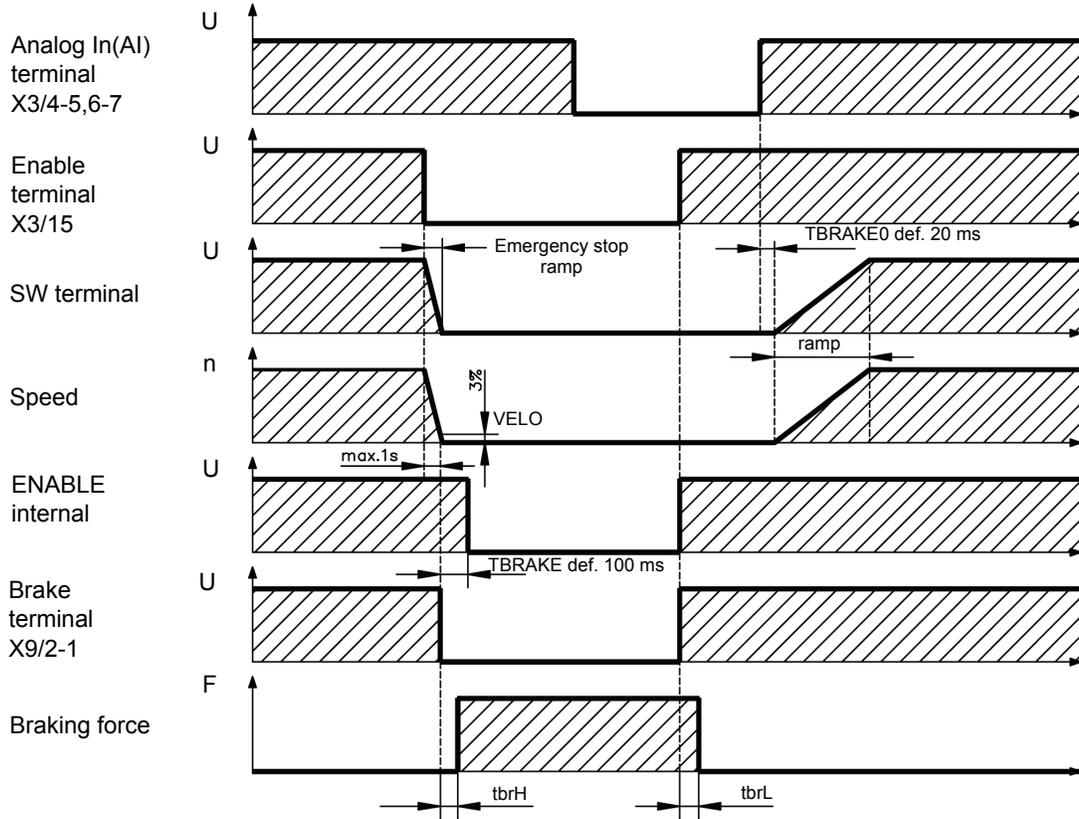
During the internal ENABLE delay time of 100 ms, the speed setpoint of the servo drive is internally driven down an adjustable ramp to 0 V. The output for the brake is switched on when the speed has fallen to 3 % of the preset final speed, at the latest after 1 second. The connection and separation time 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 MP programming manual.

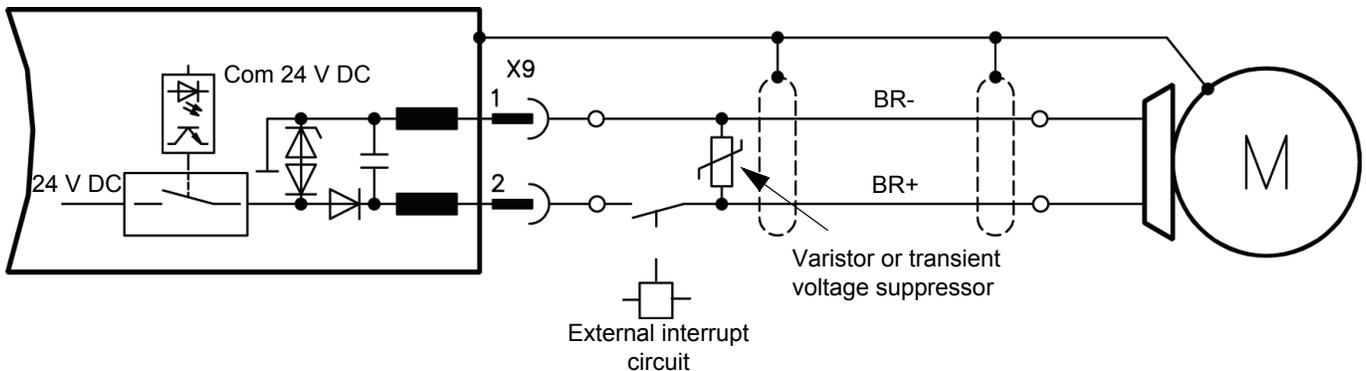### ⚠ WARNING

UNITENDED 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 :

Braking Resistors

Presentation

Internal braking resistor

A braking resistor is integrated in Lexium 15 servo drives, except LXM 15HC**N4X servo drives, to absorb the braking energy. If the DC bus voltage in the servo drive exceeds a specified value, this braking resistor is activated. The restored energy is converted into heat by the braking resistor.

External braking resistor

For LXM 15HC**N4X servo drives or for applications requiring the servo motor to perform frequent braking operations, it may be necessary to add an external braking resistor.

If an external braking resistor is used, the internal braking resistor must be deactivated. To do this, the shunt between terminals PBe and PBi must be removed and the external braking resistor connected between terminals PA/+ and PBe.

Two or more external braking resistors can be connected in parallel. The servo drive monitors the power dissipated in the braking resistor.

Sizing the braking resistor

During braking or deceleration requested by the servo drive, the kinetic energy of the moving load must be absorbed by the servo drive. The energy generated by deceleration charges the capacitors integrated in the servo drive.

When the voltage at the capacitor terminals exceeds the permitted threshold, the braking resistor (internal or external) will be activated automatically in order to dissipate this energy. In order to calculate the power to be dissipated by the braking resistor, the user needs a knowledge of the timing diagram giving the motor torques and speeds according to the time in order to identify the curve segments in which the servo drive decelerates the load.

Motor cycle timing diagram

These curves are those used in pages 146 and 192 for selecting the size of the servo motor. The curve segments to be taken into account, when the servo drive is decelerating, are marked in blue by D_i.

Motor speed n_i

Required torque M_i
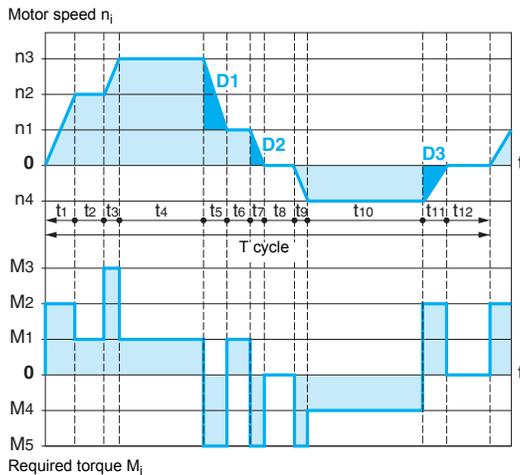
Calculation of the constant deceleration energy

To do this, the user must know the total inertia, defined as follows:
J_t: total inertia
where:
J_t = Jm (motor inertia) + Jc (load inertia).
The energy E_i of each segment is defined as follows:

$$E_i = \frac{1}{2}J_t \cdot \omega_i^2 = \frac{1}{2}J_t \cdot \left(\frac{2\pi n_i}{60}\right)^2$$

Which gives the following for the various segments:

$$E_1 = \frac{1}{2}J_t \cdot \left(\frac{2\pi[n_3 - n_1]}{60}\right)^2$$

$$E_2 = \frac{1}{2}J_t \cdot \left(\frac{2\pi n_1}{60}\right)^2$$

$$E_3 = \frac{1}{2}J_t \cdot \left(\frac{2\pi n_4}{60}\right)^2$$

where E_i is in joules, J_t in kgm^2, ω in radians and n_i in rpm.

Braking Resistors

Energy absorbed by the internal capacitor

The energy absorption capacity **Edrive** (without using an internal or external braking resistor) is given for each servo drive.
In the calculation, only take account of segments **D$_i$** for which the energy **E$_i$** is greater than the absorption capacities given in the table opposite.
This additional energy **E$_{Di}$** must be dissipated in the resistor (internal or external):
E$_{Di}$ = **E$_i$** - **Edrive** (in joules).

Calculation of the continuous power

The continuous power Pc is calculated for each machine cycle:

$$Pc = \frac{\Sigma E_{Di}}{T \text{ cycle}}$$

where **Pc** is in W, **E$_{Di}$** in joules and **T cycle** in s.

Selecting the braking resistor (internal or external)

Note: This is a simplified selection method. In extreme applications, for example with vertical axes, this method is inadequate. In this case, please consult your Regional Sales Office.

The selection is carried out in two steps:
1 The maximum energy during a braking procedure must be less than the peak energy that can be absorbed by the internal braking resistor:
   E$_{Di}$ < **EPk** and the internal braking resistor's continuous power must in turn not exceed: **Pc** < **PPr**. If these conditions are met, the internal braking resistor is adequate.
2 If one of the above conditions is not met, an external braking resistor must be used to satisfy these conditions.
   The value of the external braking resistor must be between the minimum and maximum values given in the table. Otherwise the servo drive may be subject to disturbance and the load can no longer be braked safely.

Characteristics

Braking resistors used with Lexium 15 MP servo drives

Type of servo drive		LXM 15		MD28N4			MD40N4			MD56N4		
Supply voltage			V	230	400	480	230	400	480	230	400	480
Number of phases				Three phase								
Load threshold			V DC	400	720	840	400	720	840	400	720	840
Energy absorption of the internal capacitors		Edrive	Joule (Ws)	6	23	28	12	46	57	12	46	57
Internal resistor	Resistance		Ω	33								
	Continuous power	PPr	W	200								
	Peak energy	EPk	Joule (Ws)	5000	16,000	21,000	5000	16,000	21,000	5000	16,000	21,000
External resistor	Minimum resistance		Ω	16	28	33	12	21	25	8	14	16
	Maximum resistance *(1)*		Ω	57	106	120	41	76	86	28	53	60
	Degree of protection			IP 65								

Braking resistors used with Lexium 15 HP servo drives

Type of servo drive		LXM 15		HC11N4X			HC20N4X		
Supply voltage			V	230	400	480	230	400	480
Number of phases				Three phase					
Load threshold			V DC	400	720	840	400	720	840
Energy absorption of the internal capacitors		Edrive	Joule (Ws)	60	150	180	120	300	360
External resistor	Minimum resistance		Ω	3	6	7	2	3	4
	Maximum resistance *(1)*		Ω	14	27	30	7	13	17
	Degree of protection			IP 20					

Braking Resistors

General characteristics

Type of braking resistor			VW3 A7 601 R**…608 R**	VW3 A7 705, 707
Ambient air temperature around the device	Operation	°C	0…+ 50	
	Storage	°C	- 25…+ 85	- 25…+ 70
Degree of protection of the casing			IP 65	IP 20
Thermal protection			Via the servo drive (1)	Via temperature-controlled switch (2) or via the servo drive (1)
Temperature-controlled switch	Activation temperature	°C	–	120
	Max. voltage - max. current		–	250 V ~ - 1 A
	Min. voltage - min. current		–	24 V DC - 0.1 A
	Maximum switch resistance	mΩ	–	60

Connection characteristics

Type of terminal			For servo drive	For temperature-controlled switch
Maximum wire size	VW3 A7 601 R**…608 R**		Supplied with connection cable	–
	VW3 A7 705, 707		Connected on a bar, M6	2.5 mm² (AWG 14)

External braking resistors

*VW3 A7 602 R***

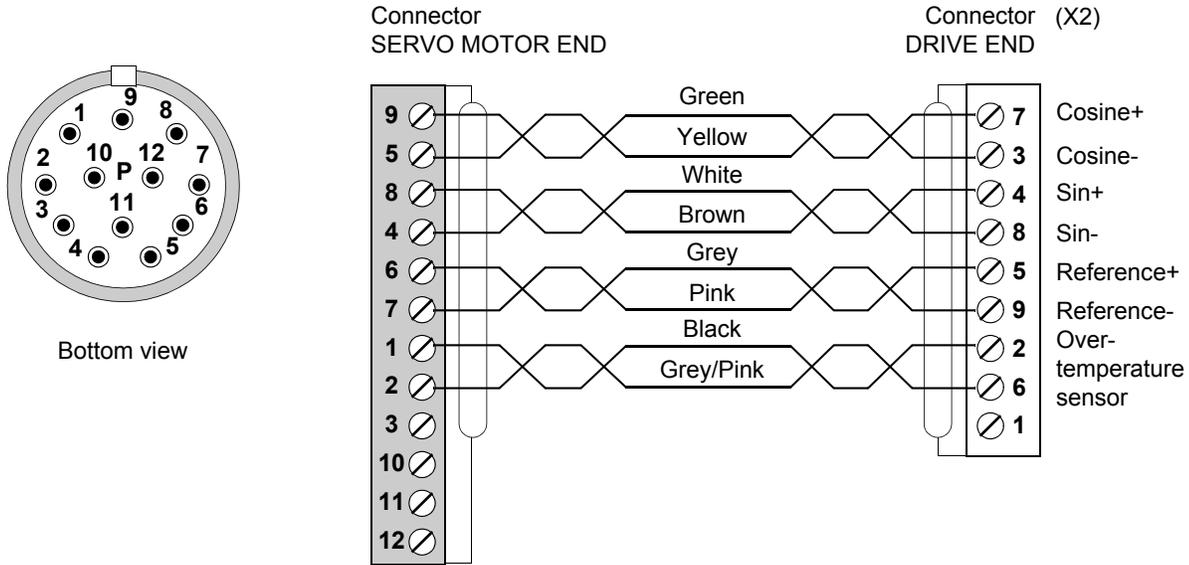| Value	Continuous power PPr	Peak energy EPk			Length of connection cable	Reference	Weight
		230 V	400 V	480 V			
Ω	W	Ws	Ws	Ws	m		kg
5	1000	45,000	45,000	45,000	–	VW3 A7 707	11.000
10	400	13,000	8600	7700	0.75	VW3 A7 601 R07	1.420
					2	VW3 A7 601 R20	1.470
					3	VW3 A7 601 R30	1.620
	1000	45,000	45,000	45,000	–	VW3 A7 705	11.000
27	100	3000	1900	1700	0.75	VW3 A7 602 R07	0.630
					2	VW3 A7 602 R20	0.780
					3	VW3 A7 602 R30	0.900
	200	7500	4800	4300	0.75	VW3 A7 603 R07	0.930
					2	VW3 A7 603 R20	1.080
					3	VW3 A7 603 R30	1.200
	400	26,000	17,500	15,500	0.75	VW3 A7 604 R07	1.420
					2	VW3 A7 604 R20	1.470
					3	VW3 A7 604 R30	1.620
72	100	4500	3000	2700	0.75	VW3 A7 605 R07	0.620
					2	VW3 A7 605 R20	0.750
					3	VW3 A7 605 R30	0.850
	200	10,300	6800	6000	0.75	VW3 A7 606 R07	0.930
					2	VW3 A7 606 R20	1.080
					3	VW3 A7 606 R30	1.200
	400	26,500	17,500	15,500	0.75	VW3 A7 607 R07	1.420
					2	VW3 A7 607 R20	1.470
					3	VW3 A7 607 R30	1.620
100	100	4500	3000	2700	0.75	VW3 A7 608 R07	0.410
					2	VW3 A7 608 R20	0.560
					3	VW3 A7 608 R30	0.760

(1) Thermal protection is provided by internal limitation of the servo drive braking power.
(2) The switch should be connected in sequence (used for signalling or controlling the line contactor).

Resolver connection

BDH servo motor resolver connection

The following diagram shows the connections between the resolver and the Lexium 15 MP servo drive.
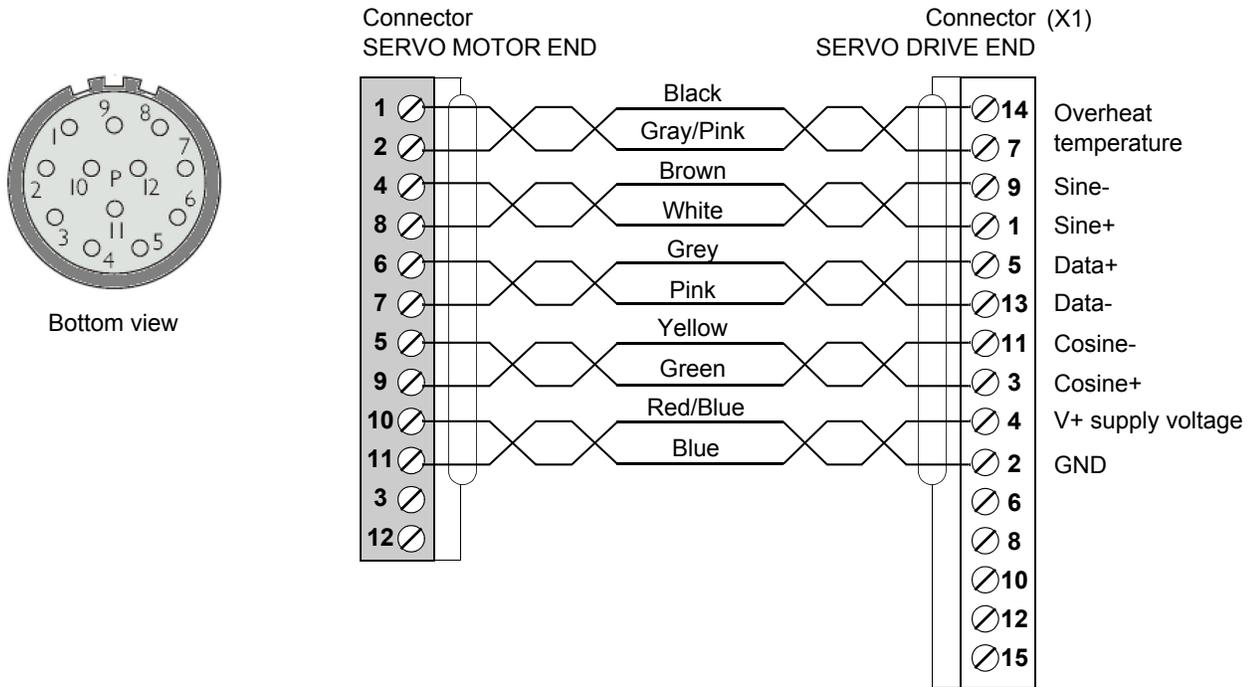
Connector SERVO MOTOR END		Connector (X2) DRIVE END
9	Green	7 Cosine+
5	Yellow	3 Cosine-
8	White	4 Sin+
4	Brown	8 Sin-
6	Grey	5 Reference+
7	Pink	9 Reference-
1	Black	2 Over-temperature sensor
2	Grey/Pink	6
3		1
10		
11		
12		

Bottom view

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 MP servo drive.

Bottom view

Connector
SERVO MOTOR END

Connector (X1)
SERVO DRIVE END

Motor pin	Wire color	Drive pin	Signal
1	Black	14	Overheat temperature
2	Gray/Pink	7	
4	Brown	9	Sine-
8	White	1	Sine+
6	Grey	5	Data+
7	Pink	13	Data-
5	Yellow	11	Cosine-
9	Green	3	Cosine+
10	Red/Blue	4	V+ supply voltage
11	Blue	2	GND
3		6	
12		8	
		10	
		12	
		15	

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 MP positioning or extremely smooth running. In addition, the thermistor contact in the servo motor is connected via the encoder cable to the Lexium 15 MP servo drive.

Encoder Input Specifications Table

The following table provides Lexium 15 MP 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	4...128 TTL lines per sine line	analog pass 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 10 meters.

Connections and signals for the incremental encoder interface are as follows:
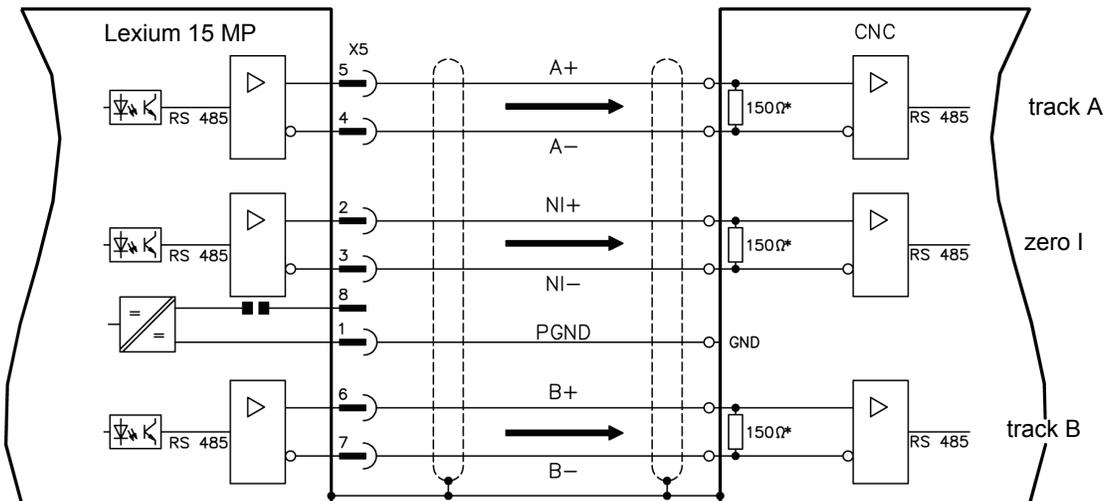
*A terminating impedance is required for operation of the communication bus.

Edge spacing a $\geq$ 0.20 µs

Edge steepness tv $\leq$ 0.1 µs

Delay N-I-td $\leq$ 0.1 µs

$|\Delta U| \geq$ 2 V/20 mA
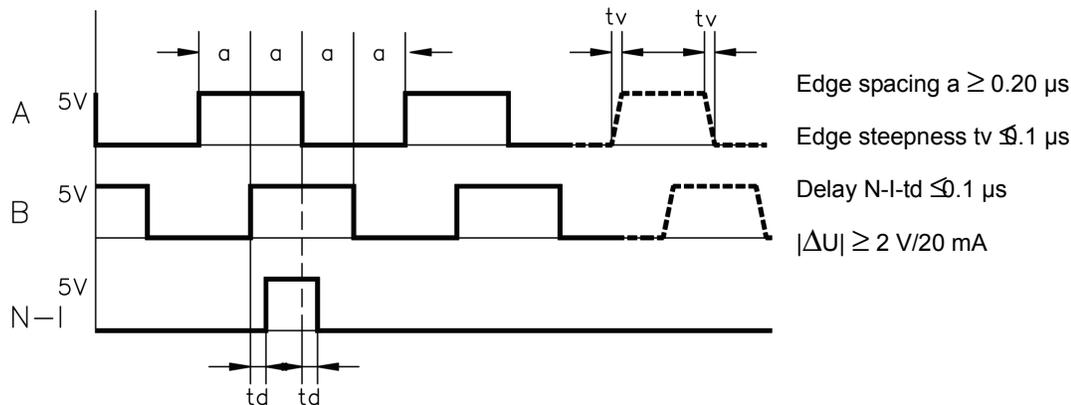
Encoder emulation

SSI output (X5)

The SSI interface (synchronous serial absolute-encoder simulation) is part of the delivered package. Select the encoder function SSI (screen page "Encoder"). In the servo drive, the position of the motor shaft is calculated from the cyclically absolute signals from the resolver or encoder. This information is used to create a position output in a format that is compatible with the standard SSI-absolute-encoder format. 24 bits are transmitted.

SINGLE TURN selected: The upper 12 bits are fixed to ZERO, the lower 12 bits contain the position information. For 2-pole resolvers, the position value refers to the position within one turn of the motor, for 4-pole resolvers it is within half a turn, and for 6-pole resolvers it is within a third of a turn.

Exception: If an encoder with a commutation track is used as the feedback unit, then the upper 12 bits are set to 1 (data invalid!) until a homing run is performed.

MULTI TURN selected: The upper 12 bits contain the number of motor turns, the lower 12 bits contain the position information.

The signal sequence can be output in Gray code (standard) or in binary code (parameter SSI-CODE). The servo amplifier can be adjusted to the clock frequency of your SSI-evaluation with the SSI-TAKT parameter (200 kHz or 1.5 MHz and inverted).

Drivers are supplied from internal supply voltage. PGND must always be connected.

Connection and signals for the SSI interface are described below:
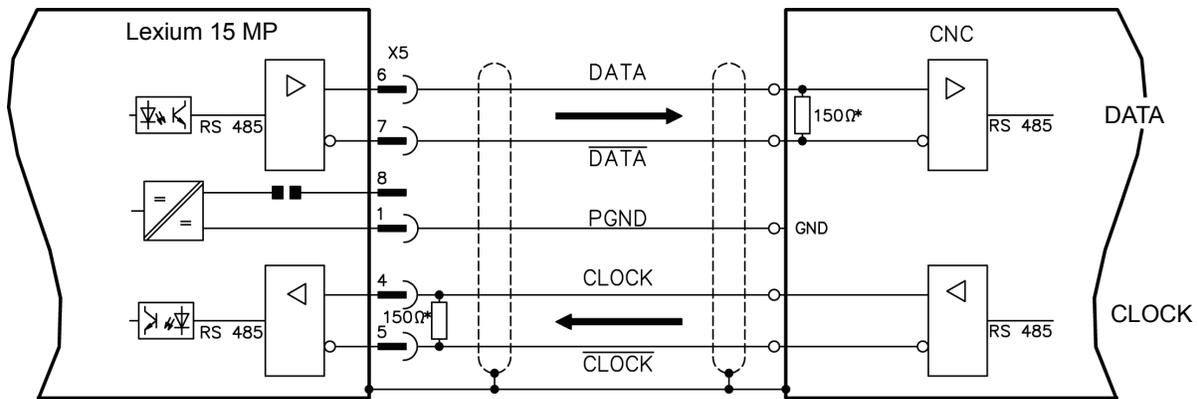
*A terminating impedance is required for operation of the communication bus.

Transfert bit rate	Monoflop stabilize time
200 KBaud	Tp $\approx$ 13µs
1.5 MBaud	Tp $\approx$ 3µs
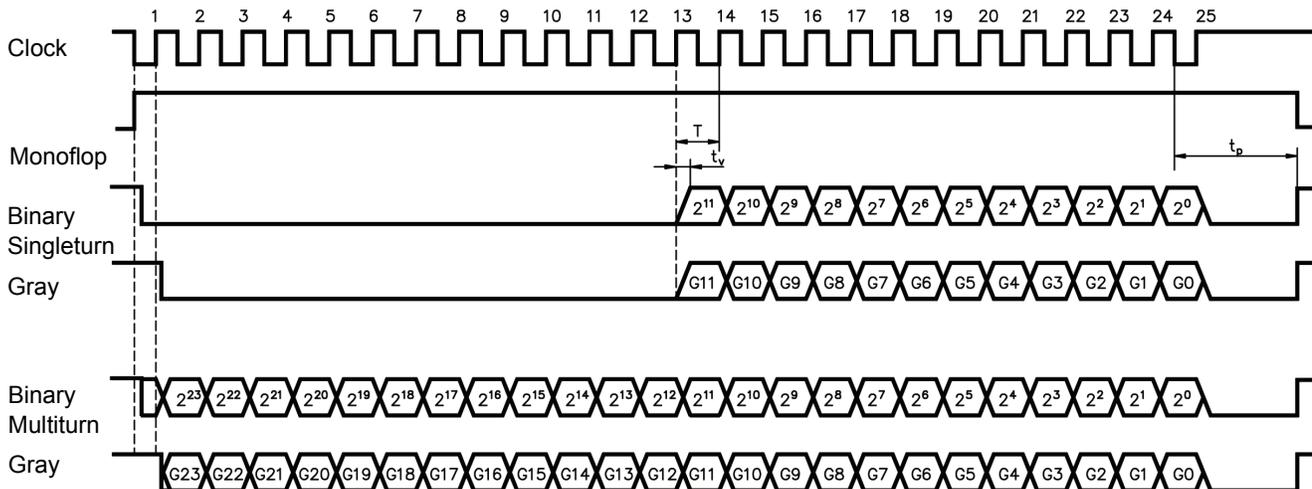
Output $|\Delta U| \geq 2$ V/20 mA

Input $|\Delta U| \geq 0.3$ V

Switch over time Data $t_v \leq 300$ ns

Period T = 600 ns

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 MP 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.

The 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 MP 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.

*A terminating impedance is required for operation of the communication bus.

Encoder input (slave) specifications table

The following table provides Lexium 15 MP 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 MP servo drive and an external incremental encoder.
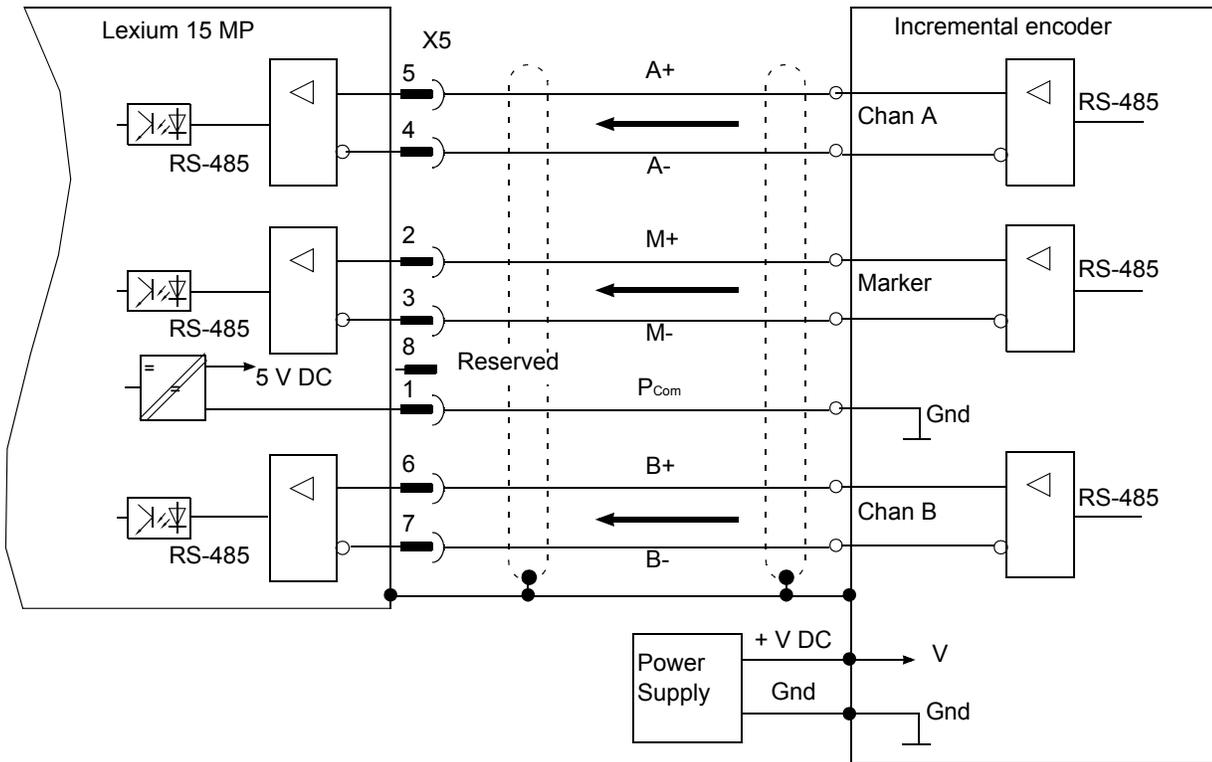
Note: The receivers are supplied with an internal supply voltage.

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 MP servo drive.
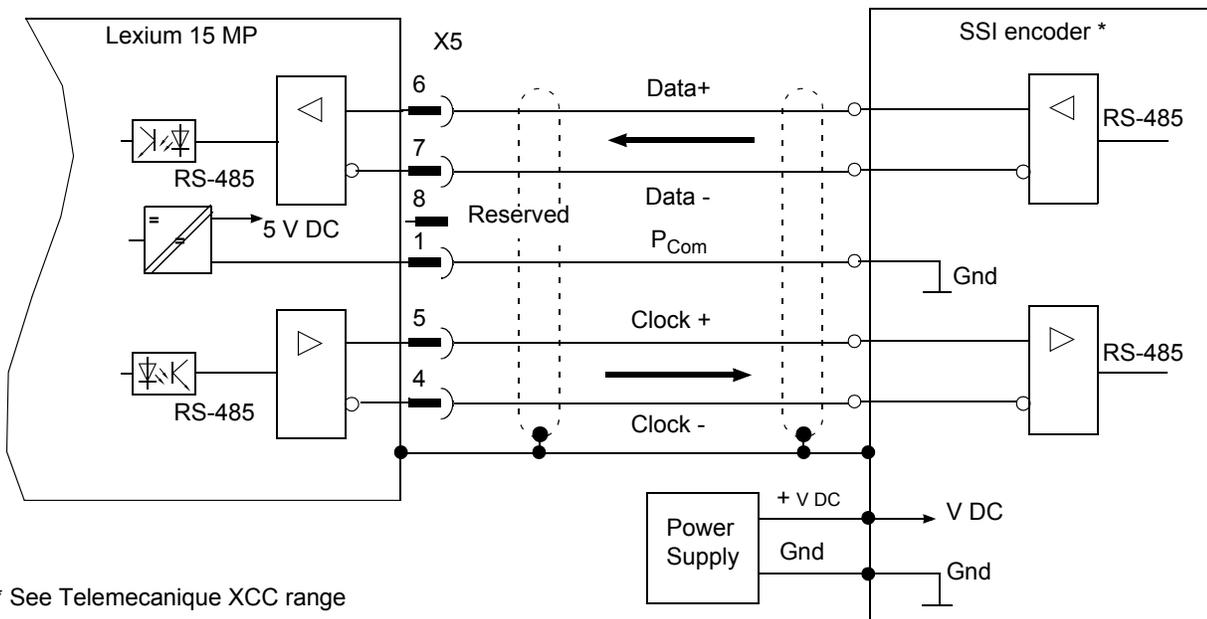
* See Telemecanique XCC range

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

I/O wiring recommendations

⚠ CAUTION

RISK OF EQUIPMENT DAMAGE

Ground connections must be made to the correct terminals: ACOM is the ground for analog inputs, internal analog ground, encoder emulation, RS232 and CAN.

DCOM 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 MP 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 tie

1

2

3

30 mm
1.18 "

30 mm
1.18 "

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.

Cable tie

4

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

Cable tie

5

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

LXM15M	Wire Size	Tightening torque Nm (lbf.in)	Notes
D28N4, D40N4, D56N4	0.25 mm^2 or 22 AWG	0.5...0.6 (4.4...5.3)	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 ground reference.

The following diagram shows the connections between the two fully programmable, differential analog inputs on the Lexium 15 MP servo drive and a user device.
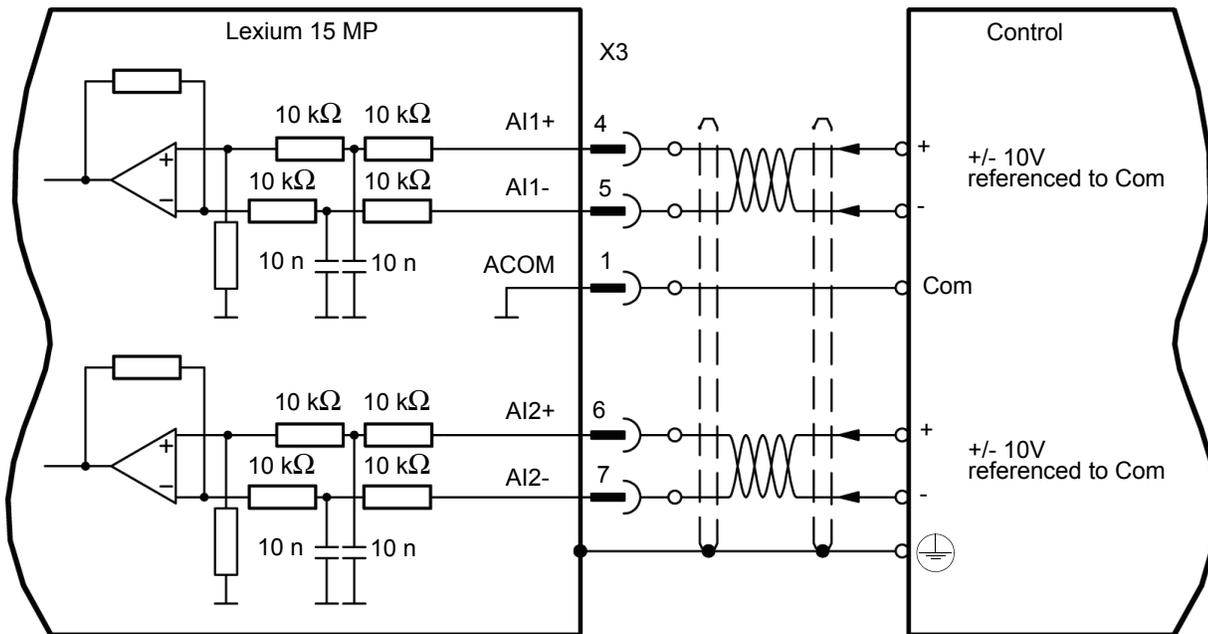
The list below describes the technical characteristics for the analog inputs (X3):
- Ground reference : ACOM, terminal X3/1
- Input resistance 20 kΩ

The table below describes terminals X3/4-5 (AI1+/AI2-) and X3/6-7 (AI2+/AI2-)caracteristics:

Terminals	Caracteristics	Application examples for setpoint input
Analog-In 1 input (terminals X3/4-5)	Differential input voltage max. ± 10 V Resolution 14-bit Scalable Standard setting : speed setpoint	-
Analog-In 2 input (terminals X3/6-7)	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 X3/4 (+) and terminal X3/5 (-) or
- Positive voltage between terminal X3/6 (+) and terminal X3/7 (-)

To reverse the direction of rotation, swap the connections to terminals X3/4-5 or X3/6-7 respectively, or change the ROTATION DIRECTION parameter in the "Speed controller" screen page.

Analog I/O connection

Analog outputs (X3)

Reference ground for the analog outputs (X3) is ACOM (terminal X3/1 and X3/10).

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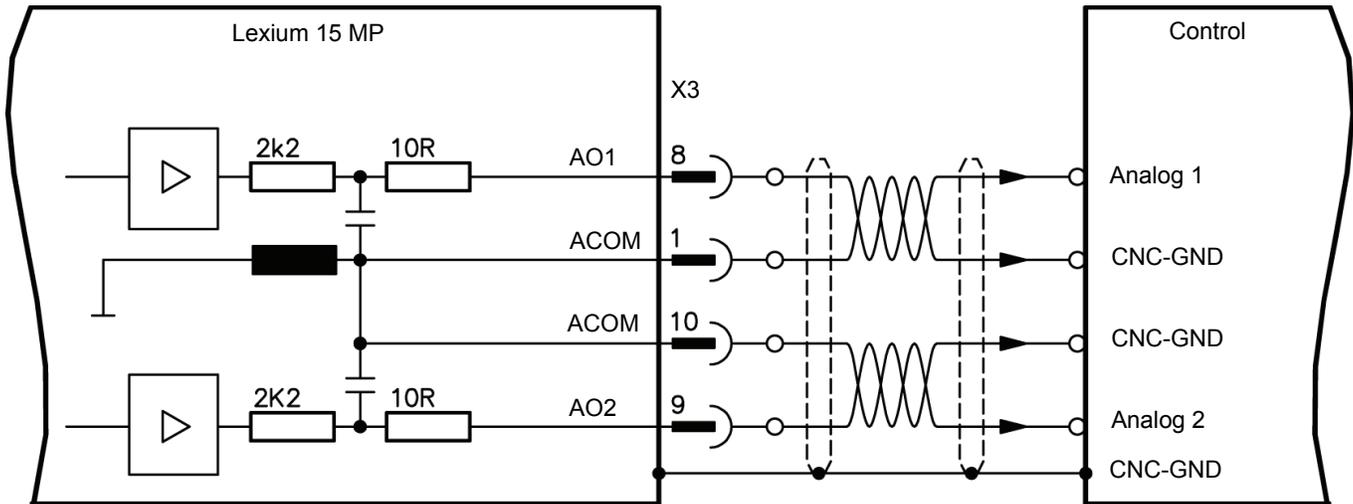
Analog output specifications table

The following table lists the analog output specifications.

Analog outputs	
Channels	Two
Type	Single-ended, non-isolated referenced to ACOM
V_{OUT}	± 10 V
I_{OUT}	± 5 mA
Output impedance	2.2 kΩ
Maximum load capacitance	0.1 µF
Resolution	10 bits
Update time	5 ms

Programmable analog outputs Analog-out 1 / Analog-out 2

The terminals X3/8 (AO1) or X3/9 (AO2) can have the following analog signals assigned to them:

Standard setting :

Analog-out 1 : Tachometer voltage VTA (speed)

The output delivers 10 V at the preset limit speed.

Analog-out 2 : Current setpoint IDC (torque)

The IDC-monitor delivers 10 V at the preset peak current Ipeak (effective r.m.s. value).

You can use the terminals X3/8 (AO1) or X3/9 (AO2) to output converted analog values for digital measurements which are contained in the servo drive.

You can find a list of pre-programmed functions on the "analog I/O" screen of our setup software.

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

LXM15M	Wire Size	Tightening torque Nm (lbf.in)
D28N4, D40N4, D56N4	0.5 mm^2 or 20 AWG	0.5...0.6 (4.4...5.3)

Digital control inputs(X3)

All digital inputs are electrically isolated via optocouplers.
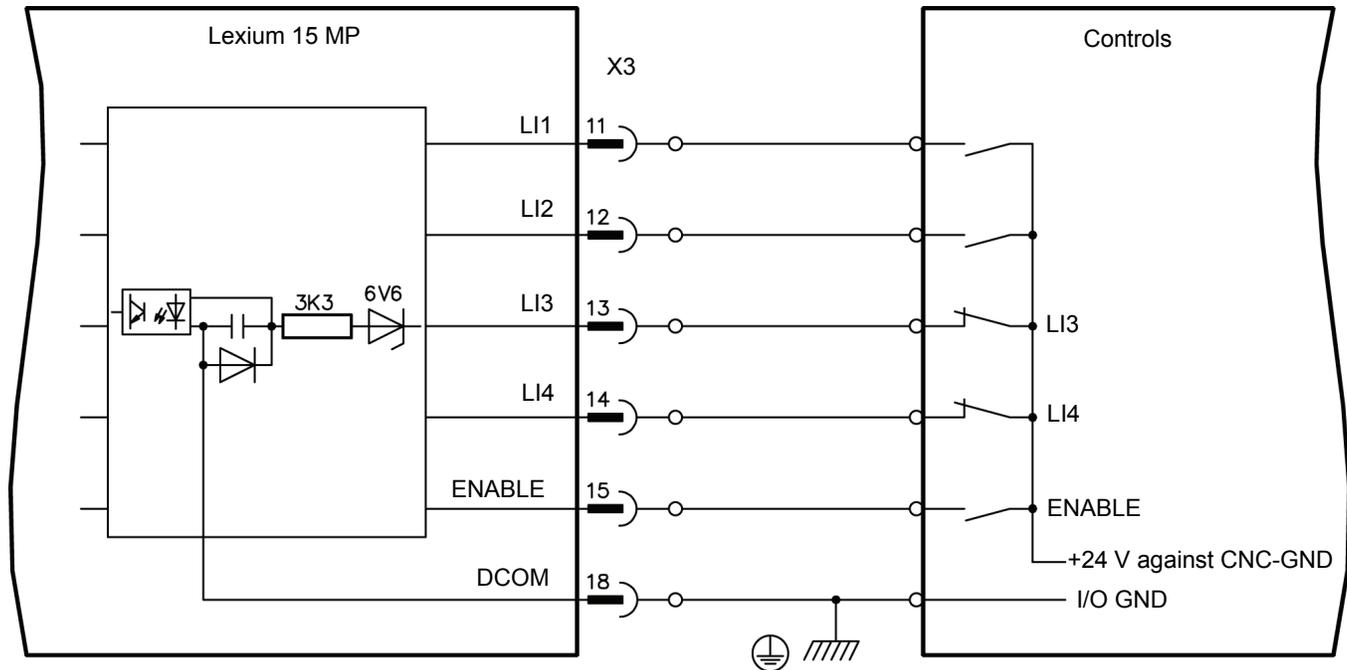
Discrete Input Specifications Table

The following table provides Lexium 15 MP 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	5 mA
V_{IH} minimum	12 V (minimum input voltage to be recognized as high – true)
V_{IL} maximum	7 V (maximum input voltage to be recognized as low – false)
Scan time:	
Normal	1 ms
High speed	< 50 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 $^\circ$C or greater, unless otherwise specified

LXM15M	Wire Size	Tightening torque Nm (lbf.in)
D28N4, D40N4, D56N4	0.5 mm^2 or 20 AWG	0.5...0.6 (4.4...5.3)

Digital control outputs(X3)
The following diagram shows the different control outputs:
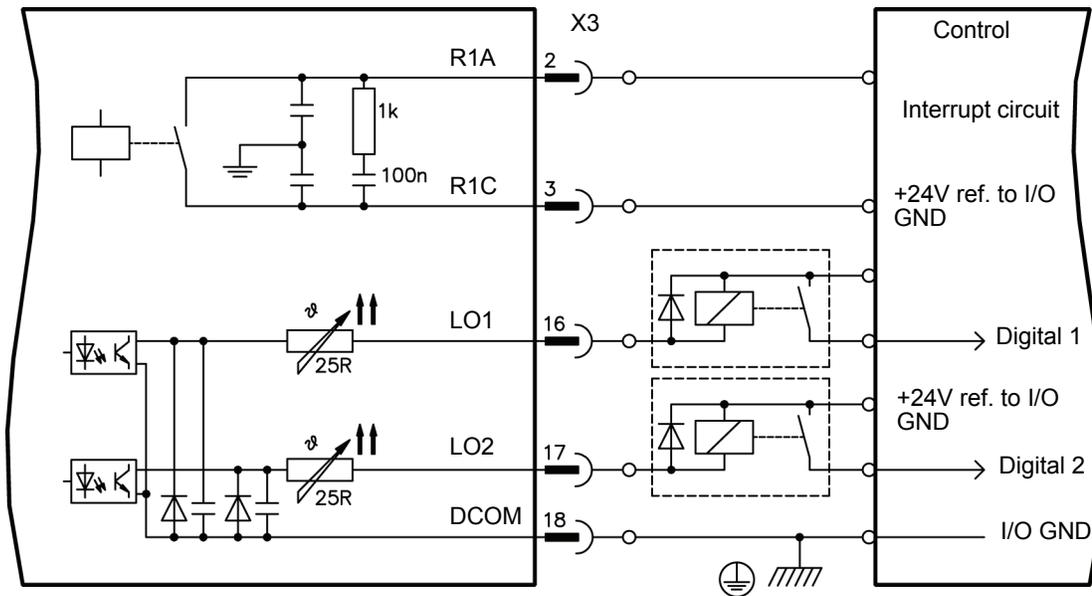
Note:The Lexium 15 MP logic outputs are open collectors therefore they need to be relayed to be connected to a PLC

Discrete Output Specifications Table
The following table provides Lexium 15 MP discrete output specifications.

DISCRETE OUTPUT	
Channels	Two
Type	Solid state: open collector 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	1 ms

R1A/R1C Relay Output Specifications Table
The following table provides Lexium 15 MP 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

Power removal function connection

Power removal function 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

LXM15M	Wire Size	Tightening torque Nm (lbf.in)
D28N4, D40N4, D56N4	0.5 mm^2 or 20 AWG	0.5...0.6 (4.4...5.3)

Power removal function inputs

The following diagram shows the power removal function inputs

---
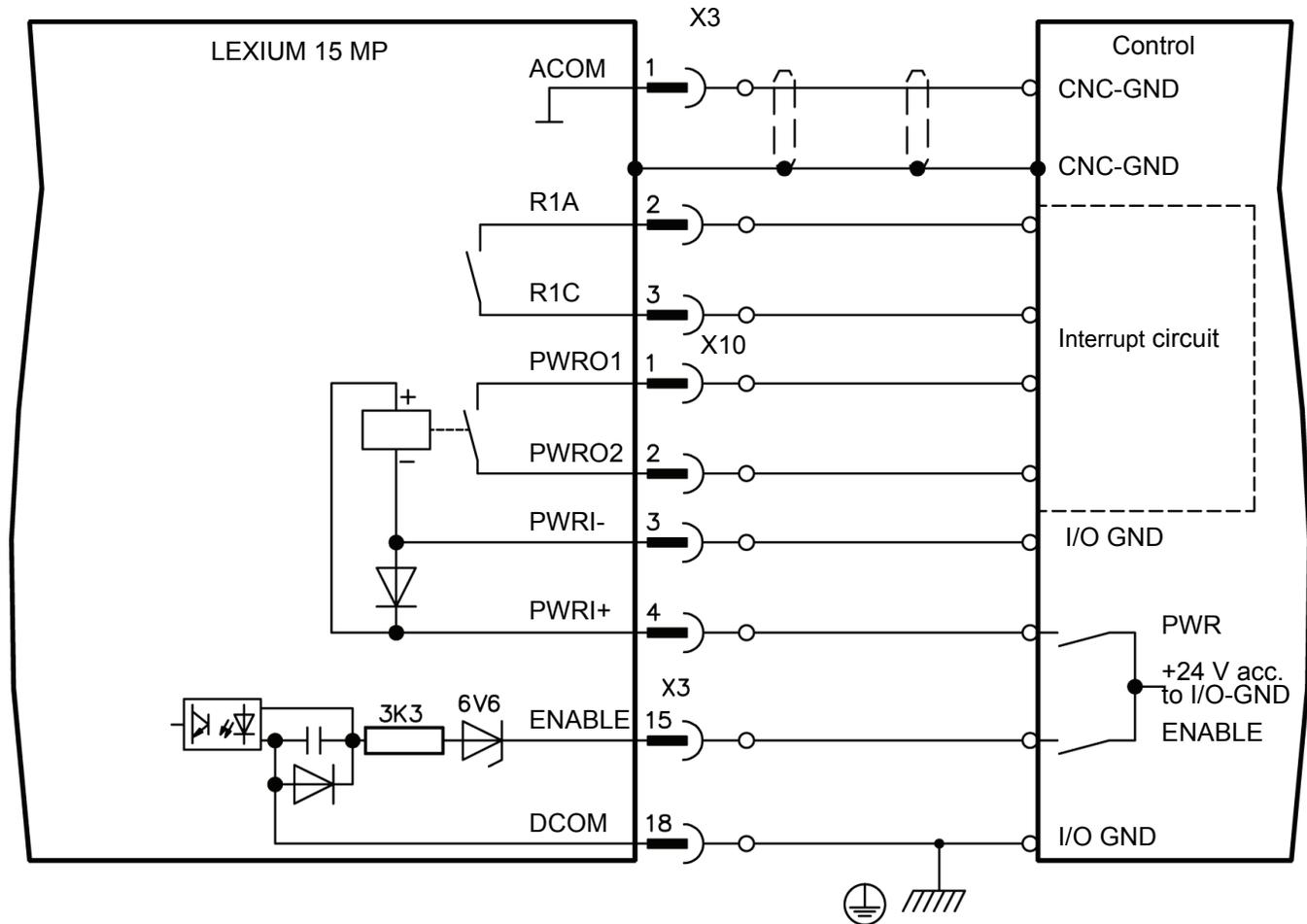
⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

The power removal function (PWR) must be properly wired using an interruption circuit per EN 954-1 and in accordance with pages 14 through 19 of this Installation Manual.

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

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
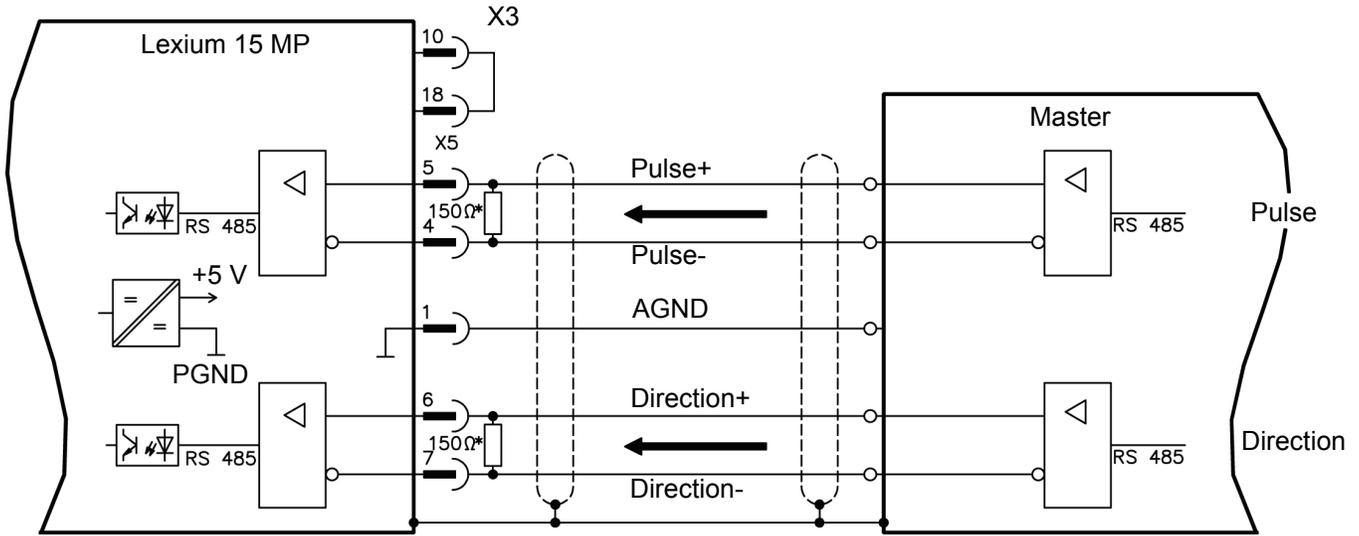
*A terminating impedance is required for operation of the communication bus.

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: 250 kHz
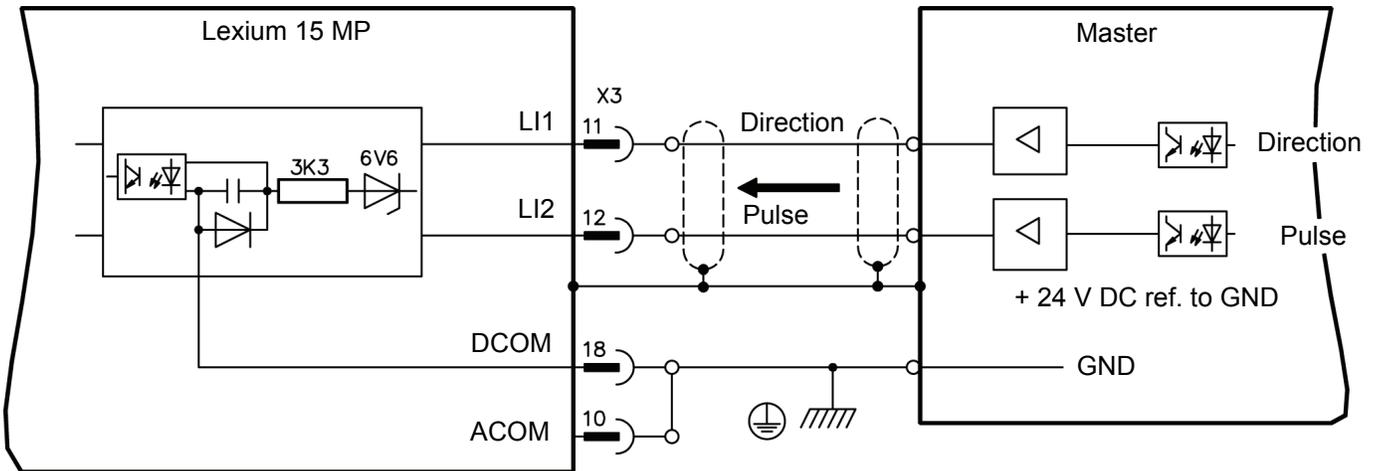
Serial communications connection (X6)

⚠ **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.
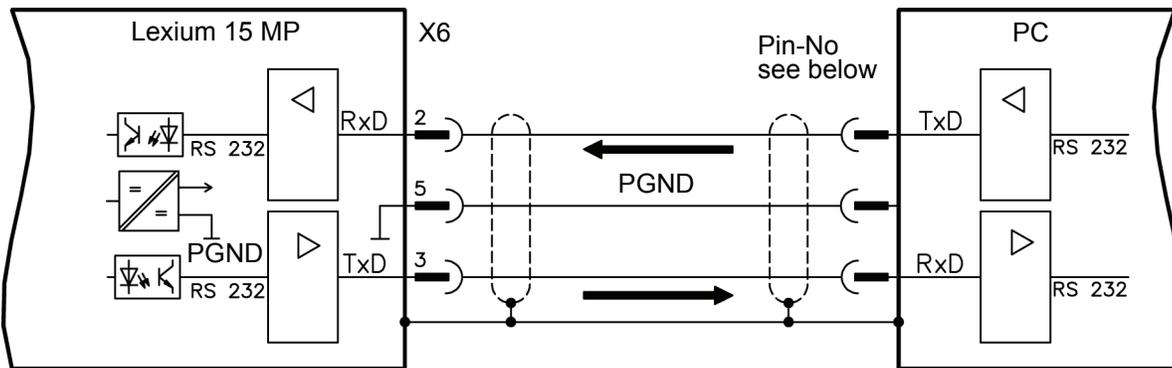
The following diagram shows the interface cable between the PC and servo drives of the Lexium 15 MP series:

(View : looking at the solder side of the SubD sockets on the cable)
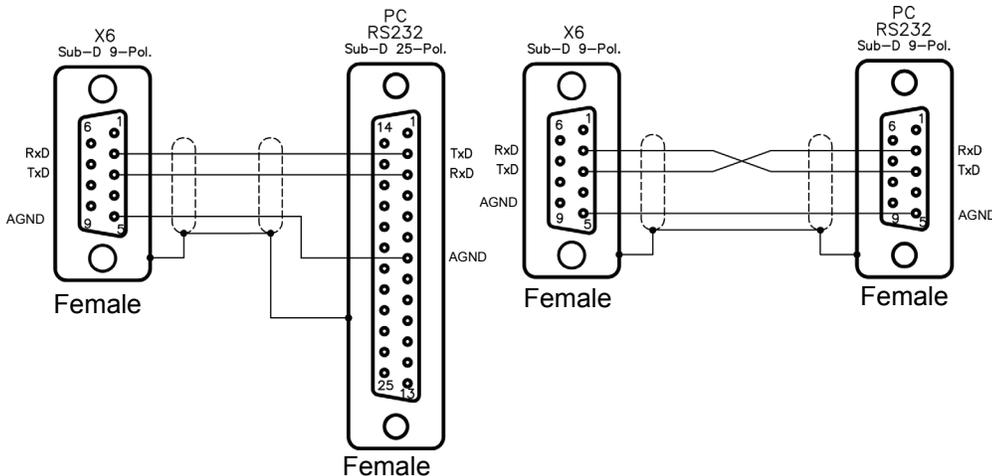
Serial communications specifications table

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)

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.
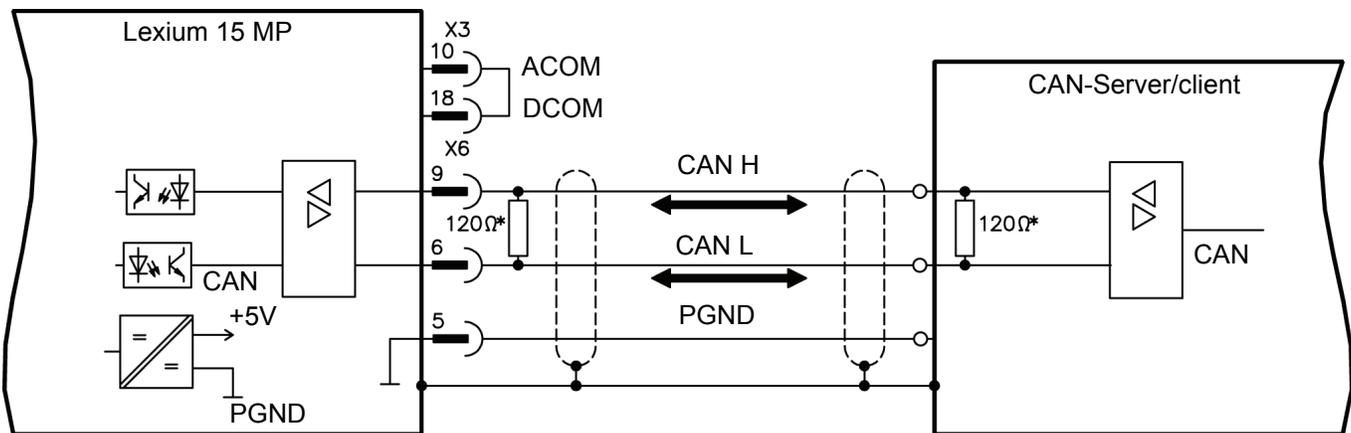
*A terminating impedance is required for operation of the communication bus.

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

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

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

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

● metal or metallized housing
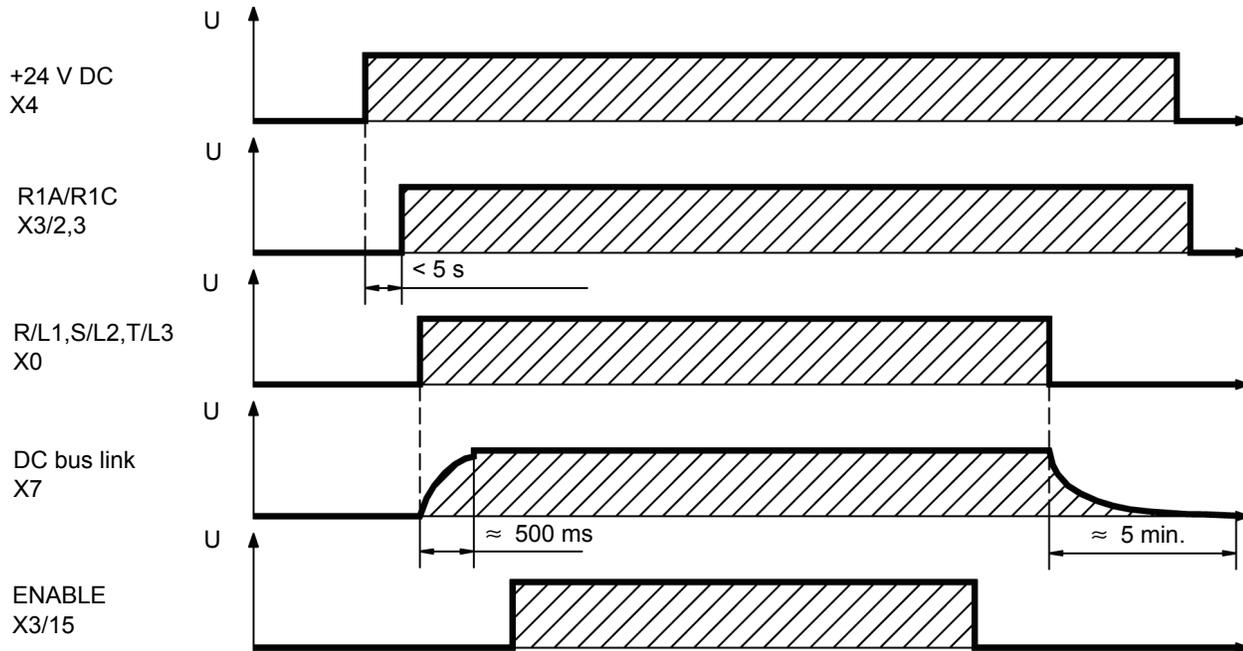
● shield connection to housing.
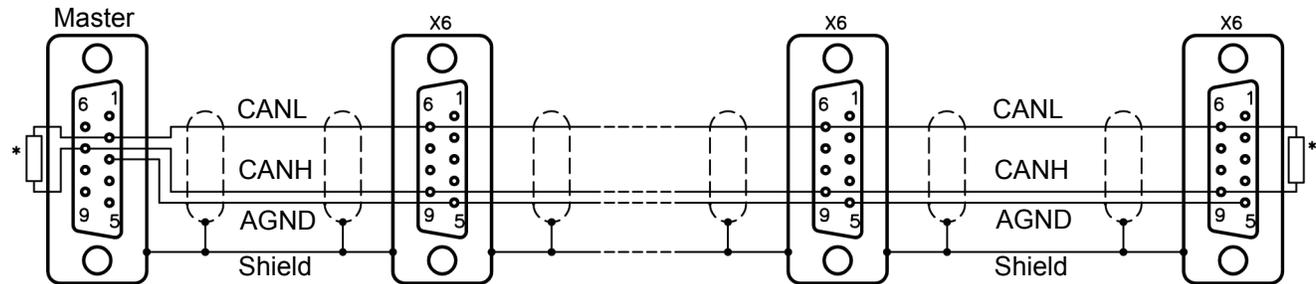
*A terminating impedance (about 120) is required for operation of the communication bus.

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 MP 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 before powering up the servo drive.

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 X3/15 (Enable) and between the 2 analog inputs PWRI-/PWRI+.
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	⚠ **DANGER** **UNINTENDED EQUIPMENT OPERATION** It is VERY important to check the displayed parameters and to correct them if necessary. Please refer to the Lexium 15 MP/HP programming manual. **Failure to follow these instructions will result in death or serious injury.**
		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 MP programming manual).
6	Check Interrupt devices	⚠ **DANGER** **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.**
7	Switch on supply power	Use the ON/OFF button of the contactor controls.
8	Apply 0 V command	Apply 0 V to terminals X3/4-5 (AI1+/AI1-) or X3/6-7 (AI2+/AI2-) respectively.
9	Enable	Apply 24 V DC (500 ms after switching on the supply power) to terminal X3/15 (ENABLE), servo motor stands with standstill torque M0.

10	Setpoint	Apply a small analog setpoint (about 0.5 V is recommended) to terminals X3/4-5 (AI1+/AI1-) or X3/6-7 (AI2+/AI2-) respectively.
		CAUTION **SERVO MOTOR DAMAGE** If the servo motor oscillates, the parameter Kp on the menu page "Speed controller" must be reduced, the servo motor may be permanently damaged! **Failure to follow these instructions can result in equipment damage.**
11	Optimization	Optimize speed, current and position controllers (see the Lexium 15 MP 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 MP 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
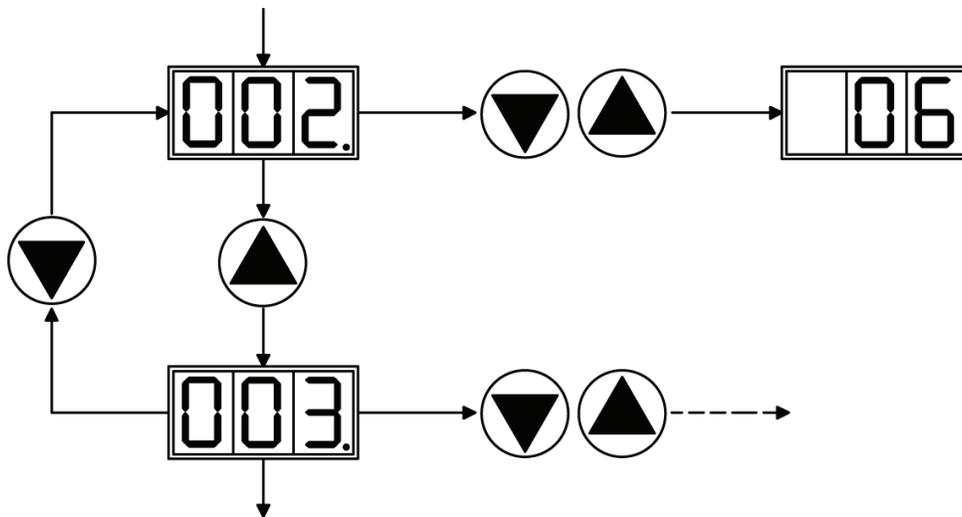
Front panel controls and indicators

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

Switch on 24 V

E — Data are being read from EnDat

5 — Option -AS- is active

A — Reset input active
The reset function is assigned to a digital input where a High signal is connected

1.01 — status 1: 24 V switched on
Unit indicates software version
after 1 s shift to status 2, 3 or 4

06. — status 2: 24 V switched on
Unit indicates current (here 6 A)
flashing dot

P06. — status 3: 24 V switched on, supply power switched on
Unit indicates current and supply power on
flashing dot

E06. — status 4: 24 V and supply power on, unit enabled
Unit indicates current, supply power on an enable
flashing dot

F01 → 1 s → F02. → 1 s → n01. → 1 s → n02. → 1 s — Detected Error/Alert signal : each error/alert that has occured will be indicated successively by 4 blinks each

Parameters

Standard menu

The following diagram describes the standard menu

State

000. to 063. — Station adress
The entry will be automatically stored when you exit the input field.
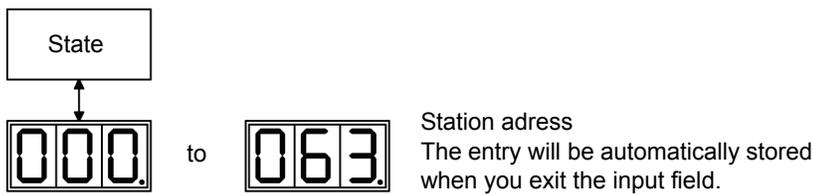
Alert messages

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 warning number.

Number	Designation	Explanation
n01	I²t	I²t 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	a 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 accordiing to speed/current table INXMODE 35
n16	summarized alert	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 temprature too high limit is set by manufacturer to 80 °C
F02*	DC bus 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*	DC bus 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 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	I²t max.	I²t 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 detected error	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	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 troubleshootings.

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 possibles 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 faults

Detected Error	Possible causes	Measures to remove the cause of the detected error
F25 message: **Commutation interruption**	Wrong cable used.	Check cable.
	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.