# 4 - Lexium integrated drives

## ILS1 integrated drives with I/O interface for motion sequence

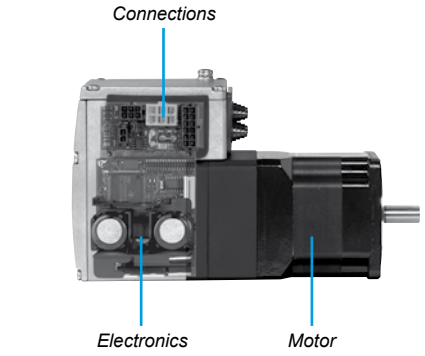


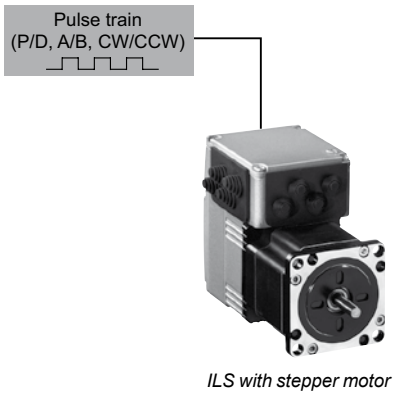
## ILS1 integrated drives with pulse/direction interface



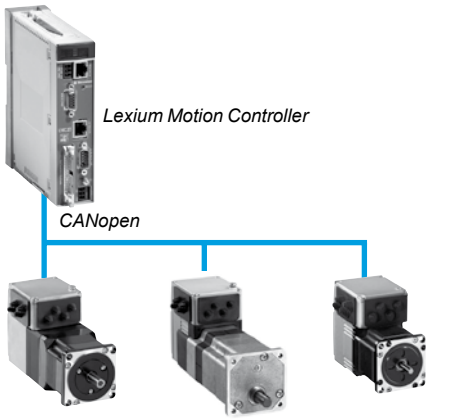
## Options and accessories

# Lexium integrated drives
## Presentation




*ILS with stepper motor*




*ILA with servo motor*

*ILE with brushless DC motor*

*ILS with stepper motor*

### Product offer

Lexium Integrated Drives consist of a motor and control electronics. They are controlled via a fieldbus, pulse/direction or I/O interface (“motion sequence” operating mode). The Lexium Integrated Drives are used as decentralised drives in machine building and automation technology. Together with a motion controller such as Lexium Motion Controller or a PLC, the systems allow for simple and economic implementation of complex automation task. Ready-to-be-used function blocks facilitate motion programming with a Schneider Electric motion controller . The Lexium Integrated Drives from Schneider Electric excel with the following properties:

### Compactness

Motor and electronics form a single, compact and small-footprint unit. No space at all is required for the control electronics in the control cabinet and only very little space in the machine.

### Simplicity

Integration of motor and electronics reduces the installation costs and simplifies the EMC concept. The user-friendly PC commissioning software allows for rapid commissioning.

### Openness

The Lexium Integrated Drives with fieldbus interface are available in two versions:
- for communication via CANopen, PROFIBUS DP, RS 485
- for communication via DeviceNet, EtherCAT, Ethernet Powerlink, Modbus TCP

Lexium Integrated Drives with stepper motors are available with a pulse/direction interface or an I/O interface for motion sequence.

This open communication concept allows for integration into existing system environments.

### Flexibility

The Lexium Integrated Drives can be equipped with various motor types: AC synchronous servo motor, brushless DC motor or stepper motor. Each motor type offers specific advantages so that the Lexium Integrated Drives can be used in a large variety of different applications.

### Safety

The integrated “Safe Torque Off” (“Power Removal”) safety function enables a stop of category 0 or 1 as per IEC/EN 60204-1 without external power contactors. This reduces the system costs and response times. The drive system fulfils the requirements of IEC 61508 SIL2 as well as of ISO 13849-1 perfomance level “d” (PL “d”) and IEC/EN 61800-5-2 (“STO”) .

## Product offer

| ILA● | ILE● | ILS●●57 | ILS●●85 |
|---|---|---|---|
|  |  |  |  |

| **IL●1 with fieldbus interface for CANopen, PROFIBUS DP, RS 485** | | |
|---|---|---|
| **ILA1 with AC synchronous servo motor** | **ILA1●** | |
| **Torque range** | 0.26 ... 0.45 Nm; peak torque: 0.4 ... 0.72 Nm (without gearing) | |
| **Range of speed of rotation** | Without gearing: up to 7500 rpm | |
| **Positioning resolution** | 0.02° (singleturn encoder, optional: multiturn encoder with positioning range of 4096 revolutions) | |
| **Interfaces** | Fieldbus interface: CANopen, PROFIBUS DP, RS 485<br>24 V signal interface with 4 freely programmable I/O signals; interface for “Safe Torque Off” safety function (“Power Removal”) | |
| **Operating modes** | Homing, jog, profile position, profile velocity, electronic gear *(1)* | |
| **Configuration** | Via “Lexium CT” commissioning software or fieldbus | |
| **ILE1 with brushless DC motor** | **ILE1●** | |
| **Torque range** | Without gearing: 0.17 Nm; with spur wheel gear: 3.1 ... 11 Nm | |
| **Range of speed of rotation** | Without gearing: up to 4800 rpm | |
| **Detent torque** | 0.08 Nm (without gearing); 1 ... 8 Nm (with spur wheel gear) | |
| **Positioning resolution** | 0.26° ... 1.67° (with spur wheel gear) | |
| **Interfaces** | Fieldbus interface: CANopen, PROFIBUS DP, RS 485<br>24 V signal interface with 4 freely programmable I/O signals; interface for “Safe Torque Off” safety function (“Power Removal”) | |
| **Operating modes** | Homing, jog, profile position, profile velocity | |
| **Configuration** | Via “Lexium CT” commissioning software or fieldbus | |
| **ILS1 with 3-phase stepper motor** | **ILS1●57** | **ILS1●85** |
| **Torque range** | Without gearing: 0.45 ... 1.5 Nm | Without gearing: 2 ... 6 Nm |
| **Range of speed of rotation** | Without gearing: up to 2000 rpm | Without gearing: up to 1000 rpm |
| **Positioning resolution** | 0.018° | |
| **Interfaces** | Fieldbus interface: CANopen, PROFIBUS DP, RS 485<br>24 V signal interface with 4 freely programmable I/O signals; interface for “Safe Torque Off” safety function (“Power Removal”) | |
| **Operating modes** | Homing, jog, profile position, profile velocity | |
| **Configuration** | Via “Lexium CT” commissioning software or fieldbus | |

*(1) “Electronic gear” operating mode not with ILA1 with multiturn encoder*

**Supply voltage**
Lexium Integrated Drives IL●1 can be operated with a supply voltage of 24 V⎓ or 36 V⎓.

| **IL●2 with fieldbus interface for DeviceNet, EtherCAT, Modbus TCP, Ethernet Powerlink** *(1)* | | |
|---|---|---|
| **ILA2 with AC synchronous servo motor** | **ILA2●** | |
| **Torque range** | 0.31 ... 0.78 Nm; peak torque 0.45 ... 1.62 Nm | |
| **Range of speed of rotation** | Without gearing: up to 7000 rpm | |
| **Positioning resolution** | 0.02° (singleturn encoder, optional: multiturn encoder with positioning range of 4096 revolutions) | |
| **Interfaces** | Fieldbus interface: DeviceNet, EtherCAT, Modbus TCP/IP, Ethernet Powerlink<br>24 V signal interface with 4 freely programmable I/O signals; interface for "Safe Torque Off" safety function ("Power Removal") | |
| **Operating modes** | Profile velocity, jog, profile position, homing, electronic gear *(1)* | |
| **Configuration** | Via "Lexium CT" commissioning software or fieldbus | |
| **ILE2 with brushless DC motor** | **ILE2●** | |
| **Torque range** | Without gearing: 0.26 ... 0.5 Nm; with spur wheel gear: 3.1 ... 11 Nm;<br>with worm gear: 2.5 ... 10.6 Nm | |
| **Range of speed of rotation** | Without gearing: up to 6000 rpm; with spur wheel gear: up to 4800 rpm;<br>with worm gear: up to 4000 rpm | |
| **Detent torque** | Without gearing: 0.08 ... 0.106 Nm; with spur wheel gear: 1.1 ... 8 Nm;<br>with worm gear: 2.9 ... 16.7 Nm | |
| **Positioning resolution** | Without gearing: 30°; with spur wheel gear: 0.26° ... 1.67°;<br>with worm gear: 0.26° ... 1.26° | |
| **Interfaces** | Fieldbus interface: DeviceNet, EtherCAT, Modbus TCP/IP, Ethernet Powerlink<br>24 V signal interface with 4 freely programmable I/O signals; interface for "Safe Torque Off" safety function ("Power Removal") | |
| **Operating modes** | Profile velocity, jog, profile position, homing | |
| **Configuration** | Via "Lexium CT" commissioning software or fieldbus | |
| **ILS2 with 3-phase stepper motor** | **ILS2●57** | **ILS2●85** |
| **Torque range** | Without gearing: 0.45 ... 1.5 Nm | Without gearing: 2 ... 6 Nm |
| **Range of speed of rotation** | Without gearing: up to 2000 rpm | Without gearing: up to 1000 rpm |
| **Positioning resolution** | 0.018° | |
| **Interfaces** | Fieldbus interface: DeviceNet, EtherCAT, Modbus TCP/IP, Ethernet Powerlink<br>24 V signal interface with 4 freely programmable I/O signals; interface for "Safe Torque Off" safety function ("Power Removal") | |
| **Operating modes** | Profile velocity, jog, profile position, homing | |
| **Configuration** | Via "Lexium CT" commissioning software or fieldbus | |

*(1) "Electronic Gear" operating mode not with ILA2 with multiturn encoder*

**Supply voltage**
Lexium Integrated Drives IL●2 can be operated with a supply voltage of 24 V⎓ or 48 V⎓.

| IL●1 with I/O interface for motion sequence | | |
|---|---|---|
| **ILS1 with 3-phase stepper motor** | **ILS1M57** | **ILS1M85** |
| **Torque range** | Without gearing: 0.45 ... 1.5 Nm | Without gearing: 2 ... 6 Nm |
| **Range of speed of rotation** | Without gearing: up to 2000 rpm | Without gearing: up to 1000 rpm |
| **Positioning resolution** | 0.036° | |
| **Interfaces** | Multifunction interface for motion sequence; RS 485 commissioning interface;<br>24 V signal interface; interface for “Safe Torque Off” safety function<br>(“Power Removal”) | |
| **Operating modes** | Motion sequence; jog, profile position, homing | |
| **Configuration** | With “Lexium CT” commissioning software | |

| IL●1 with pulse/direction interface | | |
|---|---|---|
| **ILS1 with 3-phase stepper motor** | **ILS1●57** | **ILS1●85** |
| **Torque range** | Without gearing: 0.45 ... 1.5 Nm | Without gearing: 2 ... 6 Nm |
| **Range of speed of rotation** | Without gearing: up to 2000 rpm | Without gearing: up to 1000 rpm |
| **Positioning resolution** | 0.036° | |
| **Interfaces** | Multifunctional interface for pulse/direction or A/B signals (encoder);<br>service interface;<br>24 V signal interface; interface for “Safe Torque Off” safety function<br>(“Power Removal”) | |
| **Operating modes** | Current reduction, blocking detection, I/O signal assignment | |
| **Configuration** | Via parameter switch: motor phase current, number of steps, phase current reduction, blocking detection, RS 485 terminating resistor, I/O signal assignment | |

**Supply voltage**
Lexium Integrated Drives IL●1 can be operated with a supply voltage of 24 V⎓ or 36 V⎓.

# Lexium integrated drives
## IL●1 for CANopen, PROFIBUS DP, RS 485

*ILA1 with AC synchronous servo motor*



## Presentation

The Lexium integrated drives comprise motor, control electronics and a fieldbus interface:
- CANopen DS301 (IL●1F)
- PROFIBUS DP (IL●1B)
- RS 485 (IL●1R)

The IL●1 product group includes:
- ILA1 with AC synchronous servo motor
- ILE1 with brushless DC motor
- ILS1 with 3-phase stepper motor

**ILA1 – the Integrated Drive System for dynamic processes**
ILA1 has an AC synchronous servo motor. This motor is characterised by high dynamics with the possibility of short-term overcurrent during acceleration.

**ILE1 – the Integrated Drive System for automatic format adjustment**
ILE1 is fitted with a brushless DC motor.
The brushless DC motors have high detent torque at zero current. This makes a holding brake unnecessary in most applications.
In combination with the electronics, ILE1 has the characteristics of an absolute encoder.

**ILS1 – the Lexium integrated drives for short-distance positioning**
With its 3-phase stepper motor, ILS1 offers high torque at low speeds of rotation. ILS1 are ideally suited as drives in velocity mode with excellent constant velocity characteristics and also or for high-resolution positioning. Commissioning the stepper motor drives is simple because it is not necessary to adjust the control loop.

## Special features

**ILA1 with AC synchronous servo motor**
- High dynamics and high peak torque
- High-resolution singleturn encoder with a resolution of 16384 increments/revolution (0.02°)
- Optionally with multiturn encoder with a resolution of 16384 increments/revolution (0.02°) with a positioning range of 4096 revolutions
- Optionally with integrated holding brake
- Planetary gear available as options

**ILE1 with brushless DC motor**
- High detent torque
- Quasi-absolute encoder, therefore, no homing required after switching off and on
- Optionally available with spur wheel gear or worm gear; planetary gear available as options

**ILS1 with 3-phase stepper motor**
- High continuous stall torque
- Good constant velocity characteristics
- High positioning resolution (0.018°)
- Optionally with holding brake ( ILS1●85 only)
- Planetary gear available as options

## Electronics

The electronic system comprises control electronics and power amplifier. They have a common power supply. The Lexium integrated drives can be parameterised and controlled via the fieldbus interface.
Four different 24 V signals are also available. They can be used as input or output.

**Supply voltage**
IL●1 can be operated with a voltage range of 24 V to 36 V.

## Connection technologies

IL●1 have the following connections:
- Supply voltage 24 ... 36 V⎓
- Fieldbus interface: CANopen DS301, PROFIBUS DP or RS 485
- 24 V signal interface for four inputs/outputs
- Signal interface for “Safe Torque Off” safety function (“Power Removal”)

### Fieldbus interface

The following fieldbuses can be connected to the fieldbus interface depending on the device version:
- CANopen (DS301 protocol)
- PROFIBUS DP-V0 (data format as per Profidrive V2.0 PPO Type 2)
- RS 485 (manufacturer-specific protocol)

The fieldbus interface is used to parameterise and control the Integrated Drive System.
In addition, the Integrated Drive System can be commissioned with a PC connected to the fieldbus interface and the PC commissioning software. This requires a compatible fieldbus converter, such as USB-CANopen, USB-RS 485, RS 232-RS 485 or USB-Profibus (see accessories).

### 24 V signal interface

Four 24 V signals are available, which can be used either as an input or an output. The 24 V signals are available to the master controller via the fieldbus. They can also be used for predefined functions, such as for connection of limit switches and reference switches.
The 24 V power supply to the outputs is internal via the supply voltage of the Integrated Drive System.

### Signal interface for “Safe Torque Off” safety function (“Power Removal”)

The integrated “Safe Torque Off” safety function (“Power Removal”) enables a stop of category 0 or 1 as per IEC/EN 60204-1 without external power contactors. The supply voltage does not have to be interrupted. This reduces the system costs and response times.
The “Safe Torque Off” safety function (“Power Removal”) is activated via two redundant 24 V input signals (low active).

*Integrated drive system with printed circuit board connectors*

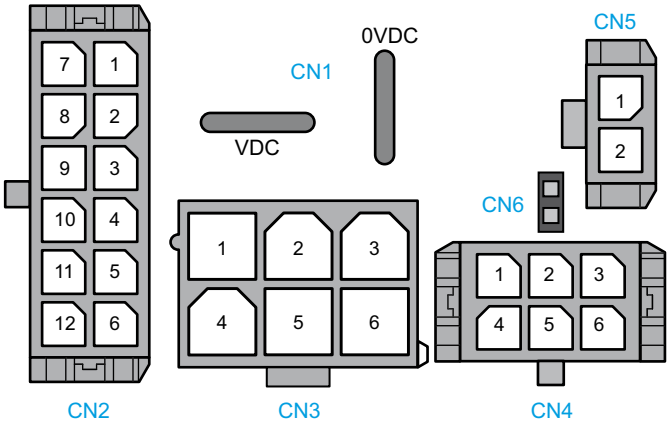
## Connection technologies (continued)

### Printed circuit board connector

Printed circuit board plug connectors are preferably used for cabling series machines with cable harnesses.

- Fieldbus and I/O signal connection with connector “Molex Micro Fit"
- Power supply connection with “AMP Positive Lock” crimp contacts

Two cable entries are required for cabling the Lexium integrated drives (see accessories, page 4/107).




*Printed circuit board connector, overview of connections*

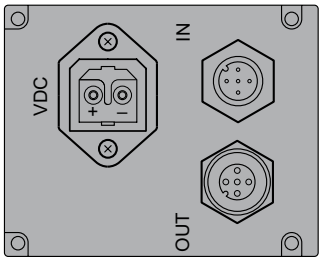
| Connection | Assignment |
|---|---|
| CN1 | Supply voltage ⎓ V |
| CN2 | For all IL●1: fieldbus interface for PROFIBUS DP<br>For ILA1●57 only: interface for PROFIBUS DP and “Electronic Gear” operating mode (reference signal) |
| CN3 | Fieldbus interface for CANopen DS301 or RS 485 |
| CN4 | 24 V signal interface |
| CN5 | Interface for “Safe Torque Off” safety function (“Power Removal”) |
| CN6 | Jumper for disabling “Safe Torque Off” safety function (“Power Removal”) |

*Integrated drive system with industrial connectors*

### Industrial connectors (optional)

Lexium integrated drives with industrial connectors are preferably used in special machines and small series.

The device version with industrial connectors has a connector housing cover with two M12 circular connectors for the fieldbus connection and a Hirschmann STASEI 200 connector for connection of the power supply.



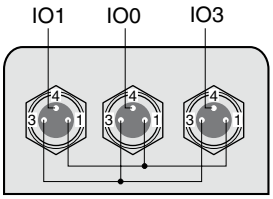

*Industrial connector, overview of connections*

## Connection technologies (continued)

### I/O signal inserts

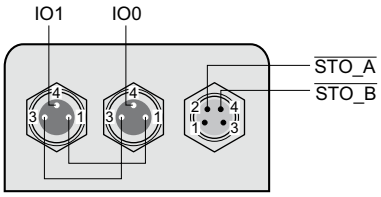
One or two I/O signal inserts with industrial connectors can be ordered for connection of the I/O signals (see accessories, pages 4/109 and 4/110).
The 24 V power supply to the outputs is internal. Different I/O signal inserts are available for this purpose.

#### I/O signal insert without “Safe Torque Off” safety function (“Power Removal”)

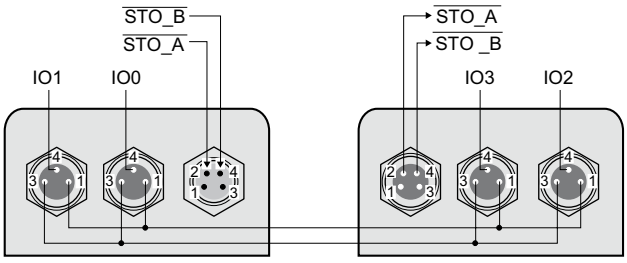



*Inserts for three I/O signals*

#### I/O signal inserts with “Safe Torque Off” safety function (“Power Removal”)

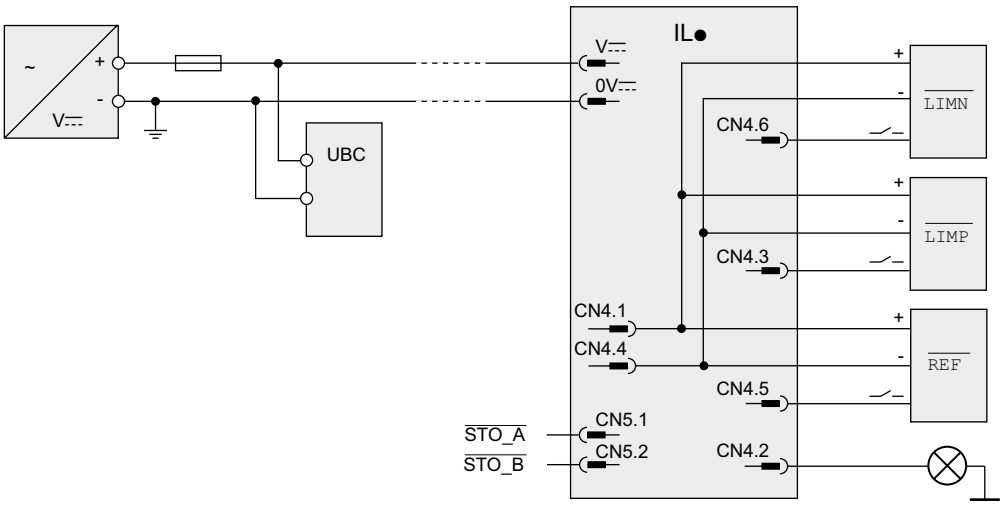



*Insert for two I/O signals and STO signals for safety function*




*Inserts for four I/O signals and STO signals for safety function*

#### Connection example I/O signal




*Connection example with four I/O signals*

# Lexium integrated drives
IL●1 for CANopen, PROFIBUS DP, RS 485

## Configuration via parameter switches

The following settings can be made at the Integrated Drive System via parameter switches:

- ■ PROFIBUS DP
  - □ Setting fieldbus address
  - □ Activating terminating resistor
- ■ CANopen DS301 and RS 485
  - □ Setting fieldbus address
  - □ Setting baud rate
  - □ Activating terminating resistor
  - □ Setting pulse input for “electronic gear” operating mode (pulse/direction or A/B signals), only with ILA1●57 with singleturn encoder

## Operating modes

### Overview

The following operating modes can be set via the fieldbus:

- ■ Electronic gear (only ILA1●57 with singleturn encoder)
- ■ Profile velocity
- ■ Jog
- ■ Profile position
- ■ Homing

### Electronic gear (only ILA1●57 with singleturn encoder)

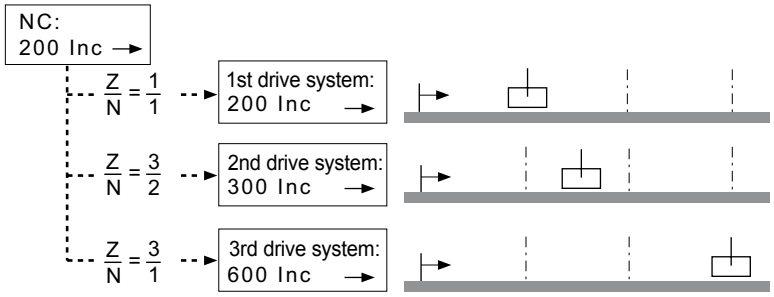
In “Electronic Gear” operating mode with singleturn encoder, the reference signals are supplied from an encoder (A/B signals) or a controller (pulse/direction signals) and a new position reference value is calculated using an adjustable gear ratio.

**Reference value setting**

The reference values are supplied as pulse/direction or A/B encoder signals (adjustable via parameter switch). In the case of ILA1●57 with PROFIBUS DP, only pulse/direction signals can be used as reference values.

**Application example**

Synchronisation of motion sequences, e.g. cutting material on a conveyor belt.



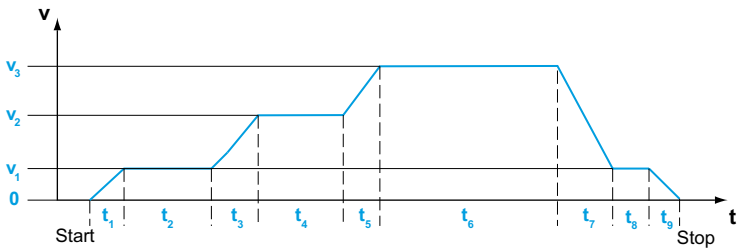

*"Electronic Gear" operating mode*

## Profile velocity

In operating mode “Profile velocity", a reference speed for the motor is set and a movement without a target position is started. This speed is maintained until a different reference speed is specified or the operating mode is changed.

**Reference value setting**
The reference value is set via fieldbus or PC.

**Application example**
Application of paint in CD manufacture




*Profile velocity*

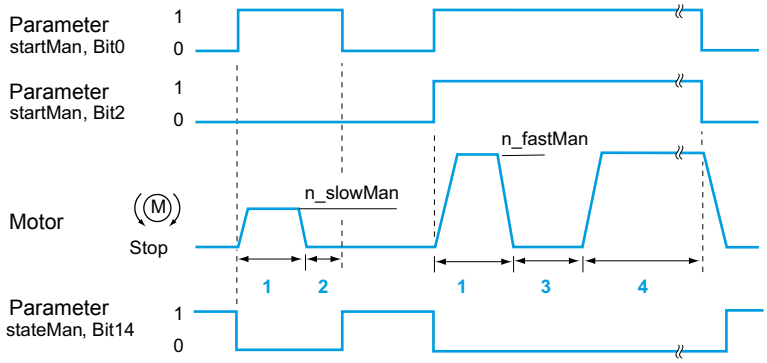
$t_1$, $t_3$, $t_5$ = acceleration
$t_2$, $t_4$, $t_6$, $t_8$ = constant movement
$t_7$, $t_9$ = braking

## Jog mode

The motor moves by one distance unit or at constant speed in continuous operation. The value of the distance unit, the speed levels and the change-over time in continuous operation can be adjusted manually.

**Reference value setting**
The reference value is set via fieldbus or PC.

**Application example**
Setting up a machine during commissioning




*Jog, slow and fast*

1 step_Man
2 t < time_Man
3 time_Man
4 Continuous operation

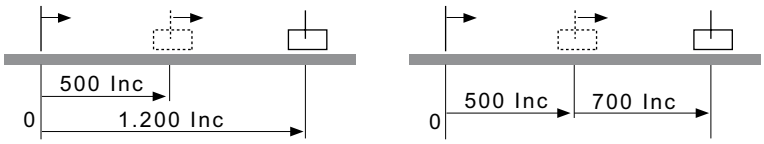
## Profile position

In the operating mode “Profile Position", the motor is positioned from a point A to a point B with a positioning command.

**Settings**
The positioning path can be specified in two ways:
- Absolute positioning, reference point is the zero point of the axis
- Relative positioning, reference point is the current position of the motor

**Reference value setting**
The reference value is set via fieldbus or PC.

**Application example**
Pick-and-place with a linear robot




*Operating mode “Profile Position", absolute and relative*

## Homing

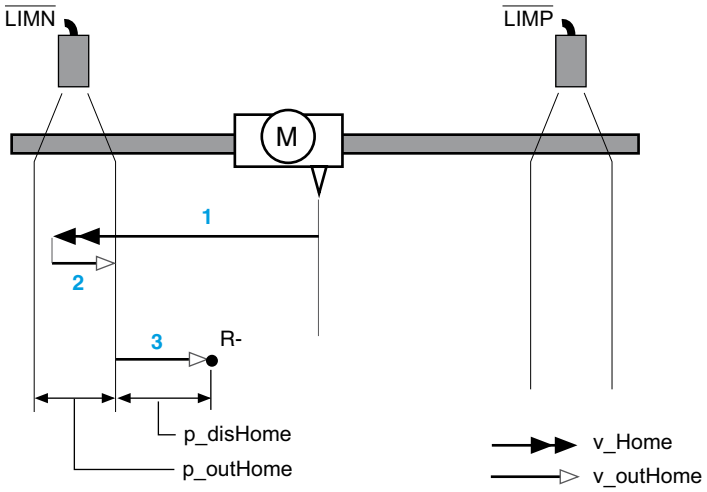
There are two types of the “Homing” operating mode:
- Reference movement
  Specifying the dimension reference by approach to a limit or reference switch
- Position setting
  Specifying the position reference relative to the current motor position

***Note:** In the case of ILA1 with multiturn encoder, a valid actual motor position is available immediately after starting. Therefore, homing to external limit switches is not required.*

**Reference movement**
During reference movement, the motor moves to a defined position on the axis. The position is defined by a mechanical switch:
- LIMP, LIMN limit switches
- REF reference switch

**Types of reference movements**
There are six standard reference movements:
- Movement to negative limit switch LIMN
- Movement to positive limit switch LIMP
- Movement to REF reference switch with first movement counterclockwise
- Movement to REF reference switch with first movement clockwise
- Reference movement to index pulse with clockwise or counterclockwise rotation (not with ILE1)
- Reference movement to block = mechanical stop (ILE1 only)

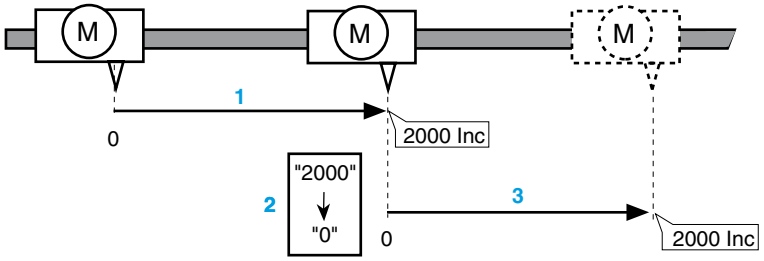
**Example 1: reference movement to limit switch**




*Operating mode "Homing", reference movement to limit switch*

1 Movement to limit switch at search speed
2 Movement to switching edge at clearance speed
3 Movement to distance from switching edge at clearance speed

**Example 2: position setting**
Position setting can be used to execute a continuous motor movement without overtravelling the positioning limits.




*Positioning by 4000 increments with position setting*

1 The motor is positioned 2000 increments.
2 The current motor position is set to position value 0 by position setting to 0 and the new zero point is defined at the same time.
3 The new target position is 2000 increments after triggering a new travel command by 2000 increments.

This procedure prevents overtravel of the absolute position limits during positioning, because the zero point is continuously made to follow.

**Reference value setting**
The reference value is set via fieldbus or PC.

**Application example**
Setting a reference before switching to "Profile Position" mode

**Additional operating modes**

Additional operating modes can be activated via fieldbus or PC:
- Reversing direction of rotation of motor
- Programming inputs/outputs.
- Setting motion profile via profile generator
- Triggering "Quick Stop" function
- Fast position capture via signal input (Capture)

## "Safe Torque Off" ("Power Removal") safety function

The Lexium integrated drive integrates the "Safe Torque Off" ("Power Removal") safety function which prevents unintended restarting of the motor. The motor no longer produces any torque if the safety function is active.

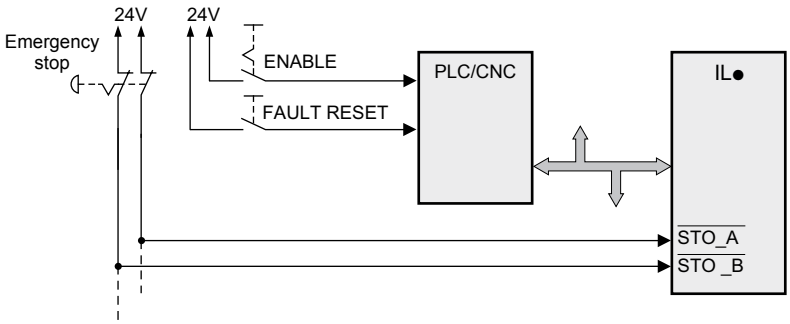
This safety function:
- Complies with the machine safety standard ISO 13849-1, perfomance level "d" (PL d) .
- Complies with the standard for functional safety IEC/EN 61508, SIL2 capability (safety control-signalling applied to processes and systems). The SIL (Safety Integrity Level) capability depends on the connection diagram for the servo drive and for the safety function. Failure to observe the setup recommendations could inhibit the SIL capability of the "Safe Torque Off" ("Power Removal") safety function.
- Complies with product standard IEC/EN 61800-5-2 "Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional" for both stop functions:
  - Safe Torque Off ("STO") corresponds to Category 0 stop according to IEC/EN 60204-1. Standstill by immediate power shutdown to the machine drive elements (i.e. an uncontrolled stop).
  - Safe Stop 1 ("SS1") corresponds to Category 1 stop according to IEC/EN 60204-1. A controlled stop in which the machine drive elements are retained to effect the standstill. The final shutdown is ensured by an external Emergency stop module with safe time delay, e.g. Preventa XPS-AV *(1)*.

The "Safe Torque Off" ("Power Removal") safety function has a redundant electronic architecture *(2)* which is monitored continuously by a diagnostics function.

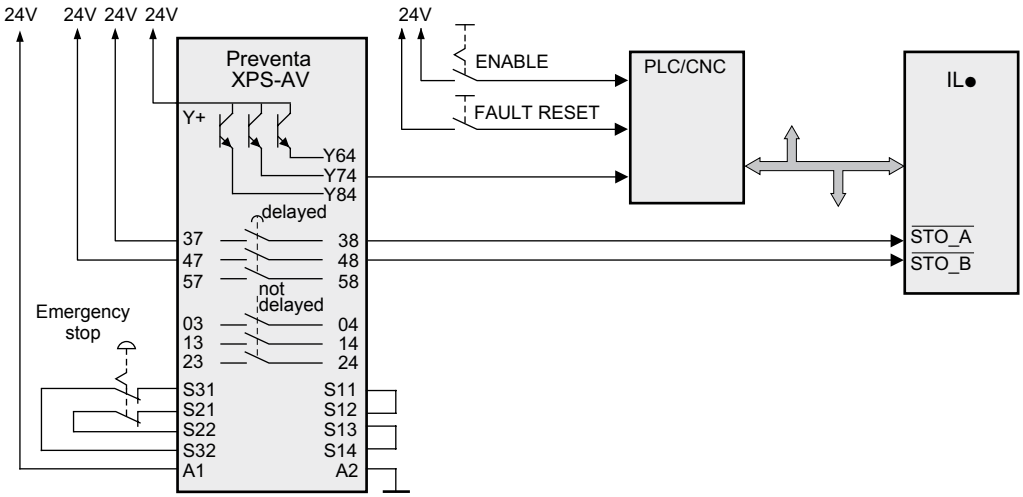
This PL d and SIL2 safety function is certified as conforming to these standards by the TÜV certification body in the context of a voluntary certification.

*(1) Please refer to the "Safety functions and solutions using Preventa" catalogue.*
*(2) Redundant: Consists of mitigating the effects of the failure of one component by means of the correct operation of another, assuming that faults do not occur simultaneously on both.*

**Examples of applications of the safety function**




*Example of Category 0 Stop*

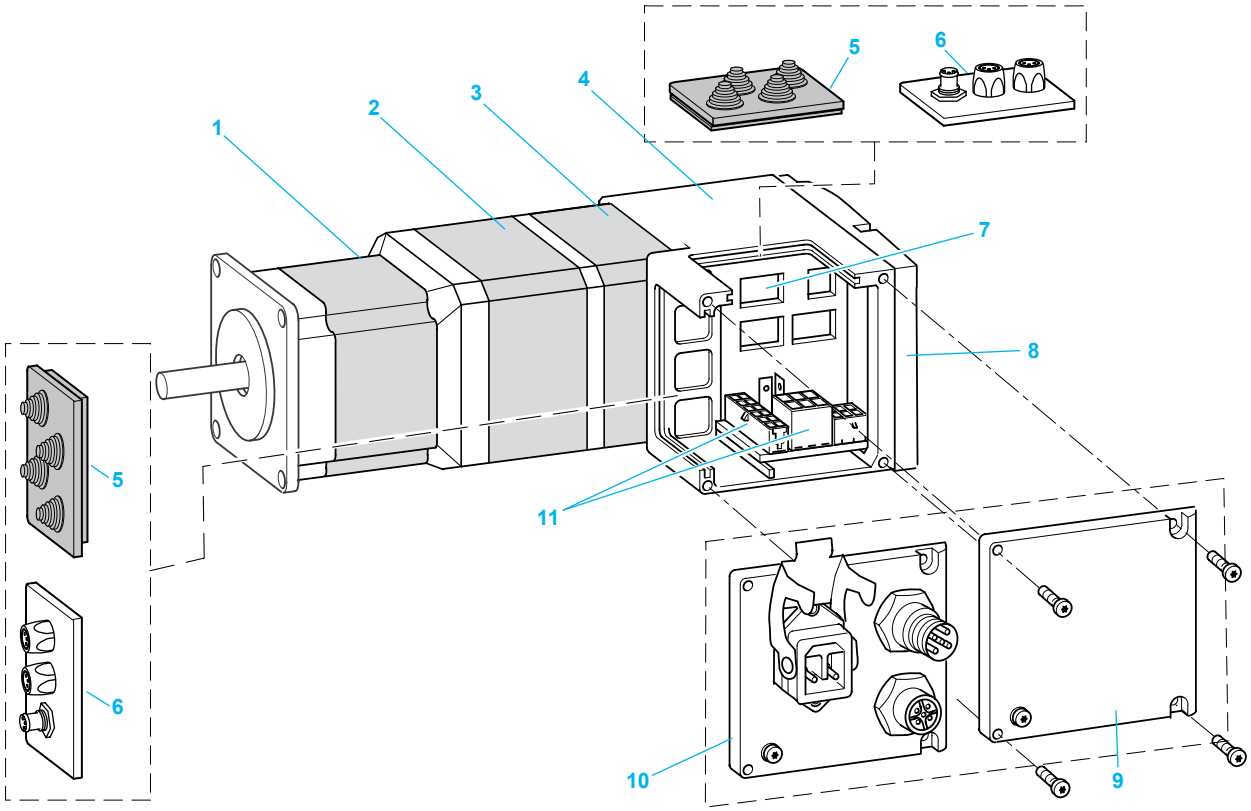



*Example of Category 1 Stop*

# Lexium integrated drives
IL●1 for CANopen, PROFIBUS DP, RS 485
ILA1 with AC synchronous servo motor

## Description

ILA1 comprise control electronics with a fieldbus interface for CANopen DS301, PROFIBUS DP or RS 485 and an AC synchronous servo motor. ILA1 is optionally available with printed circuit board connectors or industrial connectors. A multiturn encoder is optionally available for ILA1. A holding brake is optionally available for the ILA1 with a singleturn encoder.




1 Synchronous AC servo motor
2 Holding brake (optional)
3 Singleturn or multiturn encoder (optional)
4 Electronics housing
5 Insert cable entry (accessory)
6 I/O insert with industrial connectors (accessory)
7 Settings via parameter switches
8 Cover for electronics housing
9 Cover for Lexium integrated drives with option “PCB connector"
10 Cover for supply voltage ⎓ V and fieldbus connection for Lexium integrated drives with option “industrial connector”
11 Electrical interfaces

# Lexium integrated drives
IL●1 for CANopen, PROFIBUS DP, RS 485
ILA1 with AC synchronous servo motor

## Certifications

| | | | |
|---|---|---|---|
| **Conformity to standards** | | | Lexium integrated drives have been developed to comply with the stringent international standards and with the recommendations for adjustable speed power drive systems, specifically: IEC/EN 61800-3 (noise immunity to conducted and radiated high-frequency signals) and IEC/EN 50178 (resistance of devices to vibration). |
| | EMC immunity | | EN 61800-3:2001, second environment |
| | Conducted and radiated EMC emissions | | EN 61800-3:2001-02; IEC 61800-3, Ed.2<br>■ Power supplies without external mains filter:<br>□ C3 up to 10 m supply cable length<br>■ Power supplies with external mains filter:<br>□ C2 up to 20 m supply cable length<br>□ C3 up to 50 m supply cable length |
| **CE marking** | | | The Lexium integrated drives are CE marked in accordance with the European Machinery Directive (98/37/EEC) and the European EMC Directive (2004/108/EEC). |
| **Product certifications** | | | UL (USA), cUL (Canada) |
| | | | TÜV certification: Lexium integrated drives are TÜV-certified for device safety and medical devices. The certification includes:<br>■ Functional safety of electrical/electronic/programmable safety-related electronic systems (IEC 61508:2000; SIL 2)<br>■ Safety of machinery – functional safety of safety-related electrical and electronic and programmable electronic control systems (IEC 62061:2005; SILcl2)<br>■ Safety of machinery – safety-related parts of control systems – Part 1: General principles for design (ISO 13849-1:2006; PL d (Category 3)) |

## Ambient conditions

| | | | |
|---|---|---|---|
| **Ambient temperature** *(1)* | | **°C** | 0 ... 65; power reduction by 2%/°C at 50 ... 65 |
| **Max. permissible temperature of the power amplifier** | | **°C** | 105 |
| **Max. permissible temperature of the motor** *(2)* | | **°C** | 110 |
| **Transport and storage temperature** | | **°C** | -25 ... +70 |
| **Installation height without power reduction** | | **m** | < 1000 m above mean sea level |
| **Relative humidity** | | **%** | 15 ... 85 (not condensing) |
| **Vibration load during operation as per IEC/EN 60068-2-6** | Number of cycles | | 10 |
| | Acceleration amplitude: | **m/s²** | 20 |
| | Frequency range | **Hz** | 10 ... 500 |
| **Continuous shocks as per IEC/EN 60068-2-29** | Number of shocks | | 1000 |
| | Peak acceleration | **m/s²** | 150 |
| **Shaft wobble and perpendicularity** | | | According to EN 50347 (IEC 60072-1) |
| **Degree of protection as per DIN EN 60034-5** | | | Total except shaft bushing IP54, shaft bushing IP41 |

## Electrical data

| | | | | |
|---|---|---|---|---|
| **Supply voltage (CN1)** | | | Corresponds to PELV according to DIN 19240, not protected against reverse polarity | |
| **Supply voltage range (absolute limit values)** | | ⎓ **V** | 18 ... 40 | |
| **Nominal supply voltage** | | ⎓ **V** | 24 ... 36 | |
| **Ripple at nominal voltage** | | $V_{PP}$ | ≤ 3.6 | |
| | | | **ILA1●571** | **ILA1●572** |
| **Max. continuous current consumption** | ■ Winding type T | **A** | 7.5 | 7.5 |
| | ■ Winding type P | **A** | 5 | 7 |
| **Peak current consumption** | ■ Winding type T | **A** | 11 | 9 |
| | ■ Winding type P | **A** | 7 | 8.5 |
| **Inrush current** | | | Inrush current time-dependent by current incline function and depending on device capacitance C = 1500 µF and resistance of connectivity | |
| **External fuse** | | **A** | 10 | |
| **Fieldbus interfaces (CN2 and CN3)** | | | | |
| **CANopen** | Signal inputs/outputs | | According to ISO 11898 standard, no galvanic isolation | |
| | Transmission rate | **kBaud** | 50 / 100 / 125 / 250 / 500 / 800 / 1000 | |
| | Transmission protocol | | CANopen as per DS301 | |
| **PROFIBUS DP** | Signal inputs/outputs | | According to RS 485, galvanic isolation, 2-wire | |
| | Transmission rate | **kBaud** | 9.6 / 19.2 / 45.45 / 93.75 / 187.5 / 500 / 1500 / 3000 / 6000 / 12000 | |
| | Transmission protocol | | PROFIBUS DP-V0 (data format as per Profidrive V2.0 PPO Type 2) | |
| **RS 485** | Signal inputs/outputs | | According to RS 485, no galvanic isolation, 2-wire | |
| | Transmission rate | **kBaud** | 9.6 / 19.2 / 38.4 | |
| | Transmission protocol | | Manufacturer-specific | |

*(1) Limit values with flanged motor mounted on a steel plate 300 x 300 x 10 mm*
*(2) Measured at the surface*

| | | | |
|---|---|---|---|
| **Electrical data** | | | |
| **24 V signal interface (CN4)** | | | 4 signals, can each be used as input or output |
| **24 V signal inputs** | | | Galvanically connected to 0VDC, protected against reverse polarity |
| **Logic 0 ($U_{low}$)** | | **V** | -3 ... +4.5 |
| **Logic 1 ($U_{high}$)** | | **V** | +15 ... +30 |
| **Input current (typical at 24 V)** | | **mA** | 2 |
| **Debounce time** | IO0 and IO1 | **ms** | 0.1 |
| | IO2 and IO3 | **ms** | 0.01 |
| **24 V signal outputs** | | | Switching to plus, short-circuit protected, suitable for inductive load (1000 mH / 100 mA) |
| **Supply voltage range** | | ⎓ **V** | 23 ... 25 |
| **Max. switching current (total)** | | **mA** | 200 |
| **Max. switching current per output** | | **mA** | 100 |
| | | | The internal power supply unit is protected against:<br>■ Short circuit of the output voltage<br>■ Overload of output voltage (limited to 6 W output power) |
| **Interface for safety function "Safe Torque Off" ("Power Removal") (CN5)** | | | No galvanic isolation; corresponds to RS 485 standard |
| **Logic 0 ($U_{low}$)** | | **V** | -3 ... +4.5 |
| **Logic 1 ($U_{high}$)** | | **V** | +15 ... +30 |
| **Input current (typical at 24 V)** | $\overline{STO\_A}$ | **mA** | ≤ 10 |
| | $\overline{STO\_B}$ | **mA** | ≤ 3 |
| **Debounce time** | | **ms** | 1 |
| **Response time (until shutdown of power amplifier)** | | **ms** | < 50 |
| **Max. time offset until detection of signal differences between $\overline{STO\_A}$ and $\overline{STO\_B}$** | | **S** | < 1 |
| **Safety function "Safe Torque Off" ("Power Removal")** | | | |
| **Protection** | Of machine | | "Safe Torque Off" safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard ISO 13849-1, performance level "d" (PL d) , and standard IEC/EN 61800-5-2 |
| | Of the system process | | "Safe Torque Off" safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard IEC/EN 61508 level SIL2 and standard IEC/EN 61800-5-2 |

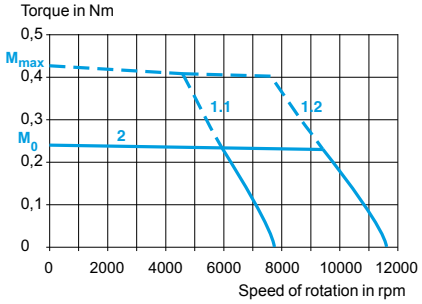
## Mechanical data

| Type of integrated drive | | | ILA1●571 | | | | ILA1●572 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Winding type** | | | T | | P | | T | | P | |
| **Nominal supply voltage** | | ⎓ V | 24 | 36 | 24 | 36 | 24 | 36 | 24 | 36 |
| **Nominal speed of rotation** | | rpm | 5100 | 7500 | 3200 | 5500 | 3100 | 5000 | 2600 | 4300 |
| **Max. torque** *(1)* | $M_{max}$ | Nm | 0.43 | | 0.6 | | 0.61 | | 0.72 | |
| **Continuous torque** *(2)* | $M_0$ | Nm | 0.26 | | 0.26 | | 0.41 | | 0.45 | |
| **Positioning resolution per revolution** | | Inc. | 16384 | | | | 16384 | | | |
| **Accuracy of positioning sensor** | | ° | ±0.05 | | | | ±0.05 | | | |
| **Rotor inertia** | | kg·cm² | 0.1 | | | | 0.18 | | | |
| **Mass** | | kg | 1.4 | | | | 1.7 | | | |
| **Shaft load** | Max. radial force *(3)* | N | 89 | | | | 107 | | | |
| | Max. axial tensile force | N | 104 | | | | 104 | | | |
| | Max. axial force pressure | N | 104 | | | | 104 | | | |
| | Nominal bearing service life *(4)* | h | 20000 | | | | 20000 | | | |
| **Holding brake (optional)** *(5)* | | | | | | | | | | |
| **Holding torque** | | Nm | 1.2 | | | | | | | |
| **Electrical pull-in power** | | W | 10 | | | | | | | |
| **Brake release time** | | ms | 14 | | | | | | | |
| **Brake application time** | | ms | 13 | | | | | | | |
| **Moment of inertia** | | kg·cm² | 0.07 | | | | | | | |
| **Multiturn encoder (optional)** *(5)* | | | | | | | | | | |
| **Measuring range absolute** | | rpm | 4096 | | | | | | | |
| **Positioning resolution per revolution** | | Inc. | 16384 | | | | | | | |
| **Accuracy of positioning sensor** | | ° | ±0.05 | | | | | | | |

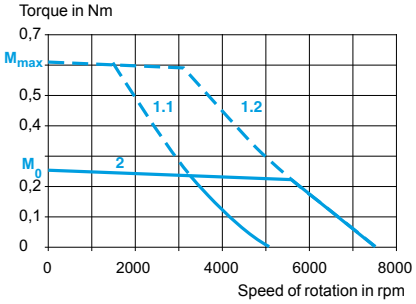
*(1) Max. 2.5 s*
*(2) At 20 rpm; at 0 rpm the continuous torque is reduced to 89% of the specified value*
*(3) Point of application of radial force: 10 mm distance to flange*
*(4) Operating hours at a probability of failure of 10%; conditions for shaft load: speed 4000 rpm, 100% duty cycle at continuous torque, ambient temperature 40 °C*
*(5) Holding brake and multiturn encoder cannot be used in combination.*

## Torque characteristics

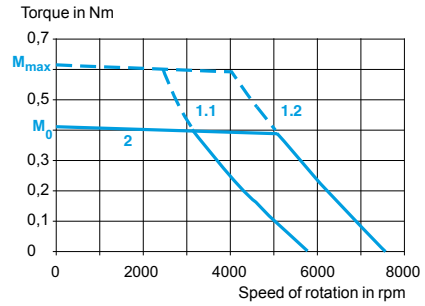
**ILA1●571T (winding type T)**



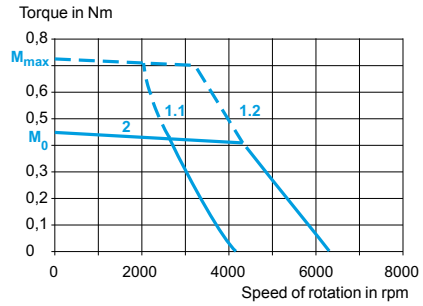

**ILA1●571P (winding type P)**




**ILA1●572T (winding type T)**




**ILA1●572P (winding type P)**




1.1 Max. torque at 24 V
1.2 Max. torque at 36 V
2 Continuous torque

# Lexium integrated drives

## IL●1 for CANopen, PROFIBUS DP, RS 485

### ILA1 with AC synchronous servo motor

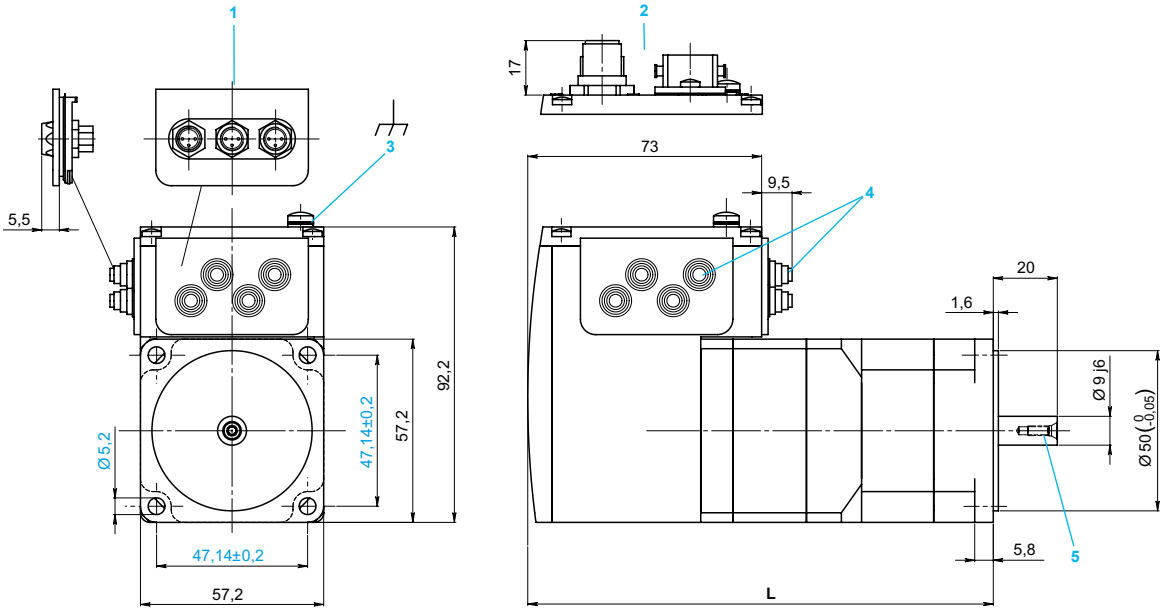
## References

| Example: | I | L | A | 1 | B | 5 | 7 | 1 | P | B | 1 | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Motor type**<br>**A** = AC synchronous servo motor | I | L | **A** | 1 | B | 5 | 7 | 1 | P | B | 1 | A |
| **Supply voltage**<br>**1** = 24 ... 36 V | I | L | A | **1** | B | 5 | 7 | 1 | P | B | 1 | A |
| **Communication interface**<br>**B** = PROFIBUS DP<br>**F** = CANopen DS301<br>**R** = RS 485 | I | L | A | 1 | **B** | 5 | 7 | 1 | P | B | 1 | A |
| **Flange size**<br>**57** = 57 mm | I | L | A | 1 | B | **5** | **7** | 1 | P | B | 1 | A |
| **Motor length ("L")** *(1)*<br>**1** = motor length ("L")<br>**2** = motor length ("L") | I | L | A | 1 | B | 5 | 7 | **1** | P | B | 1 | A |
| **Winding type**<br>**P** = medium speed of rotation, medium torque<br>**T** = high speed of rotation, medium torque | I | L | A | 1 | B | 5 | 7 | 1 | **P** | B | 1 | A |
| **Connection technology**<br>**B** = printed circuit board connector<br>**C** = industrial connector | I | L | A | 1 | B | 5 | 7 | 1 | P | **B** | 1 | A |
| **Measurement system**<br>**1** = singleturn encoder<br>**2** = multiturn encoder *(2)* | I | L | A | 1 | B | 5 | 7 | 1 | P | B | **1** | A |
| **Holding brake**<br>**A** = no holding brake<br>**F** = with holding brake *(2)* | I | L | A | 1 | B | 5 | 7 | 1 | P | B | 1 | **A** |

*(1) The motor length "L" depends on the mechanical characteristics, see pages 4/19 and 4/21.*
*(2) Holding brake and multiturn encoder cannot be used in combination.*

# Lexium integrated drives
IL●1 for CANopen, PROFIBUS DP, RS 485
ILA1 with AC synchronous servo motor

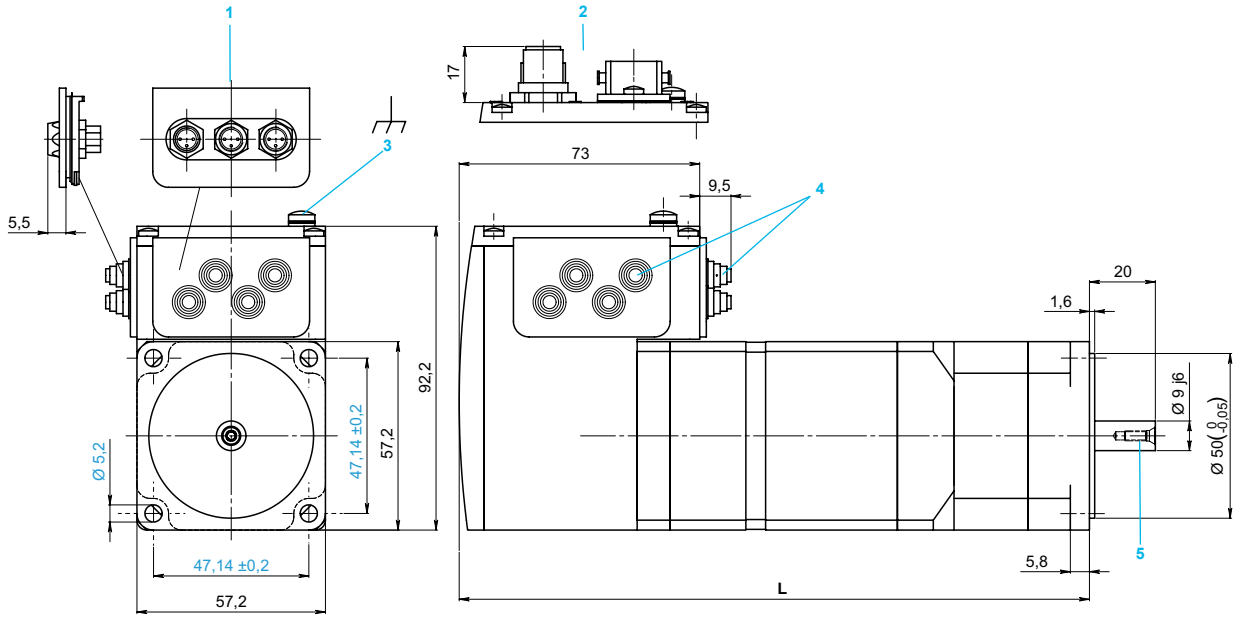
## ILA1 integrated drives without holding brake




| | L (without multiturn encoder) | L (with multiturn encoder) |
|---|---|---|
| **ILA1●571** | 145.3 | 189.3 |
| **ILA1●572** | 163.8 | 207.8 |

1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm
5 Centring hole DIN 332 - DS M3

## ILA1 integrated drives with holding brake




| | L |
|---|---|
| **ILA1●571** | 190.8 |
| **ILA1●572** | 209.3 |

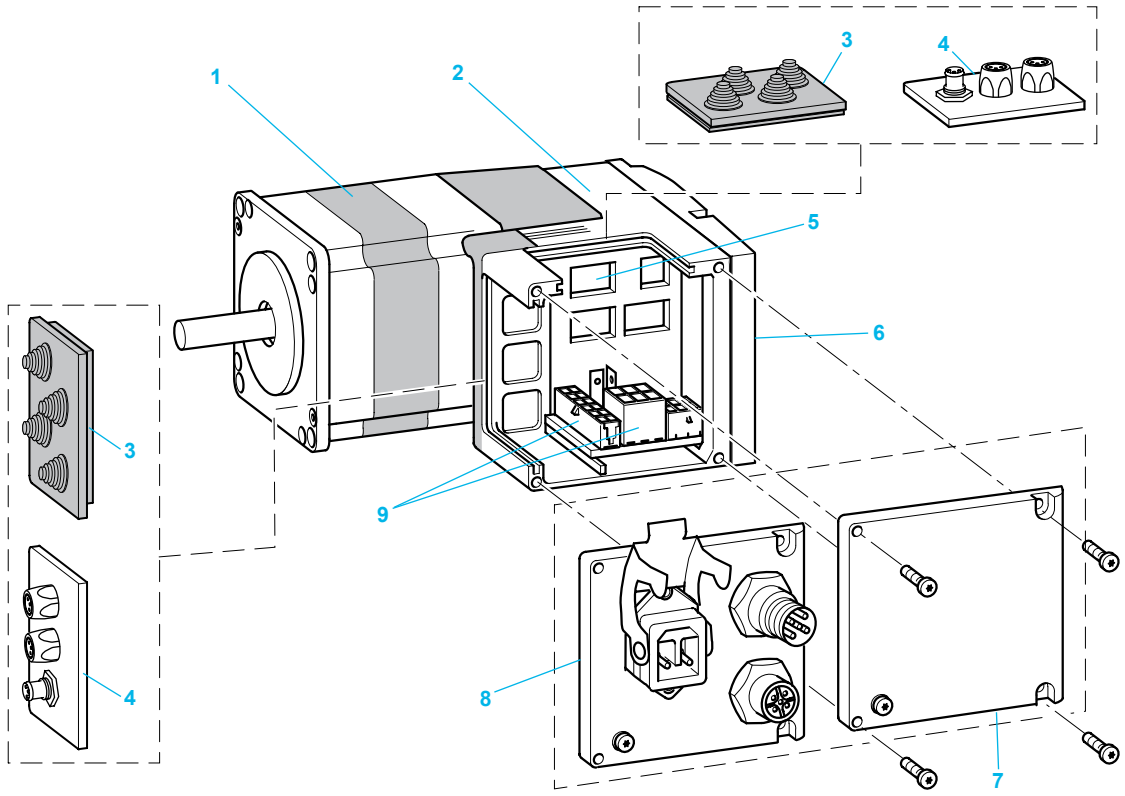
1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm
5 Centring hole DIN 332 - DS M3

# Lexium integrated drives
## IL●1 for CANopen, PROFIBUS DP, RS 485
## ILE1 with brushless DC motor



### Description

ILE1 comprise control electronics with a fieldbus interface for CANopen DS301, PROFIBUS DP or RS 485 and a brushless DC motor. ILE1 is optionally available with straight teeth gear or worm gear and printed circuit board connectors or industrial connectors.




1 Brushless DC motor
2 Electronics housing
3 Insert cable entry (accessory)
4 I/O insert with industrial connectors (accessory)
5 Settings via parameter switches
6 Cover for electronics housing
7 Cover for Lexium integrated drives with option “PCB connector"
8 Cover for supply voltage ⎓ V and fieldbus connection for Lexium integrated drives with option “industrial connector”
9 Electrical interfaces

# Lexium integrated drives
IL●1 for CANopen, PROFIBUS DP, RS 485
ILE1 with brushless DC motor

## Certifications

| | | | |
|---|---|---|---|
| **Conformity to standards** | | | Lexium integrated drives have been developed to comply with the stringent international standards and with the recommendations for adjustable speed power drive systems, specifically: IEC/EN 61800-3 (noise immunity to conducted and radiated high-frequency signals) and IEC/EN 50178 (resistance of devices to vibration). |
| | EMC immunity | | EN 61800-3:2001, second environment |
| | Conducted and radiated EMC emissions | | EN 61800-3:2001-02; IEC 61800-3, Ed.2<br>■ Power supplies without external mains filter:<br>□ C3 up to 10 m supply cable length<br>■ Power supplies with external mains filter:<br>□ C2 up to 20 m supply cable length<br>□ C3 up to 50 m supply cable length |
| **CE marking** | | | The Lexium integrated drives are CE marked in accordance with the European Machinery Directive (98/37/EEC) and the European EMC Directive (2004/108/EEC). |
| **Product certifications** | | | UL (USA), cUL (Canada) |
| | | | TÜV certification: Lexium integrated drives are TÜV-certified for device safety and medical devices. The certification includes:<br>■ Functional safety of electrical/electronic/programmable safety-related electronic systems (IEC 61508:2000; SIL 2)<br>■ Safety of machinery – functional safety of safety-related electrical and electronic and programmable electronic control systems (IEC 62061:2005; SILcl2)<br>■ Safety of machinery – safety-related parts of control systems – Part 1: General principles for design (ISO 13849-1:2006; PL d (Category 3)) |

## Ambient conditions

| | | | |
|---|---|---|---|
| **Ambient temperature** *(1)* | | **°C** | 0 ... 65; power reduction by 2%/°C at 50 ... 65 |
| **Max. permissible temperature of the power amplifier** | | **°C** | 105 |
| **Max. permissible temperature of the motor** *(2)* | | **°C** | 110 |
| **Transport and storage temperature** | | **°C** | -25 ... +70 |
| **Installation height without power reduction** | | **m** | < 1000 m above mean sea level |
| **Relative humidity** | | **%** | 15 ... 85 (not condensing) |
| **Vibration load during operation as per DIN EN 60068-2-6** | Number of cycles | | 10 |
| | Acceleration amplitude: | **m/s²** | 20 |
| | Frequency range | **Hz** | 10 ... 500 |
| **Continuous shocks as per DIN EN 60068-2-29** | Number of shocks | | 1000 |
| | Peak acceleration | **m/s²** | 150 |
| **Shaft wobble and perpendicularity** | | | According to EN 50347 (IEC 60072-1) |
| **Degree of protection as per DIN EN 60034-5** | | | Total except shaft bushing IP54, shaft bushing IP41 |

## Electrical data

| | | | |
|---|---|---|---|
| **Supply voltage (CN1)** | | | Corresponds to PELV according to DIN 19240, not protected against reverse polarity |
| **Supply voltage range (absolute limit values)** | | ⎓ **V** | 18 ... 40 |
| **Nominal supply voltage** | | ⎓ **V** | 24 ... 36 |
| **Ripple at nominal voltage** | | $V_{PP}$ | ≤ 3.6 |
| **Max. continuous current consumption** | | **A** | 5,5 |
| **Peak current consumption** | | **A** | 7 |
| **Inrush current** | | | Charging current for capacitor C=1500 µF |
| **External fuse** | | **A** | 10 |
| **Fieldbus interfaces (CN2 and CN3)** | | | |
| **CANopen** | Signal inputs/outputs | | According to ISO 11898 standard, no galvanic isolation |
| | Transmission rate | **kBaud** | 50 / 100 / 125 / 250 / 500 / 800 / 1000 |
| | Transmission protocol | | CANopen as per DS301 |
| **PROFIBUS DP** | Signal inputs/outputs | | According to RS 485, galvanic isolation, 2-wire |
| | Transmission rate | **kBaud** | 9.6 / 19.2 / 45.45 / 93.75 / 187.5 / 500 / 1500 / 3000 / 6000 / 12000 |
| | Transmission protocol | | PROFIBUS DP-V0 (data format as per Profidrive V2.0 PPO Type 2) |
| **RS 485** | Signal inputs/outputs | | According to RS 485, no galvanic isolation, 2-wire |
| | Transmission rate | **kBaud** | 9.6 / 19.2 / 38.4 |
| | Transmission protocol | | Manufacturer-specific |

*(1) Limit values with flanged motor mounted on a steel plate 300 x 300 x 10 mm*
*(2) Measured at the surface*

## Electrical data

| | | | | |
|---|---|---|---|---|
| **24 V signal interface (CN4)** | | | 4 signals, can each be used as input or output | |
| **24 V signal inputs** | | | Galvanically connected to 0VDC, protected against reverse polarity | |
| **Logic 0 ($U_{low}$)** | | **V** | -3 ... +4.5 | |
| **Logic 1 ($U_{high}$)** | | **V** | +15 ... +30 | |
| **Input current (typical at 24 V)** | | **mA** | 2 | |
| **Debounce time** | IO0 and IO1 | **ms** | 0.1 | |
| | IO2 and IO3 | **ms** | 0.01 | |
| **24 V signal outputs** | | | Switching to plus, short-circuit protected, suitable for inductive load (1000 mH / 100 mA) | |
| **Supply voltage range** | | ⎓ **V** | 23 ... 25 | |
| **Max. switching current (total)** | | **mA** | 200 | |
| **Max. switching current per output** | | **mA** | 100 | |
| | | | The internal power supply unit is protected against:<br>■ Short circuit of the output voltage<br>■ Overload of output voltage (limited to 6 W output power) | |
| **Interface for safety function "Safe Torque Off" ("Power Removal") (CN5)** | | | No galvanic isolation; corresponds to RS 485 standard | |
| **Logic 0 ($U_{low}$)** | | **V** | -3 ... +4.5 | |
| **Logic 1 ($U_{high}$)** | | **V** | +15 ... +30 | |
| **Input current (typical at 24 V)** | $\overline{STO\_A}$ | **mA** | ⩽ 10 | |
| | $\overline{STO\_B}$ | **mA** | ⩽ 3 | |
| **Debounce time** | | **ms** | 1 | |
| **Response time (until shutdown of power amplifier)** | | **ms** | < 50 | |
| **Max. time offset until detection of signal differences between $\overline{STO\_A}$ and $\overline{STO\_B}$** | | **S** | < 1 | |

## Safety function "Safe Torque Off" ("Power Removal")

| | | | |
|---|---|---|---|
| **Protection** | Of machine | | "Safe Torque Off" safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard ISO 13849-1, performance level "d" (PL d) , and standard IEC/EN 61800-5-2 |
| | Of the system process | | "Safe Torque Off" safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard IEC/EN 61508 level SIL2 and standard IEC/EN 61800-5-2 |

## Mechanical data ILE1 without gear

| | | | | |
|---|---|---|---|---|
| **Nominal supply voltage** | | ⎓ **V** | 24 | 36 |
| **Nominal current** | | **A** | 4.7 | 5.1 |
| **Nominal speed of rotation** | | **rpm** | 4000 | 4800 |
| **Nominal output power** | | **W** | 74 | 117 |
| **Nominal torque** | | **Nm** | 0.175 | 0.24 |
| **Max. torque** | $M_{max}$ | **Nm** | 0.26 | 0.36 |
| **Max. current with power stage disabled** | | **A** | 0.1 | 0.06 |
| **Detent torque (at zero current)** | | **Nm** | 0.08 | |
| **Moment of inertia** | | **kg·cm²** | 0.149 | |
| **Max. speed of rotation** | | **rpm** | 5000 | |
| **Positioning resolution per revolution** | | **Inc.** | 12 | |
| **Accuracy of positioning sensor** | | **°** | ±1 | |
| **Mass** | | **kg** | 1.4 | |
| **Shaft load** | Max. radial force *(1)* | **N** | 80 | |
| | Max. axial tensile force | **N** | 30 | |
| | Max. axial force pressure | **N** | 30 | |
| | Nominal bearing service life *(2)* | **h** | 20000 | |

*(1) Point of application of radial force: 12.5 mm distance to flange*
*(2) Operating hours at a probability of failure of 10%*

## Mechanical data ILE1●661 with straight teeth gear

| | | | G1 | | G2 | | G3 | | G4 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Ratio** | | | 18:1 (160:9) | | 38:1 (75:2) | | 54:1 (490:9) | | 115:1 (3675:32) | |
| **Number of gear stages** | | | 3 | | 3 | | 4 | | 4 | |
| **Nominal supply voltage** | | ⎓ V | 24 | 36 | 24 | 36 | 24 | 36 | 24 | 36 |
| **Nominal current** | | A | 4.5 | 4 | 4 | 3.4 | 4.3 | 3.5 | 2.6 | 2.1 |
| **Nominal speed of rotation of motor** | | rpm | 4000 | 4800 | 4000 | 4800 | 4000 | 4800 | 4000 | 4800 |
| **Nominal output speed of rotation** | | rpm | 225 | 270 | 107 | 128 | 73 | 88 | 35 | 42 |
| **Nominal output torque** | | Nm | 3.1 | 3.5 | 5.8 | 6.0 | 9.5 | 10.0 | 10.0 | 11.0 |
| **Nominal output power** | | W | 74 | 98 | 65 | 81 | 73 | 88 | 38 | 48 |
| **Max. current with power stage disabled** | | A | 0.1 | 0.06 | 0.1 | 0.06 | 0.1 | 0.06 | 0.1 | 0.06 |
| **Detent torque (at zero current)** | | Nm | 1.1 | | 3.0 | | 3.3 | | 8.0 | |
| **Moment of inertia output** | | kg·cm² | 48 | | 211 | | 441 | | 1962 | |
| **Max. speed of rotation** | | rpm | 281 | | 133 | | 92 | | 44 | |
| **Positioning resolution of motor per revolution** | | Inc. | 12 | | | | | | | |
| **Positioning accuracy motor** | | Inc. | ±1 | | | | | | | |
| **Positioning resolution of output** | | ° | 1.667 | | 0.8 | | 0.55 | | 0.26 | |
| **Torsional backlash** | | ° | ≤ 1 | | | | | | | |
| **Mass** | | kg | 1.85 | | | | | | | |
| **Shaft load (short-term operation)** | Max. radial force *(1)* | N | 200 | | | | | | | |
| | Max. axial force | N | 80 | | | | | | | |
| | Nominal bearing service life *(2)* | h | 2500 | | | | | | | |
| **Shaft load (long-term operation)** | Max. radial force *(1)* | N | 200 | | | | | | | |
| | Max. axial force | N | 10 | | | | | | | |
| | Nominal bearing service life *(2)* | h | 15000 | | 15000 | | 15000 *(3)* | | 15000 *(4)* | |

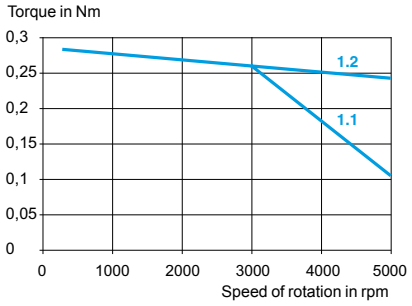
## Mechanical data ILE1●661 with worm gear

| | | | G5 | | G6 | | G7 | | G8 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Ratio** | | | 24:1 (525:22) | | 54:1 (1715:32) | | 92:1 (735:5) | | 115:1 (3675:32) | |
| **Number of gear stages** | | | 2 | | 3 | | 3 | | 3 | |
| **Nominal supply voltage** | | ⎓ V | 24 | 36 | 24 | 36 | 24 | 36 | 24 | 36 |
| **Nominal current** | | A | 6.8 | 5.1 | 6.8 | 3.8 | 6.8 | 3.8 | 6.8 | 3.8 |
| **Nominal speed of rotation of motor** | | rpm | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| **Nominal output speed of rotation** | | rpm | 168 | | 75 | | 44 | | 35 | |
| **Nominal output torque** | | Nm | 2.5 | 3.5 | 5.8 | 6.0 | 9.0 | 9.2 | 10.2 | 10.6 |
| **Nominal output power** | | W | 45 | 61 | 45 | 47 | 41 | 42 | 37 | 39 |
| **Max. current with power stage disabled** | | A | 0.1 | | | | | | | |
| **Detent torque (at zero current)** | | Nm | 2.9 | | 6.5 | | 12.3 | | 16.7 | |
| **Moment of inertia output** | | kg·cm² | 90 | | 430 | | 1270 | | 1980 | |
| **Max. speed of rotation** | | rpm | 186 | | 93 | | 54 | | 44 | |
| **Positioning resolution of motor per revolution** | | Inc. | 12 | | | | | | | |
| **Positioning accuracy motor** | | Inc. | ±1 | | | | | | | |
| **Positioning resolution of output** | | ° | 1.26 | | 0.56 | | 0.33 | | 0.26 | |
| **Torsional backlash** | | ° | ≤ 1.5 | | ≤ 1.0 | | ≤ 1.0 | | ≤ 1.0 | |
| **Mass** | | kg | 2.3 | | | | | | | |
| **Shaft load** | Max. radial force *(1)* | N | 200 | | | | | | | |
| | Max. axial force | N | 80 | | | | | | | |
| | Nominal bearing service life *(2)* | h | 3000 | | 6000 | | 9000 | | 9000 | |

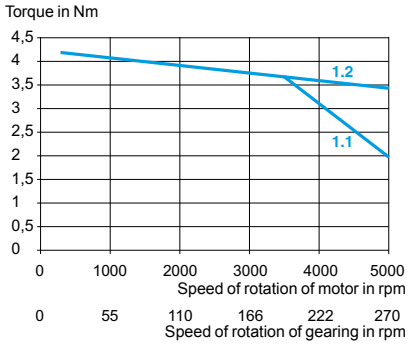
*(1) Point of application of radial force: 12.5 mm distance to flange*
*(2) Operating hours at a probability of failure of 10%*
*(3) With reduced nominal output torque = 6 Nm; 2500 h at maximum torque*
*(4) With reduced nominal output torque = 8 Nm; 2500 h at maximum torque*

## Torque characteristics

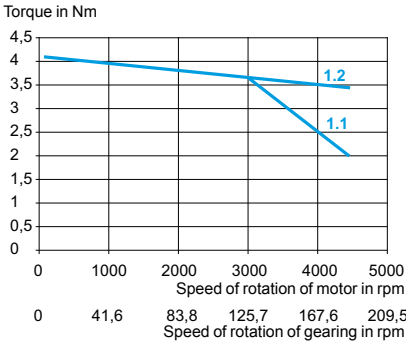
### ILE1 without gearing



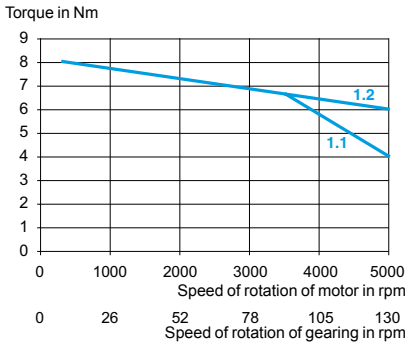

### ILE1●661 with straight teeth gear G1



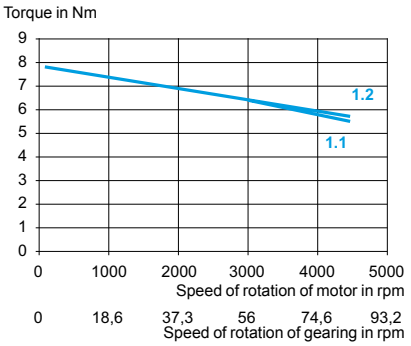

### ILE1●661 with worm gear G5



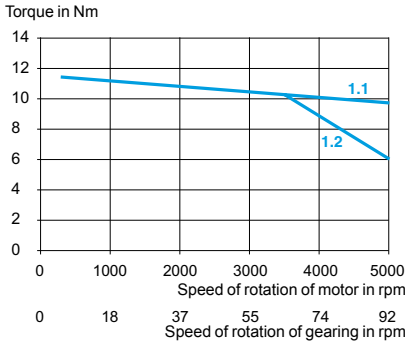

### ILE1●661 with straight teeth gear G2



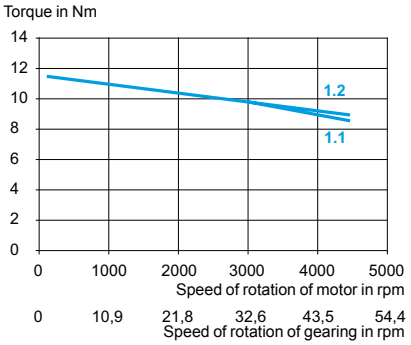

### ILE1●661 with worm gear G6



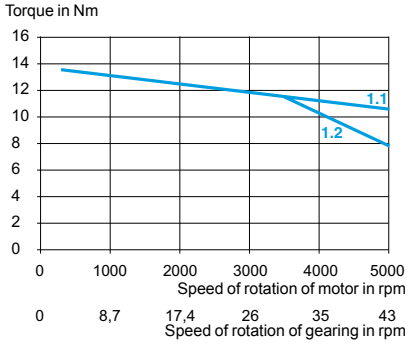

### ILE1●661 with straight teeth gear G3



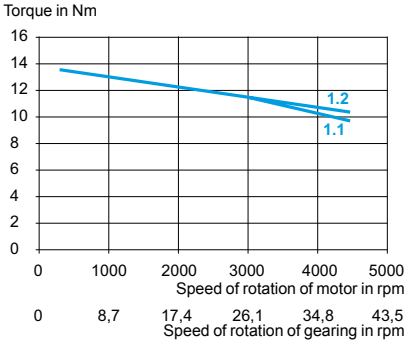

### ILE1●661 with worm gear G7




### ILE1●661 with straight teeth gear G4




### ILE1●661 with worm gear G8




1.1 Max. torque at 24 V
1.2 Max. torque at 36 V

# Lexium integrated drives

## IL●1 for CANopen, PROFIBUS DP, RS 485

### ILE1 with brushless DC motor

## References

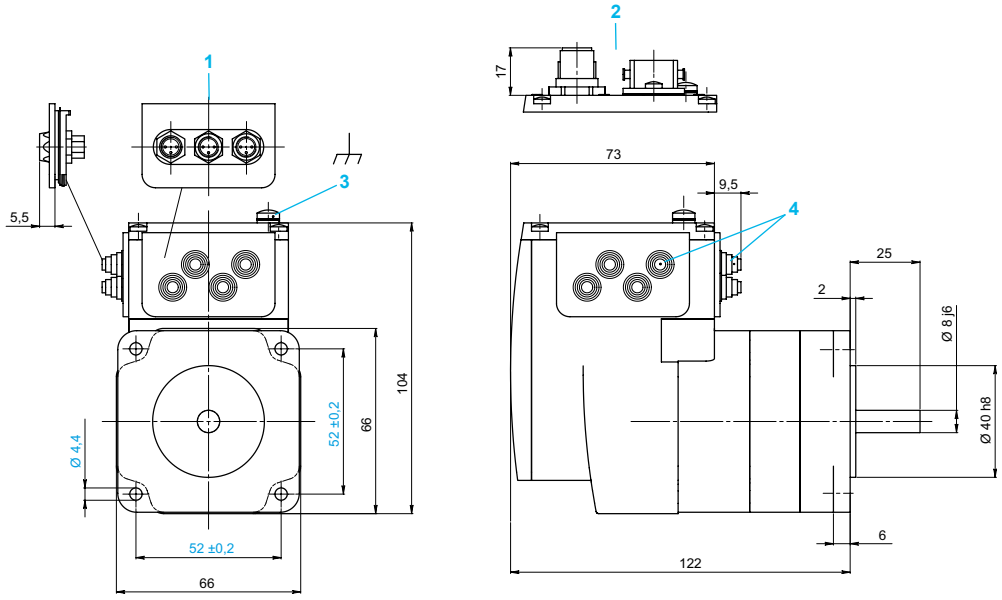
| Example: | I | L | E | 1 | B | 6 | 6 | 1 | P | B | 1 | A | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Motor type**<br>**E** = brushless DC motor | I | L | **E** | 1 | B | 6 | 6 | 1 | P | B | 1 | A | 1 |
| **Supply voltage**<br>**1** = 24 ... 36 V | I | L | E | **1** | B | 6 | 6 | 1 | P | B | 1 | A | 1 |
| **Communication interface**<br>**B** = PROFIBUS DP<br>**F** = CANopen DS301<br>**R** = RS 485 | I | L | E | 1 | **B** | 6 | 6 | 1 | P | B | 1 | A | 1 |
| **Flange size**<br>**66** = 66 mm | I | L | E | 1 | B | **6** | **6** | 1 | P | B | 1 | A | 1 |
| **Motor length**<br>**1** = motor length 1 | I | L | E | 1 | B | 6 | 6 | **1** | P | B | 1 | A | 1 |
| **Winding type**<br>**P** = medium speed of rotation, medium torque | I | L | E | 1 | B | 6 | 6 | 1 | **P** | B | 1 | A | 1 |
| **Connection technology**<br>**B** = printed circuit board connector<br>**C** = industrial connector | I | L | E | 1 | B | 6 | 6 | 1 | P | **B** | 1 | A | 1 |
| **Measurement system**<br>**1** = BLDC encoder | I | L | E | 1 | B | 6 | 6 | 1 | P | B | **1** | A | 1 |
| **Holding brake**<br>**A** = no holding brake | I | L | E | 1 | B | 6 | 6 | 1 | P | B | 1 | **A** | 1 |
| **Gearing** *(1)* | I | L | E | 1 | B | 6 | 6 | 1 | P | B | 1 | A | **1** |

Straight teeth gear
**1** = ratio 18:1 (160:9)
**2** = ratio 38:1 (75:2)
**3** = ratio 54:1 (490:9)
**4** = ratio 115:1 (3675:32)

Worm gear
**5** = ratio 24:1 (525:22)
**6** = ratio 54:1 (1715:32)
**7** = ratio 92:1 (735:5)
**8** = ratio 115:1 (3675:32)

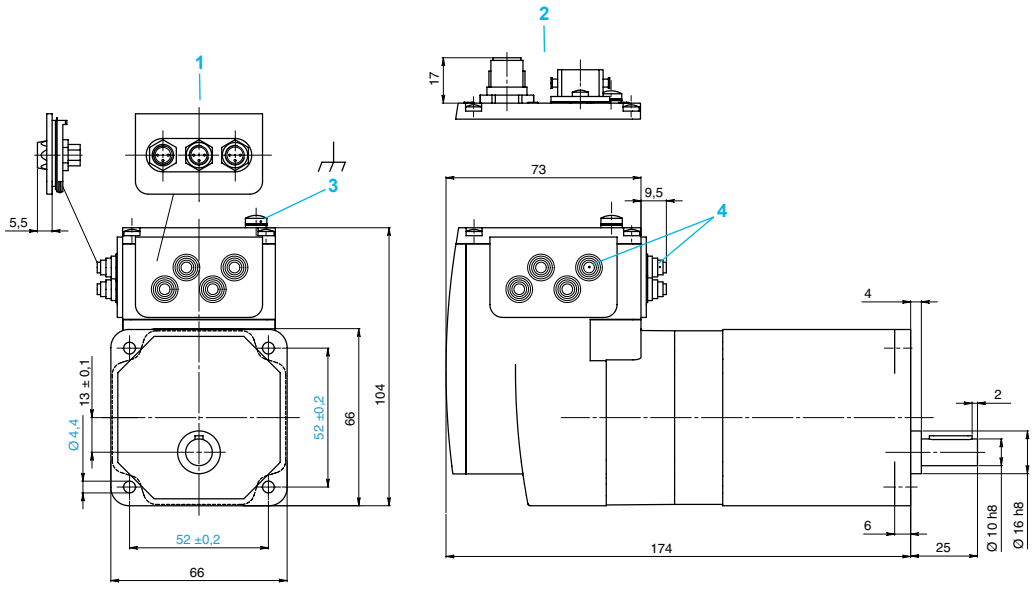
*(1) Without gearing: leave out gearing identification in the reference (specify 12 characters only).*

## ILE1 integrated drives without gearing



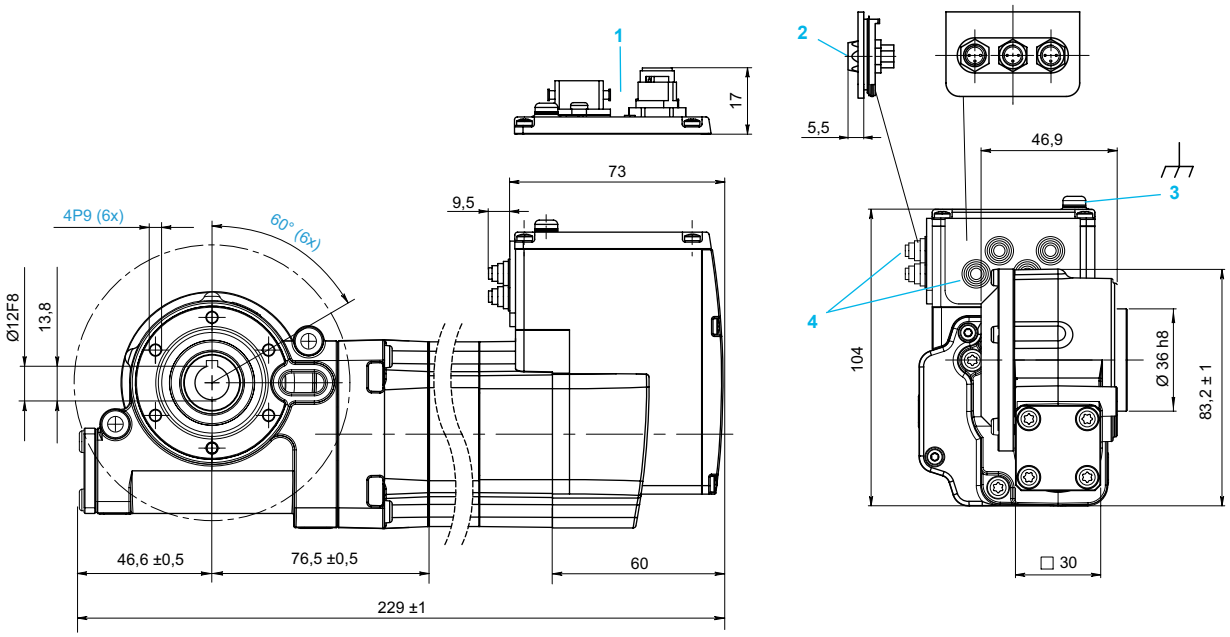

1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm

## ILE1 integrated drives with straight teeth gear




1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm

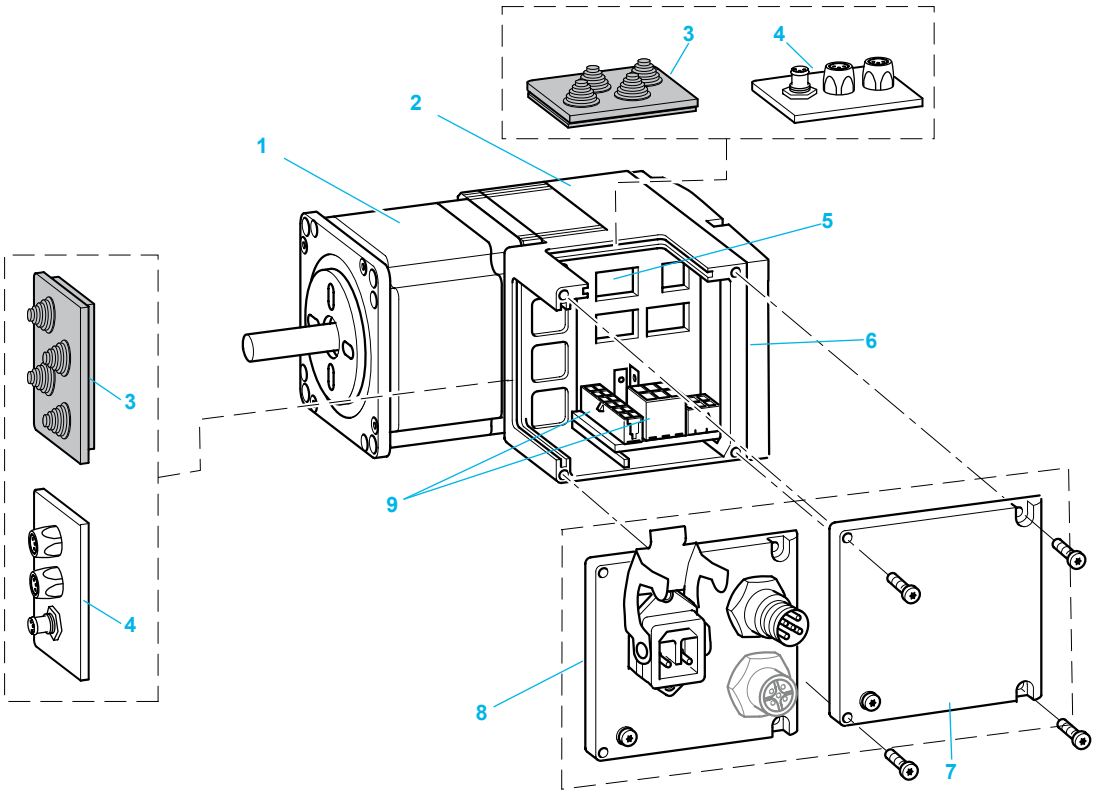
## ILE1 integrated drives with worm gear




1 Optional: industrial connectors
2 Accessories: I/O signal insert with industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm

# Lexium integrated drives
IL●1 for CANopen, PROFIBUS DP, RS 485
ILS1 with 3-phase stepper motor

## Description
ILS1 comprise control electronics with a fieldbus interface for CANopen DS301, PROFIBUS DP or RS 485 and a 3-phase stepper motor. ILS1 is optionally available with printed circuit board connectors or industrial connectors. A holding brake is optionally available for ILS1●85.




1 3-phase stepper motor
2 Electronics housing
3 Insert cable entry (accessory)
4 I/O insert with industrial connectors (accessory)
5 Settings via parameter switches
6 Cover for electronics housing
7 Cover for Lexium integrated drives with option “PCB connector"
8 Cover for supply voltage ⎓ V and fieldbus connection for Lexium integrated drives with option “industrial connector”
9 Electrical interfaces

# Lexium integrated drives
IL●1 for CANopen, PROFIBUS DP, RS 485
ILS1 with 3-phase stepper motor

## Certifications

| | | | |
|---|---|---|---|
| **Conformity to standards** | | | Lexium integrated drives have been developed to comply with the stringent international standards and with the recommendations for adjustable speed power drive systems, specifically: IEC/EN 61800-3 (noise immunity to conducted and radiated high-frequency signals) and IEC/EN 50178 (resistance of devices to vibration). |
| | EMC immunity | | EN 61800-3:2001, second environment |
| | Conducted and radiated EMC emissions | | EN 61800-3:2001-02; IEC 61800-3, Ed.2<br>■ Power supplies without external mains filter:<br>□ C3 up to 10 m supply cable length<br>■ Power supplies with external mains filter:<br>□ C2 up to 20 m supply cable length<br>□ C3 up to 50 m supply cable length |
| **CE marking** | | | The Lexium integrated drives are CE marked in accordance with the European Machinery Directive (98/37/EEC) and the European EMC Directive (2004/108/EEC). |
| **Product certifications** | | | UL (USA), cUL (Canada) |
| | | | TÜV certification: Lexium integrated drives are TÜV-certified for device safety and medical devices. The certification includes:<br>■ Functional safety of electrical/electronic/programmable safety-related electronic systems (IEC 61508:2000; SIL 2)<br>■ Safety of machinery – functional safety of safety-related electrical and electronic and programmable electronic control systems (IEC 62061:2005; SILcl2)<br>■ Safety of machinery – safety-related parts of control systems – Part 1: General principles for design (ISO 13849-1:2006; PL d (Category 3)) |

## Ambient conditions

| | | | |
|---|---|---|---|
| **Ambient temperature** *(1)* | | **°C** | 0 ... 65; power reduction by 2%/°C at 50 ... 65 |
| **Max. permissible temperature of the power amplifier** | | **°C** | 105 |
| **Max. permissible temperature of the motor** *(2)* | | **°C** | 110 |
| **Transport and storage temperature** | | **°C** | -25 ... +70 |
| **Installation height without power reduction** | | **m** | < 1000 m above mean sea level |
| **Relative humidity** | | **%** | 15 ... 85 (not condensing) |
| **Vibration load during operation as per DIN EN 60068-2-6** | Number of cycles | | 10 |
| | Acceleration amplitude: | **m/s²** | 20 |
| | Frequency range | **Hz** | 10 ... 500 |
| **Continuous shocks as per DIN EN 60068-2-29** | Number of shocks | | 1000 |
| | Peak acceleration | **m/s²** | 150 |
| **Shaft wobble and perpendicularity** | | | According to EN 50347 (IEC 60072-1) |
| **Degree of protection as per DIN EN 60034-5** | | | Total except shaft bushing IP54, shaft bushing IP41 |

## Electrical data

| | | | |
|---|---|---|---|
| **Power supply connection (CN1)** | | | Corresponds to PELV according to DIN 19240, not protected against reverse polarity |
| **Supply voltage range (absolute limit values)** | | ⎓ **V** | 18 ... 40 |
| **Nominal supply voltage** | | ⎓ **V** | 24 ... 36 |
| **Ripple at nominal voltage** | | $V_{PP}$ | ≤ 3.6 |
| **Max. current consumption** | ILS1●57 | **A** | 3.5 |
| | ILS1●851, ILS1●852 | **A** | 5 |
| | ILS1●853: | | |
| | ■ Winding type P | **A** | 5 |
| | ■ Winding type T | **A** | 6 |
| **Inrush current** | | | Charging current for capacitor C=1500 µF |
| **External fuse** | | **A** | 10 |
| **Fieldbus interfaces (CN2 and CN3)** | | | |
| **CANopen** | Signal inputs/outputs | | According to ISO 11898 standard, no galvanic isolation |
| | Transmission rate | **kBaud** | 50 / 100 / 125 / 250 / 500 / 800 / 1000 |
| | Transmission protocol | | CANopen as per DS301 |
| **PROFIBUS DP** | Signal inputs/outputs | | According to RS 485, galvanic isolation, 2-wire |
| | Transmission rate | **kBaud** | 9.6 / 19.2 / 45.45 / 93.75 / 187.5 / 500 / 1500 / 3000 / 6000 / 12000 |
| | Transmission protocol | | PROFIBUS DP-V0 (data format as per Profidrive V2.0 PPO Type 2) |
| **RS 485** | Signal inputs/outputs | | According to RS 485, no galvanic isolation, 2-wire |
| | Transmission rate | **kBaud** | 9.6 / 19.2 / 38.4 |
| | Transmission protocol | | Manufacturer-specific |

*(1) Limit values with flanged motor mounted on a steel plate 300 x 300 x 10 mm*
*(2) Measured at the surface*

| | | | |
|---|---|---|---|
| **Electrical data** | | | |
| **24 V signal interface (CN4)** | | | 4 signals, can each be used as input or output |
| **24 V signal inputs** | | | Galvanically connected to 0VDC, not protected against reverse polarity |
| **Logic 0 ($U_{low}$)** | | **V** | -3 ... +4.5 |
| **Logic 1 ($U_{high}$)** | | **V** | +15 ... +30 |
| **Input current (typical at 24 V)** | | **mA** | 2 |
| **Debounce time** | IO0 and IO1 | **ms** | 0.1 |
| | IO2 and IO3 | **ms** | 0.01 |
| **24 V signal outputs** | | | Switching to plus, short-circuit protected, suitable for inductive load (1000 mH / 100 mA) |
| **Supply voltage range** | | ⎓ **V** | 23 ... 25 |
| **Max. switching current (total)** | | **mA** | 200 |
| **Max. switching current per output** | | **mA** | 100 |
| | | | The internal power supply unit is protected against:<br>■ Short circuit of the output voltage<br>■ Overload of output voltage (limited to 6 W output power) |
| **Interface for safety function "Safe Torque Off" (“Power Removal”) (CN5)** | | | No galvanic isolation; corresponds to RS 485 standard |
| **Logic 0 ($U_{low}$)** | | **V** | -3 ... +4.5 |
| **Logic 1 ($U_{high}$)** | | **V** | +15 ... +30 |
| **Input current (typical at 24 V)** | $\overline{STO\_A}$ | **mA** | ≤ 10 |
| | $\overline{STO\_B}$ | **mA** | ≤ 3 |
| **Debounce time** | | **ms** | 1 |
| **Response time (until shutdown of power amplifier)** | | **ms** | < 50 |
| **Max. time offset until detection of signal differences between $\overline{STO\_A}$ and $\overline{STO\_B}$** | | **S** | < 1 |
| **Safety function “Safe Torque Off” (“Power Removal”)** | | | |
| **Protection** | Of machine | | “Safe Torque Off” safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard ISO 13849-1, performance level “d” (PL d) , and standard IEC/EN 61800-5-2 |
| | Of the system process | | “Safe Torque Off” safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard IEC/EN 61508 level SIL2 and standard IEC/EN 61800-5-2 |

## Mechanical data ILS1●57

| Type of integrated drive | | | ILS1●571 | ILS1●572 | ILS1●573 |
|---|---|---|---|---|---|
| **Winding type** | | | P | P | P |
| **Max. torque** | | **Nm** | 0.45 | 0.9 | 1.5 |
| **Holding torque** | | **Nm** | 0.51 | 1.02 | 1.70 |
| **Moment of inertia** | | **kg·cm²** | 0.1 | 0.22 | 0.38 |
| **Positioning resolution per revolution** | | **Inc.** | 20000 | | |
| **Systematic angle tolerance per step** *(1)* | | **arcmin** | ±6 | | |
| **Mass** | | **kg** | 1.3 | 1.6 | 2.0 |
| **Shaft load** *(2)* | Max. radial force *(3)* | **N** | 24 | 24 | 50 |
| | Max. axial tensile force | **N** | 100 | | |
| | Max. axial force pressure | **N** | 8.4 | | |
| | Nominal bearing service life *(4)* | **h** | 20000 | | |

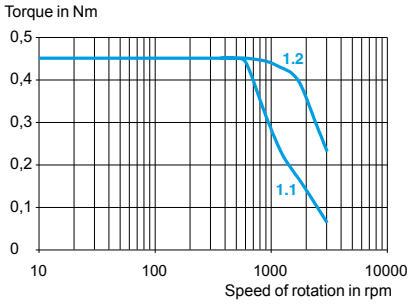
## Mechanical data ILS1●85

| Type of integrated drive | | | ILS1●851 | ILS1●852 | ILS1●853 | |
|---|---|---|---|---|---|---|
| **Winding type** | | | P | P | P | T |
| **Max. torque** | | **Nm** | 2.0 | 4.0 | 6.0 | 4.5 |
| **Holding torque** | | **Nm** | 2.0 | 4.0 | 6.0 | 4.5 |
| **Moment of inertia** | | **kg·cm²** | 1.1 | 2.2 | 3.3 | |
| **Positioning resolution** | | **Inc.** | 20000 | | | |
| **Systematic angle tolerance per step** *(1)* | | **arcmin** | ±6 | | | |
| **Mass** | | **kg** | 2.6 | 3.6 | 4.7 | |
| **Shaft load** *(2)* | Max. radial force *(3)* | **N** | 100 | 100 | 110 | |
| | Max. axial tensile force | **N** | 170 | | | |
| | Max. axial force pressure | **N** | 30 | | | |
| | Nominal bearing service life *(4)* | **h** | 20000 | | | |
| **Holding brake** | | | | | | |
| **Holding torque** | | **Nm** | 6 | | | |
| **Electrical pull-in power** | | **W** | 22 | | | |
| **Brake release time** | | **ms** | 40 | | | |
| **Brake application time** | | **ms** | 20 | | | |
| **Moment of inertia** | | **kg·cm²** | 0.2 | | | |
| **Mass** | | **kg** | 1.8 | | | |

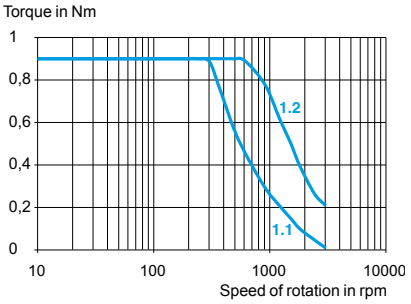
*(1) Measured at 1000 steps/revolution*
*(2) Conditions for shaft load: speed of rotation 60 rpm, 100% duty cycle at continuous torque, ambient temperature 40 °C*
*(3) Point of application of radial force: 10.5 mm distance to flange*
*(4) Operating hours at a probability of failure of 10%*

## Torque characteristics ILS1●57

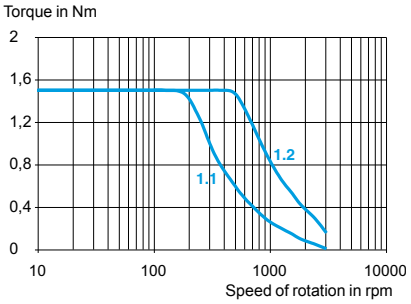
**ILS1●571P (winding type P)**




**ILS1●572P (winding type P)**

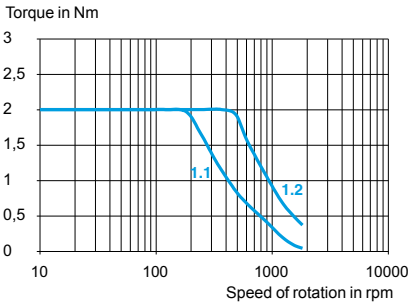



**ILS1●573P (winding type P)**

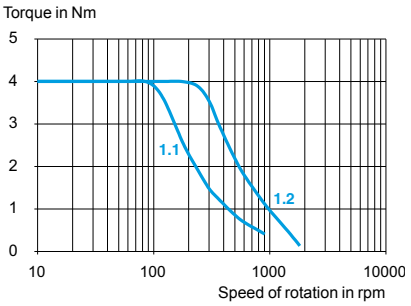



## Torque characteristics ILS1●85

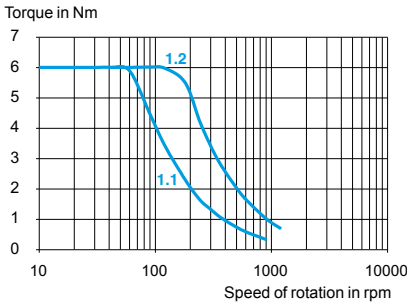
**ILS1●851P (winding type P)**



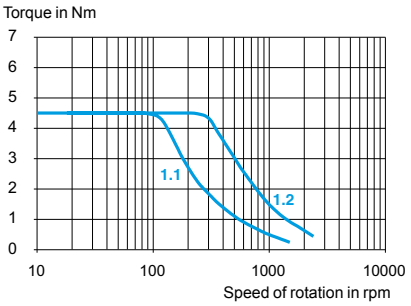

**ILS1●852P (winding type P)**




**ILS1●853P (winding type P)**




**ILS1●853T (winding type T)**




1.1 Max. torque at 24 V
1.2 Max. torque at 36 V

# Lexium integrated drives

## IL●1 for CANopen, PROFIBUS DP, RS 485

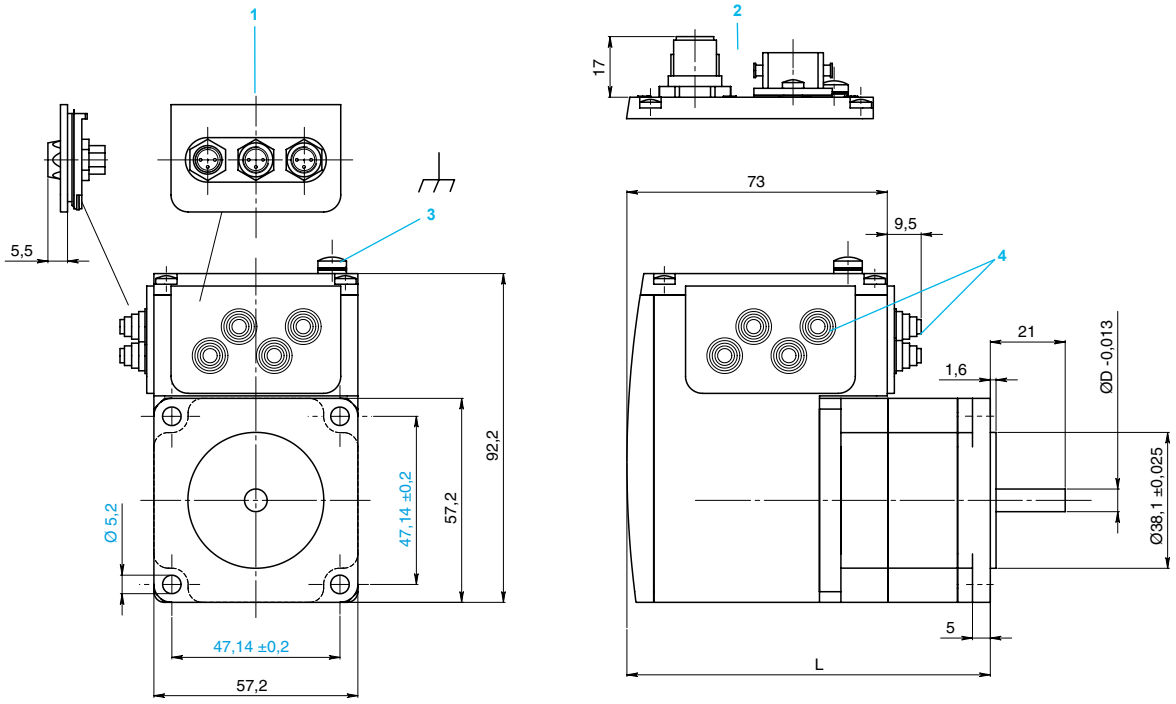
### ILS1 with 3-phase stepper motor

## References

| Example: | I | L | S | 1 | B | 5 | 7 | 1 | P | B | 1 | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Motor type**<br>**S** = 3-phase stepper motor | I | L | **S** | 1 | B | 5 | 7 | 1 | P | B | 1 | A |
| **Supply voltage**<br>**1** = 24 ... 36 V | I | L | S | **1** | B | 5 | 7 | 1 | P | B | 1 | A |
| **Communication interface**<br>**B** = PROFIBUS DP<br>**F** = CANopen DS301<br>**R** = RS 485 | I | L | S | 1 | **B** | 5 | 7 | 1 | P | B | 1 | A |
| **Flange size**<br>**57** = 57 mm<br>**85** = 85 mm | I | L | S | 1 | B | **5** | **7** | 1 | P | B | 1 | A |
| **Motor length ("L")** *(1)*<br>**1** = motor length ("L")<br>**2** = motor length ("L")<br>**3** = motor length ("L") | I | L | S | 1 | B | 5 | 7 | **1** | P | B | 1 | A |
| **Winding type**<br>**P** = medium speed of rotation, medium torque<br>**T** = high speed of rotation, medium torque *(2)* | I | L | S | 1 | B | 5 | 7 | 1 | **P** | B | 1 | A |
| **Connection technology**<br>**B** = printed circuit board connector<br>**C** = industrial connector | I | L | S | 1 | B | 5 | 7 | 1 | P | **B** | 1 | A |
| **Measurement system**<br>**1** = index pulse | I | L | S | 1 | B | 5 | 7 | 1 | P | B | **1** | A |
| **Holding brake**<br>**A** = no holding brake<br>**F** = with holding brake *(3)* | I | L | S | 1 | B | 5 | 7 | 1 | P | B | 1 | **A** |

*(1) The motor length "L" depends on the mechanical characteristics, see pages 4/33, 4/36 and 4/37.*
*(2) Winding type T only with ILS1●853.*
*(3) Holding brake only with ILS1●85.*

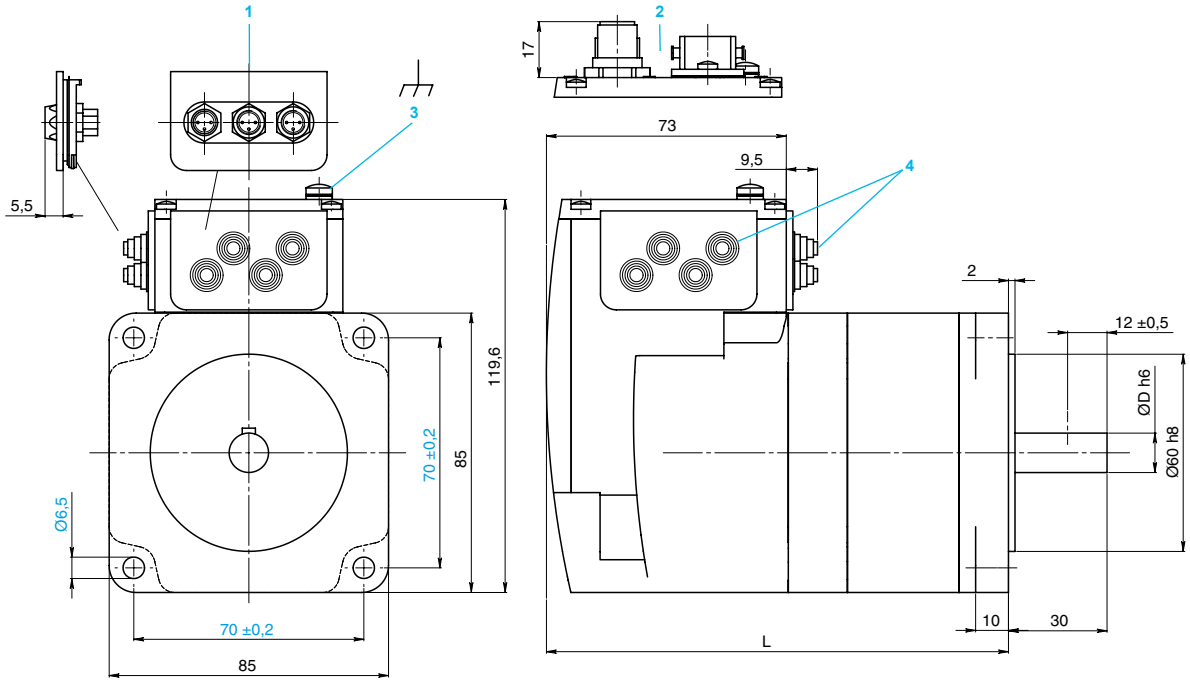
## ILS1●57 integrated drives




| | L | D |
|---|---|---|
| **ILS1●571** | 101.9 | 6.35 |
| **ILS1●572** | 115.9 | 6.35 |
| **ILS1●573** | 138.9 | 8.00 |

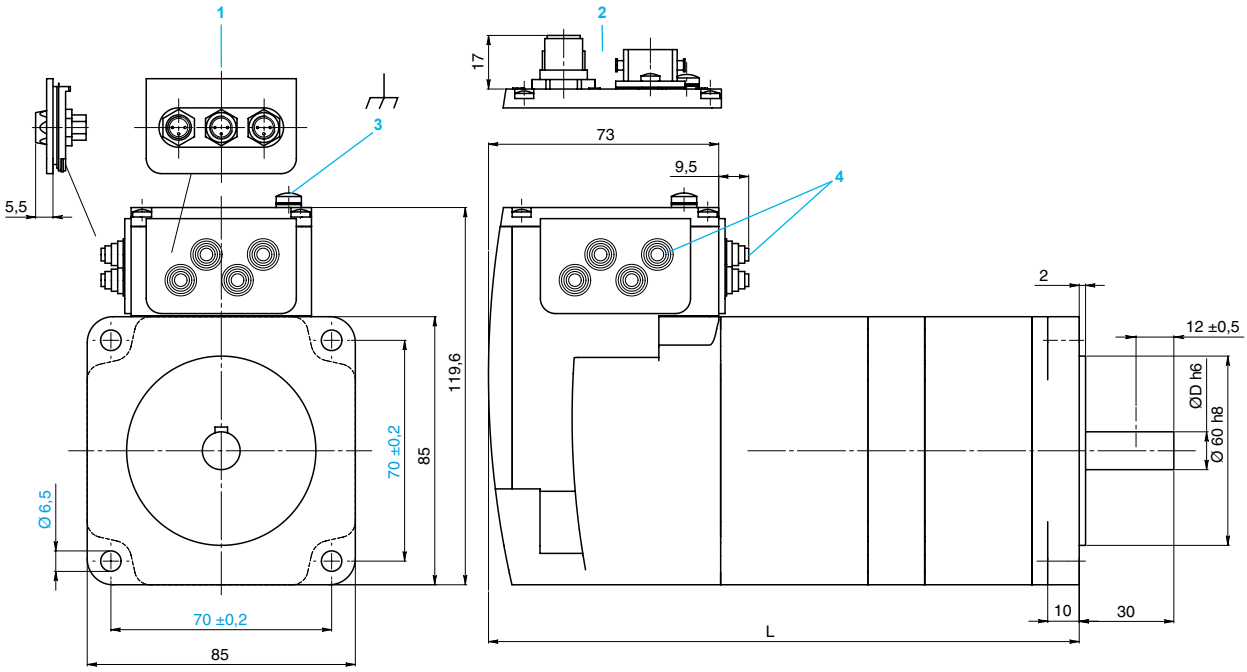
1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal

## ILS1●85 integrated drives without holding brake




| | L | D |
|---|---|---|
| **ILS1●851** | 140.6 | 12 |
| **ILS1●852** | 170.6 | 12 |
| **ILS1●853** | 200.6 | 14 |

## ILS1●85 integrated drives with holding brake




| | L | D |
|---|---|---|
| **ILS1●851** | 187.3 | 12 |
| **ILS1●852** | 217.3 | 12 |
| **ILS1●853** | 247.3 | 14 |

1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm

# Lexium integrated drives
## IL●2 for DeviceNet, EtherCAT, Modbus TCP, Ethernet Powerlink

*ILA2 with AC synchronous servo motor*



## Presentation

IL●2 comprise motor, control electronics and a fieldbus interface for DeviceNet, EtherCAT, Modbus TCP and Ethernet Powerlink.

The IL●2 product group includes:
- ILA2 with AC synchronous servo motor
- ILE2 with brushless DC motor
- ILS2 with 3-phase stepper motor

**ILA2 – the Integrated Drive System for dynamic processes**
ILA2 has an AC synchronous servo motor. This motor is characterised by high dynamics with the possibility of short-term overcurrent during acceleration.

**ILE2 – the Integrated Drive System for automatic format adjustment**
ILE2 is fitted with a brushless DC motor. The brushless DC motors have high detent torque at zero current. This makes a holding brake unnecessary in most applications. In combination with the electronics ILE2 has the characteristics of an absolute value encoder.

**ILS2 – the Integrated Drive System for short-distance positioning**
With its 3-phase stepper motor, ILS2 offers high torque at low speeds of rotation. ILS2 are ideally suited as drives in velocity mode with excellent constant velocity characteristics and also or for high-resolution positioning Commissioning the stepper motor drives is simple because it is not necessary to adjust the control loop.

## Special features

**ILA2 with AC synchronous servo motor**
- High dynamics and high peak torque
- High-resolution singleturn encoder with a resolution of 16384 increments/revolution
- Optionally with multiturn encoder with a resolution of 16384 increments/revolution with a positioning range of 4096 revolutions
- Optionally with integrated holding brake
- Planetary gear available as options

**ILE2 with brushless DC motor**
- High detent torque
- Quasi-absolute encoder, therefore, no homing required after switching off and on
- Optionally available with spur wheel gear or worm gear; planetary gear available as options

**ILS2 with 3-phase stepper motor**
- High continuous stall torque
- Good constant velocity characteristics
- High positioning resolution (0.018°)
- Optionally with holding brake (ILS2●85 only)
- Planetary gear available as options

## Electronics

The electronic system comprises control electronics and power amplifier. They have a common power supply. The Lexium integrated drives can be parameterised and controlled via the fieldbus interface.
Four different 24 V signals are also available. They can be used as input or output.

**Supply voltage**
These Lexium integrated drives can be operated with a supply voltage from 24 V up to 48 V.

## Connection technologies

IL●2 have the following connections:
- Supply voltage ⎓ V
- Fieldbus interface: DeviceNet, EtherCAT, Ethernet Powerlink, Modbus TCP/IP
- RS 485 commissioning interface
- 24 V signal interface for four inputs/outputs
- Signal interface for “Safe Torque Off” safety function (“Power Removal”)

### Fieldbus interface

The following fieldbuses can be connected to the fieldbus interface depending on the device version:
- DeviceNet (DeviceNet Standard)
- EtherCAT (as per IEEE 802.3 standard)
- Ethernet Powerlink (as per IEEE 802.3 standard)
- Modbus TCP (as per IEEE 802.3 standard)

The fieldbus interface is used to parameterise and control the Integrated Drive System.
IL●2 with DeviceNet interface support the ADR function (Automatic Device Replacement). This function enables easy replacement of drive systems with automatic parameterisation.
In addition, the Integrated Drive System can be commissioned with a PC connected to the fieldbus interface and the PC commissioning software. This requires an appropriate fieldbus converter.

### RS 485 commissioning interface

An RS 485 commissioning interface is available in addition to the fieldbus interface. The RS 485 commissioning interface is also used for commissioning the drive system.
The drive system can also be monitored during operation with the RS 485 commissioning interface and the “Lexium CT” commissioning software.
Simultaneous fieldbus and RS 485 connections are possible.

### 24 V signal interface

Four 24 V signals are available, which can be used either as an input or an output. The 24 V signals are available to the master controller via the fieldbus. They can also be used for predefined functions, such as for connection of limit switches and reference switches.
The 24 V power supply to the signal outputs is internal via the supply voltage of the Integrated Drive System.

### Signal interface for “Safe Torque Off” safety function (“Power Removal”)

The integrated “Safe Torque Off” safety function (“Power Removal”) enables a stop of category 0 or 1 as per IEC/EN 60204-1 without external power contactors. The supply voltage does not have to be interrupted. This reduces the system costs and response times.
The safety function is activated via two redundant 24 V input signals (low active).

*Integrated drive system with printed circuit board connectors*

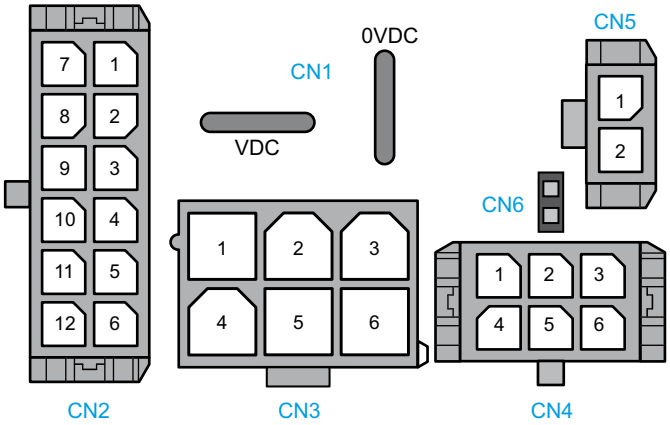
## Connection technologies (continued)

### Printed circuit board connector

Printed circuit board plug connectors are preferably used for cabling series machines with cable harnesses.

- Fieldbus and I/O signal connection with connector “Molex Micro Fit"
- Power supply connection with “AMP Positive Lock” crimp contacts

Two cable entries are required for cabling the Lexium integrated drives (see accessories, page 4/107).

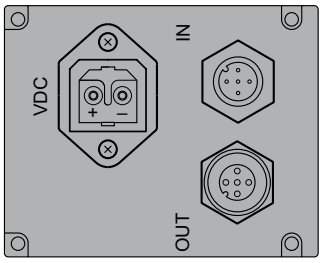



*Printed circuit board connector, overview of connections*

| Connection | Assignment |
|---|---|
| CN1 | Supply voltage ⎓ V |
| CN2 | Fieldbus interface |
| CN3 | RS 485 commissioning interface |
| CN4 | 24 V signal interface |
| CN5 | Interface for “Safe Torque Off” safety function (“Power Removal”) |
| CN6 | Jumper for disabling “Safe Torque Off” safety function (“Power Removal”) |

### Industrial connectors (optional)

Lexium integrated drives with industrial connectors are preferably used in special machines and small series.
The device version with industrial connectors has a connector housing with M12 circular connectors (5 poles) for the fieldbus connection and a Hirschmann STASEI 200 connector for connection of the power supply.




*Industrial connector, overview of connections*

*Integrated drive system with industrial connectors*

***Note:***

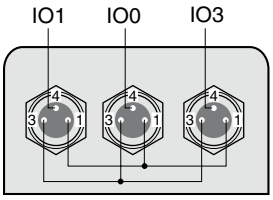
- *DeviceNet and Modbus TCP: 1 circular connector for IN and OUT signals*
- *EtherCAT and Ethernet Powerlink: 2 circular connectors (1 circular connector each for IN and OUT signals)*

## Connection technologies (continued)

### I/O signal inserts

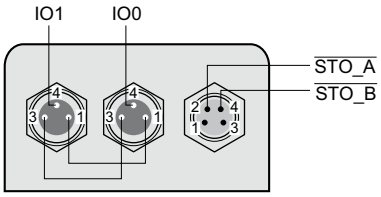
One or two I/O signal inserts with industrial connectors can be ordered for connection of the I/O signals (see accessories, pages 4/109 and 4/110).
The 24 V power supply to the signal outputs is internal. Different I/O signal inserts are available for this purpose.

#### I/O signal inserts without “Safe Torque Off” safety function (“Power Removal”)

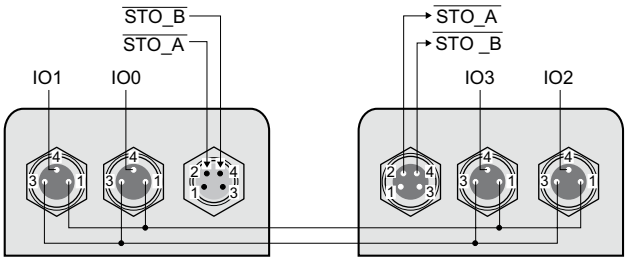



*Inserts for three I/O signals*

#### I/O signal inserts with “Safe Torque Off” safety function (“Power Removal”)

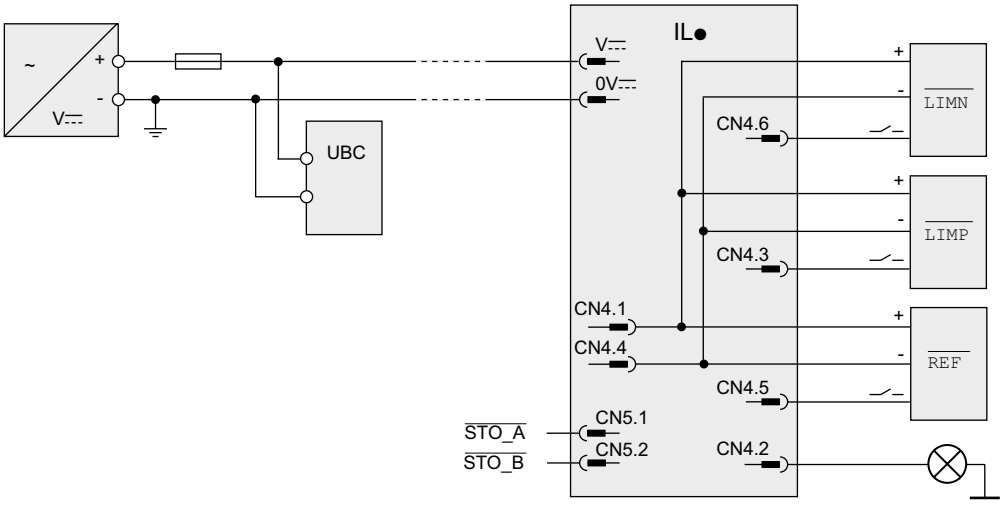



*Insert for two I/O signals and STO signals for safety function*




*Inserts for four I/O signals and STO signals for safety function*

#### Connection example I/O signal




*Connection example with four I/O signals*

# Lexium integrated drives
IL●2 for DeviceNet, EtherCAT, Modbus TCP, Ethernet Powerlink

## Configuration via parameter switches

The following settings can be made at the Integrated Drive System via parameter switches:
- ■ Ethernet
- □ Setting IP address
- ■ DeviceNet
- □ Setting fieldbus address

## Operating modes

### Overview

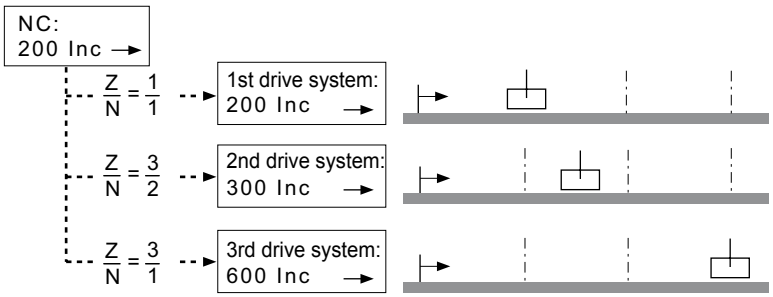
The following operating modes can be set via the fieldbus:
- ■ Electronic gear (only ILA2 with singleturn encoder)
- ■ Profile velocity
- ■ Jog
- ■ Profile position
- ■ Homing

### Electronic gear (only ILA2 with singleturn encoder)

In “Electronic Gear” operating mode with singleturn encoder, the reference signals are supplied from an encoder (A/B signals) or a controller (pulse/direction signals) and a new position reference value is calculated using an adjustable gear ratio.

**Reference value setting**
The reference value are supplied as pulse/direction or A/B encoder signals.

**Application example**
Synchronisation of motion sequences, e.g. cutting material on a conveyor belt.



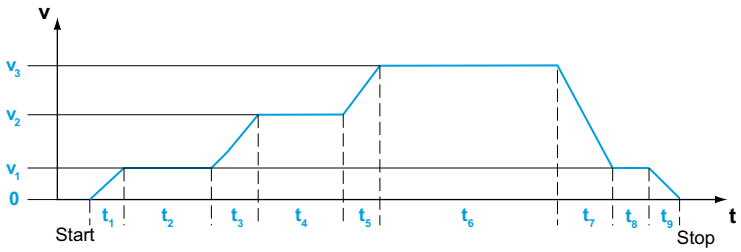

*"Electronic Gear" operating mode*

### Profile velocity

In operating mode “Profile velocity", a reference speed for the motor is set and a movement without a target position is started. This speed is maintained until a different reference speed is specified or the operating mode is changed.

**Reference value setting**
The reference value is set via fieldbus or PC.

**Application example**
Application of paint in CD manufacture




*Profile velocity*

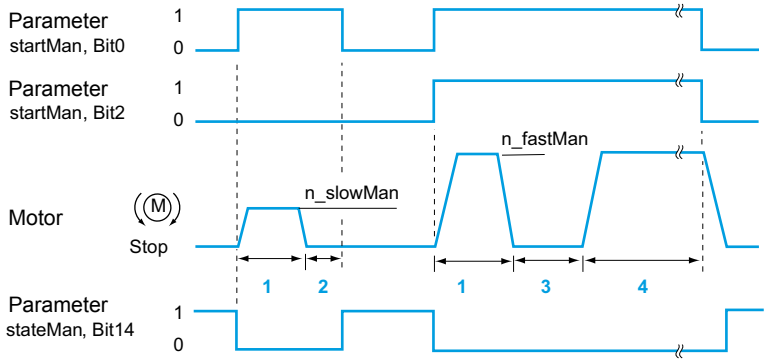
$t_1$, $t_3$, $t_5$ = acceleration
$t_2$, $t_4$, $t_6$, $t_8$ = constant movement
$t_7$, $t_9$ = braking

### Jog mode

The motor moves by one distance unit or at constant speed in continuous operation. The value of the distance unit, the speed levels and the change-over time in continuous operation can be adjusted manually.

**Reference value setting**
The reference value is set via fieldbus or PC.

**Application example**
Setting up a machine during commissioning




*Jog, slow and fast*

1 step_Man
2 t < time_Man
3 time_Man
4 Continuous operation

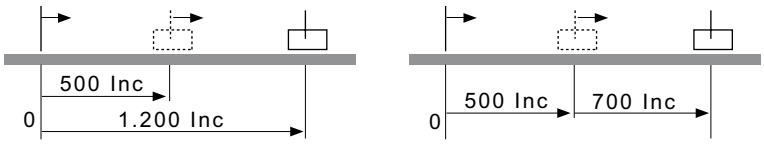
## Profile position

In the operating mode “Profile Position", the motor is positioned from a point A to a point B with a positioning command.

**Settings**
The positioning path can be specified in two ways:
- Absolute positioning, reference point is the zero point of the axis
- Relative positioning, reference point is the current position of the motor

**Reference value setting**
The reference value is set via fieldbus or PC.

**Application example**
Pick-and-place with a linear robot




*Operating mode “Profile Position", absolute and relative*

## Homing

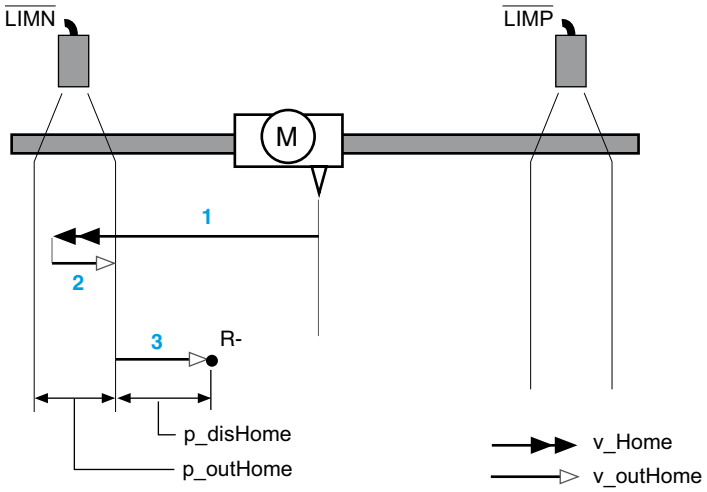
There are two types of the “Homing” operating mode:
- Reference movement
  Specifying the dimension reference by approach to a limit or reference switch
- Position setting
  Specifying the position reference relative to the current motor position

***Note:** In the case of ILA2 with multiturn encoder, a valid actual motor position is available immediately after starting. Therefore, homing to external limit switches is not required.*

**Reference movement**
During reference movement, the motor moves to a defined position on the axis. The position is defined by a mechanical switch:
- LIMN, LIMP limit switches
- REF reference switch

**Types of reference movements**
There are six standard reference movements:
- Movement to negative limit switch LIMN
- Movement to positive limit switch LIMP
- Movement to REF reference switch with first movement counterclockwise
- Movement to REF reference switch with first movement clockwise
- Reference movement to index pulse with clockwise or counterclockwise rotation (not with ILE2)
- Reference movement to block = mechanical stop (ILE2 only)

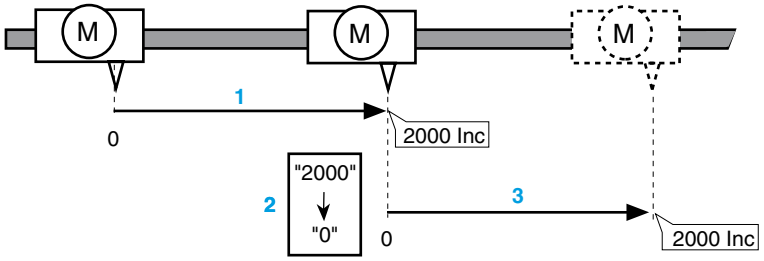
**Example 1: reference movement to limit switch**




*Operating mode "Homing", reference movement to limit switch*

1 Movement to limit switch at search speed
2 Movement to switching edge at clearance speed
3 Movement to distance from switching edge at clearance speed

**Example 2: position setting**
Position setting can be used to execute a continuous motor movement without overtravelling the positioning limits.




*Positioning by 4000 increments with position setting*

1 The motor is positioned 2000 increments.
2 The current motor position is set to position value 0 by position setting to 0 and the new zero point is defined at the same time.
3 The new target position is 2000 increments after triggering a new travel command by 2000 increments.

This procedure prevents overtravel of the absolute position limits during positioning, because the zero point is continuously made to follow.

**Reference value setting**
The reference value is set via fieldbus or PC.

**Application example**
Prior to absolute positioning in "Profile Position" mode.

**Additional operating modes**
Additional operating modes can be activated via fieldbus or PC:
- Brake function
- Reversing direction of rotation of motor
- Setting motion profile via profile generator
- Setting motor phase current
- Triggering "Quick Stop" function
- Fast position capture via signal input (Capture)
- Programming signal inputs/outputs.
- Translation of user-defined units (scaling)
- Monitoring functions

## "Safe Torque Off" ("Power Removal") safety function

The Lexium integrated drive integrates the "Safe Torque Off" ("Power Removal") safety function which prevents unintended restarting of the motor. The motor no longer produces any torque if the safety function is active.

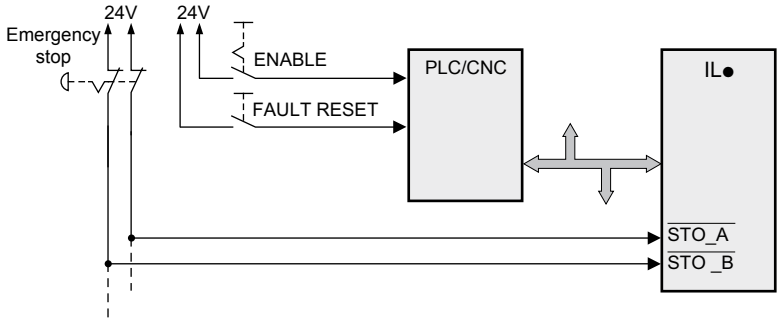
This safety function:
- Complies with the machine safety standard ISO 13849-1, perfomance level "d" (PL d) .
- Complies with the standard for functional safety IEC/EN 61508, SIL2 capability (safety control-signalling applied to processes and systems). The SIL (Safety Integrity Level) capability depends on the connection diagram for the servo drive and for the safety function. Failure to observe the setup recommendations could inhibit the SIL capability of the "Safe Torque Off" ("Power Removal") safety function.
- Complies with product standard IEC/EN 61800-5-2 "Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional" for both stop functions:
  - Safe Torque Off ("STO") corresponds to Category 0 stop according to IEC/EN 60204-1. Standstill by immediate power shutdown to the machine drive elements (i.e. an uncontrolled stop).
  - Safe Stop 1 ("SS1") corresponds to Category 1 stop according to IEC/EN 60204-1. A controlled stop in which the machine drive elements are retained to effect the standstill. The final shutdown is ensured by an external Emergency stop module with safe time delay, e.g. Preventa XPS-AV *(1)*.

The "Safe Torque Off" ("Power Removal") safety function has a redundant electronic architecture *(2)* which is monitored continuously by a diagnostics function.

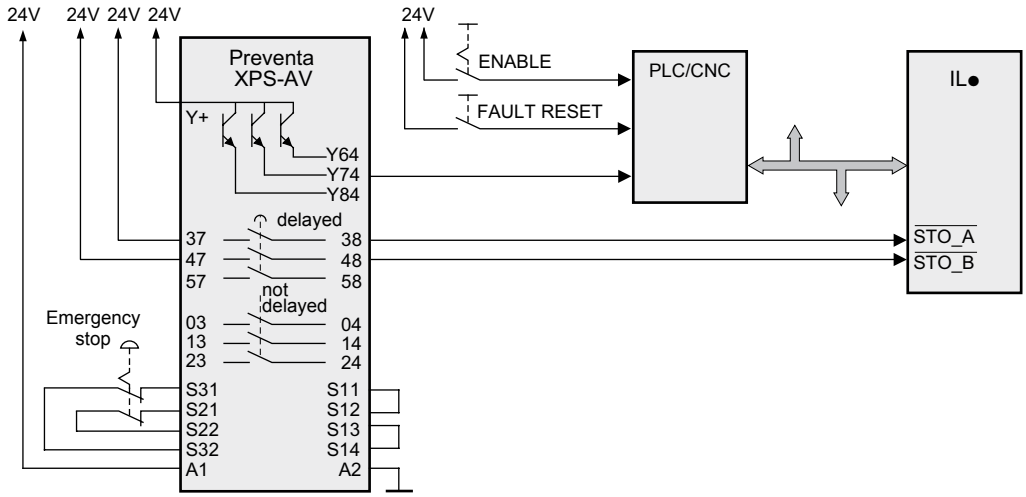
This PL d and SIL2 safety function is certified as conforming to these standards by the TÜV certification body in the context of a voluntary certification.

*(1) Please refer to the "Safety functions and solutions using Preventa" catalogue.*
*(2) Redundant: Consists of mitigating the effects of the failure of one component by means of the correct operation of another, assuming that faults do not occur simultaneously on both.*

**Examples of applications of the safety function**




*Example of Category 0 Stop*




*Example of Category 1 Stop*

# Lexium integrated drives

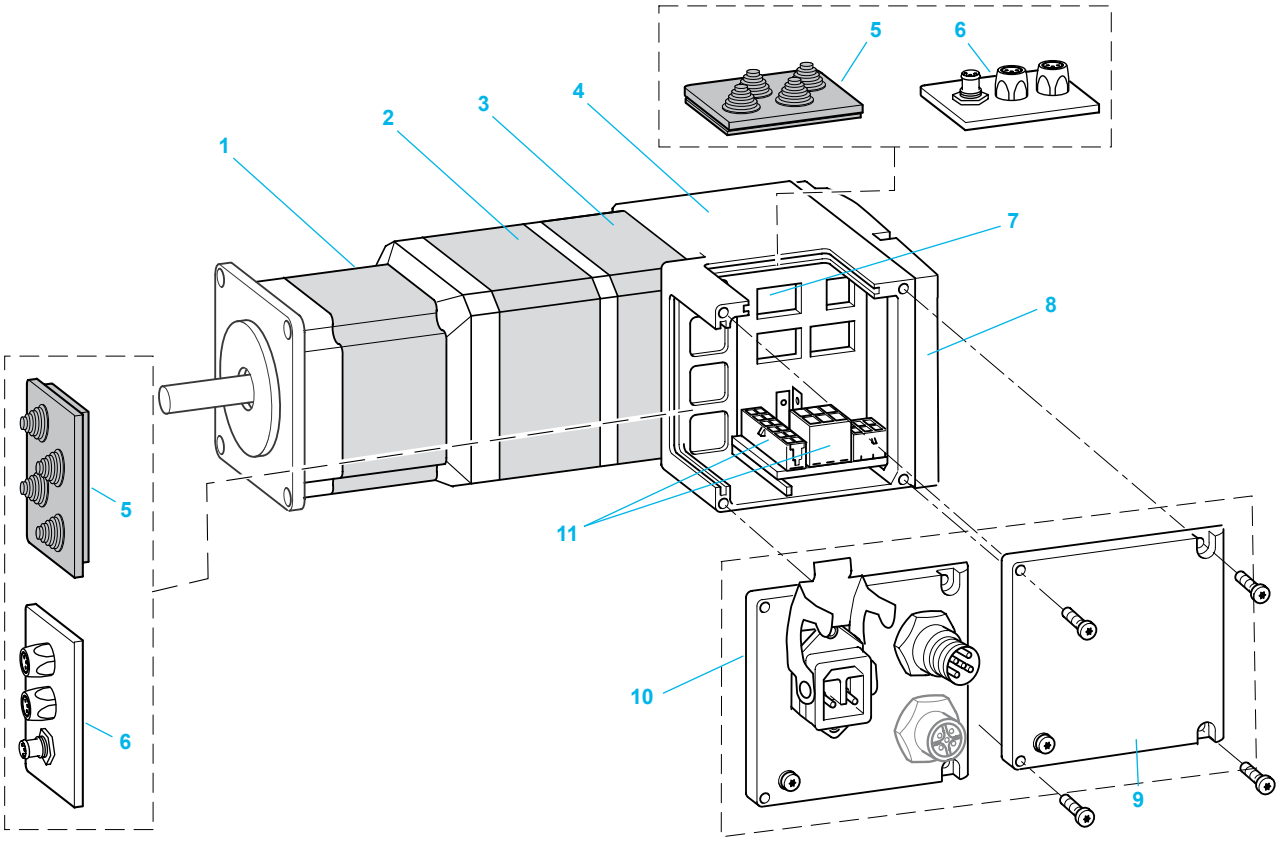
## IL●2 for DeviceNet, EtherCAT, Modbus TCP, Ethernet Powerlink

### ILA2 with AC synchronous servo motor



## Description

ILA2 comprise control electronics with a fieldbus interface for DeviceNet, EtherCAT, Modbus TCP or Ethernet Powerlink and an AC synchronous servo motor. ILA2 is optionally available with printed circuit board connectors or industrial connectors. A multiturn encoder is optionally available for ILA2. A holding brake is optionally available for the ILA2 with a singleturn encoder.




1 Synchronous AC servo motor
2 Holding brake (optional)
3 Singleturn or multiturn encoder (optional)
4 Electronics housing
5 Insert cable entry (accessory)
6 I/O insert with industrial connectors (accessory)
7 Settings via parameter switches
8 Cover for electronics housing
9 Cover for Lexium integrated drives with option “PCB connector"
10 Cover for supply voltage ⎓ V and fieldbus connection for Lexium integrated drives with option “industrial connector”
11 Electrical interfaces

***Note:***

- *DeviceNet and Modbus TCP: 1 circular connector for IN and OUT signals*
- *EtherCAT and Ethernet Powerlink: 2 circular connectors (1 circular connector each for IN and OUT signals)*

# Lexium integrated drives

IL●2 for DeviceNet, EtherCAT, Modbus TCP, Ethernet Powerlink

ILA2 with AC synchronous servo motor

## Certifications

| | | | |
|---|---|---|---|
| **Conformity to standards** | | | Lexium integrated drives have been developed to comply with the stringent international standards and with the recommendations for adjustable speed power drive systems, specifically: IEC/EN 61800-3 (noise immunity to conducted and radiated high-frequency signals) and IEC/EN 50178 (resistance of devices to vibration). |
| | EMC immunity | | EN 61800-3:2001, second environment |
| | Conducted and radiated EMC emissions | | EN 61800-3:2001-02; IEC 61800-3, Ed.2<br>■ Power supplies without external mains filter:<br>□ C3 up to 10 m supply cable length<br>■ Power supplies with external mains filter:<br>□ C2 up to 20 m supply cable length<br>□ C3 up to 50 m supply cable length |
| **CE marking** | | | The Lexium integrated drives are CE marked in accordance with the European Machinery Directive (98/37/EEC) and the European EMC Directive (2004/108/EEC). |
| **Product certifications** | | | UL (USA), cUL (Canada) |
| | | | TÜV certification: Lexium integrated drives are TÜV-certified for device safety and medical devices. The certification includes:<br>■ Functional safety of electrical/electronic/programmable safety-related electronic systems (IEC 61508:2000; SIL 2)<br>■ Safety of machinery – functional safety of safety-related electrical and electronic and programmable electronic control systems (IEC 62061:2005; SILcl2)<br>■ Safety of machinery – safety-related parts of control systems – Part 1: General principles for design (ISO 13849-1:2006; PL d (Category 3)) |

## Ambient conditions

| | | | |
|---|---|---|---|
| **Ambient temperature** *(1)* | | **°C** | 0 ... 55; power reduction by 2%/°C at 40 ... 55 |
| **Max. permissible temperature of the power amplifier** | | **°C** | 105 |
| **Max. permissible temperature of the motor** *(2)* | | **°C** | 110 |
| **Transport and storage temperature** | | **°C** | -25 ... +70 |
| **Installation height without power reduction** | | **m** | < 1000 m above mean sea level |
| **Relative humidity** | | **%** | 15 ... 85 (not condensing) |
| **Vibration load during operation as per DIN EN 60068-2-6** | Number of cycles | | 10 |
| | Acceleration amplitude: | **m/s²** | 20 |
| | Frequency range | **Hz** | 10 ... 500 |
| **Continuous shocks as per DIN EN 60068-2-29** | Number of shocks | | 1000 |
| | Peak acceleration | **m/s²** | 150 |
| **Shaft wobble and perpendicularity** | | | According to EN 50347 (IEC 60072-1) |
| **Degree of protection as per DIN EN 60034-5** | | | Total except shaft bushing IP54, shaft bushing IP41 |

## Electrical data

| | | | | |
|---|---|---|---|---|
| **Supply voltage (CN1)** | | | Corresponds to PELV according to DIN 19240, protected against reverse polarity | |
| **Supply voltage range (absolute limit values)** | | **⎓ V** | 18 ... 55.2 | |
| **Nominal supply voltage** | | **⎓ V** | 24 / 48 | |
| **Ripple at nominal voltage** | | **$V_{PP}$** | ≤ 3.6 | |
| | | | ILA2●571 | ILA2●572 |
| **Max. continuous current consumption** | ■ Winding type T | **A** | 7.5 | 7.5 |
| | ■ Winding type P | **A** | 5 | 7 |
| **Peak current consumption** | ■ Winding type T | **A** | 11 | 9 |
| | ■ Winding type P | **A** | 7 | 8.5 |
| **Inrush current** | | | Inrush current time-dependent by current incline function and depending on device capacitance C = 1500 µF and resistance of connectivity | |
| **External fuse** | | **A** | 16 | |
| **Fieldbus interface (CN2)** | | | | |
| **DeviceNet** | Signal inputs/outputs | | According to OVDA, galvanic isolation | |
| | Transmission rate | **kBaud** | 125 / 250 / 500 | |
| | Transmission protocol | | DeviceNet Position Controller Profile | |
| **EtherCAT** | Signal inputs/outputs | | According to IEEE 802.3 standard, no galvanic isolation | |
| | Transmission rate | **MBit** | 100 | |
| | Transmission protocol | | EtherCAT | |
| **Modbus TCP** | Signal inputs/outputs | | According to IEEE 802.3 standard, no galvanic isolation | |
| | Transmission rate | **MBit** | 10 / 100 | |
| | Transmission protocol | | Modbus TCP | |
| **Ethernet Powerlink** | Signal inputs/outputs | | According to IEEE 802.3 standard, no galvanic isolation | |
| | Transmission rate | **MBit** | 100 | |
| | Transmission protocol | | Ethernet Powerlink | |

*(1) Limit values with flanged motor mounted on a steel plate 300 x 300 x 10 mm*
*(2) Measured at the surface*

| | | | |
|---|---|---|---|
| **Electrical data** | | | |
| **RS 485 commissioning interface (CN3)** | | | |
| **RS 485** | Signal inputs/outputs | | According to RS 485, no galvanic isolation, 2-wire |
| | Transmission rate | **kBaud** | 9.6 / 19.2 / 38.4 |
| | Transmission protocol | | Modbus TCP |
| **24 V signal interface (CN4)** | | | 4 signals, can each be used as input or output |
| **24 V signal inputs** | | | Galvanically connected to 0VDC, protected against reverse polarity |
| **Logic 0 ($U_{low}$)** | | **V** | -3 ... +4.5 |
| **Logic 1 ($U_{high}$)** | | **V** | +15 ... +30 |
| **Input current (typical at 24 V)** | | **mA** | 2 |
| **Debounce time** | LIO1 ... LIO4 | **ms** | 1.25 ... 1.5 |
| **24 V signal outputs** | | | Switching to plus, short-circuit protected, suitable for inductive load (1000 mH / 100 mA) |
| **Nominal voltage** | | **⎓ V** | 24 |
| **Supply voltage range** | | **⎓ V** | 23 ... 25 |
| **Max. switching current (total)** | | **mA** | 200 |
| **Max. switching current per output** | | **mA** | 100 |
| **Voltage drop at 50 mA load** | | **V** | ≤ 1 |
| | | | The internal power supply unit is protected against:<br>■ Short circuit of the output voltage<br>■ Overload of output voltage (limited to 6 W output power) |
| **Interface for safety function "Safe Torque Off" ("Power Removal") (CN5)** | | | No galvanic isolation; corresponds to RS 485 standard |
| **Logic 0 ($U_{low}$)** | | **V** | -3 ... +4.5 |
| **Logic 1 ($U_{high}$)** | | **V** | +15 ... +30 |
| **Input current (typical at 24 V)** | | **mA** | 10 |
| **Debounce time** | | **ms** | 1 ... 5 |
| **Response time (until shutdown of power amplifier)** | | **ms** | < 50 |
| **Max. time offset until detection of signal differences between $\overline{\text{STO\_A}}$ and $\overline{\text{STO\_B}}$** *(1)* | | **S** | < 1 |
| **Safety function "Safe Torque Off" ("Power Removal")** | | | |
| **Protection** | Of machine | | "Safe Torque Off" safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard ISO 13849-1, performance level "d" (PL d) , and standard IEC/EN 61800-5-2 |
| | Of the system process | | "Safe Torque Off" safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard IEC/EN 61508 level SIL2 and standard IEC/EN 61800-5-2 |

*(1) Switching process must be simultaneous for both signal inputs (time offset < 1 s).*

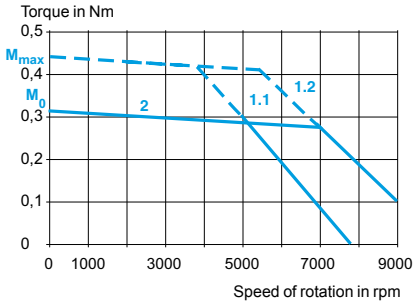
## Mechanical data

| Type of integrated drive | | | ILA2●571 | | | | ILA2●572 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Winding type** | | | T | | P | | T | | P | |
| **Nominal supply voltage** | | ⎓ V | 24 | 48 | 24 | 48 | 24 | 48 | 24 | 48 |
| **Nominal speed of rotation** | | rpm | 5000 | 7000 | 3200 | 5100 | 3000 | 5100 | 1600 | 3400 |
| **Max. torque** *(1)* | $M_{max}$ | Nm | 0.45 | | 0.62 | | 0.85 | | 1.62 | |
| **Continuous torque** *(2)* | $M_0$ | Nm | 0.31 | | 0.44 | | 0.57 | | 0.78 | |
| **Positioning resolution per revolution** | | Inc. | 16384 | | | | 16384 | | | |
| **Accuracy of positioning sensor** | | ° | ±0.05 | | | | ±0.05 | | | |
| **Rotor inertia** | | kg·cm² | 0.095 | | | | 0.173 | | | |
| **Mass** | | kg | 1.4 | | | | 1.7 | | | |
| **Shaft load** | Max. radial force *(3)* | N | 89 | | | | 107 | | | |
| | Max. axial tensile force | N | 104 | | | | 104 | | | |
| | Max. axial force pressure | N | 104 | | | | 104 | | | |
| | Nominal bearing service life *(4)* | h | 20000 | | | | 20000 | | | |
| **Holding brake (optional)** *(5)* | | | | | | | | | | |
| **Holding torque** | | Nm | 1.2 | | | | | | | |
| **Electrical pull-in power** | | W | 10 | | | | | | | |
| **Brake release time** | | ms | 14 | | | | | | | |
| **Brake application time** | | ms | 13 | | | | | | | |
| **Moment of inertia** | | kg·cm² | 0.07 | | | | | | | |
| **Multiturn encoder (optional)** *(5)* | | | | | | | | | | |
| **Measuring range absolute** | | rpm | 4096 | | | | | | | |
| **Positioning resolution per revolution** | | Inc. | 16384 | | | | | | | |
| **Accuracy of positioning sensor** | | ° | ±0.05 | | | | | | | |

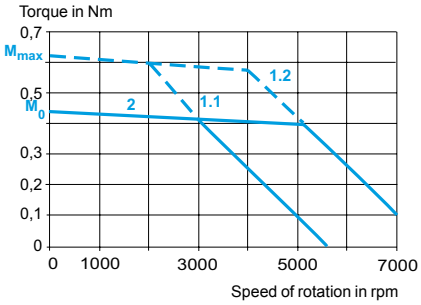
*(1) Max. 2.5 s*
*(2) At 20 rpm; at 0 rpm the continuous torque is reduced to 89% of the specified value*
*(3) Point of application of radial force: 10 mm distance to flange*
*(4) Operating hours at a probability of failure of 10%; conditions for shaft load: speed 4000 rpm, 100% duty cycle at continuous torque, ambient temperature 40 °C*
*(5) Holding brake and multiturn encoder cannot be used in combination.*

## Torque characteristics

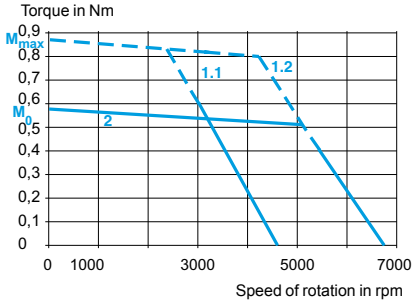
**ILA2●571T (winding type T)**



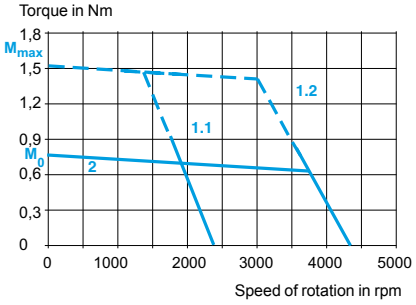

**ILA2●571P (winding type P)**




**ILA2●572T (winding type T)**




**ILA2●572P (winding type P)**




1.1 Max. torque at 24 V
1.2 Max. torque at 48 V
2 Continuous torque

# Lexium integrated drives

## IL●2 for DeviceNet, EtherCAT, Modbus TCP, Ethernet Powerlink

### ILA2 with AC synchronous servo motor

## References

| Example: | I | L | A | 2 | D | 5 | 7 | 1 | P | B | 1 | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Motor type**<br>**A** = AC synchronous servo motor | I | L | **A** | 2 | D | 5 | 7 | 1 | P | B | 1 | A |
| **Supply voltage**<br>**2** = 24 ... 48 V | I | L | A | **2** | D | 5 | 7 | 1 | P | B | 1 | A |
| **Communication interface**<br>**D** = DeviceNet<br>**E** = EtherCAT<br>**P** = Ethernet Powerlink<br>**T** = Modbus TCP | I | L | A | 2 | **D** | 5 | 7 | 1 | P | B | 1 | A |
| **Flange size**<br>**57** = 57 mm | I | L | A | 2 | D | **5** | **7** | 1 | P | B | 1 | A |
| **Motor length ("L")** *(1)*<br>**1** = motor length ("L")<br>**2** = motor length ("L") | I | L | A | 2 | D | 5 | 7 | **1** | P | B | 1 | A |
| **Winding type**<br>**P** = medium speed of rotation, medium torque<br>**T** = high speed of rotation, medium torque | I | L | A | 2 | D | 5 | 7 | 1 | **P** | B | 1 | A |
| **Connection technology**<br>**B** = printed circuit board connector<br>**C** = industrial connector | I | L | A | 2 | D | 5 | 7 | 1 | P | **B** | 1 | A |
| **Measurement system**<br>**1** = singleturn encoder<br>**2** = multiturn encoder *(2)* | I | L | A | 2 | D | 5 | 7 | 1 | P | B | **1** | A |
| **Holding brake**<br>**A** = no holding brake<br>**F** = with holding brake *(2)* | I | L | A | 2 | D | 5 | 7 | 1 | P | B | 1 | **A** |

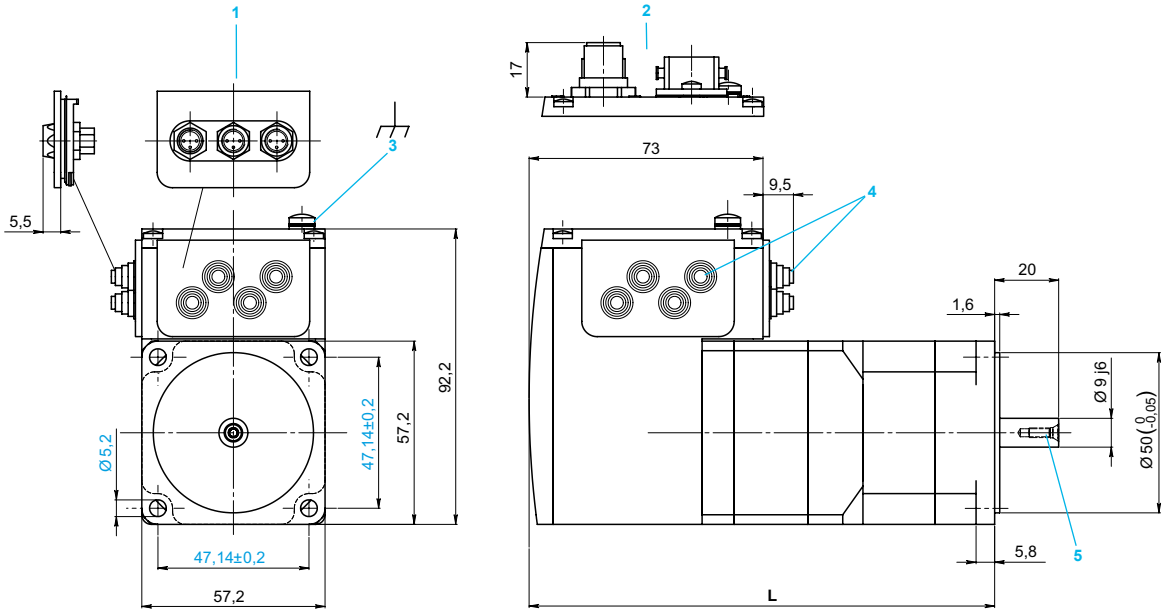
*(1) The motor length "L" depends on the mechanical characteristics, see pages 4/51 and 4/53.*
*(2) Holding brake and multiturn encoder cannot be used in combination.*

# Lexium integrated drives

IL●2 for DeviceNet, EtherCAT, Modbus TCP, Ethernet Powerlink

ILA2 with AC synchronous servo motor

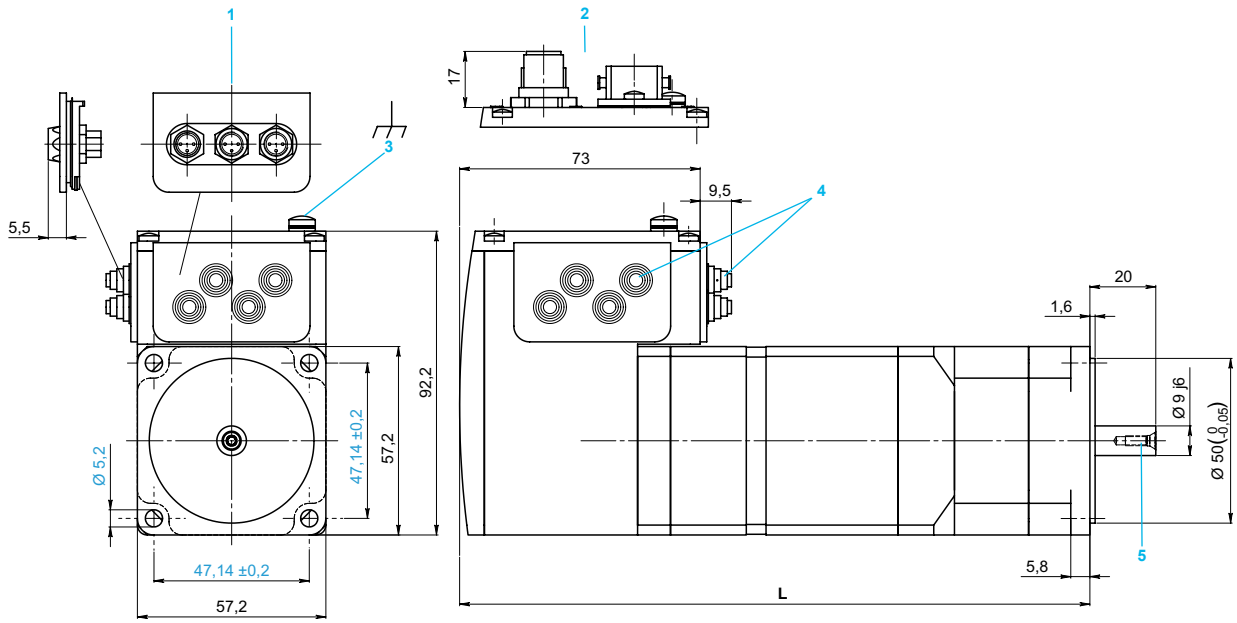
## ILA2 integrated drives without holding brake




| | L (without multiturn encoder) | L (with multiturn encoder) |
|---|---|---|
| **ILA2●571** | 145.3 | 189.3 |
| **ILA2●572** | 163.8 | 207.8 |

1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm
5 Centring hole DIN 332 - DS M3

## ILA2 integrated drives with holding brake




| | L |
|---|---|
| **ILA2●571** | 190.8 |
| **ILA2●572** | 209.3 |

1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm
5 Centring hole DIN 332 - DS M3

# Lexium integrated drives

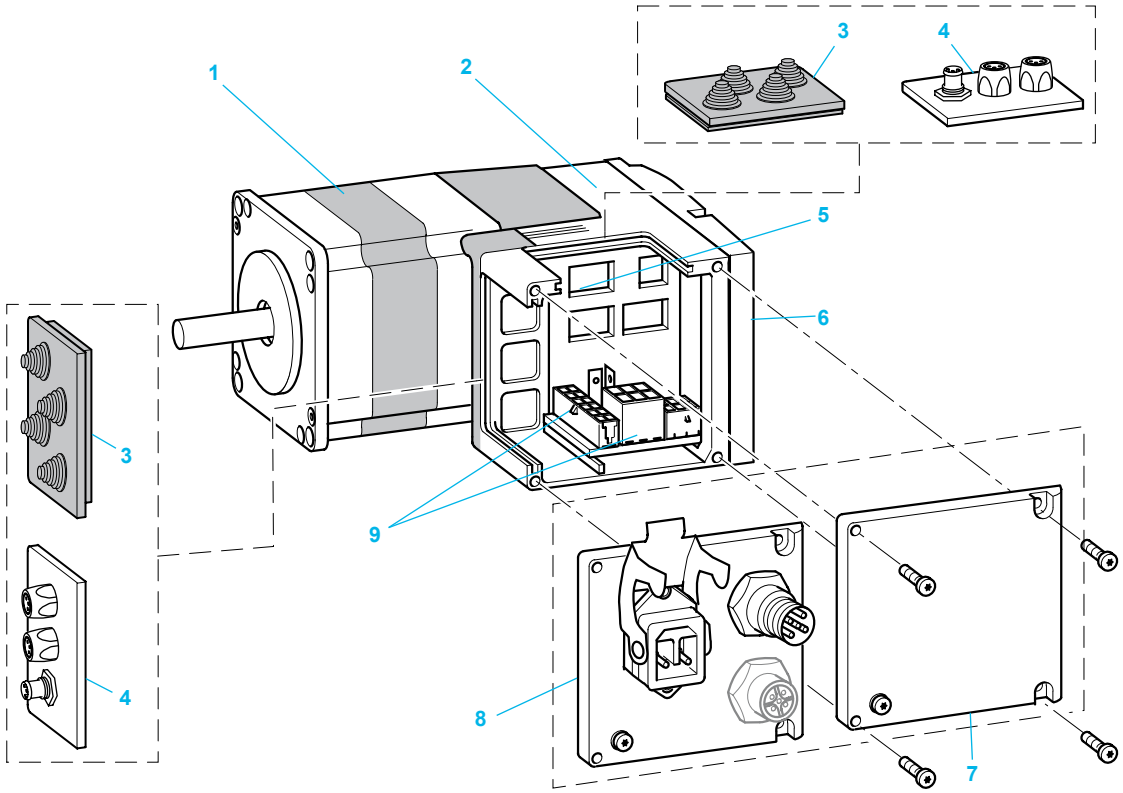
## IL●2 for DeviceNet, EtherCAT, Modbus TCP, Ethernet Powerlink

### ILE2 with brushless DC motor



## Description

ILE2 comprise control electronics with a fieldbus interface for DeviceNet, EtherCAT, Modbus TCP or Ethernet Powerlink and a brushless DC motor. ILE2 is optionally available with straight teeth gear or worm drive and printed circuit board connectors or industrial connectors.




1 Brushless DC motor
2 Electronics housing
3 Insert cable entry (accessory)
4 I/O insert with industrial connectors (accessory)
5 Settings via parameter switches
6 Cover for electronics housing
7 Cover for Lexium integrated drives with option “PCB connector"
8 Cover for supply voltage ⎓ V and fieldbus connection for Lexium integrated drives with option “industrial connector”
9 Electrical interfaces

# Lexium integrated drives

## IL●2 for DeviceNet, EtherCAT, Modbus TCP, Ethernet Powerlink

### ILE2 with brushless DC motor



## Certifications

| | | | |
|---|---|---|---|
| **Conformity to standards** | | | Lexium integrated drives have been developed to comply with the stringent international standards and with the recommendations for adjustable speed power drive systems, specifically: IEC/EN 61800-3 (noise immunity to conducted and radiated high-frequency signals) and IEC/EN 50178 (resistance of devices to vibration). |
| | EMC immunity | | EN 61800-3:2001, second environment |
| | Conducted and radiated EMC emissions | | EN 61800-3:2001-02; IEC 61800-3, Ed.2<br>■ Power supplies without external mains filter:<br>□ C3 up to 10 m supply cable length<br>■ Power supplies with external mains filter:<br>□ C2 up to 20 m supply cable length<br>□ C3 up to 50 m supply cable length |
| **CE marking** | | | The Lexium integrated drives are CE marked in accordance with the European Machinery Directive (98/37/EEC) and the European EMC Directive (2004/108/EEC). |
| **Product certifications** | | | UL (USA), cUL (Canada) |
| | | | TÜV certification: Lexium integrated drives are TÜV-certified for device safety and medical devices. The certification includes:<br>■ Functional safety of electrical/electronic/programmable safety-related electronic systems (IEC 61508:2000; SIL 2)<br>■ Safety of machinery – functional safety of safety-related electrical and electronic and programmable electronic control systems (IEC 62061:2005; SILcl2)<br>■ Safety of machinery – safety-related parts of control systems – Part 1: General principles for design (ISO 13849-1:2006; PL d (Category 3)) |

## Ambient conditions

| | | | |
|---|---|---|---|
| **Ambient temperature** *(1)* | | **°C** | 0 ... 55; power reduction by 2%/°C at 40 ... 55 |
| **Max. permissible temperature of the power amplifier** | | **°C** | 105 |
| **Max. permissible temperature of the motor** *(2)* | | **°C** | 110 |
| **Transport and storage temperature** | | **°C** | -25 ... +70 |
| **Installation height without power reduction** | | **m** | < 1000 m above mean sea level |
| **Relative humidity** | | **%** | 15 ... 85 (not condensing) |
| **Vibration load during operation as per DIN EN 60068-2-6** | Number of cycles | | 10 |
| | Acceleration amplitude: | **m/s²** | 20 |
| | Frequency range | **Hz** | 10 ... 500 |
| **Continuous shocks as per DIN EN 60068-2-29** | Number of shocks | | 1000 |
| | Peak acceleration | **m/s²** | 150 |
| **Shaft wobble and perpendicularity** | | | According to EN 50347 (IEC 60072-1) |
| **Degree of protection as per DIN EN 60034-5** | | | Total except shaft bushing IP54, shaft bushing IP41 |

## Electrical data

| | | | |
|---|---|---|---|
| **Supply voltage (CN1)** | | | Corresponds to PELV according to DIN 19240, protected against reverse polarity |
| **Supply voltage range (absolute limit values)** | | ⎓ **V** | 18 ... 55.2 |
| **Nominal supply voltage** | | ⎓ **V** | 24 / 48 |
| **Ripple at nominal voltage** | | $V_{PP}$ | ≤ 3.6 |
| **Max. continuous current consumption** | | **A** | 5,5 |
| **Peak current consumption** | | **A** | 7 |
| **Inrush current** | | | Charging current for capacitor C=1500 µF |
| **External fuse** | | **A** | 16 |
| **Fieldbus interface (CN2)** | | | |
| **DeviceNet** | Signal inputs/outputs | | According to OVDA, galvanic isolation |
| | Transmission rate | **kBaud** | 125 / 250 / 500 |
| | Transmission protocol | | DeviceNet Position Controller Profile |
| **EtherCAT** | Signal inputs/outputs | | According to IEEE 802.3 standard, no galvanic isolation |
| | Transmission rate | **MBit** | 100 |
| | Transmission protocol | | EtherCAT |
| **Modbus TCP** | Signal inputs/outputs | | According to IEEE 802.3 standard, no galvanic isolation |
| | Transmission rate | **MBit** | 10 / 100 |
| | Transmission protocol | | Modbus TCP |
| **Ethernet Powerlink** | Signal inputs/outputs | | According to IEEE 802.3 standard, no galvanic isolation |
| | Transmission rate | **MBit** | 100 |
| | Transmission protocol | | Ethernet Powerlink |

*(1) Limit values with flanged motor mounted on a steel plate 300 x 300 x 10 mm*
*(2) Measured at the surface*

## Electrical data

| | | | |
|---|---|---|---|
| **RS 485 commissioning interface (CN3)** | | | |
| **RS 485** | Signal inputs/outputs | | According to RS 485, no galvanic isolation, 2-wire |
| | Transmission rate | **kBaud** | 9.6 / 19.2 / 38.4 |
| | Transmission protocol | | Modbus TCP |
| **24 V signal interface (CN4)** | | | 4 signals, can each be used as input or output |
| **24 V signal inputs** | | | Galvanically connected to 0VDC, protected against reverse polarity |
| **Logic 0 ($U_{low}$)** | | **V** | -3 ... +4.5 |
| **Logic 1 ($U_{high}$)** | | **V** | +15 ... +30 |
| **Input current (typical at 24 V)** | | **mA** | 2 |
| **Debounce time LIO1 ... LIO4** | | **ms** | 1.25 ... 1.5 |
| **24 V signal outputs** | | | Switching to plus, short-circuit protected, suitable for inductive load (1000 mH / 100 mA) |
| **Supply voltage range** | | **⎓ V** | 23 ... 25 |
| **Max. switching current (total)** | | **mA** | 200 |
| **Max. switching current per output** | | **mA** | 100 |
| | | | The internal power supply unit is protected against:<br>■ Short circuit of the output voltage<br>■ Overload of output voltage (limited to 6 W output power) |
| **Interface for safety function "Safe Torque Off" ("Power Removal") (CN5)** | | | No galvanic isolation; corresponds to RS 485 standard |
| **Logic 0 ($U_{low}$)** | | **V** | -3 ... +4.5 |
| **Logic 1 ($U_{high}$)** | | **V** | +15 ... +30 |
| **Input current (typical at 24 V)** | $\overline{STO\_A}$ | **mA** | ≤ 10 |
| | $\overline{STO\_B}$ | **mA** | ≤ 3 |
| **Debounce time** | | **ms** | 1 |
| **Response time (until shutdown of power amplifier)** | | **ms** | < 50 |
| **Max. Time offset until detection of signal differences between $\overline{STO\_A}$ and $\overline{STO\_B}$** | | **S** | < 1 |

## Safety function "Safe Torque Off" ("Power Removal")

| | | | |
|---|---|---|---|
| **Protection** | Of machine | | "Safe Torque Off" safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard ISO 13849-1, performance level "d" (PL d) , and standard IEC/EN 61800-5-2 |
| | Of the system process | | "Safe Torque Off" safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard IEC/EN 61508 level SIL2 and standard IEC/EN 61800-5-2 |

## Mechanical data of ILE2 without gear

| **Type of integrated drive** | | | **ILE2●661** | | **ILE2●662** | |
|---|---|---|---|---|---|---|
| **Nominal supply voltage** | | **⎓ V** | **24** | **48** | **24** | **48** |
| **Nominal current** | | **A** | 6.8 | 3.8 | 9.5 | 7 |
| **Nominal speed of rotation** | | **rpm** | 4800 | 6000 | 3100 | 5000 |
| **Nominal output power** | | **W** | 131 | 163 | 162 | 262 |
| **Nominal torque** | | **Nm** | 0.26 | | 0.5 | |
| **Max. torque** | $M_{max}$ | **Nm** | 0.43 | | 0.8 | |
| **Max. current with power stage disabled** | | **A** | 0.1 | | | |
| **Detent torque (at zero current)** | | **Nm** | 0.08 | | 0.106 | |
| **Moment of inertia** | | **kg·cm²** | 0.17 | | 0.34 | |
| **Max. speed of rotation** | | **rpm** | 6500 | 7000 | 5000 | 7000 |
| **Positioning resolution per revolution** | | **Inc.** | 12 | | | |
| **Accuracy of positioning sensor** | | **°** | ±0.5 | | | |
| **Mass** | | **kg** | 1.4 | | 1.75 | |
| **Shaft load** | Max. radial force *(1)* | **N** | 80 | | | |
| | Max. axial tensile force | **N** | 30 | | | |
| | Max. axial force pressure | **N** | 30 | | | |
| | Nominal bearing service life *(2)* | **h** | 20000 | | | |

*(1) Point of application of radial force: 12.5 mm distance to flange*
*(2) Operating hours at a probability of failure of 10 %*

## Mechanical data of ILE2●661 with straight teeth gear

| | | | G1 | | G2 | | G3 | | G4 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Ratio** | | | 18:1 (160:9) | | 38:1 (75:2) | | 54:1 (490:9) | | 115:1 (3675:32) | |
| **Number of gear stages** | | | 3 | | 3 | | 4 | | 4 | |
| **Nominal supply voltage** | | ⎓ V | 24 | 48 | 24 | 48 | 24 | 48 | 24 | 48 |
| **Nominal current** | | A | 6.8 | 3.8 | 6.8 | 3.8 | 6.8 | 3.8 | 6.8 | 3.8 |
| **Nominal speed of rotation of motor** | | rpm | 4000 | 5000 | 4000 | 5000 | 4000 | 5000 | 4000 | 5000 |
| **Nominal output speed of rotation** | | rpm | 225 | 281 | 107 | 133 | 73 | 92 | 35 | 44 |
| **Nominal output torque** | | Nm | 3.5 | | 7,3 | | 10 | | 12 | |
| **Nominal output power** | | W | 95 | 119 | 95 | 119 | 90 | 112 | 54 | 68 |
| **Max. current with power stage disabled** | | A | 0.1 | | | | | | | |
| **Detent torque (at zero current)** | | Nm | 1.42 | | 3.00 | | 4.36 | | 9.19 | |
| **Moment of inertia output** | | kg·cm² | 48 | | 211 | | 441 | | 1962 | |
| **Max. speed of rotation** | | rpm | 281 | | 133 | | 92 | | 44 | |
| **Positioning resolution of motor per revolution** | | Inc. | 12 | | | | | | | |
| **Positioning accuracy motor** | | Inc. | ±0.5 | | | | | | | |
| **Positioning resolution of output** | | ° | 1.667 | | 0.8 | | 0.55 | | 0.26 | |
| **Torsional backlash** | | ° | ≤1 | | | | | | | |
| **Mass** | | kg | 1.85 | | | | | | | |
| **Shaft load (short-term operation)** | Max. radial force *(1)* | N | 200 | | | | | | | |
| | Max. axial force | N | 80 | | | | | | | |
| | Nominal bearing service life *(2)* | h | 2500 | | | | | | | |
| **Shaft load (long-term operation)** | Max. radial force *(1)* | N | 200 | | | | | | | |
| | Max. axial force | N | 10 | | | | | | | |
| | Nominal bearing service life *(2)* | h | 15000 | | 15000 | | 15000 *(3)* | | 15000 *(4)* | |

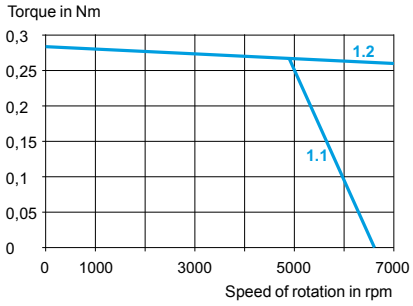
## Mechanical data of ILE2●661 with worm gear

| | | | G5 | | G6 | | G7 | | G8 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Ratio** | | | 24:1 (525:22) | | 54:1 (1715:32) | | 92:1 (735:5) | | 115:1 (3675:32) | |
| **Number of gear stages** | | | 2 | | 3 | | 3 | | 3 | |
| **Nominal supply voltage** | | ⎓ V | 24 | 48 | 24 | 48 | 24 | 48 | 24 | 48 |
| **Nominal current** | | A | 6.8 | 3.8 | 6.8 | 2.7 | 6.8 | 2.6 | 6.8 | 2.9 |
| **Nominal speed of rotation of motor** | | rpm | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| **Nominal output speed of rotation** | | rpm | 168 | | 75 | | 44 | | 35 | |
| **Nominal output torque** | | Nm | 3.8 | | 6.0 | | 9.2 | | 10.6 | |
| **Nominal output power** | | W | 45 | 66 | 45 | 47 | 41 | 42 | 37 | 39 |
| **Max. current with power stage disabled** | | A | 0.1 | | | | | | | |
| **Detent torque (at zero current)** | | Nm | 2.9 | | 6.5 | | 12.3 | | 16.7 | |
| **Moment of inertia output** | | kg·cm² | 90 | | 430 | | 1270 | | 1980 | |
| **Max. speed of rotation** | | rpm | 186 | | 93 | | 54 | | 44 | |
| **Positioning resolution of motor per revolution** | | Inc. | 12 | | | | | | | |
| **Positioning accuracy motor** | | Inc. | ±1 | | | | | | | |
| **Positioning resolution of output** | | ° | 1.26 | | 0.56 | | 0.33 | | 0.26 | |
| **Torsional backlash** | | ° | ≤ 1.5 | | ≤ 1.0 | | ≤ 1.0 | | ≤ 1.0 | |
| **Mass** | | kg | 2.3 | | | | | | | |
| **Shaft load** | Max. radial force *(1)* | N | 200 | | | | | | | |
| | Max. axial force | N | 80 | | | | | | | |
| | Nominal bearing service life *(2)* | h | 3000 | | 6000 | | 9000 | | 9000 | |

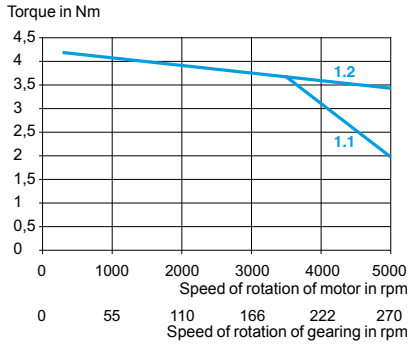
*(1) Point of application of radial force: 12.5 mm distance to flange*
*(2) Operating hours at a probability of failure of 10%*
*(3) With reduced nominal output torque = 6 Nm; 2500 h at maximum torque*
*(4) With reduced nominal output torque = 8 Nm; 2500 h at maximum torque*

## Torque characteristics ILE2●66

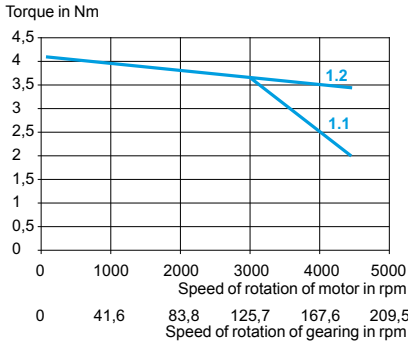
### ILE2●661 without gearing



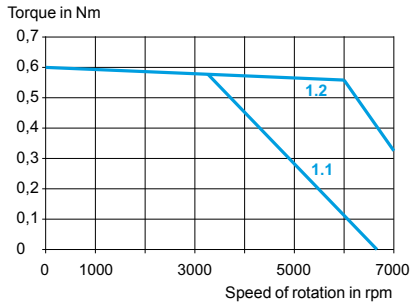

### ILE2●661 with straight teeth gear G1



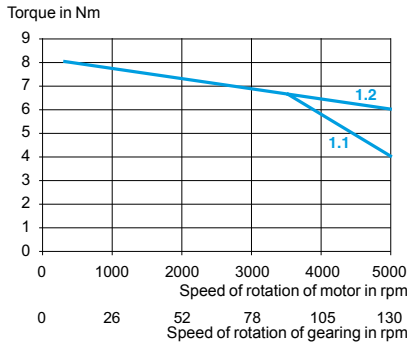

### ILE2●661 with worm gear G5



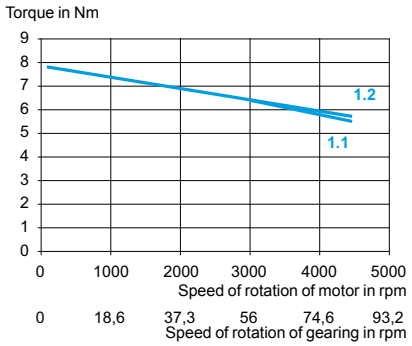

### ILE2p662 without gearing



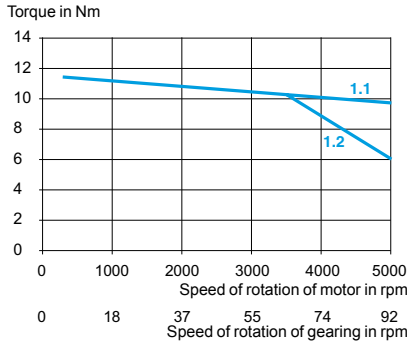

### ILE2●661 with straight teeth gear G2



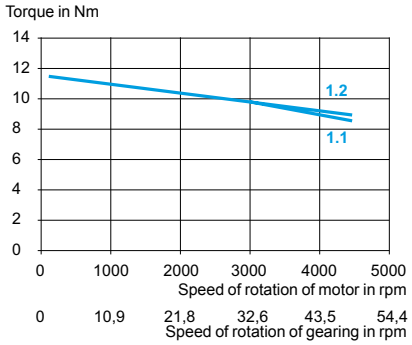

### ILE2●661 with worm gear G6



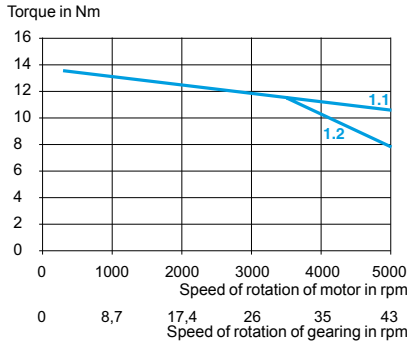

### ILE2●661 with straight teeth gear G3



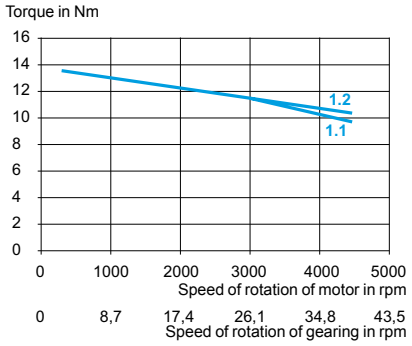

### ILE2●661 with worm gear G7




### ILE2●661 with straight teeth gear G4




### ILE2●661 with worm gear G8




1.1 Max. torque at 24 V
1.2 Max. torque at 48 V

# Lexium integrated drives

## IL●2 for DeviceNet, EtherCAT, Modbus TCP, Ethernet Powerlink

### ILE2 with brushless DC motor

## References

| Example: | I | L | E | 2 | D | 6 | 6 | 1 | P | B | 1 | A | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Motor type**<br>**E** = brushless DC motor | I | L | **E** | 2 | D | 6 | 6 | 1 | P | B | 1 | A | 1 |
| **Supply voltage**<br>**2** = 24 ... 48 V | I | L | E | **2** | D | 6 | 6 | 1 | P | B | 1 | A | 1 |
| **Communication interface**<br>**D** = DeviceNet<br>**E** = EtherCAT<br>**P** = Ethernet Powerlink<br>**T** = Modbus TCP | I | L | E | 2 | **D** | 6 | 6 | 1 | P | B | 1 | A | 1 |
| **Flange size**<br>**66** = 66 mm | I | L | E | 2 | D | **6** | **6** | 1 | P | B | 1 | A | 1 |
| **Motor length ("L")** *(1)*<br>**1** = motor length ("L")<br>**2** = motor length ("L") | I | L | E | 2 | D | 6 | 6 | **1** | P | B | 1 | A | 1 |
| **Winding type**<br>**P** = medium speed of rotation, medium torque | I | L | E | 2 | D | 6 | 6 | 1 | **P** | B | 1 | A | 1 |
| **Connection technology**<br>**B** = printed circuit board connector<br>**C** = industrial connector | I | L | E | 2 | D | 6 | 6 | 1 | P | **B** | 1 | A | 1 |
| **Measurement system**<br>**1** = BLDC encoder | I | L | E | 2 | D | 6 | 6 | 1 | P | B | **1** | A | 1 |
| **Holding brake**<br>**A** = no holding brake | I | L | E | 2 | D | 6 | 6 | 1 | P | B | 1 | **A** | 1 |
| **Gearing** *(2) (3)*<br>Straight teeth gear<br>**1** = ratio 18:1 (160:9)<br>**2** = ratio 38:1 (75:2)<br>3 = ratio 54:1 (490:9)<br>4 = ratio 115:1 (3675:32)<br><br>Worm gear<br>**5** = ratio 24:1 (525:22)<br>**6** = ratio 54:1 (1715:32)<br>**7** = ratio 92:1 (735:5)<br>**8** = ratio 115:1 (3675:32) | I | L | E | 2 | D | 6 | 6 | 1 | P | B | 1 | A | **1** |

*(1) The motor length "L" depends on the mechanical characteristics, see pages 4/56, 4/57, 4/60 and 4/61.*
*(2) Gearing only with ILE2●661.*
*(3) Without gearing: leave out gearing identification in order code (specify 12 characters only).*

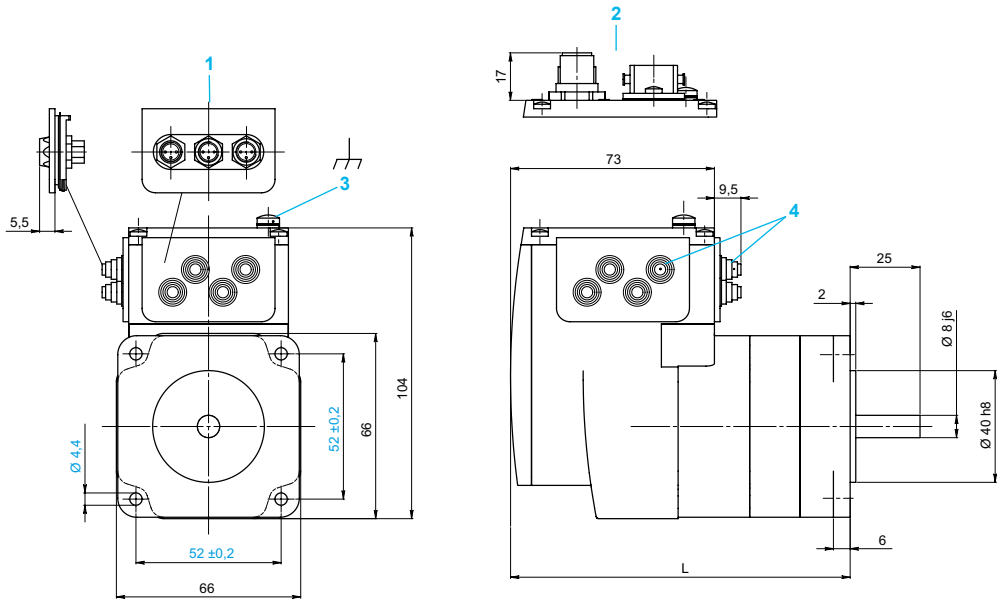
# Lexium integrated drives

IL●2 for DeviceNet, EtherCAT, Modbus TCP, Ethernet Powerlink

ILE2 with brushless DC motor



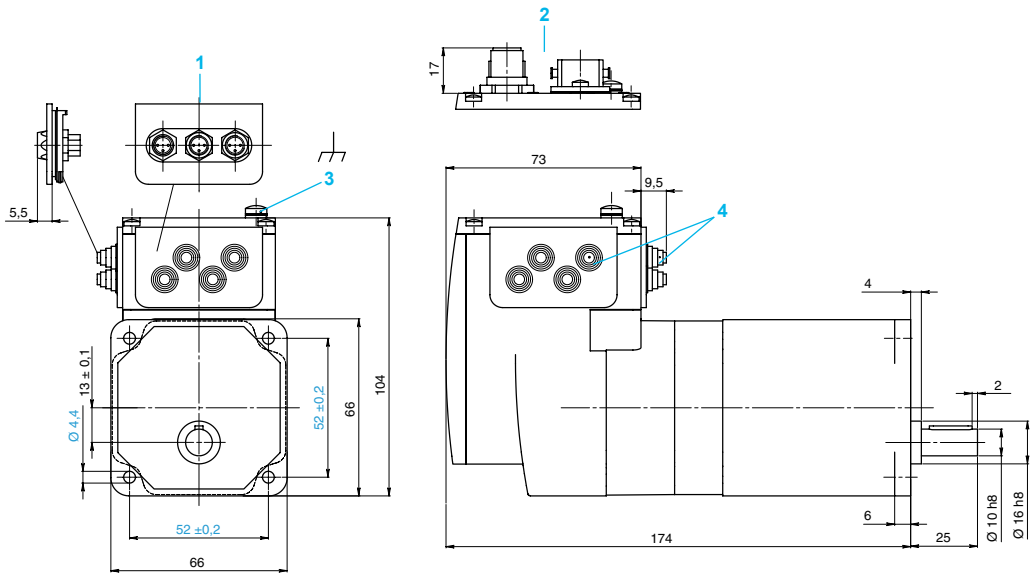
## ILE2 integrated drives without gearing




| | L |
|---|---|
| **ILE2●661** | 122 |
| **ILE2●662** | 140 |

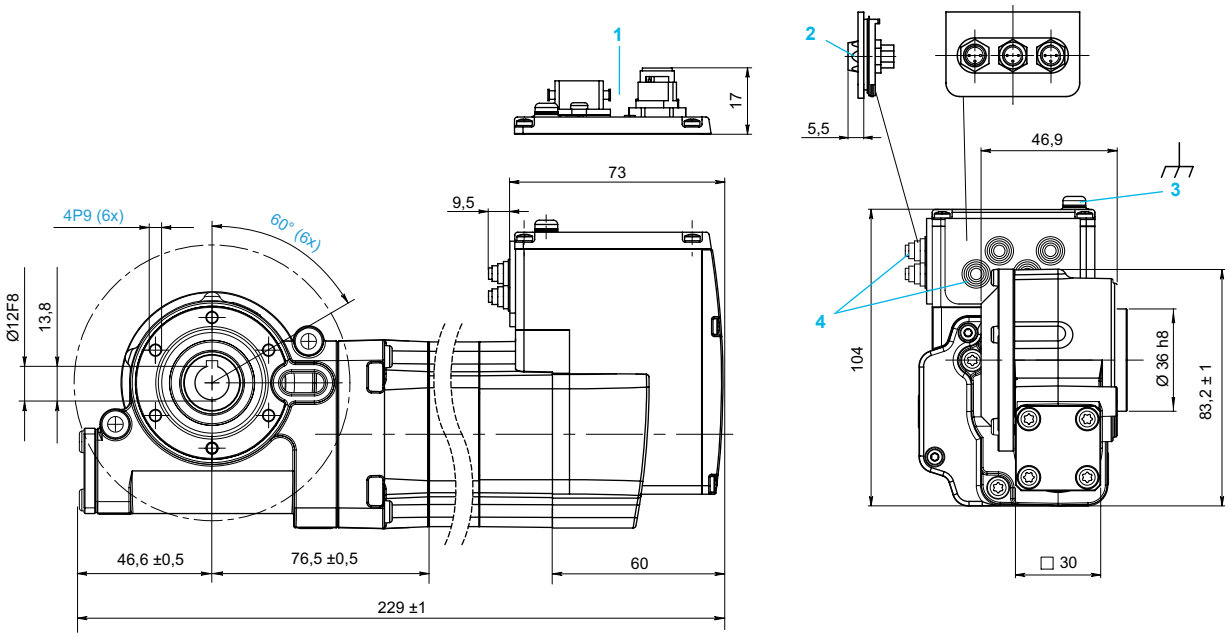
1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm

## ILE2 integrated drives with straight teeth gear




1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm

## ILE2 integrated drives with worm gear




1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm

# Lexium integrated drives

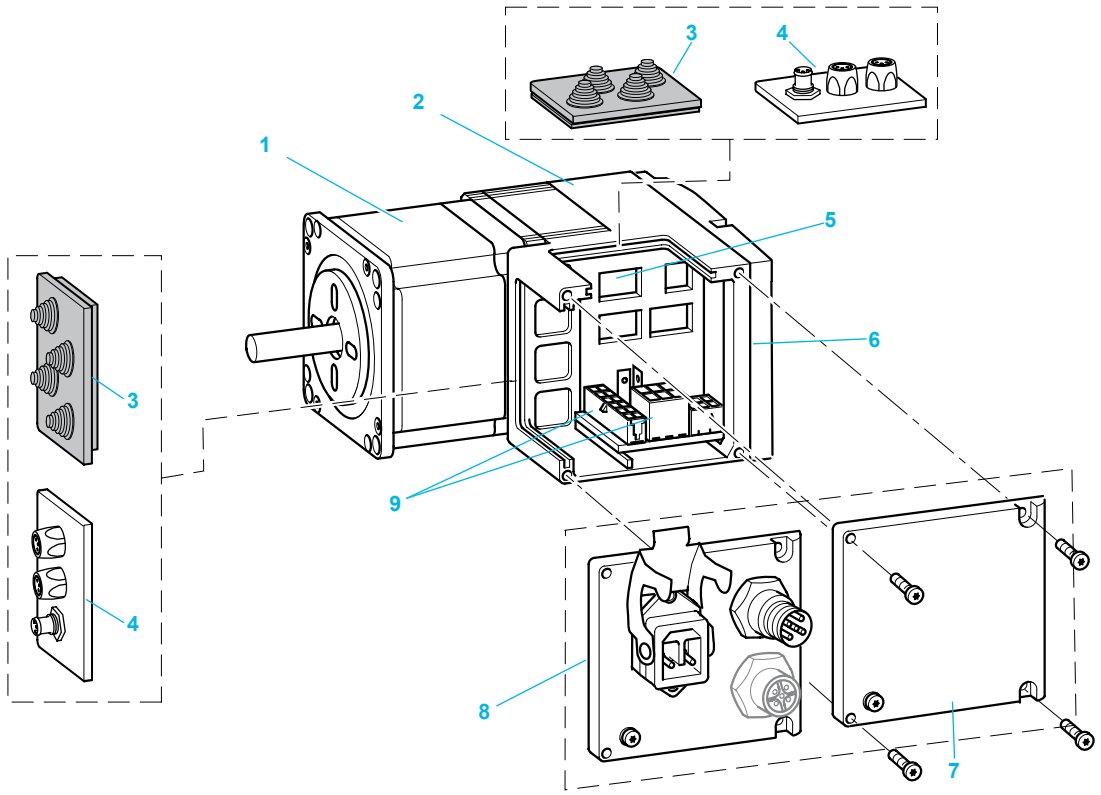
## IL●2 for DeviceNet, EtherCAT, Modbus TCP, Ethernet Powerlink

### ILS2 with 3-phase stepper motor



## Description

ILS2 comprise control electronics with a fieldbus interface for DeviceNet, EtherCAT, Modbus TCP or Ethernet Powerlink and a 3-phase stepper motor. ILS2 is optionally available with printed circuit board connectors or industrial connectors. A holding brake is optionally available for ILS2●85.




1 3-phase stepper motor
2 Electronics housing
3 Insert cable entry (accessory)
4 Insert with industrial connectors (accessory)
5 Settings via parameter switches
6 Cover for electronics housing
7 Cover for Lexium integrated drives with option “PCB connector"
8 Cover for supply voltage ⎓ V and fieldbus connection for Lexium integrated drives with option “industrial connector”
9 Electrical interfaces

# Lexium integrated drives

## IL●2 for DeviceNet, EtherCAT, Modbus TCP, Ethernet Powerlink

## ILS2 with 3-phase stepper motor

### Certifications

| | | | |
|---|---|---|---|
| **Conformity to standards** | | | Lexium integrated drives have been developed to comply with the stringent international standards and with the recommendations for adjustable speed power drive systems, specifically: IEC/EN 61800-3 (noise immunity to conducted and radiated high-frequency signals) and IEC/EN 50178 (resistance of devices to vibration). |
| | EMC immunity | | EN 61800-3:2001, second environment |
| | Conducted and radiated EMC emissions | | EN 61800-3:2001-02; IEC 61800-3, Ed.2<br>■ Power supplies without external mains filter:<br>□ C3 up to 10 m supply cable length<br>■ Power supplies with external mains filter:<br>□ C2 up to 20 m supply cable length<br>□ C3 up to 50 m supply cable length |
| **CE marking** | | | The Lexium integrated drives are CE marked in accordance with the European Machinery Directive (98/37/EEC) and the European EMC Directive (2004/108/EEC). |
| **Product certifications** | | | UL (USA), cUL (Canada) |
| | | | TÜV certification: Lexium integrated drives are TÜV-certified for device safety and medical devices. The certification includes:<br>■ Functional safety of electrical/electronic/programmable safety-related electronic systems (IEC 61508:2000; SIL 2)<br>■ Safety of machinery – functional safety of safety-related electrical and electronic and programmable electronic control systems (IEC 62061:2005; SILcl2)<br>■ Safety of machinery – safety-related parts of control systems – Part 1: General principles for design (ISO 13849-1:2006; PL d (Category 3)) |

### Ambient conditions

| | | | |
|---|---|---|---|
| **Ambient temperature** *(1)* | | **°C** | 0 ... 55; power reduction by 2%/°C at 40 ... 55 |
| **Max. permissible temperature of the power amplifier** | | **°C** | 105 |
| **Max. permissible temperature of the motor** *(2)* | | **°C** | 110 |
| **Transport and storage temperature** | | **°C** | -25 ... +70 |
| **Installation height without power reduction** | | **m** | < 1000 m above mean sea level |
| **Relative humidity** | | **%** | 15 ... 85 (not condensing) |
| **Vibration load during operation as per DIN EN 60068-2-6** | Number of cycles | | 10 |
| | Acceleration amplitude: | **m/s²** | 20 |
| | Frequency range | **Hz** | 10 ... 500 |
| **Continuous shocks as per DIN EN 60068-2-29** | Number of shocks | | 1000 |
| | Peak acceleration | **m/s²** | 150 |
| **Shaft wobble and perpendicularity** | | | According to EN 50347 (IEC 60072-1) |
| **Degree of protection as per DIN EN 60034-5** | | | Total except shaft bushing IP54, shaft bushing IP41 |

### Electrical data

| | | | |
|---|---|---|---|
| **Supply voltage (CN1)** | | | Corresponds to PELV according to DIN 19240, protected against reverse polarity |
| **Supply voltage range (absolute limit values)** | | ⎓ **V** | 18 ... 55 |
| **Nominal supply voltage** | | ⎓ **V** | 24 / 48 |
| **Ripple at nominal voltage** | | $V_{PP}$ | ≤ 3.6 |
| **Max. current consumption** | ILS2●57 | **A** | 3.5 |
| | ILS2●851, ILS2●852 | **A** | 5 |
| | ILS2●853: | | |
| | ■ Winding type P | **A** | 5 |
| | ■ Winding type T | **A** | 6 |
| **External fuse** | | **A** | 16 |
| **Fieldbus interface (CN2)** | | | |
| **DeviceNet** | Signal inputs/outputs | | According to ODVA, galvanic isolation |
| | Transmission rate | **kBaud** | 125 / 250 / 500 |
| | Transmission protocol | | DeviceNet Position Controller Profile |
| **EtherCAT** | Signal inputs/outputs | | According to IEEE 802.3 standard, galvanic isolation |
| | Transmission rate | **MBit** | 100 |
| | Transmission protocol | | EtherCAT |
| **Modbus TCP** | Signal inputs/outputs | | According to IEEE 802.3 standard, galvanic isolation |
| | Transmission rate | **MBit** | 10 / 100 |
| | Transmission protocol | | Modbus TCP |
| **Ethernet Powerlink** | Signal inputs/outputs | | According to IEEE 802.3 standard, galvanic isolation |
| | Transmission rate | **MBit** | 100 |
| | Transmission protocol | | Ethernet Powerlink |

*(1) Limit values with flanged motor mounted on a steel plate 300 x 300 x 10 mm*
*(2) Measured at the surface*

## Electrical data

| | | | |
|---|---|---|---|
| **RS 485 commissioning interface (CN3)** | | | |
| **RS 485** | Signal inputs/outputs | | According to RS 485, no galvanic isolation, 2-wire |
| | Transmission rate | **kBaud** | 9.6 / 19.2 / 38.4 |
| | Transmission protocol | | Modbus TCP |
| **24 V signal interface (CN4)** | | | 4 signals, can each be used as input or output |
| **24 V signal inputs** | | | Galvanically connected to 0VDC, protected against reverse polarity |
| **Logic 0 ($U_{low}$)** | | **V** | -3 ... +4.5 |
| **Logic 1 ($U_{high}$)** | | **V** | +15 ... +30 |
| **Input current (typical at 24 V)** | | **mA** | 2 |
| **Debounce time** | IO0 ... IO3 | **ms** | 1.25 ... 1.5 |
| | IO0 and IO1 *(1)* | **ms** | 0.01 |
| **Jitter** | IO0 and IO1 *(1)* | **µs** | < 2 |
| **24 V signal outputs** | | | Switching to plus, short-circuit protected, suitable for inductive load (1000 mH / 100 mA) |
| **Supply voltage range** | | ⎓ **V** | 23 ... 25 |
| **Max. switching current (total)** | | **mA** | 200 |
| **Max. switching current per output** | | **mA** | 100 |
| **Voltage drop at 50 mA load** | | **V** | ≤ 1 |
| | | | The internal power supply unit is protected against:<br>■ Short circuit of the output voltage<br>■ Overload of output voltage (limited to 6 W output power) |
| **Interface for safety function "Safe Torque Off" ("Power Removal") (CN5)** | | | No galvanic isolation; corresponds to RS 485 standard |
| **Logic 0 ($U_{low}$)** | | **V** | -3 ... +4.5 |
| **Logic 1 ($U_{high}$)** | | **V** | +15 ... +30 |
| **Input current (typical at 24 V)** | | **mA** | 10 |
| **Debounce time** | | **ms** | 1 |
| **Response time (until shutdown of power amplifier)** | | **ms** | < 50 |
| **Max. Time offset until detection of signal differences between $\overline{STO\_A}$ and $\overline{STO\_B}$** | | **S** | < 1 |

## Safety function "Safe Torque Off" ("Power Removal")

| | | | |
|---|---|---|---|
| **Protection** | Of machine | | "Safe Torque Off" safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard ISO 13849-1, performance level "d" (PL d) , and standard IEC/EN 61800-5-2 |
| | Of the system process | | "Safe Torque Off" safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard IEC/EN 61508 level SIL2 and standard IEC/EN 61800-5-2 |

*(1) When the "Fast position capture" function is used*

## Mechanical data ILS2●57

| Type of integrated drive | | | ILS2●571 | ILS2●572 | ILS2●573 |
|---|---|---|---|---|---|
| **Winding type** | | | P | P | P |
| **Max. torque** | | **Nm** | 0.45 | 0.9 | 1.5 |
| **Holding torque** | | **Nm** | 0.45 | 0.9 | 1.5 |
| **Moment of inertia** | | **kg·cm²** | 0.1 | 0.22 | 0.38 |
| **Positioning resolution per revolution** | | **Inc.** | 20000 | | |
| **Systematic angle tolerance per step** *(1)* | | **arcmin** | ±6 | | |
| **Mass** | | **kg** | 1.3 | 1.6 | 2.0 |
| **Shaft load** *(2)* | Max. radial force *(3)* | **N** | 24 | 24 | 50 |
| | Max. axial tensile force | **N** | 100 | | |
| | Max. axial force pressure | **N** | 8.4 | | |
| | Nominal bearing service life *(4)* | **h** | 20000 | | |

## Mechanical data ILS2●85

| Type of integrated drive | | | ILS2●851 | ILS2●852 | ILS2●853 | |
|---|---|---|---|---|---|---|
| **Winding type** | | | P | P | P | T |
| **Max. torque** | | **Nm** | 2.0 | 4.0 | 6.0 | 4.5 |
| **Holding torque** | | **Nm** | 2.0 | 4.0 | 6.0 | 4.5 |
| **Moment of inertia** | | **kg·cm²** | 1.1 | 2.2 | 3.3 | |
| **Positioning resolution** | | **Inc.** | 20000 | | | |
| **Systematic angle tolerance per step** *(1)* | | **arcmin** | ±6 | | | |
| **Mass** | | **kg** | 2.6 | 3.6 | 4.7 | |
| **Shaft load** *(2)* | Max. radial force *(3)* | **N** | 100 | 100 | 110 | |
| | Max. axial tensile force | **N** | 170 | | | |
| | Max. axial force pressure | **N** | 30 | | | |
| | Nominal bearing service life *(4)* | **h** | 20000 | | | |

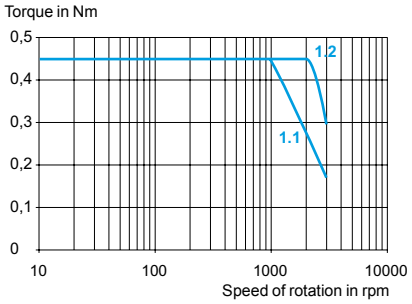
### Holding brake

| | | |
|---|---|---|
| **Holding torque** | **Nm** | 6 |
| **Electrical pull-in power** | **W** | 22 |
| **Brake release time** | **ms** | 40 |
| **Brake application time** | **ms** | 20 |
| **Moment of inertia** | **kg·cm²** | 0.2 |
| **Mass** | **kg** | 1.8 |

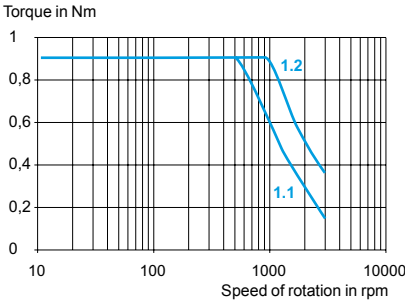
*(1) Measured at 1000 steps/revolution*
*(2) Conditions for shaft load: speed of rotation 60 rpm, 100% duty cycle at continuous torque, ambient temperature 40 °C*
*(3) Point of application of radial force: 10.5 mm distance to flange*
*(4) Operating hours at a probability of failure of 10%*

## Torque characteristics ILS2●57

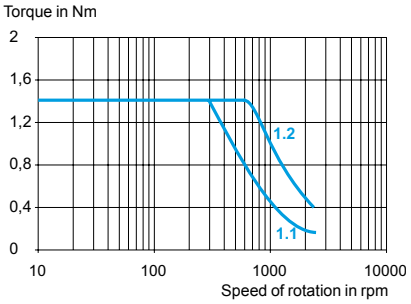
**ILS2●571P (winding type P)**




**ILS2●572P (winding type P)**

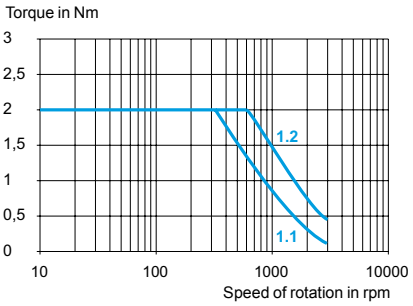



**ILS2●573P (winding type P)**

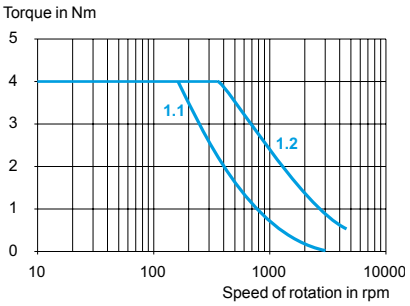



## Torque characteristics ILS2●58

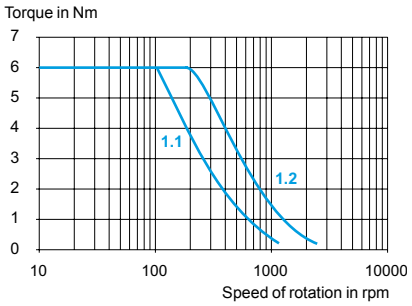
**ILS2●851P (winding type P)**



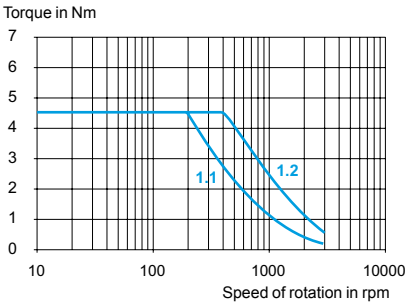

**ILS2●852P (winding type P)**




**ILS2●853P (winding type P)**




**ILS2●853T (winding type T)**




1.1 Max. torque at 24 V
1.2 Max. torque at 48 V

# Lexium integrated drives

## IL●2 for DeviceNet, EtherCAT, Modbus TCP, Ethernet Powerlink

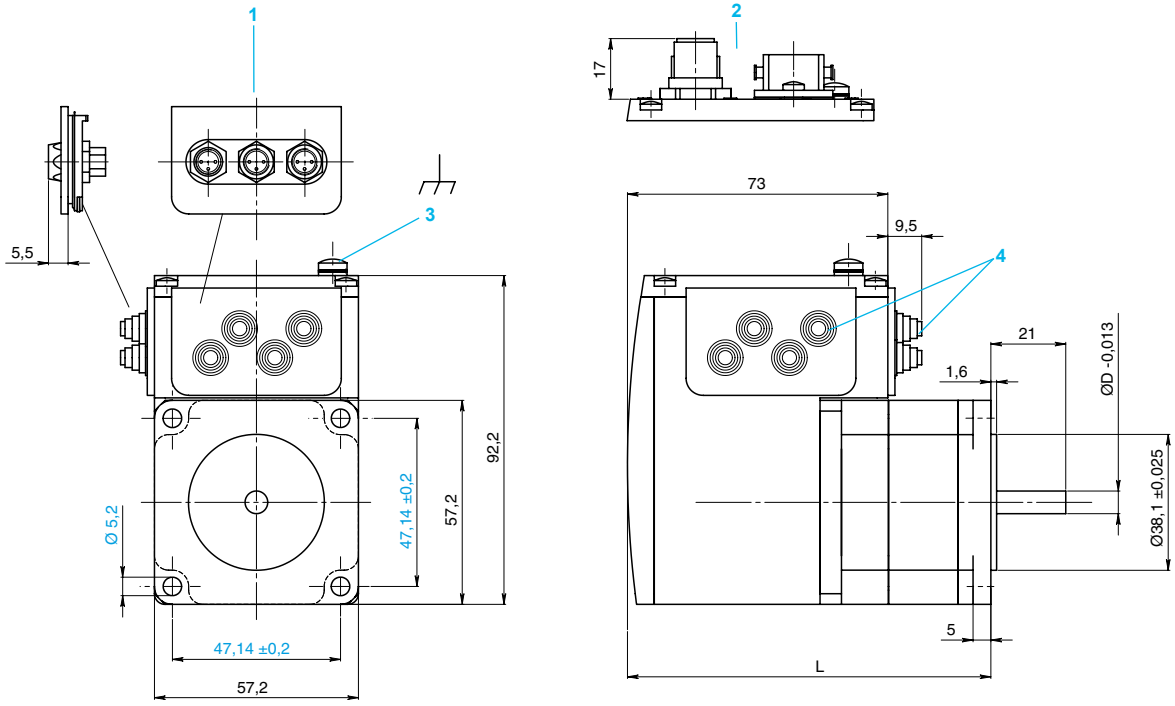
### ILS2 with 3-phase stepper motor

## References

| Example: | I | L | S | 2 | D | 5 | 7 | 1 | P | B | 1 | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Motor type**<br>**S** = 3-phase stepper motor | I | L | **S** | 2 | D | 5 | 7 | 1 | P | B | 1 | A |
| **Supply voltage**<br>**2** = 24 ... 48 V | I | L | S | **2** | D | 5 | 7 | 1 | P | B | 1 | A |
| **Communication interface**<br>**D** = DeviceNet<br>**E** = EtherCAT<br>**P** = Ethernet Powerlink<br>**T** = Modbus TCP | I | L | S | 2 | **D** | 5 | 7 | 1 | P | B | 1 | A |
| **Flange size**<br>**57** = 57 mm<br>**85** = 85 mm | I | L | S | 2 | D | **5** | **7** | 1 | P | B | 1 | A |
| **Motor length (“L”)** *(1)*<br>**1** = motor length (“L”)<br>**2** = motor length (“L”)<br>**3** = motor length (“L”) | I | L | S | 2 | D | 5 | 7 | **1** | P | B | 1 | A |
| **Winding type**<br>**P** = medium speed of rotation, medium torque<br>**T** = high speed of rotation, medium torque *(2)* | I | L | S | 2 | D | 5 | 7 | 1 | **P** | B | 1 | A |
| **Connection technology**<br>**B** = printed circuit board connector<br>**C** = industrial connector | I | L | S | 2 | D | 5 | 7 | 1 | P | **B** | 1 | A |
| **Measurement system**<br>**1** = index pulse | I | L | S | 2 | D | 5 | 7 | 1 | P | B | **1** | A |
| **Holding brake**<br>**A** = no holding brake<br>**F** = with holding brake | I | L | S | 2 | D | 5 | 7 | 1 | P | B | 1 | **A** |

*(1) The motor length “L” depends on the mechanical characteristics, see pages 4/65, 4/68 and 4/69.*
*(2) Winding type T only with ILS2●853.*
*(3) Holding brake only with ILS2●85.*

## ILS2●57 integrated drives




| | L | D |
|---|---|---|
| **ILS2●571** | 101.9 | 6.35 |
| **ILS2●572** | 115.9 | 6.35 |
| **ILS2●573** | 138.9 | 8.00 |

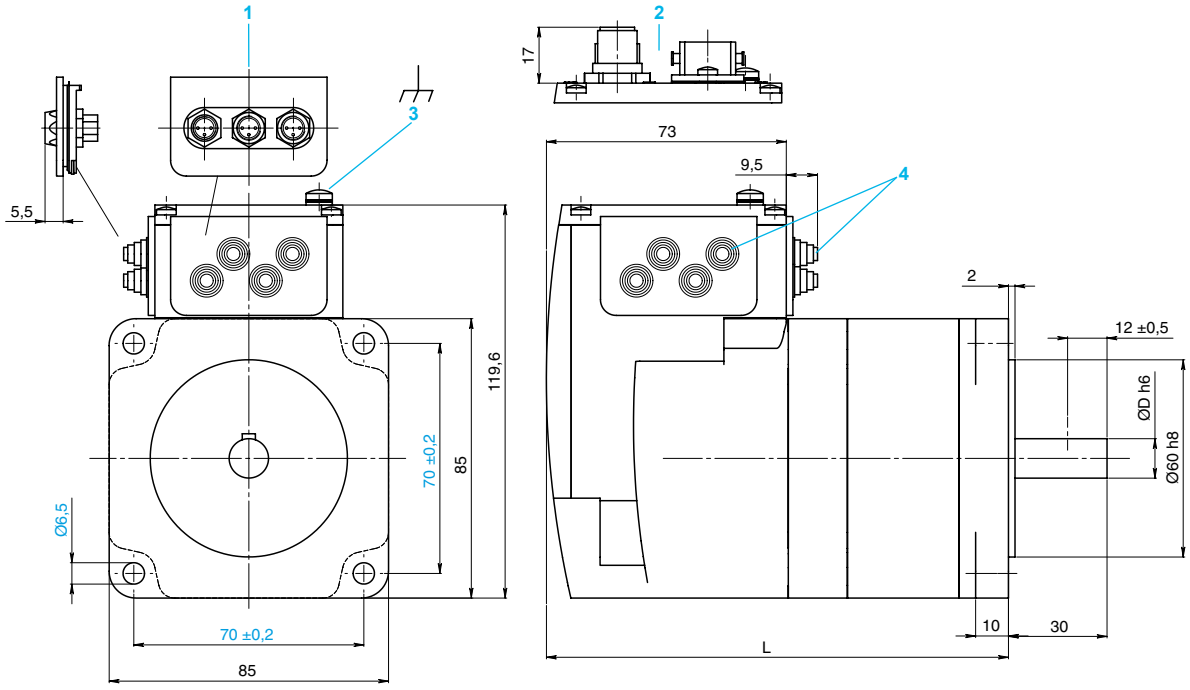
1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm

# Lexium integrated drives

IL●2 for DeviceNet, EtherCAT, Modbus TCP, Ethernet Powerlink

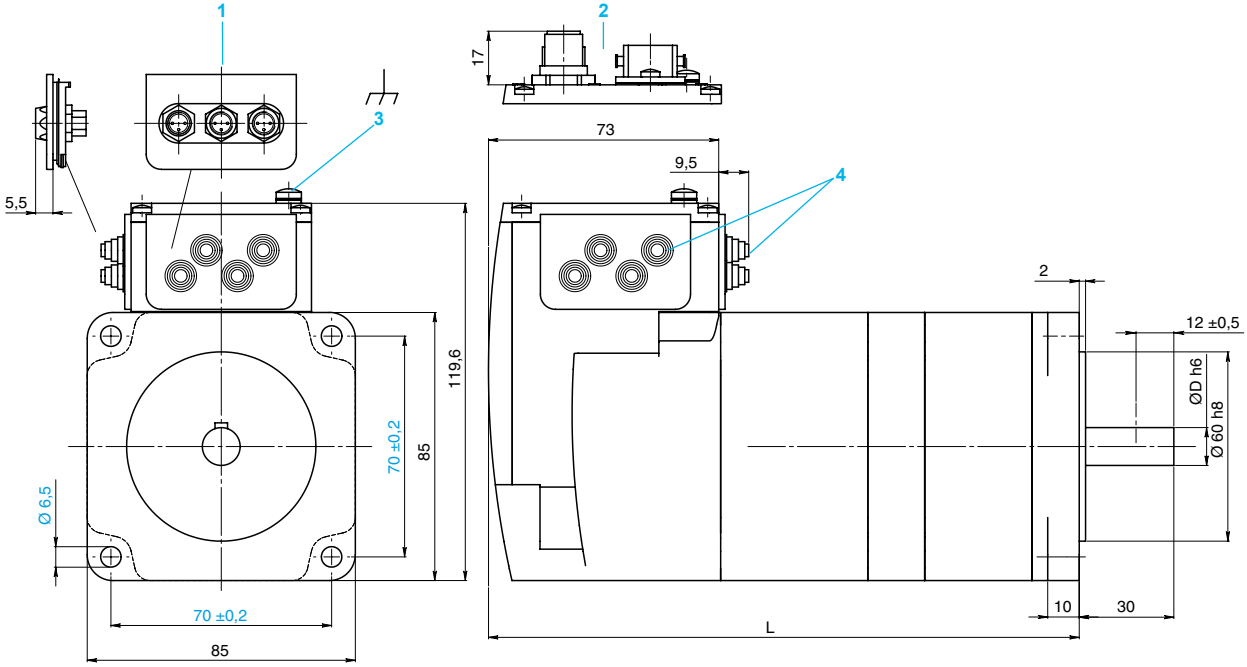
ILS2 with 3-phase stepper motor

## ILS2●85 integrated drives without holding brake




| | L | D |
|---|---|---|
| **ILS2●851** | 140.6 | 12 |
| **ILS2●852** | 170.6 | 12 |
| **ILS2●853** | 200.6 | 14 |

## ILS2●85 integrated drives with holding brake




| | L | D |
|---|---|---|
| **ILS2●851** | 187.3 | 12 |
| **ILS2●852** | 217.3 | 12 |
| **ILS2●853** | 247.3 | 14 |

1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm

# Lexium integrated drives
## ILS1 with I/O interface for motion sequence

*ILS1 with 3-phase stepper motor*

## Presentation

The ILS1 with I/O interface for motion sequence consist of a 3-phase stepper motor and integrated electronics. The drive system has integrated interfaces, control electronics, holding brake (optional) and power amplifier.

### Application areas

Lexium integrated drives with 3-phase stepper motors offer high torque at low speed of rotation. These Lexium integrated drives are ideally suited as drives in velocity mode with excellent constant velocity characteristics and also or for high-resolution positioning. Commissioning the stepper motor drives is simple because it is not necessary to adjust the controller.

## Special features

- High continuous stall torque
- Good constant velocity characteristics
- High positioning resolution (0.018°)
- Optionally with holding brake

## Control

Up to 16 movement commands can be selected and started directly or sequentially via digital signal inputs. The movement commands can include reference movements or positioning commands. This way, motion sequences can be saved in the drive system and controlled via a master PLC.

The PC commissioning software is used to enter data sets and parameterise the drive system.

## Electronics

The electronic system comprises control and power electronics. They have a common power supply and are not galvanically isolated. Four 24 V signals are also available. The assignment of the signal inputs and outputs can be set via parameters.
The electronics are thermally decoupled from the motor by a plastic element.

**Supply voltage**
These Lexium integrated drives can be operated with a supply voltage of 24 V⎓ or 36 V⎓.

## Connection technologies

ILS1 with I/O interface for motion sequence have the following connections:
- Supply voltage ⎓V
- Multifunction interface
- RS 485 commissioning interface
- 24 V signal interface
- Signal interface for “Safe Torque Off” safety function (“Power Removal”)

Printed circuit board connectors are used for cabling.

### Multifunction interface

Up to 16 data sets with movement commands can be selected and started via digital signals of the multifunctional interface.
In addition. two additional signal outputs can be parameterised with special functions.

### RS 485 commissioning interface

The RS 485 commissioning interface is used to connect the RS 485 bus for commissioning purposes. A PC can be connected to the commissioning interface via an RS 485-RS 232 converter. The “Lexium CT” commissioning software can be used for tasks such as reading the error memory or monitoring the temperature.

### 24 V signal interface

Four digital 24 V signals are available. They can be used as signal input or output. The 24 V signals are available to the master controller. However, they can also be parameterised for special functions, e.g. for connection of limit switches.
The 24 V power supply is internal via the supply voltage of the Integrated Drive System.

### Signal interface for “Safe Torque Off” safety function (“Power Removal”)

The integrated “Safe Torque Off” safety function (“Power Removal”) enables a stop of category 0 or 1 as per IEC/EN 60204-1 without external power contactors. The supply voltage does not have to be interrupted. This reduces the system costs and response times.
The “Safe Torque Off” safety function (“Power Removal”) is activated via two redundant 24 V input signals (low active).

*Integrated drive system with printed circuit board connectors*

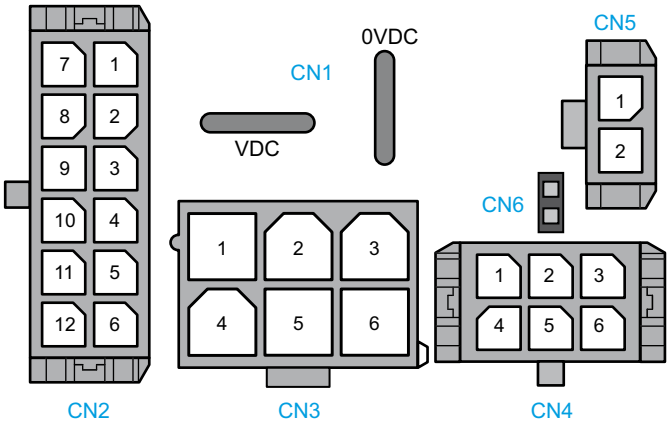
## Connection technologies (continued)

### Printed circuit board connector

Printed circuit board connectors are preferably used for cabling series machines with cable harnesses.

- Fieldbus and I/O signal connection with connector “Molex Micro Fit"
- Power supply connection with “AMP Positive Lock” crimp contacts

Two cable entries are required for cabling the Lexium integrated drives (see accessories, page 4/107).



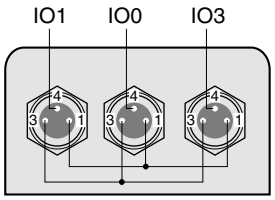

*Printed circuit board connector, overview of connections*

| Connection | Assignment |
|---|---|
| CN1 | Supply voltage ⎓ V |
| CN2 | Multifunction interface |
| CN3 | RS 485 commissioning interface |
| CN4 | 24 V signal interface |
| CN5 | Interface for “Safe Torque Off” safety function (“Power Removal”) |
| CN6 | Jumper for disabling “Safe Torque Off” safety function (“Power Removal”) |

### I/O signal inserts

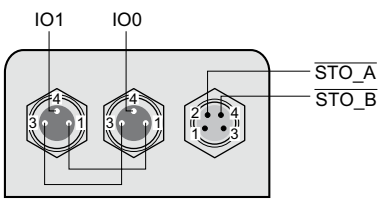
The signals for the “Safe Torque Off” safety function (“Power Removal”) and the freely usable signal input and outputs use industrial connectors.
The 24 V power supply to the signal outputs is internal. Different I/O signal inserts are available for this purpose.

#### I/O signal insert without “Safe Torque Off” safety function (“Power Removal”)



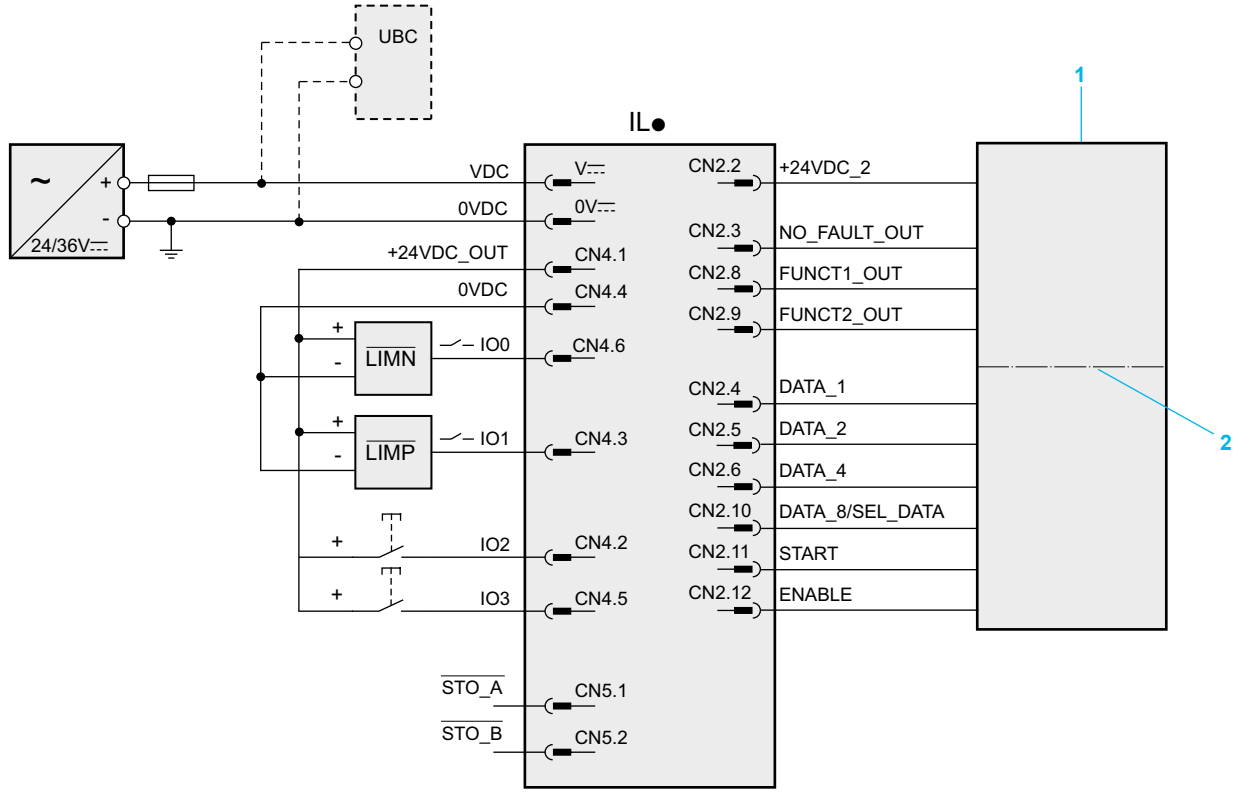

*Inserts for three I/O signals*

#### I/O signal insert with “Safe Torque Off” safety function (“Power Removal”)




*Insert for two I/O signals and STO signals for safety function*

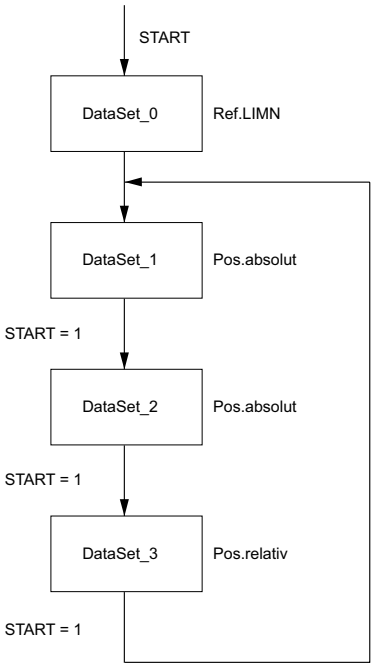
**Connection example I/O signal connection**




*Connection example with four I/O signals*

1 PLC
2 Galvanic isolation

# Lexium integrated drives
ILS1 with I/O interface for motion sequence




*Example of sequential selection of movement commands*

## "Motion Sequence" operating mode

### General

In the "Motion Sequence" operating mode, up to 16 data sets with movement commands can be activated directly or sequentially with a PC, fieldbus or digital inputs. The movement commands can include reference movements or positioning commands. This way, a motion sequence can be saved in the drive system and controlled via a master PLC.
The "Lexium CT" PC commissioning software or the fieldbus is used to enter data sets and parameterise the drive system.

### Direct selection of movement commands

The direct selection of movement commands is used if a master controller (e.g. PLC) controls the time coordination of the various data sets. The data set to be processed is selected via signal inputs and then activated by a start signal.

### Sequential selection of movement commands

The sequential selection of movement commands is used to process simple motion sequences. The time coordination is programmed in the individual data sets via specification of a wait time, a transition condition and the subsequent data set. A transition condition can be, for instance, a rising edge at the START signal input.
A motion sequence can also be executed cyclically with or without return to the initial position.

### Processing status of a movement command

The processing status of a movement command can be output via the handshake output. In addition, an internal processing status such as "drive system in motion" can be output via an additional signal output.

### Selection of the motion profile

Speeds and accelerations are saved in motion profiles. One of the motion profiles can be assigned to every movement command data set.

## Operating modes

### Overview

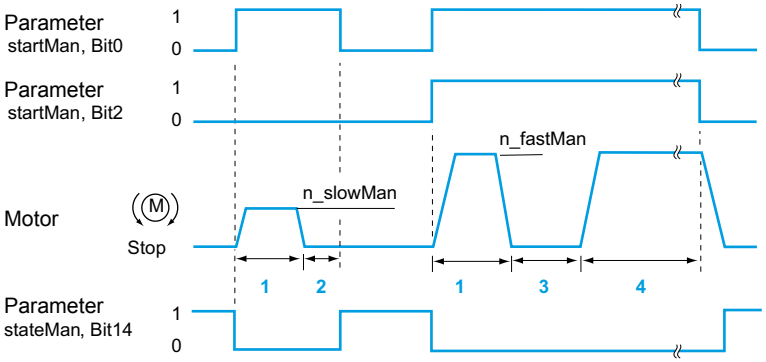
The following operating modes can be set via the fieldbus:
- Jog
- Profile position
- Homing

### Jog mode

The motor moves by one distance unit or at constant speed in continuous operation. The value of the distance unit, the speed levels and the change-over time in continuous operation can be adjusted manually.

**Reference value setting**
The reference value is set via PC.

**Application example**
Setting up a machine during commissioning




*Jog, slow and fast*

1 step_Man
2 t < time_Man
3 time_Man
4 Continuous operation

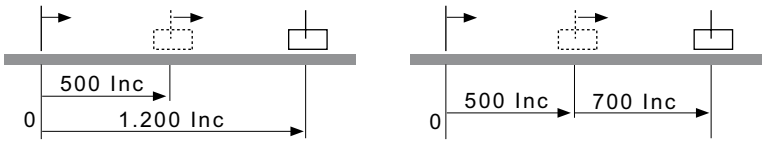
### Profile position

In the operating mode “Profile Position", the motor is positioned from a point A to a point B with a positioning command.

**Settings**
The positioning path can be specified in two ways:
- Absolute positioning, reference point is the zero point of the axis
- Relative positioning, reference point is the current position of the motor

**Reference value setting**
The reference value is set via PC.

**Application example**
Pick-and-place with a linear robot




*Operating mode “Profile Position", absolute and relative*

## Homing

There are two types of homing:
- Reference movement
  Specifying the dimension reference by approach to a limit or reference switch
- Position setting
  Specifying the position reference relative to the current motor position

**Reference movement**

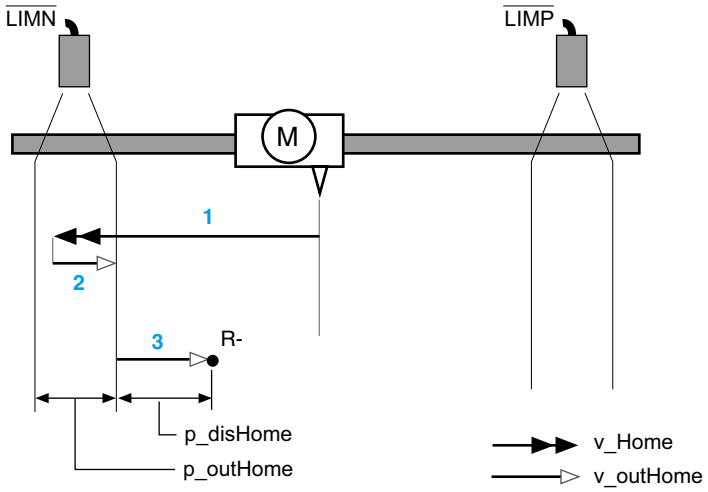
During reference movement, the motor moves to a defined position on the axis. The position is defined by a mechanical switch:
- LIMN, LIMP limit switches
- REF reference switch

**Types of reference movements**

There are five standard reference movements:
- Movement to negative limit switch LIMN
- Movement to positive limit switch LIMP
- Movement to REF reference switch with first movement counterclockwise
- Movement to REF reference switch with first movement clockwise
- Reference movement to index pulse with clockwise or counterclockwise rotation

These standard reference movements can be executed without and with index pulse.

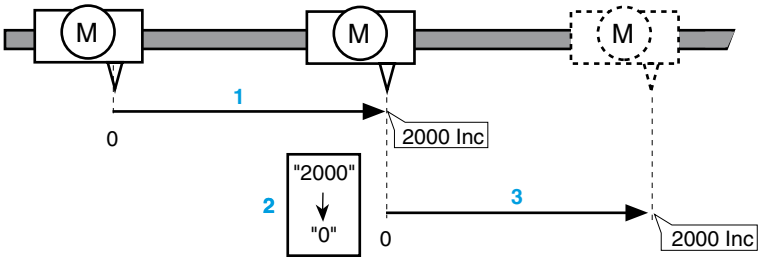
**Example 1: reference movement to limit switch**




*Operating mode "Homing", reference movement to limit switch*

1 Movement to limit switch at search speed
2 Movement to switching edge at clearance speed
3 Movement to distance from switching edge at clearance speed

**Example 2: position setting**
Position setting can be used to execute a continuous motor movement without overtravelling the positioning limits.




*Positioning by 4000 increments with position setting*

1 The motor is positioned by 2000 increments.
2 The current motor position is set to position value 0 by position setting to 0 and the new zero point is defined at the same time.
3 The new target position is 2000 increments after a new movement command by 2000 increments is triggered.

This procedure prevents overtravel of the absolute position limits during positioning, because the zero point is continuously made to follow.

**Reference value setting**
The reference value is set via PC.

**Application example**
Prior to absolute positioning in “Profile Position” mode.

**Additional operating modes**

Additional operating modes can be activated via PC.
- Reversing direction of rotation of motor
- Setting motion profile via profile generator
- Triggering Quick Stop function
- Function of holding brake
- Programming inputs/outputs.

## "Safe Torque Off" ("Power Removal") safety function

The Lexium integrated drive integrates the "Safe Torque Off" ("Power Removal") safety function which prevents unintended restarting of the motor. The motor no longer produces any torque if the safety function is active.

This safety function:

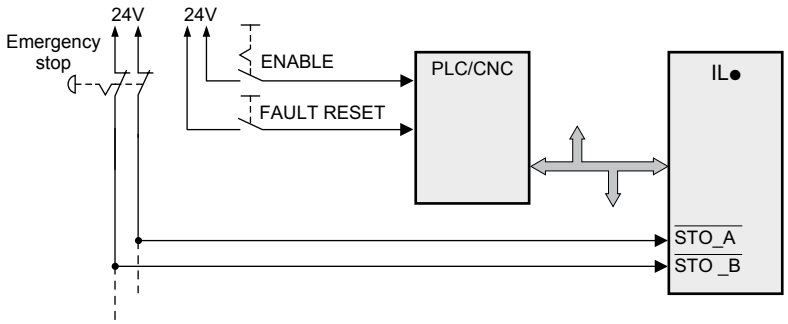
- Complies with the machine safety standard ISO 13849-1, perfomance level "d" (PL d)
- Complies with the standard for functional safety IEC/EN 61508, SIL2 capability (safety control-signalling applied to processes and systems). The SIL (Safety Integrity Level) capability depends on the connection diagram for the servo drive and for the safety function. Failure to observe the setup recommendations could inhibit the SIL capability of the "Safe Torque Off" ("Power Removal") safety function.
- Complies with product standard IEC/EN 61800-5-2 "Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional" for both stop functions:
  - Safe Torque Off ("STO") corresponds to Category 0 stop according to IEC/EN 60204-1. Standstill by immediate power shutdown to the machine drive elements (i.e. an uncontrolled stop).
  - Safe Stop 1 ("SS1") corresponds to Category 1 stop according to IEC/EN 60204-1. A controlled stop in which the machine drive elements are retained to effect the standstill. The final shutdown is ensured by an external Emergency stop module with safe time delay, e.g. Preventa XPS-AV *(1)*.

The "Safe Torque Off" ("Power Removal") safety function has a redundant electronic architecture *(2)* which is monitored continuously by a diagnostics function.

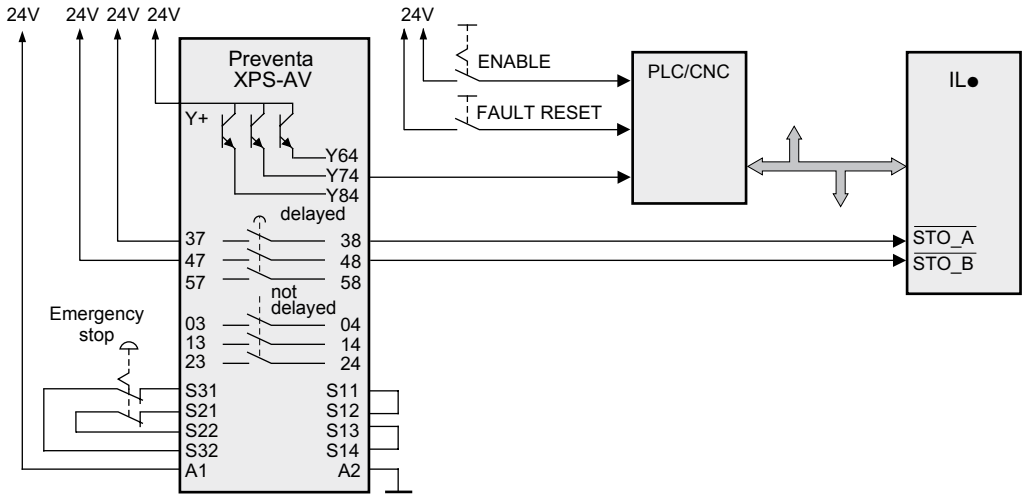
This PL d and SIL2 safety function is certified as conforming to these standards by the TÜV certification body in the context of a voluntary certification.

*(1) Please refer to the "Safety functions and solutions using Preventa" catalogue.*
*(2) Redundant: Consists of mitigating the effects of the failure of one component by means of the correct operation of another, assuming that faults do not occur simultaneously on both.*

**Examples of applications of the safety function**




*Example of Category 0 Stop*



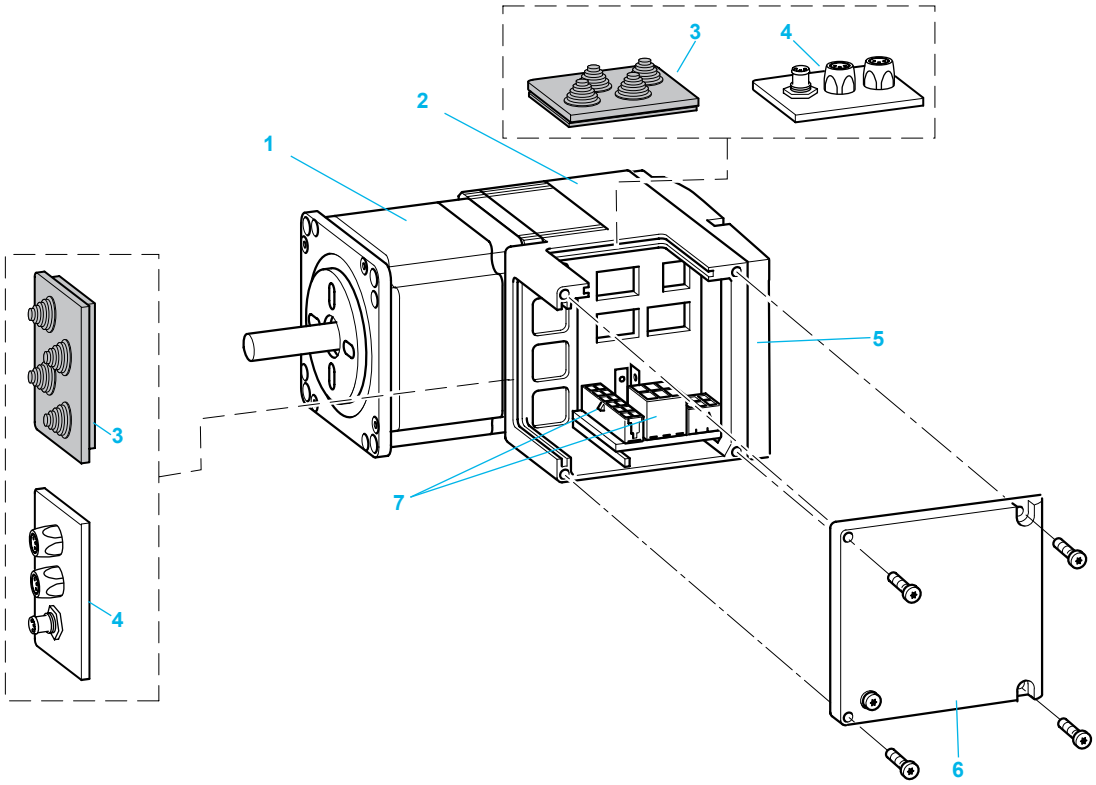

*Example of Category 1 Stop*

# Lexium integrated drives
## ILS1 with I/O interface for motion sequence
## ILS1 with 3-phase stepper motor



### Description

ILS1 with I/O interface for motion sequence consist of control electronics and a 3-phase stepper motor. ILS1 for motion sequence is available with printed circuit board connectors. A holding brake is optionally available for ILS1●85.




1 3-phase stepper motor
2 Electronics housing
3 Insert cable entry (accessory)
4 I/O insert with industrial connectors (accessory)
5 Cover for electronics housing
6 Cover for connector housing
7 Electrical interfaces

# Lexium integrated drives
## ILS1 with I/O interface for motion sequence
## ILS1 with 3-phase stepper motor



### Certifications

| | | | |
|---|---|---|---|
| **Conformity to standards** | | | Lexium integrated drives have been developed to comply with the stringent international standards and with the recommendations for electronic control systems in the industry (IEC, EN), specifically: low-voltage switchgear, IEC/EN 61800-5-1, IEC/EN 50178, IEC/EN 61800-3 (noise immunity to conducted and radiated high-frequency signals) |
| | EMC immunity | | EN 61800-3:2001, second environment |
| | Conducted and radiated EMC emissions | | EN 61800-3:2001-02; IEC 61800-3, Ed.2<br>■ Power supplies without external mains filter:<br>□ C3 up to 10 m supply cable length<br>■ Power supplies with external mains filter:<br>□ C2 up to 20 m supply cable length<br>□ C3 up to 50 m supply cable length |
| CE **marking** | | | The Lexium integrated drives are CE marked in accordance with the European Machinery Directive (98/37/EEC) and the European EMC Directive (89/336/EEC). |
| **Product certifications** | | | UL (USA), cUL (Canada) |
| | | | TÜV certification: Lexium integrated drives are TÜV-certified for device safety and medical devices. The certification includes:<br>■ Functional safety of electrical/electronic/programmable safety-related electronic systems (IEC 61508:2000; SIL 2)<br>■ Safety of machinery – functional safety of safety-related electrical and electronic and programmable electronic control systems (IEC 62061:2005; SILcl2)<br>■ Safety of machinery – safety-related parts of control systems – Part 1: General principles for design (ISO 13849-1:2006; PL d (Category 3)) |

### Ambient conditions

| | | | |
|---|---|---|---|
| **Ambient temperature** *(1)* | | **°C** | 0 ... 65; power reduction by 2%/°C at 50 ... 65 |
| **Max. permissible motor temperature** *(2)* | | **°C** | 110 |
| **Installation height without power reduction** | | **m** | < 1000 m above mean sea level |
| **Transport and storage temperature** | | **°C** | -25 ... +70 |
| **Relative humidity** | | **%** | 15 ... 85 (not condensing) |
| **Vibration load during operation as per DIN EN 60028-2-6** | Number of cycles | | 10 |
| | Acceleration amplitude: | **m/s²** | 20 |
| | Frequency range | **Hz** | 10 ... 500 |
| **Continuous shocks as per DIN EN 60028-2-29** | Number of shocks | | 1000 |
| | Peak acceleration | **m/s²** | 150 |
| **Thermal class as per DIN EN 60034-1** | | | 155 (F) |
| **Shaft wobble and perpendicularity** | | | According to EN 50347 (IEC 60072-1) |
| **Degree of protection as per DIN EN 60034-5** | | | Total except shaft bushing IP54, shaft bushing IP41 |

### Electrical data

| | | | |
|---|---|---|---|
| **Power supply connection (CN1)** | | | Corresponds to PELV according to DIN 19240, not protected against reverse polarity |
| **Supply voltage range** | | ⎓ **V** | 18 ... 40 |
| **Nominal supply voltage** | | ⎓ **V** | 24 / 36 |
| **Ripple at nominal voltage** | | $V_{PP}$ | ≤ 3.6 |
| **Max. current consumption** | ILS1M57 | **A** | 3.5 |
| | ILS1M851, ILS1M852 | **A** | 5 |
| | ILS1M853 | | |
| | ■ Winding type P | **A** | 5 |
| | ■ Winding type T | **A** | 6 |
| **Inrush current** | | | Charging current for capacitor C=1500 µF |
| **External fuse** | | **A** | 10 |
| **Multifunction interface (CN2)** | | | Galvanically isolated from supply voltage VDC; suitable for inductive load (1000 mH) |
| **Voltage supply range** | | ⎓ **V** | 10 ... 30 |
| **Max. switching current per output** | | **mA** | 50 |
| **RS 485 commissioning interface (CN3)** | | | No galvanic isolation; corresponds to RS 485 standard |
| **Transmission rate** | | **kBaud** | 9.6 / 19.2 / 38.4 |
| **24 V signal interface (CN4)** | | | 4 signals, each usable as input or output, galvanically connected to 0VDC, not protected against reverse polarity |
| **24 V signal inputs** | | | |
| **Logic 0 ($U_{low}$)** | | **V** | -3 ... +5 |
| **Logic 1 ($U_{high}$)** | | **V** | +15 ... +30 |
| **Input current (typical at 24 V)** | | **mA** | 10 |
| **Debounce time IO0..IO3** | | **ms** | 1 ... 1.5 |

*(1) Limit values with flanged motor mounted on a steel plate 300 x 300 x 10 mm.*
*(2) Measured at the surface.*

## Electrical data (continued)

| | | | |
|---|---|---|---|
| **24 V signal outputs** | | | Switching to plus, short-circuit protected, suitable for inductive load (1000 mH / 100 mA) |
| **Supply voltage range** | | ⎓ V | 10 ... 30 |
| **Max. switching current (total)** | | mA | 200 |
| **Max. switching current per output** | | mA | 100 |
| **Interface for safety function "Safe Torque Off" (CN5)** | | | No galvanic isolation; corresponds to RS 485 standard |
| **Logic 0 ($U_{low}$)** | | V | -3 ... +4.5 |
| **Logic 1 ($U_{high}$)** | | V | +15 ... +30 |
| **Input current (typical at 24 V)** | $\overline{STO\_A}$ | mA | ≤ 10 |
| | $\overline{STO\_B}$ | mA | ≤ 3 |
| **Debounce time** | | ms | 1 |
| **Response time (until shutdown of power amplifier)** | | ms | < 50 |
| **Max. Time offset until detection of signal differences between $\overline{STO\_A}$ and $\overline{STO\_B}$** | | S | < 1 |

## Safety function "Safe Torque Off" ("Power Removal")

| | | | |
|---|---|---|---|
| **Protection** | Of machine | | "Safe Torque Off" safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard ISO 13849-1, performance level "d" (PL d) , and standard IEC/EN 61800-5-2 |
| | Of the system process | | "Safe Torque Off" safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard IEC/EN 61508 level SIL2 and standard IEC/EN 61800-5-2 |

## Mechanical data ILS1●57

| **Type of integrated drive** | | | **ILS1●571** | **ILS1●572** | **ILS1●573** |
|---|---|---|---|---|---|
| **Winding type** | | | P | P | P |
| **Max. torque** | $M_{max}$ | Nm | 0.45 | 0.90 | 1.50 |
| **Holding torque** | | Nm | 0.51 | 1.02 | 1.70 |
| **Rotor inertia** | | kg·cm² | 0.1 | 0.22 | 0.38 |
| **Positioning resolution per revolution** | | | 20000 | | |
| **Systematic angle tolerance per step** *(1)* | | arcmin | ±6 | ±6 | ±6 |
| **Mass** | | kg | 1.3 | 1.6 | 2.0 |
| **Shaft load** *(2)* | Max. radial force *(3)* | N | 24 | 24 | 50 |
| | Max. axial tensile force | N | 100 | | |
| | Max. axial force pressure | N | 8.4 | | |
| | Nominal bearing service life *(4)* | h | 20000 | | |

## Mechanical data ILS1●85

| **Type of integrated drive** | | | **ILS1●851** | **ILS1●852** | **ILS1●853** | |
|---|---|---|---|---|---|---|
| **Winding type** | | | P | P | P | T |
| **Max. torque** | $M_{max}$ | Nm | 2.0 | 4.0 | 6.0 | 4.5 |
| **Holding torque** | | Nm | 2.0 | 4.0 | 6.0 | 4.5 |
| **Rotor inertia** | | kg·cm² | 1.1 | 2.2 | 3.3 | |
| **Positioning resolution per revolution** | | | 20000 | | | |
| **Systematic angle tolerance per step** *(1)* | | arcmin | ±6 | | | |
| **Mass** | | kg | 2.6 | 3.6 | 4.7 | |
| **Shaft load** *(2)* | Max. radial force *(3)* | N | 100 | 100 | 110 | |
| | Max. axial tensile force | N | 170 | | | |
| | Max. axial force pressure | N | 30 | | | |
| | Nominal bearing service life *(4)* | h | 20000 | | | |

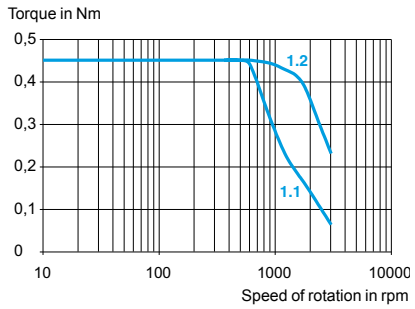
### Holding brake

| | | |
|---|---|---|
| **Holding torque** | Nm | 6 |
| **Electrical pull-in power** | W | 22 |
| **Brake release time** | ms | 40 |
| **Brake application time** | ms | 20 |
| **Moment of inertia** | kg·cm² | 0.2 |
| **Mass** | kg | 1.8 |

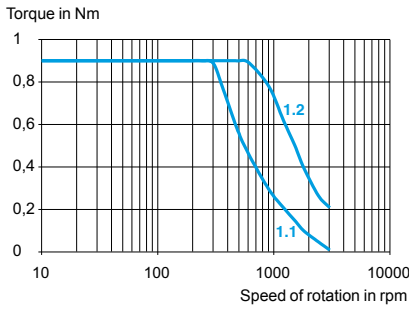
*(1) Measured at 1000 steps/revolution, unit: minutes of arc*
*(2) Conditions for shaft load: speed of rotation 60 rpm, duty cycle at torque, ambient temperature 40 °C*
*(3) Point of application of radial force: 10.5 mm distance to flange*
*(4) Operating hours at a probability of failure of 10 %*

## Torque characteristics ILS1●57

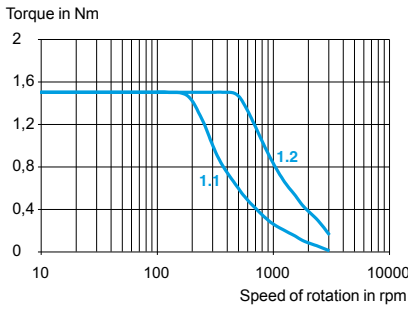
**ILS1●571P (winding type P)**




**ILS1●572P (winding type P)**

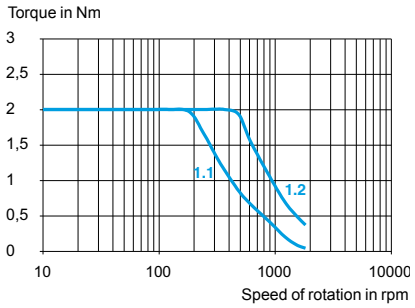



**ILS1●573P (winding type P)**

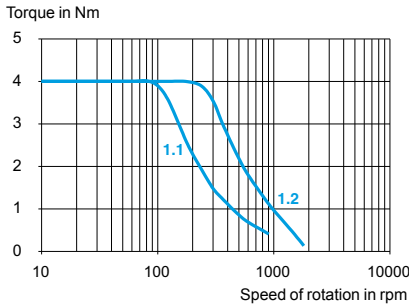



## Torque characteristics ILS1●85

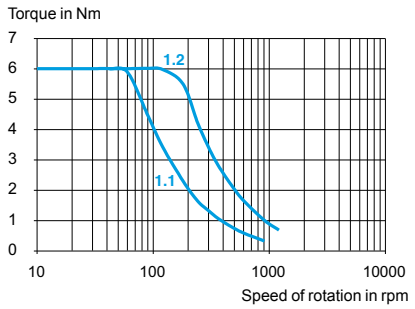
**ILS1●851P (winding type P)**



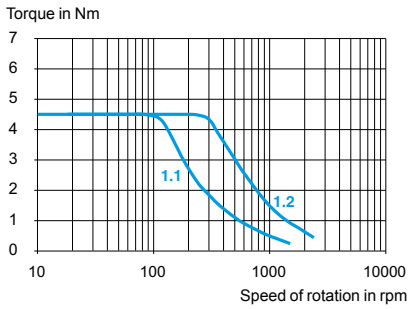

**ILS1●852P (winding type P)**




**ILS1●853P (winding type P)**




**ILS1●853T (winding type T)**




1.1 Max. torque at 24 V
1.2 Max. torque at 36 V

4

# Lexium integrated drives

## ILS1 with I/O interface for motion sequence

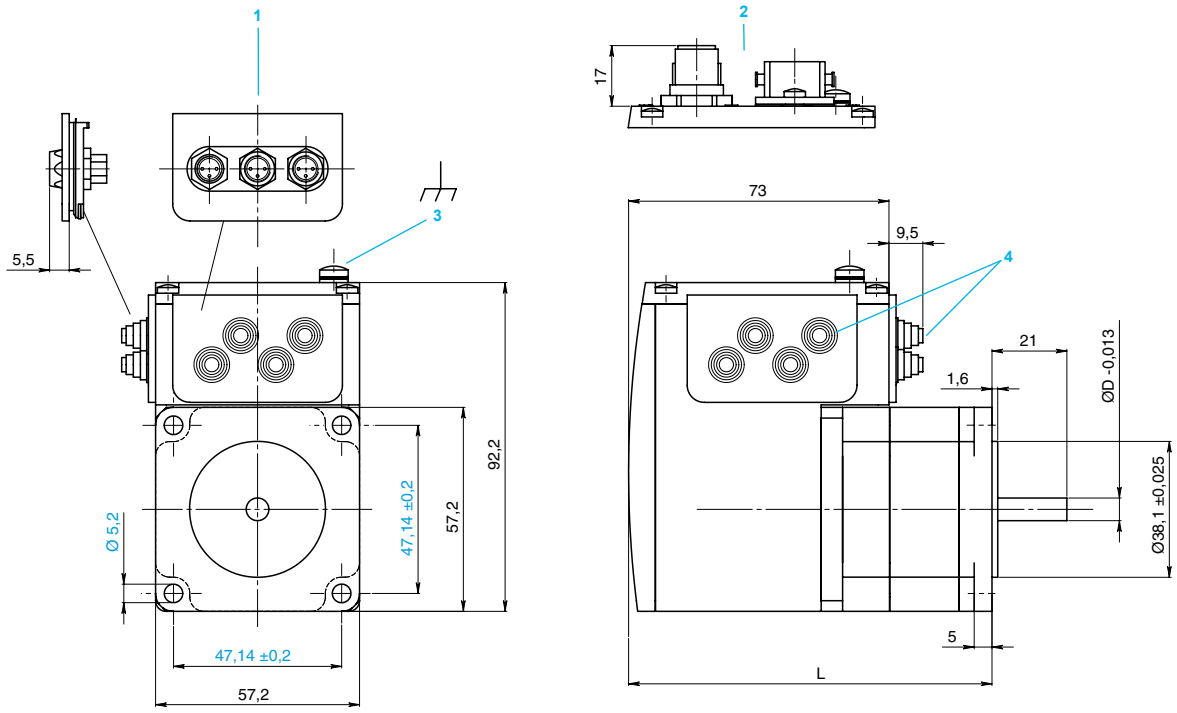
## ILS1 with 3-phase stepper motor

### References

| Example: | I | L | S | 1 | M | 5 | 7 | 1 | P | B | 1 | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Motor type**<br>**S** = 3-phase stepper motor | I | L | **S** | 1 | M | 5 | 7 | 1 | P | B | 1 | A |
| **Supply voltage**<br>**1** = 24 ... 36 V | I | L | S | **1** | M | 5 | 7 | 1 | P | B | 1 | A |
| **Communication interface**<br>**M** = I/O interface for motion sequence | I | L | S | 1 | **M** | 5 | 7 | 1 | P | B | 1 | A |
| **Flange size**<br>**57** = 57 mm<br>**85** = 85 mm | I | L | S | 1 | M | **5** | **7** | 1 | P | B | 1 | A |
| **Motor length ("L")** *(1)*<br>**1** = motor length "L"<br>**2** = motor length "L"<br>**3** = motor length "L" | I | L | S | 1 | M | 5 | 7 | **1** | P | B | 1 | A |
| **Winding type**<br>**P** = medium speed of rotation, medium torque<br>**T** = high speed of rotation, medium torque *(2)* | I | L | S | 1 | M | 5 | 7 | 1 | **P** | B | 1 | A |
| **Connection technology**<br>**B** = printed circuit board connector<br>**C** = industrial connector | I | L | S | 1 | M | 5 | 7 | 1 | P | **B** | 1 | A |
| **Measurement system**<br>**1** = index pulse | I | L | S | 1 | M | 5 | 7 | 1 | P | B | **1** | A |
| **Holding brake**<br>**A** = no holding brake<br>**F** = with holding brake *(3)* | I | L | S | 1 | M | 5 | 7 | 1 | P | B | 1 | **A** |

*(1) The motor length "L" depends on the mechanical characteristics, see pages 4/82, 4/85 and 4/87.*
*(2) Winding type T only with ILS1M853.*
*(3) Holding brake only with ILS1M85.*

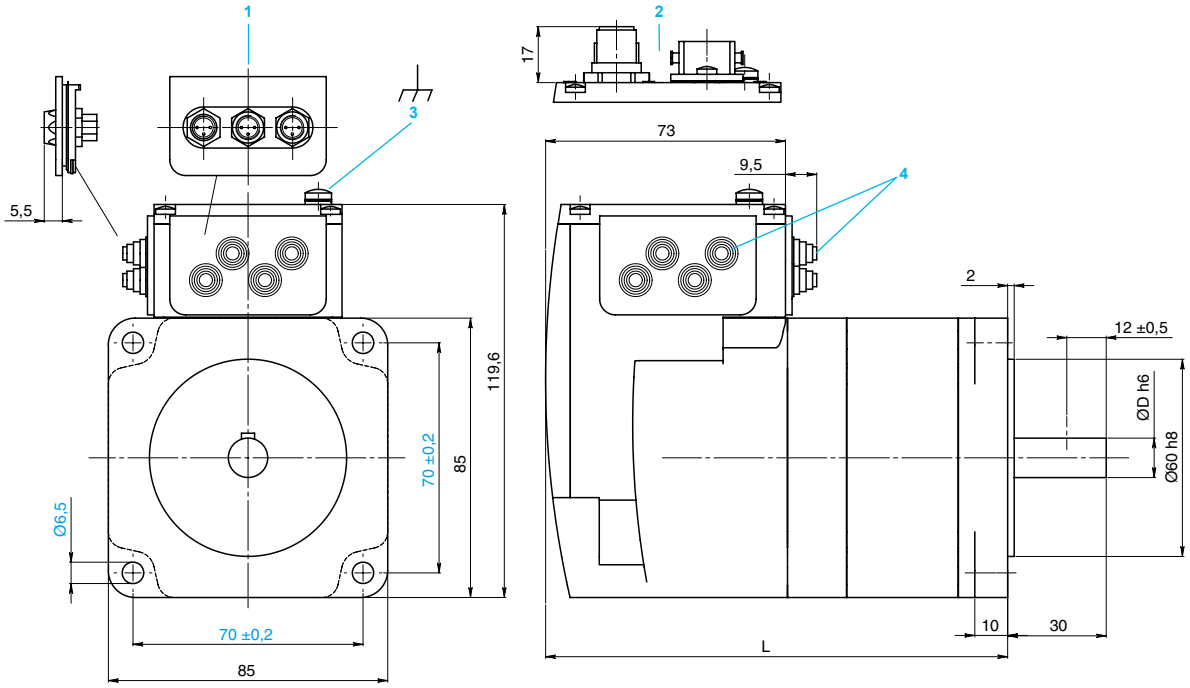
## ILS1●57 integrated drives




| | L | D |
|---|---|---|
| **ILS1●571** | 101.9 | 6.35 |
| **ILS1●572** | 115.9 | 6.35 |
| **ILS1●573** | 138.9 | 8.00 |

1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm

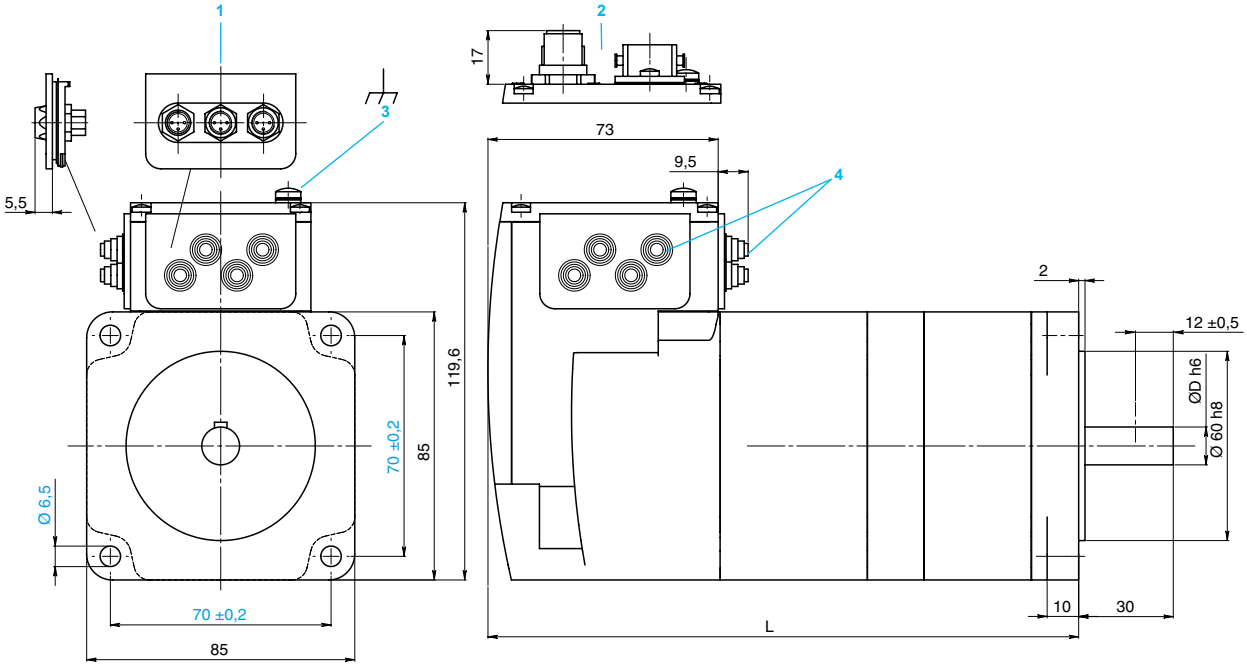
## ILS1●85 integrated drives without holding brake




| | L | D |
|---|---|---|
| **ILS1●851** | 140.6 | 12 |
| **ILS1●852** | 170.6 | 12 |
| **ILS1●853** | 200.6 | 14 |

1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm

## ILS1●85 integrated drives with holding brake




| | L | D |
|---|---|---|
| **ILS1●851** | 187.3 | 12 |
| **ILS1●852** | 217.3 | 12 |
| **ILS1●853** | 247.3 | 14 |

1 Accessories: I/O signal insert with industrial connectors
2 Option: industrial connectors
3 Earth (ground) terminal
4 Accessories: cable entries Ø = 3 ... 9 mm

# Lexium integrated drives
## ILS1 with pulse/direction interface

*ILS1●57 with 3-phase stepper motor*

## Presentation

ILS1 contain a 3-phase stepper motor and control electronics with pulse/direction interface. Pulse/direction signals of a master controller, e.g. a motion controller, or A/B signals of an encoder are converted directly into motion.

### Application areas

Lexium integrated drives with 3-phase stepper motors offer high torque at low speed of rotation. These Lexium integrated drives are ideally suited as drives in velocity mode with excellent constant velocity characteristics and also or for high-resolution positioning. Commissioning the stepper motor drives is simple because it is not necessary to adjust the controller.

## Special features

- High continuous stall torque
- Good constant velocity characteristics
- High positioning resolution (0.018°)
- Holding brake (option for ILS1●85)

## Control

ILS1 moves the stepper motor according to a reference value. The reference value signal is generated by a controller or an encoder and is sent to the multifunction interface as a pulse signal.
The number of steps (steps per revolution) is set with a parameter switch.

## Electronics

The electronic system comprises control and power electronics. They have a common power supply and are not galvanically isolated. Four 24 V signals are also available. The assignment of the signal inputs and outputs can be adjusted via parameter switches.
The electronics are thermally decoupled from the motor by a plastic element.

## Connection technologies

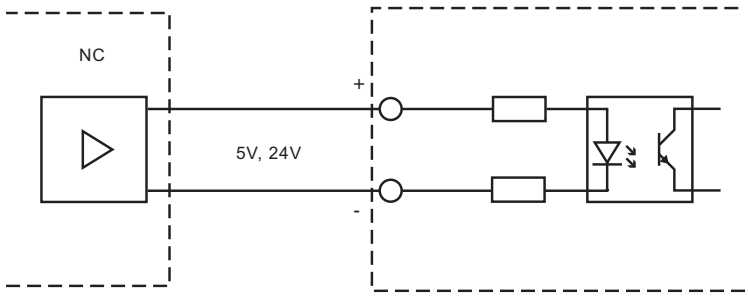
ILS1 have the following connections:
- Power supply
- Multifunction interface
- Service interface
- 24 V signal interface for four signal inputs/outputs
- Signal interface for safety function “Safe Torque Off” (“Power Removal”)

Printed circuit board connectors are used for cabling.

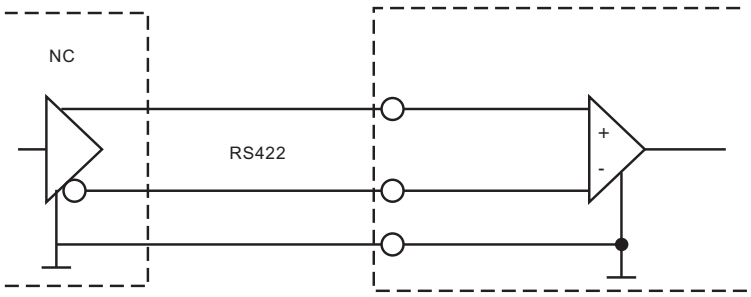
### Multifunction interface

The multifunction interface operates at one of the following signal levels depending on the device model:
- 5V signals opto-isolated (ILS1V)
- 5 V differential signals without galvanic isolation (ILS1W)
- 24 V signals opto-isolated (ILS1U)

The reference pulses are supplied via two of the signal inputs, either as pulse/direction signals or as A/B signals. The other signal inputs have the functions “power amplifier enable/pulse blocking” and “step size switching/PWM motor current control".




*Circuit of signal inputs of ILS1U and ILS1V*




*Circuit of signal inputs of ILS1W*

## Connection technologies (continued)

### Service interface

The service interface is used to connect the RS 485 bus for service purposes. A PC can be connected to the service interface via an RS 485-RS 232 converter. The “Lexium CT” commissioning software can be used for tasks such as reading the error memory or monitoring the temperature.

### 24 V signal interface

Two signal inputs and two signal outputs are available. The signal inputs have the functions “step size switching” and “power amplifier enable/pulse blocking". The signal outputs have the functions “power amplifier standby” and “fault output/index pulse".
The 24 V power supply to the signal outputs is internal via the supply voltage of the Integrated Drive System.

### Signal interface for “Safe Torque Off” safety function (“Power Removal”)

The integrated “Safe Torque Off” safety function (“Power Removal”) enables a stop of category 0 or 1 as per IEC/EN 60204-1 without external power contactors. The supply voltage does not have to be interrupted. This reduces the system costs and response times.
The “Safe Torque Off” safety function (“Power Removal”) is activated via two redundant 24 V input signals (low active).

*Integrated drive system with printed circuit board connectors*

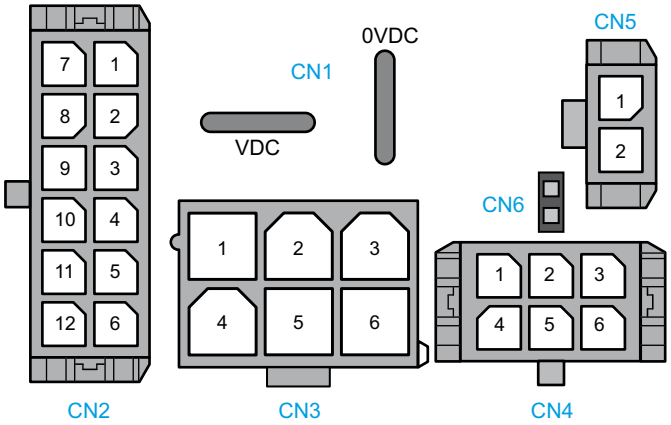
## Connection technologies (continued)

### Printed circuit board connector

Printed circuit board connectors are preferably used for cabling series machines with cable harnesses.

- Fieldbus and I/O signal connection with connector “Molex Micro Fit"
- Power supply connection with “AMP Positive Lock” crimp contacts

Two cable entries are required for cabling the Lexium integrated drives (see accessories, page 4/107).




*Printed circuit board connector, overview of connections*

| Connection | Assignment |
|---|---|
| CN1 | Supply voltage ⎓ V |
| CN2 | Multifunction interface |
| CN3 | Service interface |
| CN4 | 24 V signal interface |
| CN5 | Interface for safety function “Safe Torque Off" |
| CN6 | Jumper for disabling “Safe Torque Off” safety function (“Power Removal”) |

# Lexium integrated drives
ILS1 with pulse/direction interface



## Functions

### Overview

The following functions can be set on ILS1 with the parameter switches:
- ■ Number of steps: 200 / 400 / 500 / 1000 / 2000 / 4000 / 5000 / 10000
- ■ Motor phase current (25% ... 100% of nominal current)
- ■ Idle current reduction to 70% of specified motor phase current
- ■ Functions of signal inputs
- □ Reference pulses supplied as pulse/direction or A/B encoder signals (PULSE/DIR / A/B signal input)
- □ Enable or block power amplifier (ENABLE / GATE signal input)
- □ Enable or block reference pulse (ENABLE / GATE signal input)
- □ Control motor phase current with PWM signal (PWM / STEP2_INV signal input)
- □ Increase or reduce number of steps by a factor of 10, e. g. 200/2000 (PWM / STEP2_INV signal input)
- ■ Functions of signal outputs
- □ Output error signal (FAULT / INDEXPULSE signal output)
- □ Output index pulse signal (FAULT / INDEXPULSE signal output)
- □ The operating readiness is signalled via the ACTIVE signal output.
- ■ Activate blocking detection. If the actual position deviates more than one revolution from the reference position, an error is generated and the compact drive system is de-energised. The motor has no torque in this operating status.
- ■ Switch on RS 485 terminating resistor
- ■ Switch on/off safety function “Safe Torque Off"

### Setting the number of steps

The number of steps per axis revolution can be set via the number of steps function.

Example:
At a number of steps of 1000, the Integrated Drive System executes exactly one complete motor revolution at 1000 pulses. At a pulse frequency of 1 kHz this corresponds to a speed of 1 $s^{-1}$ = 60 rpm.
The STEP2_INV setting at the parameter switch can be inverted via the input signal STEP2_INV of the multifunction interface or the 24 V signal interface.

**Settings via parameter switch**
Number of steps: 200 / 400 / 500 / 1000 / 2000 / 4000 / 5000 / 10000 per revolution

### Setting the motor phase current

The motor phase current is set with a rotary switch. A high motor phase current generates a high motor torque.

**Settings via rotary switch**
Motor phase current (25% ... 100% (in increments of 5%) of nominal current

### Activating the motor phase reduction

If the full holding torque is not required, the motor phase current reduction can be used to reduce the holding torque.
Advantage: motor and electronics heat up less and efficiency is improved.
The motor phase current is reduced to approximately 70% of the set motor phase current value 100 ms after the last pulse edge is received.
The motor phase current is set with a rotary switch. A high motor phase current generates a high motor torque.

**Settings via parameter switch**
Activate/deactivate motor phase current reduction

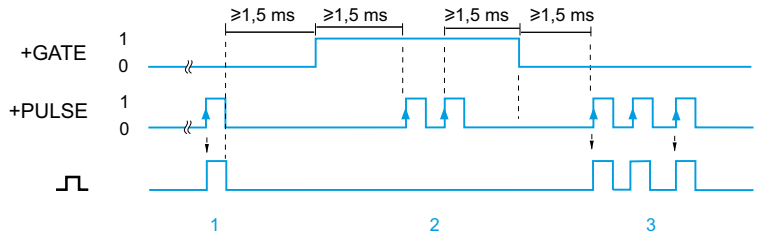
**Setting the function of the ENABLE/GATE signal input**

The ENABLE/GATE signal is available at the following interfaces:
- 24 V signal interface
- Multifunction interface

The ENABLE/GATE signal can have two functions:

**ENABLE function: enable/block power amplifier**
The ENABLE function enables the power amplifier so that the motor can be controlled.

**GATE function: enable/block the pulse input**
The GATE function blocks the pulses at the reference input without switching off the operating readiness. In a multi-axis system, individual axes can be selected with the GATE function.




*Signal sequences when the Integrated Drive System is switched on with the GATE function*

1 Motor step
2 No motor steps
3 Motor steps

The diagram shows the motor movement with activated GATE function. No pulse may be applied for 1.5 ms before and after the GATE signal changes to ensure that the Integrated Drive System can follow the preset pulse step by step. If the time interval is not kept, the LED signals a warning. The warning does not affect the operating readiness of the Integrated Drive System.

**Settings via parameter switch**
Set the function of the ENABLE/GATE signal input

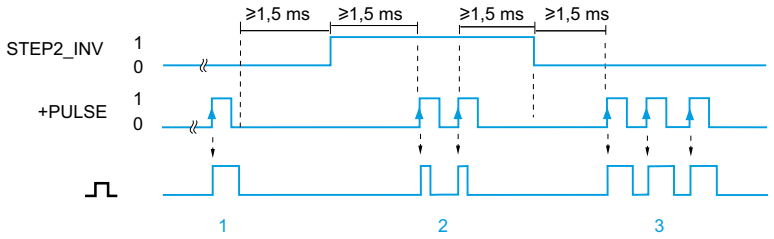
**Setting the function of the STEP2_INV / PWM signal input**

The STEP2_INV/PWM signal is available at the following interfaces:
- Multifunction interface
- 24 V signal interface (only STEP2_INV)

The STEP2_INV/PWM signal can have two functions:

**STEP2_INV function**

The STEP2_INV function can be used if a high positioning accuracy is required but the output frequency of the master controller is limited.
The number of steps can be increased or reduced by a factor of 10 with the STEP2_INV / PWM signal.
If the STEP2_INV function is activate, the setting of the parameter switch 1.1 is inverted.




*Signal sequences when the STEP2_INV signal changes*

1 Large motor step
2 Motor steps decreased by a factor of 10
3 Large motor steps

**PWM function**

The PWM (pulse width modulation) function can be used to reduce the motor phase current and, by implication, the torque to a value between 0% and 100% of the motor phase current that is set at the HEX rotary switch.
At constant level HIGH, motor phase current does not flow (current set to zero).
At constant level LOW, the motor operates with the adjusted maximum motor phase current.
If rectangular pulse signals are supplied, the motor phase current can be set using the pulse-pause ratio.

**Settings via parameter switch**

Set the function of the STEP2_INV / PWM signal input

### Setting the function of the FAULT/INDEX PULSE signal output

The index pulse signal can be made available at the FAULT / INDEXPULSE signal output.
The FAULT/INDEX PULSE signal is available at the following interfaces:
■ 24 V signal interface
The FAULT/INDEX PULSE signal can have two functions:

**FAULT function**
The FAULT function displays an error status. An error can be reset by blocking and enabling the power amplifier (ENABLE: LOW → HIGH signal).

**INDEXPULSE function**
If the integrated Drive System is equipped with the optional internal Hall sensor at the motor shaft, the Hall sensor sends the INDEXPULSE signal per revolution.

**Settings via parameter switch**
Set the function of the FAULT/INDEX PULSE signal output

### Activating blocking detection.

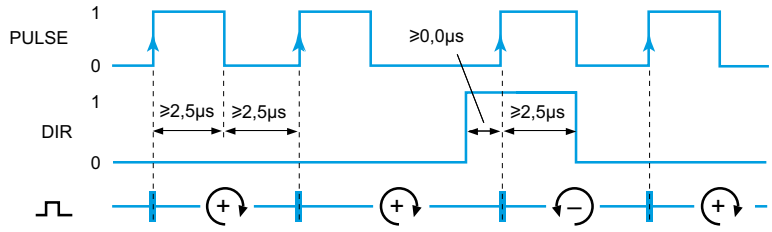
The blocking detection responds if the actual position of the axis deviates from the reference position by more than one revolution.
When the blocking detection responds, the Integrated Drive System is de-energised and the FAULT signal output is set.

**Settings via parameter switch**
Activate/deactivate blocking detection

### Setting the function of the DIR/A and PULSE/B signal inputs

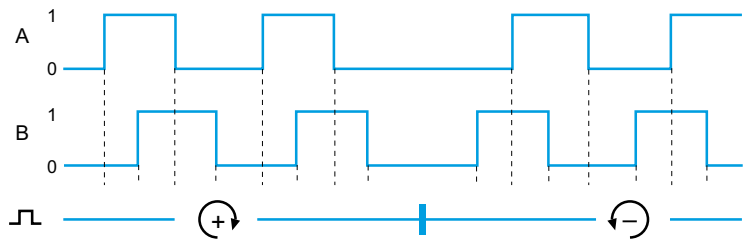
The reference position values can be supplied to the multifunction interface as pulse/direction signals or as A/B encoder signals. The Integrated Drive System converts the input signals into a motor movement.
Two interface modes are available:

**PULSE/DIR interface mode**
The motor executes an angle step with the rising edge of the PULSE signal. The direction of rotation is controlled by the DIR signal.




*Pulse/direction signals*

**A/B interface mode**
In A/B interface mode, A/B encoder signals are supplied as reference values.




*A/B encoder signals*

**Settings via parameter switch**
Set the function of the DIR / A and PULSE / B signal inputs

## "Safe Torque Off" ("Power Removal") safety function

The Lexium integrated drive integrates the "Safe Torque Off" ("Power Removal") safety function which prevents unintended restarting of the motor. The motor no longer produces any torque if the safety function is active.

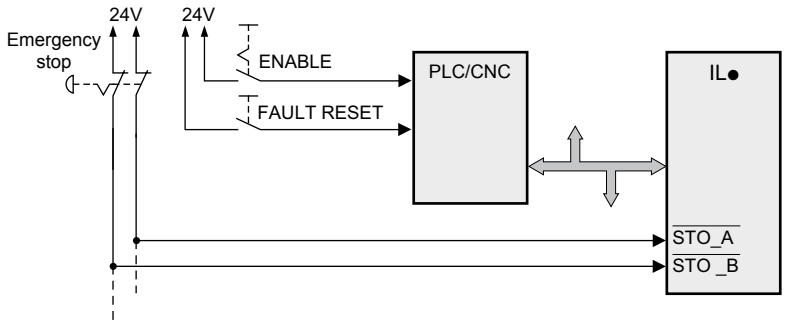
This safety function:
- Complies with the machine safety standard ISO 13849-1, perfomance level "d" (PL d).
- Complies with the standard for functional safety IEC/EN 61508, SIL2 capability (safety control-signalling applied to processes and systems). The SIL (Safety Integrity Level) capability depends on the connection diagram for the servo drive and for the safety function. Failure to observe the setup recommendations could inhibit the SIL capability of the "Safe Torque Off" ("Power Removal") safety function.
- Complies with product standard IEC/EN 61800-5-2 "Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional" for both stop functions:
  - Safe Torque Off ("STO") corresponds to Category 0 stop according to IEC/EN 60204-1. Standstill by immediate power shutdown to the machine drive elements (i.e. an uncontrolled stop).
  - Safe Stop 1 ("SS1") corresponds to Category 1 stop according to IEC/EN 60204-1. A controlled stop in which the machine drive elements are retained to effect the standstill. The final shutdown is ensured by an external Emergency stop module with safe time delay, e.g. Preventa XPS-AV *(1)*.

The "Safe Torque Off" ("Power Removal") safety function has a redundant electronic architecture *(2)* which is monitored continuously by a diagnostics function.

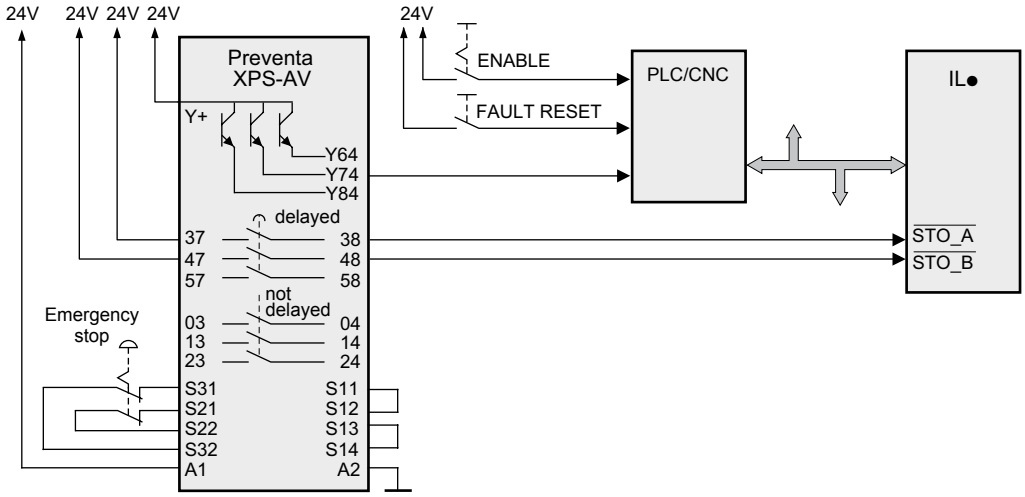
This PL d and SIL2 safety function is certified as conforming to these standards by the TÜV certification body in the context of a voluntary certification.

*(1) Please refer to the "Safety functions and solutions using Preventa" catalogue.*
*(2) Redundant: Consists of mitigating the effects of the failure of one component by means of the correct operation of another, assuming that faults do not occur simultaneously on both.*

**Examples of applications of the safety function**




*Example of Category 0 Stop*

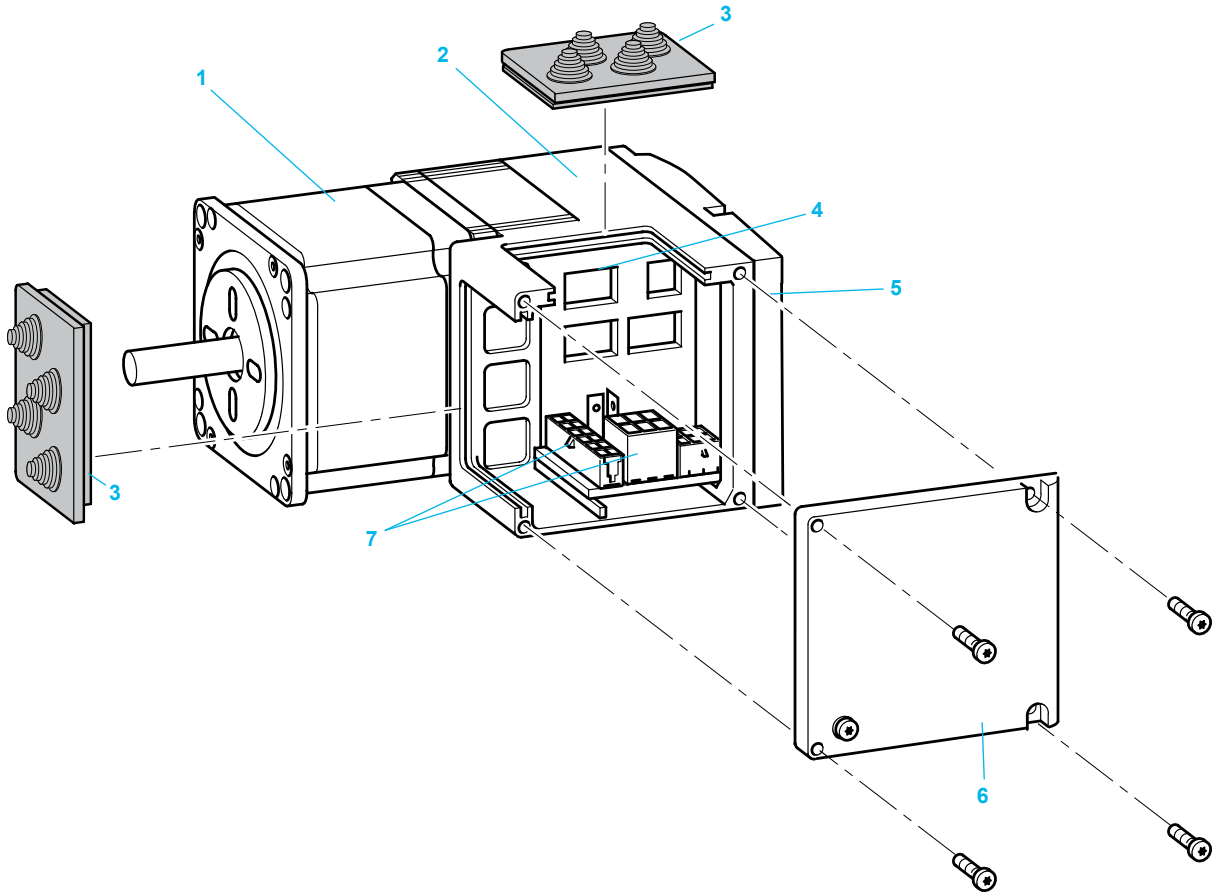



*Example of Category 1 Stop*

# Lexium integrated drives
## ILS1 with pulse/direction interface
## ILS1 with 3-phase stepper motor

### Description

ILS1 consist of control electronics with pulse/direction interface and a 3-phase stepper motor. ILS1 is optionally available with printed circuit board connectors or industrial connectors. A holding brake is optionally available for ILS1●85.




1 3-phase stepper motor
2 Electronics housing
3 Insert cable entry (accessory)
4 Settings via parameter switches
5 Cover for electronics housing
6 Cover for connector housing
7 Electrical interfaces

# Lexium integrated drives
ILS1 with pulse/direction interface
ILS1 with 3-phase stepper motor

## Certifications

| | | | |
|---|---|---|---|
| **Conformity to standards** | | | Lexium integrated drives have been developed to comply with the stringent international standards and with the recommendations for adjustable speed power drive systems, specifically: IEC/EN 61800-3 (noise immunity to conducted and radiated high-frequency signals) and IEC/EN 50178 (resistance of devices to vibration). |
| | EMC immunity | | EN 61800-3:2001, second environment |
| | Conducted and radiated EMC emissions | | EN 61800-3:2001-02; IEC 61800-3, Ed.2<br>■ Power supplies without external mains filter:<br>□ C3 up to 10 m supply cable length<br>■ Power supplies with external mains filter:<br>□ C2 up to 20 m supply cable length<br>□ C3 up to 50 m supply cable length |
| **CE marking** | | | The Lexium integrated drives are CE marked in accordance with the European Machinery Directive (98/37/EEC) and the European EMC Directive (2004/108/EEC). |
| **Product certifications** | | | UL (USA), cUL (Canada) |
| | | | TÜV certification: Lexium integrated drives are TÜV-certified for device safety and medical devices. The certification includes:<br>■ Functional safety of electrical/electronic/programmable safety-related electronic systems (IEC 61508:2000; SIL 2)<br>■ Safety of machinery – functional safety of safety-related electrical and electronic and programmable electronic control systems (IEC 62061:2005; SILcl2)<br>■ Safety of machinery – safety-related parts of control systems – Part 1: General principles for design (ISO 13849-1:2006; PL d (Category 3)) |

## Ambient conditions

| | | | |
|---|---|---|---|
| **Ambient temperature** *(1)* | | **°C** | 0 ... 65; power reduction by 2%/°C at 50 ... 65 |
| **Max. permissible temperature of the power amplifier** | | **°C** | 105 |
| **Max. permissible temperature of the motor** *(2)* | | **°C** | 110 |
| **Transport and storage temperature** | | **°C** | -25 ... +70 |
| **Installation height without power reduction** | | **m** | < 1000 m above mean sea level |
| **Relative humidity** | | **%** | 15 ... 85 (not condensing) |
| **Vibration load during operation as per DIN EN 60068-2-6** | Number of cycles | | 10 |
| | Acceleration amplitude: | **m/s²** | 20 |
| | Frequency range | **Hz** | 10 ... 500 |
| **Continuous shocks as per DIN EN 60068-2-29** | Number of shocks | | 1000 |
| | Peak acceleration | **m/s²** | 150 |
| **Shaft wobble and perpendicularity** | | | According to EN 50347 (IEC 60072-1) |
| **Degree of protection as per DIN EN 60034-5** | | | Total except shaft bushing IP54, shaft bushing IP41 |

## Electrical data

### Power supply connection (CN1)

| | | | |
|---|---|---|---|
| | | | Corresponds to PELV according to DIN 19240, not protected against reverse polarity |
| **Supply voltage range** | | **⎓ V** | 18 ... 40 |
| **Nominal supply voltage** | | **⎓ V** | 24 / 36 |
| **Ripple at nominal voltage** | | **$V_{PP}$** | ≤ 3.6 |
| **Max. current consumption** | ILS1●57 | **A** | 3.5 |
| | ILS1●851, ILS1●852 | **A** | 5 |
| | ILS1●853 | | |
| | ■ with winding type T | **A** | 6 |
| | ■ with winding type P | **A** | 5 |
| **Inrush current** | | | Charging current for capacitor C=1500 µF |
| **External fuse** | | **A** | 10 |

### Multifunction interface (CN2)

| **Type of integrated drive** | | | **ILS1V (5 V)** | **ILS1W (5 V RS 422)** | **ILS1U (24 V)** |
|---|---|---|---|---|---|
| **Signal inputs** | Galvanically isolated | | yes | no | yes |
| | Logic 0 ($U_{low}$) | **V** | -5.25 ... +0.4 | RS 422 | -3 ... +3 |
| | Logic 0 ($U_{high}$) | **V** | +2.5...+5.25 | RS 422 | +20 ... +30 |
| | Permissible voltage range | **V** | -5.25 ... +5.25 | -2 ... +26 *(3)* | -3 ... 30 |
| | Input resistance | **Ω** | 140 | 5000 | 2000 |
| | PULSE/DIR frequency input | **kHz** | ≤ 200 | ≤ 200 | ≤ 200 |
| | Frequency input PWM current reduction | **kHz** | 6 ... 25 | 6 ... 25 | 6 ... 25 |
| **Signal outputs** | | | Short-circuit protected, protected against reverse polarity up to 100 mA, suitable for inductive load (1000 mH / 100 mA) | | |
| | Galvanically isolated | | yes | no | yes |
| | Max. switching voltage | **V** | 30 | 30 | 30 |
| | Max. switching current | **mA** | 100 | 100 | 100 |
| | Internal voltage drop at 10 mA / 100 mA | **V** | ≤ 1.6 / 1.9 | ≤ 0.2 / 0.2 | ≤ 1.6 / 1.9 |

*(1) Limit values with flanged motor mounted on a steel plate 300 x 300 x 10 mm*
*(2) Measured at the surface*
*(3) Voltage relating to 0V ⎓*

| | | |
|---|---|---|
| **Electrical data** | | |
| **24 V signal interface (CN4)** | | 4 signals, can each be used as input or output<br>GND galvanically connected to GND supply voltage, not protected against reverse polarity |
| **24 V signal inputs** | | |
| **Logic 0 ($U_{low}$)** | **V** | -3 ... +3 |
| **Logic 1 ($U_{high}$)** | **V** | +20 ... +30 |
| **Permissible voltage range** | **V** | -3 ... 30 |
| **Input resistance** | **Ω** | 2000 |
| **Debounce time IO0..IO3** | **ms** | 0.1 |
| **Debounce time IO2, IO3 with capture function** | **ms** | 0.01 |
| **24 V signal outputs** | | Switching to plus, short-circuit protected, suitable for inductive load (1000 mH / 100 mA) |
| **Supply voltage range** | **⎓ V** | 23 ... 25 |
| **Max. switching current (total)** | **mA** | 200 |
| **Max. switching current per output** | **mA** | 100 |
| | | The internal power supply unit is protected against:<br>■ Short circuit of the output voltage<br>■ Overload of output voltage (limited to 6 W output power) |
| **Interface for safety function "Safe Torque Off" (CN5)** | | No galvanic isolation; corresponds to RS 485 standard |
| **Logic 0 ($U_{low}$)** | **V** | -3 ... +4.5 |
| **Logic 1 ($U_{high}$)** | **V** | +15 ... +30 |
| **Input current (typical at 24 V)** | **mA** | 10 |
| **Debounce time** | **ms** | 1 ... 5 |
| **Response time (until shutdown of power amplifier)** | **ms** | < 50 |
| **Max. Time offset until detection of signal differences between $\overline{\text{STO\_A}}$ and $\overline{\text{STO\_B}}$** *(1)* | **S** | < 1 |
| **Safety function "Safe Torque Off" ("Power Removal")** | | |
| **Protection** Of machine | | "Safe Torque Off" safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard ISO 13849-1, performance level "d" (PL d) , and standard IEC/EN 61800-5-2 |
| Of the system process | | "Safe Torque Off" safety function which forces stopping and/or prevents unintended restarting of the motor, conforming to standard IEC/EN 61508 level SIL2 and standard IEC/EN 61800-5-2 |

*(1) Switching process must be simultaneous for both signal inputs (time offset < 1 s).*

## Mechanical data ILS1●57

| Type of integrated drive | | | ILS1●571 | ILS1●572 | ILS1●573 |
|---|---|---|---|---|---|
| **Winding type** | | | P | P | P |
| **Max. torque** | $M_{max}$ | **Nm** | 0.45 | 0.90 | 1.50 |
| **Holding torque** | | **Nm** | 0.51 | 1.02 | 1.70 |
| **Rotor inertia** | | **kg·cm²** | 0.1 | 0.22 | 0.38 |
| **Number of steps** | | | 200 / 400 / 500 / 1000 / 2000 / 4000 / 5000 / 10000 | | |
| **Step angle** | | **°** | 1.8 / 0.9 / 0.72 / 0.36 / 0.18 / 0.09 / 0.072 / 0.036 | | |
| **Systematic angle tolerance per step** *(1)* | | **arcmin** | ±6 | ±6 | ±6 |
| **Mass** | | **kg** | 1.3 | 1.6 | 2.0 |
| **Shaft load** *(2)* | Max. radial force *(3)* | **N** | 24 | 24 | 50 |
| | Max. axial tensile force | **N** | 100 | | |
| | Max. axial force pressure | **N** | 8.4 | | |
| | Nominal bearing service life *(4)* | **h** | 20000 | | |

## Mechanical data ILS1●85

| Type of integrated drive | | | ILS1●851 | ILS1●852 | ILS1●853 | |
|---|---|---|---|---|---|---|
| **Winding type** | | | P | P | P | T |
| **Max. torque** | $M_{max}$ | **Nm** | 2.0 | 4.0 | 6.0 | 4.5 |
| **Holding torque** | | **Nm** | 2.0 | 4.0 | 6.0 | 4.5 |
| **Rotor inertia** | | **kg·cm²** | 1.1 | 2.2 | 3.3 | |
| **Number of steps** | | | 200 / 400 / 500 / 1000 / 2000 / 4000 / 5000 / 10000 | | | |
| **Step angle** | | **°** | 1.8 / 0.9 / 0.72 / 0.36 / 0.18 / 0.09 / 0.072 / 0.036 | | | |
| **Systematic angle tolerance per step** *(1)* | | **arcmin** | ±6 | | | |
| **Mass** | | **kg** | 2.6 | 3.6 | 4.7 | |
| **Shaft load** *(2)* | Max. radial force *(3)* | **N** | 100 | 100 | 110 | |
| | Max. axial tensile force | **N** | 170 | | | |
| | Max. axial force pressure | **N** | 30 | | | |
| | Nominal bearing service life *(4)* | **h** | 20000 | | | |

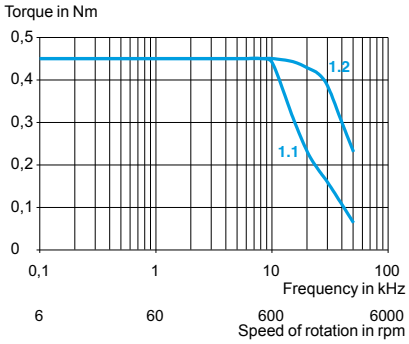
### Holding brake

| | | |
|---|---|---|
| **Holding torque** | **Nm** | 6 |
| **Electrical pull-in power** | **W** | 22 |
| **Brake release time** | **ms** | 40 |
| **Brake application time** | **ms** | 20 |
| **Moment of inertia** | **kg·cm²** | 0.2 |
| **Mass** | **kg** | 1.8 |

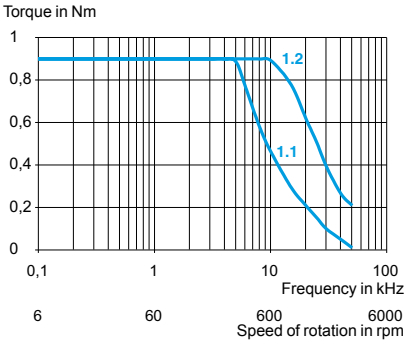
*(1) Measured at 1000 steps/revolution*
*(2) Conditions for shaft load: speed of rotation 60 rpm, duty cycle at torque, ambient temperature 40 °C*
*(3) Point of application of radial force: 10.5 mm distance to flange*
*(4) Operating hours at a probability of failure of 10 %*

## Torque characteristics ILS1●57

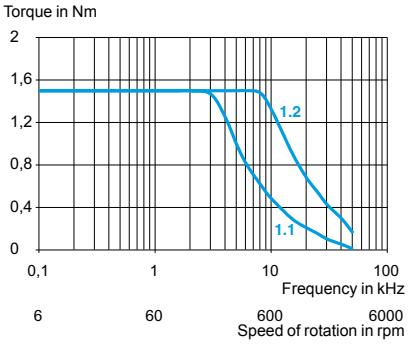
### ILS1●571P (winding type P)




### ILS1●572P (winding type P)

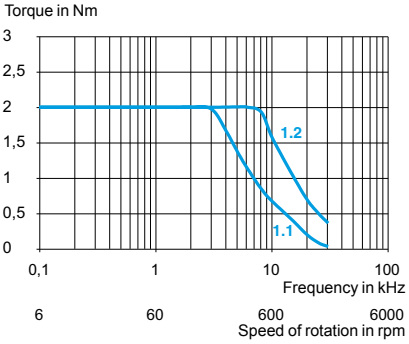



### ILS1●573P (winding type P)

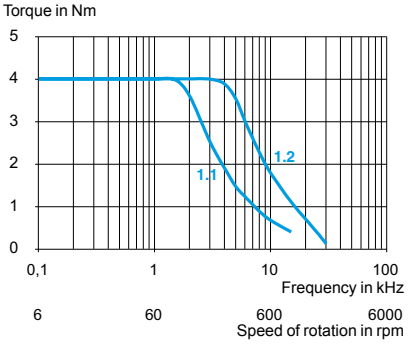



## Torque characteristics ILS1●85

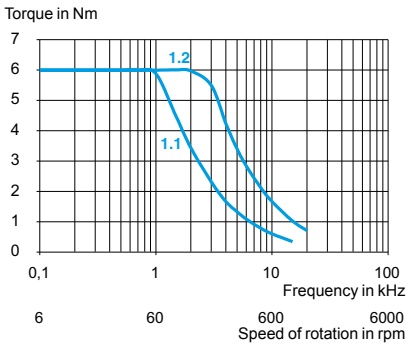
### ILS1●851P (winding type P)



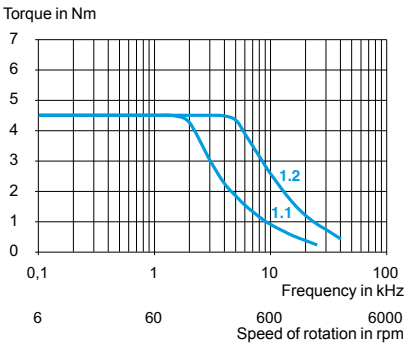

### ILS1●852P (winding type P)




### ILS1●853P (winding type P)




### ILS1●853T (winding type T)




1.1 Max. torque at 24 V
1.2 Max. torque at 36 V

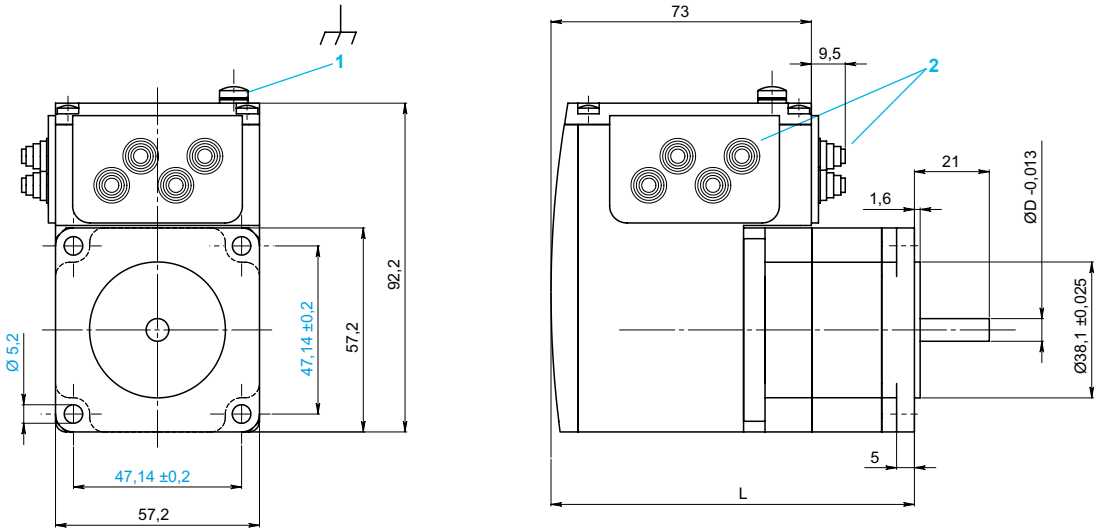
# Lexium integrated drives
## ILS1 with pulse/direction interface
## ILS1 with 3-phase stepper motor

### References

| Example: | I | L | S | 1 | U | 5 | 7 | 1 | P | B | 1 | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Motor type**<br>**S** = 3-phase stepper motor | I | L | **S** | 1 | U | 5 | 7 | 1 | P | B | 1 | A |
| **Supply voltage**<br>**1** = 24 ... 36 V | I | L | S | **1** | U | 5 | 7 | 1 | P | B | 1 | A |
| **Communication interface**<br>**U** = pulse/direction 24 V, opto-isolated<br>**V** = pulse/direction 5 V, opto-isolated<br>**W** = pulse/direction 5 V RS 422 | I | L | S | 1 | **U** | 5 | 7 | 1 | P | B | 1 | A |
| **Flange size**<br>**57** = 57 mm<br>**85** = 85 mm | I | L | S | 1 | U | **5** | **7** | 1 | P | B | 1 | A |
| **Motor length ("L")** *(1)*<br>**1** = motor length "L"<br>**2** = motor length "L"<br>**3** = motor length "L" | I | L | S | 1 | U | 5 | 7 | **1** | P | B | 1 | A |
| **Winding type**<br>**P** = medium speed of rotation, medium torque<br>**T** = high speed of rotation, medium torque *(2)* | I | L | S | 1 | U | 5 | 7 | 1 | **P** | B | 1 | A |
| **Connection technology**<br>**B** = printed circuit board connector<br>**C** = industrial connector | I | L | S | 1 | U | 5 | 7 | 1 | P | **B** | 1 | A |
| **Measurement system**<br>**1** = index pulse | I | L | S | 1 | U | 5 | 7 | 1 | P | B | **1** | A |
| **Holding brake**<br>**A** = no holding brake<br>**F** = with holding brake *(3)* | I | L | S | 1 | U | 5 | 7 | 1 | P | B | 1 | **A** |

*(1) The motor length "L" depends on the mechanical characteristics, see pages 4/101, 4/104 and 4/105.*
*(2) Winding type T only with ILS1●853.*
*(3) Holding brake only with ILS1●85.*

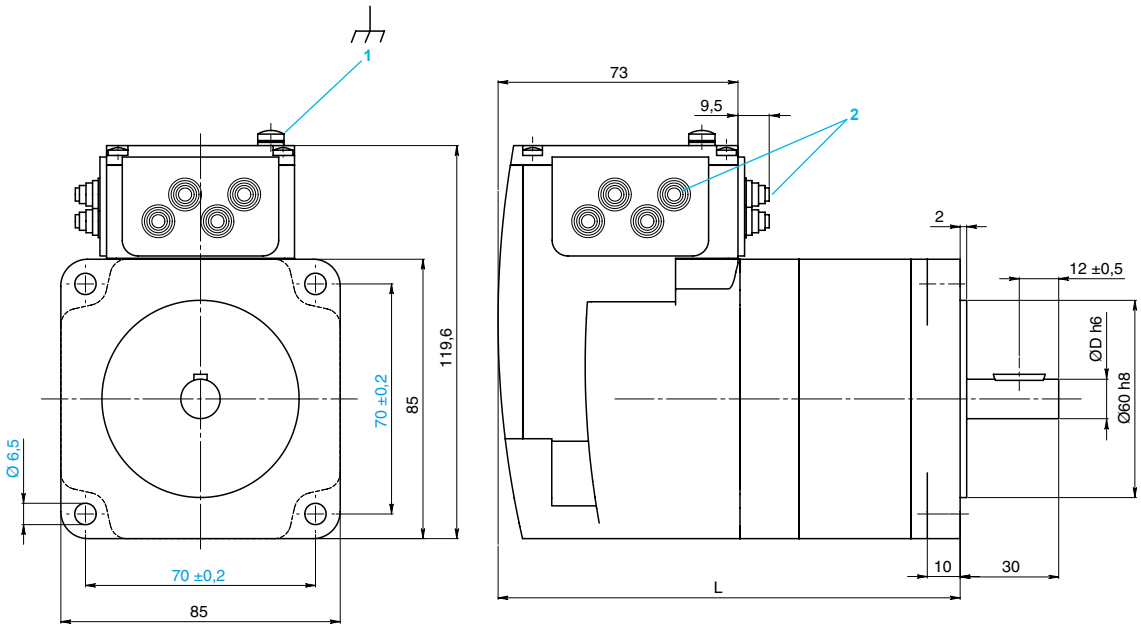
## ILS1●57 integrated drives




| | L | D |
|---|---|---|
| **ILS1●571** | 101.9 | 6.35 |
| **ILS1●572** | 115.9 | 6.35 |
| **ILS1●573** | 138.9 | 8.00 |

1 Earth (ground) terminal
2 Accessories: cable entries Ø = 3 ... 9 mm

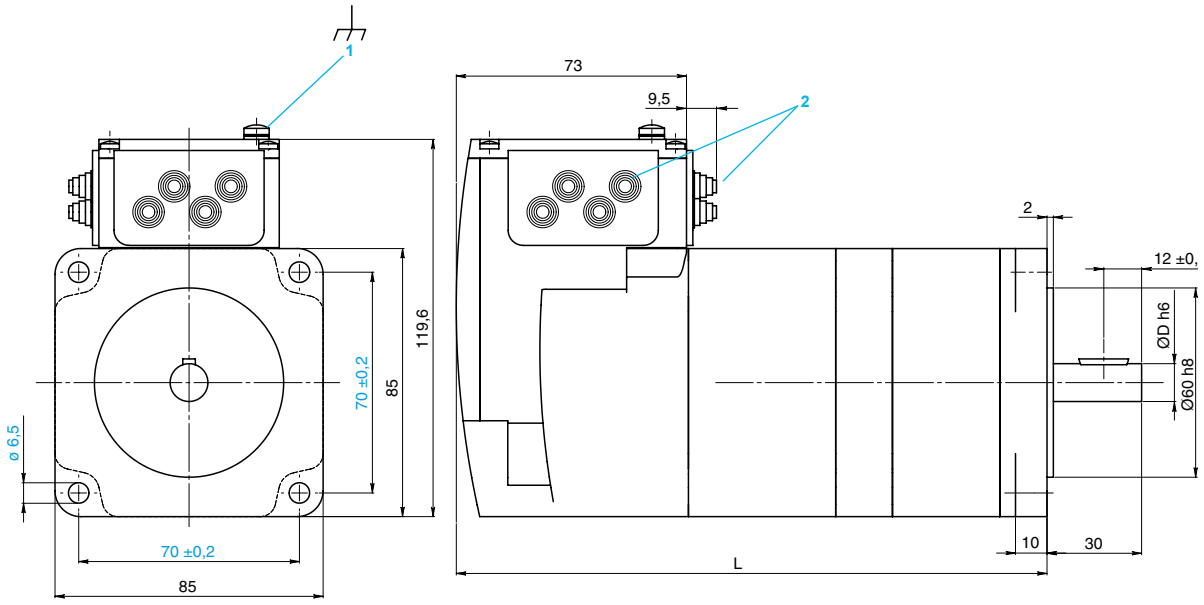
## ILS1●85 integrated drives without holding brake




| | L | D |
|---|---|---|
| **ILS1●851** | 140.6 | 12 |
| **ILS1●852** | 170.6 | 12 |
| **ILS1●853** | 200.6 | 14 |

1 Earth (ground) terminal
2 Accessories: cable entries Ø = 3 ... 9 mm

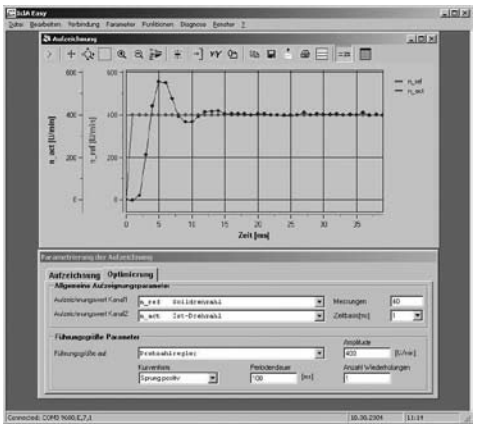
## ILS1●85 integrated drives with holding brake




| | L | D |
|---|---|---|
| **ILS1●851** | 187.3 | 12 |
| **ILS1●852** | 217.3 | 12 |
| **ILS1●853** | 247.3 | 14 |

1 Earth (ground) terminal
2 Accessories: cable entries Ø = 3 ... 9 mm

# Lexium integrated drives
## Option: Commissioning software “Lexium CT”



## Presentation

### Functions

The “Lexium CT” commissioning software includes the following functions:
- Input and display device parameters
- Archive and duplicate device parameters
- Display status and device information
- Position the motor with the PC
- Trigger reference movements
- Access all documented parameters
- Diagnostics of malfunctions
- Controller optimisation (ILA only)

### Requirements and interfaces

"Lexium CT” commissioning software runs on a PC under Microsoft Windows® 2000/XP/Vista. The Lexium integrated drives are connected via the CN3 interface for commissioning.
Fieldbus converters, e.g. NuDAM ND-6530 and ND-6520 from Acceed, can be used, please consult your Regional Sales Office.

### Integrated drive/PC interface

| Integrated drive system interface | PC interface |
|---|---|
| RS 485 | USB |
| | RS 232 |
| CANopen | USB |
| | Parallel |
| PROFIBUS DP | PCMCIA |
| | PCI |
| | USB |

Lexium integrated drives with EtherCAT, Ethernet Powerlink and Modbus TCP fieldbuses can also be configured directly via the Ethernet connection.

### Source

The latest version of the “Lexium CT” PC commissioning software is available for download on our website at www.schneider-electric.com.

## Reference

### “Lexium CT” PC commissioning software

| Description | Reference | Weight kg |
|---|---|---|
| CD-ROM, multilingual;<br>Contents:<br>■ Technical documentation, multilingual<br>■ Commissioning software “Lexium CT”<br>■ EPlan macros<br>■ CAD drawings<br>■ EDS and GSD files | **VW3M8703** | – |

# Lexium integrated drives
## Accessories for integrated drives

VW3L10100N●

### Installation accessories

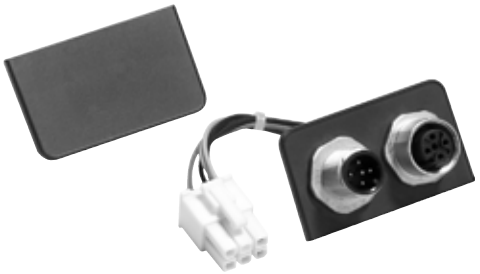
| Description | Sold in lots of | Reference | Weight kg |
|---|---|---|---|
| **Cable entries** | | | |
| For up to 4 cables with a diameter of 3 to 9 mm. Two cable entries per integrated drive system are required. The cable entries are for sealing, strain relief and shield connection. | 2 | **VW3L10100N2** | – |
| | 10 | **VW3L10100N10** | – |

VW3L10000N●●

| | | | |
|---|---|---|---|
| **Insert for sealing IP 54** | | | |
| For closing the cutouts for the inserts. | 10 | **VW3L10000N10** | – |
| | 20 | **VW3L10000N20** | – |
| | 50 | **VW3L10000N50** | – |

VW3L10222

| | | | |
|---|---|---|---|
| **Cable entry IP 54** | | | |
| 1 insert for variable use for signals and power supply via 2 x M16 cable entries and 1 insert for sealing (IP 54).<br>For two cables with a diameter of 5 to 9 mm. | 1 | **VW3L10222** | – |

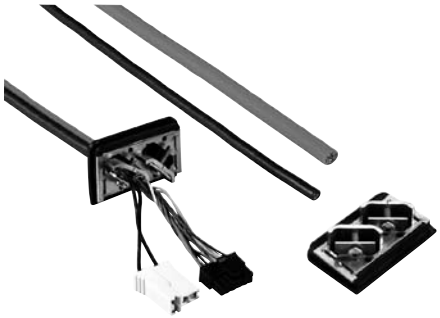


VW3L1R000

| | | | |
|---|---|---|---|
| **Insert for commissioning interface** | | | |
| 1 insert for connection of RS 485 (IN/OUT) with circular connector and 1 insert for sealing (IP 54).<br><br>Contents:<br>■ 1 insert<br>□ 1 M12 socket (5 poles)<br>□ 1 M12 plug (5 poles)<br>■ 1 insert for sealing | 1 | **VW3L1R000** | – |
| **Suitable accessories** | | | |
| CANopen/RS 485 connector kit | 1 | **VW3L5F000** | – |

VW3L10111

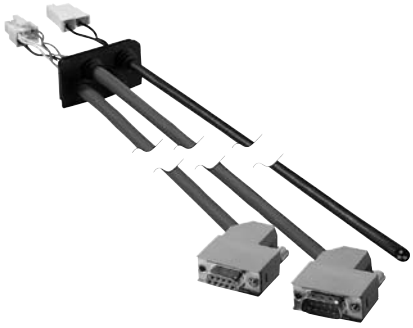
| | | | |
|---|---|---|---|
| **Installation kit** | | | |
| Installation kit for customised cabling of fieldbus, power supply and “Safe Torque Off” safety function (“Power Removal”)<br><br>Contents:<br>■ Cable entries<br>■ Crimp contacts<br>■ Crimp connectors<br>■ Connector housings<br>■ Shielding foil | 1 | **VW3L10111** | – |



*VW3L2U001R●●*

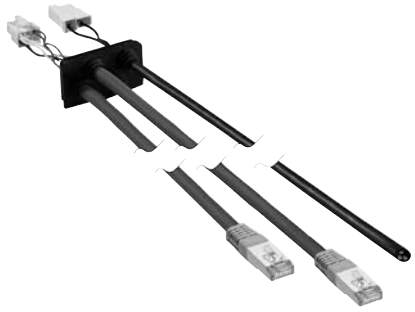
## Accessories for Lexium integrated drives with printed circuit board connectors

| Description | Length m | Reference | Weight kg |
|---|---|---|---|
| **Cable kit for Lexium integrated drives ILS1 with pulse/direction interface** | | | |
| Cable equipped with:<br>■ Drive end of cable pre-assembled and with strain relief.<br>For power supply and pulse/direction signals or A/B signals.<br>■ Other cable end open. | 3 | **VW3L2U001R30** | – |
| | 5 | **VW3L2U001R50** | – |
| | 10 | **VW3L2U001R100** | – |
| | 15 | **VW3L2U001R150** | – |
| | 20 | **VW3L2U001R200** | – |



*VW3L2●001R30*

| Description | | Length m | Reference | Weight kg |
|---|---|---|---|---|
| **Cable kits for fieldbus interfaces (CANopen, PROFIBUS DP, RS 485, DeviceNet) and power supply** | | | | |
| Cable equipped with:<br>■ Drive end of cable pre-assembled and with strain relief<br>For power supply and fieldbus.<br>■ Other cable end: power supply open, fieldbus with SubD (9 poles) | CANopen | 3 | **VW3L2F001R30** | – |
| | PROFIBUS DP | 3 | **VW3L2B001R30** | – |
| | RS 485 | 3 | **VW3L2R001R30** | – |
| | DeviceNet | 3 | **VW3L2D001R30** | |



*VW3L2●03001*

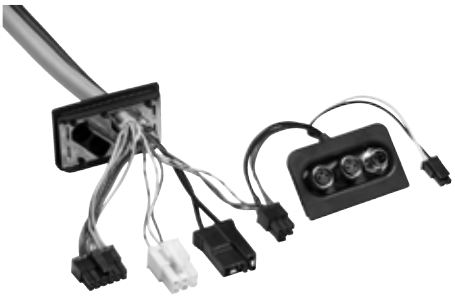
| Description | | Length m | Reference | Weight kg |
|---|---|---|---|---|
| **Cable kits for fieldbus interfaces (power supply, EtherCAT, Ethernet Powerlink, Modbus TCP)** | | | | |
| Cable equipped with:<br>■ Drive end of cable pre-assembled and with strain relief.<br>For power supply and fieldbus.<br>■ Other cable end: power supply open, fieldbus with RJ45 | EtherCAT | 3 | **VW3L2E03001** | – |
| | Ethernet Powerlink | 3 | **VW3L2P03001** | – |
| | Modbus TCP | 3 | **VW3L2T03001** | – |

# Lexium integrated drives
## Accessories for integrated drives

VW3L2M001R●●

## Accessories for Lexium integrated drives with printed circuit board connectors (continued)

| Description | Length m | Reference | Weight kg |
|---|---|---|---|
| **Cable kit for Lexium integrated drives ILS1 with I/O interface for motion sequence** | | | |
| Cable equipped with:<br>■ Drive end of cable pre-assembled and with strain relief, for data set mode. For power supply and I/O signals.<br>■ Other cable end open. | 3 | **VW3L2M001R30** | – |
| | 5 | **VW3L2M001R50** | – |
| | 10 | **VW3L2M001R100** | – |
| | 15 | **VW3L2M001R150** | – |
| | 20 | **VW3L2M001R200** | – |



VW3L2M211R●●

| Description | Length m | Reference | Weight kg |
|---|---|---|---|
| **Cable kit for Lexium integrated drives with motion sequence and insert with 2 I/O, 1 STO** | | | |
| Cable equipped with:<br>■ Drive end of cable pre-assembled and with strain relief, for data set mode. For power supply and I/O signals.<br>■ Other cable end open.<br><br>Additional insert equipped with:<br>■ 2 I/O and 1 "Safe Torque Off" via M8 circular connector. | 3 | **VW3L2M211R30** | – |
| | 5 | **VW3L2M211R50** | – |
| | 10 | **VW3L2M211R100** | – |
| | 15 | **VW3L2M211R150** | – |
| | 20 | **VW3L2M211R200** | – |

VW3L40300

## Accessories for Lexium integrated drives with industrial connectors

| Description | Reference | Weight kg |
|---|---|---|
| **Insert for 3 I/O signals** | | |
| Contents:<br>■ 1 insert with 3 M8 sockets (3 poles) for connection of 3 I/O signals<br>■ 1 blind insert | **VW3L40300** | – |
| **Suitable accessories** | | |
| Connector kit 3 I/O | **VW3L50300** | – |

VW3L40210

| Description | Reference | Weight kg |
|---|---|---|
| **Inserts for 2 I/O signals and signals for "Safe Torque Off" safety function ("Power Removal")** | | |
| Contents:<br>■ 1 insert<br>□ 2 M8 sockets (3 poles) for connection of 2 I/O signals<br>□ 1 M8 plug (4 poles) for connection of signals for Safe Torque Off<br>■ 1 insert for sealing (IP 54) | **VW3L40210** | – |
| **Suitable accessories** | | |
| Connector kit 2 I/O | **VW3L50200** | – |
| Cable (STO M8x4) | **VW3L30010R●●●** | |

4

VW3L400200

## Accessories for Lexium integrated drives with industrial connectors (continued)

| Description | Reference | Weight kg |
|---|---|---|
| **Insert with 2 signals for "Safe Torque Off" safety function ("Power Removal")** | | |
| Contents:<br>■ 2 M8 plugs (4 poles) for connection of signals for Safe Torque Off<br>■ 1 blind insert | **VW3L400200** | – |
| **Suitable accessories** | | |
| Cable for STO" | **VW3L30010R●●●** | – |

VW3L50200

| | | |
|---|---|---|
| **Connector kit 2 I/O** | | |
| Connector kit for assembly of cables for 2 I/O signals<br>Contents:<br>■ 2 M8 circular connector (3-pin) | **VW3L50200** | – |

VW3L50300

| | | |
|---|---|---|
| **Connector kit 3 I/O** | | |
| Connector kit for assembly of cables for 3 I/O signals<br>Contents:<br>■ 3 M8 circular connector (3 poles) | **VW3L50300** | – |

VW3L50010

| | | |
|---|---|---|
| **Connector 1 STO output** | | |
| Connector for assembly of cables for transmitting the signals for the "Safe Torque Off" safety function ("Power Removal")<br>Contents:<br>■ 1 M8 circular connector (4-pin) | **VW3L50010** | – |

VW3L30001R●●

## Accessories for Lexium integrated drives with industrial connectors (continued)

| Description | Length m | Reference | Weight kg |
|---|---|---|---|
| **Cable (power supply, STAK)** | | | |
| For connection of power supply; for drag chain applications; complies with DESINA standard This cable is suitable only for Lexium integrated drives with fieldbus interface. | 3 | **VW3L30001R30** | – |
| | 5 | **VW3L30001R50** | – |
| | 10 | **VW3L30001R100** | – |
| | 15 | **VW3L30001R150** | – |
| | 20 | **VW3L30001R200** | – |

VW3L30010R●●

| | | | |
|---|---|---|---|
| **Cable (STO M8x4)** | | | |
| Cable with M8 socket (4 poles) for connection of signals for “Safe Torque Off” safety function (“Power Removal”) | 3 | **VW3L30010R30** | – |
| | 5 | **VW3L30010R50** | – |
| | 10 | **VW3L30010R100** | – |
| | 15 | **VW3L30010R150** | – |
| | 20 | **VW3L30010R200** | – |

VW3L5B000

| | | | |
|---|---|---|---|
| **Connector kits for IL●1 for PROFIBUS DP** | | | |
| For assembly of PROFIBUS DP cables<br>Contents:<br>■ 1 M12 circular connector (B-coded)<br>■ 1 M12 circular socket (B-coded)<br>■ 1 M12 protective cap | | **VW3L5B000** | – |

VW3L5F000

| | | | |
|---|---|---|---|
| **Connector kits for IL●1 for CANopen / RS 485** | | | |
| For assembly of CANopen cables or RS 485 cables<br>Contents:<br>■ 1 M12 circular connector (A-coded)<br>■ 1 M12 circular socket (A-coded)<br>■ 1 M12 protective cap | | **VW3L5F000** | – |

VW3L5E000

VW3L5P000

VW3L5D000

VW3L5T000

VW3L40420

## Accessories for Lexium integrated drives with industrial connectors (continued)

| Description | Reference | Weight kg |
|---|---|---|
| **Connector kit EtherCAT** | | |
| For assembly of EtherCAT cables<br>Contents:<br>■ 2xM12 circular connector (D-coded, 4 poles)<br>■ 1 M12 protective cap | **VW3L5E000** | – |
| **Connector kit Ethernet Powerlink** | | |
| For assembly of Ethernet Powerlink cables<br>Contents:<br>■ 2xM12 circular connector (D-coded, 4 poles)<br>■ 1 M12 protective cap | **VW3L5P000** | – |
| **Socket DeviceNet** | | |
| Socket DeviceNet M12, 5 poles, female, A coded | **VW3L5D000** | – |
| **Socket Modbus TCP** | | |
| Socket Modbus TCP M12 (D-coded, 4 poles), female | **VW3L5T000** | – |
| **Inserts with 4 I/O signals and 2 signals for "Safe Torque Off" safety function ("Power Removal")** | | |
| Contents:<br>■ 1 insert<br>□ 2 M8 sockets (3 poles) for connection of 2 I/O signals<br>□ 1 M8 plug (4 poles) for connection of signals for "Safe Torque Off"<br>■ 1 insert<br>□ 2 M8 sockets (3 poles) for connection of 2 I/O signals<br>□ 1 M8 socket (4 poles) for transmitting the signals for "Safe Torque Off" | **VW3L40420** | – |

| Suitable accessories | | |
|---|---|---|
| Connector kit 2 I/O (2x) | **VW3L50200** | – |
| STO connector | **VW3L50010** | – |
| Cable (STO M8x4) | **VW3L30010R●●●** | – |

# Lexium integrated drives
## Option: GBX planetary gearboxes

*GBX planetary gearbox*

## Presentation

In many cases the axis controller requires the use of a planetary gearbox for adjustment of speed of rotation and torque; the accuracy required by the application must be maintained.

To meet these requirements, Schneider Electric has decided to use the Neugart GBX planetary gearbox which are specially tuned to the Lexium integrated drives. This gearing features lifetime lubrication. The GBX planetary gearboxes are easy to install and operate.

The GBX planetary gearboxes – depending on the power of the Lexium integrated drives – are available in three sizes (GBX 40, GBX 60, GBX 80) and with five reduction ratios (3:1 ... 40:1) (see table below).

The values for the continuous torque and the peak torque at standstill which are available at the output shaft, are calculated by multiplying the motor characteristics with the gear ratio and the efficiency of the gearing (0.96 or 0.94 depending on the reduction ratio).

The following table shows the suitable GBX planetary gearbox for the Lexium integrated drives.

**Assignment of integrated drive system and GBX planetary gearbox**

| Type of integrated drive | Reduction ratio | | | | |
|---|---|---|---|---|---|
| | 3:1 | 5:1 | 8:1 | 16:1 | 40:1 |
| ILA1●571T | GBX 60 | GBX 60 | GBX 60 | GBX 60 | GBX 60 |
| ILA1●571P | GBX 60 | GBX 60 | GBX 60 | GBX 60 | GBX 60 |
| ILA1●572T | GBX 60 | GBX 60 | GBX 60 | GBX 60 | GBX 60 |
| ILA1●572P | GBX 60 | GBX 60 | GBX 60 | GBX 60 | GBX 60 |
| ILA2●571T | GBX 60 | GBX 60 | GBX 60 | GBX 60 | GBX 60 |
| ILA2●571P | GBX 60 | GBX 60 | GBX 60 | GBX 60 | GBX 60 |
| ILA2●572T | GBX 60 | GBX 60 | GBX 60 | GBX 60 | GBX 60 |
| ILA2●572P | GBX 60 | GBX 60 | GBX 60 | GBX 60 | GBX 60 |
| ILE1●661P | GBX 40 | GBX 40 | GBX 40 | GBX 60 | GBX 60 |
| ILE2●661P | GBX 40 | GBX 40 | GBX 40 | GBX 60 | GBX 60 |
| ILE2●662P | GBX 40 | GBX 40 | GBX 40 | GBX 60 | GBX 60 |
| ILS1●571P | GBX 60 | GBX 60 | GBX 60 | – | – |
| ILS1●572P | GBX 60 | GBX 60 | GBX 60 | – | – |
| ILS1●573P | GBX 60 | GBX 60 | GBX 60 | – | – |
| ILS1●851P | GBX 80 | GBX 80 | GBX 80 | – | – |
| ILS1●852P | GBX 80 | GBX 80 | GBX 80 | – | – |
| ILS1●853P | GBX 80 | GBX 80 | GBX 80 | – | – |
| ILS1●573T | GBX 80 | GBX 80 | GBX 80 | – | – |
| ILS2●571P | GBX 60 | GBX 60 | GBX 60 | – | – |
| ILS2●572P | GBX 60 | GBX 60 | GBX 60 | – | – |
| ILS2●573P | GBX 60 | GBX 60 | GBX 60 | – | – |
| ILS2●851P | GBX 80 | GBX 80 | GBX 80 | – | – |
| ILS2●852P | GBX 80 | GBX 80 | GBX 80 | – | – |
| ILS2●853P | GBX 80 | GBX 80 | GBX 80 | – | – |
| ILS2●573T | GBX 80 | GBX 80 | GBX 80 | – | – |

**GBX 60** *For these combinations, you must check that the application will not exceed the maximum output torque of the gearbox, see page 4/114.*

# Lexium integrated drives
## Option: GBX planetary gearboxes

### Characteristics

| Type | | | GBX 40 | GBX 60 | GBX 80 |
|---|---|---|---|---|---|
| **Version** | | | Planetary gearbox with straight teeth | | |
| **Backlash** | 3:1 ... 8:1 | **arcmin** | < 24 | < 16 | < 9 |
| | 16:1 ... 40:1 | | < 28 | < 20 | < 14 |
| **Torsional rigidity** | 3:1 ... 8:1 | **Nm/ arcmin** | 1 | 2.3 | 6 |
| | 16:1 ... 40:1 | | 1.1 | 2.5 | 6.5 |
| **Noise level** *(1)* | | **dB(A)** | 55 | 58 | 60 |
| **Casing** | | | Black anodized aluminium | | |
| **Shaft material** | | | C 45 | | |
| **Shaft output dust and dump protection** | | | IP 54 | | |
| **Lubrication** | | | Lubricated life | | |
| **Average service life** *(2)* | | **h** | 30,000 | | |
| **Mounting position** | | | Any position | | |
| **Operating temperature** | | **°C** | -25 ... +90 | | |
| **Efficiency** | 3:1 ... 8:1 | | 0.96 | | |
| | 16:1 ... 40:1 | | 0.94 | | |
| **Maximum permitted radial force** *(2) (3)* | $L_{10h}$ = 10,000 h | **N** | 200 | 500 | 950 |
| | $L_{10h}$ = 30,000 h | **N** | 160 | 340 | 650 |
| **Maximum permitted axial force** *(2)* | $L_{10h}$ = 10,000 h | **N** | 200 | 600 | 1200 |
| | $L_{10h}$ = 30,000 h | **N** | 160 | 450 | 900 |
| **Moment of inertia of gearbox** | 3:1 | **kgcm²** | 0.031 | 0.135 | 0.77 |
| | 5:1 | **kgcm²** | 0.019 | 0.078 | 0.45 |
| | 8:1 | **kgcm²** | 0.017 | 0.065 | 0.39 |
| | 16:1 | **kgcm²** | 0.022 | 0.088 | 0.5 |
| | 40:1 | **kgcm²** | 0.016 | 0.064 | 0.39 |
| **Continuous output torque** *(2)* | 3:1 | **Nm** | 11 | 28 | 85 |
| | 5:1 | **Nm** | 14 | 40 | 110 |
| | 8:1 | **Nm** | 6 | 18 | 50 |
| | 16:1 | **Nm** | 20 | 44 | 120 |
| | 40:1 | **Nm** | 18 | 40 | 110 |
| **Maximum output torque** *(2)* | 3:1 | **Nm** | 17.6 | 45 | 136 |
| | 5:1 | **Nm** | 22 | 64 | 176 |
| | 8:1 | **Nm** | 10 | 29 | 80 |
| | 16:1 | **Nm** | 32 | 70 | 192 |
| | 40:1 | **Nm** | 29 | 64 | 176 |

*(1) Value measured at a distance of 1 m, at no-load for a servo motor speed of 3000 rpm and a reduction ratio of 5:1.*
*(2) Values given for an output shaft speed of 100 rpm in S1 mode (cyclic ratio = 1) on electrical machines for an ambient temperature of 30 °C.*
*(3) Force applied at mid-distance from the output shaft.*

# Lexium integrated drives
Option: GBX planetary gearboxes

## References

*GBX ●●● planetary gearbox*

| Size | Reduction ratio | Reference *(1)* | Weight |
|---|---|---|---|
| | | | kg |
| **GBX 40** | 3:1, 5:1, 8:1 | **GBX 040 ●●● ●●● ●L** | 0.350 |
| **GBX 60** | 3:1, 5:1, 8:1 | **GBX 060 ●●● ●●● ●L** | 0.900 |
| | 16:1, 40:1 | **GBX 060 ●●● ●●● ●L** | 1.100 |
| **GBX 80** | 3:1, 5:1, 8:1 | **GBX 080 ●●● ●●● ●L** | 2.100 |
| | 16:1, 40:1 | **GBX 080 ●●● ●●● ●L** | 2.600 |

***(1) To order a GBX planetary gearbox, complete each reference above with:***

| | | | GBX | ●●● | ●●● | ●●● | ● | L |
|---|---|---|---|---|---|---|---|---|
| **Size** | Diameter of the housing *(2)* | 40 mm | | **040** | | | | |
| | | 60 mm | | **060** | | | | |
| | | 80 mm | | **080** | | | | |
| **Reduction ratio** | | 3:1 | | | **003** | | | |
| | | 5:1 | | | **005** | | | |
| | | 8:1 | | | **008** | | | |
| | | 16:1 | | | **016** | | | |
| | | 40:1 | | | **040** | | | |
| **Associated integrated drive** | Type | ILA●●57 | | | | **A57** | | |
| | | ILE●●66 | | | | **E66** | | |
| | | ILS●●57 | | | | **S57** | | |
| | | ILS●●85 | | | | **S85** | | |
| | Motor length *(3)* | 1 | | | | | **1** | |
| | | 2 | | | | | **2** | |
| | | 3 | | | | | **3** | |
| **Integrated drive system adaptation** | | | | | | | | **L** |

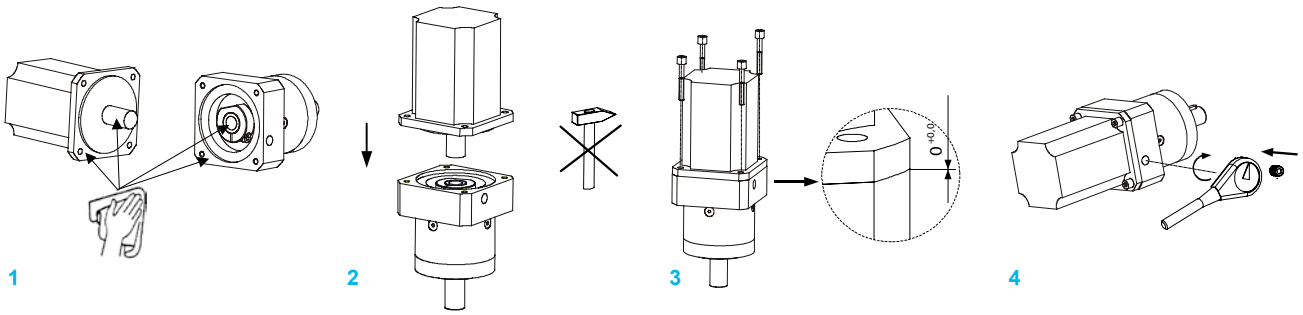
*(2) See table of combinations with Lexium integrated drive on page 4/113.*
*(3) See reference of the corresponding integrated drive system for possible motor lengths.*

## Mounting recommendations

Special tools are not required for mounting the GBX planetary gear to the integrated drive system. Note the following requirements:

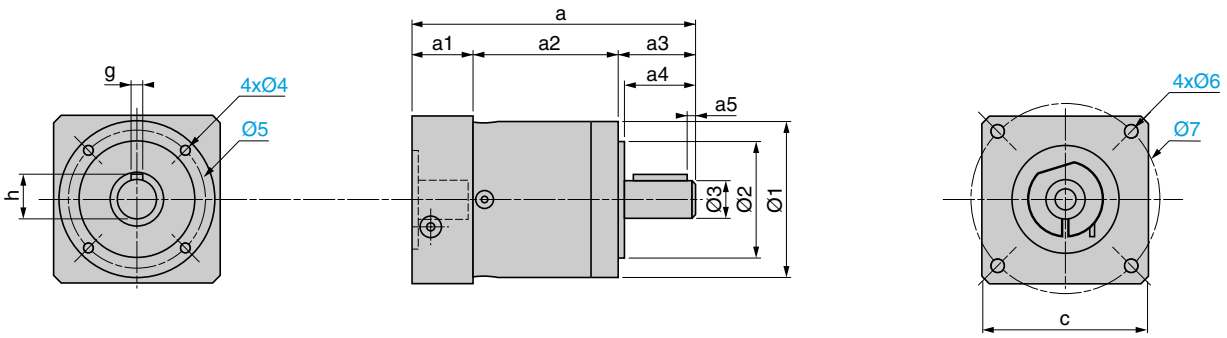
1 Clean grease off contact areas and seals.
2 If possible, mount the motor in a vertical position. Fit motor into gearing.
3 Motor flange must be in contact with gearing flange. Tighten screws crosswise.
4 Tighten clamping ring with torque spanner.

More information can be found in the instructions supplied with the product.



## GBX planetary gearboxes

**Mounting at motor side**




| | c | a | a1 | a2 | a3 | a4 | a5 | h | g | Ø1 | Ø2 | Ø3 | Ø4 | Ø5 | Ø6 | Ø7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **GBX 040 003/005/008** | 40 | 93.5 | 28.5 | 39 | 26 | 23 | 2.5 | 11.2 | 3 | 40 | 26 h7 | 10 h7 | M4 x 6 | 34 | M4 x 10 | 46 |
| **GBX 060 003/005/008** | 60 | 106.5 | 24.5 | 47 | 35 | 30 | 2.5 | 16 | 5 | 60 | 40 h7 | 14 h7 | M5 x 8 | 52 | M5 x 12 | 63 |
| **GBX 060 016/040** | 60 | 118.5 | 24.5 | 59.5 | 35 | 30 | 2.5 | 16 | 5 | 60 | 40 h7 | 14 h7 | M5 x 8 | 52 | M5 x 12 | 63 |
| **GBX 080 003/005/008** | 90 | 134 | 33.5 | 60.5 | 40 | 36 | 4 | 22.5 | 6 | 80 | 60 h7 | 20 h7 | M6 x 10 | 70 | M6 x 15 | 100 |
| **GBX 080 016/040** | 90 | 151 | 33.5 | 77.5 | 40 | 36 | 4 | 22.5 | 6 | 80 | 60 h7 | 20 h7 | M6 x 10 | 70 | M6 x 15 | 100 |