Lexium Controller

Axis controller

Schneider Electric

Contents

Important information

PLEASE NOTE

Please read these instructions carefully and examine the equipment in order to familiarize yourself with the device before installing, operating or carrying out any maintenance work on it.

The following special messages that you will come across in this document or on the device are designed to warn you about potential risks or draw your attention to information that will clarify or simplify a procedure.

The addition of this symbol to a "Danger" or "Warning" safety label indicates that there is an electrical risk that will result in injury if the instructions are not followed.

This is a safety warning symbol. It warns you of the potential risk of injury. You must comply with all safety messages that follow this symbol in order to avoid the risk of injury or death.

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

PLEASE NOTE:

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, must provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.[1]
- Each implementation of a Lexium Motion Controller must be individually and thoroughly tested for proper operation before being placed into service.

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

1. For additional information refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control"

Documentation structure

This manual is part of a series describing the Lexium Motion Controller (LMC). The following manuals may be downloaded at www.us.telemecanique.com

Installation Manual

This manual describes:
• How to install the controller
• How to connect the controller

Optional Graphic Display Terminal User's Manual This manual describes:

• How to install the graphic display terminal
• How to connect the graphic display terminal
• How to program the controller via the graphic display terminal

EasyMotion - Programming Manual (Not available in the USA)

Supplied preinstalled in the Lexium Controller, the application model associated with EasyMotion mode is a user-friendly tool that can be used for:
• Rapid axis configuration
• Use of Manual/Automatic mode
• Creating positioning tasks
• Editing cam profiles
• Backup and recovery of the machine parameters
• Diagnostics of the motion controller and the various axes
This programming manual also contains a table of the parameters that can be accessed via the communication protocols.

MotionPro - Programming Manual

The MotionPro Programming Manual is included in the software online help.
This online help describes:
• The software interface
• IEC 1131 programming
• The function libraries (standard functions, motion control functions, application functions)
• The Lexium controller configuration screens

Modbus, Ethernet, PROFIBUS DP, and DeviceNet manuals

These manuals describe:
• Connection to the bus or network
• Diagnostics
• Software setup
• The protocol communication services

Introduction

Presentation

The Lexium Controller performs axis synchronization and coordination, via fieldbuses, for applications requiring control of up to 8 synchronized axes.

It includes the following standard motion control functions:
• Speed control
• Relative and absolute positioning
• Cam profiles
• Electronic gearing function for speed and position
• Linear and circular interpolation (2½D)
• Master axis via external encoder
• Distance measurement and position capture on high-speed discrete input (30 μs)

It can be easily integrated into the standard architectures available on the market. It can be connected directly via the Modbus, CANopen, Ethernet, PROFIBUS DP, and DeviceNet communication ports.

Models

References	Number of logic inputs	Number of logic outputs	Integrated communication			
			Modbus	CANopen	Ethernet network	Third-party bus
LMC 10	8 (24 V DC)	8 (24 V DC)	Yes	-	-	-
LMC 20	8 (24 V DC)	8 (24 V DC)	Yes	Yes	Yes	-
LMC 20A1307	8 (24 V DC)	8 (24 V DC)	Yes	Yes	Yes	PROFIBUS
LMC 20A1309	8 (24 V DC)	8 (24 V DC)	Yes	Yes	Yes	DeviceNet

Description of LMC10/LMC20
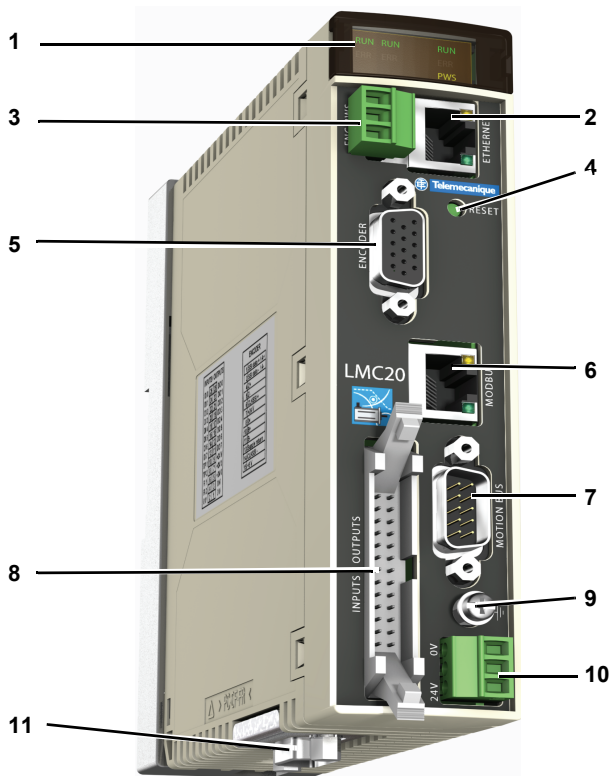
1 Signaling and diagnostic LEDs

2 Ethernet connector (LMC 20 only)

3 Encoder power supply

4 Reset button

5 Master encoder input

6 Modbus or graphic display terminal connector

7 Motion bus connector

8 Connector for logic I/O

9 Equipment grounding conductor connection

10 24 V power supply terminals

11 CANopen connector (LMC 20 only)

Introduction

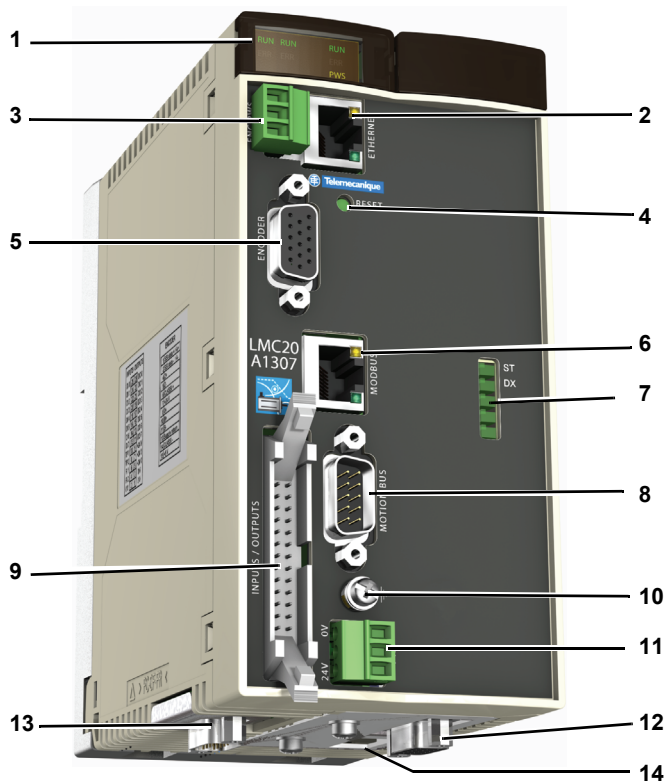## Description of LMC20A****

1   Signaling and diagnostic LEDs

2   Ethernet connector

3   Encoder power supply

4   Reset button

5   Master encoder input

6   Modbus or graphic display terminal connector

7   LEDs for:
    - PROFIBUS on LMC20A1307
    - DeviceNet on LMC20A1309

8   Motion bus connector

9   Connector for logic I/O

10 Equipment grounding conductor connection

11 24 V power supply terminals

12 Connector for:
    - PROFIBUS on LMC20A1307
    - DeviceNet on LMC20A1309

13 CANopen connector

14 Address configuration switches

Hardware setup

On receipt

- Check that the device reference marked on the label is the same as that on the delivery note corresponding to the purchase order.
- Open the packaging and check that the device has not been damaged in transit.
- Check that the device is complete. The packaging must contain:
  - The Lexium Controller
  - A bag containing three removable connectors (24 V power supply, encoder power supply, I/O)
  - A CD-ROM containing the documentation
  - A quick reference guide
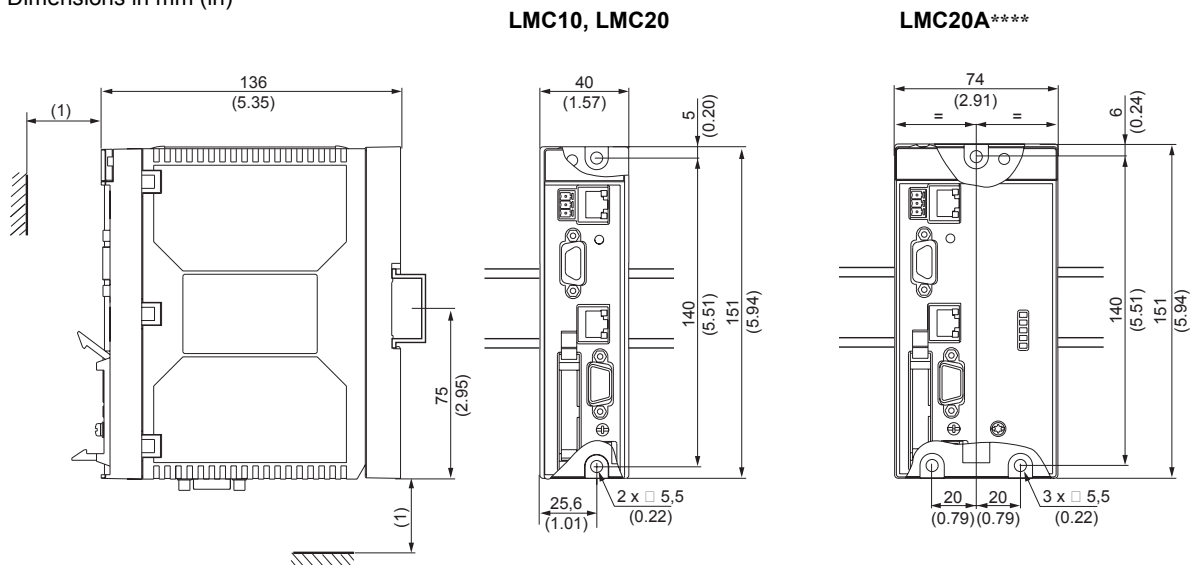

⚠ WARNING

DAMAGED CONTROLLER EQUIPMENT
Do not operate or install any controller that appears damaged.

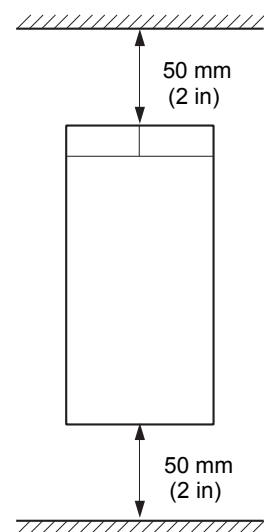**Failure to follow these instruction can result in death, serious injury, or additional equipment damage.**

Mounting

Fasten using M5 screws, or on DIN rail 35 mm (1.38 in)

Dimensions in mm (in)

LMC10, LMC20   **LMC20A****

(1) Leave sufficient space for the connectors used.

Installation recommendations

- Install the unit vertically.

- Leave at least 50 mm (2 in) free space above and below the device to allow for cooling.

- Max. ambient temperature: LMC10: 60°C
                                LMC20: 50°C

- Protect from condensation and keep away from any heat sources.

Hardware setup

Grounding

General recommendations for fieldbus connectivities:
- Twisted cable needs to be used to cancel/minimize the EMC effects.
- Shield connection between the controller and the drive must be connected to the ground on both ends. In the control cabinet the ground clamp needs to be used to connect the shield to the panel ground. On the LMC end the connector shell needs to be connected to the shield conductor for grounding.
- Equipotential bonding conductor needs to be used if the drives are located at the remote cabinet from that of the LMC.

Recommendations on Fieldbus specific requirements for LMC:
- CanOpen, Motion Bus and DeviceNet : The Can High/ DeviceNet High signal line and Can Low / DeviceNet Low signal line must be isolated from the system ground. The Can GND/ DeviceNet GND should be connected to the shield conductor to bring it to the same potential as the system ground.
- Profibus: The RxD and TxD signal lines A1/B1 and A2/B2 must be isolated from the system ground.

| ⚠ **DANGER** |
|---|
| **ELECTRIC SHOCK** |
| This product and associated equipment must be grounded according to the above recommendations. |
| **Failure to follow these instructions will result in death or serious injury.** |

Connecting the power supply

Use the connector supplied in the bag:
- Max. connectable cross-section: 1.5 mm^2 - AWG 16
- Max. tightening torque: 0.3 Nm (2.66 lb-in)

Terminal	Function
3	0 V
2	not connected
1	+ 24 V
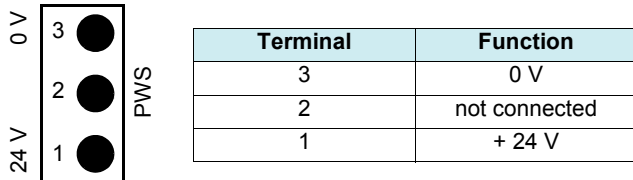
Characteristics of the power supplies

	LMC10	LMC20	LMC20A ****
Nominal voltage	24 V DC	24 V DC	24 V DC
Voltage limit (including ripple)	19 ... 30 V DC	19 ... 30 V DC	19 ... 30 V DC
Nominal input current	0.3 A	0.4 A	0.5 A

Hardware setup

Example circuit

100 ... 240 V AC

N   L   24 V power supply
          ABL7 RE2402

+   -

24 V   0 V

PWS

LMC●●
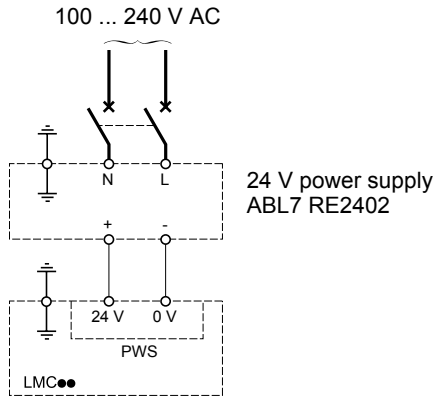
☞ **Note:** If the LMC∗∗∗ controller is left without a power supply for around 20 days, the clock will have to be reset.

⚠ CAUTION

INCONSISTENT EQUIPMENT OPERATION

Ensure that the power supply does not exceed the specified voltage limits. Excessive ripple or exceeding the voltage limits will cause inconsistent operation and may damage the LMC.

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

Hardware setup

## Connection to a master encoder

The Lexium Controller has a 15-way female HD SUB-D connector for connecting an encoder.
The VW3M4701 option (to be ordered separately) consists of a male connector with a 1-meter cable, with no connector on the other end, and can be used to connect the encoder to an intermediate screw terminal block.

The master encoder input is compatible with encoders:
• RS422
• 5 V push-pull
• 5 V open collector
• SSI

Female SUB-D connector
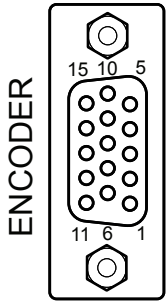
Description	Encoder terminal	Pin	VW3M4701 option - wire colors
Incremental encoder	A+	1	red/white
	A-	2	brown
	Z+	4	orange
	Z-	5	yellow
	B+	10	white
	B-	11	purple
Absolute encoder	SSI data +	1	red/white
	SSI data -	2	brown
	CLKSSI +	6	green
	CLKSSI -	14	light brown
5 V encoder	+ 5 V	15	light purple
	0 V	8	pink
24 V encoder	+ 24 V	7	blue
	0 V	8	pink
Encoder power supply feedback (1)	Supply return	13	light green
			black = shielding

(1) For monitoring the encoder power supply and the presence of the encoder cable. The Lexium Controller trips on a fault if the encoder power supply feedback is missing.

## Characteristics of the master encoder input

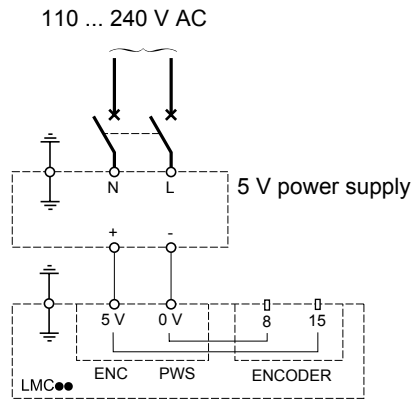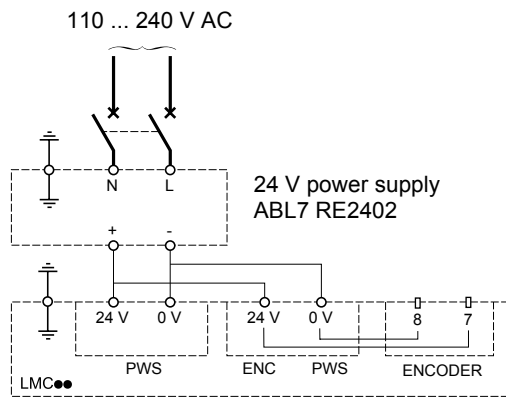|			
Power supply	Nominal voltage	**V**	5 DC or 24 DC
	Nominal current	**mA**	500
Input limit values	Voltage	**V**	5.5 DC
	Current	**mA**	12
Input impedance for nominal U		**kΩ**	2
Isolation		**V**	2500
Incremental encoder	Type of signal		$A, \overline{A}, B, \overline{B}, Z, \overline{Z}$
	Maximum operating frequency		250 kHz per input x 4, or 1 MHz for counting
SSI serial absolute encoder	Number of bits		32, with configurable frame (number of turns, number of bits/turn, binary or gray format, parity, etc)
	Clock frequency	**kHz**	200
	Clock voltage	**V**	5

Hardware setup

Encoder power supply

Use the connector supplied in the bag:
- Max. connectable cross-section: 1.5 mm^2 - AWG 16
- Max. tightening torque: 0.3 Nm (2.65 lb-in)
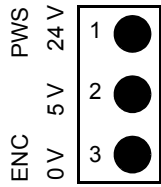
Terminal	Function	Power
1	+ 24 V	Depends on the type of encoder used
2	+ 5 V	
3	0 V	

PWS 24 V — 1
ENC 5 V — 2
0 V — 3

Example circuits

110 ... 240 V AC

N L

24 V power supply
ABL7 RE2402

+ -

24 V 0 V   24 V 0 V   8   7
PWS   ENC   PWS   ENCODER
LMC●●

110 ... 240 V AC

N L

5 V power supply

+ -

5 V 0 V   8   15
ENC   PWS   ENCODER
LMC●●

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Hardware setup

Connecting the Motion bus 9-way SUB-D connector

Male SUB-D connector.
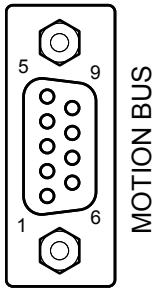
Terminal	Description
1	not connected
2	CAN_L
3	CAN_GND
4	not connected
5	not connected
6	CAN_GND
7	CAN_H
8	not connected
9	not connected

The CANopen connection dedicated to the Motion bus provides the option of connecting up to 8 Lexium 05 and/or Lexium 15 servo drives and/or SD328 stepper drives.
The Motion bus is used to control the movement of these 8 axes.
The network cycle allows that the position setpoints to be updated for axis synchronization.

LMC 10, LMC 20 and LMC 20A130* Lexium Controllers integrate the CANopen protocol dedicated to the Motion bus as standard.

For the best performance of the Motion bus, it is advisable to set it up in a daisy-chain formation, without any tap-offs; our range of connection accessories has been extended with this in mind.

Example of architecture with the CANopen machine bus dedicated to the Motion bus
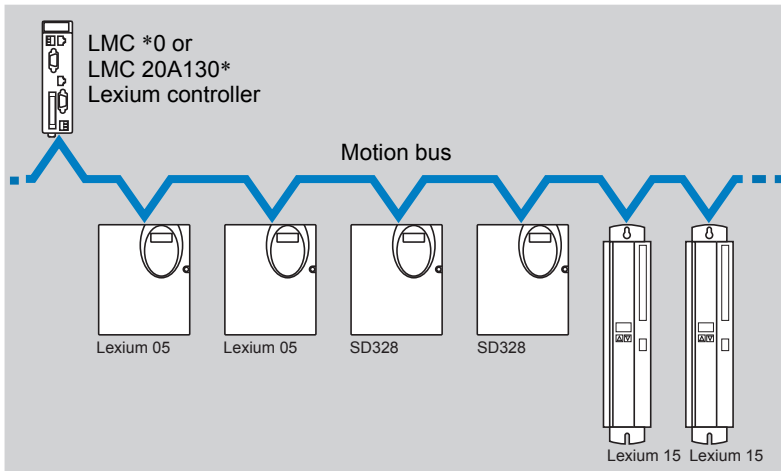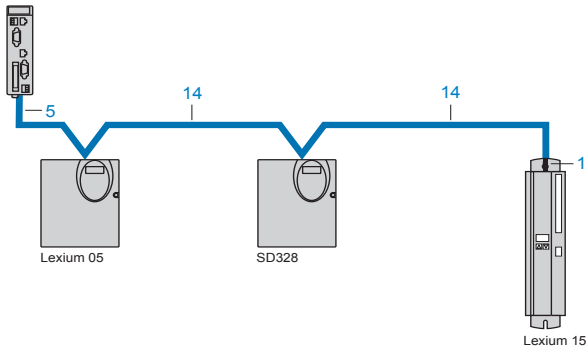
Hardware setup

Examples of connection to the Motion bus

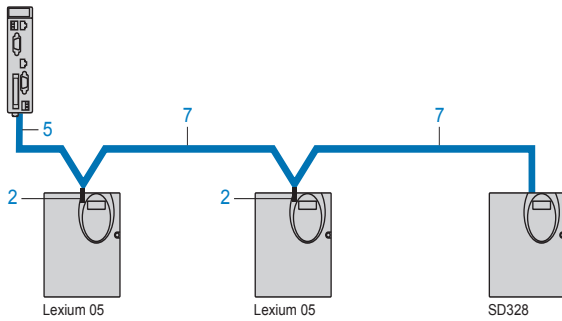### For Lexium 05 and Lexium 15 and SD328 for customer assembly

LMC *0 or
LMC 20A130*
Lexium Controller

Lexium 05   SD328   Lexium 15

For Lexium 05, SD328 prewired

LMC *0 or
LMC 20A130*

Lexium 05   Lexium 05   SD328

Hardware setup

Connection accessories

Connectors and junction boxes

Description	Use	No.	Reference
Connector, 9-way female SUB-D with line terminator	Connection of Lexium 15	**1**	**VW3 M3 802**
Tap (3) with 3 RJ45 connectors	Daisy-chain connection of Lexium 05	**2**	**TCS CTN023F13M03**

Cordsets and connection cables

Description	Use		No.	Length	Reference
	From	To		m	
Cordset with one 9-way female SUB-D connector and one RJ45 connector with line terminator	LMC Lexium controller	Lexium 05 Tap TCS CTN023F13M03	**5**	1	**VW3 M3 805R010**
CANopen cordsets (1) with one RJ45 connector at each end	Tap TCS CTN023F13M03	Tap TCS CTN023F13M03	**7**	0.3	**TSX CAN CARR 03**
CANopen IP 20 cables (1)			**14**		
Standard cables, CE marking Low smoke emission, halogen-free Flame retardant (IEC 60332-1)				50	**TSX CAN CA 50**
				100	**TSX CAN CA 100**
				300	**TSX CAN CA 300**
UL certification, CE marking Flame retardant (IEC 60332-2)			**14**	50	**TSX CAN CB 50**
				100	**TSX CAN CB 100**
				300	**TSX CAN CB 300**
Cable for harsh environment (2) or mobile installation, CE marking Low smoke emission, halogen-free Flame retardant (IEC 60332-1)			**14**	50	**TSX CAN CD 50**
				100	**TSX CAN CD 100**
				300	**TSX CAN CD 300**

(1) Please refer to the catalog
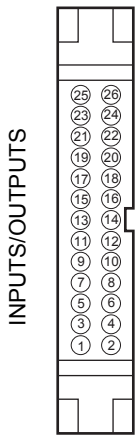(2) Harsh environment:
  - Resistance to hydrocarbons, industrial oils, detergents, solder splashes
  - Relative humidity up to 100%
  - Saline atmosphere
  - Significant temperature variations
  - Operating temperature between - 10°C and + 70°C
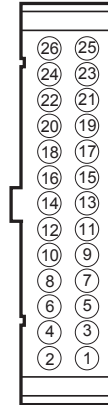(3) Available 4th quarter 2007

Hardware setup

Connecting the I/O

Controller male connector

Female connector plug side view

Description	Terminal
Logic input DI0	26
Logic input DI1	24
Logic input DI2	22
Logic input DI3	20
Logic input DI4	18
Logic input DI5	16
Logic input DI6	14
Logic input DI7	12
Position capture TP1	10
Position capture TP2	8
Event input EI1	6
Event input EI2	4
0 V	2

Terminal	Description
25	Logic output DO0
23	Logic output DO1
21	Logic output DO2
19	Logic output DO3
17	Logic output DO4
15	Logic output DO5
13	Logic output DO6
11	Logic output DO7
9	+ 24 V
7	+ 24 V
5	+ 24 V
3	0 V
1	0 V

Input characteristics

Type of base		LMC10	LMC20
Number of channels		8	
Nominal voltage		24 V DC (positive logic)	
Voltage limits		19 V ... 30 V DC	
Nominal input current		7 mA	
Impedance		3 kΩ	
Filtering time	At state 1	15 μs	
	At state 0	70 μs	
"Position capture" input filtering time	At state 1	1 μs	
	At state 0	0.5 μs	
Isolation		No isolation between channels, isolation with internal logic via opto-isolators	

Output characteristics

| Type of base		LMC10	LMC20
Number of channels		8 x 24 V DC open collector (source) logic outputs, compatible with level 1 PLC, standard IEC 65A-68 Maximum switching voltage: 30 V	
Nominal voltage		24 V DC (positive logic)	
Limit voltages		19 V ... 30 V DC	
Output current		0.2 A per channel	
Filtering time	At state 1	150 μs	
	At state 0	250 μs	

Hardware setup

I/O connection example

Using a Telefast sub-base **ABE 7B20MPN22**:
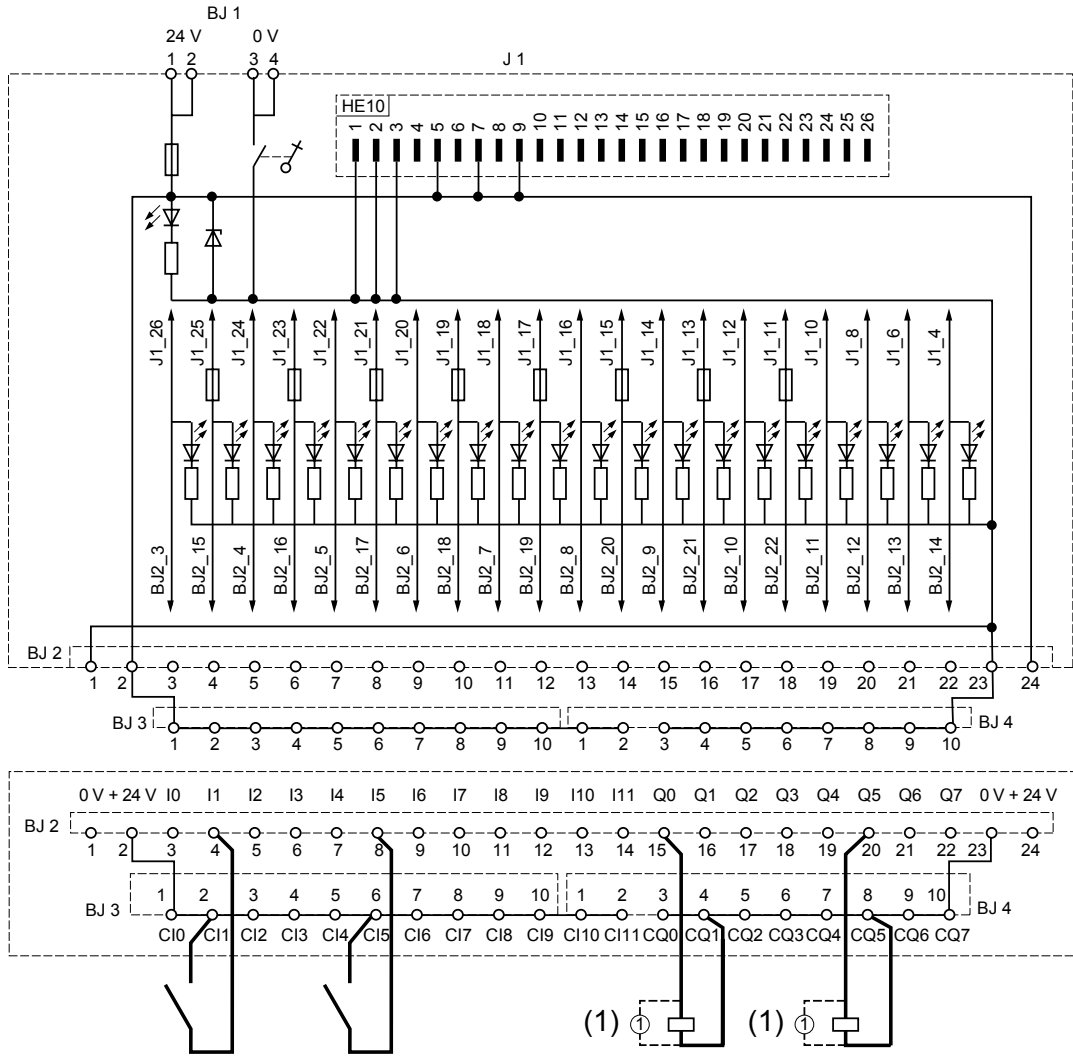
(1) Install interference suppressors on inductive circuits such as relays.
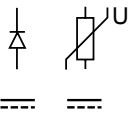
A prefabricated connection cable with two HE10 connectors can be used to connect the Lexium Controller and the Telefast sub-base:
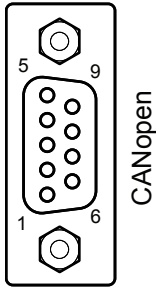* **ABF T26B050** 0.5 m (1.64 ft)
* **ABF T26B100** 1 m (3.28 ft)
* **ABF T26B200** 2 m (6.56 ft)

Hardware setup

Connecting the CANopen 9-way SUB-D connector

Refer to the EasyMotion and MotionPro software online help.

Male SUB-D connector

Terminal	Description
1	not connected
2	CAN_L
3	CAN_GND
4	not connected
5	not connected
6	CAN_GND
7	CAN_H
8	not connected
9	not connected

Speed and length of the CANopen bus

It is essential to make sure that all devices connected to the CANopen bus operate at the same transmission speed.

The maximum length of the CANopen bus depends on the transmission speed on this bus.
The table below indicates the maximum lengths permitted according to the transmission speed:

Transmission speed	50 kbps	125 kbps	250 kbps	500 kbps	1 Mbps
Max. length of bus	1,000 m (3,281 ft)	500 m (1,640 ft)	250 m (820 ft)	100 m (328 ft)	20 m (66 ft)

Connecting the RJ45 Ethernet connector

Refer to the Ethernet User's Manual.
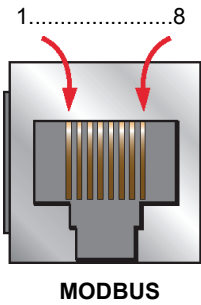
View from sub-base side

1........................8

ETHERNET
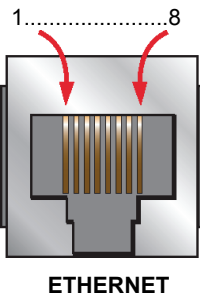
Terminal	Description
1	TD+
2	TD-
3	RD+
4	not connected
5	not connected
6	RD-
7	not connected
8	not connected

Hardware setup

Connecting the Modbus RJ45 connector or graphic display terminal

Refer to the Modbus User's Manual or the Graphic Display Terminal User's Manual.

View from sub-base
side

1......................8

MODBUS

Terminal	Description
1	not connected
2	not connected
3	not connected
4	B signal (RS485) = V1 signal (Modbus)
5	A signal (RS485) = V0 signal (Modbus)
6	not connected
7	Modbus VP signal 12 V DC power supply provided by the Motion Controller (only for supplying an RS485/RS232 converter or a graphic display terminal)
8	Modbus common signal 0V

Connecting the PROFIBUS bus 9-way SUB-D connector (LMC20A1307)
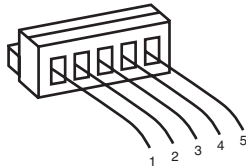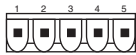
Refer to the PROFIBUS User's Manual.

Female SUB-D connector
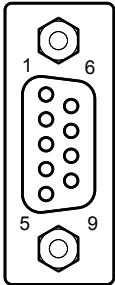
Terminal	Description
1	not connected
2	not connected
3	RxD/TxD-N (Reception/Transmission -)
4	not connected
5	DGND (ground)
6	VP (5 volts)
7	not connected
8	RxD/TxD-P (Reception/Transmission +)
9	not connected

Connecting the DeviceNet terminals (LMC20A1309)

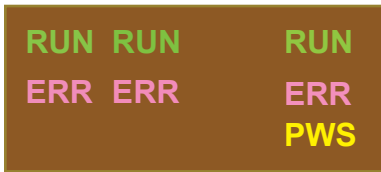Refer to the DeviceNet User's Manual.

Terminal	Name	Color	Function
1	V-	black	common
2	CAN_L	blue	signal
3	SHIELD	none	shielding
4	CAN_H	white	signal
5	V+	red	power supply

Diagnostics

Status LEDs
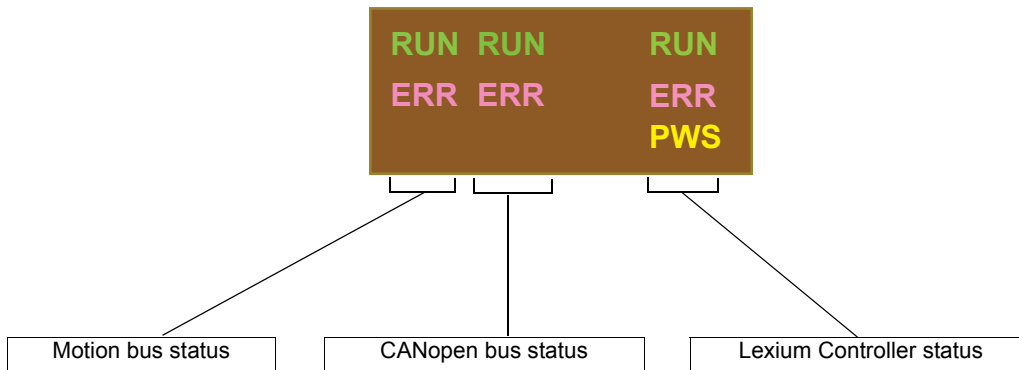
RUN RUN   RUN
ERR ERR   ERR
              PWS

| Motion bus status | CANopen bus status | Lexium Controller status |

Motion bus status LEDs

RUN RUN   RUN
ERR ERR   ERR
              PWS

Marking	Color	Status	Meaning
RUN	Green	Off	No CAN master configured
		Flashing	The Motion bus is in initialization phase
		1 flash per second	The Motion bus is stopped
		On	The Motion bus is operational
ERR	Red	Off	No Motion bus fault
		Flashing	Motion bus fault

Diagnostics

CANopen bus status LEDs

RUN	RUN	RUN
ERR	ERR	ERR
		PWS
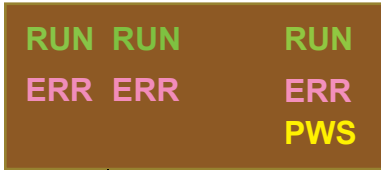
Marking	Color	Status	Meaning
RUN	Green	Off	No CAN master configured
		Flashing	The CANopen bus is in initialization phase
		1 flash per second	The CANopen bus is stopped
		On	The CANopen bus is operational
ERR	Red	Off	No CANopen fault
		Flashing	CANopen configuration not valid
		1 flash per second	Alarm threshold exceeded (too many errors)
		2 flashes per second	A "Node Guarding" or "Heartbeat" event has occurred
		On	The CANopen bus is stopped (BUS OFF)

Lexium Controller status LEDs

RUN	RUN	RUN
ERR	ERR	ERR
		PWS
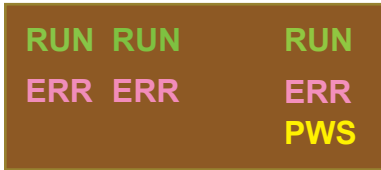
Marking	Color	Status	Meaning
RUN	Green	Off	The Lexium Controller is not configured (application missing, invalid or incompatible)
		Flashing	The Lexium Controller is in STOP state or locked by a software error. The application program is not executed.
		On	The Lexium Controller is in RUN state. The application program is executed.
ERR	Red	Off	No fault
		Flashing	Minor Lexium Controller fault or application fault (event-triggered task cycle time too long, encoder supply fault, etc.).
		On	Lexium Controller hardware fault or serious application fault (watchdog, etc.)
PWS	Yellow	Off	Lexium Controller off
		On	Lexium Controller on

PROFIBUS (LMC20A 1307) LEDs

Refer to the PROFIBUS User's Manual

DeviceNet (LMC20A 1309) LEDs

Refer to the DeviceNet User's Manual.