Modicon Premium PLCs
TSX CSY 84 / 85 / 164

SERCOS® Motion Control

Quick reference guide

Edition June 2009

Schneider
Electric

1 General

This documentation aims to help qualified technical personnel to install, operate and maintain the products described herein. Advanced users of our products should contact their nearest sales office for additional information.

The contents of this documentation are not contractual and may in no circumstances extend or restrict any binding warranty clauses.

2 Qualification of Personnel

Only **qualified personnel** are authorized to install, operate and maintain the products. Intervention by non-qualified personnel or failure to observe the safety precautions contained in this document or displayed on the equipment may risk the safety of personnel and/or the safety and reliability of equipment.

3 Warnings

These warnings are intended to indicate the particular risks to personnel and/or equipment. They are indicated according to their importance by a warning mark in the documentation and on the products:

Caution

Indicates that failure to follow the instructions or to heed the warning may lead to serious personal injury, death and/or significant damage to the equipment.

Important or ⚠

Indicates that failure to follow the particular instructions may lead to minor personal injury and/or damage to the equipment.

Note

Highlights important information relating to the product, its handling or its accompanying documentation.

4 Conformity of Use

The products described in this documentation **conform to the applicable European Directives*** (CE marking). However, they can only be used correctly with the applications covered in the relevant documentation and with approved third party products.

(*) EMC (Electromagnetic Compatibility) and LV (Low Voltage) Directives

5 Installing and Setting Up Equipment

It is important to observe the following rules when installing and starting up equipment. In addition, if the installation includes non-optical digital links, it is essential to follow the basic wiring rules given in the manual «Electromagnetic Compatibility of Industrial Networks and Fieldbuses», **reference TSX DG KBLE**.

- Safety instructions, in documentation or on the equipment being installed and implemented, must be followed meticulously.
- The type of equipment defines the way in which it should be installed:
  - A flush-mountable device (for example, an operator terminal or cell controller) must be flush-mounted.
  - A device which is to be built in (for example, a PLC) must be placed in a cabinet or enclosure.
  - The casing of a laptop or portable device (for example, a programming terminal or a notebook) must remain closed.

- If the device is permanently connected, its electrical installation must include a device to isolate it from the power supply and a circuit-breaker to protect it against overcurrents and isolation faults. If this is not the case, the power socket must be grounded and easily accessible. **The device must be connected to the protective ground**.
- If the device is supplied with 24 or 48 VDC, the low voltage circuits must be protected. Only use power supplies which conform to standards currently in force.
- Check that the supply voltages remain within the tolerance ranges defined in the technical specifications of the devices.
- All measures must be taken to ensure that any power return (immediate, warm or cold) does not lead to a state which may present a danger to personnel or the installation.
- Emergency stop devices must remain effective in all the device's operating modes, even those which are abnormal (for example, if a wire breaks). Resetting these devices must not cause uncontrolled or improper restarts.
- Cables which carry signals must be located where any capacitive, inductive, or electromagnetic interference will not affect the control system functions.
- Control system equipment and their control devices must be installed in such a way as to ensure that they protect against unintentional operation.
- Appropriate safety measures must be taken for the inputs and outputs, to prevent improper states in the control system device, if no signal is received.

6 Equipment Operation

The reliability of a device is its ability to avoid the appearance of faults and minimize their effects if they occur.

A fault inside the control system is known as:

- Passive, if it results in an open output circuit (no command is sent to the actuators)
- Active, if it results in a closed output circuit (a command is sent to the actuators)

From a safety point of view, a given fault is dangerous or not depending on the type of command given during normal operation. A passive fault is dangerous if the normal command is the operation of an alarm; an active fault is dangerous if it maintains or activates an undesirable command.

The system designer must **use devices external to the PLC** to protect against active faults inside the PLC, which may or may not be indicated.

7 Electrical and Thermal Specifications

Details of electrical and thermal specifications are given in the associated technical documents (installation manuals, quick reference guides).

8 Maintenance

Troubleshooting Procedure

- Control system equipment should only be repaired by qualified personnel (after sales service engineer, or engineer approved by Schneider Automation). Only certified replacement parts or components should be used.
- Before performing any operation on equipment, cut the power supply off and mechanically lock any moving parts.

Replacing and Recycling Used Batteries

Use batteries of the same type as the originals and dispose of defective batteries in the same way as toxic waste.
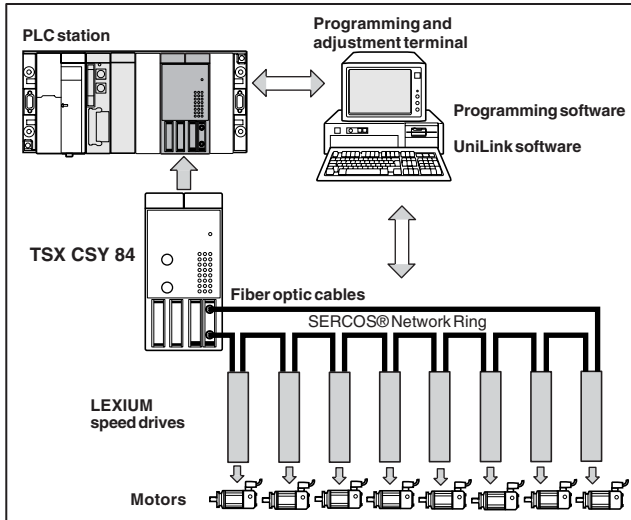
General Presentation

The TSX CSY 84/85/164 are double format Premium modules. They can be integrated in a TSX RKY•• rack in a Premium/Atrium PLC station. They are part of the SERCOS® offer on Premium PLCs which is used to create a multi-axis control system.

- **Components of the SERCOS® offer:**
  - A TSX/PMX/PCX 57 PLC station with one or more TSX CSY 84/85/164 modules
  - A range of LEXIUM servo drives
  - motors associated with the different drives
  - Fiber optic cables,
  - PL7 Junior/Pro or Unity Pro software which is used to configure the TSX CSY 84/85/164 modules and program the application (TSX CSY 84 for Unity Pro),
  - UniLink software which is used to enter parameters and adjust drives,
  - TjE (Trajectory Editor) software for the TSX CSY 85 module.

- **Overview of an installation using a TSX CSY 84 module**

Physical Presentation

1 Screw for fixing the module on the TSX RKY •• rack,

2 Module casing which supports and protects the electronic cards, and which is used to fix the module on the rack,

3 Display block comprising 6 LEDs which display the module states and faults,

4 Pencil-point pushbutton which is used to initialize the module,

5 COM2 8-pin mini DIN connector, reserved for Schneider Automation functions,

6 LEDs for module application-specific channel diagnostics,

7 COM1 8-pin mini DIN connector, reserved for Schneider Automation functions,

8 SMA connector (TX), for connecting the fiber optic transmission cable,

9 SMA connector (RX), for connecting the fiber optic reception cable,
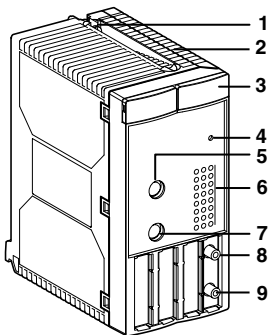
Compatibility with the Installed Base

• **Hardware Compatibility**
  To take a TSX CSY 84/85/164 module, the PLC station must have a processor TSX/PMX/ PCX 57••2 SV ≥ 3.3, TSX/PCX 57••3 or TSX/PCI 57 ••4 (TSX CSY 84).

• **Software Compatibility**
  - to develop an application which integrates the TSX CSY 84 modules, the PL7 Junior/Pro software must be version 3.4 + C option.
  - for the TSX CSY 84 module, a program is functionally compatible with the TSX CSY 164 module, once the PL7 application has been reconfigured.
  - to develop an application which integrates the TSX CSY 164 modules, the PL7 Junior/Pro software must be version 4.3 + Add-on Motion TSX CSY 164..
  - the Unity Pro software allows to develop an application which integrates the TSX CSY 84 modules.
 - to develop an application which integrates the TSX CSY 85 modules, the PL7 Junior/Pro software must be version 4.4 + Add-on Motion TSX CSY 85..

Mounting

- **Mounting the Module in a PLC Station Rack**

  The TSX CSY 84/85/164 modules can be mounted in any of the available slots in a TSX RKY •• rack on a Premium/Atrium PLC station, except for those slots specifically for the power supply and processor modules. These double format modules take up 2 slots on a rack. The mounting procedure is identical to that for a single format module, which is shown in the diagrams below.
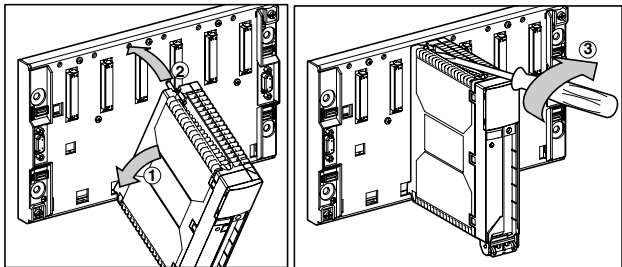
- **Mounting in a PLC Station**

  The TSX CSY 84/85/164 modules can be installed in any of the racks on the main Bus X segment of a PLC station. The distance between the rack supporting the TSX CSY module and the rack supporting the processor should not exceed 100 meters.

Bus X≤ 100 meters

TSX CSY 84/85/164   TSX CSY 84/85/164

Processor
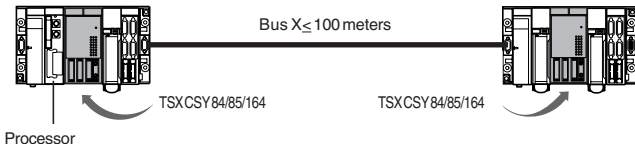
Note:
The TSX CSY 84/85/164 modules cannot be installed in a rack belonging to a Bus X segment which is remotely located using a TSX REY 200 module.

6

Installation Precautions

• **Installing and Removing the Module**

A module can be safely installed or removed without switching off the power supply to the rack. It should, however, be carried out with the module switched off.

• **Connecting and Disconnecting the Fiber Optic Connectors on the Front Panel of the Module**

The fiber optic connectors on the front panel of the module can be safely connected or disconnected with the module powered up.

To prevent the application from malfunctioning, these operations should preferably be performed with the module powered down.
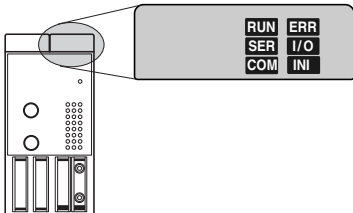
• **Tightening Torque for the Module Fixing Screw**

The maximum tightening torque is 2.0 N.m.

Module displays

- **Display Block**

  This comprises 6 LEDs whose role it is to inform the user about:
  - the module operating mode
  - operating faults which are internal or external to the module

LED	Color	State	Meaning
RUN	Green	Lit	Module operating normally
		Off	Module faulty, powered down, in the initialization phase or application missing
ERR	Red	Lit	Module internal fault: module failure
		Flashing	Power up of module, communication fault, application missing, invalid or fault in operating application
		Off	Normal operation
I/O	Red	Lit	External module fault: wiring fault
		Flashing	Not significant
		Off	Normal operation
INI	Yellow	Lit	Not significant
		Flashing	The module is in the initialization phase
		Off	Normal operation
SER	Yellow	Lit	Not significant
		Flashing	Traffic on the SERCOS® network functioning normal
		Off	No traffic on the SERCOS® network
COM	Yellow	-	Not used

Module Displays, continued

• **LEDs for the Application-Specific Channels** (green)
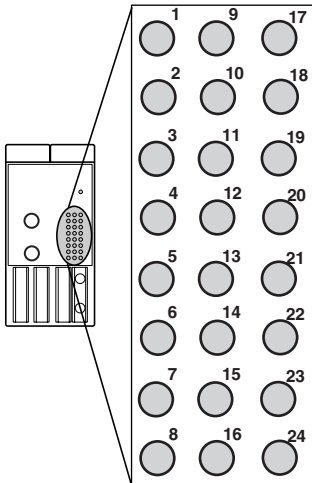
TSX CSY 84/85

LEDs 1 to 8:
Display the 8 real axes

LEDs 9 to 12:
Display the 4 imaginary axes

LEDs 13 to 16:
Display the 4 remote axes

LEDs 17 to 20:
Display the 4 sets of coordinated axes

LEDs 21 to 24:
Display the 4 sets of follower axes

TSX CSY 164

LEDs 1 to 16:
Independent axes displays (real, imaginary and remote axes)

LEDs 17 to 20:
Display the 4 sets of coordinated axes

LEDs 21 to 24:
Display the 4 sets of follower axes

Module Displays, continued

LED	Assignment TSX CSY 84/85	Assignment TSX CSY 164	State	Signal
1	real axis 1			
2	real axis 2			
3	real axis 3	randomly		
4	real axis 4	real axis,		
5	real axis 5	imaginary axis,		
6	real axis 6	remote axis.		
7	real axis 7			
8	real axis 8			
9	imaginary axis 1		Lit	axis functioning
10	imaginary axis 2			normal
11	imaginary axis 3			
12	imaginary axis 4			
13	remote axis 1			
14	remote axis 2		flashing	axis under configuration
15	remote axis 3			or faulty.
16	remote axis 4			
17	coordinated set of axes 1			
18	coordinated set of axes 2			
19	coordinated set of axes 3			
20	coordinated set of axes 4		off	axis not configured or
21	follower set of axes 1			faulty.
22	follower set of axes 2			
23	follower set of axes 3			
24	follower set of axes 4			

Initialization of the Module on an Internal Fault

The module is initialized by pressing the pencil-point button on the front panel as shown in the diagram opposite.

⚠ This button should only be pressed gently. The point of the tool must be held at right angles to the front panel of the module and in the center of the aperture.
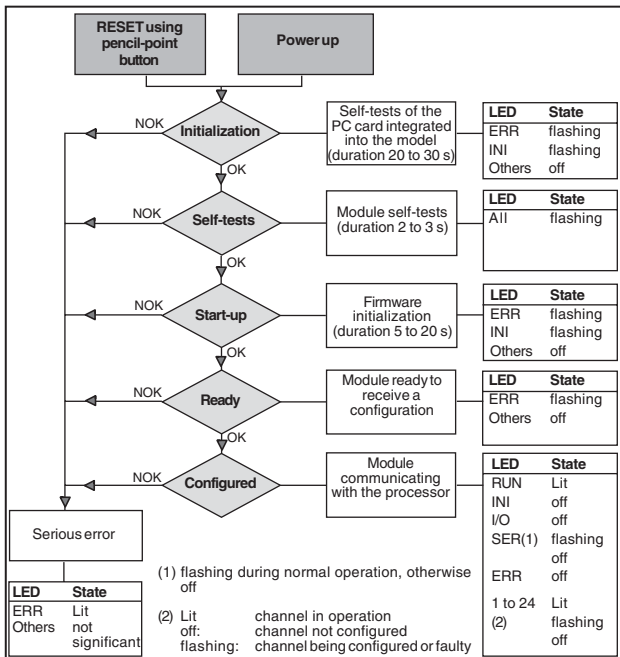Failure to follow these recommendations may damage the button.

Pencil-point
Push button
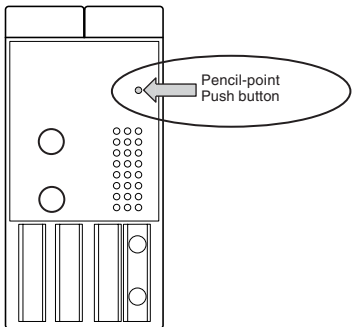
Consequences of an Initialization:

The module restarts in the same way as when it is powered up (see the operating mode on the next page).

Module Operating Mode

The following diagram describes the various steps in the operation of the module and gives the state of the LEDs on the module front panel for each step.

LED	State
ERR	flashing
INI	flashing
Others	off

Self-tests of the PC card integrated into the model (duration 20 to 30 s)

LED	State
All	flashing

Module self-tests (duration 2 to 3 s)

LED	State
ERR	flashing
INI	flashing
Others	off

Firmware initialization (duration 5 to 20 s)

LED	State
ERR	flashing
Others	off

Module ready to receive a configuration

LED	State
RUN	Lit
INI	off
I/O	off
SER(1)	flashing off
ERR	off
1 to 24 (2)	Lit flashing off

Module communicating with the processor

Serious error

LED	State
ERR	Lit
Others	not significant

(1) flashing during normal operation, otherwise off

(2) Lit   channel in operation
    off: channel not configured
   flashing: channel being configured or faulty

SERCOS® Multi-Axis Control System on Premium PLCs

- **Architecture**
  The architecture of a SERCOS® multi-axis control system on Premium PLCs consists of:
  - A Premium/Atrium PLC station with at least one TSX CSY 84/85/164 module
  - Speed drives which control the motors associated with the different axes
  - A SERCOS® fiber optic network ring
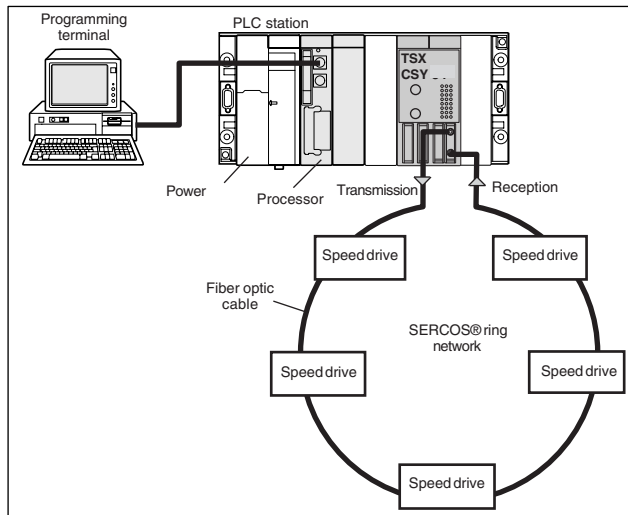
- **Operating principle**
  The TSX CSY 84/85/164 multi-axis control modules and the drives are connected together in a network using fiber optic cables to form the multi-axis control system. Drives which are connected together on the fiber optic network behave in the same way as individual axes. Motion control instructions transmitted by the TSX CSY 84/85/164 modules are sent to each drive on the network, and in return the modules receive the actual position values for each axis from the network.

SERCOS® Multi-Axis Control System on Premium PLCs, continued

• Configuration of channels for a TSX CSY 84/85 module

A TSX CSY 84 module controls a maximum of 8 real axes (channels 1 to 8), that is, axes associated with speed drives. In addition to these real axes, the module can control:
- 4 imaginary axes (channels 9 to 12)
- 4 remote axes (channels 13 to 16)
- 4 sets of coordinated axes (channels 17 to 20)
- 4 sets of follower axes (channels 21 to 24)
- 7 cam profiles (channels 25 to 31)

• Configuration of channels for a TSX CSY 164 module

- channels 1 to 16 can support at random a real axis, imaginary axis or remote axis function
- 4 sets of coordinated axes (channels 17 to 20)
- 4 sets of follower axes (channels 21 to 24)
- 7 cam profiles (channels 25 to 31)

• Developing Applications

Applications are developed using a terminal (PC) equipped with PL7 Junior/Pro or Unity Pro software to:
- configure the axes
- start the system
- adjust and diagnose the application.
(See the application-specific setup manual Movement Control with TSX CSY 84 / 164 SERCOS® Module - Reference 35007113 using PL7 and Motion control for SERCOS® motion Reference 35008790 using Pl7 and Motion control for SERCOS® motion Reference 35006234 using Unity Pro).

SERCOS® Network Ring

• At a Glance

Via the SERCOS® fiber optic ring network, the TSX CSY 84/85/164 modules:
- Transmit motion control instructions defined by the application program to each axis
- In return receive, via the drives, the actual data transmitted by the various position sensors on the axes

The diagram below shows an example of a SERCOS® network configuration comprising 5 LEXIUM servo drives, connected to a TSX CSY 84 module via fiber optic cables.
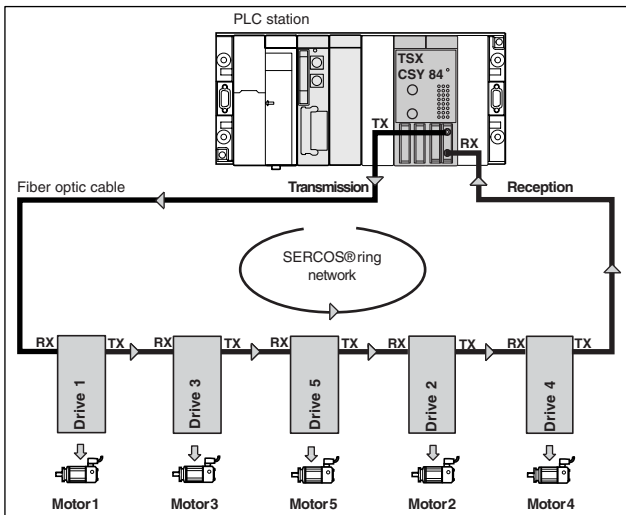
• Transmission of Commands

The module transmits the move instructions from the connector (TX), via the fiber optic cable, to the first drive, which interprets and executes them. The instructions are then transmitted to the next drive.

SERCOS® Ring Network, continued

• **Reception of Data**

The last drive on the ring sends the actual data on all the axes to the (RX) connector on the TSX CSY module via the fiber optic cable.

Note: If a drive on the SERCOS® network is powered down, this will cause the ring to open and the system to be set to fault mode.

• **Cycle time**

Data is transmitted on the network in one direction only and with a typical cycle time of 4 ms. This cycle time can be reduced to 2ms in configuration mode if the volume of data make it possible.

• **Transmission Speed**

The default transmission speed is 4 Mbauds. If the drives do not support this speed, it may be reduced to 2 Mbauds.

• **Length of the Various Network Segments**

The length of each segment of the SERCOS® network must not exceed 40 meters when using the fiber optic cables recommended by Schneider Automation.

• **Setting the Optical Power of the Transceiver According to the Length of the Segment**

Each component on the SERCOS® network (TSX CSY module and drives) has a fiber optic transceiver. The operator should set the optical power of each fiber optic transceiver according to the length of the segment:

- Optical power of segment module / first drive: This is always provided by the fiber optic transceiver of the TSX CSY module.
  The optical power is set in configuration mode using PL7 Junior / Pro software by defining a percentage of the optical power according to the length of the segment.

Length of the segment	Optical power
0 to 15 meters	66%
15 meters to 40 meters	100%

- Optical power of the other segments (drive / drive and last drive / module): This is always provided by the fiber optic transceiver of the drive.
  The optical power is set using UniLink software by defining only the length of the segment.

(See the application-specific setup manual Movement Control with TSX CSY 84 / 164 SERCOS® Module - Reference 35007113 using PL7 and Motion control for SERCOS® motion Reference 35008790 using Pl7 and Motion control for SERCOS® motion Reference 35006234 using Unity Pro).

Recommended and Pre-Equipped Fiber Optic Cables

Schneider Automation has a range of 1 mm diameter plastic fiber optic cables for connecting the various components on the SERCOS® network (TSX CSY 84/85/164 modules and servo drives). Each cable is equipped with an SMA connector at both ends).

Cable reference	Length
990 MCO 00001	0.3 meters
990 MCO 00003	0.9 meters
990 MCO 00005	1.5 meters
990 MCO 00015	4.5 meters
990 MCO 00055	16.5 meters
990 MCO 00075	22.5 meters
990 MCO 000125	37.5 meters

Note:

Schneider Automation suggests two kits for creating cable on request:

• 1 tool kit, reference 990 MCO KIT 00, comprising:
  - 1 cable stripping tool
  - 1 crimping pliers for connectors
  - 1 soldering iron (25 W, 110 V).

• 1 equipment kit, reference 990 MCO KIT 01, comprising:
  - 12 SMA type connectors
  - 12 insulating sleeves
  - 1 plastic fiber optic cable, diameter 1mm, length 30 meters

Module Specifications

• Electrical Specifications

Description of the parameters	Values	
	Typical	**Maximum**
Current consumption of the module on the 5V power supply to the rack	1.8 A	2A
Power dissipated in the module	9W	10W
Optical fiber outputs	Conforming to standard EN 61491	

• Operating and Storage Temperature / Relative Humidity / Altitude

Description of the parameters	Values
Operating temperature	0...60°C
Storage temperature	-25°C......+70°C
Relative humidity (without condensation)	5% to 95%
Operating altitude	0 to 2000 m

SERCOS® Network Specifications

Description of the parameters	Value
Addresses	1...254
Baud rate	2 or 4 Mbauds, configurable via the software
Cycle time	4 ms

Conforming to Standards

Standards are identical to those applied to Premium PLCs
(See Premium PLC Installation Manual).

Standard EN 61491:   Electrical equipment for industrial machines. Serial data link for realtime communication between the control unit and drive device.

List of Speed Drives

• **List of Drives from the Schneider Automation Offer**

Reference	Description
MHDA 1004 •00	LEXIUM speed drive, continuous current 1.5A rms
MHDA 1008 •00	LEXIUM speed drive, continuous current 3A rms
MHDA 1017 •00	LEXIUM speed drive, continuous current 6A rms
MHDA 1028 •00	LEXIUM speed drive, continuous current 10A rms
MHDA 1056 •00	LEXIUM speed drive, continuous current 20A rms
MHDA 1112 •00	LEXIUM speed drive, continuous current 40A rms
MHDA 1198 •00	LEXIUM speed drive, continuous current 70A rms

• **Other Drives:**

Any drive which complies with standard EN 61491 can be used with the TSX CSY 84/85/164 modules.

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Owing to changes in standards and equipment,
the characteristics given in the text and images
in this document are not binding us
until they have been confirmed with us.

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