Premium using EcoStruxure™ Control Expert

TSX ESY 007 Module Installation Manual

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When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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Safety Information

Important Information

NOTICE

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

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

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

⚠ DANGER

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

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

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.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

About the Book

At a Glance

Document Scope

This manual describes how to install hardware and software for the TSX ESY 007 Module.

Validity Note

This documentation is valid for EcoStruxure™ Control Expert 14.0 or later.

Product Related Information

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise should be allowed to program, install, alter, and apply this product.

Follow all local and national safety codes and standards.

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

Part I
The TSX ESY 007 Module

Chapter 1
General Presentation of the TSX ESY 007 Module

Object of this chapter

This chapter provides general information about the TSX ESY 007 Module.

What Is in This Chapter?

This chapter contains the following topics:

At a Glance

TSX ESY 007 Module

The TSX ESY 007 Module acts as gateway for retrieval of I/O of TSX Series 7 PLC racks to a Premium PLC, via the I/O extension bus. It is intended for upgrading automated systems equipped with programmable TSX Series 7 PLCs 40 (47, 67, 87 and 107 in version V2, V3, V4 or V5).

It is mounted in a Premium rack equipped with a Premium V2.00 minimum processor.

The configuration of this coupler in Control Expert is protected by access rights. These rights may only be used by Schneider Services Industries entities in France, and abroad by Schneider Services entities or otherwise by its representatives.

Recovery of the PL7-3 program of the system to be upgraded is possible through the successive use of PL7-3/PL7 Pro and PL7 Pro/Control Expert converters.

Note concerning the input/output extension bus

Overview

The input/output bus is a serial bus that enables control of TSX Series 7 racks. It allows routing of "Discrete", "Analog" and "Message" type information between bus master and Series 7 modules through LES20, LES120, LFS120 and LFS121 slave modules.

The input/output bus is made up of three major components:

- a bus master,
- slaves (input/output entrance link modules),
- TSX Series 7 I/O modules.

NOTE: For additional information on the input/output bus and the features of Series 7 devices, see the Series 7 documentation.

Panorama of the Series 7 products in the Schneider catalog

Overview

Complete list of Series 7 products in the Schneider catalog supported by the **TSX ESY 007 Module**:

Discrete I	Discrete O	I ANA	O ANA	Other
TSX DET 4 66	TSX DST 4 17	TSX AEM 4 11	TSX ADT 2 01	TSX AXT 2 00
TSX DET 8 02	TSX DST 8 04	TSX AEM 4 12	TSX ADT 2 02	TSX CCM 1 00
TSX DET 8 03	TSX DST 8 05	TSX AEM 4 13	TSX ADT 2 03	TSX CTM 1 00
TSX DET 8 05	TSX DST 8 17	TSX AEM 8 11	TSX AST 2 00	TSX DTM 1 00
TSX DET 8 12	TSX DST 8 35	TSX AEM 8 21	TSX ASR 2 00	TSX DMR 16 52
TSX DET 8 13	TSX DST 8 82	TSX AEM 12 12	TSX ASR 4 01	TSX DEM 24xx
TSX DET 8 14	TSX DST 16 04	TSX AEM 16 01	TSX ASR 4 02	
TSX DET 8 24	TSX DST 16 12	TSX AEM 16 02	TSX ASR 4 03	
TSX DET 16 03	TSX DST 16 32	TSX AEM 16 13	TSX ASR 8 00	
TSX DET 16 04	TSX DST 16 33			
TSX DET 16 12	TSX DST 16 34			
TSX DET 16 13	TSX DST 16 35			
TSX DET 16 33	TSX DST 16 82			
TSX DET 32 12	TSX DST 24 72			
TSX DET 32 32	TSX DST 24 82			
TSX DET 32 42	TSX DST 32 92			
TSX DET 32 52				

List of products in the Schneider catalog not supported by the **TSX ESY 007 Module**:

- TSX AXM 171/1711 axial command couplers,
- TSX AXM 162/172/182 axial command couplers,
- TSX AXM 292/492 axial command couplers,
- TSX SCM XXX, TSX MPT 10, TSX ETH XXX, TSX FMP XXX, TSX IBS XXX, TSX MAP XXX communication couplers,
- TSX PCM37(MMX), PCM00, TSX LSM 200, TSXLSM240 (warm-stand by), TSX ADA200, TSX ETH 200, TSY MSM XXX couplers,
- couplers specifically designed for target clients.

Main components - Presentation

The cable

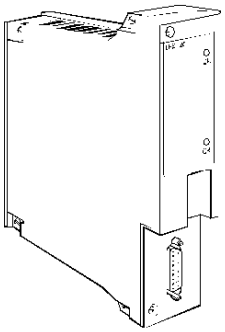
The type of cable required is dependent upon the type of slave module used:

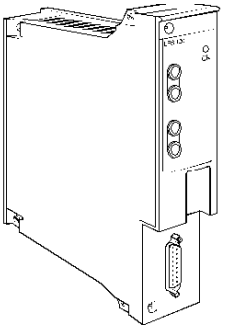
- For LES20: TSX CBC xxx cable for a local entrance link
- For LFS120 and LFS121: TSX CBD xxx cable for a fiber optic link.
- For LES120: TSX CBxxx cable for a remote entrance link.

Slave modules

Installed in the first position in the TSX Series 7 tray, they dialog with the TSX ESY 007 module and control the TSX Series 7 present on their main and direct extension (optional) racks.

Illustration examples of LES20 and LFS120 slave modules:





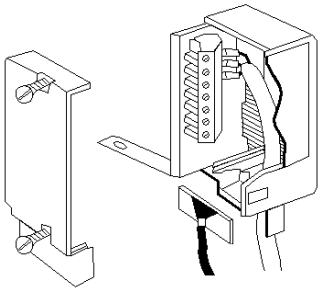
The terminal block connectors

The terminal block connectors provide chaining between the cables and the TSX LES20 slave modules. They allow encoding of the TSX Series 7 rack address on the LES20 bus.

On the TSX ESY 007 side, mainly the TSX LES 64, 65, 74 and 75 references are used.

On the Series 7 rack side, mainly the TSX LES 61, 62, 70 and 71 references are used.

Illustration:

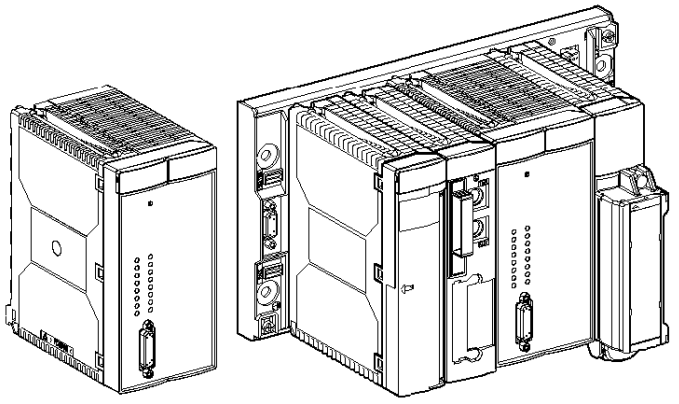


The Bus master

The I/O bus master manages all data exchanges on the I/O extension bus.

It is possible to integrate the TSX ESY 007 Module in a Premium PLC station to manage the I/O extension bus.

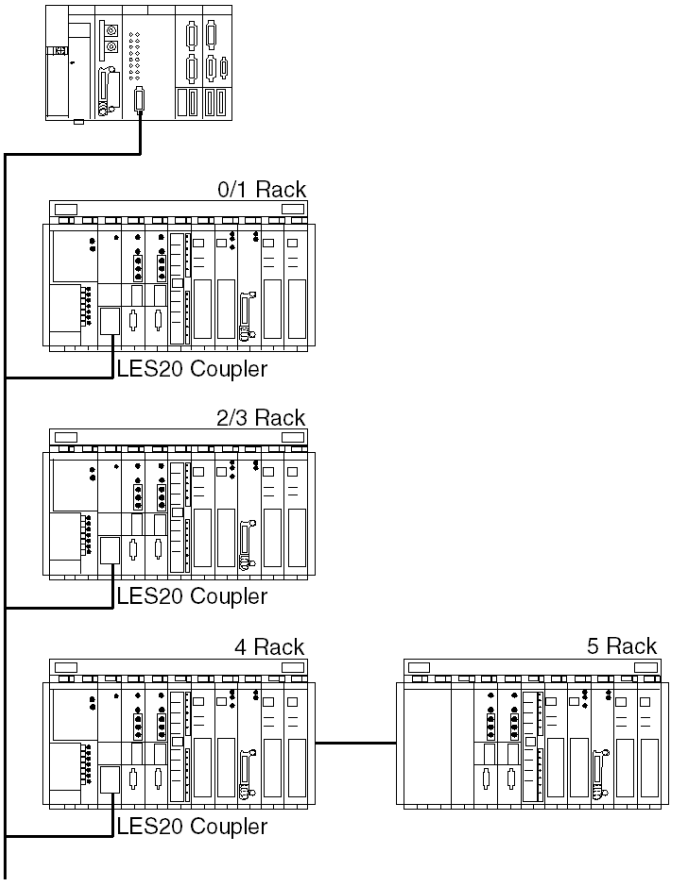
Premium Illustration



TSX ESY 007 **Premium Station**

Figure showing sample topology of input/output extension bus

Illustration



Main features of input/output extension bus

General Points

The I/O extension bus is a system in which interchange management is ensured by a single master that calls each LES 20 slave module.

The serial communication frame sends the following services:

- read 4/8/16 bits (Discrete)
- write 4/8/16 bits (Discrete)
- read 8 words (Analog)
- write 8 words (Analog)
- message read in module
- message write in module
- read module status
- read LES20 module status
- LES20 module command

The I/O Serial Extension Bus is a type RS422 Bus with a speed of 2 Mbits/s on TSX 47/67/87/107 and 4 Mbits/s on some TSX 107.

TSX LES 20 slave addressing

Each LES 20 module must have an even address between 0 and 14.

The address is encoded using switches in the TSX LES 6x/7x terminal blocks.

TSX LES 200/LFS 200 slave addressing

Each LES 200/LFS 200 module must have an even address between 2 and 14.

The address is encoded using straps directly on the module.

Maximum number of inputs/outputs

An I/O extension bus handles a maximum of 16 8-slot racks.

The maximum number of I/Os is:

- 2048 Discrete Inputs
- 2048 Discrete Output
- 256 Analog Inputs
- 256 Analog Outputs

I/O Bus Extension Cable

The I/O extension cable is a type of cable entrance link reference: TSX CBC xxx, TSX CBD xxx or TSX CB xxx depending on the type of slave.

For additional information on its features, see the TSX Series 7 documentation.

I/O extension bus layout and maximum length

The I/O extension bus layout is defined by the number of racks to connect.

The total length of all bus branches must not exceed:

- 30 m for a local extension using TSX LES 20,
- 500 m for a electrical remote extension using TSX LES 200,
- 2000 m for a fiber optic extension using TSX LFS 200.

⚠ CAUTION

UNEXPECTED EQUIPMENT BEHAVIOR

Do not exceed the maximum cable length:

- 30 m for a local extension using TSX LES 20,
- 500 m for a electrical remote extension using TSX LES 200,
- 2000 m for a fiber optic extension using TSX LFS 200.

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

I/O extension bus scan time

This is the scan time between output transmit to Series 7 modules by the TSX ESY 007 module and recovery of Series 7 module inputs.

The TSX ESY 007 module transmits or requests variable length information to each Series 7 module via the bus based on the type of module (Track No., Discrete/Analog, Messaging). The I/O extension bus scan time depends on the number and type of Series 7 module driven on the bus.

With a complete representative configuration, the maximum time does not exceed 90 ms.

Reliability, flexibility

The transmission procedure used guarantees reliable operation. The TSX ESY 007 master monitors the activity of the LES 20 slave modules and the data sent.

It detects transmission errors, Series 7 rack and TSX LES 20 failures then sends this information to the PLC.

Part II

Hardware Installation of TSX ESY 007 Input/Output Extension Bus Interface Coupler

Chapter 2
Input/Output Extension Bus Coupler Interface: TSX ESY 007

Subject of this Chapter

This chapter covers hardware installation of the **TSX ESY 007** module for a Premium PLC.

What Is in This Chapter?

This chapter contains the following sections:

Section 2.1
Description of the TSX ESY CM 007 Module

Subject of this Section

This section covers hardware installation and features of the TSX ESY 007 Module.

What Is in This Section?

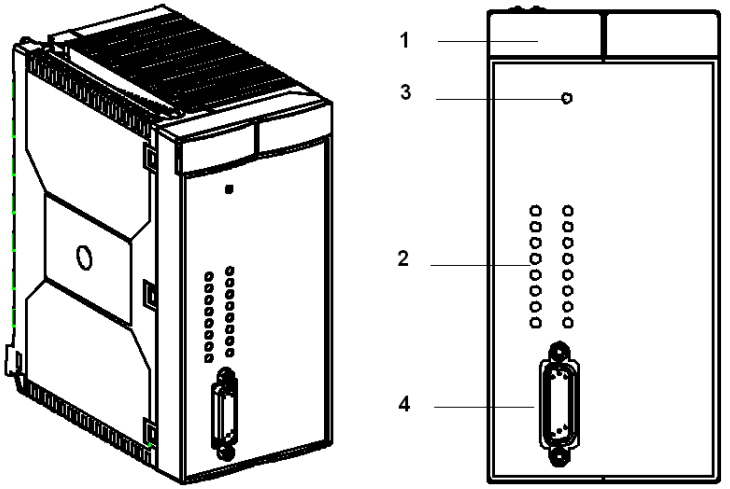
This section contains the following topics:

Physical presentation

Description

The TSX ESY 007 Module has a double slot format.

Illustration:



The following table describes the parts of the module

Number	Description
1	Status indicator panel with 4 indicator lights indicating the module operation modes: ● RUN (green): on, inormal operation, ● ERR (red): on, an error has been detected, ● I/O (red): on, an input/output error has been detected on an I/O extension bus.
2	Status indicator panel with 16 lights (0 to F) for diagnostics of racks on the I/O extension bus.
3	Reset button.
4	SUB D 26-pin, high-density connector for connection to the I/O extension bus. It receives the TSX LES 64/65/74/75 terminal block connectors.

Mounting/Installation

Overview

The TSX ESY 007 Module mounts in any position on a Premium TSX RKY rack on the main segment of the back plane, except for positions dedicated for the processor and power supply. The processor must be at least a Premium Control Expert processor V2.00.

⚠ WARNING

Not allowed in an extension rack

This module cannot operate in an extension rack (distance > 100 m), and absolutely must be assembled in a main segment rack of the X bus.

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

The mounting and dismounting procedures are identical to the mounting and dismounting procedures of other modules. (Refer to Premium and Atrium using EcoStruxure™ Control Expert, Discrete I/O modules, User Manual).

Installation and removal of this module is performed using a flat or cross-slot screwdriver.

NOTE: Mounting and dismounting the module may be performed with PLC power on and I/O extension bus connected.

Number of modules per station

The maximum number of TSX ESY 007 modules that can be installed in a Premium station depends on the features of the processor used. The coupler is installed as a field bus and not as an application track.

Processor reference	Authorized number of TSX ESY 007 Modules
TSX P57 0244	1
TSX P57 104	2
TSX P57 154	2
TSX P57 1634	2
TSX P57 204	4
TSX P57 254	4
TSX P57 2634	4
TSX P57 304	8
TSX P57 354	8
TSX P57 3634	8
TSX P57 454	8
TSX P57 4634	8

Processor reference	Authorized number of TSX ESY 007 Modules
TSX P57 554	8
TSX P57 5634	8
TSX P57 6634	8

It is recommended to choose at least a TSX P57 3xxx/4xxx/5xxx/6xxx processor to ensure proper functioning of the TSX ESY 007 Module.

For information, refer to the following documents:

- Premium and Atrium using EcoStruxure™ Control Expert, Processors, racks and power supply modules, Implementation Manual
- TSX 57 Processor Catalogue

Maximum number of input/outputs managed by the TSX ESY 007 Module

The TSX ESY 007 Module may control a maximum of 16 8-slot racks.

The maximum number of I/Os managed is:

- 2048 Discrete Inputs
- 2048 Discrete Outputs
- 256 Analog Inputs
- 256 Analog Outputs

The Series 7 Discrete, analog and working tracks controlled by the TSX ESY 007 Module are not included in the calculation of the maximum number of Discrete, analog or application tracks of a Premium processor.

Connections

Connecting to the X bus

The TSX ESY 007 is automatically connected to the X bus when it is inserted into the receiving rack .

If the TSX ESY 007 is in the base rack, it is directly connected to the CPU and power supply modules.

If the TSX ESY 007 is not in the base rack, it is connected to the CPU by the X bus and powered directly by the rack where it is located.

Connecting LES 20 to the I/O extension bus

When connecting LES 20, it is not necessary to connect either the Bus Master or TSX 7 Rack first. The overall operation cannot be guaranteed during this phase of the installation.

The I/O extension bus does not require a specific ground connection, but the Power Supply and PLC equipment must follow standard installation requirements. It is recommended not to place the I/O extension bus next to high-energy cables.

This connection system uses a TSX CBC xxx cable. Whatever the layout, the sum of cable lengths of the same I/O extension bus must not exceed 30 m.

NOTE: For an electric remote or a fiber optic link, the TSX ESY 007 module must be directly connected to TSX LFS 120/121 or LES 120 modules before connecting to the other TSX LES 20 modules. The sum of cable lengths of the same I/O extension bus must not exceed 500 m for an electric remote link and 2000 m for a fiber optic link.

⚠ CAUTION

UNEXPECTED EQUIPMENT BEHAVIOR

Do not exceed the maximum cable length:

- 30 m for a local extension using TSX LES 20,
- 500 m for a electrical remote extension using TSX LES 200,
- 2000 m for a fiber optic extension using TSX LFS 200.

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

I/O Extension Bus Cables

The I/O extension bus cables carry signals to TSX 7 racks and modules. The features of these cables refer to the documentation for I/O configuration installation on TSX Series 7 modules.

Recommended Cables: TSX CBC xxx, TSX CB xxx and TSX CBD xxx.

Cable Routing

The I/O extension bus cables and high-energy power cables must be separated and protected by a metallic divider.

When the control cable is routed with these cables, the control link connections must be made according to generally accepted practices.

Connector plug

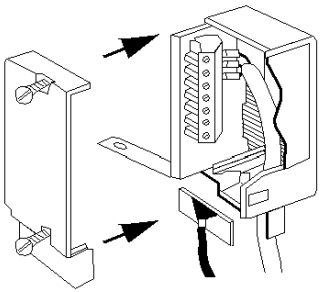
The TSX LES 64/65/74/75 terminal blocks connect the module to the I/O extension bus. These terminal blocks are connected to the I/O extension bus cable and assembled by the user according to steps described below.

In most cases, you can use the existing TSX LES 64/65/74/75 connector from the existing installation that was used to connect the TSX 7 processor to the I/O extension bus.

In all cases:

- a TSX LES 64 or 65 terminal block is used when the TSX ESY 007 module drives Series 7 racks as local entrance link.
- a TSX LES 74 or 75 terminal block is used when the TSX ESY 007 module drives Series 7 racks as an electrical remote link or optic fiber link.

Illustration:



Connecting the module to the bus

If there is no existing terminal block, connect the module to the bus as follows:

Step	Action
1	**Preparing the TSX LES 64/65/74/75 terminal block:** ● open the cover, ● connect one end of the TSX CBC chaining cable to the connecting block (Refer to the TSX Series 7 documentation), ● close the cover.
2	Position the box on the 26-pin connector of the TSX ESY 007 Module.
3	Connect the ground wire of the box to the ground lug of the case. If the ground wire is too short to be connected to the case, replace it with a longer wire while respecting the length/width to avoid the "Pigtail" phenomena.

LED module status indicators

General Points

3 LED indicators located on the module, RUN, ERR, I/O provide information on module operation.

LED indicator	On	Flashing	Off
RUN (green)	Module operating normally	Module self-tests (1) or in standby for configuration	Powered off or module failure
ERR (red)	Serious internal fault, module failure	Module self-tests (1) or fault But fault maybe outside of the module: ● application fault ● I/O extension bus cables fault	No internal fault
I/O (red)	Default inputs/outputs	Module self-tests (1)	Module operating normally

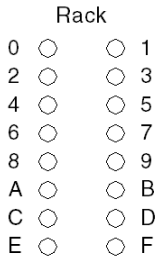
(1) All three LEDs flash during self-tests on module power-up.

Special LED indicators of the TSX ESY 007 Module

Overview

16 LED indicators allow visual inspection of operation status of TSX 7 extension racks controlled by the TSX ESY 007 Module.

LED appearance:



LED status:

LED status:	Meaning
LED green	Corresponding rack configured in the Control Expert Premium application and operating normally
LED flashing green	Corresponding rack configured in the Control Expert Premium application and by default
LED off	Corresponding rack not configured in the Control Expert Premium application

Technical Features

TSX LES 20 bus

Feature	Value
Maximum I/O extension bus scan time	50 ms
Rack number on I/O extension bus	16
Maximum length of I/O extension bus	30 m
Maximum number of inputs/outputs	2048 I/O Discrete + 256 I/O Analog

TSX LES 200 bus

Feature	Value
Maximum I/O extension bus scan time	50 ms
Rack number on I/O extension bus	16
Maximum length of I/O extension bus	500 m
Maximum number of inputs/outputs	2048 I/O Discrete + 256 I/O Analog

TSX LFS 200 bus

Feature	Value
Maximum I/O extension bus scan time	50 ms
Rack number on I/O extension bus	16
Maximum length of I/O extension bus	2000 m
Maximum number of inputs/outputs	2048 I/O Discrete + 256 I/O Analog

TSX ESY 007 Module

Feature	Value
Programming the TSX ESY 007 Module	Control Expert
Response time for 128 16-channel discrete modules in the MAST task (1)	75 ms typical, 85 ms maximum
Calculation of I/O extension bus polling time for n modules (normal operation)	0.192 ms x Number of 4-channel discrete modules + 0.228 ms x Number of 8-channel discrete modules + 0.300 ms x Number of 16-channel discrete modules + 1.900 ms x Number of ANA/Analog modules + 7.3 ms
Current consumed by 5 V PLC	75 mA typical/100 mA maximum
Power dissipation	0.5 W maximum
Level of protection	IP20
Operating temperature	0 to 60 degrees Celsius
Standards and conditions of service	In conformity with those of Premium PLCs

(1) Logical response time = time between one I/O extension bus input activated on the bus, processed in the PLC application and applied on an I/O extension bus output.

NOTE: The PLC scan time must be adjusted on the periodic mode and not on the scan mode and a task period calculated according to the following formula:
"Scan time MAST task >= Estimated scan time of theoretical LES20 MAST task + Execution time of programmed MAST task".
Program execution time for a given task may be calculated from %SW30 to 35. For details on I/O extension bus scan time, refer to the Chapter 6. In debug phase, information on the real scan time of the I/O extension bus (current and maximum) is provided to allow more a accurate adjustment of the PLC scan time.
If the PLC scan time is less than the LES20 bus scan time or if the task is in the scan mode, synchronization of cycles is not guaranteed. In this case, the operation mode is asynchronous between the PLC scan and the LES20 bus scan.
If the PLC program uses messaging features for the TSX Series 7 modules, you must increase the configured cycle type to enable the TSX ESY 007 module to manage the messaging requests.

User safety

Overview

To ensure user safety, you must:

- Connect the PLC ground wire to the ground,
- For a PLC connected to an AC networks, place a differential circuit breaker upstream in the network to interrupt the PLC power supply in the event that a leak with the ground is detected,
- For a PLC connected to a DC power supply, to ensure that the power supply placed upstream of the PLC is TBTS,
- To use certified Schneider Electric products on the bus,

On account of its technology and connection, the TSX ESY 007 Module only receives 5 VDC and its zero electrical volt is connected to the ground of the PLC.

Section 2.2
Use of the TSX ESY 007 Module for System Upgrade

Subject of this Section

This section covers installation of the TSX ESY 007 Module for a system upgrade.

What Is in This Section?

This section contains the following topics:

At a Glance

Overview

The TSX ESY 007 Module is a Premium X bus module for revamping automated systems equipped with TSX Series 7 programmable PLCs. It allows creation of a gateway between a Premium PLC and the I/O serial extension bus of TSX Series 7 PLCs. It offers the possibility of replacing the processor of a TSX Series 7 system by a TSX Premium processor and keeping the base racks and extension racks of the TSC Series 7. It thus allows recovery of all in a TSX Series 7 by connecting and controlling the LES20 series bus.

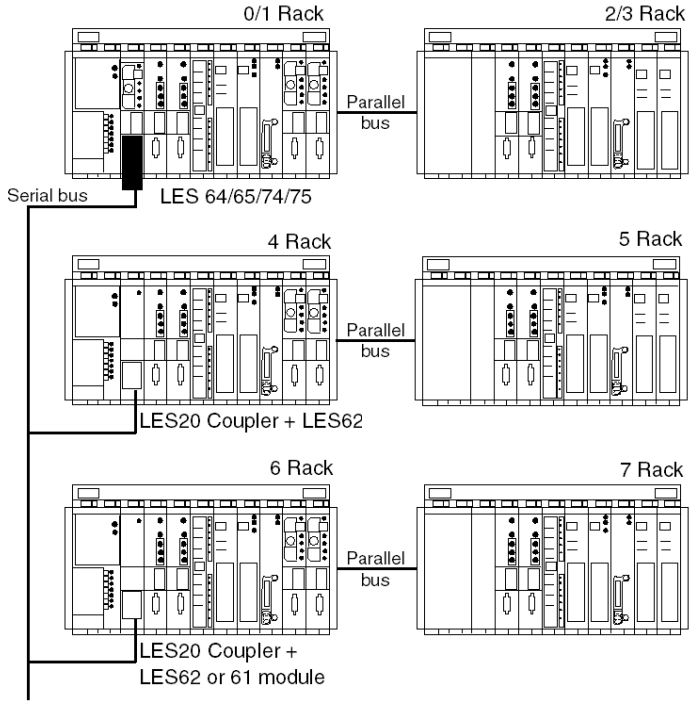
It thus offers a solution to modernize TSX Series 7 systems and benefit from Premium / Control Expert technology without having to redo all the cabling of the I/O modules.

Installation

A TSX Series 7 PLC, V3, V4 and V5, is composed of 2 main racks numbered 0/1 and 2/3 and 12 extension racks numbered from 4 to 15.

The two main racks are linked by a parallel bus.The extension racks are linked to the CPU by a serial bus. Each direct extension is linked to its main extension rack by a parallel bus.

Illustration:



The TSX LES 20 Series 7 module manages data exchange with the TSX 7 CPU. It transforms the I/O data that it receives via serial bus into data on the parallel bus of the extension racks. Through a TSX LES 61/62 connection box, the LES20 Series 7 module has the address of the extension rack it manages.

Special architecture

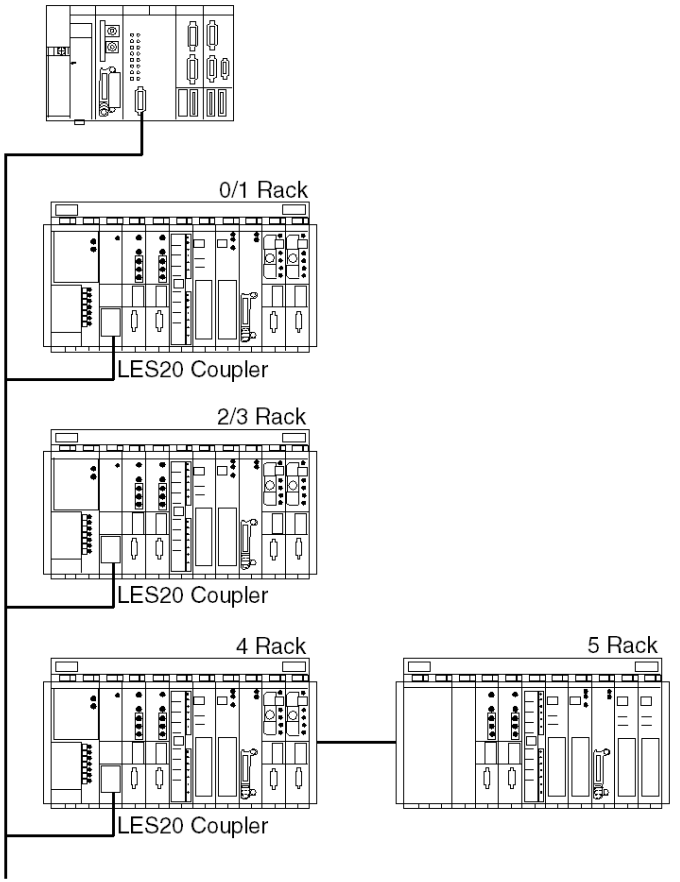
- 2/3 rack managed by a LES 20 coupler.
  In certain configurations, the 2/3 rack is not managed as a direct extension of the base rack by a parallel bus, but is managed as a serial bus by a LES 20 coupler. In this case, the 2/3 rack may also be kept during an upgrade.
- Double format rack
  In V2, 67/30, 87/10 and 87/20 processors and in V3, 87/30 processors are positioned in the double format racks. The lower part has a complete bus, and the upper part has a simplified bus. For 87/10 and 87/20 processors, positions 00 and 10 may be occupied by a memory extension card (TSXMEM4x). To upgrade these configurations, a LES20 coupler must be installed in place of the processor in the lower part of the rack.
- Electrical remote and fiber optic extensions (LES 120 and LFS 120)
  Remote I/O extensions allow a longer entrance linkage distances between the CPU rack and the extension rack containing any of these modules.
  Two technologies can be used:
  - fiber optic links (the maximum length is 2000 m)
  - electric remote links (the maximum permitted length is 500 m)

  Remote extensions I/O use racks which are connected using either of the following modules:
  - TSX LFS 200 if the rack is linked by a fiber optic bus
  - TSX LES 200 if the rack is linked by an electrical bus

  In both cases, an upgrade using the TSX ESY 007 module is possible.

The upgrade solution offered by the TSX ESY 007 Module can substitute racks 0/1 and 2/3 with a Premium rack and keep Series 7 extension racks. Recovery of racks 0/1 and 2/3 is also possible. In this case, the Premium rack is added to the top of the I/O configuration.

Illustration:



In the illustration above, the TSX Series 7 processor for the 0/1 rack was replaced by a TSX LES 20 coupler. A TSX LES 20 coupler was installed in position M of the 2/3 rack. The 2/3 rack is fitted with a power supply. These two couplers were connected to the I/O extension bus by two TSX LES 62 connector terminal blocks.

The existing TSX LES 65 terminal block that was previously plugged into the TSX Series 7 processor is now plugged into the front panel connector of the TSX ESY 007 coupler.

The TSX Series 7 PL7-3 processor application program was migrated to Control Expert software using PL7-3/PL7 Pro and PL7 Pro/Control Expert converters.

Recovering racks 0 to 3

At a Glance

Recovery of the 0/1 rack and the 2/3 rack managed as a direct extension is possible when the following conditions are met:

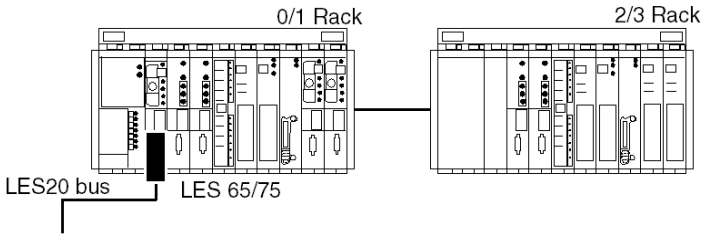
- Move the 2/3 rack from direct extension to local extension and install a TSX LES 20 Coupler in slot M with a power supply. On type RKE 8 racks, there are slots for installing a power supply and the TSX LES 20 Coupler. On the other hand, on type RKE 7 racks these slots do not exist and the cards in the first two slots must be removed in order to mount a power supply and the LES20 Coupler.
- Install a TSX LES 20 Coupler in the place of the Series 7 CPU in the 0/1 rack.
- In the LES62 terminal block of the LES20 module of the 0/1 rack, encode address 0 and in the LES62 terminal block of the LES20 module of the 2/3 rack, encode address 2.

Encoding addresses:

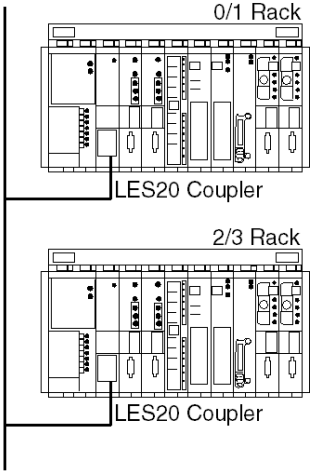
Address 0 Address 2

Illustration

Forward:



After



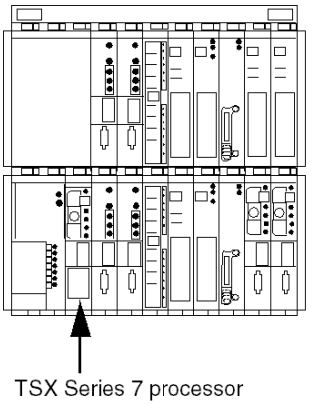
For double format racks

Recovering a double-format rack involves installing a LES20 Coupler in place of the processor in the lower part of the rack.

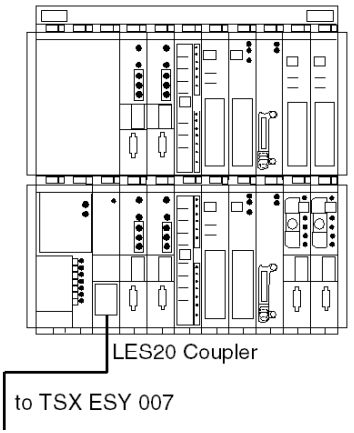
Recovering I/O modules on the upper side follows the same principle as for a double address rack. In the case of a double format direct extension I/O rack, a LES20 Coupler should be placed in slot M.

Illustration

Before



After



LES120/LFS120 Remote Entrance Links

At a Glance

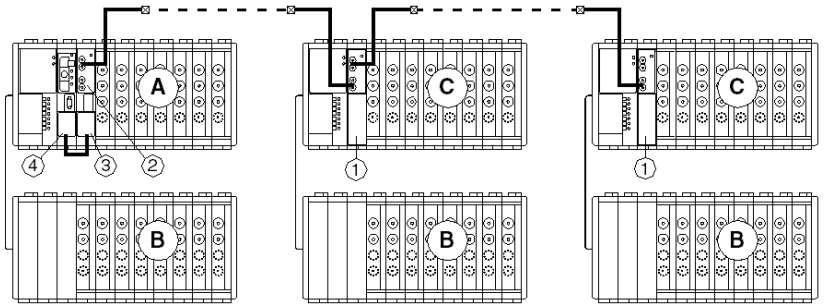
There are two types of links in configurations with I/O remote entrance linkage:

- Fiber optic remote I/O link: LFS 120,
- Electrical remote I/O link: LES 120.

Recuperation of this type of remote link by the TSX ESY 007 coupler is possible if the base configuration is modified as indicated hereafter.

Optic configuration before configuration:

Illustration:

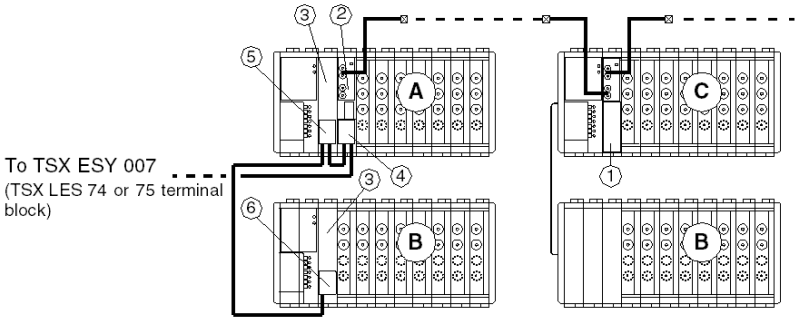


Definitions:

Code	Definition
A	PLC base tray
B	Direct extension input/output tray:
C	Remote optic direct extension input/output tray
1	TSX LFS 200 optic chaining module
2	TSX LFS 120 optic entrance link module
3	TSX LES 70 Module
4	TSX LES 74/75 Module

Optic configuration after upgrade:

Illustration:



Definitions:

Code	Definition
A	PLC base tray
B	Direct extension input/output tray:
C	Remote optic direct extension input/output tray
1	TSX LFS 200 optic chaining module
2	TSX LFS 120 optic entrance link module
3	TSX LES 20 Module
4	TSX LES 70 Module
5	TSX LES 62 Module
6	TSX LES 61 Module

The configuration of the electrical link architecture is the same as the fiber optic link as above.

NOTE: The maximum permitted length of the TSX CBC cable between the ESY 007 module and theTSX LFS 120 or TSX LES 120 coupler is 3 m.

NOTE: The TSX LES 70 terminal bloc is replaced by a TSX LES 71 terminal block to connect the TSX LES 20 module of rack 0 by the TSX LES 62 terminal block. If the rack 0 is not recovered, use the TSX LES 70 terminal block.

Module Installation Order

It is mandatory to link the TSX ESY 007 module first to the TSX LFS 120 module then to the TSX LES 20 module and install the modules in this order:

1	TSX LES 75
2	TSX LES 71
3	TSX LES 62

Methodology for Upgrading the PL7-3 PLC Program

At a Glance

The different steps for migrating a PL7-3 program of a TSX Series 7 PLC for updating to a Control Expert program are presented below. Porting a PL7-3 program to Control Expert requires the successive use of PL7-3/PL7 Pro and PL7 Pro/Control Expert converters. It also requires XTEL (V5 minimum), PL7-3 (V5 minimum), PL7 Pro (V4.3 minimum) and Control Expert (V2.1 minimum) software.

- Analysis of the I/O configuration of the PL7-3 program (under XTEL-CONF): establish the list of I/O modules supported by the TSX ESY 007 Module and those that are not supported.
- Modular backup under XTEL-PL7-3 of each part of the PL7-3 (PRL, G7, POST, Sri) program: obtain the text file (.LAD, .LIT, .GR7).
- Backup the symbols file (.SCY) and the constants file (.CST)
- Conversion of the exported files (.LAD, .LIT, .GR7, .SCY, .CST) to a PL7 Pro compatible file format (.LD, .ST, .GR7, .SCY) using the PL7-3/PL7 Pro converter associating PL7-3 and PL7 Pro objects.
- Creating a PL7 Pro receiving program and successive importing of compatible exported PL7-3 files. Be sure to respect the order in which you import the sections to preserve the structure of the source program.
- Exporting the PL7 Pro application to .FEF file.
- Creating the receiving station in Control Expert by adding the TSX ESY 007 Module and creating the I/O extension bus configuration.
- Importing the FEF application in Control Expert using the PL7 Pro/Control Expert converter associating PL7 Pro objects with Control Expert objects. The correspondence of the Series 7 I/Os with the Control Expert I/Os is described in detail in chapter 3.
- Adaptation of the program to the upgrade through the use of the TSX ESY 007 Module (Porting PL7-3 instructions for explicit read/write and text block send through the use of EF SEND_REQ in Control Expert).

For steps 1 to 5, see the documentation for the PL7-3/PL7 Pro converter (on-line converter help: convpl73.hlp)

For step 8, see the documentation for the PL7 Pro/Control Expert converter (on-line Control Expert help:

Key points for migrating a PL7-3 program to Control Expert

Application structure:

- A PL7-3 application may include up to six tasks (five MAST/AUX0/AUX1/AUX2/AUX3 periodic tasks and one interruption task. A Control Expert application using the TSX ESY 007 Module can only include the MAST task for the I/O configured on the LES20 Bus.
- Modular backup and import of each part of the program involves a loss of program structure. Successful recovery of this structure is the responsibility of the user when importing into PL7 Pro. Because the PL7-3 task number is greater than the PL7 Pro task number, there may be collision problems that must be resolved by the user.

Objects:

- Objects handled by a PL7-3, PL7 Pro or Control Expert application are predefined. Some PL7-3 objects still exist in PL7 Pro and Control Expert, others not. A key point in conversion is to associate each PL7-3 object used with its equivalent in PL7 Pro then Control Expert.
- Converter documentation contains correspondence tables for PL7-3/PL7 Pro and PL7 Pro/Control Expert objects.

Languages syntax:

- The PL7-3 (LIT) literal language is transformed into structured language in PL7 Pro and Control Expert (ST). Syntactical differences exist between the two languages. A table of equivalencies is available in the documentation of the converters.
- The Ladder PL7-3 language is not processed in the same manner as the Ladder PL7 Pro and Control Expert language. In PL7-3, the Ladder is processed, for each rung, from left to right, column by column, and in each column from top to bottom. In PL7 Pro and Control Expert, the Ladder is processed connected network by connected network, and within a connected network, in the direction of the equation. Even though they are converted in identical graphical form, some networks of contacts may thus be processed differently (producing a different result on execution).
- The Grafcet language is transformed in Control Expert into SFC language. Because of this, some functions no longer exist and their migration is the responsibility of the user (Section PRL/POST, Jump,). Moreover, some execution rules are different (empty receptivity, macro steps). See the converter documentation for more information on the differences between Grafcet and the SFC language.

Hardware and software configuration:

- Software configuration is partially recovered. Configuring task parameters, memory (number of internal bits/words), management of common words and OFBs, information relating to Grafcet are not recovered and are the responsibility of the user.

Explicit exchange instructions:

- +Because the converters are not able to preserve the explicit exchange instructions with Series 7 modules, porting instructions is the user's responsibility.
- The READEXT and WRITEEXT instructions, as well as the exchanges by text block send may be reproduced by using EF SEND_REQ and request send to the TSX ESY 007 Module.

Section 2.3
Inputs/Outputs Extension Bus Diagnostics

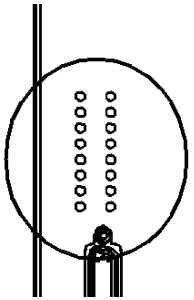
I/O extension bus diagnostics - Presentation

Overview

LED indicators block for the modules allows:

- Indicator lights for the presence of each TSX7 rack configured in the Control Expert application.
- Indicator lights for the status of these TSX7 racks configured in the Control Expert application.

Illustration:



A green LED on indicates whether the corresponding TSX7 rack or one of its modules has a communication fault.

A flashing green LED indicates that the corresponding TSX7 rack or one of its modules has a communication fault.

Section 2.4
Operating Modes of the TSX ESY CM 007 Module

TSX ESY 007 Module Operating Modes

Output fallback strategy

The fallback mode is defined for each TSX 7 rack in the configuration screen and is read in the word %KWr.m.0:

- %KWr.m.0.i = 0: I/O **Fallback to 0** of the Series 7 rack number i on the I/O extension bus
- %KWr.m.0.i = 1: **Maintain** I/O **status** of the Series 7 rack number i on the I/O extension bus

(r = TSX ESY 007 rack address, m = TSX ESY 007 module address)

Operation:

On a TSX ESY 007 (with a TSX LES 20 coupler) communication fault there are two options:

- **Fallback to 0**: outputs of this rack are forced to 0 until communication resumes.
- **Maintain status**: outputs of this rack are maintained in the same state until communication resumes.

Behavior of %S9

When %S9 bit is set to 1, the outputs of the TSX ESY 007 are positioned in the **Fallback to 0** mode.

This behavior is different from that of the X bus-to-PLC modules. The outputs of these modules are either maintained in state or positioned on the fallback to zero value according to their configuration.

Communication fault

In case of a communication break with the CPU, the TSX ESY 007 Module sends outputs according its configuration (**Fallback to 0** or **Maintain status**). The following conditions produce a communication fault:

- The CPU watchdog expires (if the module in the main rack),
- Removal of the X Bus cable (if the module in an extension rack).

Extracting a module with power on

When extracting a module with power on, communication with the X busis broken and the processor signals a module fault signal.

Communication on the I/O extension bus is also interrupted with warning. In this case, the Series 7 racks put their outputs in the desired state (maintain or fallback).

Module Fault

In the event of a serious TSX ESY 007 Module fault (defective component, etc.), the module stops communicating with the X Bus and with the I/O extension bus. The same behavior also occurs when extracting a module with power on.

Inserting a module with power on

After a system power-up, the TSX ESY 007 Module remains powered-down until it receives the configuration from the processor.

Outage of I/O extension cable

In the event of a cable outage, several situations are possible:

- A cable is cut or disconnected from the module output: Disappearance of all the Series 7 modules and activation of corresponding channel fault bits and the module fault bit.
- A cable is disconnected from some Series 7 racks (the TSX LES 61/62 terminal blocks are present but disconnected from the TSX LES 20 modules): Disappearance of disconnected Series 7 modules and activation of corresponding channel fault bits and the module fault bit. Communication with the remaining Series 7 Modules is maintained. The disconnected Series 7 racks enter the fallback or maintain mode according to their configurations.
- A cable is cut after the TSX ESY 007 Module and several Series 7 racks: Disappearance of disconnected Series 7 modules and activation of corresponding channel fault bits and the module fault bit. Communication with the remaining modules is possible but can be affected by communication error. The disconnected Series7 racks enter the fallback or maintain mode according to their configurations.

Section 2.5
Precautions for Use

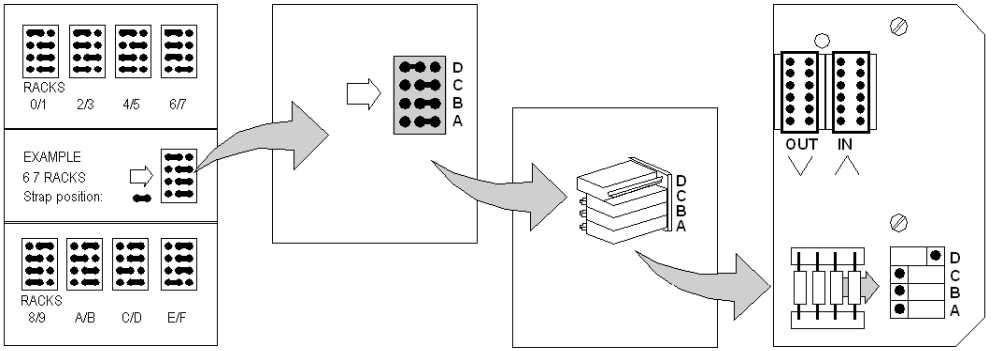
Double rack addressing

Recommendations

When connecting the I/O extension bus to the TSX ESY 007 Module, do not assign the same address to two Series 7 racks when encoding the TSX LES 61/62 module terminal blocks or encoding LES 200 and LFS 200.

Illustration

A single combination of connectors by a LES 61/62 terminal block.



Part III
Software Installation for the TSX ESY 007 Module

Subject of this Part

This part covers software installation for the TSX ESY 007 Module with Control Expert software.

What Is in This Part?

This part contains the following chapters:

Chapter 3
TSX ESY 007 Module Software Installation - Principles

Subject of this Chapter

This chapter presents the software installation principles for the TSX ESY 007 Module.

What Is in This Chapter?

This chapter contains the following topics:

Installation of the I/O extension bus - Presentation

Introduction

The TSX ESY 007 Module allows Series 7 rack control via a Premium PLC programmed with Control Expert software. The TSX ESY 007 Module is used for revamping automated systems equipped with TSX Series 7 programmable PLCs. It allows creation of a gateway between a Premium PLC and the I/O serial extension bus of TSX Series 7 PLCs. It offers the possibility of replacing the main rack of a TSX Series 7 system by a TSX Premium rack and keeping the TSX Series 7 extension racks. It thus allows recuperation of all extension racks in a TSX Series 7 by connecting and controlling the input/output serial extension bus.

It thus offers a solution to modernize TSX Series 7 systems and benefit from Premium / Control Expert technology without having to redo all the cabling of the I/O modules.

Installation of the TSX ESY 007 Module frame requires definition of the physical context of the project in which it will be used (rack, power supply, processor, modules, Series 7 devices connected by the bus), followed by installation of the software. The software installation of the application-specific modules is carried out from the various Control Expert editors:

- in offline mode,
- and in online mode.

The following order of installation phases is recommended but it is possible to change the order of certain phases (for example, starting with the configuration phase).

Installation of the TSX ESY 007 Module

The table below shows the various phases of installation of the TSX ESY 007 Module:

Phase	Description	Mode
Declaration of variables	Declaration of IODDT-type variables for the application-specific modules and project variables.	Offline (1)
Programming	Programming of the project and functions of the TSX ESY 007 Module.	Offline (1)
Configuration	Declaration of Series 7 modules and devices. Module channel configuration. Entry of configuration parameters.	Offline
Association	Association of IODDTs with the modules configured (variable editor).	Offline (1)
Build	Project generation (analysis and editing of links).	Offline
Transfer	Transfer project to PLC.	Online
Adjustment / Debugging	Debug project from debug screens, animation tables. Modifying the program and adjustment parameters.	Online

Phase	Description	Mode
Documentation	Building documentation file and printing miscellaneous information relating to the project.	Online (1)
Operation / Diagnostic	Displaying miscellaneous information necessary for supervisory control of the project. Diagnostic of project and modules.	Online

(1): These various phases can also be performed in the other mode.

*: Predefined structure containing standard language objects of the module.

TSX ESY 007 Module Architecture

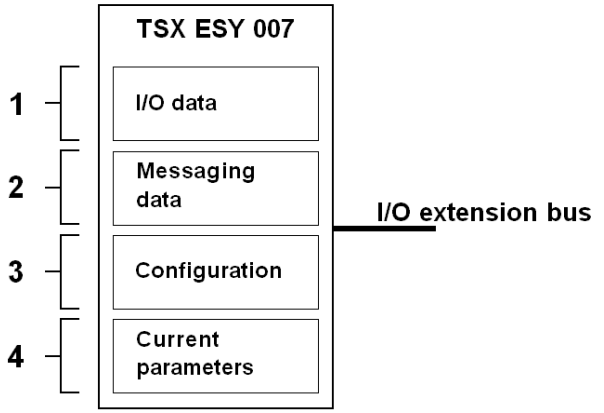
At a Glance

The TSX ESY 007 Module operates according to master/slave modes. The master alone commands exchanges on the bus.

The module integrates data fields that allow to manage Series 7 module lists and the images of input/output data.

Illustration of the architecture

The figure below shows the architecture of the TSX ESY 007 Module.



Description of components

The table below shows the different elements that make up the architecture of the TSX ESY 007 Module.

Address	Element	Description
1	I/O data	Images of the I/O of the 16 8-slot racks.
2	Messaging data	Image of the messages sent to Series 7 modules.
3	Configuration	This field contains all the codes of the Series 7 I/O modules configured on the I/O extension bus.
4	Current parameters	Image of the parameters of all Series 7 modules and racks.

Structure of a Series 7 module

At a Glance

The TSX ESY 007 Module allows to control the 128 Series 7 devices in the following list:

Discrete I	Discrete O	I ANA	O ANA	Other
TSX DET 4 66	TSX DST 4 17	TSX AEM 4 11	TSX ADT 2 01	TSX AXT 2 00
TSX DET 8 02	TSX DST 8 04	TSX AEM 4 12	TSX ADT 2 02	TSX CCM 1 00
TSX DET 8 03	TSX DST 8 05	TSX AEM 4 13	TSX ADT 2 03	TSX CTM 1 00
TSX DET 8 05	TSX DST 8 17	TSX AEM 8 11	TSX AST 2 00	TSX DTM 1 00
TSX DET 8 12	TSX DST 8 35	TSX AEM 8 21	TSX ASR 2 00	TSX DMR 16 52
TSX DET 8 13	TSX DST 8 82	TSX AEM 12 12	TSX ASR 4 01	TSX DEM 24xx
TSX DET 8 14	TSX DST 16 04	TSX AEM 16 01	TSX ASR 4 02	
TSX DET 8 24	TSX DST 16 12	TSX AEM 16 02	TSX ASR 4 03	
TSX DET 16 03	TSX DST 16 32	TSX AEM 16 13	TSX ASR 8 00	
TSX DET 16 04	TSX DST 16 33			
TSX DET 16 12	TSX DST 16 34			
TSX DET 16 13	TSX DST 16 35			
TSX DET 16 33	TSX DST 16 82			
TSX DET 32 12	TSX DST 24 72			
TSX DET 32 32	TSX DST 24 82			
TSX DET 32 42	TSX DST 32 92			
TSX DET 32 52				

The Discrete input modules have 4, 8 or 16 input channels. The-32 channel modules are represented as two 16-channel modules in the same slot of the even-numbered rack and the next odd-numbered rack.

Discrete output modules have 4, 8 or 16 output channels. The 32-channel modules are represented as two 16-channel modules in the same slot of the even-numbered rack and the next odd-numbered rack.

The ANA input modules have 16 Discrete channels, 8 analog input channels and 8 analog output channels. Some even have an internal memory area called "extended registers" that allow management of more than 8 analog channels.

The ANA output modules have 16 Discrete output channels, 8 analog input channels and 8 analog channels for output.

The other ANA modules have either:

- 16 Discrete input channels, 8 analog input channels and 8 analog output channels.
- 16 Discrete output channels, 8 analog input channels and 8 analog output channels.
- 8 Discrete input channels, 8 Discrete output channels, 8 analog input channels and 8 analog output channels.

Some also have an internal memory area called "extended registers" that allow management of more than 8 analog channels and a second internal memory area called "message registers" that allows management of messages.

Addressing Language Objects Associated with Series 7 Devices On the I/O Extension Bus

At a Glance

Acquisition of inputs from and updating of outputs for Series 7 devices connected to the I/O extension bus are performed in two different ways based on the channel type at the start and the end of each device type:

- automatically, at the beginning and at the end of each scan of the task they are configured for Discrete and Analog implicit I/O objects.
- by messaging with the use of EF SEND_REQ for objects based on extended registers and message registers.

The program user has access to these inputs and these outputs by language objects.

Addressing is defined as follows:

%	I,Q,IW,QW \	b.1 \	r .	m .	c
Symbol	Object type	Bus number followed by .1	Rack No.	Module position	channel

Syntax

The table below describes the different elements included in the addressing:

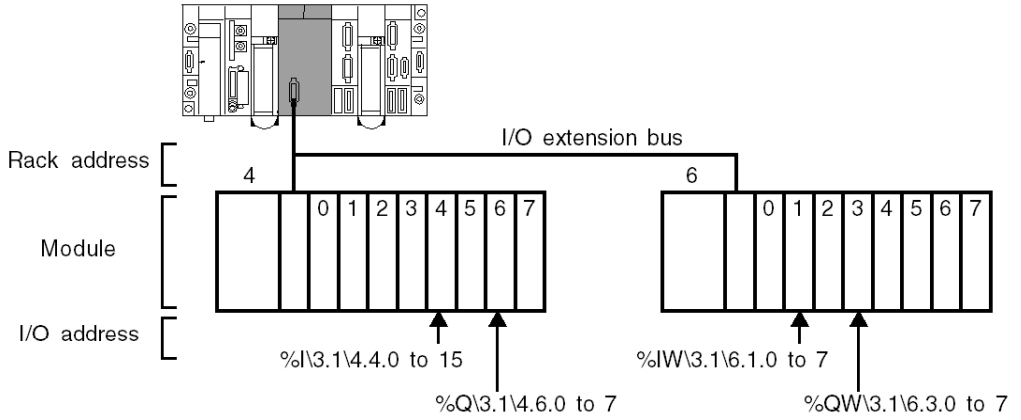
Family	Element	Values	Meaning
Symbol	%	-	-
Object type	I Q IW QW	-	Image of the Discrete module input, Image of the Discrete module output, Image of the analog input of the module, Image of the analog output of the module, This information is exchanged automatically for each cycle of the task to which they are attached.
Bus no.	b	2 to 999	Bus number (assigned by Control Expert)
Rack No.	r	0 to 15	Series 7 rack number
Module position	m	0 to 7	Series7 module number
Channel	c	0 to 15	Channel number

NOTE: With the TSX ESY 007 coupler, it is not allowed to use dynamic and direct representations of language objects arrays (examples: %Q\3.1\2.1.0[5], %Q\3.1\2.1.0:16).

Example

%I\3.1\0.2.6 indicates: input 6 of Series 7 module in slot 2 of 0 rack (formerly I2,6 in PL7-3).

Illustration:



Word bit addressing for an analog variable

To address an individual bit, use the following syntax:

%	IW/QW	\b.1\	r .	m .	c	.0.	i
Symbol	Object type	Bus number followed by .1	Rack No.	Module position	Channel		Bit position

Example: %IW\3.1\0.5.6.0.4 indicates: bit 4 of analog input 6 for the Series 7 module in slot 5 of rack 0 (formerly IW5,6:X4 in PL7-3).

Multiple addressing

When connecting one or more Series 7 racks, do not assign an address to a rack that is already used by another rack on the bus.

If two racks have the same address and:

- if the two racks have the same I/O modules, the TSX ESY 007 Module does not detect any errors on the output modules but detects transmission errors on the input modules,
- if the two racks contain some of the same I/O modules, the TSX ESY 007 Module does not detect any errors on the duplicated modules but detects transmission errors on the modules that are not the same in both racks.

Use of EF SEND_REQ for Handling Series 7 Modules with Extended and Message Registers

At a Glance

Some Series 7 modules have a specific operation mode for management of analog channels and for management of their internal configuration. They have two internal memory areas respectively called "extended register" and "message register".

The former allows management of analog channels and the latter allows management of module configuration modes.

⚠ CAUTION

UNEXPECTED EQUIPMENT BEHAVIOR

Reading or writing in extended register may take several MAST tasks, to limit the number of cycle it is recommended to increase the mast task period.

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

Management with PL7-3

PL7-3 software allowed, thorough the use of the "send text block, explicit read/write" functions to communicate with the extended register areas and message register areas of the Series 7 Modules.

The table below describes the different PL7-3 functions that dialogue with the extended and message registers:

Instruction	Meaning
READEXT	Read Series 7 module extended registers and store in a PLC internal word.
WRITEEXT	Write Series 7 module extended registries from a PLC internal word.
CPL TXT	Coupler type text block for sending PLC internal words and receiving data for configuration, reading data and diagnostic of Series 7 module.

NOTE: For all additional information on the use of explicit read/write instructions and sending text block (procedure for transfer of a configuration for example), see the TSX Series 7 documentation.

Management using Control Expert

The TSX ESY 007 Module allows, with the use of EF SEND_REQ, emulation of PL7-3 instructions for managing Series 7 modules with extended and message registries.

With the TSX ESY 007 Module, EF SEND_REQ is used in the following manner:

SEND_REQ(ADDR('r.m.SYS'),C,%MWx:x,%MWy:4,%MWz:z); with

- ADDR('r.m.SYS') address encoding of the TSX ESY 007 Module,
- C the request code to send to the TSX ESY 007 Module ,%MWx:x the table containing data to send to the TSX ESY 007 Module,
- %MWy:4 the exchange management table with the TSX ESY 007 Module,
- %MWz:z the receive table of the TSX ESY 007 Module response.

Illustration

Send identification request

```
if RE (%M0) then
%mw13:=0;
SEND_REQ(ADDR('0.4.SYS'),16#0F,%MW0:1,%MW10:4,%MW100:24);
end_if;
```

Illustration

Send request for read object

```
if RE (%M0) then
%mw13:= 8;
%MW0: = 16#0696;
%MW1: = 16#0101;
%MW2: = 16#00FF;
%MW3: = 16#0001;
SEND_REQ(ADDR('0.4.SYS'),16#82,%MW0:4,%MW10:4,%MW100:24);
end_if;
```

The table containing data to send to the coupler (%MW0:4 in the illustration above) contains a series of bytes representing the send request. The contents and length of this table depends on the type of request to send.

The management table of the data exchange with the coupler (%MW10:4 in the illustration above) is a 4-word table containing the following information:

	Word number	Most significant bit of the word	Least significant bit of the word
System data	1	Exchange number	Activity bit
	2	Request response	Communication result
User data	3	Timeout to apply to the request	
	4	Length of request to be broadcast, then length received in response.	

The receive table (%MW100:24 in the above illustration) contains the response request sent by the TSX ESY 007 Module. The contents and length of this table depend on the type of send request.

Read extended registers

To emulate the READEXT instruction with the TSX ESY 007 Module, the EF SEND_REQ parameters are the following:

Parameter	Meaning	Values (hexadecimal)
ADDR('r.m.SYS')	address encoding of the TSX ESY 007 Module	
C	request code	82
%MWx:4	table containing send data	0696,FFii,00FF,0001 with ii the address of the Series 7 recipient (rack*8 + module = 0 to 127)
%MWy:4	exchange management table	xxxx,xxxx (exchange result), 000A (exchange timeout), 0008 (transmit time except for DEM24xx modules with the request code 1 which requires a length of 12)
%MWz:20	response receive table	only if response.

The management and receive tables contain the following data if the exchange was successful:

- %MWy[1]=16#B200,
- %MWy[3]=
  - 16#002A if TSX AEM 1601/1602/1603 module,
  - 16#0024 if TSX AEM 1212 module,
  - 16#001C if TSX AEM 821 module,
- %MWz[0-2] contains the request header: 16#0696, 16#FFii, 16#0100,
- %MWz[3] contains the status of the exchange with the Series 7 module (16#FE if exchange OK, 16#FD if exchange KO),
- %MWz[4 to 19] contains the data for the 16 analog channels for the Series 7 TSX AEM 16xx modules,
- %MWz[4 to 16] contain the data for the 13 analog channels for the Series 7 TSX AEM 1212 module (13th channel: Cold Junction),
- %MWz[4 to 11] contain the data for the 8 analog channels for the Series 7 TSX AEM 821 module.

Illustration

```
if RE (%M1) then
%mw13:= 8;
%MW0: = 16#0696;
%MW1: = 16#FF01;
%MW2: = 16#00FF;
%MW3: = 16#0001;
SEND_REQ(ADDR('0.4.SYS'),16#82,%MW0:4,%MW10:4,%MW100:20);
end_if;
```

NOTE: use of EF SEND_REQ to reproduce a READEXT instruction is only possible on the following module. TSX AEM 821, TSX AEM 1212, TSX AEM 1601, TSX AEM 1602 and TSX AEM 1613.

Write extended registers

To emulate the WRITEEXT instruction with the TSX ESY 007 Module, the EF SEND_REQ parameters are the following:

Parameter	Meaning	Values (hexadecimal)
ADDR('r.m.SYS')	address encoding of the TSX ESY 007 Module	
C	request code	83
%MWx:20	table containing send data	0696,FEii,00FF,0001,jj...jj with ii the address of the destination Series 7 module (rack*8 + module = 0 to 127) and jj..jj the data for the 8 registers for the TSX ASR 800 module
%MWy:4	exchange management table	xxxx,xxxx (exchange result), 000A (exchange timeout), 0018 (transmit time)
%MWz:4	response receive table	only if response.

The management and receive tables contain the following data if the exchange was successful:

- %MWy[1]=16#B300,
- %MWy[3]=16#0008,
- %MWz[0-2] contains the request header: 16#0696, 16#FEii, 16#0100,
- %MWz[3] contains the status of the exchange with the Series 7 module (16#FE if exchange OK, 16#FD if exchange KO).

Illustration

```
if RE (%M2) then
%mw13 := 16#28;
%MW0: = 16#0696;
%MW1: = 16#FE01;
%MW2: = 16#00FF;
%MW3: = 16#0001;
%MW4: = 16#1234;
...
SEND_REQ(ADDR('0.4.SYS'),16#83,%MW0:20,%MW10:4,%MW100:4);
end_if;
```

NOTE: Use of EF SEND_REQ to reproduce a WRITEEXT instruction is only possible on the TSX ASR 800 module.

Read message registers

To emulate the use of send text block to read data using the TSX ESY 007 Module, the parameters of the EF SEND_REQ instruction are the following:

Parameter	Meaning	Values (hexadecimal)
ADDR('r.m.SYS')	address encoding of the TSX ESY 007 Module	
C	request code	82
%MWx:4	table containing send data	0696,jjii,00FF,00kk, nn..nn with ii the address of the Series 7 destination module (rack*8 + module = 0 to 127), jj the request code (1=read data, 3= read threshold 0 value, 5= read threshold 1 value, 41=read configuration, 47= read default chain, 4A=read application name, F=read version, F7= read parameters) and kk the amount of data in bytes: see table below)
%MWy:4	exchange management table	xxxx,xxxx (exchange result), 000A (exchange timeout), 0008 (transmit time)
%MWz:zz	response receive table	only if response.

The management and receive tables contain the following data if the exchange was successful:

- %MWy[1]=16#B200,
- %MWy[3]=16#00xx where xx is the length received according to the request (kk+8),
- %MWz[0-2] contains the request header: 16#0696, 16#jjii, 16#kk00,
- %MWz[3] contains the status of the exchange with the Series 7 module (16#81 if exchange OK for request 16#01, 16#83 if exchange OK for request 16#03, 16#85 if exchange OK for request 16#05, 16#71 if exchange OK for request 16#41, 16#77 if exchange OK for request 16#47, 16#7A if exchange OK for request 16#4A, 16#3F if exchange OK for request 16#0F, 16#FD if exchange KO),
- %MWz[4 to kk+4] contains the data received.

TSX Series 7 Module	Request code (Hexa)	Length (decimal)	Meaning
AEM 411/412/413	41	4 to 36 bytes	Read configuration
	47	6 bytes	Character string fault
	4A	1 to 20 bytes	Read application name
	F	27 bytes	Read version
AEM 811/821	1	16 bytes	Read 8 channel ANA,
	3	16 bytes	Read threshold 0
	5	16 bytes	Read threshold 1
	41	4 to 68 bytes	Read configuration
	47	10 bytes	Character string fault
	4A	1 to 20 bytes	Read application name
	F	27 bytes	Read version
AEM 1212	1	26 bytes	Read 12 channels ANA, + Cold Junction
	41	74 bytes	Read configuration
	47	10 bytes	Character string fault
	4A	1 to 20 bytes	Read application name
	F	27 bytes	Read version
AEM 1601/1602	1	32 bytes	Read 16 channel ANA,
	41	34 bytes	Read configuration
	47	12 bytes	Character string fault
	4A	1 to 20 bytes	Read application name
	F	27 bytes	Read version

TSX Series 7 Module	Request code (Hexa)	Length (decimal)	Meaning
AEM 1613	1	32 bytes	Read 16 channel ANA,
	3	32 bytes	Read threshold 0
	5	32 bytes	Read threshold 1
	41	98 bytes	Read configuration
	47	12 bytes	Character string fault
	4A	1 to 20 bytes	Read application name
	F	27 bytes	Read version
CCM 100	41	16/18 or 6 to 92 bytes	Read configuration
	47	4 bytes	Character string fault
	4A	1 to 20 bytes	Read application name
	F	27 bytes	Read version
CTM 100 / DTM 100	41	16 or 6 to 108 bytes	Read configuration
	47	4 bytes	Character string fault
	4A	1 to 20 bytes	Read application name
	F	27 bytes	Read version
	F7	2 bytes	Read parameters before PWF
DEM 24xx	1	1 to 234 bytes	Read setpoints
	41	18 bytes	Read configuration
	47	12 bytes	Character string fault
	4A	1 to 20 bytes	Read application name
	F	27 bytes	Read version

Write message registers

To emulate the use of send text block to write data using the TSX ESY 007 Module, the parameters of the EF SEND_REQ instruction are the following:

Parameter	Meaning	Values (hexadecimal)
ADDR('r.m.SYS')	address encoding of the TSX ESY 007 Module	
C	request code	83
%MWx:xx	table containing send data	0696,jjii,00FF,00kk, nn..nn with ii the address of the Series 7 destination module (rack*8 + module = 0 to 127), jj the request code (2= read threshold value 0 or time, 4=write threshold value 1, 40=write configuration, 49=write application name) and kk the amount of data in bytes, based on the request (see table below) and nn..nn the data to send

Parameter	Meaning	Values (hexadecimal)
%MWy:4	exchange management table	xxxx,xxxx (exchange result), 000A (exchange timeout), 00mm (transmit time with mm=kk+8)
%MWz:4	response receive table	only if response.

The management and receive tables contain the following data if the exchange was successful:

- %MWy[1]=16#B300,
- %MWy[3]=16#0008,
- %MWz[0-2] contains the request header: 16#0696, 16#jjii, 16#kk00,
- %MWz[3] contains the status of the exchange with the Series 7 module (16#FE if exchange OK, 16#FD if exchange KO),

TSX Series 7 Module	Request code (Hexa)	Length (Decimal)	Meaning
AEM 411/412/413	40	4 to 36 bytes	Write configuration
	49	1 to 20 bytes	Write application name
AEM 811/821	2	16 bytes	Write threshold 0
	4	16 bytes	Write threshold 1
	40	4 to 68 bytes	Write configuration
	49	1 to 20 bytes	Write application name
AEM 1212	40	74 bytes	Write configuration
	49	1 to 20 bytes	Write application name
AEM 1601/1602	40	34 bytes	Write configuration
	49	1 to 20 bytes	Write application name
AEM 1613	2	32 bytes	Write threshold 0
	4	32 bytes	Write threshold 1
	40	98 bytes	Write configuration
	49	1 to 20 bytes	Write application name
CCM 100	40	16/18 or 6 to 92 bytes	Write configuration
	49	1 to 20 bytes	Write application name
CTM 100 / DTM 100	40	16 or 6 to 108 bytes	Write configuration
	49	1 to 20 bytes	Write application name
DEM 24xx	2	8 bytes	Write
	40	18 bytes	Write configuration
	49	1 to 20 bytes	Write application name

Error management

If an exchange error occurs between the EF SEND_REQ and the TSX ESY 007 module, an error request code (16#FD) is returned in the second exchange management table word.

16#FD returned may mean the following:

- module TSX ESY 007 absent or faulty,
- maximum number of requests processed per TSX ESY 007 module (4/mast cycle) attained,
- exchange destination module TSX Series 7 absent or faulty,
- exchange destination module TSX Series 7 cannot support request,
- exchange destination module TSX Series 7 cannot support length to be written,
- exchange destination module TSX Series 7 cannot support length to be read,
- exchange destination module TSX Series 7 not ready.

Chapter 4
Configuring the TSX ESY 007 Module

Subject of this Chapter

This chapter describes the configuration process during set-up of the I/O extension bus.

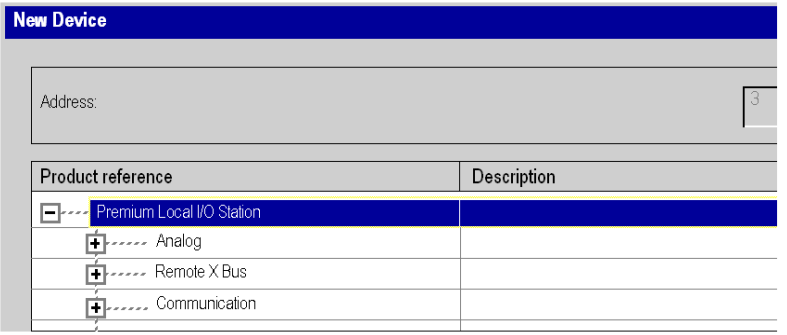
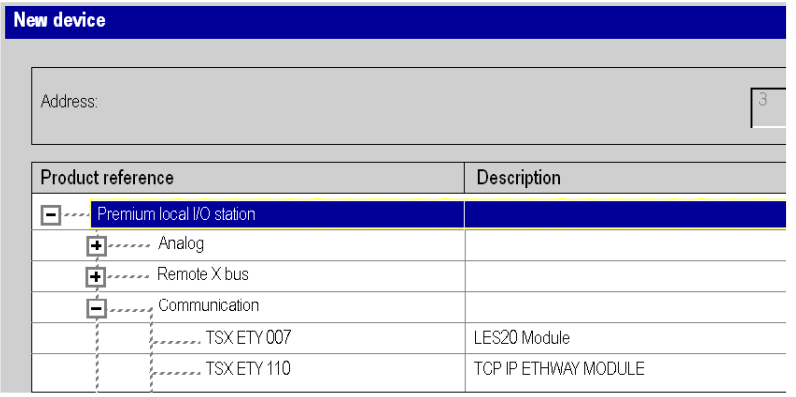
What Is in This Chapter?

This chapter contains the following topics:

Declaring a TSX ESY 007 Module in the PLC rack

Procedure

This operation allows insertion of a TSX ESY 007 Module in the PLC rack.

Step	Action
1	Open the hardware configuration editor.
2	Select the slot in which you wish to insert the module.
3	Select the **New device** command in the context menu. **Result**: The **New device** window appears. 
4	Develop the **Premium local input/output station** and the **Communication** lines by clicking on the + sign. **Result**: 
5	Select the **TSX ESY 007** Module then confirm by clicking on OK.

Description of the Configuration Screen of a TSX ESY 007 Module

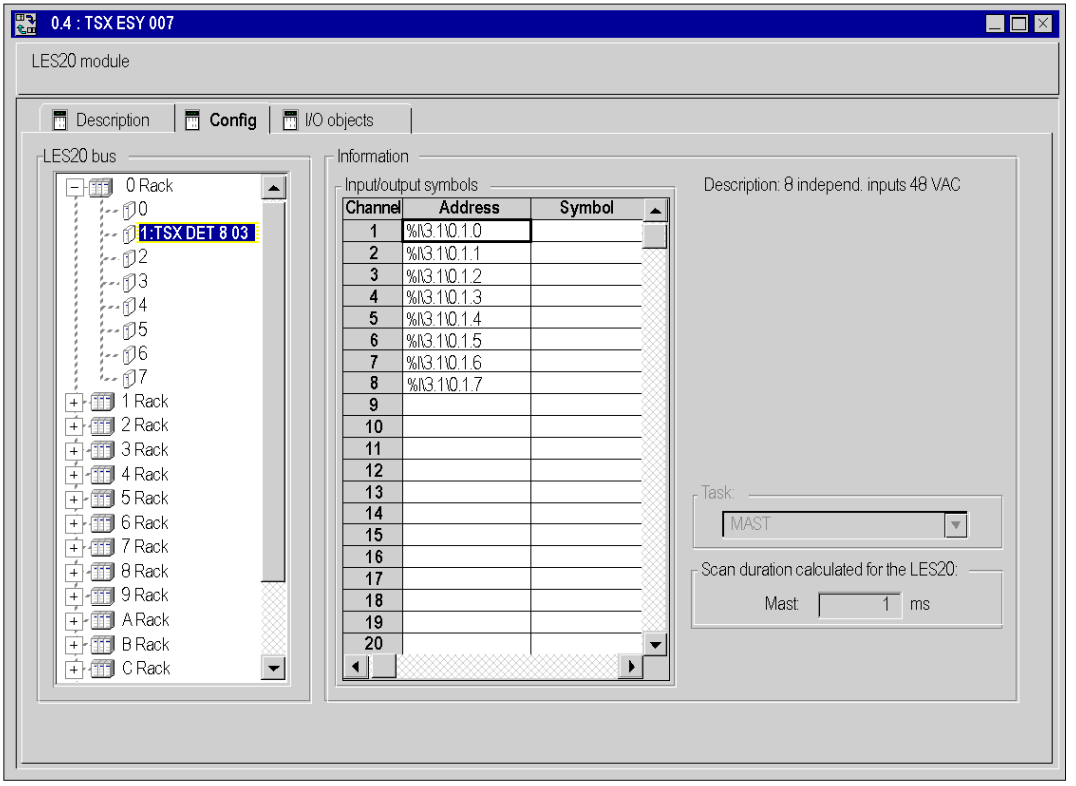
At a Glance

The configuration screen is a graphic tool designed for configuring a selected module in a rack. It provides access to the module's parameters and to devices on the I/O extension bus.

The configuration of this coupler in Control Expert is protected by access rights. These rights may only be used by Schneider Services Industries entities in France, and abroad by Schneider Services entities or otherwise by its representatives.

Illustration

The diagram below shows a configuration screen.



The front tab indicates the currently used mode (**Config** in this example). Each mode may be selected using the tab for the mode.

The following modes are available:

- **Description**,
- **Config** (configuration),
- **Debug** (or Diagnostics), accessible only in online mode.
- **Diagnostics** (Fault) only accessible in online mode.

The **I/O objects** tab (See Control Expert Manual, Operation modes, I/O objects tab for a module) allows to presymbolize the I/O objects.

The configuration screen allows you to choose or view the following features:

- The behavior of the Series 7 rack in fallback mode,
- The task controlling a Series 7 module,
- The I/O objects of a Series 7 module,
- The theoretical scan time of the I/O extension bus in milliseconds for MAST task.

Note: The PLC scan time must be configured in periodic mode and not in scan mode and with a task period calculated according to the following formula:

"Mast task scan time> Theoretical Mast I/O bus scan time + Execution time of the Mast program task".

The execution time of the program for a given task may be calculated from %SW30 to 35. Please see Chapter 6 for details on I/O extension bus scan time.

In debug phase, information on the real scan time of the I/O extension bus (current and maximum) is provided to allow more exact adjustment of the PLC scan time.

If using messaging with the TSX Series 7 modules by EF SEND_REQ, also provide request processing time during the master task period.

Declaring a Series 7 Device to the TSX ESY 007 Module

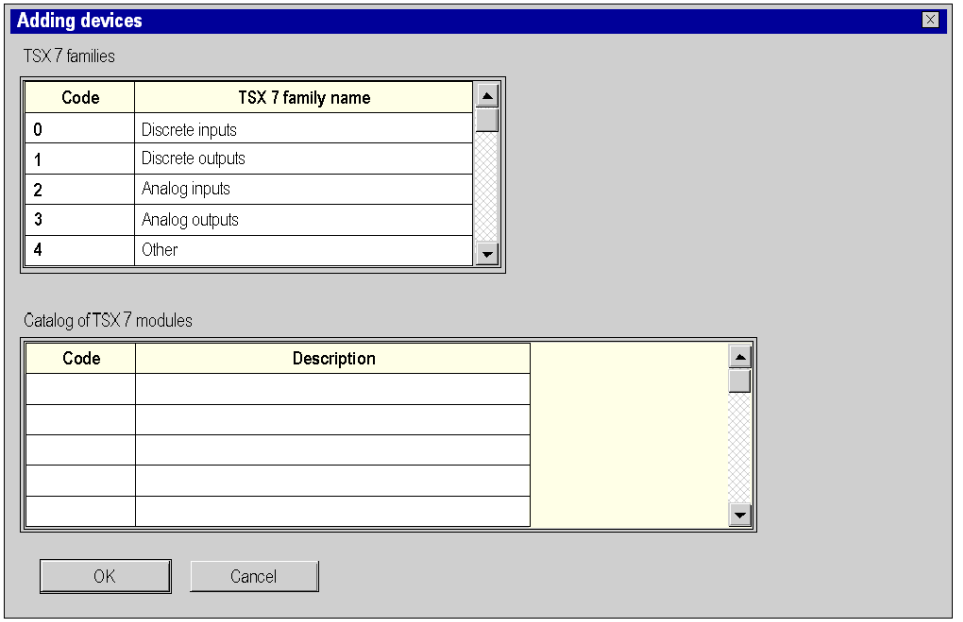
At a Glance

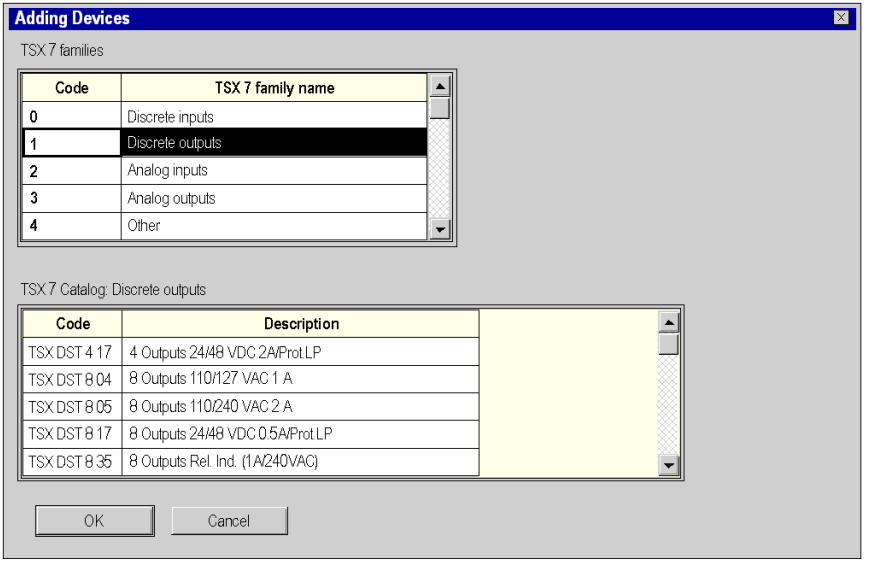
The Control Expert software offers a catalog including all Series 7 modules available. This catalog is structured in families:

- Discrete inputs
- Discrete outputs
- ANA inputs
- ANA outputs
- Other

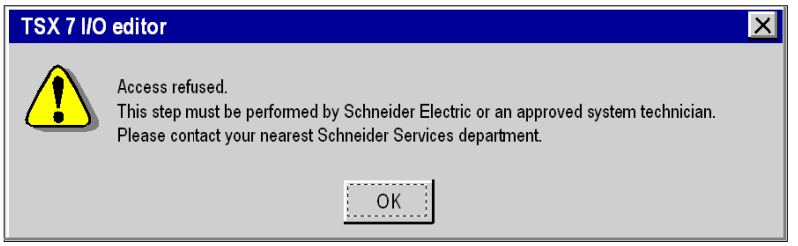
Procedure

This operation is used to declare a Series 7 device on the I/O extension bus.

Step	Action
1	Access the hardware configuration screen of the TSX ESY 007 Module.
2	In the I/O Extension bus field, double click in the cell corresponding to the receiving slot number of the new device (0 rack to F, slot 0 to 7) or select that cell then execute the **Edit** command. **Add a Series 7 module**. **Result**: The Add a module screen appears. 

Step	Action
3	In the **TSX7 Family name** field, select the desired family. **Result**: The **Modules catalog** linked to the selected family appears. 
4	In the **Modules catalog** select the desired device.
5	Click **OK** to confirm your choice. **Result**: The Series 7 device is defined in its slot, the device reference appears opposite the slot number.
6	To declare other Series 7 devices on the TSX ESY 007 Module, repeat the step 2 procedure.

Note: When adding the first device, the following message may appear:



This means that you do not have adequate rights to configure the TSX ESY 007 Module. Contact Schneider Services Industries entities in France, and abroad Schneider Services entities or otherwise their representative.

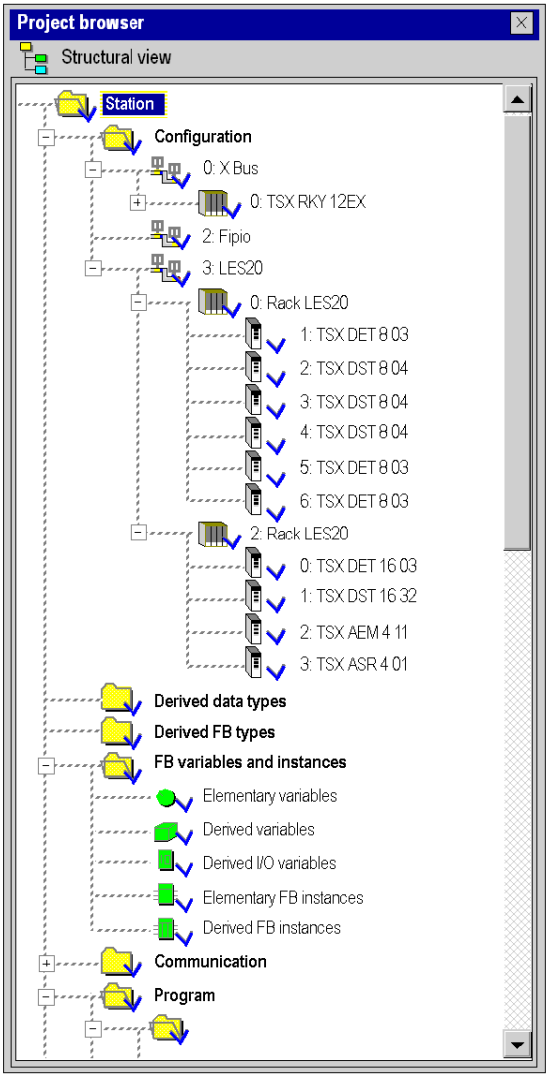
Displaying the I/O Extension Bus in the Project Browser

At a Glance

When you declare a TSX ESY 007 Module on the PLC rack, the I/O extension bus is shown in the **configuration** folder of the project browser. The extension bus number is automatically calculated by Control Expert. **This value cannot be modified**.

After **declaring** all Series 7 devices on the I/O extension bus and **confirming** the configuration, the Series 7 modules also appear on the I/O extension bus of the project browser. Each module appears with its address number. Display of the I/O extension bus and Series 7 devices allows you to quickly know their topological address.

The following illustration shows the LES20 bus with its Series 7 modules in the project browser:



The I/O extension bus is shown by LES20 in the project browser.

Modifying the software configuration of a TSX ESY 007 Module

Introduction

Control Expert software offers, from the module configuration screen, a range of functions that allow easy modification of the software configuration of the I/O extension bus in offline mode.

Note: Standard Windows keyboard shortcut commands (Del, Ctrl-X, Ctrl-C, Ctrl-V) are also available for the following operations.

Note: The move and copy commands are only available with configuration rights.

Procedure for deleting a Series 7 module

This operation is used to delete a module declared on the I/O extension bus.

Step	Action
1	Select the module to be deleted.
2	Select the **Edit> command. Delete a Series 7 module**.

Procedure for moving a Series 7 module

This operation is used to move a module declared on the I/O extension bus.

Step	Action
1	Select the module to be moved.
2	Select the **Edit> command. Cut a Series 7 module**.
3	Select the new slot desired.
4	Select the **Edit> command. Paste a Series 7 module**.

Procedure for copying a Series7 module

This operation is used to copy a module declared on the I/O extension bus.

Step	Action
1	Select the module to be copied.
2	Select the **Edit> command. Copy a Series 7 module**.
3	Select the slot of the new module.
4	Select the **Edit> command. Paste a Series 7 module**.

Accessing the Description of a Series 7 Module

At a Glance

The Control Expert software provides access to all information relating to a Series 7 device, such as:

- description of the module,
- the list of I/O objects that it controls.

Procedure for accessing device information

The table below shows the procedure for viewing the features of a Series 7 device.

Step	Action
1	Open the TSX ESY 007 Module to be configured.
2	Access the configuration screen by clicking on the **Configuration** tab.
3	Click on the desired Series 7 device. **Results:** The right side of the configuration screen shows information about the selected device

Accessing the Description of a Series 7 Rack

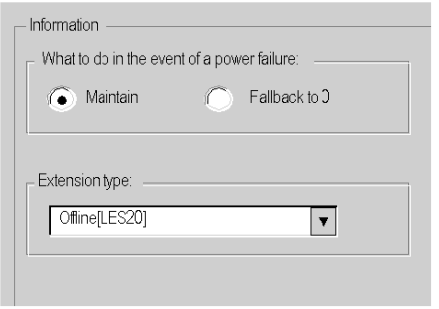
At a Glance

The Control Expert software provides access to all information relating to a Series 7 rack, such as:

- fallback mode,
- type of extension (local/electrical/optical).

Procedure for accessing rack information

The table below shows the procedure for viewing the features of a Series 7 rack.

Step	Action
1	Open the TSX ESY 007 Module to be configured.
2	Access the configuration screen by clicking on the Configuration tab.
3	Click on the desired Series 7 rack. **Results**: The right side of the configuration screen shows information about the selected rack. 

Modifying General Parameters of a Series 7 Rack

At a Glance

Each Series 7 rack must have assigned to it (by configuration) a fallback mode as well as a type of entrance link.

Procedure

The table below shows the procedure for defining the **Fallback mode** parameter.

Step	Action
1	Open the TSX ESY 007 Module to be configured.
2	Access the configuration screen by clicking on the **Configuration** tab.
3	Click on the device whose **Fallback mode** parameter you wish to modify.
4	Select the radio button that corresponds to the type of fallback mode **(Maintain/Fallback)** that you wish to define for the rack.

Chapter 5
Debugging the TSX ESY 007 Module

Subject of this Chapter

This chapter describes the TSX ESY 007 Module debug feature.

What Is in This Chapter?

This chapter contains the following topics:

The debug function - Presentation

Introduction

For each TSX ESY 007 communication module in the project the **Debug** function allows:

- display of Series 7 racks (connection, parameters etc.),
- display of status of Series 7 modules (connection, parameters, channel values),

The function also provides access to module diagnostics in the event of a fault.

Note: This function is only accessible in online mode.

Rack viewer

It is also possible to access information about a TSX ESY 007 Module from the **Rack viewer** page of an on board Web FactoryCast server in a TSX ETY 4102 or TSX ETY 5102 module. These Web pages are accessible using an Internet web browser.

Actual ETHERNET couplers are TSX ETY 4103, TSX TEY 5103 or TSX WMY 100 modules. WEB pages are also accessible on the Ethernet ports of the CPUs.

See Ethernet installation manual (See Control Expert Premium Manual, Ethernet Networks, Installation of Ethernet communication software) and in the FactoryCast Manual for more information.

Description of the Debug Screen of a TSX ESY 007 Module

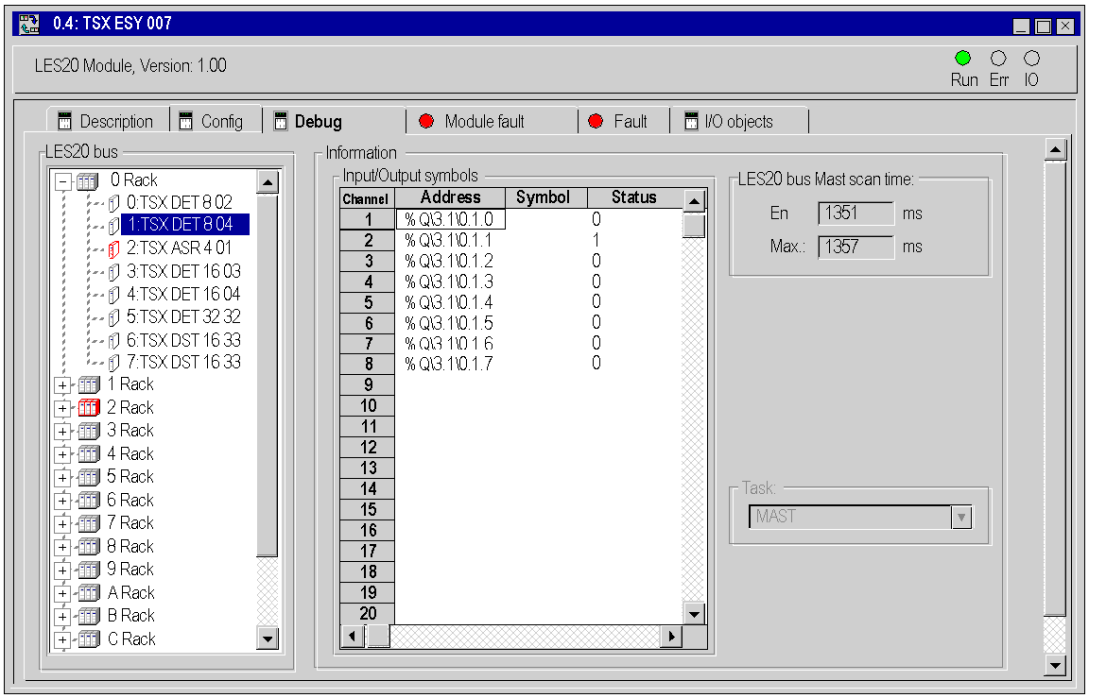
At a Glance

The debug screen dynamically displays the status of the TSX ESY 007 Module and the devices connected on the bus.

Note: if you use the READ_STS () function in your user program to read information about the TSX ESY 007 Module, you should not execute the function more than once every 5 seconds, otherwise the debug screen will not display properly.

Illustration

The figure below shows a sample debug screen.



The tab in the foreground indicates the mode in progress (**Debug** in this example). Each mode may be selected using the tab for the mode. The following modes are available:

- **Description**,
- **Debug** only accessible in online mode,
- **Diagnostics** (fault) only accessible in online mode,
- **Configuration**.

The **I/O objects** tab (See Control Expert Manual, Operation Modes, Module I/O Objects Tab) allows to presymbolize I/O objects.

The debug screen allows you to view the following features:

- The behavior type of the Series 7 rack in fallback mode,
- The task controlling a Series 7 module,
- The I/O objects of a Series 7 module and their values,
- The current and maximum scan times of the I/O extension bus in milliseconds for MAST task
- Faults present on the Series 7 modules and racks

In the upper area are 3 LED indicators which indicate the operating mode of the module

- **RUN** indicates the operating status of the module,
- **ERR** indicates an internal module fault,
- **I/O** indicates an input/output fault on the I/O extension bus.

Accessing TSX ESY 007 Module Diagnostics and Channel Diagnostics Functions

At a Glance

The module and channel diagnostics are displayed, when current errors exist, and are classed according to their category:

- internal faults (software internal fault, communication failure with processor, configuration or parameter fault, or command fault),
- external faults (Series 7 device fault),
- other faults (module absent or power off).

A module or channel fault is signaled when some LED indicators turn red, such as:

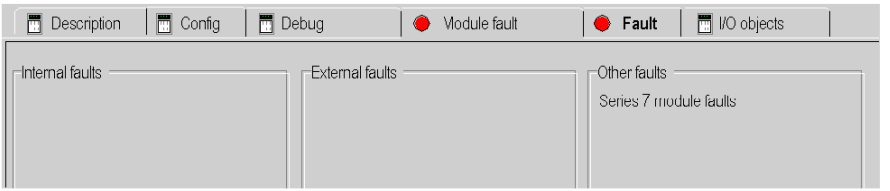
- in the rack configuration screen, a red square in the place of the faulty I/O entrance link module,
- in all module level screens (**Description** and **Fault** tabs), the presence of the **I/O** LED indicator.
- in all channel level screens (**Description**, **Config**, **Debug** and **Fault** tabs), the presence of the **I/O** LED indicator and the channel fault LED indicator.
- in the fault screen accessible by the **Fault** tab, the fault diagnostics description.

The fault is also signaled:

- on the module, on the central display,
- by dedicated language objects: **CH_ERROR** (%Ir.m.c.ERR) and module error **MOD_ERROR** (%Ir.m.MOD.ERR), **%MWr.m.MOD**.2, etc., and the status words (See T_GEN_MOD-type IODDT Language Objects, Chapter 7.4).

Procedure for accessing module diagnostics

The following table shows the procedure for accessing the **Diagnostics** screen for the module and the LES20 channel.

Step	Action
1	Open the TSX ESY 007 Module that you would like to diagnose.
2	Access the diagnostics screen by clicking on the**Fault** tab. **Results**: The list of module faults is displayed. 

Viewing Status of Series 7 Racks and Modules

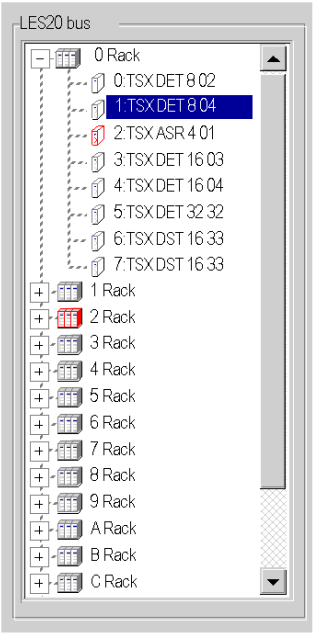
At a Glance

The left side of the TSX ESY 007 Module debug screen is reserved for I/O extension bus diagnostics.

Series 7 devices connected to the bus may be viewed in the LES20 bus area. Each Series 7 device and rack is colored in red or gray according to its status. Red indicates a failure on the rack or module concerned. When a module is selected, the I/O list of the module is displayed with the corresponding values.

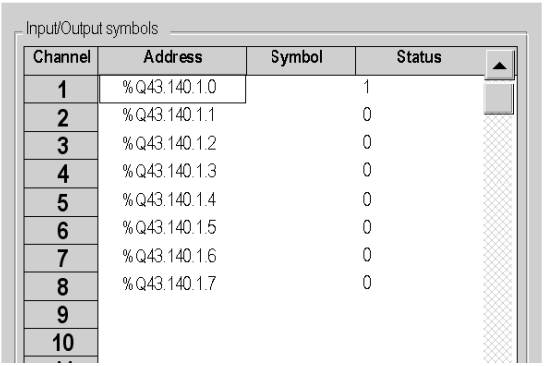
Display status of Series 7 modules and racks

Illustration



Display of Channel Status of a Series 7 Module

Illustration



NOTE: The 32-channel modules being represented as two 16-channel modules in the same slot in the even rack and the next odd rack, for displaying the states of channels 16 to 31 of these modules (TSX DET 32 xx, TSX DST 24 xx, TSX DST 32 xx), you must click on the slot marked "reserved" of the odd rack.

Accessing the Forcing/Unforcing Discrete Channels Function

At a Glance

This function allows modification of the status of the channels associated with a Series 7 module.

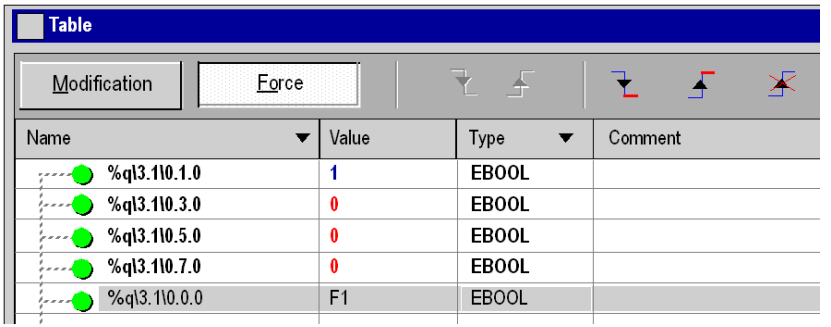
The different commands available are:

for a channel:

- forcing to 0,
- forcing to 1,
- unforcing,
- positioning to 0 (Discrete outputs only),
- positioning to 1 (Discrete outputs only).

Procedure

The table below shows the procedure for forcing, unforcing or positioning channels associated with the features of Series 7 module.

Step	Action
1	Open the I/O entrance link module on which you wish to modify a channel.
2	Access the diagnostics screen by clicking on the Debug tab.
3	Select a module in the LES20 bus area.
4	Note the channel to modify in the I/O list of the module.
5	Opening an animation table.
6	Enter the name of the channel to modify.
7	Select the desired function (Modify, Forcing).
8	Modify the value of the channel based on available functions (set to 0, set to 1, forcing to 0, forcing to 1, unforcing). 

Modifying the Value of an Analog Channel

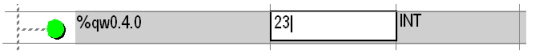
At a Glance

This function allows you to modify the value of channels associated with a Series 7 module that has analog-type channels.

This function applies only to analog outputs.

Procedure

The table below shows the procedure for modifying analog channels associated with the features of Series 7 module.

Step	Action
1	Open the I/O entrance link module you wish to configure.
2	Access the diagnostics screen by clicking on the **Debug** tab.
3	Select a module in the **I/O extension bus** area.
4	Note the channel to modify in the I/O list of the module.
5	Opening an animation table.
6	Enter the name of the channel to modify.
7	Select the **Modify** function.
8	Modify the channel's value by typing the value directly into the **value** field and confirm pressing Enter 

Chapter 6
Performance of the TSX ESY 007 Module

Performance of the TSX ESY 007 Module

Introduction

The I/O extension bus is autonomously managed by the TSX ESY 007 Module, which exchanges data with each Series 7 device configured on the bus every cycle.

For Series 7 modules configured in the MAST task, the scan cycle on the I/O extension bus is cadenced by the MAST task of the PLC.

I/O extension bus scan time

The maximum scan time t represents the exchange time between the master and the Series 7 n models (128 maximum). The t and tmax values depend on the number and types of Series 7 modules to control.

Either:

- t=0.192ms x Number of 4-channel discrete modules + 0.228ms x Number of 8-channel discrete modules + 0.300ms x Number of 16-channel discrete modules + 1.900ms x Number of ANA/Analog modules + 7.3 ms
- tmax = 0.200ms x Number of 4-channel discrete modules + 0.250ms x Number of 8-channel discrete modules + 0.350ms x Number of 16-channel discrete modules + 2.0ms x Number of ANA/Analog modules + 7.3 ms

Thus the scan time can not exceed 110 ms.

I/O extension bus response time

The response time T represents the I/O extension bus scan time.

This latter includes the following:

- bus scan time,
- internal memory update of the TSX ESY 007 Module,
- the PLC scan.

Example

The table below shows three examples of response time T for a PLC task of 10 ms, 30 ms, 60 ms.

This time T lengthens with a bus loaded with 128 16-channel discrete modules in the Mast task normally functioning without link fault.

PLC Task	Typical response time	Maximum response time
10 ms	35 ms	45 ms
30 ms	55 ms	65 ms
60 ms	85 ms	95 ms

Chapter 7
Language Objects of the TSX ESY 007 Module

Subject of this Chapter

This chapter describes the language objects associated with the TSX ESY 007 Module, along with their different uses.

What Is in This Chapter?

This chapter contains the following sections:

Section 7.1
Language Objects and IODDT of TSX ESY 007 Module Communications

Subject of This Section

This section presents general information about language objects and IODDT associated with I/O extension bus.

What Is in This Section?

This section contains the following topics:

TSX ESY 007 Module Language Objects - Presentation

General Points

IODDT are predefined by the manufacturer, and contain input/output language objects belonging to an application-specific module.

The TSX ESY 007 Module has two associated IODDT:

- T_COM_STS_GEN which applies to communication protocols except Fipio and Ethernet,
- T_COM_ESY specific to the TSX ESY 007 Module.

Note : IODDT variables can be created in two different ways:

- The **I/O objects** tab (See Control Expert Manual, Operation Modes, Module I/O Objects Tab),
- Data editor (See Control Expert Manual, Operation Modes, Creating an IODDT data instance).

Language object types

Each IODDT includes a series of language objects used to drive and monitor their operation.

There are two types of language objects:

- **Implicit exchange objects**, which are automatically exchanged on each scan of the task associated with the module,
- **Explicit exchange objects**, which are exchanged when requested to do so by the project, using explicit exchange instructions.

Implicit exchange objects allow retrieval of Series 7 module status, LESBUS scan times, etc.

Explicit exchanges allow module diagnostics.

Implicit Exchange Language Objects Associated With an Application-specific Function

At a Glance

An integrated application-specific interface or the addition of a module automatically enhances the language objects application used to program this interface or module.

These objects correspond to the input/output images and software data of the module or integrated application-specific interface.

Reminders

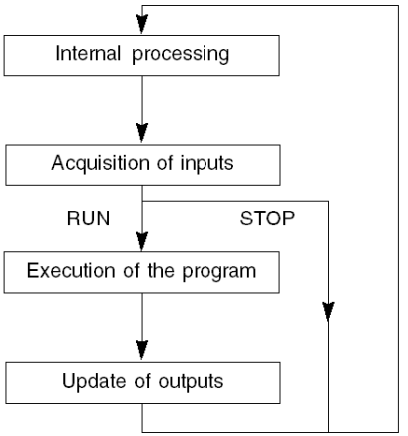
The module inputs (%I and %IW) are updated in the PLC memory at the start of the task, the PLC being in RUN or STOP mode.

The outputs (%Q and %QW) are updated at the end of the task, only when the PLC is in RUN mode.

NOTE: When the task is in STOP mode, outputs are maintained at their last value.

Illustration

The following diagram shows the operating cycle of a PLC task (scan execution).



Explicit Language Objects Associated With an Application-specific Function

At a Glance

Explicit exchanges are exchanges performed at the program user request using the following instructions:

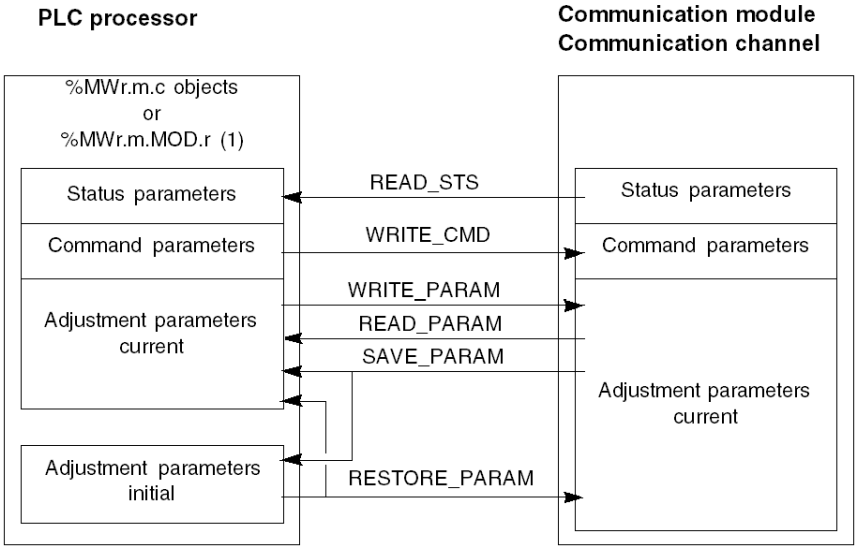
- READ_STS *(see EcoStruxure™ Control Expert, I/O Management, Block Library)* (read status words),
- WRITE_CMD *(see EcoStruxure™ Control Expert, I/O Management, Block Library)* (write command words),
- WRITE_PARAM *(see EcoStruxure™ Control Expert, I/O Management, Block Library)* (write adjustment parameters),
- READ_PARAM *(see EcoStruxure™ Control Expert, I/O Management, Block Library)* (read adjustment parameters),
- SAVE_PARAM *(see EcoStruxure™ Control Expert, I/O Management, Block Library)* (save adjustment parameters),
- RESTORE_PARAM *(see EcoStruxure™ Control Expert, I/O Management, Block Library)* (restore adjustment parameters).

These exchanges apply to a set of %MW objects of the same type (status, commands or parameters) that belong to a channel.

NOTE: These objects provide information about the module (e.g.: type of channel fault, etc.), can be used to command them (e.g.: switch command) and to define their operating modes (save and restore adjustment parameters in the process of application).

General principle for using explicit instructions

The diagram below shows the different types of explicit exchanges that can be made between the processor and module.



(1) Only with the instructions READ_STS and WRITE_CMD.

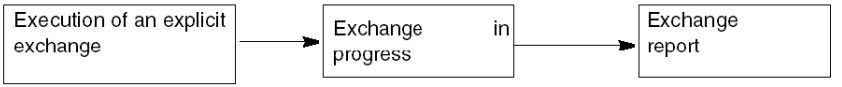
Managing exchanges

During an explicit exchange, it is necessary to check its performance in order that data is only taken into account when the exchange has been correctly executed.

To do this, two types of information are available:

- information concerning the exchange in progress *(see EcoStruxure™ Control Expert, I/O Management, Block Library)*,
- the exchange report *(see EcoStruxure™ Control Expert, I/O Management, Block Library)*.

The following diagram describes the management principle for an exchange



NOTE: In order to avoid several simultaneous explicit exchanges for the same channel, it is necessary to test the value of the word EXCH_STS (`%MWr.m.c.0`) of the IODDT associated to the channel before to call any EF using this channel.

Management of the exchange and report with explicit objects

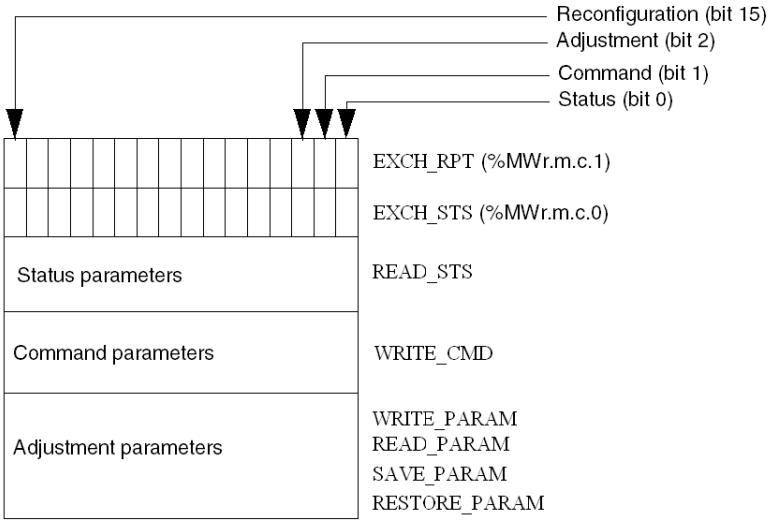
At a Glance

When data is exchanged between the PCL memory and the module, the module may require several task cycles to acknowledge this information. All IODDTs use two words to manage exchanges:

- EXCH_STS (%MWr.m.c.0): exchange in progress,
- EXCH_RPT (%MWr.m.c.1): report.

Illustration

The illustration below shows the different significant bits for managing exchanges:



Description of significant bits

Each bit of the words EXCH_STS (%MWr.m.c.0) and EXCH_RPT (%MWr.m.c.1) is associated with a type of parameter:

- Rank 0 bits are associated with the status parameters:
  - the STS_IN_PROGR bit (%MWr.m.c.0.0) indicates whether a read request for the status words is in progress,
  - the STS_ERR bit (%MWr.m.c.1.0) specifies whether a read request for the status words is accepted by the module channel.
- Rank 1 bits are associated with the command parameters:
  - the CMD_IN_PROGR bit (%MWr.m.c.0.1) indicates whether command parameters are being sent to the module channel,
  - the CMD_ERR bit (%MWr.m.c.1.1) specifies whether the command parameters are accepted by the module channel.
- Rank 2 bits are associated with the adjustment parameters:
  - the ADJ_IN_PROGR bit (%MWr.m.c.0.2) indicates whether the adjustment parameters are being exchanged with the module channel (via WRITE_PARAM, READ_PARAM, SAVE_PARAM, RESTORE_PARAM),
  - the ADJ_ERR bit (%MWr.m.c.1.2) specifies whether the adjustment parameters are accepted by the module. If the exchange is correctly executed, the bit is set to 0.
- rank 15 bits indicate a reconfiguration on channel c of the module from the console (modification of the configuration parameters + cold start-up of the channel).

NOTE: The TSX ESY 007 Module only supports the exchange instruction READ_STS.

NOTE: **r** represents the rack number and **m** the position of the module in the rack, while **c** represents the channel number in the module.

NOTE: Exchange and report words also exist at module level EXCH_STS (%MWr.m.MOD) and EXCH_RPT (%MWr.m.MOD.1) as per IODDT type T_GEN_MOD.

Execution flags of an explicit exchange: EXCH_STS

The table below shows the control bits of the explicit exchanges: EXCH_STS (%MWr.m.c.0).

Standard symbol	Type	Access	Meaning	Address
STS_IN_PROGR	BOOL	R	Reading of channel status words in progress	%MWr.m.c.0.0
CMD_IN_PROGR	BOOL	R	Command parameters exchange in progress	%MWr.m.c.0.1
ADJ_IN_PROGR	BOOL	R	Adjustment parameters exchange in progress	%MWr.m.c.0.2
RECONF_IN_PROGR	BOOL	R	Reconfiguration of the module in progress	%MWr.m.c.0.15

NOTE: If the module is not present or is disconnected, explicit exchange objects (Read_Sts for example) are not sent to the module (STS_IN_PROG (%MWr.m.c.0) = 0).

Explicit exchange report: EXCH_RPT

The table below shows the report bits: `EXCH_RPT` (%MWr.m.c.1).

Standard symbol	Type	Access	Meaning	Address
STS_ERR	BOOL	R	Error reading channel status words (1 = failure)	%MWr.m.c.1.0
CMD_ERR	BOOL	R	Error when exchanging command parameters (1 = failure)	%MWr.m.c.1.1
ADJ_ERR	BOOL	R	Error when exchanging adjustment parameters (1 = failure)	%MWr.m.c.1.2
RECONF_ERR	BOOL	R	Fault when reconfiguring the channel (1 = failure)	%MWr.m.c.1.15

R: Read access only W: Write access only R/W: Read/Write access

Section 7.2
General Language Objects and IODDT for Communication Protocols

Subject of This Section

This section presents the general language objects and IODDT that apply to all communication protocols except Fipio and Ethernet.

What Is in This Section?

This section contains the following topics:

Implicit Exchange Objects of the T_COM_STS_GEN-type IODDT - Details

At a Glance

The table below presents the IODDT implicit exchange objects of type `T_COM_STS_GEN` applicable to all communication protocols except Fipio and Ethernet.

Error bit

Meaning of the `CH_ERROR` (%Ir.m.c.ERR) error bit.

Standard symbol	Type	Access	Meaning	Address
CH_ERROR	EBOOL	R	Communication channel error bit.	%Ir.m.c.ERR

T_COM_STS_GEN-type IODDT Explicit Exchange Objects - Details

At a Glance

This section presents the T_COM_STS_GEN type IODDT explicit exchange objects applicable to all communication protocols except Fipio and Ethernet. It includes the word type objects whose bits have a specific meaning. These objects are presented in detail below.

Example of a declaration of a variable: **IODDT_VAR1** of type T_COM_STS_GEN.

Observations

- In general, the meaning of the bits is given for bit status 1. In specific cases an explanation is given for each status of the bit.
- Not all bits are used.

Execution flags of an explicit exchange: EXCH_STS

The following table explains the various meanings of EXCH_STS (%MWr.m.c.0) channel exchange control bits.

Standard symbol	Type	Access	Meaning	Address
STS_IN_PROGR	BOOL	R	Reading of channel status words in progress.	%MWr.m.c.0.0
CMD_IN_PROGR	BOOL	R	Current parameter exchange in progress.	%MWr.m.c.0.1
ADJ_IN_PROGR	BOOL	R	Adjustment parameter exchange in progress.	%MWr.m.c.0.2

Explicit Exchange Report: EXCH_RPT

The following table explains the various meanings of EXCH_RPT (%MWr.m.c.1) reporting bits.

Standard symbol	Type	Access	Meaning	Address
STS_ERR	BOOL	R	Reading error for channel status words.	%MWr.m.c.1.0
CMD_ERR	BOOL	R	Error during command parameter exchange.	%MWr.m.c.1.1
ADJ_ERR	BOOL	R	Error during adjustment parameter exchange.	%MWr.m.c.1.2

Standard channel faults, CH_FLT

The table below shows the meaning of the bits of the status word `CH_FLT` (%MWr.m.c.2). Reading is performed by a **READ_STS**(**IODDT_VAR1**).

Standard symbol	Type	Access	Meaning	Address
NO_DEVICE	BOOL	R	No device is working on the channel.	%MWr.m.c.2.0
1_DEVICE_FLT	BOOL	R	A device on the channel is faulty.	%MWr.m.c.2.1
BLK	BOOL	R	Terminal block fault (not connected).	%MWr.m.c.2.2
TO_ERR	BOOL	R	Time out error (defective wiring).	%MWr.m.c.2.3
INTERNAL_FLT	BOOL	R	Internal error or channel self-test.	%MWr.m.c.2.4
CONF_FLT	BOOL	R	Different hardware and software configurations.	%MWr.m.c.2.5
COM_FLT	BOOL	R	Problem communicating with the PLC.	%MWr.m.c.2.6
APPLI_FLT	BOOL	R	Application error (adjustment or configuration error).	%MWr.m.c.2.7

Section 7.3
Language Objects and IODDT Associated with the TSX ESY 007 Module

Subject of This Section

This section presents the language objects and IODDT associated with the TSX ESY 007 Module.

What Is in This Section?

This section contains the following topics:

Details of the implicit exchange objects of the IODDT of the T_COM_ESY type

At a Glance

The following tables present the T_COM_ESY-type IODDT implicit exchange objects that apply to the TSX ESY 007 Module.

Error bit

The following table presents the meaning of the error bit CH_ERROR (%Ir.m.0.ERR).

Standard symbol	Type	Access	Meaning	Address
CH_ERROR	EBOOL	R	Communication channel error bit.	%Ir.m.0.ERR r.m: slot of the TSX ESY 007 Module in the Premium rack

Validation bit

The following table presents the meaning of the validation bit VALID_IN (%Ir.m.0.0).

Standard symbol	Type	Access	Meaning	Address
VALID_IN	EBOOL	R	Indicates that all inputs are valid. Note: when this bit has status 0, it means that at least one input is not valid: The module is in auto-test, initialization or fault.	%Ir.m.0.0 r.m: slot of the TSX ESY 007 Module in the Premium rack

List of racks 0 to 15 in fault

The following table presents the meaning of the bits of the word (%IWr.m.c.0).

Standard symbol	Type	Access	Meaning	Address
LES20_FLT_RACKS	INT	R	Rack 0 to F faulty or absent.	%IWr.m.c.0
LES20_FLT_0	BOOL	R	0 Rack faulty or absent.	%IWr.m.c.0.0
LES20_FLT_1	BOOL	R	1 Rack faulty or absent.	%IWr.m.c.0.1
LES20_FLT_2	BOOL	R	2 Rack faulty or absent.	%IWr.m.c.0.2
LES20_FLT_3	BOOL	R	3 Rack faulty or absent.	%IWr.m.c.0.3
LES20_FLT_4	BOOL	R	4 Rack faulty or absent.	%IWr.m.c.0.4
LES20_FLT_5	BOOL	R	5 Rack faulty or absent.	%IWr.m.c.0.5
LES20_FLT_6	BOOL	R	6 Rack faulty or absent.	%IWr.m.c.0.6
LES20_FLT_7	BOOL	R	7 Rack faulty or absent.	%IWr.m.c.0.7
LES20_FLT_8	BOOL	R	8 Rack faulty or absent.	%IWr.m.c.0.8
LES20_FLT_9	BOOL	R	90 Rack faulty or absent.	%IWr.m.c.0.9

Standard symbol	Type	Access	Meaning	Address
LES20_FLT_10	BOOL	R	A Rack faulty or absent.	%IWr.m.c.0.10
LES20_FLT_11	BOOL	R	B Rack faulty or absent.	%IWr.m.c.0.11
LES20_FLT_12	BOOL	R	C Rack faulty or absent.	%IWr.m.c.0.12
LES20_FLT_13	BOOL	R	D Rack faulty or absent.	%IWr.m.c.0.13
LES20_FLT_14	BOOL	R	E Rack faulty or absent.	%IWr.m.c.0.14
LES20_FLT_15	BOOL	R	F Rack faulty or absent.	%IWr.m.c.0.15

I/O extension bus scan time value

The following table shows the meaning of the words (%Iwr.m.c.1 to 4) and of the bit (%QWr.m.c.0).

Standard symbol	Type	Access	Meaning	Address
CLEAR_LES20_DISPLAY_CYCLE_TIME	BOOL	W/R	reset to 0 the LES20 scan time.	%QWr.m.c.0.0
LES20_CUR	INT	R	LES20 MAST scan time (in ms).	%IWr.m.c.1
LES20_MAX	INT	R	LES20 MAST maximum scan time (in ms).	%IWr.m.c.2

Optimization of the I/O extension bus scan time value

The following table presents the meaning of the bit (%QWr.m.c.0.1).

Standard symbol	Type	Access	Meaning	Address
OPTIMIZE_LES20_SYNCHRO_CYCLE_TIME	BOOL	W/R	Activation of a waiting time between positioning the outputs and reading the inputs on the I/O extension bus. The value of the waiting time is encoded on the most significant byte of %QWr.m.c.0 (bits 8 to 15).	%QWr.m.c.0.1

This option is used to approach the operation of the TSX Series 7 CPUs.

without this option, the principle of exchanging I/Os with the Series 7 module is the following:

- Tabulation of outputs on the X Bus by the Premium CPU sent to ESY 007,
- Tabulation of outputs on the LES20 Bus by the ESY sent to the TSX Series 7 modules,
- Recovery by the ESY 007 of TSX Series 7 module inputs on the LES20 bus,
- Wait for the end of the task period of the Premium CPU,
- Recovery of inputs on the X Bus by the Premium CPU from the ESY 007,
- Normal execution of the application program.

With this option, the principle of exchanging I/Os with the Series 7 module is the following:

- Tabulation of outputs on the X Bus by the Premium CPU sent to ESY 007,
- Tabulation of outputs on the LES20 Bus by the ESY sent to the TSX Series 7 modules,
- Waiting period %QWr.m.c.8 to 15 = (%SW0 - %SW30 - LES20_CUR) x 0.8,
- Recovery by the ESY 007 of TSX Series 7 module inputs on the LES20 bus,
- Wait for the end of the task period of the Premium CPU,
- Recovery of inputs on the X Bus by the Premium CPU from the ESY 007,
- Normal execution of the application program,

This option allows to respect a waiting time between the positioning of the outputs on the LES20 Bus and the recovery of the inputs. This waiting period is defined by the user. It is encoded on the most significant bit of the word %QWr.m.c.0 and will respect the following formula: (%SW0 - %SW30 - LES20_CUR) x 0.8.

Example: For a periodic cycle time set at 100 ms with an average execution time of 40 ms and a LES20 bus cycle time of 30 ms, the wait time will be set at (100 - 40 - 30) x 0.8 = 24 ms. In this case the value of the word %QWr.m.0 of the ESY 007 will be 16#1802 (most significant bit of the 24 decimal word and least significant with bit 1 at 1 for wait activation).

Note: This option should be avoided when making intensive use of messaging with the TSX Series 7 modules by EF SEND_REQ. However, it is possible to modify the coefficient (0.8) in order to improve request handling, when requests exist.

Details of the T_COM_ESY-type IODDT Explicit Exchange Objects

At a Glance

This section shows the explicit exchange objects of the IODDT of type `T_COM_ESY_ESY` that applies to the TSX ESY 007 Module. It includes word objects whose bits have a special meaning. These objects are described in detail below.

Sample variable declaration: **IODDT_VAR1** de type `T_COM_ESY`

Observations

- In general, the meaning of the bits is given for bit status 1. In specific cases an explanation is given for each status of the bit.
- Not all bits are used.

Execution flags of an explicit exchange: EXCH_STS

The table below shows the meaning of channel exchange control bits from channel `EXCH_STS` (%MWr.m.c.0).

Standard symbol	Type	Access	Meaning	Address
STS_IN_PROGR	BOOL	R	Reading of channel status words in progress.	%MWr.m.c.0.0
CMD_IN_PROGR	BOOL	R	Current parameter exchange in progress.	%MWr.m.c.0.1
ADJ_IN_PROGR	BOOL	R	Adjustment parameter exchange in progress.	%MWr.m.c.0.2

Note: When the explicit exchange has a duration less than the scan time of the PLC task, the %MWr.m.c.0.0 but is never set to 1.

Explicit exchange report: EXCH_RPT

The table below presents the meaning of the exchange report bits `EXCH_RPT` (%MWr.m.c.1).

Standard symbol	Type	Access	Meaning	Address
STS_ERR	BOOL	R	Reading error for channel status words.	%MWr.m.c.1.0
CMD_ERR	BOOL	R	Error during command parameter exchange.	%MWr.m.c.1.1
ADJ_ERR	BOOL	R	Error during adjustment parameter exchange.	%MWr.m.c.1.2

Implicit Exchange Objects of the TSX ESY 007 Module - Details

At a Glance

The table below shows the different implicit exchange word objects. These objects are not integrated in the `T_COM_ESY_007`-type IODDT.

Discrete input channel bits

The table below shows the meaning of the Discrete input channel bits.

Address	Type	Access	Meaning
%I\b.1\r.m.c	EBOOL	R	Indicates that the input channel (c = 0 to 15) of the Series 7 module (m=0 to 7) of the rack (r=0 to 15) is activated.

Discrete output channel bits

The table below shows the meaning of the Discrete output channel bits.

Address	Type	Access	Meaning
%Q\b.1\r.m.c	EBOOL	R/W	Indicates that the output channel (c = 0 to 15) of the Series 7 module (m=0 to 7) of the rack (r=0 to 15) is activated.

Analog input channel bits

The table below shows the meaning of the analog input channel word bits.

Address	Type	Access	Meaning
%IW\b.1\r.m.c	INT	R	Indicates that the input channel (c = 0 to 15) of the Series 7 module (m=0 to 7) of the rack (r=0 to 15) is activated.

Analog output channel bits

The table below shows the meaning of the analog output channel word bits.

Address	Type	Access	Meaning
%QW\b.1\r.m.c	INT	R/W	Indicates that the output channel (c = 0 to 15) of the Series 7 module (m=0 to 7) of the rack (r=0 to 15) is activated.
%QWr.m.c.0.0	BOOL	R/W	Setting this bit to 1 (Set to 1) allows Set to 0 of calculation values of current and maximum I/O extension bus scan time for the MAST.

Series 7 module error bit

The table below shows the meaning of the error bits of Series 7 modules.

Address	Type	Access	Meaning
%I\b.1\r.m.0.ERR	EBOOL	R	Indicates whether the Series 7 module (m=0 to 7) of the rack (r=0 to 15) is in fault mode.

Configuration Objects for the TSX ESY 007 Module - Details

At a Glance

%KWr.m.c.d configuration constants are accessible only in read mode and correspond to configuration parameters entered using the configuration editor.

Configuration objects

The table below shows the I/O extension bus constants-type objects.

Number	Type	Access	Meaning
%KWr.m.c.0.n	BOOL	R	n = 0 to 15 -> respectively the fallback type (0=fallback to 0, 1=maintain)

Section 7.4
The IODDT Type T_GEN_MOD Applicable to All Modules

Details of the Language Objects of the T_GEN_MOD-Type IODDT

Introduction

Modules of Premium PLCs have an associated IODDT of type `T_GEN_MOD`.

Observations

- In general, the meaning of the bits is given for bit status 1. In specific cases, an explanation is given for each status of the bit.
- Not all bits are used.

List of Objects

The table below presents the objects of the IODDT:

Standard symbol	Type	Access	Meaning	Address
MOD_ERROR	BOOL	R	Module error bit	%Ir.m.MOD.ERR
EXCH_STS	INT	R	Module exchange control word	%MWr.m.MOD.0
STS_IN_PROGR	BOOL	R	Reading of status words of the module in progress	%MWr.m.MOD.0.0
EXCH_RPT	INT	R	Exchange report word	%MWr.m.MOD.1
STS_ERR	BOOL	R	Error detected while reading module status words	%MWr.m.MOD.1.0
MOD_FLT	INT	R	Internal error word of the module	%MWr.m.MOD.2
MOD_FAIL	BOOL	R	Internal error, inoperable module	%MWr.m.MOD.2.0
CH_FLT	BOOL	R	Channel error detected	%MWr.m.MOD.2.1
BLK	BOOL	R	Terminal block error	%MWr.m.MOD.2.2
CONF_FLT	BOOL	R	Hardware or software configuration mismatch	%MWr.m.MOD.2.5
NO_MOD	BOOL	R	Module missing or inoperative	%MWr.m.MOD.2.6
EXT_MOD_FLT	BOOL	R	Internal error word of the module (Fipio extension only)	%MWr.m.MOD.2.7
MOD_FAIL_EXT	BOOL	R	Module is unserviceable (Fipio extension only)	%MWr.m.MOD.2.8
CH_FLT_EXT	BOOL	R	Channel error detected (Fipio extension only)	%MWr.m.MOD.2.9
BLK_EXT	BOOL	R	Terminal block error detected (Fipio extension only)	%MWr.m.MOD.2.10
CONF_FLT_EXT	BOOL	R	Hardware or software configuration mismatch (Fipio extension only)	%MWr.m.MOD.2.13
NO_MOD_EXT	BOOL	R	Module missing or inoperative (Fipio extension only)	%MWr.m.MOD.2.14

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