

# Premium and Atrium Using EcoStruxure™ Control Expert Fipio/AS-i Gateway Setup Manual

(Original Document)

12/2018

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# Table of Contents

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|                  |  |    |
|------------------|--|----|
|                  | <b>Safety Information</b> . . . . .  | 5  |
|                  | <b>About the Book</b> . . . . .  | 7  |
| <b>Part I</b>    | <b>The TBX SAP 10 Fipio/AS-i Gateway</b> . . . . .   | 9  |
| <b>Chapter 1</b> | <b>General introduction to the AS-i bus</b> . . . . .  | 11 |
|                  | Main characteristics of the AS-i bus . . . . .   | 12 |
|                  | Master profile and structure of a slave . . . . .  | 14 |
|                  | Architecture of the TBX SAP 10 Module . . . . .  | 17 |
|                  | AS-i Master Operating Phases . . . . .   | 19 |
|                  | Operating Modes . . . . .  | 21 |
|                  | Functions of the TBX SAP 10 module . . . . .   | 22 |
|                  | Technical Characteristics . . . . .  | 24 |
|                  | Introduction to the Main Constituent Elements . . . . .  | 25 |
|                  | Example of AS-i bus topology . . . . .   | 31 |
| <b>Part II</b>   | <b>Hardware Installation for the TBX SAP 10 Gateway</b> . . . . .                              | 33 |
| <b>Chapter 2</b> | <b>Fipio/AS-i gateway: TBX SAP 10</b> . . . . .  | 35 |
| 2.1              | Description of the TBX SAP 10 Gateway . . . . .  | 36 |
|                  | Physical introduction . . . . .  | 37 |
|                  | Power supply for the TBX SAP 10 module . . . . .   | 39 |
|                  | Architecture of the Fipio bus with auxiliary connectors (IP20) . . . . .                       | 40 |
|                  | Fipio address setting for the AS-i module . . . . .  | 41 |
|                  | Connections . . . . .  | 42 |
| 2.2              | AS-i Bus Diagnostics . . . . .   | 43 |
|                  | Displaying Module States . . . . .   | 43 |
| <b>Part III</b>  | <b>Software Installation for the TBX SAP 10 Gateway</b> . . . . .                              | 45 |
| <b>Chapter 3</b> | <b>Software Installation Principles for the AS-I Bus</b> . . . . .                             | 47 |
|                  | Addressing of Inputs and Outputs for Devices Connected to the<br>TBX SAP 10 Module . . . . .   | 48 |
|                  | Introduction to Software Installation . . . . .  | 49 |
| <b>Chapter 4</b> | <b>AS-i Bus Configuration</b> . . . . .  | 51 |
|                  | How to Add a TBX SAP 10 Module . . . . .   | 52 |
|                  | How to Access the TBX SAP 10 Module Configuration Screen . . . . .                             | 55 |
|                  | TBX SAP 10 Module Configuration Screen . . . . .   | 56 |
|                  | How to Declare a Slave Device on the AS-i Bus . . . . .  | 58 |
|                  | Display of AS-i Devices Connected to the TBX SAP 10 Module in the<br>Project Browser . . . . . | 61 |

|                  |  |            |
|------------------|--|------------|
|                  | How to modify the AS-i Bus software configuration . . . . .  | 63         |
|                  | How to access the description of an AS-i slave . . . . .   | 64         |
|                  | How to Define a New Slave Profile in a Private AS-i Catalog . . . . .                              | 66         |
|                  | How to View the AS-i Slave Configuration . . . . .   | 68         |
| <b>Chapter 5</b> | <b>Debug and Diagnostics of the AS-I Bus . . . . .</b>   | <b>69</b>  |
|                  | Diagnostics . . . . .  | 70         |
|                  | TBX SAP 10 Module Debug Screen . . . . .   | 72         |
|                  | How to Access Module and Channel Diagnostics Functions on a<br>TBX SAP 10 Module . . . . .         | 74         |
|                  | AS-i Bus Diagnostics . . . . .   | 76         |
|                  | Display of Slave Status . . . . .  | 77         |
|                  | How to Access the Settings of the AS-I Device Parameters . . . . .                                 | 79         |
|                  | How to Access the Force/Unforce Function of the AS-I Channels. . . . .                             | 80         |
|                  | How to Access the SET and RESET AS-I Output Commands . . . . .                                     | 81         |
|                  | Automatic Replacement of a Faulty AS-i Slave . . . . .   | 82         |
|                  | How to Insert a Slave Device in an Existing AS-i Configuration . . . . .                           | 83         |
| <b>Chapter 6</b> | <b>Language Objects Associated with the TBX SAP 10<br/>Module . . . . .</b>                        | <b>85</b>  |
| 6.1              | The language objects and IODDTs associated with the TBX SAP 10<br>module . . . . .                 | 86         |
|                  | Presentation of Language Objects of the TBX SAP 10 Module. . . . .                                 | 87         |
|                  | Implicit Exchange Language Objects Associated with the Application-<br>Specific Function . . . . . | 88         |
|                  | Explicit Exchange Language Objects Associated with the Application-<br>Specific Function . . . . . | 89         |
|                  | Management of Exchanges and Reports with Explicit Objects . . . . .                                | 91         |
| 6.2              | The IODDT T_SAP10_STD Applicable to the TBX SAP 10 Module . . . . .                                | 95         |
|                  | Details of the TBX SAP 10-Type IODDT Implicit Exchange Objects . . . . .                           | 96         |
|                  | Details of T_SAP10_STD-type IODDT Explicit Language Objects . . . . .                              | 99         |
| 6.3              | Language Objects Associated with the TBX SAP 10 Module . . . . .                                   | 102        |
|                  | Explicit Exchange Language Objects, TBX SAP 10 Module Status . . . . .                             | 103        |
|                  | Language Objects Associated with Configuration of the TBX SAP 10<br>Module . . . . .               | 104        |
|                  | Operating phases. . . . .  | 105        |
| <b>Index</b>     | . . . . .  | <b>107</b> |

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# Safety Information

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## 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.

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## 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.

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# About the Book

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## At a Glance

### Document Scope

This manual describes the implementation of hardware and software for the Fipio/AS-i TBX SAP 10 gateway.

### Validity Note

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

The technical characteristics of the devices described in the present document also appear online. To access the information online:

| Step | Action   |
|------|--|
| 1    | Go to the Schneider Electric home page <a href="http://www.schneider-electric.com">www.schneider-electric.com</a> .  |
| 2    | In the <b>Search</b> box type the reference of a product or the name of a product range. <ul style="list-style-type: none"><li>• Do not include blank spaces in the reference or product range.</li><li>• To get information on grouping similar modules, use asterisks (*).</li></ul> |
| 3    | If you entered a reference, go to the <b>Product Datasheets</b> search results and click on the reference that interests you.<br>If you entered the name of a product range, go to the <b>Product Ranges</b> search results and click on the product range that interests you.         |
| 4    | If more than one reference appears in the <b>Products</b> search results, click on the reference that interests you.   |
| 5    | Depending on the size of your screen, you may need to scroll down to see the data sheet.   |
| 6    | To save or print a data sheet as a .pdf file, click <b>Download XXX product datasheet</b> .  |

The characteristics that are presented in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the document and online information, use the online information as your reference.

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## Related Documents

| Title of Documentation  | Reference Number  |
|---|---|
| Premium and Atrium Using EcoStruxure™ Control Expert, Fipio Bus, Setup Manual | 35008155 (English),<br>35008156 (French),<br>35008157 (German),<br>35013953 (Italian),<br>35008158 (Spanish),<br>35013954 (Chinese) |

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# Part I

## The TBX SAP 10 Fipio/AS-i Gateway

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# Chapter 1

## General introduction to the AS-i bus

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### Subject of this Chapter

This Chapter presents the general characteristics of the AS-i bus.

### What Is in This Chapter?

This chapter contains the following topics:

| Topic   | Page |
|---|------|
| Main characteristics of the AS-i bus          | 12   |
| Master profile and structure of a slave       | 14   |
| Architecture of the TBX SAP 10 Module         | 17   |
| AS-i Master Operating Phases                  | 19   |
| Operating Modes                               | 21   |
| Functions of the TBX SAP 10 module            | 22   |
| Technical Characteristics                     | 24   |
| Introduction to the Main Constituent Elements | 25   |
| Example of AS-i bus topology                  | 31   |

## Main characteristics of the AS-i bus

### General

AS-i is a system in which exchange management is ensured by a single master who calls in succession, by scanning the bus, each detected slave and awaits a response.

The serial communication frame sends:

- 4 data bits (D0 to D3), which are the image of inputs or outputs according to the nature of the interface.
- 4 parametering bits (P0 to P3), which are used to set the operating modes of the interface. P0 to P3 bits are used for **"intelligent"** devices, including AS-i ASIC (specific integrated circuit). Operation can be modified while it is running.

The address of the slave is coded on 5 bits.

At the request of the AS-i master, outputs are set and the inputs for AS-i devices are sent in the slave's response.

### Slave Addressing

Each slave connected to the AS-i bus must have an address between 1 and 31 (coding on 5 bits).

The slaves delivered from the factory have the address 0 (the address of the slave is memorized in a non-volatile format).

Addresses are programmed using an **XZMC11** specific addressing terminal.

**NOTE:** When replacing a faulty slave whose address has been set, the address of the replacement slave can be updated automatically.

### Identification of Slaves

All slave devices connected to the AS-i bus are identified by:

- An I/O Code (input/output distribution code).
- An identification code, which completes the functional identification of the slave.

These identifications allow the AS-i master to recognize the configuration present on the bus.

These different profiles have been developed by the AS-i association. They are used to distinguish between input, output and mixed modules, **"intelligent"** device families, etc.

### Maximum Number of Inputs/Outputs

An AS-i bus can support a maximum of 31 slaves.

Each slave can have a maximum of 4 inputs and/or 4 outputs.

This makes it possible to manage a maximum of 124 inputs + 124 outputs, or 248 discrete inputs/outputs when all active devices have 4 inputs and 4 outputs.

### AS-i Cable

The AS-i cable is a twin-wire link on which communications and power supply for the connected devices are transmitted.

The link does not need to be twisted.

The cross-section of wires can be from  $2 \times 0.75 \text{ mm}^2$ ,  $2 \times 1.5 \text{ mm}^2$  or  $2 \times 2.5 \text{ mm}^2$ , according to the current consumed by the devices.

### Topology and Maximum Length of AS-i Bus

The topology of the AS-i bus is flexible. It can be perfectly adapted to meet the user's needs (point to point, in line, tree structure etc.).

In all cases, the total length of all the branches of the bus must not exceed 100 meters without a relay and 300 meters with a maximum of 2 relays.

### AS-i Bus Cycle Time

The AS-i system always transmits information of the same length to each slave on the bus. The AS-i cycle time depends on the number of slaves connected to the bus.

In the presence of 31 functioning slaves, this time period will be a maximum of 5 ms.

**However, the cycle time must not be mistaken for the response time of the TBX SAP 10 module to the PLC over the Fipio network.**

### Reliability, Flexibility

Reliable operation is ensured by the transmission process used (Manchester current and coding modulation). The master monitors the line supply voltage and the data sent. It detects transmission errors as well as slave failures, and sends the information to the PLC.

Exchanging or connecting a new slave during operation does not disturb communications between the master and the other slaves.

## Master profile and structure of a slave

### Master profiles

The AS-i system operates according to the master-slave principle. The AS-i master controls exchange of data with a maximum of 31 slaves. The specifications of the AS-i master establish a distinction between the masters depending on the number of services offered (definition of profiles). Three types of master profile exist: (M0, M1, M2). AS-i specifications clearly define the functions that a master must possess for a given profile.

The AS-i standard defines several service levels offered by the master:

- Profile M0 - Minimum Master: the master exchanges data with the different slaves. The master only proposes the configuration of slaves connected to the bus on power-up, and only for input/output exchanges.
- Profile M1 - Full Master: this profile covers all the functions defined in the AS-i master specifications,
- Profile M2 - Reduced Master: this profile corresponds to the operating functions for profile M0 with a slave parametering option.

**For the TBX SAP 10, the profile used is M2, with in addition, the possibility of sending diagnostics data to the PLC.**

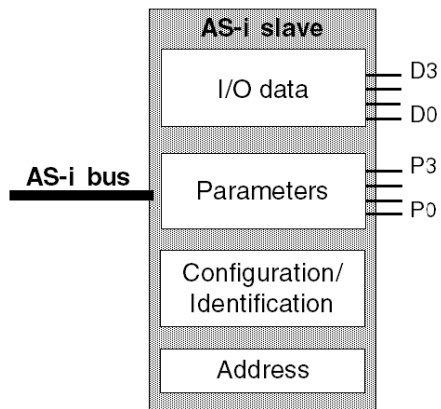
## Structure of an AS-i Slave

The AS-i slave is equipped with an integrated circuit for connection to the AS-i bus. The integrated circuit has:

- 4 configurable data inputs,
- 4 configurable data outputs,
- 4 slave parameter states.

The other operating parameters, configuration data with I/O allocation, as well as identification and address codes are saved in a non-volatile memory.

The figure below shows the structure of an AS-i slave.



## Description of Constituent Elements

The table below shows the different elements that make up the structure of a slave address.

| Element                       | Description  |
|-------------------------------|--|
| I/O data                      | The outputs are designed for automation components and are transmitted by the master AS-i to the AS-i slave. The input values are stored by the AS-i slave and made available to the master.   |
| Parameters                    | <p>AS-i slave parameter states enable the AS-i master to transmit the values that will not be interpreted as input/output data. These parameters can be used for controlling and switching internal operating modes of sensors or actuators.</p> <p>Examples: motor-starter: slow or fast rotation speed, run, stop, etc. proximity detectors: range, background suppression, etc.</p> <p>These parameters may be used to correct a calibration dimension during the different operating phases. This function can be performed on slaves with a built-in AS-i connection on the condition that they support this function. Only a master with profile M1 or M2 can modify these parameters.</p> |
| Configuration/ Identification | <p>The input/output configuration (or I/O code) defines the AS-i slave data used as inputs, outputs, or as bi-directional outputs. The I/O configuration (4 bits) is defined by the manufacturer of the slave and is specified in the slave's documentation.</p> <p>The type of an AS-i slave (or Identification Code) is defined by the I/O configuration but also by an identification code. The latter is coded by each slave on 4 bits. It is also manufacturer-specific and mentioned in the documentation.</p>   |
| Address                       | At the time of delivery, the address for slaves is 0. So that data may be exchanged, the slaves must be programmed with an address between 1 and 31. The address 0 is reserved for specific functions.   |



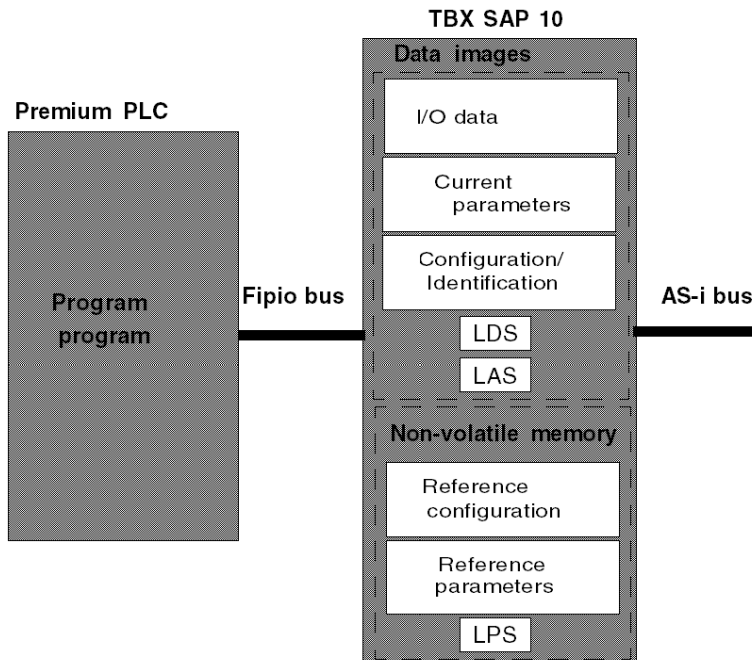
## Architecture of the TBX SAP 10 Module

### At a Glance

To enable the PLC to access the data structure of an AS-i slave, the **TBX SAP 10** must integrate data fields and manage lists.

### Illustration of the Architecture

The figure below shows the architecture of the **TBX SAP 10** module.



### Description of Constituent Elements

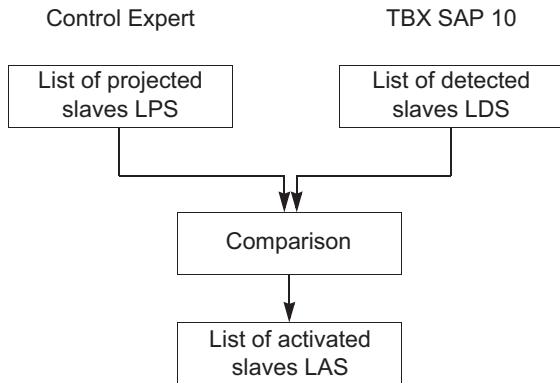
The table below shows the different elements that make up the architecture of the **TBX SAP 10** module.

| Element                      | Description   |
|------------------------------|---|
| I/O data                     | Images of the 124 inputs and 124 outputs of the AS-i bus.   |
| Current parameters           | Image of the parameters of all slaves.  |
| Configuration/Identification | This field contains all the I/O codes and identification codes for all detected slaves.   |
| LDS                          | List of all slaves detected on the bus.<br>This list stores the addresses of all slaves on the AS-i bus.  |
| LAS                          | List of active slaves on the bus.<br>This is the list of slaves that must be acknowledged when a configuration is received. In this case, the AS-i bus is in AS-i protected mode. AS-i protected mode corresponds to the mode configured in Control Expert.                           |
| LPS                          | List of projected slaves on the bus configured by Control Expert. The master checks the slaves present on the bus against this list.<br>This is the list of slave addresses provided. Their identification also comply with that provided in the reference configuration information. |

### Slave Activation Principle

Data can only be exchanged with active slaves.

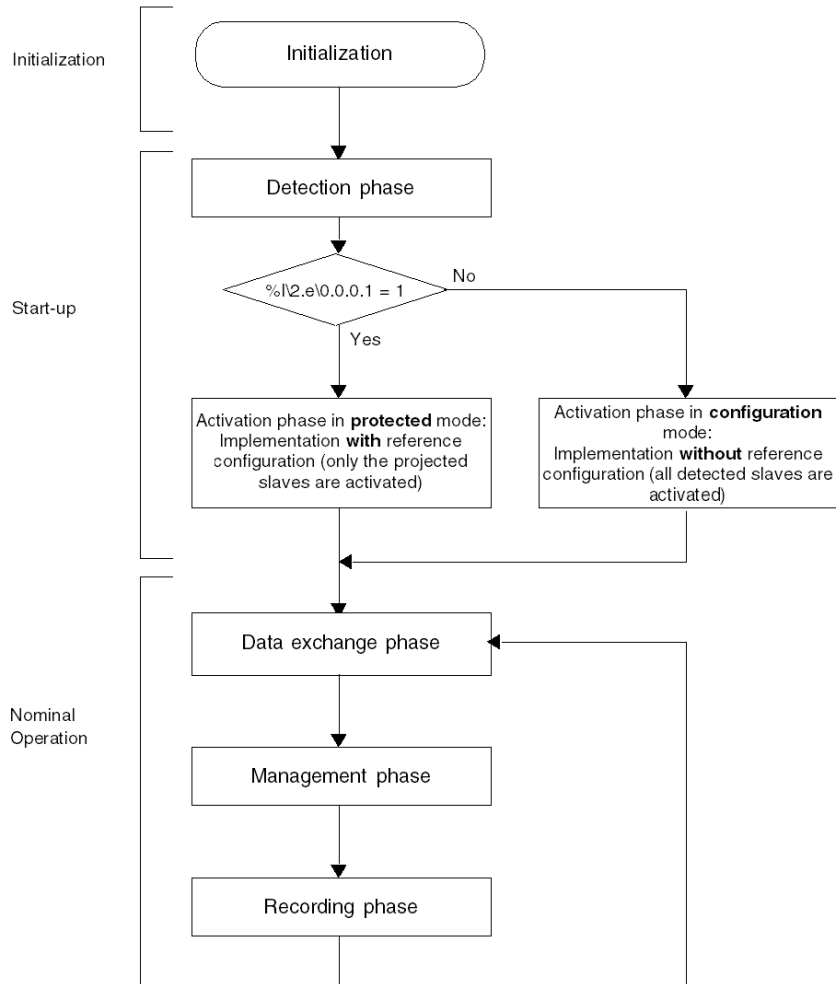
The diagram below shows the AS-i slave activation principle.



## AS-i Master Operating Phases

### Illustration of the Architecture

The diagram below shows the flowchart for the different operating phases.



## Description of Constituent Elements

The table below shows the different actions included in the each of the operating phases.

| Step              | Phase   | Description   |
|-------------------|---|---|
| Initialization    | Initialization                                    | The master is initialized at each power up or during operation when it switches from <b>Configuration</b> mode to <b>Protected</b> mode. During this initialization, which lasts approximately 1 second, the AS-i bus input and output images are set to 0, from the PLC application.   |
| Start-up          | Detection   | The AS-i master scans the AS-i bus to detect the number of slaves present, the addresses used, and the identification of each device. The slaves detected are recorded in the LDS (list of detected slaves) and the Identification Codes are recorded in the AS-i bus Configuration/Identification table. If no slave is detected on the AS-i bus, the AS-i master remains in this phase and waits for a device to be present before switching to the activation phase. |
|                   | Activation of slaves in <b>configuration mode</b> | All slaves detected on the AS-i bus are activated. Specifically, this mode allows the current AS-i bus configuration to be saved in the reference configuration (simplified method for programming the desired configuration).  |
|                   | Activation of slaves in <b>protected mode</b>     | The only slaves activated are those whose identification conforms to the one included in the reference configuration. The active slaves are recorded in the LAS (list of active slaves).  |
| Nominal operation | Data exchange                                     | The master sends the data (output data) cyclically to the different slaves, and in exchange receives acknowledgement messages (input data). If there is a transmission error, the master repeats the call in question. The cycle time for polling all the slaves on an AS-i line is less than 5 ms.   |
|                   | Management  | It is during this phase that: <ul style="list-style-type: none"> <li>● Modification of the slave parameters occurs,</li> <li>● The auto-addressing function is executed,</li> <li>● The AS-i bus configuration is saved in the reference configuration,</li> <li>● All instructions except for cyclic data exchanges are sent.</li> </ul>   |
|                   | Recording   | The LDS and LAS lists are managed during this phase when there is a connection or disappearance of a device on the AS-i bus. A slave that has just been recorded in the LDS (list of detected slaves) is activated, then recorded in the LAS list (list of active slaves) depending on the operating mode of the AS-i master. A faulty slave disappears from the LDS and the LAS and triggers a configuration fault.  |

## Operating Modes

### At a Glance

When functioning nominally, the **TBX SAP 10** can operate in two modes :

- **Configuration** mode,
- **Protected** mode.

### Configuration Mode

In **configuration mode**, all slaves detected on the network are active and can be used directly.

A configuration fault is sent to the PLC if the actual configuration on the AS-i bus is not the same as the reference configuration, but non-compliant slaves will still be active and usable.

In this mode, it is not possible to use the auto-addressing function.

This mode will be used during installation and deployment of a machine, and specifically for testing all of the devices.

### Protected Mode

In **protected mode**, only the slaves on the AS-i bus whose identification is identical to that of the reference configuration, are active. In this mode, the auto-addressing function is available.

### Diagnostics Mode

In addition to these two modes is the **diagnostics mode**, which allows the list of detected slaves (LDS), the list of projected slaves (LPS) in the reference configuration, and the list of active slaves (LAS) on the AS-i bus to be sent to the PLC.

**NOTE:** In this mode, these lists replace the state of the AS-i bus inputs; they should not be acknowledged in the application program, as the AS-i bus outputs continue to be controlled.

## Functions of the TBX SAP 10 module

### At a Glance

The M2 profile of the **TBX SAP 10** (AS-i master) enables:

- management of inputs/outputs,
- the choice of AS-i bus reference configuration,
- changing the operating mode,
- setting up parameters for intelligent **slaves**.

As for any device connected to the Fipio network, this device has diagnostics information. The **TBX SAP 10** is equipped with a display panel allowing diagnostics information to be sent concerning its state and that of the AS-i bus.

### Reading Inputs

With a maximum of 31 slaves on the AS-i bus, the **TBX SAP 10** can send the state of 124 discrete inputs to the PLC.

The information is sent cyclically over the Fipio network to the PLC. A validity indicator for AS-i bus input information can also be used in the PLC program; it indicates whether the **TBX SAP 10** is ready to function or not.

### Writing Outputs

With a maximum of 31 slaves on the AS-i bus, the **TBX SAP 10** can write 124 discrete outputs on the AS-i bus.

The information is transferred cyclically over the Fipio network toward the **TBX SAP 10**.

**NOTE:** slave outputs are written before inputs are read.

### Comparison of the Configuration

Independent of the operating mode that the **TBX SAP 10** may be in, the module continuously compares the current AS-i bus configuration with that of the reference configuration.

If an inconsistency should occur, it signals a configuration fault to the PLC.

This reference configuration is obtained either through configuration in Control Expert or by saving the actual configuration of the AS-i bus at a given time.

### Changing Mode

It is not possible to change from **configuration mode** to **protected mode** if a slave with the address 0 is present on the AS-i bus.

Switching from **configuration mode** to **protected mode** triggers the-complete initialization of the **TBX SAP 10** which lasts approximately 1 second, and causes all the AS-i bus inputs/outputs to be set to 0.

### Setting Up Slave Parameters

Parameters can be set up for certain AS-i slaves (limit switch detectors, photo-electric cells). The adjustment parameters for each slave can be alarms, test signals, time out triggers, and ranges.

The **TBX SAP 10** module enables the value of each of these parameters to be modified during operation, in order to adapt to changes in the installation. It detects the values modified by the PLC and sends the new values to the slaves in question.

### Changing a Faulty Slave

When the **TBX SAP 10** operates in **Protected mode**, it is possible to use the auto-addressing function **when a single slave is defective** on the AS-i bus.

When the operator intervenes to change the faulty slave (*see page 82*) (the factory settings for a slave always specify the address 0), the master will detect this new device with the address 0, and if its identification corresponds to that of the projected device, the master will automatically assign it a new address, which is that of the defective device.

The advantage of this is that a failure can be located rapidly and the installation can be worked on without the need for specific devices.

If several slaves are defective, the master cannot automatically assign the address to the new device. The address of each slave will have to be programmed with the drum controller before connecting them to the AS-i bus.

### Diagnostics Information

The **TBX SAP 10** can send diagnostics information about its state and that of the AS-i bus on a cyclic basis.

This information can be used in the PLC program in order to correctly manage the inputs/outputs.

The display panel of the **TBX SAP 10** has:

- 4 standard LEDs for the Fipio devices (RUN, DEF, COM, I/O) showing general operating state,
- an array of 32 LEDs associated with the AS-i bus addresses showing the state of the connected devices.

## Technical Characteristics

### Characteristics

The following table presents the technical characteristics of the **TBX SAP 10** module.

| Characteristic  | Value                          |
|---|--------------------------------|
| AS-i bus maximum cycle time                                 | 5 ms                           |
| Maximum number of slaves on the AS-i bus                    | 31                             |
| Maximum length of AS-i bus (for all branches without relay) | 100 meters                     |
| Maximum number of Inputs/Outputs                            | 124 inputs +124 outputs        |
| AS-i master profile   | M2                             |
| Address number on the Fipio network                         | 1 to 127                       |
| TBX SAP 10 module programming                               | Using Control Expert software  |
| Supply voltage  | 24VDC or 48VDC                 |
| Power dissipation   | 2 W                            |
| Protection from polarity inversion on AS-i bus inputs       | Yes                            |
| Nominal supply voltage                                      | 30VDC                          |
| AS-i current consumed on 30 V                               | 100 mA maximum                 |
| Protection from polarity inversion on AS-i bus inputs       | Yes                            |
| Size (LxHxD) in mm  | 223x87x72                      |
| Degree of protection  | IP20                           |
| Operating Temperature                                       | 0 to 55 degrees Celsius        |
| AS-i certification, M2 profile                              | AS-i certificate number: 08401 |

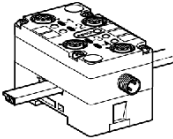


## Introduction to the Main Constituent Elements

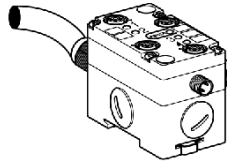
### Active Distributors

IP67 sealed interfaces for connecting sensors/actuators using M12 connectors. These distributors enable connection of four **traditional** non-communicating sensors/actuators on the same AS-i address. This type of distributor is used very often on existing machines to be renovated as it avoids having to intervene on the installation.

Illustration:



Active distributor  
for ribbon cable

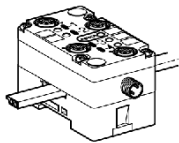


Active distributor for  
round cable

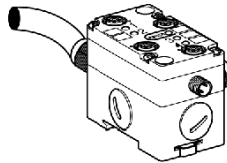
## Passive Distributors

IP67 sealed interfaces for connecting sensors/actuators using M12 connectors. These distributors do not have any electronics and can therefore be used to connect the **communicating** sensors/actuators. This type of distributor can be used for new machines but has the drawback of using four AS-i addresses.

Illustration:



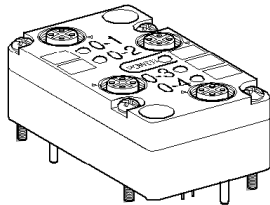
Passive distributor  
for ribbon cable



Passive distributor for  
round cable

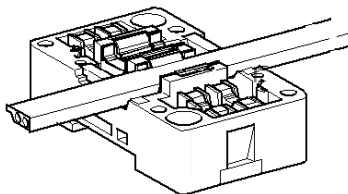
These passive and active distributors comprise:

- A connection interface that supports M12 ports as well as LED indicators,

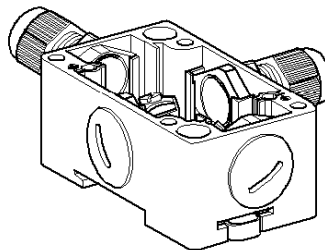


- A connection base.

connection by insulation piercing  
connector for ribbon cable



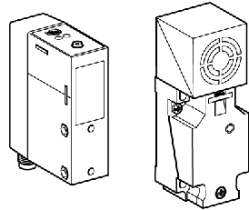
connection by screw terminal block  
for round cable



## AS-i Sensors

- Photo-electric detectors:  
They detect all kinds of objects (opaque, reflective etc) with 5 basic systems: barrier, reflex, polarized reflex, proximity and proximity with background suppression. They offer an IP 67 protection level.
- Inductive proximity detectors:  
They detect all metal objects and provide information for the functions used to check whether an object is present or not. They offer an IP 67 protection level.

Illustration:



These sensors which are fitted with an AS-i ASIC can be directly connected to the AS-i bus or to a passive distributor module. As AS-i bus slaves, they have 4 parametering bits (P0 to P3) to write information such as time out adjustments; field depth, etc.

The **TBX SAP 10** module can modify the value of these slaves during operation.

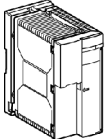
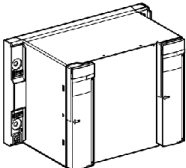
### AS-i Power Supplies

AS-i dedicated power supplies are designed to supply the components connected to the AS-i bus.

The distribution of this power supply uses the same medium as that used for data exchange.

These AS-i power supplies (*see Premium and Atrium Using Ecostruxure™ Control Expert, AS-i Bus, User Manual*) can be placed at any given point on the AS-i bus, but it is advisable to place them nearest the areas that consume the most power. These are 30 VDC power supplies designed to communicate over distances of 100m.

This table presents the various AS-i power supplies:

| AS-i bus power supply   |   |
|---|---|
| Network voltage 100...120 VAC or 200...240 VAC                                    |   |
| TSX SUP A02   | TSX SUP A05   |
|  |  |
| 30 VDC AS-i / 2.4A  | 30 VDC AS-i / 5 A & 24 VDC  |

## Cable

It transmits both communications **data** and the **power supply** to:

- The sensors and actuators connected to the distributor modules,
- The intelligent sensors,
- The **TBX SAP 10** interface.

It can be made up from:

- Either an unshielded and polarized, twin-wire AS-i ribbon cable.
- Or a standard round, shielded or unshielded twin-wire cable.

Illustration:



Polarized ribbon cable



Round cable

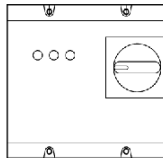
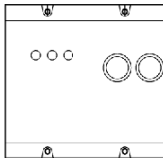
Under low disturbance conditions, any traditional standard cable (H05VV type) with a cross-section of 1.5 to 2.5 mm<sup>2</sup> can be used (depending on the consumption of all the slaves) with distributors that include screw terminal blocks.

Using a dedicated AS-i ribbon cable provides the advantage of being able to immediately connect the AS-i slaves with automatic polarization, using the piercing connector clip-on technique.

## AS-i Actuators

The direct motor starters and toggle switches in sealed boxes (IP54 and IP65) ensure electrical motors are controlled and protected up to 4KW at 400 VAC.

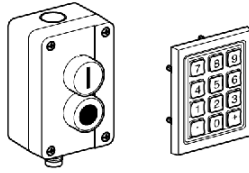
Illustration:



## Man-Machine Interface Products

- Button boxes:  
These are made up of dialog tools, which are perfectly adapted to exchanging information between the operator and machine.
- Keyboards:  
The man/machine dialog tools have 12 touch sensitive keys. The information delivered is coded in BCD on 4 bits. They offer an IP 65 protection level.

Illustration:



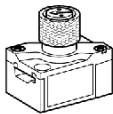
## Signaling Elements

- Illuminated indicator banks:  
Optical or sound signaling elements.

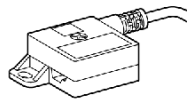
## Connecting and branching accessories

T-piece connectors are used to make connections to the AS-i bus. These are designed for linking to AS-i ribbon cables or to ribbon/round cable branches.

Illustration:



T for  
ribbon cable

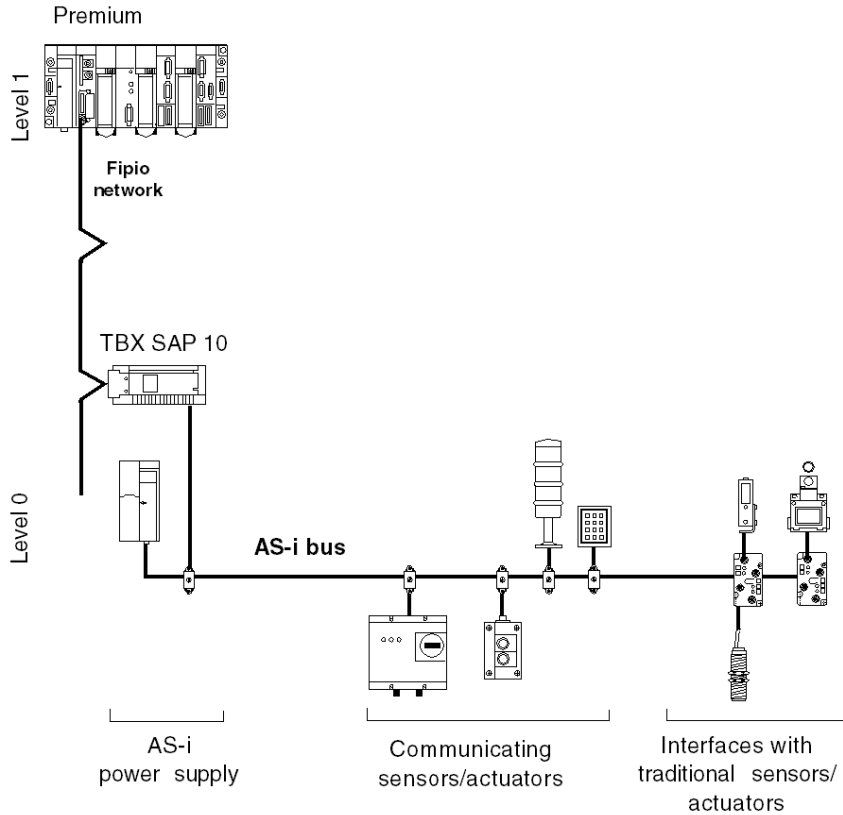


Branch  
for ribbon/round cable

## Example of AS-i bus topology

### General

Illustration:







---

## Part II

### Hardware Installation for the TBX SAP 10 Gateway

---



---

# Chapter 2

## Fipio/AS-i gateway: TBX SAP 10

---

### Subject of this Chapter

This chapter presents hardware installation for the Fipio/AS gateway-i **TBX SAP 10** from a Premium/Atrium PLC.

### What Is in This Chapter?

This chapter contains the following sections:

| Section | Topic                                 | Page |
|---------|---------------------------------------|------|
| 2.1     | Description of the TBX SAP 10 Gateway | 36   |
| 2.2     | AS-i Bus Diagnostics                  | 43   |

# Section 2.1

## Description of the TBX SAP 10 Gateway

---

### Subject of this Section

This Section deals with hardware installation and the characteristics of the **TBX SAP 10** gateway.

### What Is in This Section?

This section contains the following topics:

| Topic  | Page |
|--|------|
| Physical introduction  | 37   |
| Power supply for the TBX SAP 10 module                         | 39   |
| Architecture of the Fipio bus with auxiliary connectors (IP20) | 40   |
| Fipio address setting for the AS-i module                      | 41   |
| Connections  | 42   |

## Physical introduction

### General

The **TBX SAP 10** module comes as a TBX Monobloc (IP20) comprised of a single element with no extension possibilities.

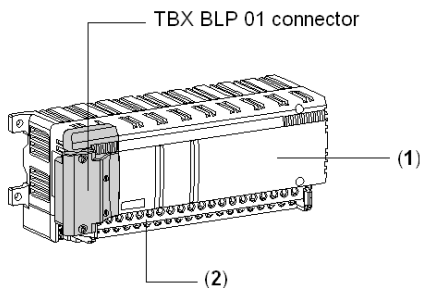
The Fipio connection point address (*see page 41*) is assigned using 8 micro-switches.

### At a Glance

The **TBX SAP 10** monobloc module is comprised of:

- an element containing both communications electronics and AS-i communication electronics (1),
- a removable terminal block (2) allowing connection of the **TBX SAP 10** module power supply.

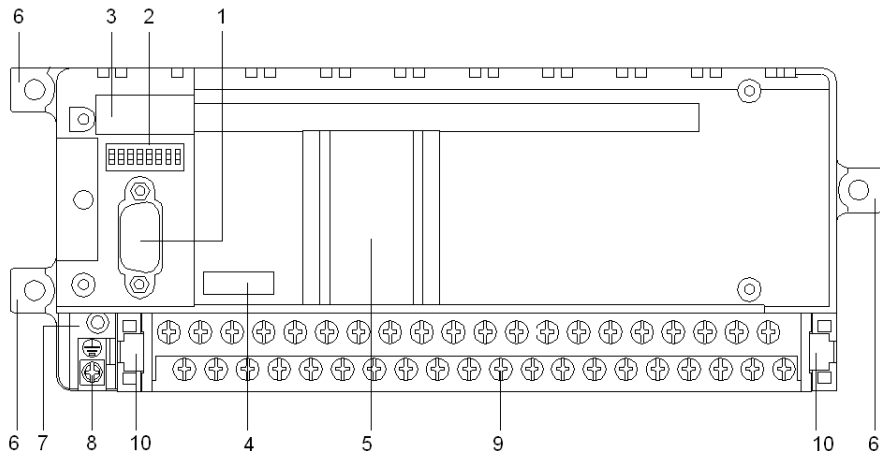
The following drawing shows the **TBX SAP 10** monobloc module.



The **TBX BLP 01** connector allows the module to be connected to the Fipio network.

### Physical Description

The following drawing shows the details of the **TBX SAP 10** monobloc module.



The following table shows the different elements of the **TBX SAP 10** monobloc module.

| Number | Description   |
|--------|---|
| 1      | A 9 pin SubD male connector for connection to the Fipio bus, via the <b>TBX BLP 01</b> connector.               |
| 2      | 8 micro-switches for coding the Fipio connection point address ( <i>see page 41</i> ).                          |
| 3      | Help label for coding of the Fipio connection point address.  |
| 4      | Slot for a client label showing connection point address and the module number.                                 |
| 5      | Display panel.  |
| 6      | Module fixing lugs.   |
| 7      | Identification label showing the type of module channels.   |
| 8      | Stirrup screw for grounding the product.  |
| 9      | Removable screw terminal block (with terminal block label) for wiring the AS-i bus and the module power supply. |
| 10     | Extractors for removing the terminal block.   |

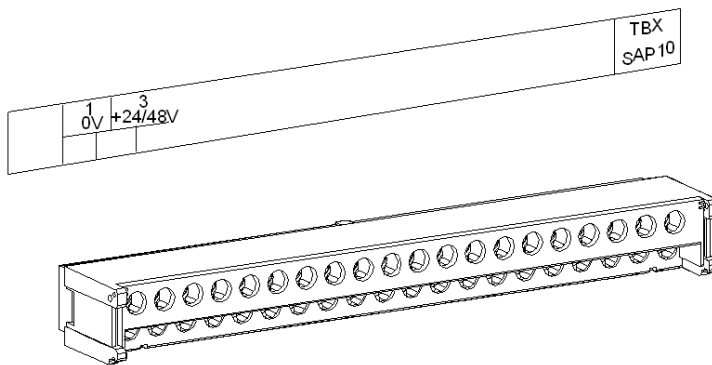
## Power supply for the TBX SAP 10 module

### At a Glance

The **TBX SAP 10** AS-i master must have a 24VDC or 48VDC direct voltage power supply insulated to 1500V RMS from the ground.

Using this external source offers the advantage of being able to cut off the AS-i bus power supply without interrupting communication between the PLC and the **TBX SAP 10**.

For unequipped sites, you can use a **TBX SUP 10** power supply module (*see Premium and Atrium Using EcoStruxure™ Control Expert, IP20 and IP65 Sealed Input/Output Modules, Setup Manual*) supplying a direct voltage of 24V / 1A. This module enables necessary power to be supplied to several TBX modules.



The **TBX SAP 10** power supply terminals are:

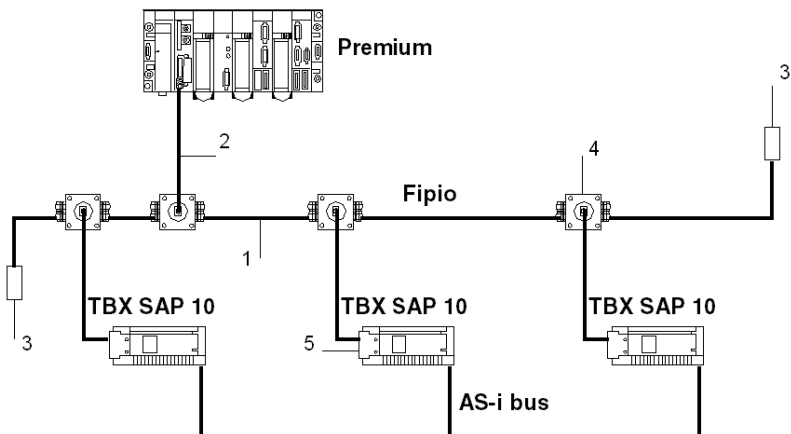
- terminal 1 for 0VDC,
- terminal 3 for 24/48VDC.

## Architecture of the Fipio bus with auxiliary connectors (IP20)

### At a Glance

In a Fipio architecture, the **TBX SAP 10** module can be integrated with various types of device (IP20).

Illustration



### Description

The following table presents the devices on the bus:

| Number | Product reference | Description                               |
|--------|-------------------|---|
| 1      | TSX FP CAxxx      | Trunk cable                               |
| 2      | TSX FP CCxxx      | Drop cable                                |
| 3      | TSX FP ACC7       | Line terminator                           |
| 4      | TSX FP ACC4       | Junction boxes                            |
| 5      | TBX BLP 01        | Connector for connecting the TBX to Fipio |



## Fipio address setting for the AS-i module

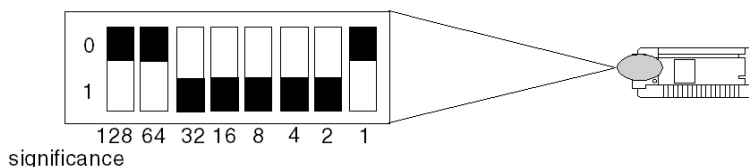
### At a Glance

A **TBX SAP 10** AS-i master on the Fipio network is identified by its address connection point. The number of the address connection point represents the physical address of the AS-i module on the Fipio network and can have a value between 1 and 127.

On Fipio, the address 0 is reserved for the bus manager PLC. The address 63 is reserved for the programming terminal.

The Fipio address of the AS-i master module is configured using the micro-switches located above the **TBX BLP 01** connector used for connection to the bus.

These 8 micro-switches allow binary coding, as illustrated below, for up to a maximum of 62 devices per architecture.



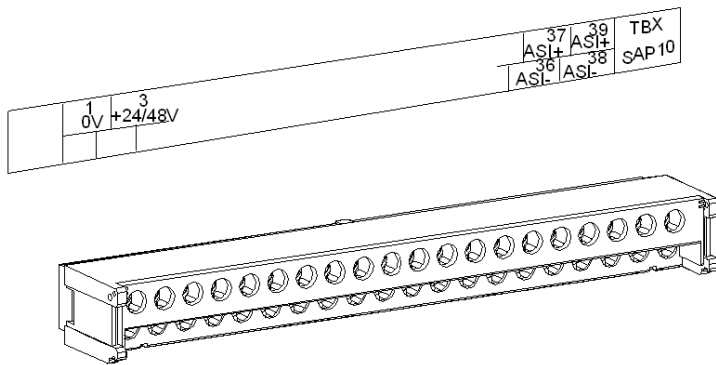
**NOTE:** Modification of the address is not acknowledged until after power for the **TBX SAP 10** has been switched off / switched on. If the address is modified while the **TBX SAP 10** is switched on, this can trigger an internal fault and disconnection from the Fipio network.

## Connections

### At a Glance

The **TBX SAP 10** module is connected to the AS-i bus directly via the removable 40-pin screw terminal block.

Illustration:



Two terminals are provided for each polarity:

- AS-i+ (brown wire of the profiled AS-i ribbon cable) on terminals 37 and 39,
- AS-i- (blue wire on the profiled AS-i ribbon cable) on terminals 36 and 38.

In order to facilitate connection when cables with a cross-section of 1.5 mm<sup>2</sup> or 2.5 mm<sup>2</sup> are used, a bridge is created on the bridge is made on the circuit board.

## Section 2.2

### AS-i Bus Diagnostics

#### Displaying Module States

##### General

The AS-i master is equipped with a display panel comprising four Fipio standard display LEDs (RUN, DEF, COM, I/O) that provide information about its state. It also has 32 display LEDs for indicating the AS-i bus configuration.

|   | RUN | DEF |    |  |
|---|-----|-----|----|--|
|   | COM | I/O |    |  |
| 0 | 8   | 16  | 24 |  |
| 1 | 9   | 17  | 25 |  |
| 2 | 10  | 18  | 26 |  |
| 3 | 11  | 19  | 27 |  |
| 4 | 12  | 20  | 28 |  |
| 5 | 13  | 21  | 29 |  |
| 6 | 14  | 22  | 30 |  |
| 7 | 15  | 23  | 31 |  |

LED status:

| LEDs                 | Permanently on   | Blinking  | Off                               |
|----------------------|--|---|-----------------------------------|
| <b>RUN</b> (green)   | Device operational.  | -   | -                                 |
| <b>DEF</b> (red)     | Device faulty.   | Faulty Fipio link.                                      | -                                 |
| <b>COM</b> (yellow)  | -  | Indicates that a Fipio frame has been sent or received. | -                                 |
| <b>I/O</b> (red)     | Fault on the AS-i bus (configuration error, absence of AS-i power supply). | -   | -                                 |
| <b>0 to 31</b> (red) | The slave is present and configured at this address.                       | Configuration fault at this address.                    | Absence of slave at this address. |

## LED and Addresses

LEDs 0 to 31 show the state of the AS-i bus configuration. An AS-i slave address corresponds to each LED; where the value of this address is between 1 and 31.

- Left-hand row: slaves 1 to 7,
- Second row: slaves 8 to 15,
- Third row: slaves 16 to 23,
- Right-hand row: slaves 24 to 31,

## Connection to the Fipio Bus

When the **TBX SAP 10** is switched on and is not connected to Fipio, its LEDs show the list of detected slaves (LDS). This is very useful during installation, as it enables the list of addresses used on the AS-i bus to be determined.

When the **TBX SAP 10** is connected to Fipio, the active slaves (LAS) are displayed on the display panel LEDs. These are the slaves that can set outputs and send inputs.

If the **TBX SAP 10** is disconnected from Fipio while running, only the active slaves (LAS) are displayed.

---

# Part III

## Software Installation for the TBX SAP 10 Gateway

---

### Subject of this Part

This part presents software installation for the **TBX SAP 10** gateway using Control Expert software.

### What Is in This Part?

This part contains the following chapters:

| Chapter | Chapter Name   | Page |
|---------|--|------|
| 3       | Software Installation Principles for the AS-I Bus      | 47   |
| 4       | AS-i Bus Configuration                                 | 51   |
| 5       | Debug and Diagnostics of the AS-I Bus                  | 69   |
| 6       | Language Objects Associated with the TBX SAP 10 Module | 85   |



---

# Chapter 3

## Software Installation Principles for the AS-I Bus

---

### Subject of this Chapter

This chapter presents the software installation principles for the AS-I bus.

### What Is in This Chapter?

This chapter contains the following topics:

| Topic   | Page |
|---|------|
| Addressing of Inputs and Outputs for Devices Connected to the TBX SAP 10 Module | 48   |
| Introduction to Software Installation   | 49   |

## Addressing of Inputs and Outputs for Devices Connected to the TBX SAP 10 Module

### At a Glance

The addressing of inputs and outputs for AS-i bus devices connected to the Fipio network depends on:

- The type of object (%I or %Q),
- The number of the AS-i bus,
- The AS-i slave number, from 1 to 31,
- The rack number, always 0,
- The module number, always 0,
- The number of the input or output channel.

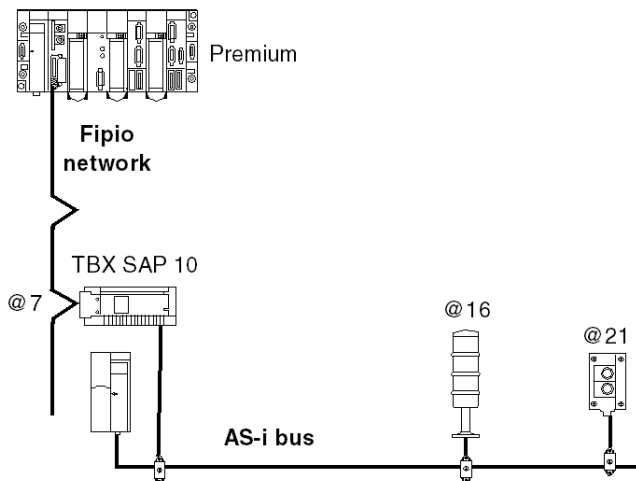
**NOTE:** The number of the AS-i bus is calculated automatically by Control Expert. This value cannot be modified.

### Example

**%I7.21\0.0.1** indicates: input 1 from the AS-i slave 21 button box of a **TBX SAP 10** module at address 7 on the Fipio bus.

**%Q7.16\0.0.2** indicates: output 2 from the AS-i slave 16 illuminated column of a **TBX SAP 10** module at address 7 on the Fipio bus.

Illustration:



**NOTE:** Certain slaves have input or output channels numbered from 1 to 4, while the numbering of the channels in the PLC is still from 0 to 3.

Example of correspondence: %I\...\0 channel 0 of the slave corresponds to I-1, and %Q\...\3 channel 3 of the slave corresponds to Q-4.



## Introduction to Software Installation

### Introduction

The software installation of the module 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 with Processor Phase

The table below shows the various phases of installation with the processor.

| Phase                    | Description  | Mode        |
|--------------------------|--|-------------|
| Declaration of variables | Declaration of IODDT-type variables for the application-specific modules and variables of the project. | Offline (1) |
| Programming              | Project programming.   | Offline (1) |
| Configuration            | Declaration of AS-i slave devices and modules.   | Offline     |
|                          | Configuration of AS-i slave devices and modules.   |             |
|                          | Entry of configuration parameters.   |             |
| Association              | Association of IODDTs with the channels configured (variable editor).                                  | Offline (1) |
| Generation               | Project generation (analysis and editing of links).  | Offline     |
| Transfer                 | Transfer project to PLC.   | Online      |
| Debugging                | Project debugging from debug screens, animation tables.  | Online      |
|                          | Modifying the program and parameters.  |             |
| 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.                 | Online      |
|                          | Project, AS-i slave and module diagnostics.  |             |
|                          |  |             |
| Key                      |  |             |
| (1)                      | These various phases can also be performed in the other mode.  |             |



---

# Chapter 4

## AS-i Bus Configuration

---

### Subject of this Chapter

This Chapter describes the Configuration aspect for installing the AS-i bus.

### What Is in This Chapter?

This chapter contains the following topics:

| Topic   | Page |
|---|------|
| How to Add a TBX SAP 10 Module  | 52   |
| How to Access the TBX SAP 10 Module Configuration Screen                          | 55   |
| TBX SAP 10 Module Configuration Screen  | 56   |
| How to Declare a Slave Device on the AS-i Bus                                     | 58   |
| Display of AS-i Devices Connected to the TBX SAP 10 Module in the Project Browser | 61   |
| How to modify the AS-i Bus software configuration                                 | 63   |
| How to access the description of an AS-i slave                                    | 64   |
| How to Define a New Slave Profile in a Private AS-i Catalog                       | 66   |
| How to View the AS-i Slave Configuration  | 68   |

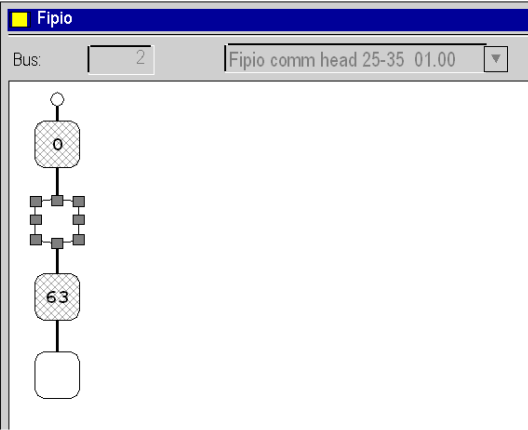
## How to Add a TBX SAP 10 Module

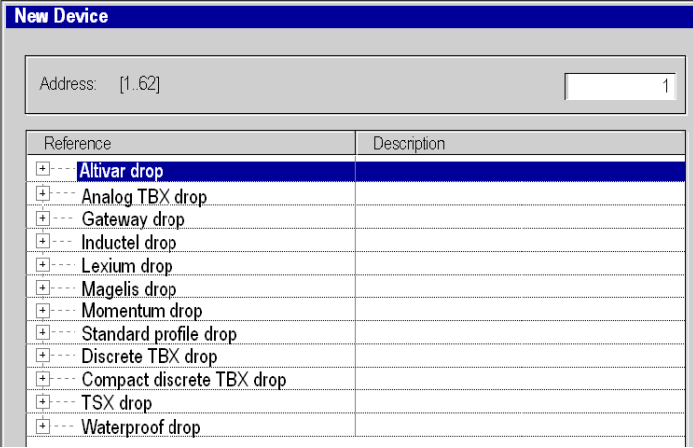
### At a Glance

This operation describes how to add a **TBX SAP 10** module for Premium PLCs.

### Procedure

The following table presents the procedure for adding, using software, a **TBX SAP 10** module to the Fipio bus:

| Step | Action  |
|------|---|
| 1    | <p>In the Fipio sub-directory of the <b>Configuration</b> directory, select the <b>Open</b> command from the contextual menu.</p> <p><b>Result:</b></p>  <p>The screenshot shows a software window titled 'Fipio'. At the top, there is a 'Bus:' field with the value '2' and a dropdown menu showing 'Fipio comm head 25-35 01.00'. Below this is a network diagram. It features a central vertical line with a circular node at the top labeled '0' and a circular node at the bottom labeled '63'. A square node is connected to the bottom of node '63'. To the left of the main vertical line, there is a small square node connected to the line, and a larger square node connected to that square node.</p> |
| 2    | In the <b>Fipio</b> network, select a square representing a connection point containing no address.   |

| Step | Action  |
|------|---|
| 3    | <p>From the contextual menu, select <b>New Device</b>.<br/> <b>Result:</b> the <b>New Device</b> screen appears.</p>  |
| 4    | <p>Enter the number of the connection point corresponding to the address.<br/> By default, the Control Expert software offers the first address of the area selected in step 2.</p>                     |
| 5    | <p>In the <b>Reference</b> field, deploy the <b>Gateway drop</b> element by selecting [+].</p>  |

| Step | Action  |
|------|---|
| 6    | In the <b>Reference</b> field, select the <b>TBX SAP 10</b> module.                               |
| 7    | Validate with <b>OK</b> .<br><b>Result:</b> the module appears in the Fipio configuration window. |

The screenshot shows a software window titled "Fipio". At the top, there is a "Bus:" field with the value "2" and a dropdown menu showing "Fipio comm head 25-35 01.00". Below this, a schematic diagram illustrates the bus configuration. A vertical line represents the bus, with several components connected to it: a circular component at the top, a component labeled "1", and a component labeled "...". A large rectangular module, labeled "TBX SAP 10", is connected to the bus. A yellow callout box points to the module with the text "TBX SAP 10: GATEWAY".

---

## How to Access the TBX SAP 10 Module Configuration Screen

### At a Glance

This operation describes how to access the configuration screen of the **TBX SAP 10** module for Premium PLCs.

### Procedure

The following table presents the procedure for accessing the **TBX SAP 10** module configuration screen on the Fipio bus:

| Step | Action  |
|------|---|
| 1    | In the <b>Fipio</b> sub-directory of the <b>Configuration</b> directory, select the <b>Open</b> command from the contextual menu. |
| 2    | Select the module to open.  |
| 3    | Using the contextual menu, click <b>Open Module</b> .   |

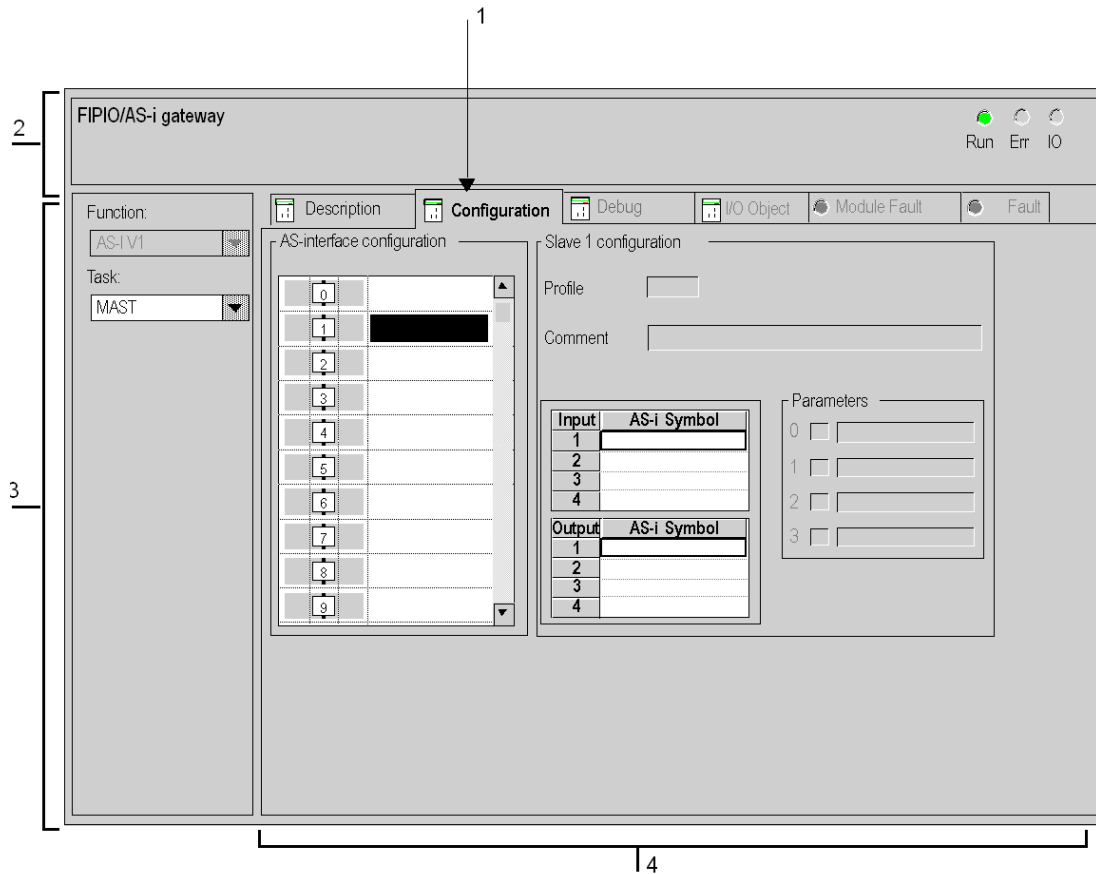
## TBX SAP 10 Module Configuration Screen

### General

The configuration screen is used to configure the required parameters of the **TBX SAP 10** module.

### Illustration

The figure below represents a configuration screen.





## Description

The following table shows the various elements of the configuration screen and their functions.

| Number | Element                                  | Function   |
|--------|--|--|
| 1      | Tabs                                     | <p>The tab in the foreground indicates the mode in progress (<b>Configuration</b> in this example). Every mode can be selected using the respective tab. The available modes are:</p> <ul style="list-style-type: none"> <li>● <b>Description</b> which gives the characteristics of the device,</li> <li>● <b>Configuration</b>,</li> <li>● <b>I/O Objects</b> (see <i>EcoStruxure™ Control Expert, Operating Modes</i>) which is used to presymbolize the input/output objects,</li> <li>● <b>Debug</b> which can be accessed only in online mode,</li> <li>● <b>Fault</b> and <b>Module Fault</b> can only be accessed in online mode.</li> </ul> |
| 2      | <b>Module</b> area                       | <p>This provides a reminder of the module's abbreviated title and the module status in online mode.</p> <p>In the same area there are 3 LEDs which indicate the status of the module in online mode :</p> <ul style="list-style-type: none"> <li>● <b>RUN</b> indicates the operating status of the module.</li> <li>● <b>ERR</b> indicates an internal fault in the module.</li> <li>● <b>I/O</b> indicates a fault from outside the module or an application fault.</li> </ul>   |
| 3      | <b>General parameters</b> area           | <p>This lets you choose the general parameters associated with the channel :</p> <ul style="list-style-type: none"> <li>● <b>Function:</b> the AS-i V1 function is frozen (grayed out).</li> <li>● <b>Task:</b> defines the <b>MAST</b> or <b>FAST</b> task through which the channel's implicit exchange objects will be exchanged.</li> </ul>  |
| 4      | <b>AS-i and Slave Configuration</b> area | <p>This lets you configure the channel configuration parameters. Certain choices may be frozen and appear in gray.</p> <p>It is divided into four areas:</p> <ul style="list-style-type: none"> <li>● The AS-interface configuration,</li> <li>● The characteristics of the selected slave,</li> <li>● The parameters applied to the selected slave,</li> <li>● The symbols of the inputs and outputs associated with a device.</li> </ul>   |

## How to Declare a Slave Device on the AS-i Bus

### At a Glance

Control Expert software offers a catalog of Schneider products which groups together all of the AS-i V2 slaves that are available. This catalog is currently structured according to the following families :

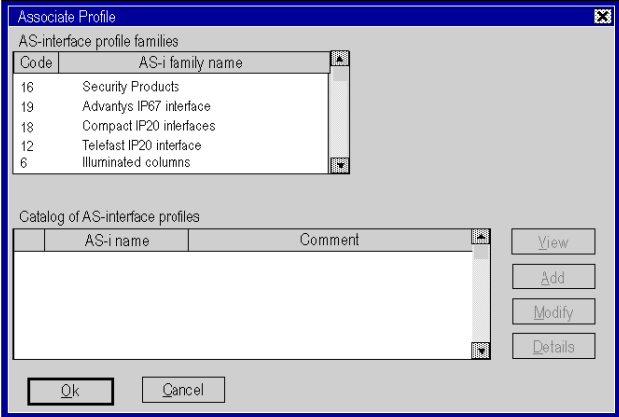
- Security products
- Advantys IP67 interface
- Compact IP20 interfaces
- Telefast IP20 interfaces
- Illuminated columns
- Button box
- Motor-starters
- Private family

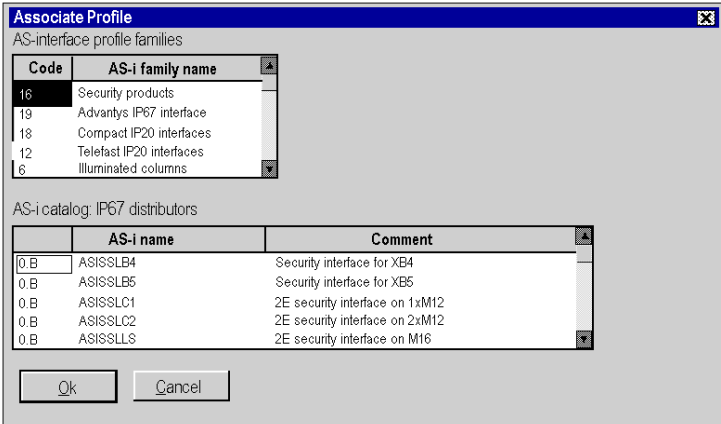
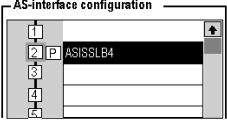
Selecting **Private Family** enables you to manage a specific AS-i device catalogue file via its programming terminal.

**NOTE:** A project using AS-i products from the **Private Family** catalog is always linked to the usage of the same **Private Family** catalog of the workstation on which the catalog was created.

## Procedure

This operation is used to declare a slave device on the AS-i bus.

| Step | Action   |
|------|--|
| 1    | Open the AS-i module to be configured.   |
| 2    | Access the configuration screen by clicking the <b>Configuration</b> tab.  |
| 3    | <p>In the <b>AS-interface configuration</b> area, double click in the cell corresponding to the new slave's host slot number (1 to 31), or select the cell then click <b>Edit</b> → <b>Add an AS-i Slave</b>.<br/> <b>Result:</b> The screen <b>Associate Profile</b> appears.</p>  |

| Step | Action  |
|------|---|
| 4    | <p>In the <b>Profile Families</b> area, select the required family.<br/> <b>Result:</b> The <b>Profile Catalog</b> linked to the selected family appears.</p>  <p><b>Note:</b> It is normal that the following products or families have been removed since they are no longer manufactured, nor marketed:</p> <ul style="list-style-type: none"> <li>● Signaling and control (code 7)</li> <li>● Inductive proximity detector (code 11)</li> <li>● Modular IP67 M12 interface (code 3)</li> <li>● IP67 M12 interface (code 10)</li> <li>● IP67 M8 interface (code 15)</li> <li>● Keyboard (code 5)</li> <li>● Photoelectric detector (code 9)</li> <li>● The XVA-S102 products of luminous columns (code 6)</li> </ul> <p>The products are still listed, but access via families only has been removed. It is no longer possible to add the above products, but if the application was using them, then these products will appear on the configuration screen (no blanks) and everything will operate normally.</p> |
| 5    | <p>In the <b>AS-Interface Profile Catalog</b> select the required device.</p>   |
| 6    | <p>Confirm the selection with <b>OK</b>.<br/> <b>Result:</b> The slave device is defined in its slot, the reference of the connected device appears opposite the number of the slave.</p>    |
| 7    | <p>To connect other slave devices to the AS-i bus, repeat the procedure from step 3.</p>  |

## Display of AS-i Devices Connected to the TBX SAP 10 Module in the Project Browser

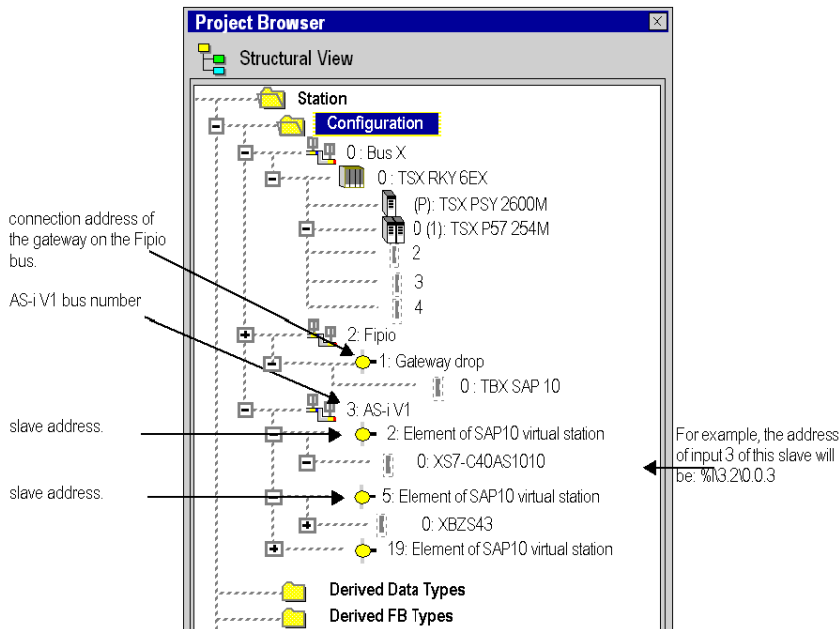
### At a Glance

When you declare a **TBX SAP 10** module on the Fipio bus, the AS-i bus is represented in the **configuration** directory of the project browser. The number of the AS-i bus is calculated automatically by Control Expert. **This value may be modified.**

After having **declared** all the slaves on the AS-i bus and **validated** the configuration, the AS-i slaves also appear on the AS-i bus of the project browser. Each slave appears with its address number.

Displaying the AS-i bus and slaves enables you to know at a glance their topological addressing (*see page 48*).

The following illustration shows the AS-i bus and slaves in the project browser ;



### Modification of the Bus Number

The following instructions describe how to modify the AS-i bus number:

| Step | Action   |
|------|--|
| 1    | Close the configuration screen of the AS-i module (if open).   |
| 2    | In the project browser, right click on the AS-i module and choose properties   |
| 3    | In the <b>Bus Properties</b> window, choose the number of the desired bus (between 1 and 999, inclusively).<br><b>Note:</b> You cannot use the number 2 for the AS-i bus because it is reserved for the Fipio bus. |
| 4    | Click on <b>OK</b> to confirm the change.<br><b>Result:</b> Addressing of slave devices directly associated with the AS-i module is automatically updated.   |

## How to modify the AS-i Bus software configuration

### Introduction

The Control Expert software offers, from the module's configuration screen, a group of functions which allow you to easily modify, in local mode, the software configuration of the AS-i bus.

**NOTE:** standard Windows keyboard shortcut keys (Del, Ctrl-X, Ctrl-C, Ctrl-V) are also available for the following operations:

### Procedure for deleting a slave

This operation allows the deletion of a slave declared on an AS-i Bus.

| Step | Action   |
|------|--|
| 1    | Select the slave to be deleted.                                |
| 2    | Select the command <b>Edit</b> → <b>Delete an AS-i slave</b> . |

### Procedure for moving a slave

This operation allows the movement of a slave declared on an AS-i Bus.

| Step | Action  |
|------|---|
| 1    | Select the slave to be moved.                                 |
| 2    | Select the command <b>Edit</b> → <b>Cut an AS-i slave</b> .   |
| 3    | Select the new required slot.                                 |
| 4    | Select the command <b>Edit</b> → <b>Paste an AS-i slave</b> . |

### Procedure for copying a slave

This operation allows the copying of a slave declared on an AS-i Bus.

| Step | Action  |
|------|---|
| 1    | Select the slave to be copied.                                |
| 2    | Select the command <b>Edit</b> → <b>Copy an AS-i slave</b> .  |
| 3    | Select the slot of the new slave.                             |
| 4    | Select the command <b>Edit</b> → <b>Paste an AS-i slave</b> . |

## How to access the description of an AS-i slave

### At a Glance

The Control Expert software allows access to all the information relating to an AS-i device such as:

- the definition of a profile,
- the details of a profile.

### Definition of a profile

A profile is defined by:

- its name,
- a comment (optional),
- identifiers (IO, ID),
- a number of inputs and/or outputs,
- operation parameters.

### Procedure for accessing information on a profile

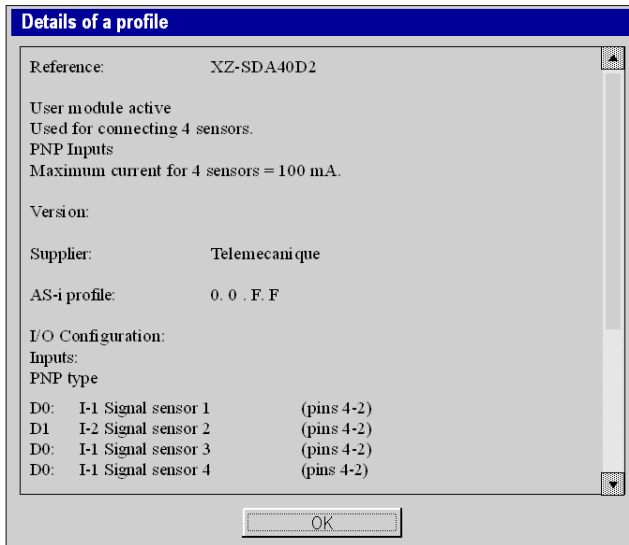
The following table shows the procedure for displaying the characteristics of a slave device.

| Step | Action   |
|------|--|
| 1    | Open the AS-i module to be configured.   |
| 2    | Access the configuration screen by clicking on the tab <b>Configuration</b> .  |
| 3    | Double click on the required slave.<br><b>Result:</b> The window <b>Associate a profile</b> displays and highlights the device in question                                   |
| 4    | Click on the button: <ul style="list-style-type: none"><li>● <b>View</b> to access definition information,</li><li>● <b>Details</b> to access all the information.</li></ul> |



## Details of a profile

The **Details** function allows access, for a given slave, to all the information presented in the catalog file.



## How to Define a New Slave Profile in a Private AS-i Catalog

### At a Glance

The Control Expert software offers the possibility of defining a slave profile that is not provided in the standard catalog.

The new profile thus defined is added to the catalog in **Private family**.

This profile can then be used as a standard catalog profile.

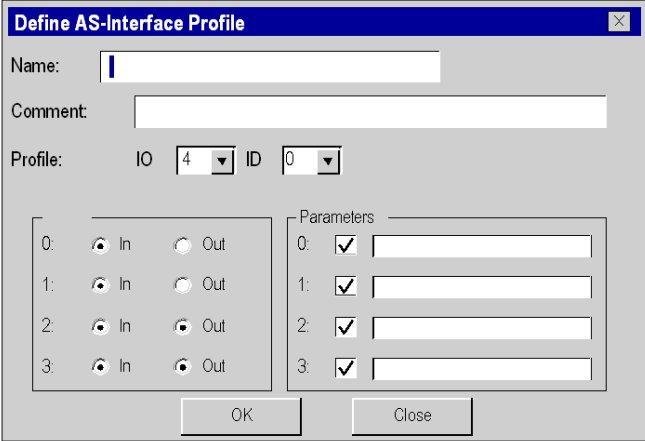
**NOTE:** A profile cannot be deleted, only their name and comment can be changed.

A profile created and added in the catalog is closely linked to the PC on which it was created, and to the programming software. A project converted using Control Expert or opened on another PC that does not have the same catalog will not display the profile's name and comment.

### Procedure

The following table presents the procedure for defining a slave profile, which is not provided in the standard catalog.

| Step | Action  |
|------|---|
| 1    | Access the AS-i module's hardware configuration screen.   |
| 2    | Double click in a slave's host cell (1 to 31).<br><b>Result:</b> the <b>Associate Profile</b> screen appears.                                       |
| 3    | Select <b>Private family</b> in the <b>AS-i family name</b> field.<br><b>Result:</b> the <b>AS-i catalog</b> linked to the selected family appears. |

| Step | Action   |
|------|--|
| 4    | <p>Click on the button <b>Add</b>.<br/> <b>Result:</b> the <b>Define AS-Interface Profile</b> window appears.</p>  |
| 5    | <p>Enter:</p> <ul style="list-style-type: none"> <li>• The name of the new profile,</li> <li>• A comment (optional).</li> </ul>  |
| 6    | <p>Select:</p> <ul style="list-style-type: none"> <li>• The <b>IO</b> code (corresponds to the input/output configuration),</li> <li>• The <b>ID</b> code (identifier).</li> </ul>                   |
| 7    | <p>For each parameter, define:</p> <ul style="list-style-type: none"> <li>• The system's acknowledgement (box checked),</li> <li>• A label (optional).</li> </ul>                                    |
| 8    | <p>Confirm the introduction of a new profile by clicking <b>OK</b>.</p>  |

## How to View the AS-i Slave Configuration

### At a Glance

The **Slave 1 configuration area** of the configuration screen shows the data associated with the slave selected in the **AS-interface configuration area**.

The screenshot shows a window titled "Slave 1 configuration". It contains the following elements:

- Profile:** A text input field.
- Comment:** A larger text input field.
- Input AS-i Symbol:** A table with 4 rows and 2 columns.
- Output AS-i Symbol:** A table with 4 rows and 2 columns.
- Parameters:** A list of 4 parameters, each with a checkbox and a text input field.

| Input | AS-i Symbol |
|-------|-------------|
| 1     |             |
| 2     |             |
| 3     |             |
| 4     |             |

| Output | AS-i Symbol |
|--------|-------------|
| 1      |             |
| 2      |             |
| 3      |             |
| 4      |             |

| Parameters | Checkbox                 | Text Field |
|------------|--------------------------|------------|
| 0          | <input type="checkbox"/> |            |
| 1          | <input type="checkbox"/> |            |
| 2          | <input type="checkbox"/> |            |
| 3          | <input type="checkbox"/> |            |

The data in the **Slave 1 configuration area** cannot be modified from this screen; the parameters can only be activated or deactivated.

The **Slave 1 configuration area** allows you to view:

- The **Profile**: composed of IO and ID data, it is determined by the type of device selected. It is user-defined when a profile has been added.
- The **Comment**: it is determined by the type of device selected. It is user-defined when a profile has been added and can be modified from the **Define AS-Interface Profile** screen.
- The **AS-i Symbol**: the symbols associated with the inputs/outputs of the slave are defined using the variable editor.
- The **Parameters**: they are determined by the type of device selected. They are user-defined when a profile has been added and can be modified from the **Define AS-Interface Profile** screen. The checkboxes can be used to activate or deactivate the parameters, which are all activated by default.

---

# Chapter 5

## Debug and Diagnostics of the AS-I Bus

---

### Subject of this Chapter

This Chapter describes the Debug and Diagnostics aspect of the AS-i bus.

### What Is in This Chapter?

This chapter contains the following topics:

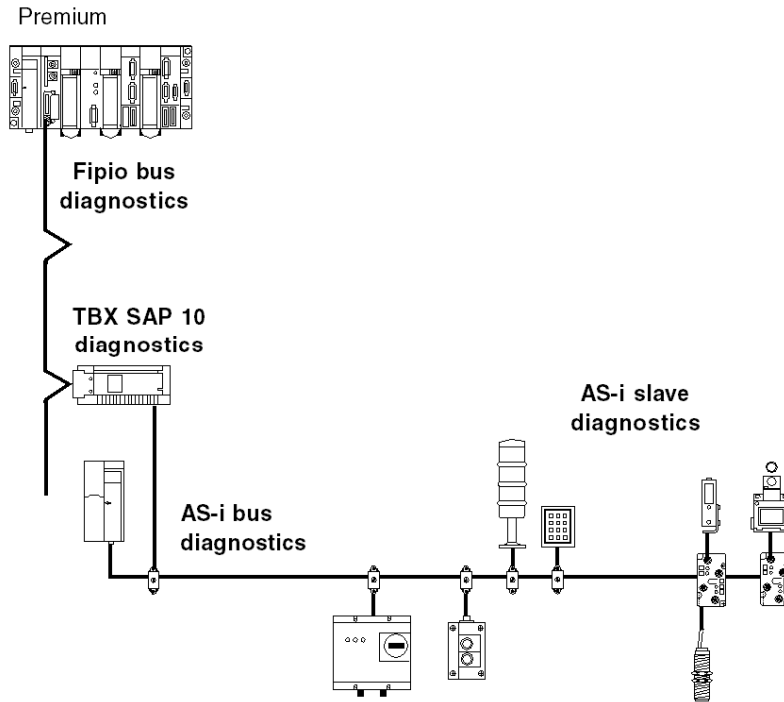
| Topic   | Page |
|---|------|
| Diagnostics   | 70   |
| TBX SAP 10 Module Debug Screen  | 72   |
| How to Access Module and Channel Diagnostics Functions on a TBX SAP 10 Module | 74   |
| AS-i Bus Diagnostics  | 76   |
| Display of Slave Status   | 77   |
| How to Access the Settings of the AS-I Device Parameters                      | 79   |
| How to Access the Force/Unforce Function of the AS-I Channels                 | 80   |
| How to Access the SET and RESET AS-I Output Commands                          | 81   |
| Automatic Replacement of a Faulty AS-i Slave                                  | 82   |
| How to Insert a Slave Device in an Existing AS-i Configuration                | 83   |

## Diagnostics

### General

A malfunction can occur on one of the components of the installation. Each element has a diagnostics function.

Illustration:



### Diagnostics of the Fipio Bus

Different functions are used to perform diagnostics of the Fipio bus (see *Premium and Atrium Using EcoStruxure™ Control Expert, Fipio Bus, Setup Manual*):

- Monitoring screen of the device(s) on the Fipio bus,
- Fipio Bus monitoring screen,
- Communication fault history screen,
- Different implicit and explicit exchange language objects.

### **TBX SAP 10 Module Visual Diagnostics**

The **TBX SAP 10** module is equipped with a display (*see page 43*) block with four LEDs which provide visual diagnostics of the module.

## TBX SAP 10 Module Debug Screen

### General

Diagnostics for the **TBX SAP 10** module are performed from the debug screen. The debug function is used:

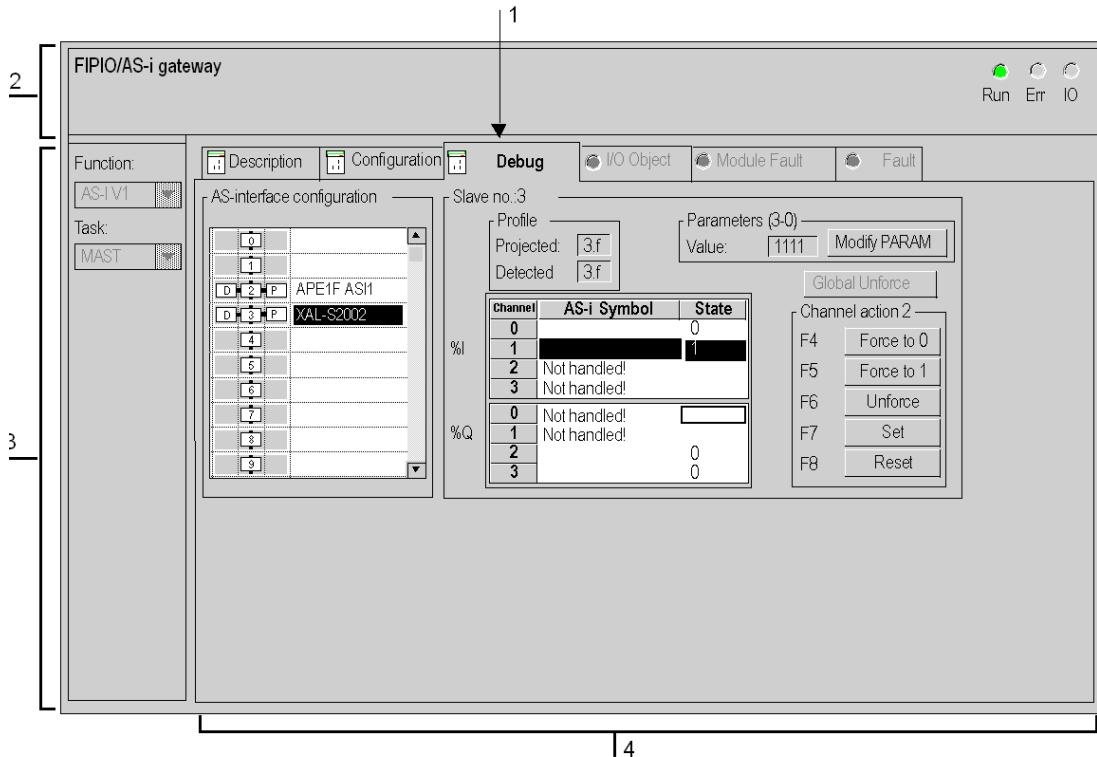
- To display the slave state (connection, parameters etc.),
- To access the adjustment function for the selected channel (channel forcing etc.).

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

**NOTE:** This function is only available in online mode.

### Illustration

The figure below represents a debug screen.





## Description

The following table shows the different elements of the debug screen and their functions.

| Number | Element                                  | Function  |
|--------|--|---|
| 1      | Tabs                                     | <p>The tab in the foreground indicates the mode in progress (<b>Debug</b> in this example). Each mode can be selected using the respective tab. The available modes are:</p> <ul style="list-style-type: none"> <li>● <b>Debug</b> which can be accessed only in online mode,</li> <li>● <b>Fault</b> and <b>Module Fault</b> which can only be accessed in online mode,</li> <li>● <b>Description</b> which gives the characteristics of the device,</li> <li>● <b>I/O Objects</b> (<i>see EcoStruxure™ Control Expert, Operating Modes</i>) which is used to presymbolize the input/output objects,</li> <li>● <b>Configuration</b>.</li> </ul> |
| 2      | <b>Module</b> area                       | <p>Specifies the abbreviated heading of the module.<br/>In the same area there are 3 LEDs which indicate the module's operating mode</p> <ul style="list-style-type: none"> <li>● <b>RUN</b> indicates the operating status of the module,</li> <li>● <b>ERR</b> indicates an internal fault in the module,</li> <li>● <b>I/O</b> indicates a fault from outside the module or an application fault.</li> </ul>   |
| 3      | <b>General parameters</b> area           | Shows the parameters of the <b>MAST</b> or <b>FAST</b> task configured for the AS-i communication channel.  |
| 4      | <b>AS-i and Slave Configuration</b> area | <p>Displays the slave devices connected to the bus.<br/>Displays the status of the slave channels and gives access to the debug functions.</p>  |

## How to Access Module and Channel Diagnostics Functions on a TBX SAP 10 Module

### At a Glance

The functions of the module or channel diagnostics display the current errors which are classed according to their category:

- **internal errors** (internal software errors, communication error with the processor, configuration, parametering or command error),
- **external errors** (slave device failed, AS-i power supply switched off, terminal error, difference between physical configuration and Control Expert configuration),
- **Other errors** (module missing or switched off).

A module or channel fault is indicated when certain LEDS change to red, such as:

- In the Fipio bus screen, the presence of a red square at the connection point between the Fipio/AS-i gateway and the Fipio bus,
- In all screens (the **Description**, **Configuration**, **Debug**, **I/O Object**, **Module Fault** and **Fault** tabs),
  - In the module area by the **I/O** LED,
- In the fault screen which can be accessed from the **Module Fault** screen where the module fault diagnostics are provided,
- In the fault screen which can be accessed from the **Module Fault** screen where the channel fault diagnostics are provided.

The fault is also signaled:

- On the module, on the central display,
- By dedicated language objects: **CH\_ERROR** (%I2.e\r.m.c.ERR) and module error **MOD\_ERROR** (%I2.e\r.m.MOD.ERR), **%MW2.e\r.m.MOD.2**, etc.

### Procedure for Accessing the Module Diagnostics

The following table presents the procedure to access the **Module diagnostics** screen.

| Step | Action   |
|------|--|
| 1    | Open the <b>TBX SAP 10</b> module on which you would like to perform diagnostics.          |
| 2    | Click on the <b>Module Fault</b> tab.<br><b>Result:</b> The list of module faults appears. |

### Procedure for Accessing the Channel Diagnostics

The following table presents the procedure for accessing the **Channel diagnostics** screen.

| Step | Action   |
|------|--|
| 1    | Open the <b>TBX SAP 10</b> module on which you would like to perform diagnostics.    |
| 2    | Click on the <b>Fault</b> tab.<br><b>Result:</b> the list of channel faults appears. |

## AS-i Bus Diagnostics

### AS-i Bus Visual Diagnostics

When a fault occurs on the AS-i bus, the I/O LED on the gateway remains lit as long as this fault remains present. The cause of the fault may be:

- **Missing power supply:** when the AS-i power supply is not present, all LEDs of slaves expected in the reference configuration flash whatever operating mode the **TBX SAP 10** is in,
- **Slave present at address 0:** when a slave with the address 0 is connected to the AS-i bus, the LED 0 of the left-hand row flashes whatever operating mode the **TBX SAP 10** is in,
- **AS-i bus configuration fault:** whatever operating mode the **TBX SAP 10** is in, it constantly compares the real configuration of the AS-i bus with the reference configuration. When a slave is removed or is missing from the AS-i bus, the LED for the address concerned flashes whatever operating mode the **TBX SAP 10** is in. When a slave whose profile differs from the one in the reference configuration is installed on the AS-i bus, the LED for the address concerned lights up if the **TBX SAP 10** is in **configuration** mode (in this case, the slave is still activated), and flashes if the **TBX SAP 10** is in **protected** mode (in which case, the slave is not activated).

## Display of Slave Status

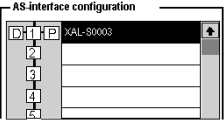
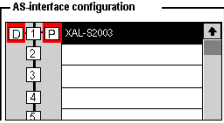
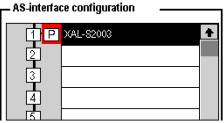
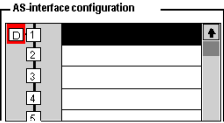
### At a Glance

Slave devices connected to the bus are displayed in the **AS-i Configuration** after clicking on the **AS-i Bus Diag.** button. On each side of the slave number, two different icons are displayed, indicating whether the slave was specified and if it was detected.

**NOTE:** Input image words send back information on the state of the AS-i bus, and not on the inputs. As the PLC is in RUN, the application will have to acknowledge this change in mode, in order not to interpret the state of the AS-i bus instead of the inputs. Bit %I2.e\0.0.0.1 (where **e** is the connection point number for the module on the Fipio bus) indicates this mode.

## Displaying Slave Status

For each slave device, one of the following four scenarios can occur:

| Scenario  | Illustration   | Explanation   |
|---|--|---|
| 1   | <p>Slave status:</p>  <p>The screenshot shows a table with columns 'D' and 'P'. Row 1 has 'D' and 'P' icons. Row 2 has '2' and '2' icons. Row 3 has '3' and '3' icons. Row 4 has '4' and '4' icons. Row 5 has '5' and '5' icons. The title is 'AS-interface configuration' and the address is 'XAL-S0003'.</p>                      | <p>The slave <b>P</b> specified in configuration and the detected slave <b>D</b> are identical.</p>                                       |
| 2   | <p>Slave status:</p>  <p>The screenshot shows a table with columns 'D' and 'P'. Row 1 has a red 'D' icon and a 'P' icon. Row 2 has '2' and '2' icons. Row 3 has '3' and '3' icons. Row 4 has '4' and '4' icons. Row 5 has '5' and '5' icons. The title is 'AS-interface configuration' and the address is 'XAL-S2003'.</p>          | <p>The slave <b>P</b> specified in configuration and the detected slave <b>D</b> are not identical. The slave is declared faulty (1).</p> |
| 3   | <p>Slave status:</p>  <p>The screenshot shows a table with columns 'D' and 'P'. Row 1 has an empty 'D' field and a red 'P' icon. Row 2 has '2' and '2' icons. Row 3 has '3' and '3' icons. Row 4 has '4' and '4' icons. Row 5 has '5' and '5' icons. The title is 'AS-interface configuration' and the address is 'XAL-S2003'.</p>  | <p>A slave <b>P</b> is specified at configuration but no slave is detected. The slave is declared faulty (1).</p>                         |
| 4   | <p>Slave status:</p>  <p>The screenshot shows a table with columns 'D' and 'P'. Row 1 has a red 'D' icon and an empty 'P' field. Row 2 has '2' and '2' icons. Row 3 has '3' and '3' icons. Row 4 has '4' and '4' icons. Row 5 has '5' and '5' icons. The title is 'AS-interface configuration' and the address is 'XAL-S2003'.</p> | <p>An additional slave, not specified at configuration, is connected to the bus. The slave is declared faulty (1).</p>                    |
|   |  |   |
| <p><b>Key:</b></p>  |  |   |
| <p>(1)</p>  | <p>When a slave is faulty, the icons situated beside the number, as well as the <b>AS-i Bus Diag.</b> button and <b>Fault</b> tab turn red.</p>  |   |
|   |  |   |
| <p><b>Note:</b> The <b>Profile</b> field in the <b>Slave area</b> of the debug screen allows you to check if the profiles of the specified (<b>Projected</b>) slave and the <b>Detected</b> slave are really identical.</p> |  |   |

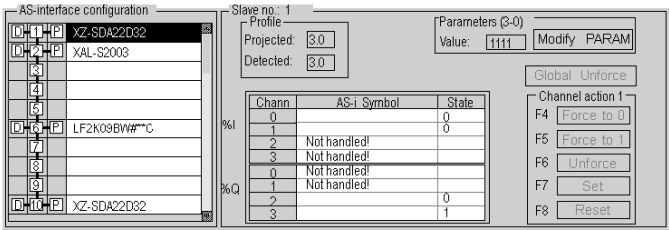
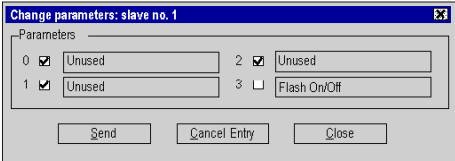
## How to Access the Settings of the AS-I Device Parameters

### At a Glance

The debugging screen of the **TBX SAP 10** module is used, among other things, to access to modification of a slave's parameters.

### Procedure

The following table shows the procedure for modifying the parameters of a slave device declared faulty.

| Step | Action   |
|------|--|
| 1    | Open the Fipio/AS-i gateway to set up.   |
| 2    | Access the diagnostics screen by clicking on the <b>Debug</b> tab.   |
| 3    | <p>In the <b>AS-i Configuration</b> area, select the faulty slave.<br/> <b>Result:</b> in the slave zone of the debug screen, it is possible to read all the information relating to the selected slave.</p>  |
| 4    | <p>Click on the <b>Modify PARAM</b> button situated in the slave zone's <b>Parameters</b> field.<br/> <b>Result:</b> the <b>Modify parameters</b> window appears.</p>                                       |
| 5    | Modify the required parameters.  |
| 6    | Click on <b>Send</b> to take into account the new values.  |

## How to Access the Force/Unforce Function of the AS-I Channels

### At a Glance

This function is used to modify the state of channels linked to the AS-i slave.

The different available commands are:

- For a channel:
  - Forcing to 0, F0 appears in the State column of the table,
  - Forcing to 1, F1 appears in the State column of the table,
  - Unforcing, F must disappear.
- For all channels (when at least one channel is forced):
  - Global unforcing.

### Procedure

The following table shows the procedure for forcing or unforcing the channels linked to an AS-i slave.

| Step | Action for one channel  | Action for all channels  |
|------|---|--|
| 1    | Open the Fipio/AS-i gateway to set up.  |  |
| 2    | Access the diagnostics screen by clicking on the <b>Debug</b> tab.  |  |
| 3    | Select a slave in the <b>AS-i Configuration</b> area.   |  |
| 4    | Select the channel to modify in the slave area table.<br><b>Result:</b> The channel can be modified using the buttons in the <b>Channel action</b> field. | Click on the <b>Global unforcing</b> button in the slave zone. |
|      |   |  |
| 5    | Select the required function (buttons <b>Force to 0</b> or <b>Force to 1</b> or <b>Unforce</b> ) in the <b>Channel Action</b> field.                      |  |



## How to Access the SET and RESET AS-I Output Commands

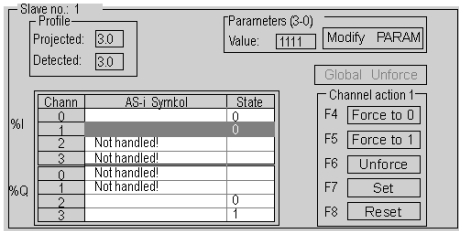
### At a Glance

These commands are used to assign the values 0 (RESET) or 1 (SET) to the outputs of an AS-i slave.

The status of the output affected by one of these commands is temporary and can be modified at any time by the application.

### Procedure

The following table presents the procedure for assigning a value of 0 or 1 to the selected AS-i slave's outputs.

| Step | Action   |
|------|--|
| 1    | Open the Fipio/AS-i gateway to debug.  |
| 2    | Access the diagnostics screen by clicking on the <b>Debug</b> tab.   |
| 3    | Select a slave in the <b>AS-i Configuration</b> area.  |
| 4    | <p>Select the channel to be modified in the <b>Slave</b> area table.</p> <p><b>Result:</b> The channel can be modified using the buttons in the <b>Channel action</b> field.</p>  |
| 5    | Select the required function (buttons <b>Set</b> or <b>Reset</b> ) in the <b>Channel action</b> field.   |

## Automatic Replacement of a Faulty AS-i Slave

### Principle

When a faulty slave is replaced, the replacement slave's address can be automatically programmed if the following two conditions are met:

- The **TBX SAP 10** must operate in **protected** mode,
- Only a single slave may be unserviceable.

In this case, the **TBX SAP 10** signals the fault to the PLC by indicating a configuration error on the AS-i bus.

The replacement of a faulty slave by a slave of the same type occurs without the AS-i bus having to stop, and without requiring any specific manipulation. Two options are available:

- The replacement slave is programmed with the same address using the pocket programmer, and has the same profile as the faulty slave. It will then be automatically inserted into the list of detected slaves (LDS) and list of active slaves (LAS).
- The replacement slave is blank (address 0, new slave) and has the same profile as the faulty slave. It will automatically assume the address of the replaced slave, and will then be inserted into the list of detected slaves (LDS) and the list of active slaves (LAS).

### Procedure

The following table shows the procedure for identifying the address of the faulty slave :

| Step | Action  |
|------|---|
| 1    | Switch the <b>TBX SAP 10</b> to <b>diagnostic</b> mode and check the list of active slaves (LAS). |
| 2    | On the <b>TBX SAP 10</b> display block, check the number of the LED that is flashing.             |

### Procedure

The following table shows the procedure for replacing a faulty slave :

| Step | Action   |
|------|--|
| 1    | Disconnect the faulty slave.   |
| 2    | Connect an identical slave instead (with the same identification and I/O code) at address 0 or at the same address as the slave to be replaced.<br><b>Result:</b> The <b>TBX SAP 10</b> automatically assigns the address of the faulty slave to the new slave connected to the AS-i bus. It is immediately activated and operational. |
| 3    | Make sure that: <ul style="list-style-type: none"> <li>• The I/O LED on the display block is not lit,</li> <li>• On the display block, the LED of the address that was flashing stays permanently on,</li> <li>• The fault sent to the PLC disappears.</li> </ul>  |

## How to Insert a Slave Device in an Existing AS-i Configuration

### At a Glance

It is possible to insert a device into an existing AS-i configuration without having to use the pocket programmer.

This operation is possible once:

- A single slave is absent in the physical configuration,
- The slave which is to be inserted is specified in the Control Expert configuration,
- The slave has the profile expected by the configuration,
- The address of the slave is 0.

The AS-i module will therefore automatically assign to the slave the value predefined in the configuration.

### Procedure

The following table shows the procedure for making the automatic insertion of a new slave effective.

| Step | Action   |
|------|--|
| 1    | Add the new slave in the configuration screen in local mode.     |
| 2    | Carry out a configuration transfer to the PLC in connected mode. |
| 3    | Physically link the new slave with address 0 to the AS-i bus.    |

**NOTE:** An application can be modified by carrying out the above manipulation as many times as necessary.



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# Chapter 6

## Language Objects Associated with the TBX SAP 10 Module

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### Subject of this Chapter

This chapter describes the language objects associated with the **TBX SAP 10** module.

### What Is in This Chapter?

This chapter contains the following sections:

| Section | Topic   | Page |
|---------|---|------|
| 6.1     | The language objects and IODDTs associated with the TBX SAP 10 module | 86   |
| 6.2     | The IODDT T_SAP10_STD Applicable to the TBX SAP 10 Module             | 95   |
| 6.3     | Language Objects Associated with the TBX SAP 10 Module                | 102  |

---

## Section 6.1

### The language objects and IODDTs associated with the TBX SAP 10 module

---

#### Subject of this Section

This section presents general information about language objects and IODDTs associated with the module .

#### What Is in This Section?

This section contains the following topics:

| Topic  | Page |
|--|------|
| Presentation of Language Objects of the TBX SAP 10 Module                            | 87   |
| Implicit Exchange Language Objects Associated with the Application-Specific Function | 88   |
| Explicit Exchange Language Objects Associated with the Application-Specific Function | 89   |
| Management of Exchanges and Reports with Explicit Objects                            | 91   |

---

## Presentation of Language Objects of the TBX SAP 10 Module

### General

The IODDTs are predefined by the manufacturer and contain inputs/output language objects belonging to the channel of a module. The IODDT associated with the TBX SAP 10 gateway is `T_SAP_10`, which is used for all standard Fipio profiles.

Other language objects (except IODDTs) are associated with the TBX SAP 10 (*see page 102*) module.

**NOTE:** IODDT variables may be created in two ways:

- Using the **I/O objects** (*see EcoStruxure™ Control Expert, Operating Modes*) tab,
- Using the Data Editor.

### Language Object Types

Each IODDT contains a group of language objects, which are used to control them and check their operation.

There are two types of language objects:

- **Implicit exchange objects**, which are automatically exchanged on each cycle 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 exchanges concern the status of the modules, the communication signals, the slaves, etc.

Explicit exchanges allow module parametering and diagnostics.

---

## Implicit Exchange Language Objects Associated with the 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.

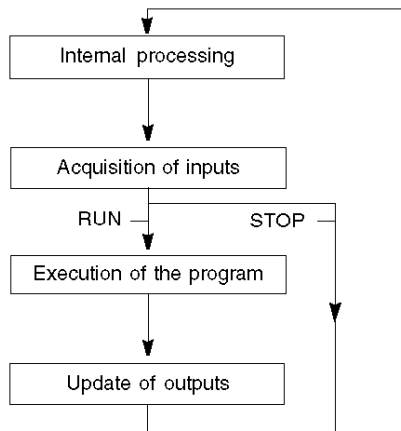
The outputs (%Q and %QW) are updated at the end of the task, only when the PLC is in RUN mode.

**NOTE:** When the task occurs in STOP mode, either of the following are possible, depending on the configuration selected:

- outputs are set to fallback position (fallback mode)
- outputs are maintained at their last value (maintain mode)

### Figure

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





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## Explicit Exchange Language Objects Associated with the Application-Specific Function

### At a Glance

Explicit exchanges are exchanges performed at the user program's request, and using instructions:

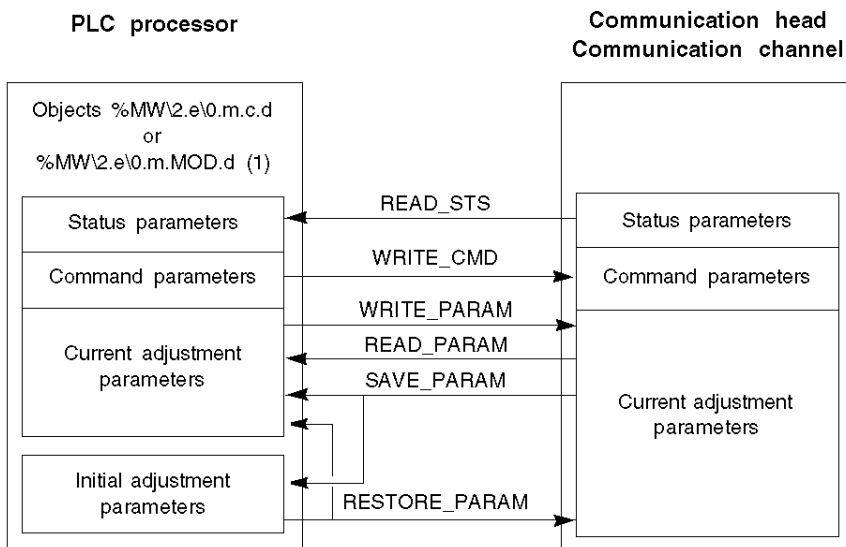
- READ\_STS (*see EcoStruxure™ Control Expert, I/O Management, Block Library*) (read status words)
- WRITE\_CMD (*see EcoStruxure™ Control Expert, I/O Management, Block Library*) (write command words)
- WRITE\_PARAM (*see EcoStruxure™ Control Expert, I/O Management, Block Library*) (write adjustment 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.), and are used to control the modules and to define their operating modes (saving and restoring currently applied adjustment parameters).

## 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.

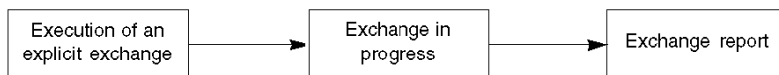
## Managing exchanges

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 page 93*)
- the exchange report (*see page 94*)

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 (%MW $\tau$ .m.c.0) of the IODDT associated to the channel before to call any EF using this channel.

## Management of Exchanges and Reports 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:

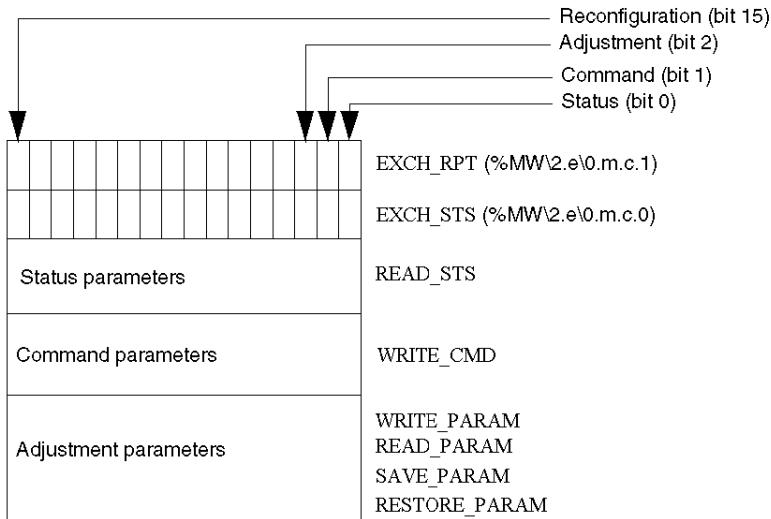
- EXCH\_STS (%MW\2.e\0.m.c.0): exchange in progress
- EXCH\_RPT (%MW\2.e\0.m.c.1): report

**NOTE:** Depending on the localization of the module, the management of the explicit exchanges (%MW0.0.MOD.0.0 for example) will not be detected by the application:

- For in-rack modules, explicit exchanges are done immediately on the local PLC Bus and are finished before the end of the execution task. So, the READ\_STS, for example, is always finished when the %MW0.0.MOD.0.0 bit is checked by the application.
- For remote bus (Fipio for example), explicit exchanges are not synchronous with the execution task. So, the detection is possible by the application.

### Illustration

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



---

## Description of the Significant Bits

Each bit of the words `EXCH_STS` (%MW2.e\0.m.c.0) and `EXCH_RPT` (%MW2.e\0.m.c.1) is associated with a type of parameter:

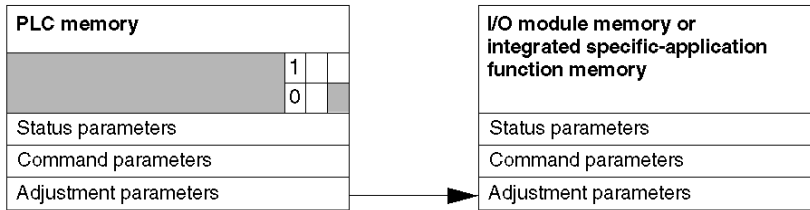
- Rank 0 bits are associated with the status parameters:
  - The `STS_IN_PROGR` bit (%MW2.e\0.m.c.0.0) indicates whether a read request for the status words is in progress.
  - The `STS_ERR` bit (%MW2.e\0.m.c.1.0) specifies whether a read request for the status words is refused by the module channel.
- Rank 1 bits are associated with the command parameters:
  - The `CMD_IN_PROGR` bit (%MW2.e\0.m.c.0.1) indicates whether command parameters are being sent to the module channel.
  - The `CMD_ERR` bit (%MW2.e\0.m.c.1.1) specifies whether the command parameters are refused by the module channel.
- Rank 2 bits are associated with the adjustment parameters:
  - The `ADJ_IN_PROGR` bit (%MW2.e\0.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 (%MW2.e\0.m.c.1.2) specifies whether the adjustment parameters are refused 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:** `m` stands for the position of the module; `c` stands for the channel number in the module.

**NOTE:** Exchange and report words also exist at module level `EXCH_STS` (%MW2.e\0.m.MOD) and `EXCH_RPT` (%MW2.e\0.m.MOD.1) in the IODDT type `T_GEN_MOD`.

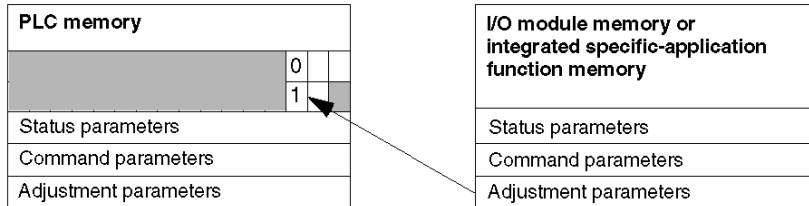
## Example

Phase 1: Sending data by using the `WRITE_PARAM` instruction.



When the instruction is scanned by the PLC processor, the **Exchange in progress** bit is set to 1 in `%MW2.e\0.m.c`.

Phase 2: Analysis of the data by the I/O module and report



When the data is exchanged between the PLC memory and the module, processing by the module is managed by the `ADJ_ERR` bit (`%MW2.e\0.m.c.1.2`): Report (0 = correct exchange, 1 = faulty exchange).

**NOTE:** There is no adjustment parameter at module level.

## Execution Indicators for an Explicit Exchange: `EXCH_STS`

The table below shows the control bits of the explicit exchanges: `EXCH_STS` (`%MW2.e\0.m.c.0`).

| Standard symbol              | Type | Access | Meaning                                     | Address                        |
|------------------------------|------|--------|---|--------------------------------|
| <code>STS_IN_PROGR</code>    | BOOL | R      | Reading of channel status words in progress | <code>%MW2.e\0m.c.0.0</code>   |
| <code>CMD_IN_PROGR</code>    | BOOL | R      | Command parameters exchange in progress     | <code>%MW2.e\0m.c.0.1</code>   |
| <code>ADJ_IN_PROGR</code>    | BOOL | R      | Adjust parameters exchange in progress      | <code>%MW2.e\0m.c.0.2</code>   |
| <code>RECONF_IN_PROGR</code> | BOOL | R      | Reconfiguration of the module in progress   | <code>%MW2.e\0.m.c.0.15</code> |

**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`) = 0), but the words are refreshed.

---

## Explicit Exchange Report: EXCH\_RPT

The table below shows the report bits: EXCH\_RPT (%MW2.e\0.m.c.1).

| Standard symbol | Type | Access | Meaning   | Address           |
|-----------------|------|--------|---|-------------------|
| STS_ERR         | BOOL | R      | Error in reading status words of the channel<br>(1 = failure) | %MW2.e\0.m.c.1.0  |
| CMD_ERR         | BOOL | R      | Error when exchanging command parameters<br>(1 = failure)     | %MW2.e\0.m.c.1.1  |
| ADJ_ERR         | BOOL | R      | Error when exchanging adjustment parameters<br>(1 = failure)  | %MW2.e\0.m.c.1.2  |
| RECONF_ERR      | BOOL | R      | Fault when reconfiguring the channel<br>(1 = failure)         | %MW2.e\0.m.c.1.15 |

---

## Section 6.2

### The IODDT T\_SAP10\_STD Applicable to the TBX SAP 10 Module

---

#### Subject of this Section

This section presents the IODDT T\_SAP10\_STD applicable to the TBX SAP 10 module.

#### What Is in This Section?

This section contains the following topics:

| Topic  | Page |
|--|------|
| Details of the TBX SAP 10-Type IODDT Implicit Exchange Objects | 96   |
| Details of T_SAP10_STD-type IODDT Explicit Language Objects    | 99   |

## Details of the TBX SAP 10-Type IODDT Implicit Exchange Objects

### At a Glance

These are the objects whose exchanges are carried out automatically on each cycle of the task in which the **TBX SAP 10** module is configured.

### Error Bit Object

The following table presents the meaning of the bit %I2.e\0.0.MOD.ERR:

| Function     | Type | Access | Meaning                              | Object            |
|--------------|------|--------|--------------------------------------|-------------------|
| Module fault | BOOL | R      | Indicates that the module is faulty. | %I2.e\0.0.MOD.ERR |

### List Status Word Object

These objects are exchanged by setting the bit (*see page 97*) %I2.e\0.0.0.1 to 1; they show the status of the information lists concerning the bus slaves (*see page 18*) (LDS, LPS and LAS).

**NOTE:** Input image words send back information of the state of the AS-i bus, and not on the inputs. As the PLC is in RUN, the application will have to acknowledge this change in mode, in order not to interpret the state of the AS-i bus instead of the inputs. The bit %I2.e\0.0.0.1 indicates this mode.

### Word Object

The following table presents the meanings of the %IW2.e\0.0.0 to %IW2.e\0.0.6 words:

| Standard symbol | Type | Access | Meaning   | Object(1)      |
|-----------------|------|--------|---|----------------|
| DIAG_IN_SAP10   | INT  | R      | Bits 0 to 3 repeat information from inputs ( <i>see page 97</i> ) %I2.e\0.0.0.0 to %I2.e\0.0.0.3. The other bits are not used.                    | %IW2.e\0.0.0.0 |
| LDS_0           | INT  | R      | List of detected slaves from 0 to 15.<br>bit n = 1 if slave n in the list.<br>Example:<br>slave 12 detected if word bit %IW2.e\0.0.0.1.12 = 1.    | %IW2.e\0.0.0.1 |
| LDS_16          | INT  | R      | List of detected slaves from 16 to 31.<br>bit n = 1 if slave n+16 in the list.<br>Example:<br>slave 18 detected if word bit %IW2.e\0.0.0.2.2 = 1. | %IW2.e\0.0.0.2 |
| LPS_0           | INT  | R      | Projected slave list from 0 to 15.<br>bit n = 1 if slave n in the list.<br>Example:<br>slave 12 projected if word bit %IW2.e\0.0.0.3.12 = 1.      | %IW2.e\0.0.0.3 |



| Standard symbol | Type  | Access | Meaning   | Object(1)      |
|-----------------|---|--------|---|----------------|
| LPS_16          | INT   | R      | Projected slave list from 16 to 31.<br>bit n = 1 if slave n+16 in the list.<br>Example:<br>slave 18 projected if word bit %IW2.e\0.0.0.4.2 =1.  | %IW2.e\0.0.0.4 |
| LAS_0           | INT   | R      | List of active slaves from 0 to 15.<br>bit n = 1 if slave n in the list.<br>Example:<br>slave 12 activated if word bit %IW2.e\0.0.0.5.12 =1.    | %IW2.e\0.0.0.5 |
| LAS_16          | INT   | R      | List of active slaves from 16 to 31.<br>bit n = 1 if slave n+16 in the list.<br>Example:<br>slave 18 activated if word bit %IW2.e\0.0.0.6.2 =1. | %IW2.e\0.0.0.6 |
| Legend:         |   |        |   |                |
| (1)             | %IW2.e\0.0.0.0 to %IW2.e\0.0.0.6<br>with e = Fipio connection point |        |   |                |

### Diagnostic Inputs

Inputs %I2.e\0.0.0.0 to %I2.e\0.0.0.3 (e is the Fipio connection point) permanently contain information on the status of the AS-i bus and the operating mode in progress for the **TBX SAP 10** module.

The following table describes the objects %I2.e\0.0.0.0 to %I2.e\0.0.0.3:

| Symbol    | Type | Access | Meaning   | Object        |
|-----------|------|--------|---|---------------|
| MODE_PROT | INT  | R      | bit 1 = 1: the <b>TBX SAP 10</b> module operates in <b>Protected</b> mode and activates only the slaves whose configuration is identical to that of the reference configuration.<br>bit 0 = 0: the <b>TBX SAP 10</b> module operates in <b>Configuration</b> mode and activates all slaves present on the bus AS-i bus. | %I2.e\0.0.0.0 |
| MODE_DIAG | INT  | R      | bit 1 = 1: the <b>TBX SAP 10</b> module operates in <b>Diagnostic</b> mode, and in this case, lists of detected, programmed and activated slaves are sent back, and not AS-i bus inputs. In this mode, the AS-i bus outputs are always positioned.  | %I2.e\0.0.0.1 |
| DIFF_CONF | INT  | R      | bit 1 = 1: indicates a discrepancy between the actual AS-i bus configuration and the reference configuration stored in the <b>TBX SAP 10</b> non volatile memory.<br>This bit can switch to 1 regardless of the <b>TBX SAP 10</b> operating mode (Configuration, Protected, Diagnostic).                                | %I2.e\0.0.0.2 |
| ADDRESS_0 | INT  | R      | bit 1 = 1: indicates the presence of a slave at address 0 on the AS-i bus.  | %I2.e\0.0.0.3 |

---

## Channel Error, CH\_ERROR

The table below presents the error bit %I2.e\0.m.c.ERR:

| Standard symbol | Type | Access | Meaning                              | Object          |
|-----------------|------|--------|--------------------------------------|-----------------|
| CH_ERROR        | BOOL | R      | Indicates that the module is faulty. | %I2.e\0.m.c.ERR |

---

## Details of T\_SAP10\_STD-type IODDT Explicit Language Objects

### At a Glance

The tables below present the T\_SAP10\_STD-type IODDT explicit objects that are applicable to all Fipio standard profiles.

### Execution Indicators of an Explicit Exchange: EXCH\_STS

The table below presents the meanings of the exchange control bits of the channel EXCH\_STS (%MW2.e\0.m.c.0).

| Standard symbol | Type | Access | Meaning  | Address           |
|-----------------|------|--------|--|-------------------|
| STS_IN_PROGR    | BOOL | R      | Reading of channel status words in progress.     | %MW2.e\0.m.c.0.0  |
| CMD_IN_PROGR    | BOOL | R      | Current command parameters exchange in progress. | %MW2.e\0.m.c.0.1  |
| ADJ_IN_PROGR    | BOOL | R      | Adjustment parameters exchange in progress.      | %MW2.e\0.m.c.0.2  |
| RECONF_IN_PROGR | BOOL | R      | Reconfiguration in progress.                     | %MW2.e\0.m.c.0.15 |

### Explicit Exchange Report: EXCH\_RPT

The table below presents the meaning of the exchange report bits EXCH\_RPT (%MW2.e\0.m.c.1).

| Standard symbol | Type | Access | Meaning                                      | Address           |
|-----------------|------|--------|--|-------------------|
| STS_ERR         | BOOL | R      | Reading error for channel status words.      | %MW2.e\0.m.c.1.0  |
| CMD_ERR         | BOOL | R      | Error during command parameter exchange.     | %MW2.e\0.m.c.1.1  |
| ADJ_ERR         | BOOL | R      | Error during adjustment parameters exchange. | %MW2.e\0.m.c.1.2  |
| RECONF_ERR      | BOOL | R      | Error when configuring channel.              | %MW2.e\0.m.c.1.15 |

## Standard Channel Faults, CH\_FLT

The status word CH\_FLT provides information on all slaves on the AS-i communication channel.

This 16-bit word contains diagnostics information for the **TBX SAP 10** module and diagnostics information relating to exchanges with the **TBX SAP 10** across the Fipio network.

The following table shows the meaning of the bits of the status word CH\_FLT (%MW2.e\0.m.c.2).

| Standard symbol | Type | Access | Object            | Meaning  | Function                                    |
|-----------------|------|--------|-------------------|--|---|
| -               | BOOL | R      | %MW2.e\0.m.c.2.0  | bit 0: not used.                                 | Statuses generated by the <b>TBX SAP 10</b> |
| ASI_CONF_FLT    | BOOL | R      | %MW2.e\0.m.c.2.1  | AS-i bus configuration fault.                    |   |
| SLAVE0_FLT      | BOOL | R      | %MW2.e\0.m.c.2.2  | slave present at address 0 on AS-i bus.          |   |
| ASI_SUPPLY_FLT  | BOOL | R      | %MW2.e\0.m.c.2.3  | AS-i power supply missing.                       |   |
| INTERNAL_FLT    | BOOL | R      | %MW2.e\0.m.c.2.4  | internal module fault (failure).                 |   |
| CONF_FLT        | BOOL | R      | %MW2.e\0.m.c.2.5  | hardware configuration fault.                    |   |
| COM_FLT         | BOOL | R      | %MW2.e\0.m.c.2.6  | communication fault with PLC.                    |   |
| APPLI_FLT       | BOOL | R      | %MW2.e\0.m.c.2.7  | application fault.                               | Statuses generated by the PLC               |
| PLC_CONF_FLT    | BOOL | R      | %MW2.e\0.m.c.2.8  | PLC configuration fault.                         |   |
| MOD_MISSING     | BOOL | R      | %MW2.e\0.m.c.2.9  | module missing.                                  |   |
| MOD_NOT_OP      | BOOL | R      | %MW2.e\0.m.c.2.10 | module not operational.                          |   |
| MOD_FLT         | BOOL | R      | %MW2.e\0.m.c.2.11 | module fault.                                    |   |
| PLC_HW_FLT      | BOOL | R      | %MW2.e\0.m.c.2.12 | internal fault, PLC hardware fault.              |   |
| PLC_SYS_FLT     | BOOL | R      | %MW2.e\0.m.c.2.13 | internal fault, PLC system fault.                |   |
| FIP_COM_FLT     | BOOL | R      | %MW2.e\0.m.c.2.14 | dialog fault, Fipio communication fault.         |   |
| PRM_FLT         | BOOL | R      | %MW2.e\0.m.c.2.15 | dialog fault, <b>TBX SAP 10</b> parameter error. |   |

- ASI\_CONF\_FLT corresponds to the error bit %MW2.e\0.0.0.2.1, and indicates a discrepancy between the actual AS-i bus configuration and the reference configuration. If the **TBX SAP 10** module is in:
  - **Protected** mode, the slaves at the addresses concerned are no longer active.
  - **Configuration** mode, this fault is indicated but the slaves at the addresses concerned remain active.
- SLAVE0\_FLT corresponds to word bit %MW2.e\0.0.0.2.2, and indicates the presence of a slave at address 0 on the AS-i bus. This has no effect on AS-i bus operation, but generates an AS-i bus configuration error.
  - When this bit is at 1, it is not possible to switch from **Configuration** to **Protected** mode.

- `ASI_SUPPLY_FLT` corresponds to word bit `%MW2.e\0.0.0.2.3`, and indicates missing AS-i bus power supply.  
When this bit is at 1:
  - All the outputs of the AS-i bus are set to 0,
  - All the inputs of the AS-i bus sent back to PLC are equal to 0.

### Slave Parameters, PRM SLV

The following table presents the language objects that contain the value of the parameters sent to the AS-i intelligent slaves using the **TBX SAP 10** module.

| Standard symbol                                      | Type | Access | Meaning  | Address  |
|--|------|--------|--|--|
| <code>PRM_SLV_0</code> to<br><code>PRM_SLV_31</code> | INT  | RW     | Parameters of slave 0 to slave 31. Contains the reply (value of the parameters sent) from the last slave parameterized. This allows you to verify via Control Expert that the slave has received them correctly. | <code>%MW2.e\0.m.c.4</code> to<br><code>%MW2.e\0.m.c.35</code> |

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## Section 6.3

### Language Objects Associated with the TBX SAP 10 Module

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#### Subject of this Section

This section presents the language objects linked to the TBX SAP 10 modules.

#### What Is in This Section?

This section contains the following topics:

| Topic   | Page |
|---|------|
| Explicit Exchange Language Objects, TBX SAP 10 Module Status            | 103  |
| Language Objects Associated with Configuration of the TBX SAP 10 Module | 104  |
| Operating phases  | 105  |

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## Explicit Exchange Language Objects, TBX SAP 10 Module Status

### At a Glance

The %MW\2.e\0.0.MOD.2 word contains the module status word. This is an explicit exchange word.

### Status Word

The table below shows the meaning of the bits of the status word (%MW\2.e\0.0.MOD.2):

| Object              | Type | Access | Meaning              |
|---------------------|------|--------|----------------------|
| %MW\2.e\0.0.MOD.2.0 | BOOL | R      | internal fault.      |
| %MW\2.e\0.0.MOD.2.1 | BOOL | R      | configuration fault. |
| %MW\2.e\0.0.MOD.2.2 | BOOL | R      | line fault.          |

## Language Objects Associated with Configuration of the TBX SAP 10 Module

### At a Glance

This page describes all the configuration language objects associated with the **TBX SAP 10** module. These objects are initialized from the configuration screen. They are transmitted to the module when a new configuration is received or upon warm or cold restart. They can be displayed by the application program.

### Syntax

These configuration objects have the following syntax:

|        |             |   |  |   |             |   |                    |   |         |   |      |
|--------|-------------|---|--|---|-------------|---|--------------------|---|---------|---|------|
| %      | KW          | \ | 2.e                                      | \ | 0           | . | 0                  | . | c       | . | d    |
| Symbol | Object type |   | Bus number<br>and<br>Fipio<br>connection |   | Rack<br>No. |   | Module<br>position |   | Channel |   | Rank |

### Configuration Objects

The following table describes the configuration objects:

| Object                                | Function  | Meaning   |
|---------------------------------------|---|---|
| %KW2.e\0.0.0.0                        | AS-i master   | Octet 0 = 10 AS-i identification in the application-specific communication function.  |
| %KW2.e\0.0.0.1                        | LPS   | Projected slave list.<br>bit n = 1 if slave n in the list.  |
| %KW2.e\0.0.0.2                        | LPS   | Projected slave list.<br>bit n = 1 if slave n in the list.  |
| %KW2.e\0.0.0.3 to<br>%KW2.e\0.0.0.18  | I/O configuration<br>I/O and identification code (ID) | Byte 0 = slave 0.<br>bit 0 to 3: I/O configuration and bit 4 to 7: Identification.<br>Byte 1 = slave 1.<br>bit 0 to 3: I/O configuration and bit 4 to 7: identification |
| %KW2.e\0.0.0.20 to<br>%KW2.e\0.0.0.51 | Information on the catalog                            | Identification of the slave 0 to 31.  |

**NOTE:** LPS is the list of projected slaves. In compliance with the AS-i standard, this is the list of slaves that must be acknowledged when a configuration is received. In this case, the AS-i bus is in AS-i protected mode. AS-i protected mode corresponds to the mode configured in Control Expert.



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## Operating phases

### At a Glance

Several operating phases exist for the **TBX SAP 10** module. These different phases use certain language objects.

### Table

The following table shows the different operating phases:

| Phase | Description  |
|-------|--|
| 1     | <b>Initialization of the PLC:</b> <ul style="list-style-type: none"><li>• The <b>TBX SAP 10</b> module must be in configuration mode (%I2.e\0.0.0.0 = 0,</li><li>• Initialization of the <b>TBX SAP 10</b> module with the configuration values,</li><li>• The AS-i outputs are set to 0.</li></ul>  |
| 2     | <b>Access to AS-i slaves:</b> <ul style="list-style-type: none"><li>• The PLC can access all AS-i slaves.</li></ul>  |
| 3     | <b>Switching to protected mode:</b> <p>Switching from configuration mode to protected mode triggers re-initialization of the <b>TBX SAP 10</b> module, which involves:</p> <ul style="list-style-type: none"><li>• Change in the word %MW2.e\0.0.0.2,</li><li>• Setting the configuration fault bit (%MW2.e\0.0.0.2.8) to 1,</li><li>• Signaling of an external fault by the processor,</li><li>• The input validation word is equal to 1.</li></ul> <p>When the reinitialization of the <b>TBX SAP 10</b> module has been completed, the configuration fault bit (%MW2.e\0.0.0.2.8) switches to 0 and the external fault disappears.</p> <p>Reinitialization of the module is complete when bit 0 of the input validation word is equal to 0: the <b>TBX SAP 10</b> is now ready to operate.</p> <p>If the module is in protected mode, one of the following elements triggers reconfiguration of the module:</p> <ul style="list-style-type: none"><li>• Switching to STOP-RUN,</li><li>• Powering-up the PLC;</li><li>• Disconnection of the Fipio connection,</li><li>• Module power supply fault.</li></ul> |
| 4     | <b>Switching to diagnostic mode:</b> <p>The state of the AS-i bus can be displayed in diagnostic mode by switching the value of the word %MW2.e\0.0.0.4 from 1 to 3 or by clicking the <b>AS-I Bus Diag.</b> button in the debug screen.</p>   |
| 5     | <b>Quitting diagnostic mode:</b> <p>To quit diagnostic mode, simply switch the value of the word %MW2.e\0.0.0.4 from 3 to 1.</p>   |

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## Precautions

**NOTE:** In phase 3, you cannot access slave inputs-outputs as long as reinitialization of the module has not been completed during the transition from configuration to protected mode. The application must acknowledge this transition phase by monitoring the input validity word.

In diagnostic mode of phase 4, input image words send back information on the state of the AS-i bus (lists of detected, programmed and activated slaves) and not on the inputs. As the PLC is in RUN, the application will have to acknowledge this change in mode, in order not to interpret the state of the AS-i bus instead of the inputs, as the outputs are still active in this operating mode.



## A

addressing  
    topological, *104*  
addressing  
    modules, *41*

## C

channel data structure for AS-interface modules  
    T\_SAP10\_STD, *95*  
configuration mode, *21*  
configuring, *51*  
connecting, *42*

## D

debugging, *69*  
diagnosing, *43*  
diagnostics, *69*  
diagnostics mode, *21*

## P

parameter settings, *85*  
protected mode, *21*

## T

T\_SAP10\_STD, *95*  
TBXSAP10, *35*  
topologies, *40*

