

Quantum using EcoStruxure™ Control Expert

140 EIA 921 00 AS-i Bus Interface Module User Manual

(Original Document)

12/2018

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

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

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

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

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Safety Information



Important Information

NOTICE

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



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



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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

PLEASE NOTE

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

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

About the Book



At a Glance

Document Scope

This document describes the hardware and software implementation of the AS-i Bus.

Validity Note

This document 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 www.schneider-electric.com .
2	In the Search box type the reference of a product or the name of a product range. <ul style="list-style-type: none">• Do not include blank spaces in the reference or product range.• To get information on grouping similar modules, use asterisks (*).
3	If you entered a reference, go to the Product Datasheets search results and click on the reference that interests you. If you entered the name of a product range, go to the Product Ranges search results and click on the product range that interests you.
4	If more than one reference appears in the Products 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 Download XXX product datasheet .

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.

Product Related Information

WARNING

UNINTENDED EQUIPMENT OPERATION

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

Follow all local and national safety codes and standards.

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

Part I

The AS-i Bus

Chapter 1

General introduction to the AS-i bus

Aim of this Chapter

This chapter provides a general introduction to the AS-i bus.

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Review of the AS-i bus	12
Overview of AS-i products from the Schneider catalog	14
Introduction to the Main Constituent Elements	15
Example of AS-i bus topology	20
Slaves	21

Review of the AS-i bus

General

The AS-i bus is a field bus (level 0) and can be used to connect sensors/actuators. This allows "Discrete" type information to be routed between a bus master and sensor/actuator slaves.

AS-i is composed of three main standard elements:

- A dedicated power supply providing 30 V DC voltage.
- A bus master.
- Slaves (sensors and actuators).

The main types of sensors/actuators

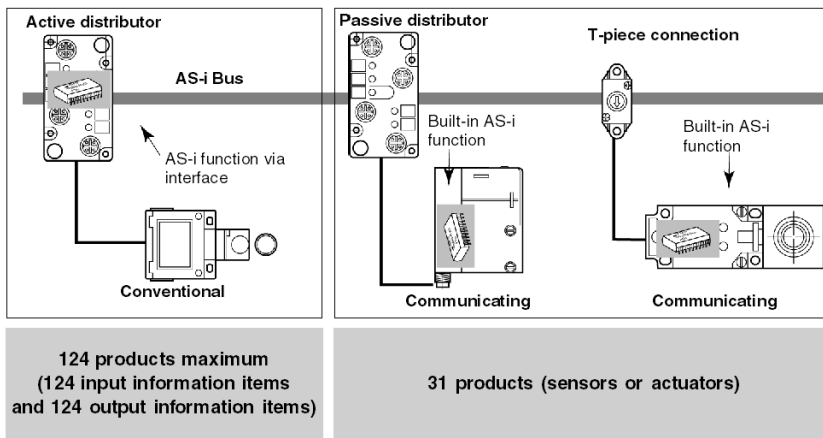
1. Communication sensors/actuators:

With a built-in AS-i function they link up directly to the AS-i bus via a passive distributor or a T-piece connection.

2. The traditional IP65 sensors/actuators:

They connect to the bus via an AS-i interface (active distributor or Telefast IP20 discrete input-output bus interface). These interfaces are used to connect conventional sensors and actuators to the AS-i bus and provide them with capacity for dialog on the bus.

Illustration:



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 is adapted to meet the user's needs (point to point, on line, tree structure etc.).

In every case, the total length of all the branches of the bus must not exceed 100 meters without a relay.

AS-i Bus Cycle Time

This is the cycle time between slave(s) and the **140 EIA 921 00** module.

The AS-i system always transmits information, which is 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.

Reliability, Flexibility

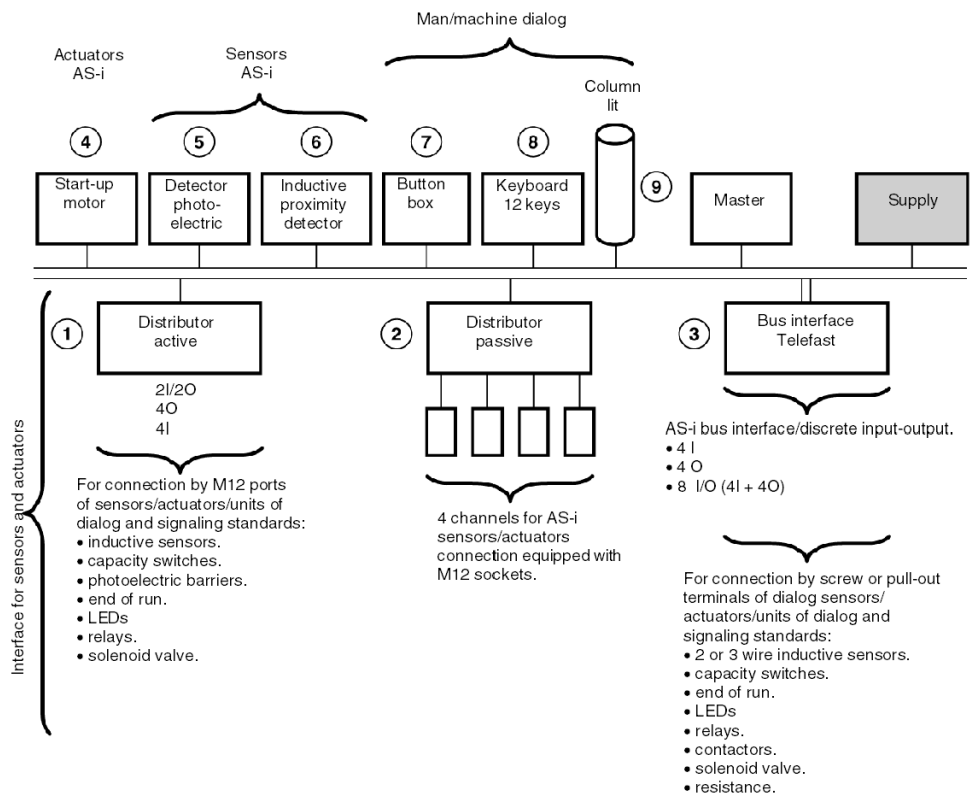
Reliable operation is ensured by the transmission process used (Manchester current and coding modulation). The master monitors the line supply voltage and the data sent. It detects transmission errors as well as slave failures, and sends the information to the PLC.

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

Overview of AS-i products from the Schneider catalog

General

Non-exhaustive list of AS-i products from the Schneider catalog:



Introduction to the Main Constituent Elements

Cable

This transmits data and carries the power. It can be made up from:

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

Illustration:



Polarized
ribbon cable

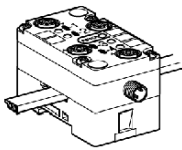


Round cable

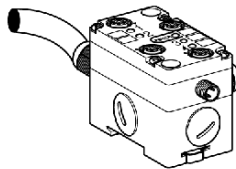
Active distributors

IP67 sealed interfaces for connecting sensors/actuators using M12 connectors. These distributors are used to connect "traditional", non-communicating sensors/actuators.

Illustration:



Active distributor for
ribbon cable

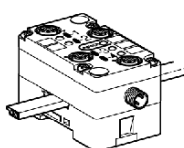


Active distributor for
round cable

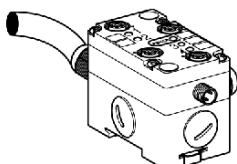
Passive distributors

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.

Illustration:



Passive distributor
for ribbon cable

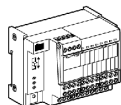


Passive distributor
for round cable

SB2 Telefast discrete inputs-outputs/bus interface

IP20 sealed interface with built-in AS-i function. It enables connection to all types of "traditional" non-communicating sensors/actuators via screw terminal blocks.

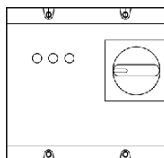
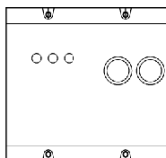
Illustration:



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 V AC.

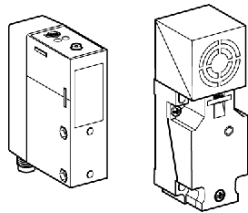
Illustration:



AS-i sensors

- Photo-electric detectors:
They ensure that all kinds of objects (opaque, reflective etc.) are detected with 5 basic systems: barrier, reflex, polarized reflex, proximity and proximity with background blanked out. They offer an IP67 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 IP67 protection level.

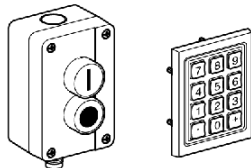
Illustration:



Man-machine interface products

- Button boxes:
These are made up of dialog tools, which are adapted to exchanging information between the operator and machine.
- Keyboards:
Man/machine dialog tools, these have 12 touch sensitive keys. The information delivered is coded in BCD on 4 bits. They offer an IP65 protection level.

Illustration:



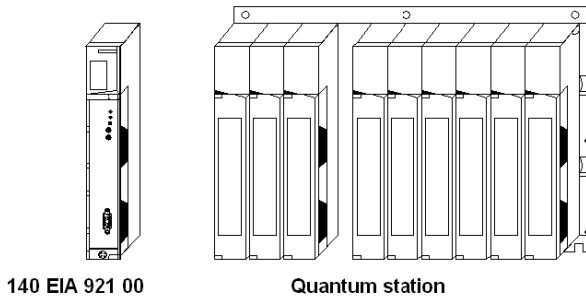
Signaling elements

- Illuminated indicator banks:
Optical or sound signaling elements.

Bus Master

Built into a Quantum PLC station, the **140 EIA 921 00** module (AS-i bus master) manages all data exchanges on the AS-i bus.

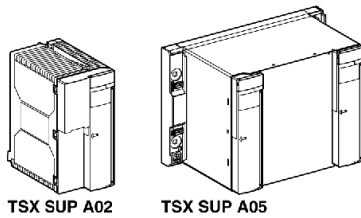
Illustration:



AS-i Power Supply

AS-i dedicated power supply, 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.

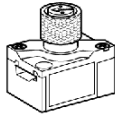
Illustration:



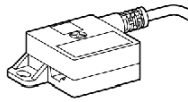
Connecting and branching accessories

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

Illustration:



T-piece for
ribbon cable

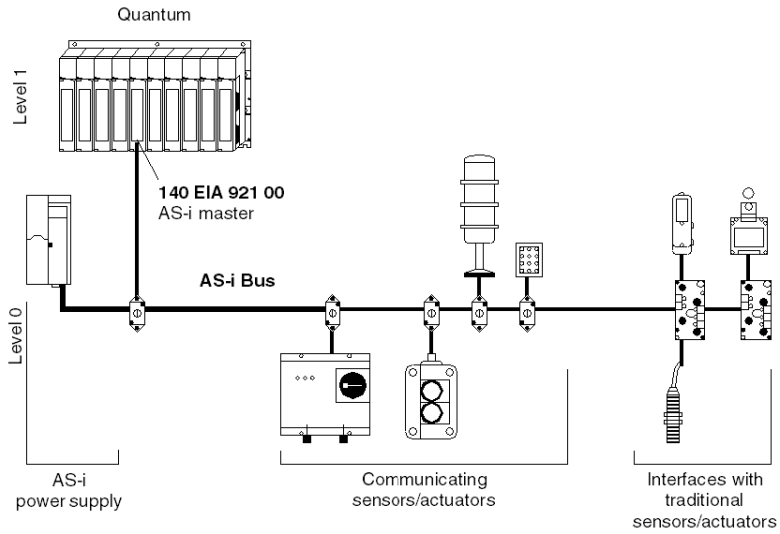


Ribbon/Round cable
branch

Example of AS-i bus topology

General

Illustration:



Slaves

At a Glance

The AS-i bus is used to interconnect 31 standard address devices.

The standard address slaves each have:

- 4 input bits,
- 4 output bits,
- 4 parametering bits.

The AS-i bus can manage a maximum of 124 standard address slave Inputs and 124 Outputs.

Each slave has its own address and a profile (defines variables exchange).

Structure

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 transmits:

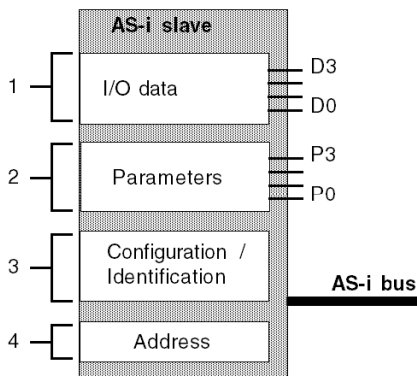
- 4 data bits (D0 to D3), which are the image of inputs or outputs according to the nature of the interface.
- 4 parametering bits (P0 to P3), which are used to set the operating modes of the interface.
P0 to P3 bits are used for "intelligent" devices, including AS-i ASIC (specific integrated circuit).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

Structure Illustration

The figure below shows the structure of a standard address slave.



Description of Constituent Elements

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

Address	Item	Description
1	Input/output data	Input data is stored by the slave and made available for the AS-i master. Output data is updated by the master module.
2	Parameters	The parameters are used to control and switch internal operating modes to the sensor or the actuator.
3	Configuration/Identification	This field contains: <ul style="list-style-type: none"> the code which corresponds to I/O configuration, the slave identification codes (ID, ID1, ID2).
4	Address	Physical address of slave.
<p>Note: The operating parameters, address, configuration and identification data are saved in a non-volatile memory.</p>		

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 a terminal specifically for addressing, a **XZMC11**.

NOTE: When replacing a faulty slave whose address has been set, the address of the slave to be replaced 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, which is 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.

Part II

Hardware installation for AS-i power supply units and the 140 EIA 921 00 AS-i bus interface module

Aim of this Part

This Part deals with the hardware installation of AS-i power supply units, and the **140 EIA 921 00** AS-i bus master interface module.

What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
2	AS-i bus interface module: 140 EIA 921 00	25
3	AS-Interface Bus Power Supply Units	59

Chapter 2

AS-i bus interface module: 140 EIA 921 00

Subject of this Chapter

This Chapter only deals with hardware installation of the **140 EIA 921 00** AS-i bus master interface module on a Quantum PLC.

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
2.1	Review of the AS-i bus	26
2.2	Description of the 140 EIA 921 00 Module	27
2.3	Input/Output Mapping	43
2.4	AS-i Bus Diagnostics	49
2.5	Operating Modes of AS-i Quantum Module	56

Section 2.1

Review of the AS-i bus

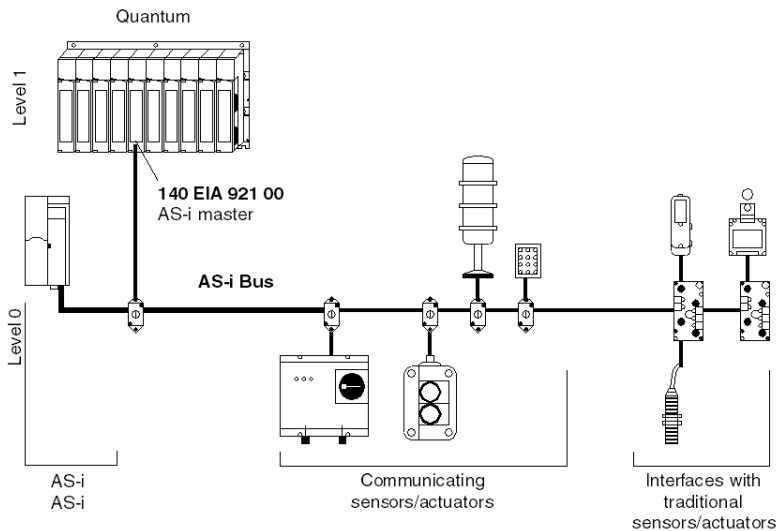
At a Glance

Bus Master

Built into a Quantum PLC station, the **140 EIA 921 00** module (AS-i bus master) manages all data exchanges on the AS-i bus.

Example

The following illustration provides an overview of the AS-i bus topology into which the **140 EIA 921 00** module can be integrated.



Section 2.2

Description of the 140 EIA 921 00 Module

Aim of this Section

This Section deals with hardware installation and the characteristics of the 140 EIA 921 00 module.

What Is in This Section?

This section contains the following topics:

Topic	Page
Module Description	28
Architecture of the Module EIA 921 00	31
Mounting/Installation	33
Connections	34
Visualization of the Module States	37
Specific Display Panels on the 140 EIA 921 00 module	38
Technical Characteristics	40
Module	41
Ground Leakage Current	42

Module Description

Introduction

The Quantum AS-i Master Module provides AS-i communications between the bus master module and the sensor/actuator slaves. One master module can control 31 slaves. Multiple master modules can be used in a single control system.

NOTE: This module is not available to directly exploit Analog slaves (profile 7.1, 7.2, 7.3, 7.4) on an AS-i bus.

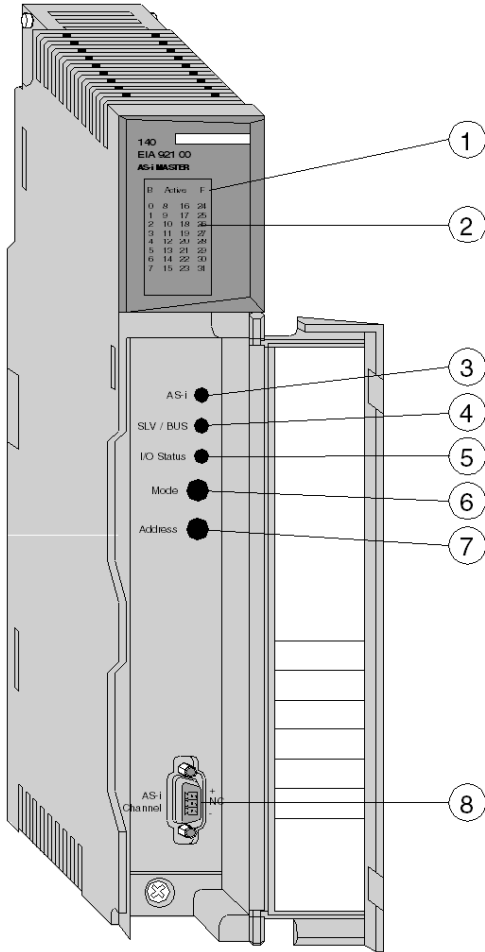
General Features

- One AS-i Channel Per Module
- I/O Map Interface with controller mapped directly to 4x and 3x references
- Module Parameter Zoom screens for AS-i Channel operating modes
- Enabling and Disabling Configuration Mode
- Auto addressing of Slave 0
- Timeout State chose (Fallback to Zero or Hold Last State)
- Supported in Local, Remote and Distributed Quantum I/O Racks
- Protected against reverse polarity of AS-i bus inputs
- MHS 80C154 at 24Mhz structure
- Internal selftest
- Hot swap protected circuit, all other operations on AS-i bus are available with power supply on (PLV)
- Uses standard AS-i cable or round cable with shield
- Connects from 0.75 mm to 2.5 mm section cable on the AS-i connector
- Easy to disconnect from the bus
- Maximum efficiency on 5 volts; 350mA
- Local Diagnostic by LED matrix and on board push buttons
- There can be multiple master modules in a single control system

Front View

The module 140 EIA 921 00 is a standard format module.

Illustration :



Legend

The following table provides a description of the functions of the equipment LEDs.

Item	Description
1	Display block comprising 3 status indicator lamps (LEDs) for displaying the module operating modes: <ul style="list-style-type: none"> ● B (green, 1 LED): Indicates, when on, data exchange between module and slave. ● Active (green, 2 LEDs): when on, indicates AS-i module being services by the local CPU, RIO, or DIO drop adapter. ● F (red, 1 LED): indicates, when on steady, module fault. Flashing shows external I/O fault (could indicate slave with address 0 or an AS-i bus configuration fault).
2	Display block of 32 indicator lamps (0 - 31, green) for diagnostics of the AS-i bus and display of the state of each slave connected to the bus.
3	AS-i (red): ON shows AS-i line not properly powered. Flashing shows automatic addressing enabled and one slave is projected but not connected.. OFF shows normal module function.
4	SLV/BUS (green): ON shows the LEDs 0-31 are in BUS display mode. Displays the slaves on the bus.
5	I/O Status (green): On shows the LEDs 0-31 are in SLV display mode. Displays the state of a selected slave.
6	Mode (Push Button): provides local diagnostics of the AS-i bus. Press this button longer than 1 sec. to change the mode. In slave mode use the Address Push Button to scroll among the 32 addresses.
7	Address (Push Button): Pressing this button (in slave mode) shorter than 1 sec. scrolls through the slaves. Press longer than 1 sec. to reverse direction of the scroll.
8	AS-i Channel cable connector - connects module to AS-i cable and AS-i power supply.

Architecture of the Module EIA 921 00

At a Glance

The EIA 921 00 module operates according to the master/slave mode. The master only controls exchanges on the bus.

The AS-i standard sets several operating levels offered by the master:

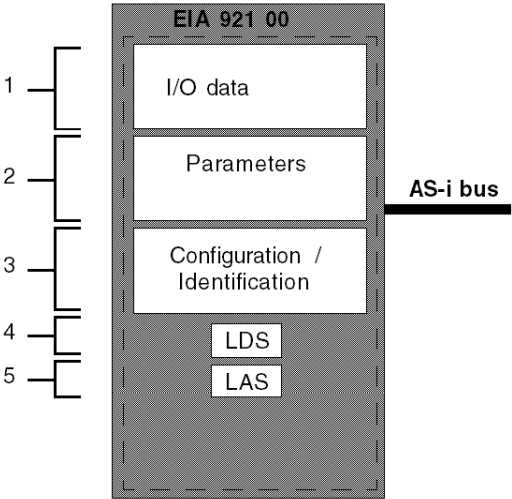
- Profile M0 and M0e - Minimum Master: the master only puts forward the configuration of slaves connected to the bus on power-up, and only input/output exchanges.
- Profile M1 and M1e - Full Master: this profile covers all the operating functions set by the AS-i standard,
- Profile M2 and M2e - Reduced Master: this profile corresponds to profile M0 operating functions with a slave-parametering option.

The master profiles with an "e" support extended profiles.

NOTE: The EIA 921 00 module corresponds to the profile M2.

Illustration of the Architecture

The figure below shows the architecture of the EIA 921 00 module.



Description of Constituent Elements

The table below shows the different elements that make up the architecture of the module.

Address	Item	Description
1	I/O data	Images showing the inputs and outputs of the AS-i bus.
2	Parameters	Image showing the parameters of all slaves.
3	Configuration/Identification	This field contains all the I/O codes and identification codes for all the detected slaves.
4	LDS	List of all the slaves detected on the bus.
5	LAS	List of active slaves on the bus.

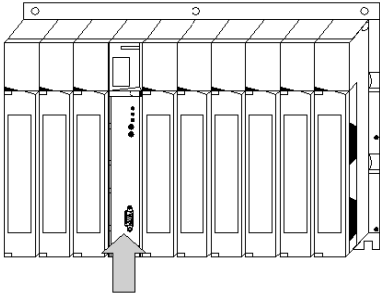
Mounting/Installation

General

The 140 EIA 921 00 module is compatible with local, remote and offset Quantum I/O racks.

The mounting and removal procedure is identical to the mounting and removal procedure for other modules.

Example of mounting a 140 EIA 921 00 module:



NOTE: The module can be mounted and removed with both PLC and AS-i bus power switched on.

Number of AS-i modules per PLC

The Quantum I/O AS-i master module is designed to enable several master modules to be used in the same control system. Each master module can control up to 31 sensors/actuators. These sensors/actuators can be located in the local processor, in an RIO device or in a DIO (input/output) station

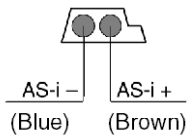
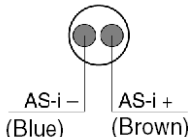
Type of I/O station	Maximum number of AS-i modules
Local	no limit
Remote per I/O station	4
Offset per I/O station	2

Connections

AS-i Bus Cables

AS-i bus cables carry the signals and supply the sensors and actuators connected to the bus with 30 Vdc.

Types of AS-i cables:

Cable type	Specifications	Illustration
Polarized AS-i ribbon cable	Color: yellow. Wire cross-section: 1.5 mm ²	
Standard round cable	Wire cross-section: 1.5 mm ² or 2.5 mm ²	

Recommended cable: Product reference H05VV-F2x1.5, conforms to the DIN VDE 0281 standard.
Wire cross-section: 1.5 mm².

Cable Routing

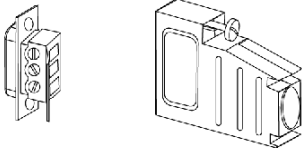
The AS-i cable and the power cables carrying higher power levels must be in separate ducts, which are protected by a metal screen.

When using a shared route for control cables it is essential that the connections on these control links should conform to the technology rules (e.g. the discharge diode or limiters on the terminals of self-inductive elements etc.).

Connector

A set (connector + cover) is delivered with the module, which is used to connect the module to the AS-i bus. This connector must be linked to the cable of the AS-i bus and assembled by the user according to the procedure described later.

Illustration:

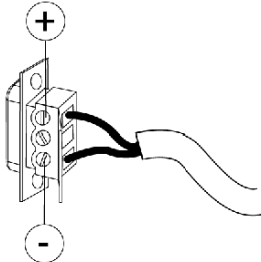
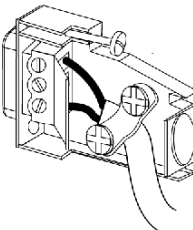


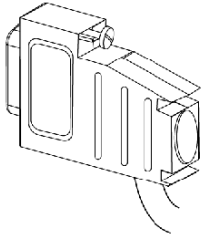
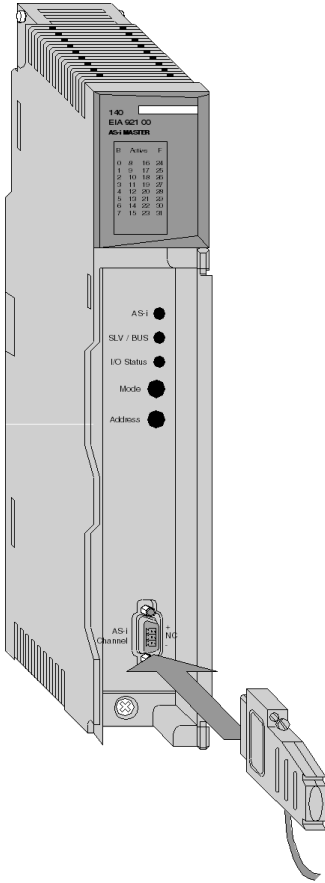
Connector

Cover

Connection of Module to Bus

To connect a module to the bus, follow the procedure below:

Step	Action
1	<p>Connect the 2 wires of the AS-i cable to the connector, taking the polarities into account:</p>  <p>In the special event that a shielded cable is used, this should be connected to the central terminal.</p>
2	<p>Mount the connector in its cover and fix the cable to it:</p> 




Step	Action																											
3	<p>Click the cover shut:</p> 																											
4	<p>Mount the assembled unit on the module:</p>  <table border="1" data-bbox="432 649 528 763"> <thead> <tr> <th>Id</th> <th>Address</th> <th>Id</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>08</td></tr> <tr><td>1</td><td>8</td><td>08</td></tr> <tr><td>2</td><td>16</td><td>08</td></tr> <tr><td>3</td><td>24</td><td>08</td></tr> <tr><td>4</td><td>32</td><td>08</td></tr> <tr><td>5</td><td>40</td><td>08</td></tr> <tr><td>6</td><td>48</td><td>08</td></tr> <tr><td>7</td><td>56</td><td>08</td></tr> </tbody> </table>	Id	Address	Id	0	0	08	1	8	08	2	16	08	3	24	08	4	32	08	5	40	08	6	48	08	7	56	08
Id	Address	Id																										
0	0	08																										
1	8	08																										
2	16	08																										
3	24	08																										
4	32	08																										
5	40	08																										
6	48	08																										
7	56	08																										

Visualization of the Module States

Status Display

The module state is displayed by the status displays B, Active, F.

LED states:



LED	On 	Flashing 	Off 
B (green)	-----	Indicates data exchange between the module and slave.	No data exchange.
Active (green)	Indicates that the AS-i module is managed via the local CPU, RIO or the DIO expansion adapter.	-----	AS-i module not active.
F (red)	Indicates a module error.	Indicates that there is an external I/O error (this could mean an error on a slave with address 0, or an error in the AS-i bus configuration).	No module error present.

Specific Display Panels on the 140 EIA 921 00 module

General




3 LEDs: AS-i, SLV / Bus and I/O Status display information specific to the 140 EIA 921 00 module.

View of the 3 LEDs:

AS-i		red
SLV / BUS		green
I/O Status		green

Status of AS-i LED







This LED displays the AS-i status.

Module display	Display status	Meaning
	AS-i LED on	Supply fault on the AS-i bus.
	AS-i LED flashing	Automatic addressing activated and a slave is projected but not connected.
	AS-i LED off	Module operating normally.

Bus and I/O LEDs

These two LEDs show the display mode selected:

- Bus display mode or
- Slave display mode.

Module display	LED state	Meaning
SLV / BUS  I/O Status 	SLV / BUS LED on I/O Status LED off	The 32 LED display panel located at the front of the module is in BUS display mode and displays all the slaves present on the bus.
SLV / BUS  I/O Status 	SLV / BUS LED off I/O Status LED off	The 32 LED display panel located on the front of the module is in Slave display mode (SLV) with display of the address of the slave selected.
SLV / BUS  I/O Status 	SLV / BUS LED off I/O Status LED on	The 32 LED display panel located on the front of the module is in Slave display mode (SLV) with display of the input/output status (I/O Status) bits for a selected slave.

Technical Characteristics

AS-i Bus

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 (all branches mixed without repeater)	100 meters
Maximum Number of Inputs/Outputs	124 inputs/124 outputs
Nominal supply voltage for AS-i bus	30 V DC

The 140 EIA 921 00 Module

Characteristic	Value
Calculation of AS-i scanning time for n slaves (normal operation)	156 μ s x (n+2) if n < 31 156 μ s x (n+1) if n = 31
Power consumption 5V PLC	Typically 185 mA / 250 mA maximum
Power consumption 30 V AS-i	Typically 105 mA / 120 mA maximum
Protection from polarity inversion on AS-i bus inputs	Yes
Degree of protection	IP20
Operating temperature	0 to 60 degrees Celsius
AS-i master profile	M2
Standards and service conditions	Compliant with those for Quantum PLCs

Module

Platform

- MHS 80C154 Hardware platform
- Uses standard AS-i function library
- All the AS-i data exchange and management functions are in a Programmable Integrated Controller (PIC)
- Module level information as status and command

Firmware Interface Definition

AS-i module configuration:

- 2 Words for List of Projected Slaves (LPS) from PLC
- 16 words for slave profile (ID and IO codes) send by the PLC
- 8 words for slave parameters

AS-i Module Input and Output

Module to PLC:

- 8 Words for input data from AS-i Bus
- 2 Words for List of Activated Slaves LAS
- 2 Words for List of Detected Slaves LDS
- 1 Word for Status information

PLC to Module:

- 8 Words for output data to AS-i Bus
- 1 Word for Control

Ground Leakage Current

When Installing BMX EIA 0100

When installing the module, be sure to:

- Connect the PLC ground terminal to ground
- Tighten the retaining screw to make sure the module is held in the rack
- Use an SELV (Safety Extra Low Voltage) AS-Interface power supply, with 30 V_{DC} nominal voltage
- Place a earth fault detection device upstream of the AC supply connected to the PLCs that disconnects this power supply source if an earth leakage is detected
- Ensure, for PLCs connected to a DC power supply source, that the power supply placed upstream of the PLC is SELV
- Use only AS-Interface certified products on the bus

DANGER

HAZARD OF ELECTRICAL SHOCK, EXPLOSION AND ARC FLASH

Follow the module grounding instructions.

Failure to follow these instructions will result in death or serious injury.

Section 2.3

Input/Output Mapping

Purpose

This section explains the Input/Output Mapping of the Quantum.

What Is in This Section?

This section contains the following topics:

Topic	Page
AS-i Input	44
AS-i Output	47

AS-i Input

Inputs

The 140 EIA 921 00 module manages up to 31 slaves. Each slave has 4 inputs. The 124 inputs are assigned by 8 words.

Words 1 to 8 - AS-i Bus Inputs

Words 1 to 8 reflect the input state of the 31 slaves. Bits D3 to D0 correspond to the input data bits for each slave.

Distribution	Most significant byte								Least significant byte							
Word bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Slave Input	D3	D2	D1	D0	D3	D2	D1	D0	D3	D2	D1	D0	D3	D2	D1	D0
Word 1	Slave 3				Slave 2				Slave 1				Unused			
Word 2	Slave 7				Slave 6				Slave 5				Slave 4			
Word 3	Slave 11				Slave 10				Slave 9				Slave 8			
Word 4	Slave 15				Slave 14				Slave 13				Slave 12			
Word 5	Slave 19				Slave 18				Slave 17				Slave 16			
Word 6	Slave 23				Slave 22				Slave 21				Slave 19			
Word 7	Slave 27				Slave 26				Slave 25				Slave 24			
Word 8	Slave 31				Slave 30				Slave 29				Slave 28			

Words 9 to 10 - Active Slaves (LAS)

Words 9 to 10 show the active slaves. A bit value of "1" indicates that the slave is active.

Words	Most significant byte								Least significant byte							
Word bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 9	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 10	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16

Words 11 to 12 - Detected Slaves (LDS)

Words 11 to 12 show the slaves detected on the bus. A bit value of "1" indicates that a slave has been detected.

Words	Most significant byte								Least significant byte							
Word bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 11	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 12	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16

Words 13 - Status Word

Word 13 contains information on the status.

Words	Most significant byte								Least significant byte							
Word 13	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

D0 - Configuration OK on AS-i bus (software and physical configurations are identical):

1 - OK

0 = NOK

D1 - Slave present with address 0:

1 = present

0 = missing

D2 - Automatic address available:

1 = available

0 = unavailable

D3 - Automatic addressing:

1 = automatic assignment of addresses possible

0 = impossible

D4 - Operating mode:

1 = AS-i protected mode

0 = AS-i configuration mode

D5 - Normal operation active:

1 = active

0 = inactive

D6 - AS-i power supply missing:

1 = AS-i power failure

0 = normal power supply for AS-i

D7 - Offline received:

1 = AS-i bus in Offline mode

0 = AS-i bus in another mode (not Offline)

D8 - Module diagnostics:

1 = Frozen mode

0 = Exchange of data activated

In order to reactivate the module, you must set the bit D2 of word 9 to 0 (control word of AS-i Output), and then to 1. If the module operates properly when the bit D2 of word 9 is set to 1 (control word of AS-i Output), the bit D8 of word 13 (Status word of AS-i Input) must be switched to 0.

AS-i Output

Outputs

The 140 EIA 921 supports a maximum of 31 slaves with 4 outputs each. The 124 outputs are mapped into 8 words.

Words 1 ... 8 AS-i Bus Outputs

Words 1 ... 8 contain the state of the AS-i output. Bits D3 ... D0 are the output data bits of each slave.

Distribution	Most significant byte								Least significant byte							
Word bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Slave output	D3	D2	D1	D0	D3	D2	D1	D0	D3	D2	D1	D0	D3	D2	D1	D0
Word 1	Slave 3				Slave 2				Slave 1				Not Used			
Word 2	Slave 7				Slave 6				Slave 5				Slave 4			
Word 3	Slave 11				Slave 10				Slave 9				Slave 8			
Word 4	Slave 15				Slave 14				Slave 13				Slave 12			
Word 5	Slave 19				Slave 18				Slave 17				Slave 16			
Word 6	Slave 23				Slave 22				Slave 21				Slave 19			
Word 7	Slave 27				Slave 26				Slave 25				Slave 24			
Word 8	Slave 31				Slave 30				Slave 29				Slave 28			

Word 9 Control Word

Word 9 contains control information.

Words	Most significant byte								Least significant byte							
Word 13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

D0 - not used

D1 - Set off-line mode

1 = Set AS-i bus to off-line mode: stops communications on AS-i bus
(all inputs and outputs are set to 0)

0 = Set AS-i bus to on-line mode

D2 - Set Data Exchange active

1 = Exchange data on AS-i bus

0 = Stop exchanging data on AS-i bus

(all inputs and outputs retain their actual state)

D3 - Operating mode

1 = Configuration mode

0 = Protected mode

Bits (4 ... 15) - not used

Section 2.4

AS-i Bus Diagnostics

Aim of this Section

This section deals with the diagnostics mode carried out by the 140 EIA 921 00 module.

What Is in This Section?

This section contains the following topics:

Topic	Page
Introduction to AS-i Bus Diagnostics	50
Moving between the different display modes	52
Display of slaves on the AS-i bus	53
Viewing the state of input/output bits for each slave	54

Introduction to AS-i Bus Diagnostics

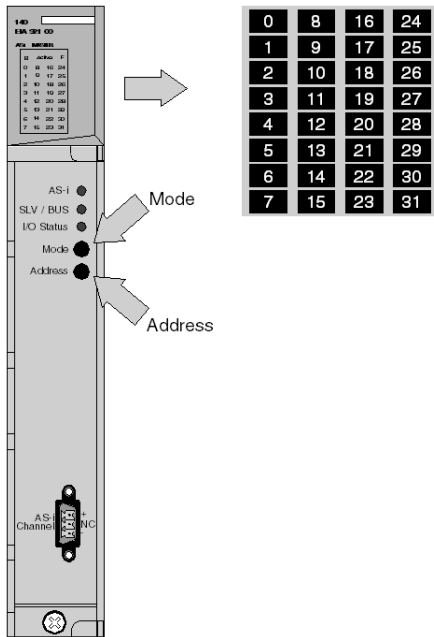
General

The module display panel is used for:

- Displaying the presence of each slave on the AS-i bus (Bus mode).
- Displaying the state of input/output bits of each slave present on the bus (Slave mode "SLV").

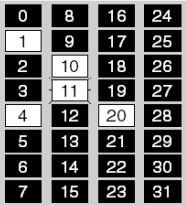


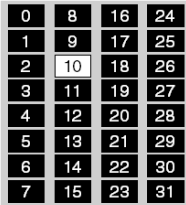


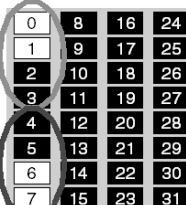


These modes can be accessed by a combination of actions on the push buttons "Mode" and "Address" of the 140 EIA 921 00 module.

Illustration:



Display Modes

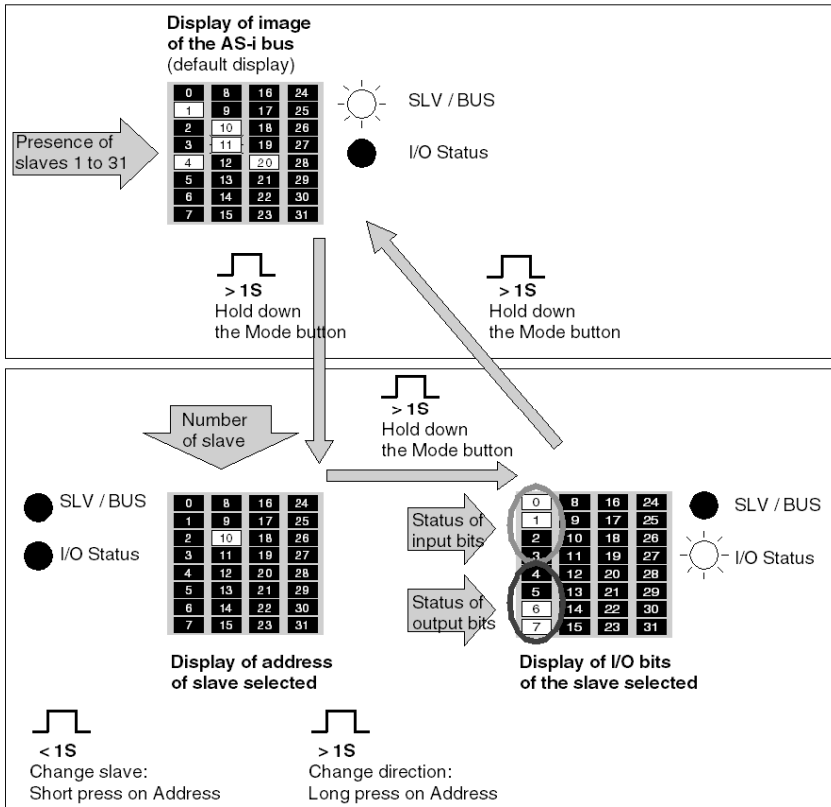
The following table describes the 2 display modes of the module:

Bus mode	Slave mode (SLV)	
<p>View of AS-i bus image. Each LED 1 to 31 corresponds to a slave address on the bus.</p> <ul style="list-style-type: none"> LED on: slave present flashing LED: slave projected and not detected or not projected and detected or projected, detected but not activated (I/O code or profile incorrect). LED off: slave not projected and not detected. 	<p>View of selected slave address.</p> <ul style="list-style-type: none"> LED on: number of slave selected. 	<p>View of input/output bit state for slave selected.</p> <ul style="list-style-type: none"> LEDs 0 to 3 display the state of the input bits. LEDs 4 to 7 display the state of the output bits. LED on: bit in state 1. LED off: bit in state 0 or not significant
<p>Illustration:</p>  <p>SLV / BUS </p> <p>I/O Status </p> <p>The display mode is shown with the "SLV / BUS" LED on and the "I/O Status" LED off.</p>	<p>Illustration:</p>  <p>SLV / BUS </p> <p>I/O Status </p> <p>The display mode is shown with the "SLV / BUS" and "I/O Status" LEDs off.</p>	<p>Illustration:</p>  <p>SLV / BUS </p> <p>I/O Status </p> <p>The display mode is shown with the "SLV / BUS" LED off and the "I/O Status" LED on.</p>

Moving between the different display modes

Illustration

This illustration shows how to move between the different display modes:



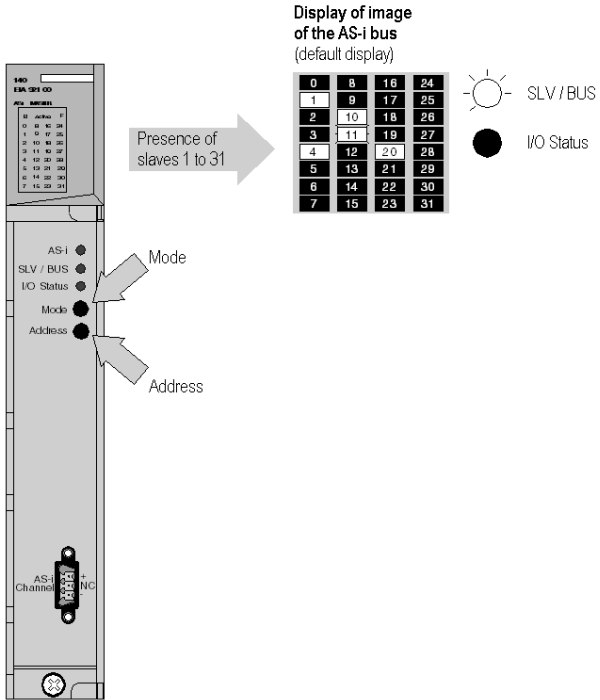
Display of slaves on the AS-i bus

General

This mode is displayed by default when the module is switched on, and is used to display:

- Slave present (LED permanently on).
- Slave not projected and not detected (LED off).
- Slave projected and not detected or not projected and detected or projected, detected but not activated (LED flashing).

Illustration:



The image of the AS-i network is displayed on the entire display panel. Each LED represents an AS-i bus slave address.

Viewing the state of input/output bits for each slave

General

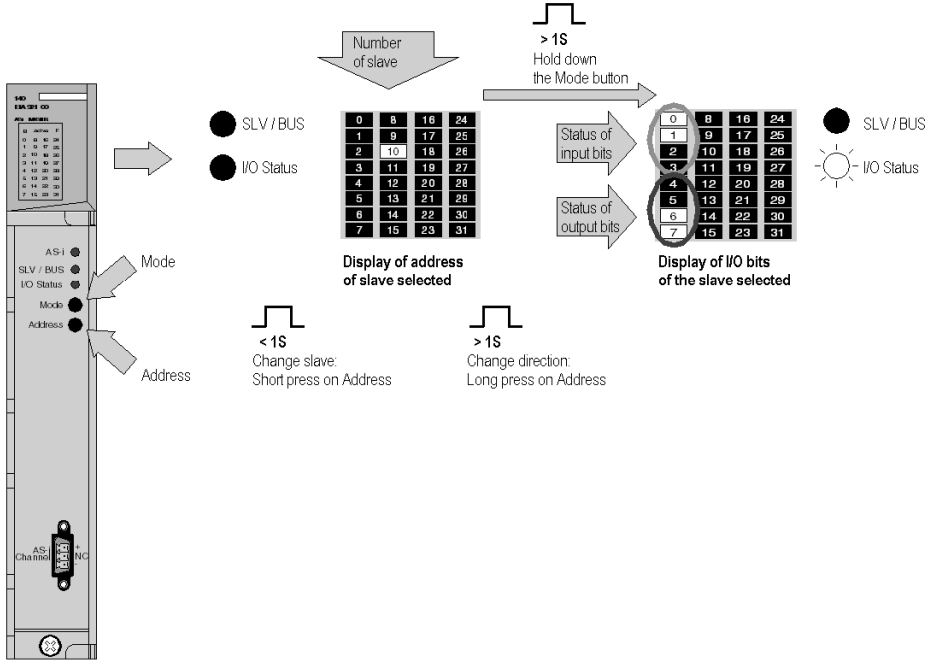
In this mode (Slave "SLV"), the display panel is used to view the state of input/output bits for each slave present on the bus.

Procedure to be followed

To access the state of input/output bits for a slave from BUS mode, proceed as follows:

Order	Action	Result
1	Press for more than one second on the Mode button	The display switches to Slave "SLV" mode.
2	Press quickly on the Address button	The display of the slave address goes up from 1 to 31.
3	Press for more than one second on the Address button	The direction of the slave address scan is reversed.
4	Press quickly on the Address button	The display of the slave address goes down from 31 to 1.
5	Press for more than one second on the Mode button	The display changes to input/output bit status mode. <ul style="list-style-type: none"> ● LEDs 0 to 3 display the state of input bits for the selected slave. ● LEDs 4 to 7 display the state of output bits for the selected slave. LED on = bit at 1 LED off = bit at 0 or no input or output
6	Press for more than one second on the Mode button	The display switches to Bus mode.

Illustration



Section 2.5

Operating Modes of AS-i Quantum Module

Operating Modes

Output Fallback Position

When the CPU changes to STOP:

- with the Fallback to 0 option, the outputs are forced to 0 if communication on the medium stops
- with the Hold Lost State option, the state of the outputs is maintained if communication on the medium stops

Automatic Slave Addressing

When this function is selected in the module configuration, a faulty slave can be replaced by a slave of the same type without stopping the AS-i bus and without the necessity for any special operation.

If the replacement slave is programmed with the same address and it has the same profile, it will be inserted automatically in the list of slaves detected and activated. If this is not the case, the AS-i indicator lamps flash.

If the new slave is unformatted (address 0, new slave) and it has the same profile, the slave will automatically take the address of the slave it replaces and will appear in the list of slaves which are detected and in the list of slaves which are active. If this is not the case, the AS-i indicator lamp flashes. These operations are only possible if a single slave in the configuration is faulty.

Processor fault

If communication with the processor is broken, the module switches to SAFETY position.

Causes of the communication break:

- tripping the LMS watchdog if the AS-i quantum module is located in the main rack
- disconnecting the remote or distributed Quantum I/O Racks system cable

Module Fault

If there is a serious fault (faulty component, etc.), inside the module, it stops communication with the CPU and with the AS-i bus. The same behavior will occur when a module is removed while powered up.

Removing the Module While it is Powered Up: Hot Swap Function

When the module is removed while it is powered up, communication with the CPU stops, and the processor indicates a module fault.

Communication on the AS-i bus is also interrupted. In this case, the slaves which have a watchdog set their outputs to the required state. All others remain in the same position and cannot be set to 0 because the module can no longer provide communication.

Inserting the module while it is powered up

After the AS-i quantum module is powered up it waits to receive the configuration from the processor or for the mode push button to be pressed, otherwise it remains stopped.

Fault on the AS-i power supply

When there is a fault on the AS-i power supply module, communication stops and:

- the outputs of the slaves, which have a watchdog, are set to the required state, unless the slave draws its power from the AS-i medium
- the inputs of the slaves change to 0 as a result of loss of power

The AS-i indicator lamp being on shows this fault.

Breaking the AS-i medium

If the medium is broken, there are several possibilities:

- the medium is cut at the module output: the behavior is the same as when there is a power break, with disappearance of all the slaves and indication of a power supply fault
- the medium is cut beyond the AS-i quantum module and AS-i power supply assembly: all the slaves disappear and there is no indication of a power supply fault
- the medium is cut beyond the AS-i Quantum module and AS-i power supply assembly and a number of slaves. the slaves located beyond the break disappear and there is no indication of a power supply fault.

Recommend-ations for 24 V Auxiliary Power Supply

If the slaves are using a 24 V auxiliary power supply, the AS-i Quantum module does not manage the disappearance of this power supply. Data on the disappearance of this power supply can be fed back using a 24V input.

WARNING

UNEXPECTED SYSTEM BEHAVIOR - MULTIPLE ADDRESSING

Do not give it/them an address already used by another slave on the bus when connecting one or more slaves.

If two slaves are given the same address, the following can happen:

- The two slaves, which have the same address may also have the same profile and manage identical I/O. In this case, the AS-i bus master does not detect any error
- The two slaves which have the same address manage different I/O. The AS-i bus master may then detect transmission errors when accessing the I/O of one of the two slaves

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

Chapter 3

AS-Interface Bus Power Supply Units

Aim of this Chapter

This chapter introduces AS-Interface bus power supply units.

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
3.1	Introduction to AS-i Bus power supply units	60
3.2	Installation of the AS-i bus power supply units	67
3.3	AS-i power supply connections	73
3.4	Characteristics of AS-i bus power supply units	81

Section 3.1

Introduction to AS-i Bus power supply units

Aim of this Section

This section introduces AS-i bus power supply units.

What Is in This Section?

This section contains the following topics:

Topic	Page
General introduction to AS-i power supply units	61
Physical description of the TSX SUP A02 power supply module	62
Physical description of the TSX SUP A05 power supply block	63
Physical description of the support board	64
Catalog of AS-i power supply units	65
AS-i power supply: specific features	66

General introduction to AS-i power supply units

General

The AS-i power supply blocks and modules **TSX SUP A02** and **TSX SUP A05** are designed to provide a 30V DC power supply to devices connected to an AS-i field bus.

This power supply is distributed over the same wires as those used for data exchange.

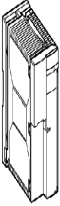
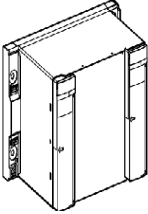
The fixing system for these products has been specially designed to meet the particular mounting distance and fixing specifications for Premium PLCs and TBX products.

All the products are mounted:

- on a Telequick AM1-PA board,
- on a central AM1-DP200/DE200 DIN rail.

Presentation table

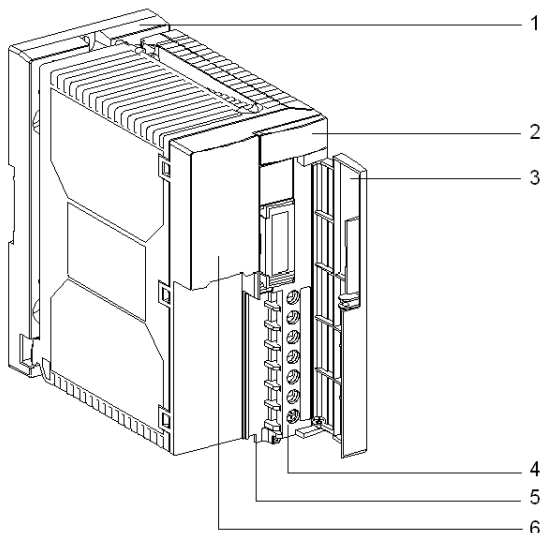
This table presents the different AS-i power supplies:

AS-i Bus power supply	
100...120 V AC or 200...240 V AC network voltage	
	
30 V DC AS-i / 2.4 A	30V DC AS-i / 5A & 24V DC

Physical description of the TSX SUP A02 power supply module

Illustration

Numbered diagram:



Reference table

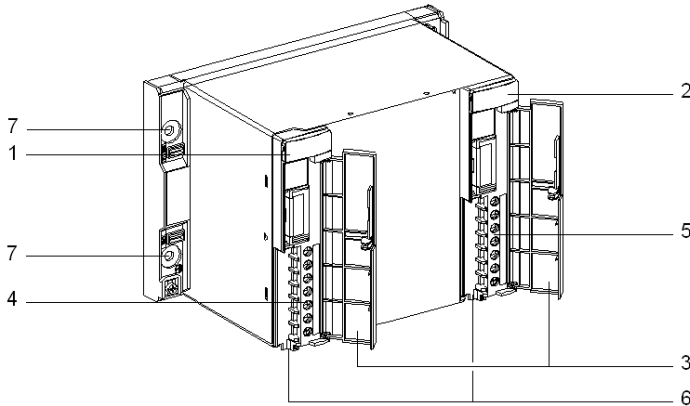
The following table provides descriptions for each of the numbers on the above diagram:

Numbers	Description
1	Support board enabling the power supply module to be fitted directly onto an AM1-DE200/DP200 type DIN rail or to a Telequick AM1-PA mounting plate
2	Display panel comprising: <ul style="list-style-type: none"> ● an AS-i LED (green): lit if the internal and output voltages are correct.
3	Protective flap for terminal block.
4	Screw terminal block for connection: <ul style="list-style-type: none"> ● to AC power supply network, ● of the 30V DC AS-i output.
5	Hole for threading of cable tie.
6	110/220 V voltage selector switch. On delivery, the selector is set at 220V.

Physical description of the TSX SUP A05 power supply block

Illustration

Numbered diagram:



Reference table

The following table provides descriptions for each of the numbers on the above diagram:

Numbers	Description
1	Display panel with an ON LED (orange): lit when the power supply is switched on.
2	Display panel with: <ul style="list-style-type: none"> ● a 24V LED (green): lit when the 24V DC output voltage is present and correct, ● an AS-i LED (green): lit when the 30V DC output voltage is present and correct,
3	Protective flaps for terminal blocks.
4	Screw terminal block for connecting to the AC power supply network.
5	Screw terminal block for connecting the AS-i 24V DC and 30V DC outputs.
6	Hole for threading of cable tie.
7	Four screw holes for M6 screws.

Physical description of the support board

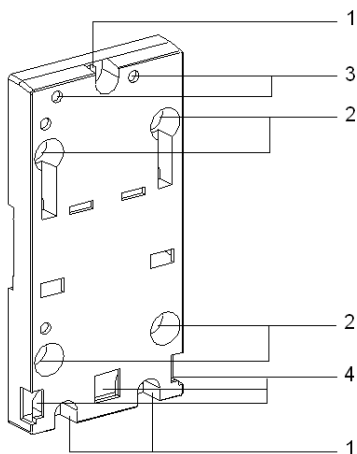
Introduction

Each **TSX SUP A02** power supply module is supplied mounted on a supporting board that enables the power supply to be fixed: either onto a DIN AM1-DE200 or AM1-DP200 DIN mounting rail, or onto a Telequick AM1-PA perforated mounting plate.

Each support board can be fitted with one **TSX SUP A02** module.

Illustration

Numbered diagram:



Reference table


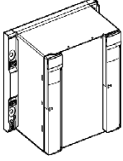
The following table provides descriptions for each of the numbers on the above diagram:

Numbers	Description
1	Three 5.5mm diameter holes enabling the support board to be fixed to a panel or to an AM1-PA perforated mounting plate with a mounting distance of 140mm (the standard mounting distance for Micro PLCs).
2	Four 6.5mm diameter holes enabling the support board to be fixed to a panel or to an AM1-PA perforated mounting plate with a mounting distance of 88.9mm (the standard mounting distance for Premium PLCs).
3	Two M4 screws enabling the TSX SUP A02 power supply to be fixed in place.
4	Slots for fixing the pins situated at the bottom and to the rear of the module.

Catalog of AS-i power supply units

Selection table

The following table lists the main characteristics of AS-i power supplies:

		
Input characteristics	100...120 V AC or 200...240 V AC	
Nominal voltage		
Threshold values	85..132 V AC or 170..264 V AC	
Frequency threshold	47..63Hz or 360..440Hz	
Nominal input current	1.3A	5A
Output characteristics		
Useful power	72W	230W
Output voltage (direct)	30 V DC AS-i	30V DC AS-i / 24V DC
Nominal current	2.4A	5A(1) / 7A(1)
Auxiliary functions		
SELV safety (1)	Yes	
Parallelization (2)	No	
Redundancy (4)	No	Yes
Product references	TBX SUP A02	TSX SUP A05

(1) Maximum current for each output. The sum of the power values is limited to 230 W.

(2) Manufacturer's specifications in accordance with IEC 950, IEC 1131-2 standards guaranteeing user safety for the 24 V output, in terms of insulation between primary and secondary, maximum overvoltage on output wires, and protection via ground circuit.

AS-i power supply: specific features

General

The simultaneous transmission of information and power over the same cable requires that data transmission be filtered from the power supply.

This is the why the AS-i bus features a decoupling filter able to withstand the maximum direct current delivered by the power supply. The power supply has an impedance which is standardized relative to the data transmission frequencies.

Section 3.2

Installation of the AS-i bus power supply units

Aim of this Section

This section describes the installation procedure for the AS-i bus power supply units.

What Is in This Section?

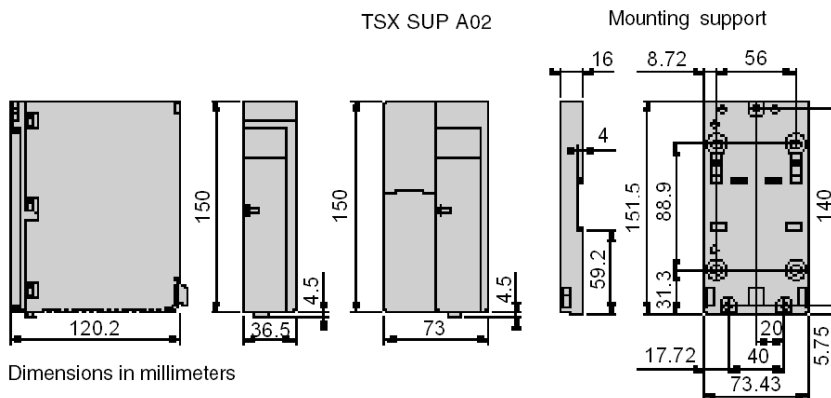
This section contains the following topics:

Topic	Page
Dimensions/Mounting of the AS-i TSX SUP A02 Power Supply Unit	68
Dimensions/Mounting of the TSX SUP A05 AS-i Power Supply Unit	71

Dimensions/Mounting of the AS-i TSX SUP A02 Power Supply Unit

Dimensions

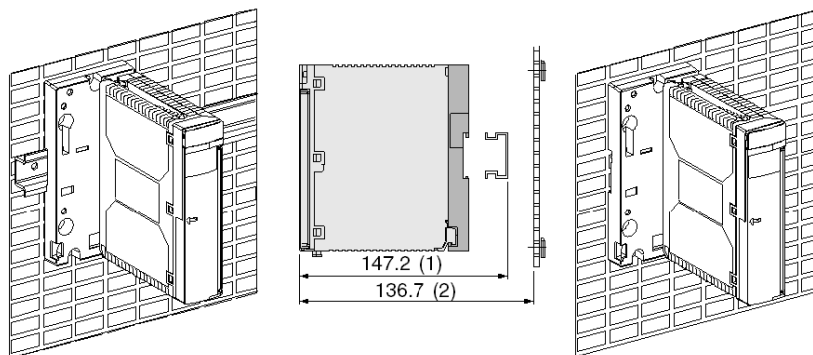
Illustration:



Mounting on an AM1-DE200 or AM1-DP200 Mounting Rail or on an AM1-PA Mounting Plate

Each power supply module is supplied mounted on a support enabling this type of mounting.

Illustration:



- (1) 147.2 mm (AM1-DE200), 139.7 mm (AM1-DP200)
- (2) 136.7 mm (AM1-PA)

Mounting on an AM1-D-200 Mounting Rail

Carry out the following steps:

Step	Action
1	Check that the module is mounted on the support.
2	Mount the module + support on the mounting rail.

Mounting on an AM1-PA Mounting Plate

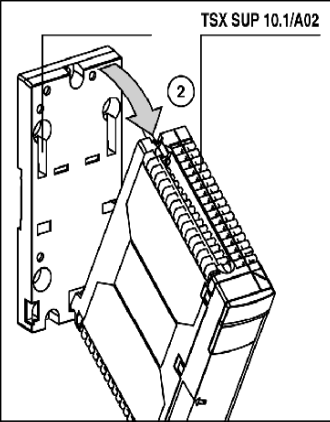
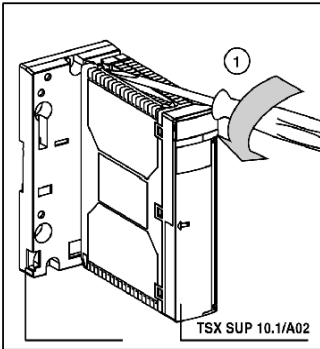
Carry out the following steps:

Step	Action
1	Remove the module from its support.
2	Mount the support on the AM1-PA mounting plate.
3	Mount the module on its support.

Mounting the Module on the Support

Each power supply module comes as standard with a support which allows it to be mounted directly on a DIN mounting rail. 1 TSX SUP A02 power supply module can be fitted to the support.

Carry out the following steps:

Step	Action	Illustration
1	Position the pins situated at the rear of the module (on the inside) in the corresponding slots of the support.	<p data-bbox="703 354 838 375">Steps 1 and 2</p> 
2	Pivot the module upwards to bring it into contact with the support.	<p data-bbox="703 868 769 889">Step 3</p> 

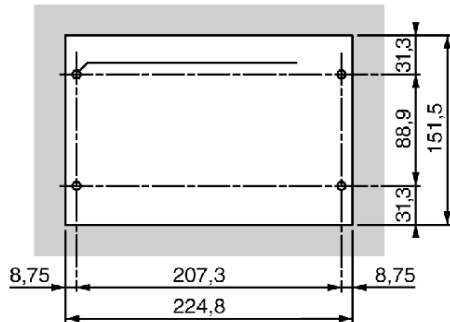
Dimensions/Mounting of the TSX SUP A05 AS-i Power Supply Unit

Introduction

The TSX SUP A05 power supply block can be mounted on a panel, an AM1-PA mounting plate or a DIN rail.

Mounting on a Panel

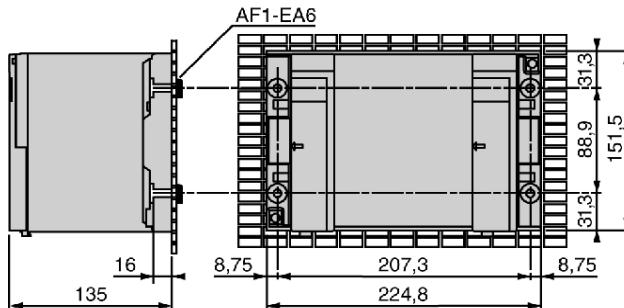
Drilling diagram (dimensions in millimeters):



(1) The diameter of the screw holes must be suitable for M6 screws.

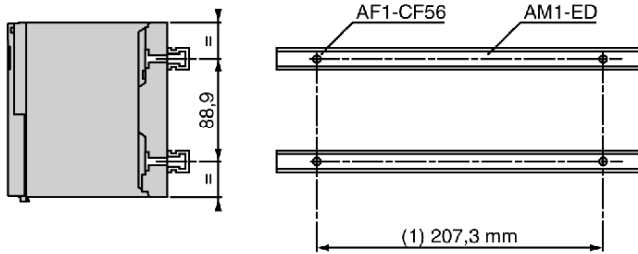
Mounting on a Telequick AM1-PA Perforated Mounting Plate

Fix the power supply block in place using M6x25 screws + washers and AF1-EA6 clip nuts (dimensions in millimeters):



Mounting on a 35mm Wide DIN Mounting Rail

Fix the power supply block in place using 4 M6x25 screws and AF1-CF56 1/4 turn sliding nuts (dimensions in millimeters):



Section 3.3

AS-i power supply connections

Aim of this Section

This section outlines the principles to be followed when making AS-i power supply connections

What Is in This Section?

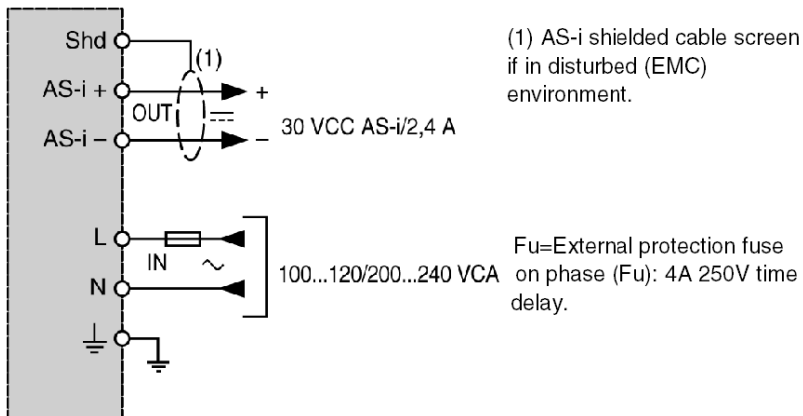
This section contains the following topics:

Topic	Page
TSX SUP A02 Power Supply Connections	74
TSX SUP A05 Power Supply Connections	76
General Precautions	79

TSX SUP A02 Power Supply Connections

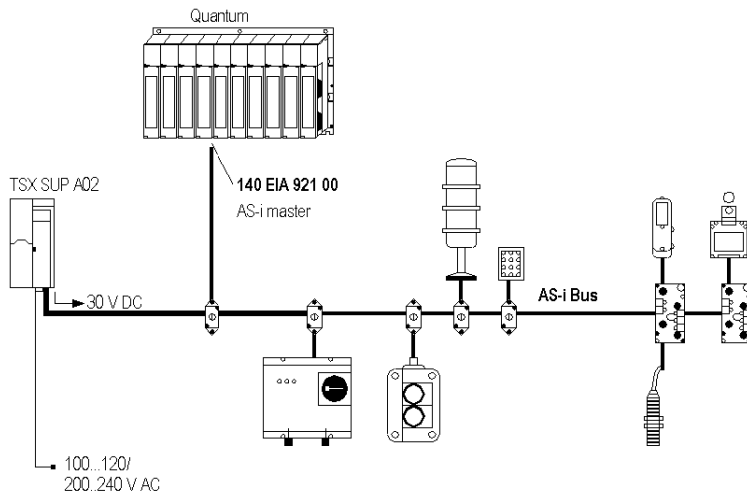
Illustration

Diagram of connections:



Synoptic of Connections

The TSX SUP A02 power supply unit is designed to supply the AS-i bus, and the connected slaves (connected to 30V DC/2.4A output).



Connection Rules

Primary: observe wiring requirements for the phase and the neutral when wiring.

DANGER

ELECTRIC SHOCK

Connect the ground terminal of the module to the protective ground by a yellow/green wire.

Failure to follow these instructions will result in death or serious injury.

To comply with isolation requirements for a 24 V SELV isolated voltage, the following wiring is used:

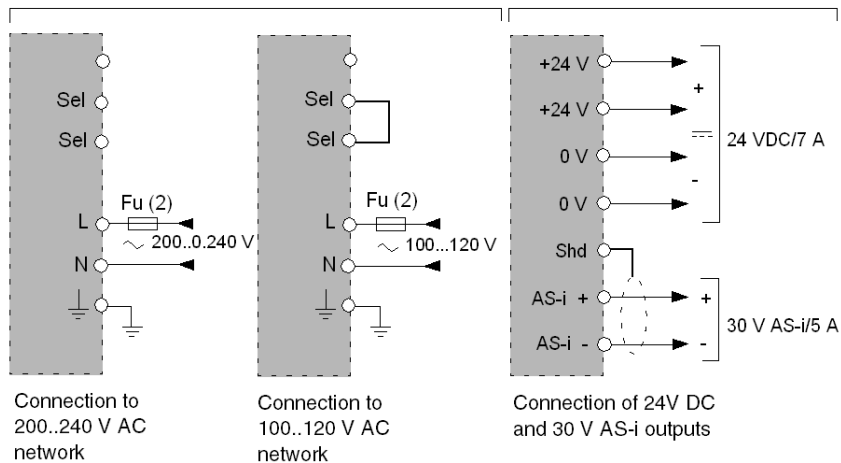
- an operating voltage ≥ 600 Vac with a 1.5mm^2 cross-section for the mains connection,
- an operating voltage ≥ 300 Vac with a cross-section of 25mm^2 for the 24 V outputs and the ground.

It is necessary to use a shielded cable for the AS-i bus only in cases where the installation is subject to very high levels of disturbance in terms of EMC (Electro Magnetic Compatibility).

TSX SUP A05 Power Supply Connections

Illustration

Diagram of connections:

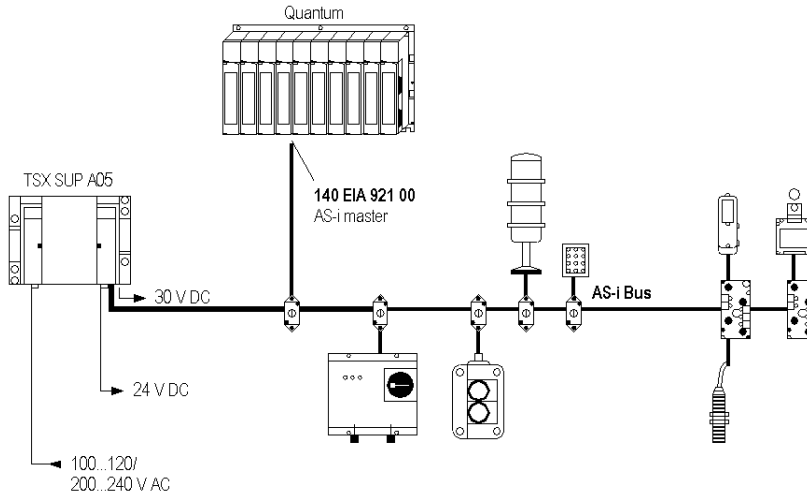


- (1) Connection to be made when using a 100...120V AC power supply network.
- (2) External protection fuse on phase (Fu): 6.3A 250V time delay.
- (3) AS-i shielded cable screen if in disturbed (EMC) environment.

Synoptic of Connections

The TSX SUP A05 power supply unit is designed to supply the AS-i bus, and the connected slaves (connected to 30 V/5A output). It is also equipped with an auxiliary 24 VDC power supply for high power consumption sensors/actuators; this is to be connected using the black AS-i ribbon cable.

Principle diagram:



Connection Rules

Primary: observe wiring requirements for the phase and the neutral when wiring.

DANGER

ELECTRIC SHOCK

Connect the ground terminal of the module to the protective ground by a yellow/green wire.

Failure to follow these instructions will result in death or serious injury.

The "AC power supply network" terminal and 24 V and 30 Vdc AS-i terminals are protected by a flap allowing access to the wiring terminals. The wiring outputs descend vertically, and can be held in place by a cable tie.

Secondary:

To comply with isolation requirements for a 24 V SELV isolated voltage, the following wiring is used:

- an operating voltage $\geq 300\text{Vac}$ with a 1.5mm^2 or 2.5mm^2 cross-section for connection to the mains,
- an operating voltage $\geq 300\text{Vac}$ with a cross-section of 2.5mm^2 for the 24 V outputs and the ground.
- wire the two 24V terminals in parallel or distribute the loads between the two 24V outputs when the total current to be delivered is greater than 5A.

It is necessary to use a shielded cable for the AS-i bus only in cases where the installation is subject to very high levels of disturbance in terms of EMC (Electro Magnetic Compatibility).

Given the high level of current this power supply can generate, its position on the bus is of great importance. If the power supply is positioned at one end of the bus, it provides its nominal current (for example 5A) for the entire bus, and the voltage drop at the other end of the bus is therefore proportional to the 5A delivered. If it is positioned in the middle of the bus, the voltage drop at either end is only proportional to 2.5A where the power consumption on each of the two sections of the bus is equal.

If there is no slave with high power consumption, it is advisable to position the power supply at the center of the installation. Conversely, if the installation has one or more high-power consumers, it is advisable to position the power supply close to these devices.

NOTE: Where high-power consumption actuators (contactors, solenoid coils , etc.), the TSX SUP A05 power supply can provide the auxiliary 24 Vdc, isolated from the AS-i line.

General Precautions

Introduction

It is essential when installing the yellow AS-i cable to place it in a separate cableway to the power cables. It is also preferable to place it flat and to avoid twisting in order to optimize the symmetry between the two wires of the AS-i cable.

The installation of the AS-i cable on a surface connected to the electrical potential of the machine (the frame for example), is recommended in order to comply with the requirements of the EMC (Electro Magnetic Compatibility) directive.

The cable end (or ends for a bus in star configuration) must be connected to a T-piece or by ensuring that it does not protrude from the last connection point.

Important

It is essential to distribute the power evenly over the AS-i bus so that each accessory connected to the bus is supplied with sufficient voltage to ensure that it operates correctly. To achieve this, it is necessary to observe the following rules.

Rule 1

Choose a power supply with a rating suited to the total power consumption of the AS-i segment. The available are ratings 2.4 A (TSX SUP A02) and 5A (TSX SUP A05).

A rating of 2.4 A is generally sufficient for an average power consumption of 65 mA per slave for a segment comprising a maximum of 31 slaves.

Rule 2

To minimize the effects of voltage drops and to reduce cable costs, it is necessary to determine the optimum power supply position on the bus, and also the minimum cable cross-section appropriate for the distribution of power.

The voltage drop should not exceed 3 V between the master and the last slave on the bus. The table below lists the elements necessary for choosing the cross section of the AS-i cable.

Table of characteristics:

AS-i cable cross-section	0.75 mm ²	1.5 mm ²	2.5 mm ²
Linear resistance	52 milli Ohms/meter	27 milli Ohms/meter	16 milli Ohms/meter
Voltage drop for 1A over 100 meters	5.2V	2.7V	1.6V

The cable that meets the requirements for the majority of applications is the cable with a 1.5 mm² cross-section. It is the standard model for the AS-i bus (cable offered in the Schneider catalog).

Cables of smaller cross-section can be used where the sensors consume very little power.

NOTE: The maximum length without repeaters of all the segments making up the AS-i bus is 100 meters. The lengths of cable connecting a slave to a passive distributor must be taken into account.

Section 3.4

Characteristics of AS-i bus power supply units

Aim of this Section

This section describes the electrical characteristics of AS-i bus power supply units.

What Is in This Section?

This section contains the following topics:

Topic	Page
Electrical characteristics of AS-i power supply units TSX SUP A02/A05	82
Physical characteristics of environment	84

Electrical characteristics of AS-i power supply units TSX SUP A02/A05

Table of characteristics

The following table describes the electrical characteristics of the power supply units:
TSX SUP A02/A05

AS-i power supply		TSX SUP A02 30 V/2.4 A AS-i	TSX SUP A05 24 V/7 A AS-i & 30 V/5 A AS-i	
Primary:				
Nominal input voltage	V	AC 100...120/200...240	AC 100...120/200...240	
Threshold input voltage	V	AC 85...132/170...264	AC 85...132/170...264	
Network frequency	Hz	47...63/360...440	47...63/360...440	
Nominal input current (U=100 V)	A	1.3	5	
Maximum inrush current (1)	at 100 V	A	30	50
	at 240 V	A	30	50
Maximum it upon activation (1)	at 100 V	As	0.06	0.17
	at 240 V	As	0.03	0.17
Maximum i^2t upon activation (1)	at 100 V	A ² s	4	8.5
	at 240 V	A ² s	4	8.5
Power factor		0.6	0.51	
Harmonic 3		10% (Phi=0° and 180°)	10% (Phi=0° and 180°)	
Efficiency at full load	%	>75	>80	
Secondary:				
Useful power	W	72(84) (2)	230 (3)	
Peak nominal current	30 V AS-i output	A	2.4(2.8) (2)	
	24 V output	A	-	
Output voltage	V	30(AS-i)	24	30(AS-i)
Global variation (-10°C to +60°C)	V	29.5 to 31.6	+/-3%	29.5 to 31.6
Ripple (from 10 to 500 kHz)	mV	50	200	50
Ripple (from 0 to 10 kHz)	mV	300	240	300
Startup time on resistive load	s	<2(with C=15000 micro Farads)	<2(with C= 15000 micro Farads)	
Duration of mains power supply micro-cuts (5)	ms	<=10	<=10	

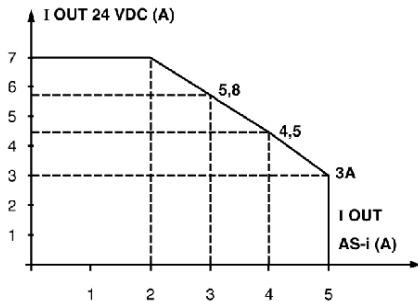
AS-i power supply			TSX SUP A02 30 V/2.4 A AS-i	TSX SUP A05 24 V/7 A AS-i & 30 V/5 A AS-i
Protection against	Short-circuits and overloads		fallback to 0 and automatic reactivation on disappearance of fault	limitation of current on each output
	Oversvoltage	V	peak clipping $U > 36$	peak clipping $U > 36$
Power dissipation		W	24	60

- (1) Values at initial power-up, at 25°C. These items must be taken into account at start-up for the dimensioning of protection devices.
- (2) Useful power and output current for an ambient temperature of 60°C. Value between() = transient useful power.
- (3) Useful power and output current for a maximum ambient temperature of 55°C, if product index II = 01. (60°C if product index II > 01).
- (4) See diagram showing the distribution of current for each output, on the next page.
- (5) Acceptable duration, at nominal voltage for a repetition period of 1 Hz.

Diagram of currents available for 30 V AS-i outputs and 24 V outputs of the TSX SUP A05 power supply block

The maximum power delivered by the power supply is 230 W. If the consumption is 5 A on the 30 V AS-i, the possible load on the 24 V output is only 3 A (see diagram below).

Diagram:



Physical characteristics of environment

Table of characteristics

The following table describes the electrical characteristics of TSX SUP A02/A05 power supplies:

AS-i power supply module/block		TSX SUP A02/A05
Connection to screw terminals		A02:1 output terminal A05: 2 terminals/output (24 V DC) and 1 terminal/output (30 V DC AS-i)
max. capacity per terminal	mm ²	2 x 1.5 with cable end or 1 x 2.5
Temperature:		-
Storage	°C	25 to +70
Operation	°C	-10 to +60 (1)
Relative humidity	%	5-95
Cooling	%	By natural convection
User safety		SELV (EN 60950 and IEC1131-2)
Dielectric strength:		
Primary/secondary	V rms	3500
Primary/ground	V rms	2200
Secondary/ground	V rms	500
Insulation resistance		
Primary/secondary	Mega Ohms	>=100
Primary/ground	Mega Ohms	>=100
Leakage current		I<=3.5 mA (EN 60950)
Immunity to electrostatic discharges		6 kV on contact/8 kV in air (compliant with IEC 1000-4-2)
Electrical Fast Transient		2 kV (series mode and common mode common on input and output)
Influence of electromagnetic field		10 V/m (80 MHz at 1 GHz)
Rejected electromagnetic disturbances		(compliant with FCC 15-A and EN 55022 class A) Test conditions: nominal U and I, resistive load, cable: 1 meter horizontal, 0.8 meter vertical
Shock wave		Input: 4kV MC, 2kV MS Outputs: 2kV MF, 0.5 kV MS (compliant with IEC 1000-4-5)
Vibration (2)		1 mm 3 Hz at 13.2 Hz 2g 57 Hz at 150 Hz (compliant with IEC 68-2-6, FC test)

AS-i power supply module/block		TSX SUP A02/A05
Degree of protection		IP 20.5
MTBF at 40°C	H	100 000
Lifetime at 50°C	H	30 000 (at nominal voltage and at 80% of nominal power)

- (1) -10°C +55°C for TSX SUP A02/A05 power supply with product index II=01.
- (2) compliant with IEC 68-2-6, FC test with module or block mounted on plate or panel.

Part III

Software Configuration and Commissioning

Chapter 4

Parameter Configuration

Overview

This chapter describes the parameter configuration of the AS-i Bus Master EIA 921 00.

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Configuration in local Quantum I/O station	90
Access to Parameter Configuration	92
Parameter Configuration	93
Configuration Example	95
Restart the ASI bus after the stop/start cycle	99

Configuration in local Quantum I/O station

Overview

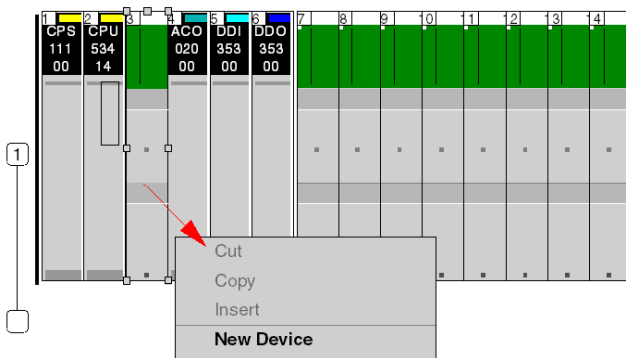
This section shows you how the AS-i Bus Master can be integrated in an existing Quantum configuration. The example uses a **local** Quantum I/O station.

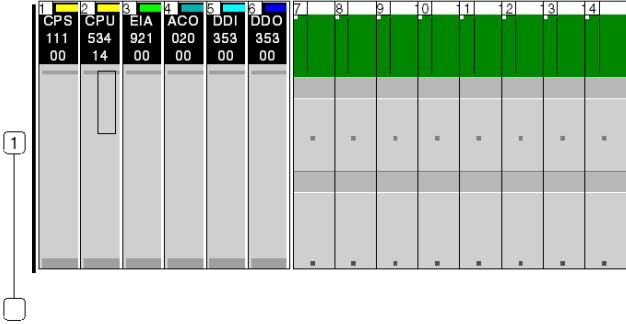
NOTE: The same procedure is used for implementation in a RIO or DIO network.

Inserting the AS-i Bus Master (local)

The following dialog box enables you to expand an existing local Quantum I/O station to include the AS-i Bus Master 140 EIA 921 00.

Step	Action
1	Call the Bus Editor
2	Mark a free slot in the local station (left mouse button)
3	Move the mouse pointer over the marked slot
4	Click the right mouse button Result: A shortcut menu is opened
5	Select New Device Result: A dialog window opens that displays all available modules



Step	Action
6	<p>Select the EIA 921 from the communication modules.</p> <p>Result: The new module (EIA 921) is inserted in the empty slot on the local station.</p>  <p>The diagram shows a rack of 14 slots. Slot 1 is highlighted with a box and a callout '1'. Slot 2 contains a CPU module (S34 14). Slot 3 contains an EIA 921 module. Slot 4 contains an ACO 020 module. Slot 5 contains a DDI 353 module. Slot 6 contains a DDO 353 module. Slots 7 through 14 are shaded green, indicating they are occupied or reserved. The modules in slots 1-6 are: CPS 111 00, CPU S34 14, EIA 921 00, ACO 020 00, DDI 353 00, and DDO 353 00.</p>

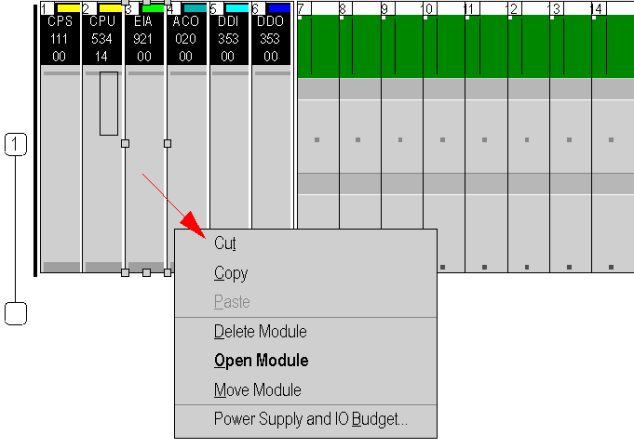
Access to Parameter Configuration

Overview

The following Control Expert dialog is necessary to access the module in preparation to the *Parameter Configuration*, page 93

Dialog to access the Parameter Configuration

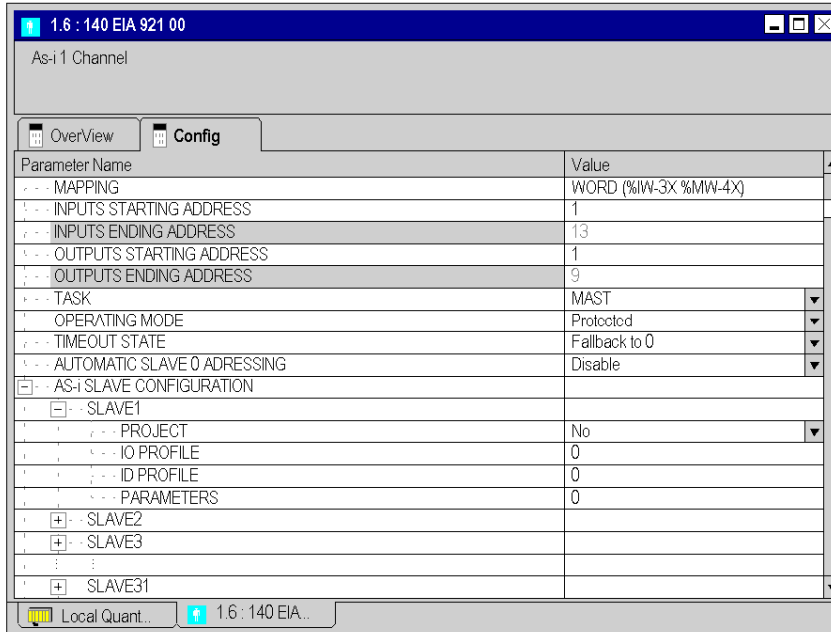
This table shows the Control Expert dialog to access the Parameter Configuration

Step	Action																																																								
1	Open the Bus Editor of Control Expert																																																								
2	Select the EIA 921 00 module																																																								
3	Click on the right mouse button Result: The context menu appears																																																								
	 <p>The screenshot shows a grid of modules in the Bus Editor. The modules are labeled as follows:</p> <table border="1"> <thead> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> <th>8</th> <th>9</th> <th>10</th> <th>11</th> <th>12</th> <th>13</th> <th>14</th> </tr> </thead> <tbody> <tr> <td>CPS</td> <td>CPU</td> <td>EIA</td> <td>ACO</td> <td>DDI</td> <td>DDO</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>111</td> <td>534</td> <td>921</td> <td>020</td> <td>353</td> <td>353</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>00</td> <td>14</td> <td>00</td> <td>00</td> <td>00</td> <td>00</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>The context menu is open over the EIA 921 00 module (row 3, column 3). The menu options are: Cut, Copy, Paste, Delete Module, Open Module, Move Module, and Power Supply and IO Budget... A red arrow points to the 'Open Module' option.</p>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	CPS	CPU	EIA	ACO	DDI	DDO									111	534	921	020	353	353									00	14	00	00	00	00								
1	2	3	4	5	6	7	8	9	10	11	12	13	14																																												
CPS	CPU	EIA	ACO	DDI	DDO																																																				
111	534	921	020	353	353																																																				
00	14	00	00	00	00																																																				
4	Choose Open Module Result: The module opens with the Parameter Configuration screen																																																								

Parameter Configuration

Parameter and Default Values

Parameter Configuration Window



Name	Default Value	Options	Description
MAPPING	WORD (%IW-3x %MW-4X)		
INPUTS STARTING ADDRESS	1	1-65522	Address area where the input information from the AS-i modules is mapped
INPUTS ENDING ADDRESS	13		
OUTPUTS STARTING ADDRESS	1	1-65526	Address area where the output information to the AS-i modules is mapped
OUTPUTS ENDING ADDRESS	9		

Name	Default Value	Options	Description
TASK (Grayed if module in other than local)	MAST	FAST AUX0 AUX1 AUX2 AUX3	Fixed to MAST if module in other than local
OPERATING MODE	Protected	Configuration	Configuration Mode: all slaves are activated, i.e. writing on outputs as well as reading from inputs is done directly. Protected Mode: Only those slaves with a configuration on the AS-i bus which matches the reference configuration are activated.
TIMEOUT STATE	Fallback to 0	HOLD LAST VALUE	Determines the state of the I/O points in case of an communication error
AUTOMATIC SLAVE 0 ADDRESSING	Disable	Enable	When this function is enabled a faulty slave can be replaced by a slave of the same type without stopping the AS-i bus.
AS-i SLAVE CONFIGURATION			
AS-i SLAVE 1			
PROJECT	No	Yes	When "Yes", the configuration is downloaded to the slave and the slave is added to the list of configured slaves
IO PROFILE	0		Refer to indications of the slave manufacturer about slave profiles and capabilities.
ID PROFILE	0		
PARAMETERS	0		
AS-i SLAVE 2-31	see AS-i SLAVE 1		

Configuration Example

Introduction

The following example shows the information required to operate a AS-i field device on a 140 EIA 921 00 AS-i Master module using Control Expert.

An inductive proximity switch (type XS1) is connected as Slave 1 and Signal column (type XVB) as Slave 2.

Proximity switch

The following table shows the communication specifications for the inductive proximity switch XS1 M30AS101:

AS-i Profile		S1.1		
		Bit Status	0	1
Data Bits	Status	D0 (Input)	Signal "Off"	Signal "On"
		D1 (Input)	Alarm "On"	Alarm "Off"
		D2 (Input)	Not operation ready	Operation ready
		D3 (Input)	Not occupied	Not occupied
	Command	D0 (Output)	Not occupied	Not occupied
		D1 (Output)	Not occupied	Not occupied
		D2 (Output)	Not occupied	Not occupied
		D3 (Output)	Not occupied	Not occupied
	Parameter	P0	Not occupied	Not occupied
		P1	Not occupied	Not occupied
		P2	Not occupied	Not occupied
		P3	Flashing light "On"	Flashing light "Off"

Signal column

The following table shows the communication specifications for the signal column type XV*:

AS-i Profile		S7.F		
		Bit Status	0	1
Data Bits	Status	D0 (Input)	Not occupied	Not occupied
		D1 (Input)	Not occupied	Not occupied
		D2 (Input)	Not occupied	Not occupied
		D3 (Input)	Not occupied	Not occupied
	Command	D0 (Output)	Element 1: "off"	Element 1: "on"
		D1 (Output)	Element 2: "off"	Element 2: "on"
		D2 (Output)	Element 3: "off"	Element 3: "on"
		D3 (Output)	Element 4: "off"	Element 4: "on"
	Parameter	P0	Element 1: "Flashing light"	Element 1: "Continuous light"
		P1	Element 2: "Flashing light"	Element 2: "Continuous light"
		P2	Element 3: "Flashing light"	Element 3: "Continuous light"
		P3	Element 4: "Flashing light"	Element 4: "Continuous light"

Addresses and functions

The input signals for the AS-i field device should be mapped in the input word area %IW101 to %IW113, the output command to the AS-i field device are found in words %MW 201 to %MW209.

The flashing light operational display for the inductive proximity switch should be deactivated.

Elements 2 and 3 of the signal column should be configured as flashing lights, the other elements as continuous lights.

Data transfer

You can transfer the following information from the data sheets for configuring the 140 EIA 921 00:

- AS-i Profile (representation: IO Profile.ID Profile)
S1.1: IO Profile = 1, ID Profile = 1
S7.F: IO Profile = 7, ID Profile = 15 (decimal value of Hex F)
- Parameter
Flashing light "OFF", P3 = "1", Parameter = $2^3 = 8$
Elements 2 and 3 flashing, P0 and P3 = "1", Parameter = $2^0 + 2^3 = 9$

Parameter configuration

Parameter Configuration Window

The screenshot shows a software window titled "1.6 : 140 EIA 921 00" with a sub-header "As-i 1 Channel". It features two tabs: "Overview" and "Config". The "Config" tab is active, displaying a table of parameters. The table has two columns: "Parameter Name" and "Value". The parameters are organized into a tree structure with expandable/collapsible icons.

Parameter Name	Value
MAPPING	WORD (%W-3X %MW-4X)
INPUTS STARTING ADDRESS	101
INPUTS ENDING ADDRESS	113
OUTPUTS STARTING ADDRESS	201
OUTPUTS ENDING ADDRESS	209
TASK	MAST
OPERATING MODE	Protected
TIMEOUT STATE	Fallback to 0
AUTOMATIC SLAVE 0 ADDRESSING	Disable
AS-I SLAVE CONFIGURATION	
- SLAVE1	
PROJECT	Yes
IO PROFILE	1
ID PROFILE	1
PARAMETERS	8
- SLAVE2	
PROJECT	Yes
IO PROFILE	7
ID PROFILE	15
PARAMETERS	9
+ SLAVE3	

At the bottom of the window, there are two status indicators: "Local Quant..." and "1.6 : 140 EIA..."

Data access

You can take the assignment of the AS-i field device I/O bits to the internal addresses in the Control Expert program from the inputs and outputs mapping table. Word 1 in the input mapping table corresponds to %IW101 and word 1 in the output mapping table corresponds to %MW201.

Input mapping table:

	Most significant Byte								Least significant Byte							
Word Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Slave Input	D3	D2	D1	D0	D3	D2	D1	D0	D3	D2	D1	D0	D3	D2	D1	D0
Word 1	Slave 3				Slave 2				Slave 1				Not Used			
Word 2	Slave 7				Slave 6				Slave 5				Slave 4			
...			

Output mapping table:

	Most significant Byte								Least significant Byte							
Word Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Slave Output	D3	D2	D1	D0	D3	D2	D1	D0	D3	D2	D1	D0	D3	D2	D1	D0
Word 1	Slave 3				Slave 2				Slave 1				Not Used			
Word 2	Slave 7				Slave 6				Slave 5				Slave 4			
...			

Restart the ASI bus after the stop/start cycle

Problem description

After a PLC stop/start cycle the ASI bus does not start automatically.

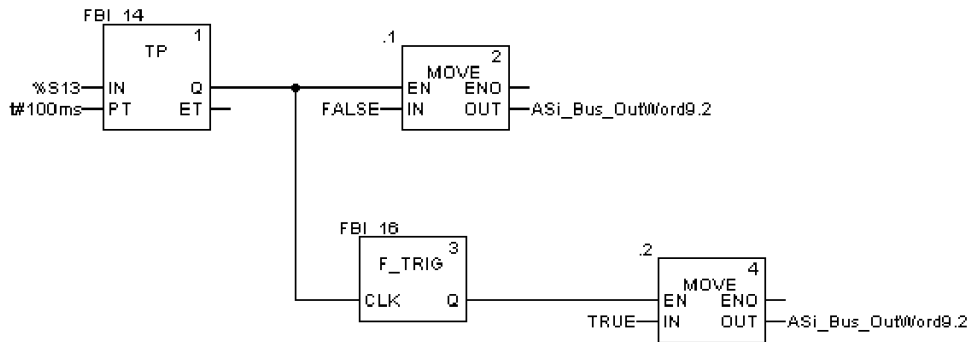
Solution

To resolve the problem, you have the following options:

- Hot swap the ASI module EIA 921 00.
 - or
 - Reset bit 2 for the ASI control word (output word 9) and then set it again.
- You can execute this
- manually in the animation table
 - or
 - by implementing it in the program.

Example code

In this example bit 2 of the ASI control word is set to FALSE for the first 100 ms after the PLC starts. When the 100 ms have elapsed bit 2 is reset to TRUE.





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