

## List of Figures

Figure 1-1 Star topology used in the architecture of Process Control .....	4
Figure 1-2 The hierarchical architecture .....	5
Figure 1-3 The distributed architecture in Process Control Systems .....	5
Figure 1-4 The fully distributed architecture, based on a Fieldbus, found in modern industrial automation systems .....	6
Figure 1-5 The Computer Integrated Manufacturing (CIM) architecture .....	7
Figure 1-6 The OSI 7-layers reference model (a), and the reduced Fieldbus 3-layer structure (b) .....	9
Figure 1-7 Fieldbus topologies: a) mesh b) star c) tree d) bus e) ring .....	11
Figure 2-1 AS-i in the automation pyramid .....	13
Figure 2-2 The AS- i certification symbol (shadow logo) .....	14
Figure 2-3 Conventional Cabling Scheme .....	15
Figure 2-4 AS-i Cabling Scheme .....	16
Figure 2-5 New A/B Technology in V 2.1 .....	17
Figure 2-6 AS-i Topology up to 100 m .....	18
Figure 2-7 AS-i network Extension up to 300 m .....	18
Figure 2-8 AS-i network Extension up to 600 m .....	19
Figure 3-1 AS-i PLC Master .....	21
Figure 3-2 AS-i Gateway Master .....	22
Figure 3-3 AS-i Power Supply .....	23
Figure 3-4 AS-i Cables .....	23
Figure 3-5 AS-i Smart Line Modules .....	24
Figure 3-6 Field Application Module SIEMENS Type .....	25
Figure 3-7 How to install an AS-i module .....	25
Figure 3-8 Different Types of AS-i Sensors .....	26
Figure 3-9 Connection of the AS-i actuator to an AS-i network .....	26
Figure 3-10 AS-i Addressing Unit .....	27
Figure 3-11 FC Insulation Displacement Connector .....	28
Figure 3-12 Different Types of Flat Cable Sealing .....	28
Figure 3-13 Repeater in AS-i network .....	28
Figure 3-14 Extender in an AS-i network .....	29
Figure 4-1 Interaction Between PLC, Master and Slaves .....	33
Figure 4-2 Master Operating Phases .....	34
Figure 4-3 Slaves Mapping into the PLC .....	36
Figure 4-4 Signal Coding in AS-i .....	37
Figure 4-5 Structure of an AS-Interface Master Message .....	38
Figure 4-6 Structure of an AS-Interface Slave Message .....	38
Figure 4-7 AS-i Bus Startup Phase .....	39
Figure 4-8 AS-i Bus Activation Phase .....	40
Figure 5-1 PLC UNIT .....	43
Figure 5-2 AS-i unit .....	44
Figure 5-3 AS-i Power Supply (AC 1236 IFM) .....	45
Figure 5-4 DP/AS-i Link Advanced .....	46
Figure 5-5 AS-i slave module (AC2264 IFM) .....	46

Figure 5-6 Schematic Diagram of IFM AS-i slave module AC2264 .....	47
Figure 5-7 PHOENIX Power Supply.....	48
Figure 5-8 AS-i Cable.....	49
Figure 5-9 Source of 220 VAC.....	50
Figure 5-10 Source of 24 VDC.....	50
Figure 5-11 AS-i power supply wiring.....	51
Figure 5-12 DP/AS-i Link wiring.....	51
Figure 5-13 AS-i Slave Module wiring.....	52
Figure 5-14 The Conveyor Unit.....	52
Figure 5-15 Starting SIMATIC Manager .....	53
Figure 5-16 Creating S7 project.....	54
Figure 5-17 Inserting S7 program.....	54
Figure 5-18 Inserting a Station .....	55
Figure 5-19 Hardware Configuration tool .....	56
Figure 5-20 CPU Selection in H.W Configuration Tool .....	57
Figure 5-21 Establish a PROFIBUS network .....	57
Figure 5-22 CPU as a DP master in the network .....	58
Figure 5-23 AS-i master in the PROFIBUS network .....	58
Figure 5-24 Assignment an address for the AS-i master in the PROFIBUS network.....	59
Figure 5-25 Assign the I/O area of the AS-i master .....	60
Figure 5-26 AS-i slave module selection.....	60
Figure 5-27 AS-i slave Properties Window .....	61
Figure 5-28 Final Hardware Configurations.....	62
Figure 5-29 Saving Final H.W Configuration .....	62
Figure 5-30 Downloading Final H.W Configuration to the PLC .....	63
Figure 5-31 Symbol Table in S7 Program .....	63
Figure 5-32 Code in LAD.....	64

## List of Tables

Table 2-1 AS-i (V3.0) Features .....	19
Table 4-1 Different AS-i Master Profiles .....	31
Table 4-2 I/O Configuration Code .....	31
Table 4-3 Allocated Profile of AS-i slaves .....	32
Table 5-1 Pin Assignment in AS-i slave module AC2264 .....	47
Table 5-2 Accessories in AS-i unit .....	49
Table 5-3 I/O symbols used in the S7 program .....	64

## **Abstract**

For about 20 years now, the word "Fieldbus" has been very widely used. Its common meaning is a network for connecting field devices such as sensors, actuators, field controllers such as PLCs, regulators, drives, controllers, etc., and Human Machine Interfaces (HMI). One of the most important Fieldbus systems is the actuator-sensor interface (AS-i) which is the standard solution for simple, cost-effective networking of sensors and actuators in the field. AS-Interface has established a strong position throughout the automation technology industry.

The actuator-sensor interface (AS-i) replaces conventional wiring technology on the sensor actuator level. AS-i has firmly established itself as a worldwide standard for the cost-effective transfer of power and signals along a single cable. It is an open system and is compatible with all common Fieldbus systems.

The AS-i has many advantages as it minimizes installation costs with high noise immunity during data transfer. AS-i is flexible as signals and power are transferred along a reverse polarity protected yellow flat cable.

The AS-i gateway controls the AS-i system and transmits process data to all types of higher-level control in a standardized I/O map. The AS-i adopts the role of a conventional I/O card in the controller, which allows a simple changeover.

In this study, we will explain the AS-i Fieldbus, its advantages, network structure, system components and message frame structure. A practical setup illustrates how to implement the AS-i Fieldbus as a solution in the field applications.