softing

Master Integration for Automation Systems

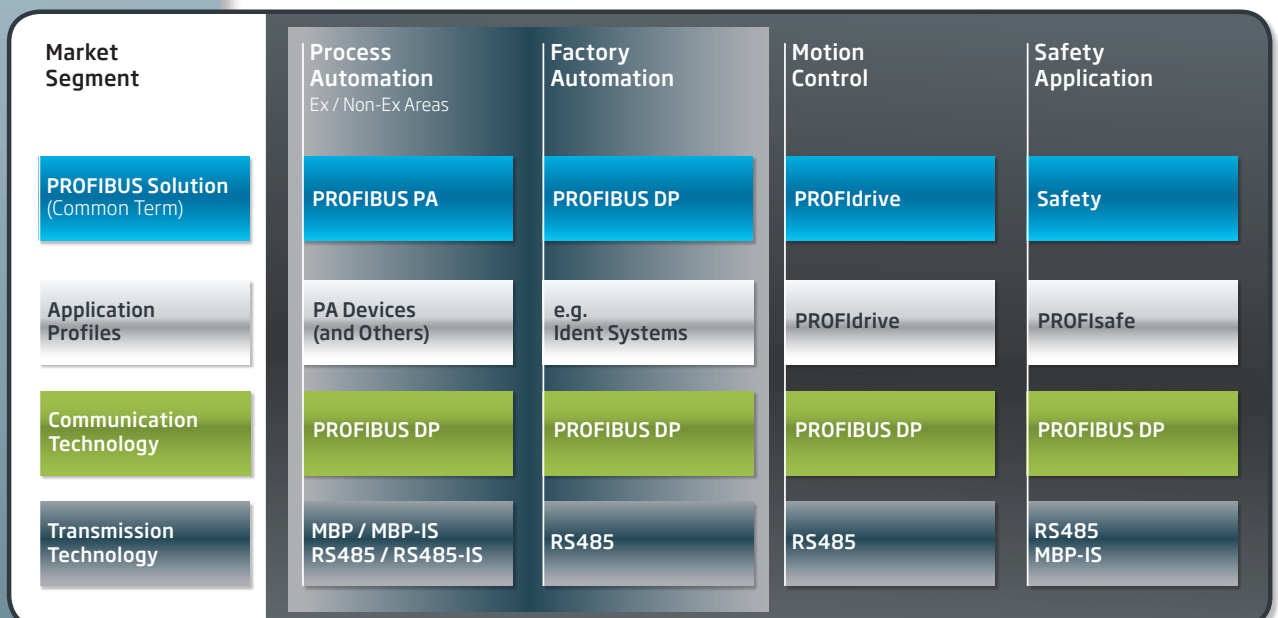## PROFIBUS – A FIELDBUS SOLUTION FOR EVERYONE

PROFIBUS (**PRO**cess **FI**eld **B**US) is a world leading fieldbus communication standard in the automation industry. It is designed for highly reliable digital data exchange within a network using a single bus cable. Based on numerous protocol extensions, PROFIBUS provides solutions for a wide range of application areas including manufacturing and process automation.

By the end of 2012, the installed base exceeded the figure of 43 million PROFIBUS devices, of which about 36 million devices are used in the factory industry and 7.5 million in process automation. More than 2,500 PROFIBUS products are available from around 300 manufacturers.

The history of PROFIBUS goes back to 1987, when a publicly-funded collaborative project was launched by 18 companies and institutes in Germany. The PROFIBUS Fieldbus Message System (FMS) standard developed in a first step was followed in 1993 by the simpler and much faster PROFIBUS Decentralized Peripherals (DP) standard, which focuses on deterministic communication between PROFIBUS masters and remote I/O field devices (sensors and actuators).

In 1996, the PROFIBUS Process Automation (PA) standard was defined. Designed specifically for process automation needs, this standard is suitable for use in hazardous and potentially explosive areas (Ex zones 0 and 1). PROFIBUS DP and PROFIBUS PA use an identical protocol. PROFIBUS PA can be linked to a PROFIBUS DP network by using a coupler device while PROFIBUS DP acts as a backbone network for transmitting process signals to the controller.

The behavior of PROFIBUS devices is determined by the PROFIBUS protocol together with the implemented customer application. Certification tests ensure high quality and fully functional PROFIBUS modules and applications, which are interoperable and easy to install.

Market Segment	Process Automation Ex / Non-Ex Areas	Factory Automation	Motion Control	Safety Application
PROFIBUS Solution (Common Term)	PROFIBUS PA	PROFIBUS DP	PROFIdrive	Safety
Application Profiles	PA Devices (and Others)	e.g. Ident Systems	PROFIdrive	PROFIsafe
Communication Technology	PROFIBUS DP	PROFIBUS DP	PROFIBUS DP	PROFIBUS DP
Transmission Technology	MBP / MBP-IS RS485 / RS485-IS	RS485	RS485	RS485 MBP-IS

ABOUT SOFTING

Softing Industrial Automation (SIA) is part of the Germany based Softing AG, founded in 1979. SIA is a world leading provider of industrial communication products and technologies for factory and process automation.

As one of the first members of the PROFIBUS Nutzerorganisation (PNO), Softing has been involved in the PROFIBUS project from the very start and has developed numerous PROFIBUS products used by a large number of manufacturers and vendors around the world, in a wide variety of applications.

With various successful FPGA-based Ethernet and fieldbus projects and product developments, Softing has gained extensive knowledge in FPGA technology and is the only provider of PROFIBUS Masters based on FPGA technology.

Softing's offerings for PROFIBUS DP Master implementations are based on cutting edge technology and vast experience, resulting in field-proven high-quality products. Supported by sales offices in the USA, China and Japan and distribution partners around the world, Softing is an efficient and reliable long-term partner dedicated to providing excellent service and support.

Softing is not only strongly committed to PROFIBUS, but also actively supports all other major fieldbus protocols!

OPTIONS FOR IMPLEMENTING A PROFIBUS SOLUTION

As a world leading provider of industrial communication products and technologies, Softing offers a complete single-source set of solutions for the implementation of a PROFIBUS device and, in particular, a full-featured PROFIBUS DP Master protocol stack with different implementation options. These options address the specific needs of various manufacturer groups and comprise hardware, software, tools and services.

The individual Softing PROFIBUS options are based on a protocol stack that was completely developed by Softing and covers the full PROFIBUS DP functionality. It includes the PROFIBUS DP versions DP-V0 for the exchange of cyclic data and diagnoses with slaves, DP-V1 for acyclic data exchange and alarm handling as well as DP-V2 for isochronous mode and time synchronization. The protocol stack supports the implementation of a PROFIBUS DP Master Class 1 or Class 2, providing the full range of defined transfer rates from 9.6Kbit/s to 12Mbit/s.

Softing's PROFIBUS stack incorporates functionality that allows single PROFIBUS Slaves to be re-configured while the plant is running, thus helping to prevent high costs. For the individual implementation, the available functionality can be adapted to specific customer requirements, for instance with regard to master and line redundancy support. In addition, the controller interface of the PROFIBUS DP Master protocol stack supports direct access to the underlying PROFIBUS Fieldbus Data Link (FDL) protocol in parallel.
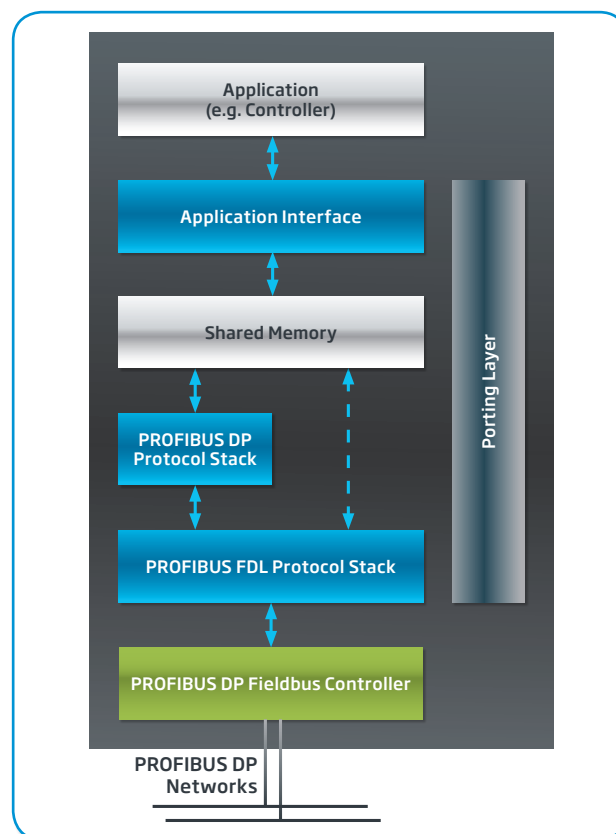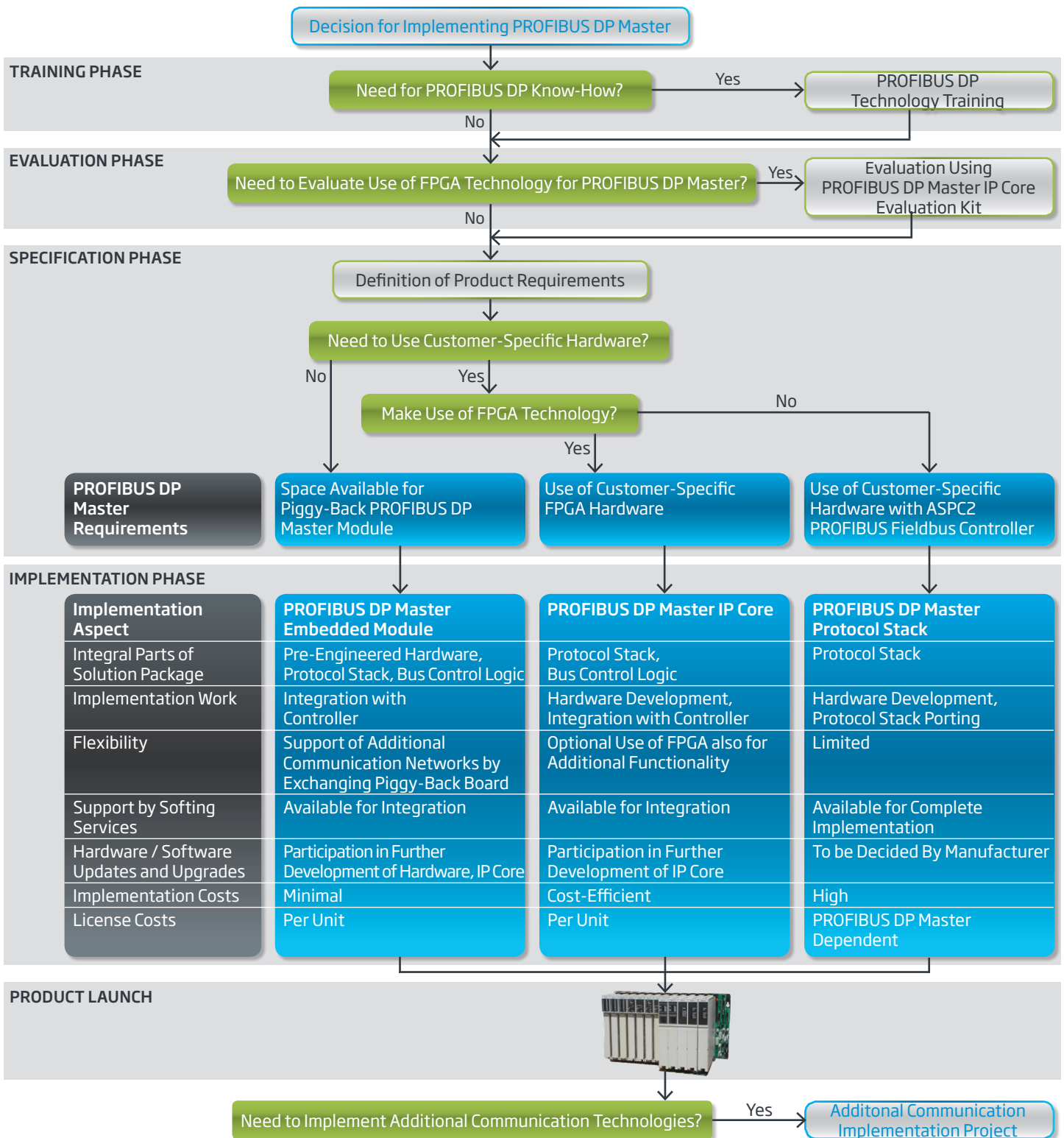

The implementation options include:

> **PROFIBUS DP Master Embedded Module** for solutions with minimum implementation effort

> **PROFIBUS DP Master IP Core** for solutions with minimum hardware

> **PROFIBUS DP Master Protocol Stack Integration** for solutions with maximum implementation flexibility

SELECTING THE
PROFIBUS OPTION OF CHOICE

The illustration below provides a guide to selecting the best fitting option for implementing a PROFIBUS DP Master.

Decision for Implementing PROFIBUS DP Master

TRAINING PHASE

Need for PROFIBUS DP Know-How? —Yes→ PROFIBUS DP Technology Training

No

EVALUATION PHASE

Need to Evaluate Use of FPGA Technology for PROFIBUS DP Master? —Yes→ Evaluation Using PROFIBUS DP Master IP Core Evaluation Kit

No

SPECIFICATION PHASE

Definition of Product Requirements

Need to Use Customer-Specific Hardware?

No / Yes

Make Use of FPGA Technology? —No→

Yes

PROFIBUS DP Master Requirements	Space Available for Piggy-Back PROFIBUS DP Master Module	Use of Customer-Specific FPGA Hardware	Use of Customer-Specific Hardware with ASPC2 PROFIBUS Fieldbus Controller

IMPLEMENTATION PHASE

Implementation Aspect	PROFIBUS DP Master Embedded Module	PROFIBUS DP Master IP Core	PROFIBUS DP Master Protocol Stack
Integral Parts of Solution Package	Pre-Engineered Hardware, Protocol Stack, Bus Control Logic	Protocol Stack, Bus Control Logic	Protocol Stack
Implementation Work	Integration with Controller	Hardware Development, Integration with Controller	Hardware Development, Protocol Stack Porting
Flexibility	Support of Additional Communication Networks by Exchanging Piggy-Back Board	Optional Use of FPGA also for Additional Functionality	Limited
Support by Softing Services	Available for Integration	Available for Integration	Available for Complete Implementation
Hardware / Software Updates and Upgrades	Participation in Further Development of Hardware, IP Core	Participation in Further Development of IP Core	To be Decided By Manufacturer
Implementation Costs	Minimal	Cost-Efficient	High
License Costs	Per Unit	Per Unit	PROFIBUS DP Master Dependent

PRODUCT LAUNCH

Need to Implement Additional Communication Technologies? —Yes→ Additonal Communication Implementation Project

PROFIBUS DP MASTER IMPLEMENTATION OPTIONS

PROFIBUS DP MASTER IP CORE

The PROFIBUS DP Master IP Core is particularly suitable for the

> Implementation of a PROFIBUS DP Master, Class 1 or Class 2

> Retrofit of an existing PROFIBUS DP Master implementation

> New development of a PROFIBUS DP Master

> Support of flexibility to integrate additional functionality in the FPGA

The PROFIBUS DP Master IP Core supports a communication implementation based on loadable IP Cores. To achieve cost-efficient target hardware including an FPGA, the PROFIBUS DP Master IP Core comprises the bus control logic and the PROFIBUS DP Master Protocol Stack.

The bus control logic provides access to the PROFIBUS DP network and handles all time-critical parts of the PROFIBUS DP Data Link Layer, like token handling and cyclic data exchange. The PROFIBUS DP Master Protocol Stack performs the PROFIBUS DP Master functionality and is executed on a soft-core processor within the FPGA.

The FPGA is part of a customer-specific hardware platform and allows the integration of additional functionality (e.g. controller functionality, access to the controller backplane bus). For this, the PROFIBUS DP Master IP Core on the FPGA can be updated via the Dual Port Memory interface.

As an FPGA is a mainstream product, the use of FPGA technology minimizes the obsolescence risk. By default, the PROFIBUS DP Master IP Core is based on an Altera or Xilinx FPGA; additional FPGAs can be supported on request.

While the PROFIBUS DP Master IP Core requires a reasonable amount of development effort, its use offers the possibility to benefit from further developments to the IP Core.

If requested, individual development tasks can be taken care of by Softing.

The PROFIBUS DP Master IP Core is supported by a Development Package.

Block Diagram of PROFIBUS DP Master IP Core Running on FPGA
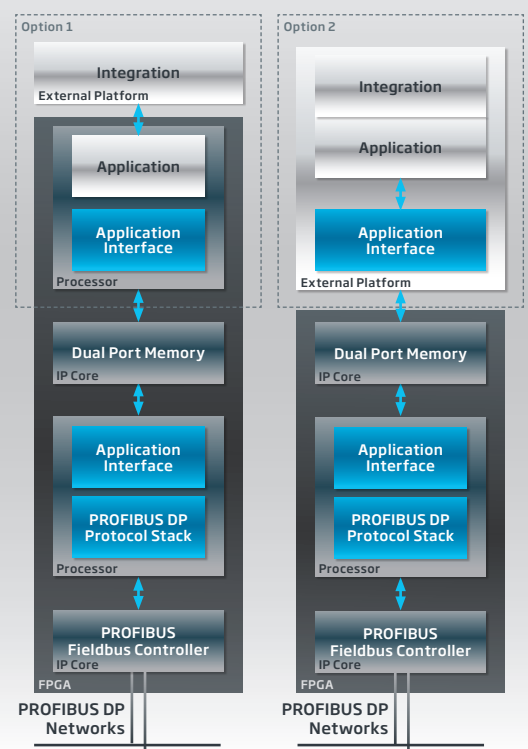
PROFIBUS DP MASTER IMPLEMENTATION OPTIONS

PROFIBUS DP MASTER EMBEDDED MODULE

The PROFIBUS DP Master Embedded Module is designed for the

> Development of a PROFIBUS DP Master, Class 1 or Class 2
> Retrofit of an existing PROFIBUS DP Master implementation
> New development of a PROFIBUS DP Master
> Integration into a controller with available space for a piggy-back board

The PROFIBUS DP Master Embedded Module provides the complete hardware and software for implementing a PROFIBUS DP Master. It is ready-to-use and requires minimal integration.

The PROFIBUS DP Master Embedded Module is based on the Softing PROFIBUS DP Master IP Core using FPGA technology. It is integrated into a customer controller hardware as a piggy-back board using the appropriate hardware interface. The controller integration is performed using the provided Dual Port Memory interface, which is also used for updates to the PROFIBUS DP Master IP Core.

The use of the PROFIBUS DP Master Embedded Module offers the possibility to benefit from further IP Core development.

If requested, individual development tasks can be taken care of by Softing.

The PROFIBUS DP Master Embedded Module allows the support of additional communication networks, e.g. PROFINET or Ethernet/IP, by simply replacing the board by the relevant embedded module.

PROFIBUS DP MASTER PROTOCOL STACK INTEGRATION

The PROFIBUS DP Master Protocol Stack integration is suitable for

> The development of a PROFIBUS DP Master controller based on
> Individual hardware requirements, e.g. regarding unit size with
> ASPC2 PROFIBUS fieldbus controller.

The PROFIBUS DP Master Protocol Stack integration allows the implementation of a PROFIBUS DP Master with maximum flexibility, e.g. regarding size, hardware, processor type, operating system, or controller interface.

The Softing PROFIBUS DP Master Protocol Stack can be ported to almost any target platform with respect to the processor, the operating system, or the operation as a process in a multitasking environment. Porting to support configurable bit stream engines (e.g. Freescale's QUICC Engine) is available on request.

The PROFIBUS DP Master Protocol Stack has the longest implementation time and requires specialist knowledge to perform the porting and adaptation work.

If requested, individual development tasks can be taken care of by Softing.
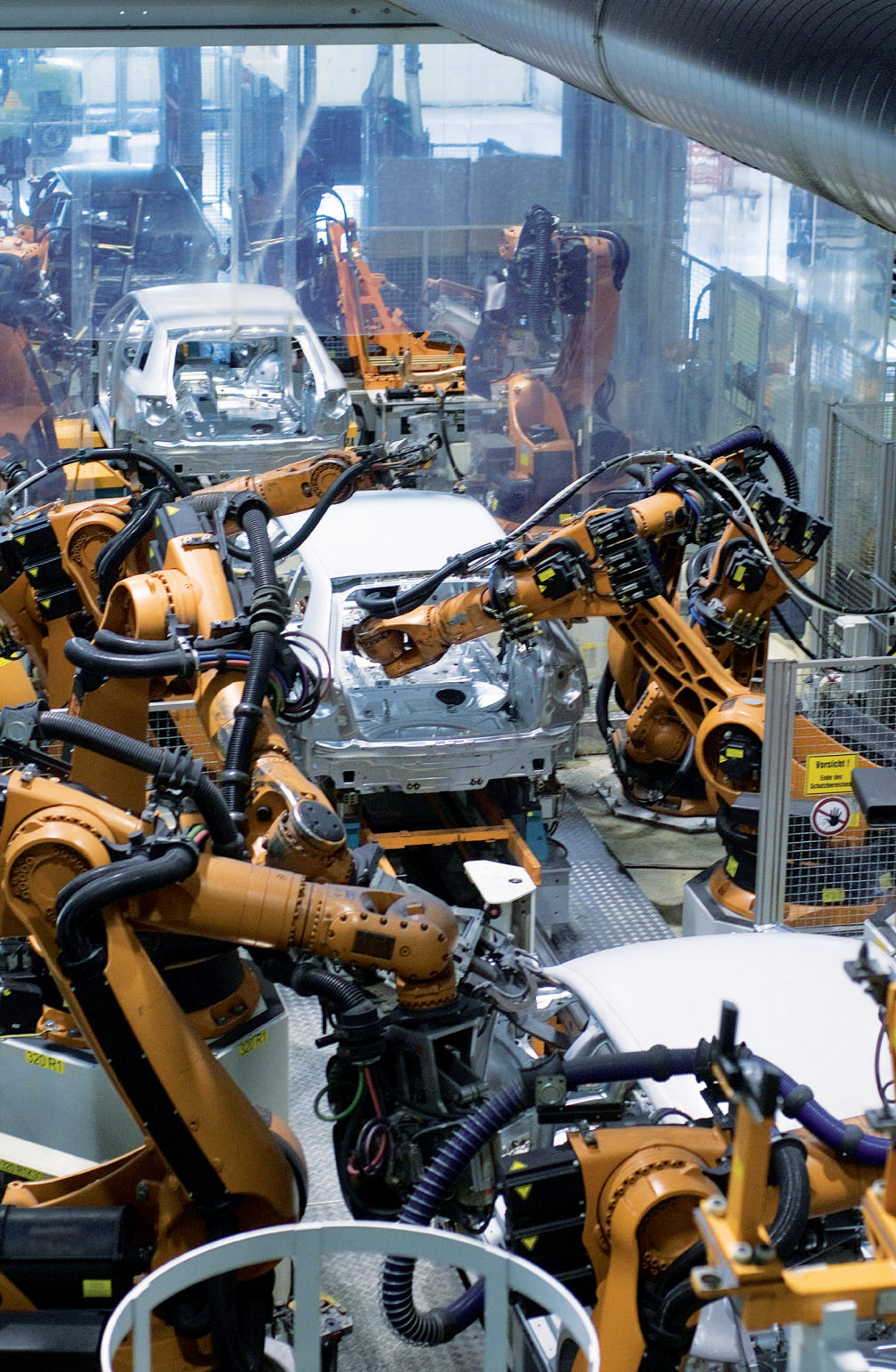
For more information on the different options for implementing a PROFIBUS DP Master as well as the range of available services, please visit http://industrial.softing.com.

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