

ABB CONTROL SYSTEMS

# Freelance DCS

## Product Catalog



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**Freelance takes the next step into the future. The Freelance provides significant improvements in all areas: scalability, usability, connectivity, compatibility and security.**

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# Table of contents

|                  |                                                                        |
|------------------|------------------------------------------------------------------------|
| <b>004 – 005</b> | <b>Introduction</b>                                                    |
| <b>006 – 009</b> | <b>System architecture</b>                                             |
| <b>010 – 062</b> | <b>The AC 900F and AC 700F controllers</b>                             |
| <b>063</b>       | <b>Power Supplies for AC 900F, AC 700F and S700 I/O</b>                |
| <b>064 – 122</b> | <b>I/Os: S700, S800, S900</b>                                          |
| <b>123 – 126</b> | <b>Fieldbus network components and PROFIBUS configuration for S700</b> |
| <b>127 – 136</b> | <b>Freelance Operations</b>                                            |
| <b>137 – 151</b> | <b>Freelance Engineering</b>                                           |
| <b>152 – 153</b> | <b>Freelance 2019 Media and documentation</b>                          |
| <b>154 – 157</b> | <b>Add-ons, extensions, and service</b>                                |
| <b>158 – 159</b> | <b>References</b>                                                      |
| <b>160 – 163</b> | <b>Index</b>                                                           |



# 1. Introduction



**Freelance is ABB's user-friendly, cost-effective and robust solution ideal for nearly all process industries with the following benefits:**

- **Easy to use:** It is very easy to install, learn, engineer, commission, back-up, maintain and expand.
- **Scalable:** Projects can start as small as a few I/Os for skids, package units or single plant equipment and grow to thousands of I/Os controlling the whole plant.
- **Reliable:** It is a proven system with high reliability and availability providing redundancy options supporting solutions without any single point of failure.
- **Value for your money:** Investment goes a long way because of its small footprint and ability to run on any standard computer. Together with its ease of use, this results in savings in installation, engineering, commissioning and life cycle costs.
- **Compatibility:** Freelance 2019 runs on Windows 10 and Windows 7.

## Freelance version 2019

Thousands of installations and still more benefits? Sure. With the latest AC 900F controller, the Freelance DCS provides significant improvements in all areas: availability, scalability, usability, connectivity.

### Benefits at a glance:

- **Enhanced scalability:** The new PM 904F expands the AC 900F controller family in the upper range
- **Improved usability:** Freelance 2019 provides significant increase of efficiency for Operations and Engineering
- **More connectivity:** Four (4) communication interfaces in new AC 900F with PM 904F
- **Support OPC UA Gateway connection.** New Foundation Fieldbus Communication interface CI 940F for AC 900F controller
- **Enhanced Security:** New Extended User Management based on Windows User accounts
- **Simple and secure login with Smart Card**
- **As a matter of course, Freelance Version 2019 still supports Freelance hardware from its first version**
- **Multi monitor support**





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**Easy to use**

Freelance can be installed on any standard computer and in just a few minutes. A Quickstart Tutorial is available, which allows users to learn at their own pace with detailed instructional videos. It takes less than a week to learn since there is just one engineering tool. Pre-engineered, ready-to-use displays make engineering much easier compared to other control systems or PLC/SCADA combinations. Additionally, a system-wide project database makes archiving or backup very easy to perform. There is also multiple language support.

The Freelance control system combines user-friendly engineering with an open, modern system architecture. This means:

- Only one tool for engineering, commissioning and diagnostics
- Fieldbus management completely integrated into control system engineering
- Time and cost savings in engineering, commissioning, testing, service and maintenance
- Assembly close to the field: reduction of field wiring and space requirements
- Freelance has a convenient cross-reference feature allowing variables and tags to be found easily in any editor right up to the graphic display. This makes troubleshooting and debugging easier, resulting in faster project execution.

**Pre-configured components for the operator level**

The engineering of the Freelance operator level is straightforward. The pre-configured visualization components include:

- Faceplates
- Module diagnostics
- Extended troubleshooting capabilities
- Automatically generated SFC displays
- Automatically generated system communication
- Event list, alarm line and message log files
- Trend displays with long-term archiving
- These components can be used straight out of the box, eliminating time-consuming manual configuration.



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**Reliable**

Freelance is a well-proven technology that has been around for more than 20 years and is installed in thousands of installations globally since its origination in Germany.

**High availability**

The technology has proven its worth in industrial use over several years and meets the toughest requirements regarding availability. The hardware can be structured redundantly at all levels. This includes the redundant fieldbus modules, redundant fieldbus lines as well as network and controller redundancy.

**Regulatory compliance**

With a view to meeting the requirements of regulatory authorities such as the American FDA (Food and Drug Administration) or the EFSA (European Food Safety Authority), Freelance provides a series of features that facilitate the validation procedure. Examples include:

- Encrypted log and trend data
- Audit trail functions
- Access rights and user administration
- Auto log-off and password aging



### Scalable

Freelance can be easily scaled up from a small system of a few I/Os to a large system of up to thousands of I/Os. Expansion can be done with minimal engineering effort. All controller types can be used in combination in a single system. They are suitable both for installation in the control room and for use in junction boxes directly in the field.

- The AC 700F controller has a small footprint that supports PROFIBUS. It can support up to eight direct I/O modules.
- The AC 900F controller can be equipped with up to four Communication Interfaces for PROFIBUS, CAN and Foundation Fieldbus. AC 900F supports redundancy.

#### The new PM 904F controller consists of:

- Four (4) built-in and free configurable Ethernet ports supporting System bus redundancy, Modbus TCP/IP, Send & Receive UDP or TCP and IEC 60870-5-104 Telecontrol protocol
- Two (2) serial ports supporting Modbus RTUASCII or IEC 60870-5-101 Telecontrol protocol
- Four (4) slots for Communication Interfaces:
  - PROFIBUS master modules, line redundancy
  - CAN bus modules for Freelance Rack I/O
  - Foundation Fieldbus Communication interface CI 940F
- Direct connection to S700 I/O modules. The S700 I/O series provides high density configurable modules that support a mix of inputs and outputs and even analog and digital I/Os in one module for small footprint.

### Multi monitor support

Freelance Operations expands its multi monitor support. With Freelance 2019 up to four (4) monitors can be connected to a single operator workplace.



### Value for your money

The easy-to-use features and use of just one tool for configuration of graphics, controllers and field devices allows engineering and commissioning time to be reduced, resulting in faster start-ups.

Freelance has a small footprint (comparable to a PLC), which means less space requirement for cabinets. Since the system uses intelligent peer-to-peer architecture, there is no need for expensive server PCs. Can be installed in few minutes.

## 2. System architecture

|                  |                                                   |
|------------------|---------------------------------------------------|
| <b>007</b>       | <b>2.1 Operator level</b>                         |
| <b>007</b>       | <b>2.2 Engineering tool</b>                       |
| <b>007</b>       | <b>2.3 Process level</b>                          |
| <b>008 – 009</b> | <b>2.4 System communication</b>                   |
| 008              | 2.4.1 Control network                             |
| 009              | 2.4.2 OPC                                         |
| 009              | 2.4.3 Advanced application programming<br>DMS-API |
| 009              | 2.4.4 Technical details of the control network    |





Freelance provides both, operator level and process level. The operator level contains the functions for operation, process monitoring, archives and logs, trends and alarms. Open- and closed-loop control functions are processed in the controllers which communicate with actuators and sensors in the field.

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## 2.1 Operator level

The Freelance Operations software runs on a simple PC or tablet- under Microsoft Windows. It installs in five minutes. Freelance Operations supports four (4) monitors operation, which offers the benefit to stay continuously tuned with essential information like the alarm list, while inspecting at the same time for example the progress of a sequential function chart, trend archives, or the system display with extended diagnostics. In a plant, several Freelance Operator Workplaces can work seamlessly together.

The extended automation functionality of ABB's System 800xA can be used for Freelance as well by utilizing the "800xA for Freelance" connectivity package. This way you can concentrate several Freelance systems under one common operator console in parallel to the existing operator stations.

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## 2.2 Engineering tool

The Freelance engineering station is used to configure and commission the whole system including the controllers, field devices and Freelance Operations. Usually, portable equipment such as laptops, which allow configuration both in the office and on site, are used. The operator level PCs can also be used for system engineering. A permanent connection to the engineering station is not necessary.

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## 2.3 Process level

A Freelance system can consist of one or combination of several AC 700F, AC 800F and/or AC 900F controllers. It can be connected to field devices through fieldbuses, direct and remote I/Os.

With AC 900F controllers, you have the option of configuring your entire system in redundancy.

As shown in the architecture drawing (see "Freelance System Architecture" on next page), Freelance can go from a typical OEM offering with an AC 700F controller, a Panel 800 and around 50-100 I/Os. The AC 700F can host up to eight direct I/O modules and can have several remote I/Os connected via PROFIBUS. Modbus RTU and TCP are also supported.

Integration of 3rd party PLCs like Safety PLCs or package units can easily be achieved by using the OPC based "PLC Integration" functionality of Freelance. This not only provides the ability read or write data, but also to create faceplates based on existing Freelance ones to interact with those units and to integrate the alarms into the Freelance alarm management.



## 2.4 System communication

The operator and the process level communicate via the control network, which is based on Standard Ethernet. You can choose between various transmission media such as twisted pair or fiber optic cable. The system components use a specific protocol called DMS, which is an enhanced MMS (Machine Message Specification) protocol. This protocol can be utilized by 3rd party network subscribers using the application interface DMS-API. This is a “C” programming interface for MS Windows to enable programmers to create tailored solutions. A more standardized and generic approach to connect to the system is provided by the Freelance OPC server to access real-time process values (DA) and alarms/ events (AE) from the Freelance System.

A Freelance system in theory can have up to 100 controllers and 100 operator stations. However the majority of the systems are in the range of 1 to 5 controllers/ operator stations. Each controller can communicate to a total of 10 Freelance operator stations, OPC- or trend servers. If the number of those exceeds 10, the system allows to segment the data communication accordingly per simply setting some check marks.

**Note:** a Freelance operator station or the Freelance OPC-server can “talk” to more than 10 controllers. So, if the number of controllers exceed 10, there is no further action required.

### 2.4.1 Control network

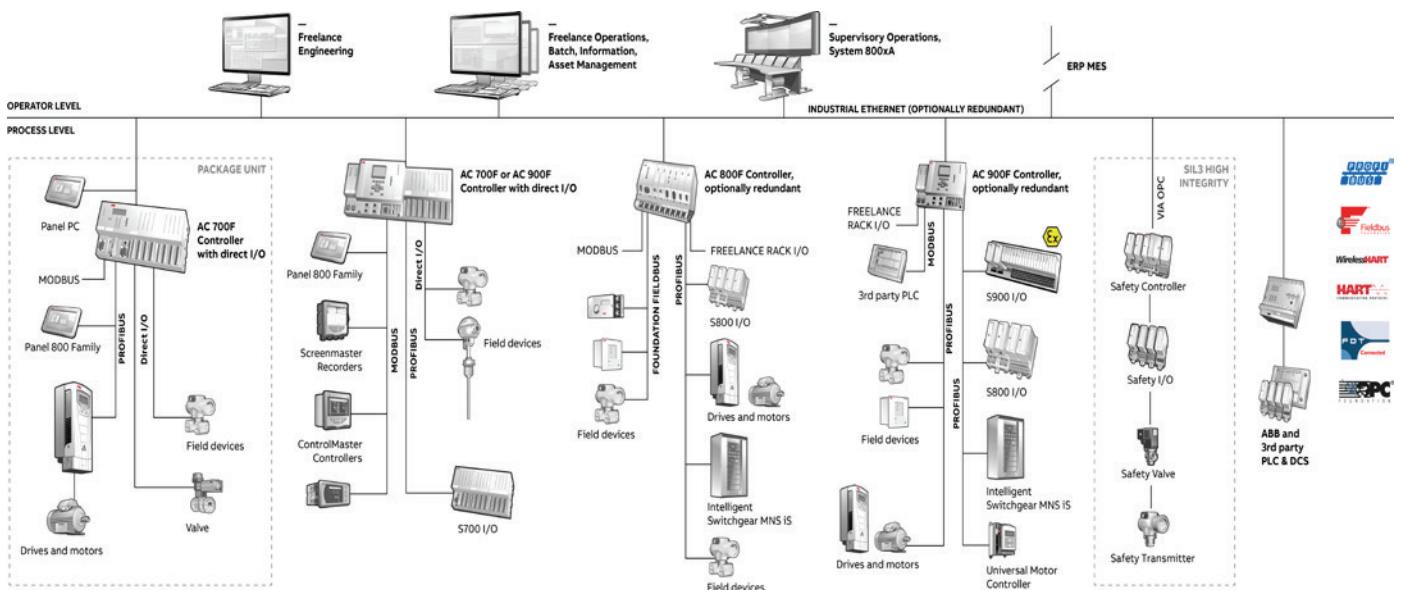
The control network connects the controllers, operator stations and engineering station in the Freelance system.

The control network complies with the Ethernet Standard according to DIN/ISO 8802, Part 3 (IEEE 802.3) and can be used with twisted pair or coaxial cable. It is also possible to use a combination of these standards or to implement 1-GBit/s components within a network as high-speed backbone. Freelance uses confirmed and unconfirmed services. The unconfirmed UDP service is used for screen updating and lateral communication between controllers. The confirmed TCP/IP service is used for alarming and trend archiving.

The control network has the following features:

- The ability to cover long distances
- A high data throughput
- A flexible network layout
- Control Network redundancy

Freelance system  
Architecture



## 2.4.2 OPC

Freelance provides an OPC gateway (server), which allows OPC clients to access data and alarms from the Freelance controllers. The OPC server also allows access to the DPV1 parameters and user parameters of PROFIBUS and HART devices. In the case of HART devices, this is only possible if they are connected to an S900 remote I/O unit. The parameters of FOUNDATION Fieldbus devices can also be accessed. It is possible to limit access to this data at the OPC gateway such that an OPC client cannot see certain tags and variables at all, can only read other tags and variables, or has both read and write access to certain tags and variables.

Freelance Operations has a built-in OPC client, which permits you to access data from external OPC servers. Using this, for example, data from third-party controllers with OPC support can be integrated into a custom graphic in Freelance Operations. Since Version 9.2, when using Freelance Operations PLC Integration, also Faceplate creation and Alarm & Events are supported.

As several OPC gateways can be used in the Freelance system, server redundancy can be established using OPC clients that support this function. The Freelance Engineering software supports this with the redundant OPC gateway configuration.

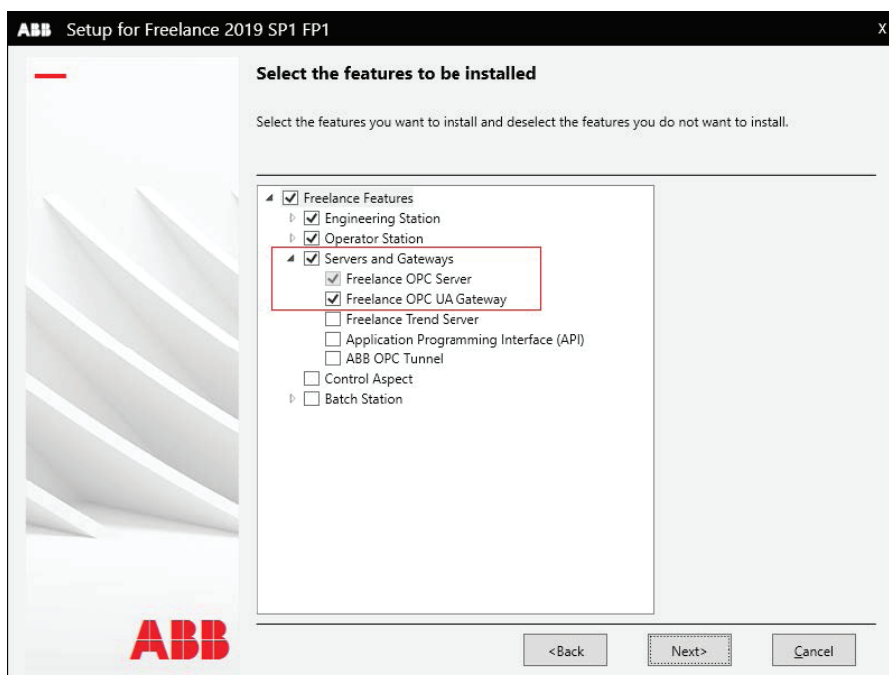
The trend server option provides a special OPC gateway that is used by the operator stations for user-defined trend displays. Access to the trend server is fixed to “read only”, and all trend variables are automatically available. There is one trend server per Freelance system.

### OPC UA Gateway

As of Freelance Version 2019 SP1 FP1, the Unified Automation Gateway can be installed as a Freelance OPC UA server solution.

With the UaGateway® it is possible to connect the Freelance OPC Server with the OPC Unified Architecture, which enables new, secure and reliable expansion and integration possibilities of any OPC UA Client application.

Also the Freelance Control Aspect has been enhanced to communicate via OPC UA.



## 2.5 Advanced application programming

### DMS-API

The DMS Application Programming Interface provides C programmers with a Windows interface through which they can access internal Freelance communications services. This enables them to create their own Windows applications that can read online data from the Freelance system and create values.

### 2.5.1 Advanced application programming DMS-API

The DMS Application Programming Interface provides C programmers with a Windows interface through which they can access internal Freelance communications services. This enables them to create their own Windows applications that can read online data from the Freelance system and create values.

### 2.5.2 Technical details of the control network

| Details of the control network |                                                                                                                                |                                                     |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| Bus type:                      | Twisted Pair (TP)                                                                                                              | Fiber optic (FL)                                    |
| Max. length:                   | 5 x 100 m<br>5 x 400 m for shielded TP                                                                                         | 4500 m                                              |
| Application:                   | Control network connection of Freelance operator stations (for operation and observation), engineering station and controllers |                                                     |
| Standard:                      | DIN/ISO 8802<br>Part 3<br>(IEEE 802.3)<br>10BASE-FL                                                                            | DIN/ISO 8802<br>Part 3<br>10BASE-FL<br>(IEEE 802.3) |
| Transmission rate:             | 10/100 MBit/s                                                                                                                  | 10/100 MBit/s                                       |



## 3. Controllers

|                |                                                   |
|----------------|---------------------------------------------------|
| <b>012</b>     | <b>3.1 Overview</b>                               |
| <b>013</b>     | <b>3.2 Functions</b>                              |
| <b>014–028</b> | <b>3.3 The controller AC 900F</b>                 |
| 014            | 3.3.1 Hardware and certificates                   |
| 017            | 3.3.2 AC 900F redundancy concept                  |
| 019            | 3.3.3 Central processing unit PM 904F and PM 902F |
| 022            | 3.3.4 Central processing unit PM 901F, lite       |
| 024            | 3.3.5 PROFIBUS Communication Interfaces           |
| 026            | 3.3.6 CAN Communication Interface                 |
| 029            | 3.3.7 Accessories                                 |
| <b>056–062</b> | <b>3.5 The controller AC 700F</b>                 |
| 056            | 3.5.1 Hardware and certificates                   |
| 058            | 3.5.2 Central processing unit PM 783F             |
| 060            | 3.5.3 PROFIBUS module CI 773F                     |
| 060            | 3.5.4 CPU terminal base TB 711F                   |
| 062            | 3.5.5 Accessories for CPU module                  |

## 3.1 Overview

Freelance comes with different types of controllers, AC 700F, and its latest Freelance controller – the AC 900F. This controller truly extends the hardware portfolio of Freelance distributed control system.



AC 900F



AC 700F

### AC 900F

- Typically around 1,500 I/Os supported with CPU PM 902F / PM 904F
- Around 400 I/O instated of up to 400 I/Os supported with CPU PM 901F (Lite)
- G3 compliant as standard
- Redundancy option for high availability
- AC 900F Plus (PM 904F) / AC 900F Standard (PM 902F): Four (4) built-in Ethernet ports supporting Modbus TCP or 60870-5-104 Telecontrol protocol
- AC 900F Lite (PM 901F): Three (3) built-in Ethernet ports supporting Modbus TCP or 60870-5-104 Telecontrol protocol
- Two (2) serial ports supporting Modbus RTU or IEC 60870-5-101 Telecontrol protocol
- Optional PROFIBUS master modules (PM 901/ PM 902 up to two, PM 904F up to four) providing integrated line redundancy
- Optional one CAN Bus communication interface for connection of Freelance Rack I/O
- Up to ten (10) S700 I/O modules can be connected directly on the right side on non-redundant AC 900F controllers
- I/O modules can also be connected remotely via PROFIBUS
- SD card support

### AC 700F

- Typically supports around 300 I/O signals per AC 700F controller.
- This PLC-like controller comes with a very small footprint. As many as eight (8) S700 direct I/O modules can be plugged to the right of the controller module.
- The connection to the Freelance control network is via Ethernet as for all other controllers. As an alternative to remote I/Os, AC 700F can be placed directly in the field, offering a very flexible and cost-effective solution for an “intelligent” I/O station.
- I/O modules can also be connected remotely via PROFIBUS. This allows for high flexibility in installation.
- SD card support

All controller types can be used side by side within a project and can easily communicate with each other via the Ethernet based control network. The engineering is performed with Freelance Engineering. All function blocks and pre-engineered functions are available for all controllers in the same way.

## 3.2 Functions

The scope of functions provided by the Freelance system corresponds to the basic supply defined in IEC 61131-3, in addition to numerous other high performance, industry-proven functions and function blocks. Furthermore user-specific function blocks can be added for dedicated tasks. During configuration, the processing capacity and speed of the controllers can be easily adapted to the demands of the automation task. Program execution in the controller is based on real-time multitasking operating system, leading to flexible strategies for processing programs.

The operating system of the controllers has two different types of tasks, system tasks and user tasks. System tasks supervise the system for example at cold start or in case of an error. User

tasks execute the application programs.

Different modes are available for user task execution:

- Up to eight tasks with individual cycle times between 5 ms and 24 hours
- Processing as fast as possible (PLC mode); one task only

System tasks are automatically available. These tasks are executed once in case of the following events:

- RUN
- STOP
- COLD START
- WARM START (voltage restored)
- REDUNDANCY TOGGLE
- ERROR

| Functions and function blocks |                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Analog value processing       | <ul style="list-style-type: none"> <li>• Input and output conversion</li> <li>• Linearization</li> <li>• Delay and dead-time filter</li> <li>• Average / extreme value determination in time</li> <li>• Setpoint adjustment</li> <li>• Counter with analog input</li> <li>• Time scheduler</li> </ul>                                                      |
| Binary value processing       | <ul style="list-style-type: none"> <li>• Binary output, monostable</li> <li>• Input and output delay</li> <li>• Pulse / Time Counter, pushbutton</li> </ul>                                                                                                                                                                                                |
| Closed-loop control           | <ul style="list-style-type: none"> <li>• Continuous controllers (PID), Step controllers</li> <li>• On / Off controller, three-position controller</li> <li>• Ratio controller</li> <li>• Basic functions</li> <li>• Auto-tuning</li> </ul>                                                                                                                 |
| Open-loop control             | <ul style="list-style-type: none"> <li>• Individual drive functions</li> <li>• Sequence control, dosing circuits</li> </ul>                                                                                                                                                                                                                                |
| Logic functions               | <ul style="list-style-type: none"> <li>• Logic processing</li> <li>• Average / Extreme value determination</li> <li>• Comparator, binary switch</li> <li>• Multiplexer</li> <li>• Converter (data type &amp; code)</li> <li>• Flip-flop, edge detection</li> <li>• String blocks</li> <li>• Radio controlled adjustment of daylight-saving time</li> </ul> |
| Monitoring                    | <ul style="list-style-type: none"> <li>• Analog and binary monitoring</li> <li>• Event monitoring</li> <li>• Audible alarm control</li> <li>• Connection monitoring</li> </ul>                                                                                                                                                                             |
| Acquisition functions         | <ul style="list-style-type: none"> <li>• Disturbance course acquisition, trend acquisition</li> </ul>                                                                                                                                                                                                                                                      |
| Arithmetic functions          | <ul style="list-style-type: none"> <li>• Basic arithmetic functions, numerical functions</li> <li>• Logarithmic functions</li> <li>• Trigonometric functions</li> <li>• Analog value and time limitation</li> </ul>                                                                                                                                        |
| Modbus functions              | <ul style="list-style-type: none"> <li>• Master and slave functions</li> </ul>                                                                                                                                                                                                                                                                             |
| PROFIBUS                      | <ul style="list-style-type: none"> <li>• DPV1 master functions</li> </ul>                                                                                                                                                                                                                                                                                  |
| Telecontrol functions         | <ul style="list-style-type: none"> <li>• Master and slave functions</li> </ul>                                                                                                                                                                                                                                                                             |
| Phase logic processing        | <ul style="list-style-type: none"> <li>• Interface module for batch applications</li> </ul>                                                                                                                                                                                                                                                                |

## 3.3 The AC 900F controller

### 3.3.1 Hardware and certificates

The AC 900F controller truly extends the hardware portfolio of Freelance distributed control system. Apart from its highly sophisticated automation functions, the AC 900F modular controller offers expanded flexibility via a pluggable SD card, several Ethernet ports, redundancy options for high availability and powers for around 1,500 I/Os when using the Plus CPU (PM 904F) and Standard CPU (PM 902F) or around 400 I/Os when using the Lite CPU (PM 901F). These limits are just recommendations and they depend on the complexity of the application, the cycle time and many more parameters.

A key feature of the AC 900F is the support of SD cards. Especially the optional display allows to load applications or firmware into the controller, without PC.

Benefits at a glance:

- More power than any previous generation Freelance controller
- More connectivity with serial ports and Ethernet ports
- Built-in SD card support
- Ethernet based protocols – Modbus TCP and IEC 60870-5-104
- G3 compliant as standard
- Built-in power supply
- Optional display providing enhanced security through controller lock
- Small footprint
- Optional redundancy

#### Mechanical design

Thanks to its four holes in the rear, the CPU modules PM 904F, PM 902F and PM 901F allow easy wall-mounting. DIN rail mounting is even faster and easier by just placing the component on the DIN rail and pushing it down to lock it in place.

#### Technical data

The AC 900F controller consists of a CPU module which is the main component. According to the application and requirements, further modules can be added to the controller. These modules are fieldbus interface modules and I/O modules.



The AC 900F consists of:

- CPU module PM 904F, PM 902F or PM 901F with
  - four Ethernet interfaces for PM 904F, PM 902F or three Ethernet interfaces for PM 901F
  - one diagnostic interface
  - two serial interfaces
  - display unit (optional)
- Up to ten S700 I/O modules directly attached on terminal units
- A maximum of four fieldbus interface modules for PM 904F
- A maximum of two fieldbus interface modules for PM 902F and PM 901F

The AC 900F controller can be arranged in a single or redundant manner. The controller supports remote I/Os, transmitters, actuators, drives and other devices through several fieldbus protocols. At present, the following field busses are available for the AC 900F controller:

- PROFIBUS DP V0/V1
- Modbus RTU and Modbus TCP
- Telecontrol and Telecontrol TCP
- CAN Bus for connection of Freelance Rack I/O
- FOUNDATION Fieldbus
- Profinet (minimum Freelance 2024)

The hardware configuration of AC 900F is based on a hardware function block concept.

Modular plug-in I/O modules are used in accordance with the type and quantity of process signals. With AC 900F controllers, fieldbus compliant components such as remote I/O, field devices, and network components can be used. ABB offers equipment for applications covering standard and hazardous areas.

### Certificates

The AC 900F controller has the following certificates:

- PM 904F: CE, cULus, ISA-S71.04 G3, UL Class I Div. 2, NAMUR NE21
- PM 902F: CE, cULus, ISA-S71.04 G3, UL Class I Div. 2
- PM 901F: CE, cULus, ISA-S71.04 G3, UL Class I Div. 2, NAMUR NE21 for all 3 PMs

### Environmental conditions

The ambient temperature range of AC 900F ranges from -20 to +70°C (operation), no forced cooling required.

| Temperature ranges and other environmental conditions |                             |                                      |
|-------------------------------------------------------|-----------------------------|--------------------------------------|
| Ambient temperature AC 900F                           | Operating                   | -20 ... +70°C (-4°F ... 158°F)       |
|                                                       | Storage:                    | - 40 °C ... +85°C (-40°F ... 185°F)  |
|                                                       | Storage (TD 951F inserted): | - 25 °C ... +70 °C (13°F ... 158°F)  |
| Ambient temperature of battery                        | Operating:                  | - 40 °C ... +85 °C (-40°F ... 185°F) |
|                                                       | Storage:                    | - 40 °C ... +85 °C (-40°F ... 185°F) |
| Humidity                                              |                             | Maximum 93%, without condensation    |
| Air pressure                                          | Operating:                  | < 2000 m (2187 yd.)                  |
|                                                       | Storage:                    | < 3500 m (3827 yd.)                  |
| Climatic category                                     |                             | 3K3 according to EN 60721-3-3        |
| Degree of protection                                  |                             | IP 20                                |
| G3 severity level                                     |                             | ISA-S71.04 G3                        |

### Product compliance

| Electromagnetic compatibility and other directives |                                                                                                        |
|----------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| 2014/30/EU                                         | EMC Directive                                                                                          |
| EN 61000-6-2                                       | Electromagnetic compatibility (EMC) – Generic standards, Immunity for industrial environments          |
| EN 61000-6-4                                       | Electromagnetic compatibility (EMC) – Generic standards, Emission standard for industrial environments |
| 2014/35/EU                                         | Low Voltage Directive                                                                                  |
| NAMUR NE21                                         | Electromagnetic Compatibility of industrial process and laboratory control equipment                   |
| 2011/65/EU                                         | RoHS Directive                                                                                         |



## Mechanical stress/mounting

| Mechanical stress and mounting                     |                                                                                                                                             |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Mounting                                           | Horizontal                                                                                                                                  |
| Mounting of the modules                            | Wall mounting or DIN rail according to DIN EN 50022, 35 mm, depth 7,5 mm or 15 mm, mounting with screws of type M4, fastening torque 1.2 Nm |
| Flammability                                       | According to UL 94 V0                                                                                                                       |
| Vibration resistance according to IEC/EN 60068-2-6 | 2 g, 2 Hz ... 150 Hz                                                                                                                        |
| Shock test according to IEC/EN 60068-2-27          | 15 g, 11 ms, half-sinusoidal                                                                                                                |

## Electric data/Electrical protection

| Voltages according to EN 61131-2                                                            |                                                                    |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| Process- and Supply-voltage                                                                 | 24 VDC                                                             |
| Absolute limits                                                                             | +19.2 V ... +32.5 V incl. ripple (see below)                       |
| Ripple                                                                                      | < 5 %                                                              |
| Protection against reverse polarity                                                         | Yes                                                                |
| Permissible interruptions of power supply as per EN 61131-2                                 |                                                                    |
| DC supply                                                                                   | Interruptions < 7.5 ms,<br>time between 2 interruptions > 1 s, PS2 |
| Creepage distances and clearances                                                           |                                                                    |
| The creepage distances and clearances meet the overvoltage category II, pollution degree 2. |                                                                    |
| Power supply units                                                                          |                                                                    |
| Power supply units meeting the PELV specification should be used for powering the modules.  |                                                                    |

## Power dissipation for the calculation of cooling systems

The following table lists the anticipated power dissipation (heat dissipation) of individual AC 900F modules.

The data for the modules contain the combined power consumption from internal and external supply sources. For detailed information see the Mounting and Installation Instructions, AC 900F manual.

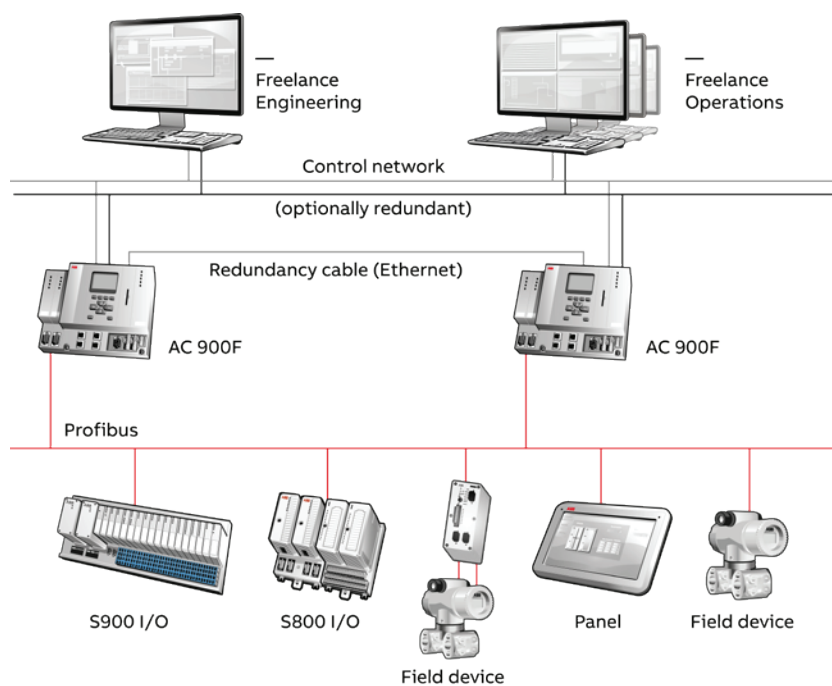
| Module                                               | Max. power dissipation |
|------------------------------------------------------|------------------------|
| Central processing unit PM 904F, PM 902F and PM 901F | 18 W                   |
| Communication interface CI 930F                      | 1.8 W                  |
| Communication module CI 773F                         | 1.8 W                  |
| Communication interface CI 910F                      | 1.9 W                  |
| Display unit TD 951F                                 | 0.35 W                 |
| Communication interface CI 940F                      | 1.8 W                  |

### 3.3.2 AC 900F redundancy concept

#### Controller redundancy

Controller redundancy can be achieved by installing two AC 900F. To ensure quick and smooth takeover by the secondary AC 900F in case the

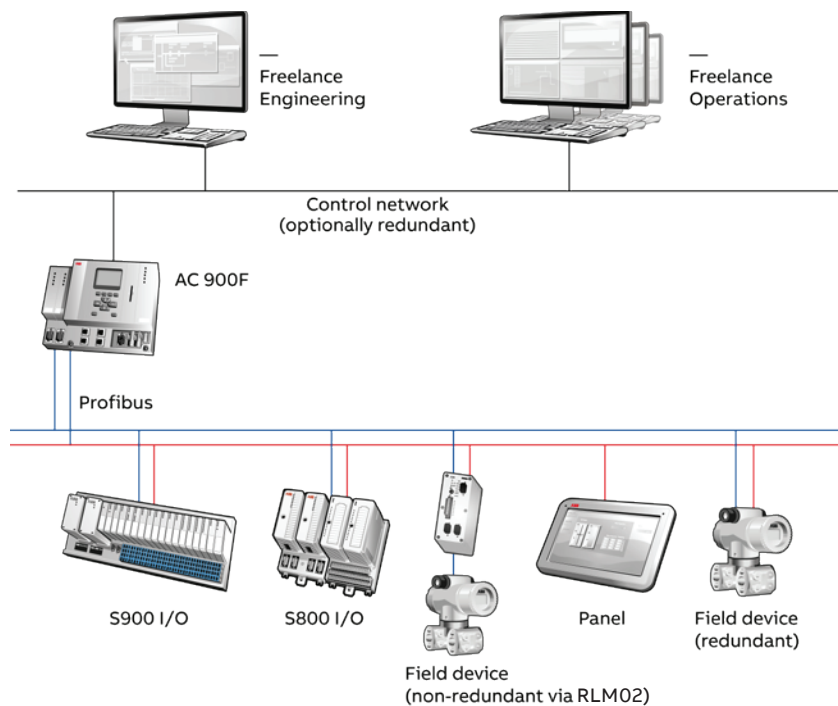
primary AC 900F fails, a dedicated redundancy communications link through the second Ethernet module makes sure that both AC 900F are always synchronized. All inputs and outputs are designed to support redundant operation.



**PROFIBUS line redundancy**

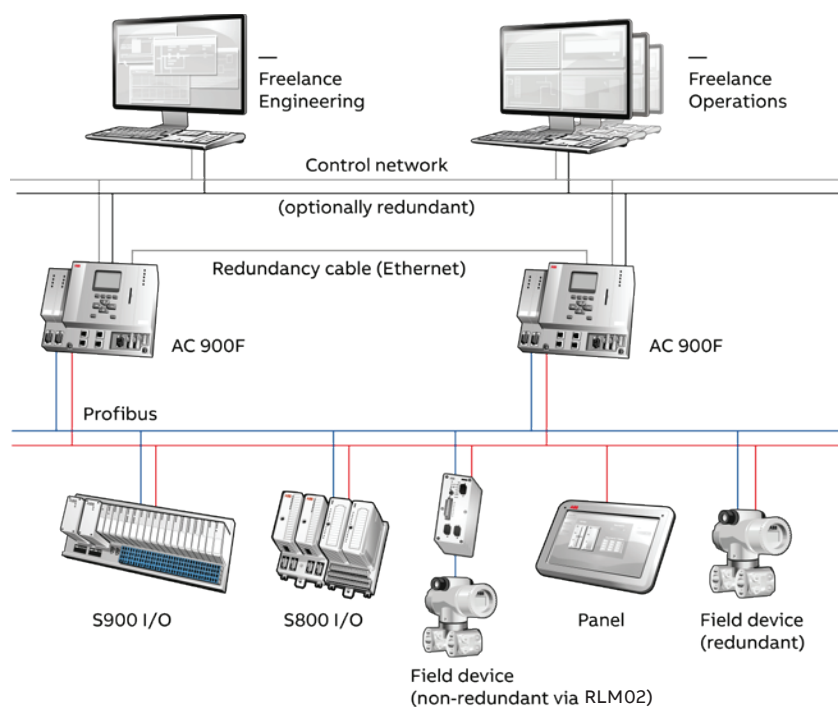
The CI 930F communication interface provides integrated PROFIBUS line redundancy. An

alternative solution to the PROFIBUS line redundancy is to use a Fiber Optic Ring.

**Controller redundancy together with PROFIBUS line redundancy**

You can achieve the highest availability when doing both, controller redundancy and PROFIBUS line redundancy by using two AC 900F with a CI 930F communication interface each. This

topology combines the advantages of controller redundancy with the one of line redundancy as described in the preceding paragraphs.



### 3.3.3 Central processing unit PM 904F, PM 902F and PM 901F

| Name                  | Short description                                                                                                                                                                                                                                                                                                                                                                                                                    | Article no.     |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| PM 904F<br>CPU Module | 4 Ethernet interfaces, 800 MHz CPU clock,<br>48 MB Controller Memory, 16 MB battery buffered SRAM, 32 MB DRAM.<br>4 slots for assembling Communication Interface Modules.<br><br>Without operating system. The operating system has to be loaded during software installation.<br>Needs external 24 VDC power supply.<br>Software version 2019 or higher is mandatory.<br>Display Unit TD 951F and Battery TA 951F are not included. | 3BDH001002R0001 |
| PM 902F<br>CPU Module | 4 Ethernet interfaces, 800 MHz CPU clock,<br>24 MB Controller Memory, 8 MB battery buffered SRAM, 16 MB DRAM. 2 slots for assembling Communication Interface Modules.<br><br>Without operating system. The operating system has to be loaded during software installation.<br>Needs external 24 VDC power supply.<br>Display Unit TD 951F and Battery TA 951F are not included.                                                      | 3BDH001000R0001 |

The Central Processing Unit (CPU) module is equipped with a high-performance processor for multitasking and executing fast loop cycle times. It offers expanded flexibility via a pluggable SD card, redundancy options for high availability and powers for around 1500 I/Os. It comes with four onboard 100 Mbit/s Ethernet network connection used for communication between controllers, operator stations and engineering tool. Two serial line interfaces can be used for Modbus communication and/or Telecontrol. A third serial interface is reserved for diagnosis purpose and radio clock connection.

The PM 904F has 48 MB of memory of which 16 MB are battery backed up. For demanding applications, eight cyclic and priority driven tasks with adjustable cycle time can be configured, as well as a cyclic PLC type task which runs as fast as possible. The additional available display unit TD 951F shows status and diagnostic information directly at the module.

Operating modes can be modified by switches on the front panel. The controller can be blocked for downloads of application and firmware to enhance security. The status, if the controller is locked or unlocked, is shown on the display.

S700 I/O modules can be directly plugged to the I/O bus interface on the right side of the CPU module. A maximum of 10 direct I/O modules can be connected to one controller.

The CPU and the local S700 I/O modules communicate very fast. I/O scan times of 2 ms are possible. Short circuit and line break detection can be realized for each channel. Coupler bus slots on the left side can be assigned with fieldbus interface modules.

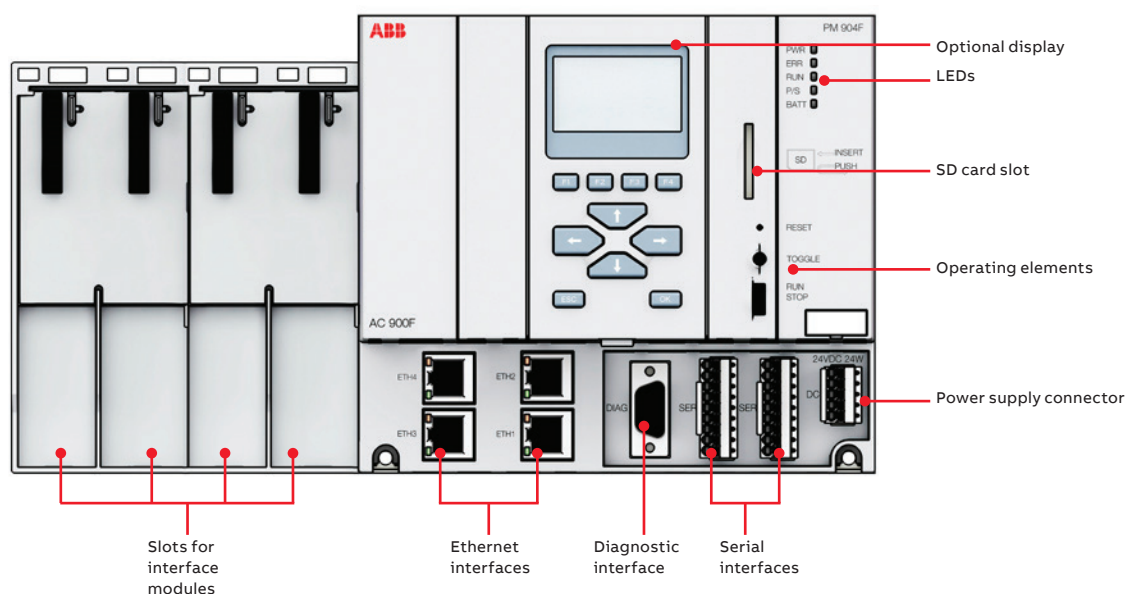
The PM 904F can be equipped with a maximum of four communication interface.

The PM 902F CPU module provides a high performance processor for multitasking and executing fast loop cycle times. PM 902F also has 24 MB of memory of which 8 MB is battery backed up.

The PM 902F can be equipped with a maximum of two communication interfaces. PM 902F comes with four on-board 100 Mbit/s Ethernet network connections and two serial interfaces. A third serial interface is reserved for diagnosis purpose and radio clock connection.

A lite version PM 901F is also available, see section “3.3.4 Central processing unit PM 901F, lite” on page 23.

CPU module PM 904F

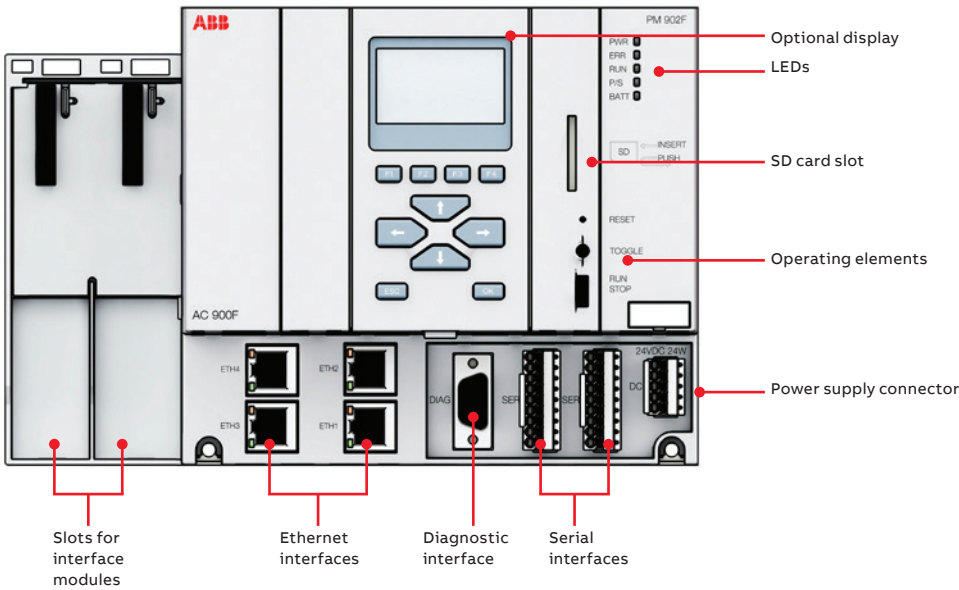


## Technical data

| Technical Data PM 904F                                    |                                                                                                                                                                                                                                 |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RAM (Total)                                               | 48 MB                                                                                                                                                                                                                           |
| RAM battery buffered                                      | 16 MB                                                                                                                                                                                                                           |
| CPU clock rate                                            | 800 MHz                                                                                                                                                                                                                         |
| Number of direct I/O modules                              | Up to 10                                                                                                                                                                                                                        |
| Power consumption                                         | 24 W (full station assembly)                                                                                                                                                                                                    |
| Power supply                                              | Terminal for 24 VDC power supply<br>DC-IN +24 VDC                                                                                                                                                                               |
| Max. power dissipation within the module                  | 18 W                                                                                                                                                                                                                            |
| Current consumption from 24 VDC                           | 1 A                                                                                                                                                                                                                             |
| Inrush current at 24 VDC                                  | 1.5 A                                                                                                                                                                                                                           |
| Data backup source                                        | Lithium battery for SRAM contents and real time clock                                                                                                                                                                           |
| Buffering time at +40 °C                                  | > 2 years<br>After battery low warning: 14 days                                                                                                                                                                                 |
| Battery low indication                                    | Warning indication issued about 2 weeks before the battery charge becomes critical                                                                                                                                              |
| Real-time clock, with battery backup                      | Yes                                                                                                                                                                                                                             |
| Multitasking program execution:                           | <ul style="list-style-type: none"> <li>• Cyclic (equidistant)</li> <li>• Cyclic (as fast as possible)</li> <li>• Event driven</li> </ul>                                                                                        |
| Serial interfaces (SER1 and SER2)                         | <ul style="list-style-type: none"> <li>• Physical link:</li> <li>• Connection:</li> <li>• Usage:</li> </ul>                                                                                                                     |
| Onboard network interface<br>4 Ethernet interfaces (RJ45) | <ul style="list-style-type: none"> <li>• Configurable for RS-232 or RS-485 (from 600 bps to 38400 bps), Pluggable terminal block with spring connection</li> <li>• Modbus RTU</li> <li>• Telecontrol IEC 60870-5-101</li> </ul> |
| Weight                                                    | 1.1 kg (2.43 lbs)                                                                                                                                                                                                               |
| Dimensions                                                | Width 285 mm (11.22 inch)<br>Height 152 mm (5.98 inch)<br>Depth 95 mm (3.74 inch)                                                                                                                                               |



CPU module PM 902F



Technical data

| Technical Data PM 902F                                                                                          |                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RAM (Total)                                                                                                     | 24 MB                                                                                                                                                                                                                     |
| RAM battery buffered                                                                                            | 8 MB                                                                                                                                                                                                                      |
| CPU clock rate                                                                                                  | 800 MHz                                                                                                                                                                                                                   |
| Number of direct I/O modules                                                                                    | Up to 10                                                                                                                                                                                                                  |
| Power consumption                                                                                               | 24 W (full station assembly)                                                                                                                                                                                              |
| Power supply                                                                                                    | Terminal for 24 VDC power supply<br>DC-IN +24 VDC                                                                                                                                                                         |
| Max. power dissipation within the module                                                                        | 18 W                                                                                                                                                                                                                      |
| Current consumption from 24 VDC                                                                                 | 1 A                                                                                                                                                                                                                       |
| Inrush current at 24 VDC                                                                                        | 1.5 A                                                                                                                                                                                                                     |
| Data backup source                                                                                              | Lithium battery for SRAM contents and real time clock                                                                                                                                                                     |
| Buffering time at +40 °C                                                                                        | > 2 years<br>After battery low warning: 14 days                                                                                                                                                                           |
| Battery low indication                                                                                          | Warning indication issued about 2 weeks before the battery charge becomes critical                                                                                                                                        |
| Real-time clock, with battery backup                                                                            | Yes                                                                                                                                                                                                                       |
| Multitasking program execution:                                                                                 | <ul style="list-style-type: none"> <li>Cyclic (equidistant)</li> <li>Cyclic (as fast as possible)</li> <li>Event driven</li> </ul>                                                                                        |
| Serial interfaces (SER1 and SER2)                                                                               | <ul style="list-style-type: none"> <li>Configurable cycle times from 5 ms</li> <li>PLC mode</li> <li>Predefined events</li> </ul>                                                                                         |
| Onboard network interface                                                                                       |                                                                                                                                                                                                                           |
| 4 Ethernet interfaces (RJ45)                                                                                    |                                                                                                                                                                                                                           |
| <ul style="list-style-type: none"> <li>Ethernet 1:</li> <li>Ethernet 2:</li> <li>Ethernet 3 &amp; 4:</li> </ul> | <ul style="list-style-type: none"> <li>Configurable for RS-232 or RS-485 (from 600 bps to 38400 bps), Pluggable terminal block with spring connection</li> <li>Modbus RTU</li> <li>Telecontrol IEC 60870-5-101</li> </ul> |
| Weight                                                                                                          | 1.07 kg (2.36 lbs)                                                                                                                                                                                                        |
| Dimensions                                                                                                      | Width 227 mm (8.94 inch)<br>Height 152 mm (5.98 inch)<br>Depth 95 mm (3.74 inch)                                                                                                                                          |

—

### 3.3.4 Central processing unit PM 901F, lite

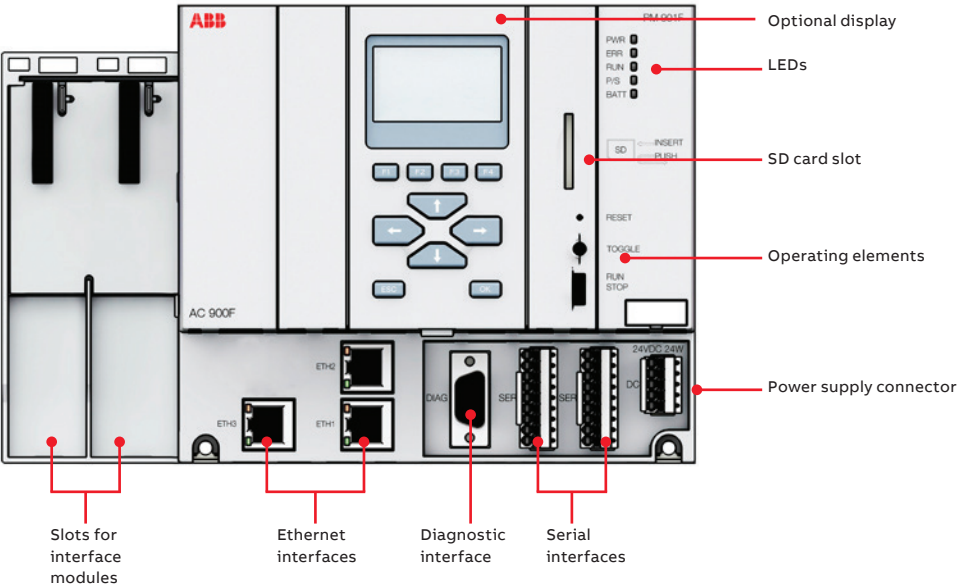
| Name                  | Short description                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Article no.     |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| PM 901F<br>CPU Module | 3 Ethernet interfaces, 400 MHz CPU clock,<br>11 MB Controller Memory, 3 MB battery buffered SRAM, 8 MB DRAM.<br>Processing of around 400 IO's.<br>2 slots for assembling Communication Interface Module.<br><br>Without operating system. The operating system has to be loaded during<br>software installation.<br>Needs external 24 VDC power supply.<br>Software version 2016 or higher is mandatory.<br>Display Unit TD 951F and Battery TA 951F are not included. | 3BDH001001R0001 |

A CPU module is the central part of the AC 900F controller. It provides a high performance processor for multitasking and executing fast loop cycle times.

It comes with three on-board 100 Mbit/s Ethernet network connections and two serial interfaces. A third serial interface is reserved for diagnosis purpose and radio clock connection.

Coupler bus slots and an I/O bus interface enables for adding further modules left and right to the CPU modules.

An optional front panel display shows status and diagnostic information directly at the module. Operating modes can be modified by switches on the front panel.



—  
CPU module PM 901F

## Technical data

| Technical Data PM 901F                                                                                      |                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RAM (Total)                                                                                                 | 11 MB                                                                                                                                                                                                                                          |
| RAM battery buffered                                                                                        | 3 MB                                                                                                                                                                                                                                           |
| CPU clock rate                                                                                              | 400 MHz                                                                                                                                                                                                                                        |
| Number of direct I/O modules                                                                                | Up to 10                                                                                                                                                                                                                                       |
| Power consumption                                                                                           | 24 W (full station assembly)                                                                                                                                                                                                                   |
| Power supply                                                                                                | Terminal for 24 VDC power supply<br>DC-IN +24 VDC                                                                                                                                                                                              |
| Max. power dissipation within the module                                                                    | 18 W                                                                                                                                                                                                                                           |
| Current consumption from 24 VDC                                                                             | 1 A                                                                                                                                                                                                                                            |
| Inrush current at 24 VDC                                                                                    | 1.5 A                                                                                                                                                                                                                                          |
| Data backup source                                                                                          | Lithium battery for SRAM contents and real time clock                                                                                                                                                                                          |
| Buffering time at +40 °C                                                                                    | > 2 years<br>After battery low warning: 14 days                                                                                                                                                                                                |
| Battery low indication                                                                                      | Warning indication issued about 2 weeks before the battery charge becomes critical                                                                                                                                                             |
| Real-time clock, with battery backup                                                                        | Yes                                                                                                                                                                                                                                            |
| Multitasking program execution:                                                                             | <ul style="list-style-type: none"> <li>• Cyclic (equidistant)</li> <li>• Cyclic (as fast as possible)</li> <li>• Event driven</li> </ul>                                                                                                       |
| Serial interfaces (SER1 and SER2)                                                                           | <ul style="list-style-type: none"> <li>• Configurable cycle times from 5 ms</li> <li>• PLC mode</li> <li>• Predefined events</li> </ul>                                                                                                        |
| <ul style="list-style-type: none"> <li>• Physical link:</li> <li>• Connection:</li> <li>• Usage:</li> </ul> | <ul style="list-style-type: none"> <li>• Configurable for RS-232 or RS-485 (from 600 bps to 38400 bps), Pluggable terminal block with spring connection</li> <li>• Modbus RTU</li> <li>• Telecontrol IEC 60870-5-101</li> </ul>                |
| Onboard network interface<br>3 Ethernet interfaces (RJ45)                                                   | <ul style="list-style-type: none"> <li>• Ethernet 1:</li> <li>• Ethernet 2:</li> <li>• Ethernet 3:</li> </ul>                                                                                                                                  |
|                                                                                                             | <ul style="list-style-type: none"> <li>• for ControlNet (optional Modbus TCP and Telecontrol IEC 60870-5-104)</li> <li>• for redundancy link</li> <li>• for Modbus TCP and Telecontrol IEC 60870-5-104 or for ControlNet redundancy</li> </ul> |
| Weight                                                                                                      | 1.07 kg (2.36 lbs)                                                                                                                                                                                                                             |
| Dimensions                                                                                                  | Width 227 mm (8.94 inch)<br>Height 152 mm (5.98 inch)<br>Depth 95 mm (3.74 inch)                                                                                                                                                               |

3.3.5 PROFIBUS Communication Interfaces

Two types of PROFIBUS Master interface modules can be used with AC 900F: CI 930F and CI 773F.

For AC 900F, these PROFIBUS interface modules enable communication over the PROFIBUS DP fieldbus. The interfaces can be mounted to the slots on the left side of the CPU module. (see "Figure 1: CPU Module PM 904F" on page 21 and "Figure 2: CPU Module PM 902F" on page 22 and "Figure 3: CPU Module PM 901F" on page 23) The internal coupler bus makes the connection to

the CPU. PROFIBUS modules are configured in the Freelance Engineering hardware structure. Information on configuring the PROFIBUS module, see Engineering Manual System Configuration, Hardware Structure.

The parameter data directly influence the functionality of the module. Further information on configuration and parameterization of the module, refer to the Engineering Manual AC 900F.

Communication Interface CI 930F

| Name    | Short description                                                                                                                                                                                                                                                                    | Article no.     |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| CI 930F | Communication Interface, PROFIBUS DP Master<br>DP-V0/V1, 12 MBit/s<br>Supports PROFIBUS line redundancy<br>Two D-Sub terminals (9-pole), one each for line A/B<br>Software version 2013 or higher is mandatory<br>Requires one coupler bus slot on the CPU module.<br>White housing. | 3BDH001010R0002 |



CI 930F is module is a PROFIBUS DP master, but with additional features compared to CI 773F. CI 930F supports built-in line redundancy.

Each PROFIBUS module allows the connection of a PROFIBUS line of maximum of 126 slaves. Each of these slaves can be modular.

LED Status Displays

The PROFIBUS module CI 930F runs a self test during the power ON process. During the initialization procedure if the module is newly configured or if the operating mode is changed then all the LEDs may light up for a short period of time before reaching a definite condition.

| Technical data CI 930F            |                                             |
|-----------------------------------|---------------------------------------------|
| Transmission protocol             | PROFIBUS DP master, DP-V0/V1                |
| Transmission rate                 | 9.6 kBit/s to 12 MBit/s                     |
| Transmission standard             | EIA RS-485 acc. to EN 50170, potential free |
| Fieldbus connectors               | 2 x D-SUB, 9-pole, female                   |
| Number of slaves                  | up to 126                                   |
| Useable CPU                       | PM 904F, PM 902F or PM 901F                 |
| Data interchange                  | 64 kB module, dual-port memory              |
| PROFIBUS line redundancy          | yes                                         |
| Support controller redundancy     | yes                                         |
| Hotplug, hot configuration in run | yes                                         |
| Current consumption               | 80 mA, via 24 V terminal of CPU module      |
| Power dissipation                 | 1.8 W                                       |

| Technical data CI 930F   |                                                                            |
|--------------------------|----------------------------------------------------------------------------|
| Status display           | PWR, STA, RUN, Line A, Line B                                              |
| Protection               | IP20                                                                       |
| Weight                   | 115 g (0.25 lbs)                                                           |
| Dimensions               | Width: 28 mm (1.1 inch)                                                    |
|                          | Height: 152 mm (5.98 inch)                                                 |
|                          | Depth: 85 mm (3.35 inch)                                                   |
| Ambient temperature      | Operation: -20 .. +70 °C (-4 °F .. 158 °F)                                 |
|                          | Storage: -40 °C .. +85 °C (-40 °F .. 185 °F)                               |
| Certificates / Approvals | CE, ANSI/ISA 71.04-1985 G3<br>cULus, UL Class I Div 2 (Group A,B,C,D), EAC |

### Communication Interface CI 773F

| Name    | Short description                                                                                                                                                                                                                                          | Article no.     |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| CI 773F | Communication Interface, PROFIBUS DP Master<br>DP-V0/V1, 12 MBit/s<br>D-Sub terminal, 9-pole<br>Software version 2013 SP1 or higher is mandatory<br>Requires one coupler bus slot on the CPU module on PM 904F, PM 902F, PM 901F or Terminal Base TB 711F. | 3BDH000395R0001 |



CI 773F module is a PROFIBUS DP master and very similar to CI 930F, the only thing missing is the built-in support for line redundancy. CI 773F supports controller redundancy.

#### LED Status Displays

After having switched on, the CI 773F module performs a self-test during power-up. During the initialization procedure, with newly configured modules or after a change of the operating mode, then all the LEDs may light up briefly before reaching the defined status.

| Technical data CI 773F   |                                                                            |
|--------------------------|----------------------------------------------------------------------------|
| Transmission protocol    | PROFIBUS DP master, DP-V0/V1                                               |
| Transmission rate        | 9.6 kBit/s to 12 MBit/s                                                    |
| Transmission standard    | EIA RS-485 acc. to EN 50170, potential free                                |
| Fieldbus connectors      | 1 x D-SUB, 9-pole, female                                                  |
| Number of slaves         | up to 126                                                                  |
| Useable CPU              | PM 904F, PM 902F, PM 901F or PM 783F                                       |
| Data interchange         | 16/64 kB, dual-port memory                                                 |
| Current consumption      | 80 mA, via 24 V terminal of CPU module                                     |
| Power dissipation        | 1.6 W                                                                      |
| Status display           | PWR, STA, RUN, L                                                           |
| Protection               | IP20                                                                       |
| Weight                   | 96 g (0.21 lbs)                                                            |
| Dimensions               | Width: 28 mm (1.1 inch)                                                    |
|                          | Height: 135 mm (5.31 inch)                                                 |
|                          | Depth: 75 mm (2.95 inch)                                                   |
| Ambient temperature      | Operation: -20 .. +70 °C (-4 °F .. 158 °F)                                 |
|                          | Storage: -40 °C .. +70 °C (-40 °F .. 158 °F)                               |
| Certificates / Approvals | CE, ANSI/ISA 71.04-1985 G3<br>cULus, UL Class I Div 2 (Group A,B,C,D), EAC |



**3.3.6 CAN Communication Interface**



An AC 900F controller with CI 910F CAN Bus module allows for connecting traditional Freelance Rack I/O. The CI 910F CAN Bus interface comprises three CAN Bus lines, CAN 1 to CAN 3. The lines are electrically isolated from the system and designed for redundant operation with a second AC 900F controller.

The internal coupler bus connects the CI 910F to the CPU module. This is for both data transmission and power supply. A dual port RAM is used for data exchange.

CAN modules are configured in the Freelance Engineering hardware structure. Information on configuring the CAN module, see Engineering Manual System Configuration, Hardware Structure. Further information on configuration and parameterization of the module, refer to the Engineering Manual AC 900F.



**Communication Interface CI 910F**

| Name    | Short description                                                                                                                                                                  | Article no.     |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| CI 910F | Three CAN Bus channels.<br>ABB CAN Bus protocol.<br>D-Sub terminals (9-pole).<br>Software version 2016 or higher is mandatory.<br>Requires one coupler bus slot on the CPU module. | 3BDH001005R0001 |

| Technical data CI 910F                   |                                                  |
|------------------------------------------|--------------------------------------------------|
| Transmission protocol                    | ABB CAN Bus protocol                             |
| Transmission rate                        | max. 1 MBit/s                                    |
| Settings for rack-based I/O modules      | 100 kBit/s or 500 kBit/s depending on bus length |
| Fieldbus connector                       | D-SUB, 9-pole, female                            |
| CAN interface                            | Acc. to ISO/DIN 11898, CAN 2.0                   |
| Electrical isolation                     | CAN channels to system                           |
| Number of I/O racks                      | max. 5                                           |
| Dual-port memory                         | 256 kB                                           |
| Channels / Lines                         | CAN 1, CAN 2, CAN 3                              |
| Power supply                             | Via coupler bus                                  |
| Current consumption                      | 90 mA, via DC-IN of the CPU module               |
| Power dissipation                        | 1.9 W                                            |
| Number of CI 910F modules per controller | max. 1, optionally in slot C1 or C2              |
| Useable CPU                              | PM 904F, PM 902F or PM 901F                      |
| LEDs                                     | Five LEDs for the status display                 |



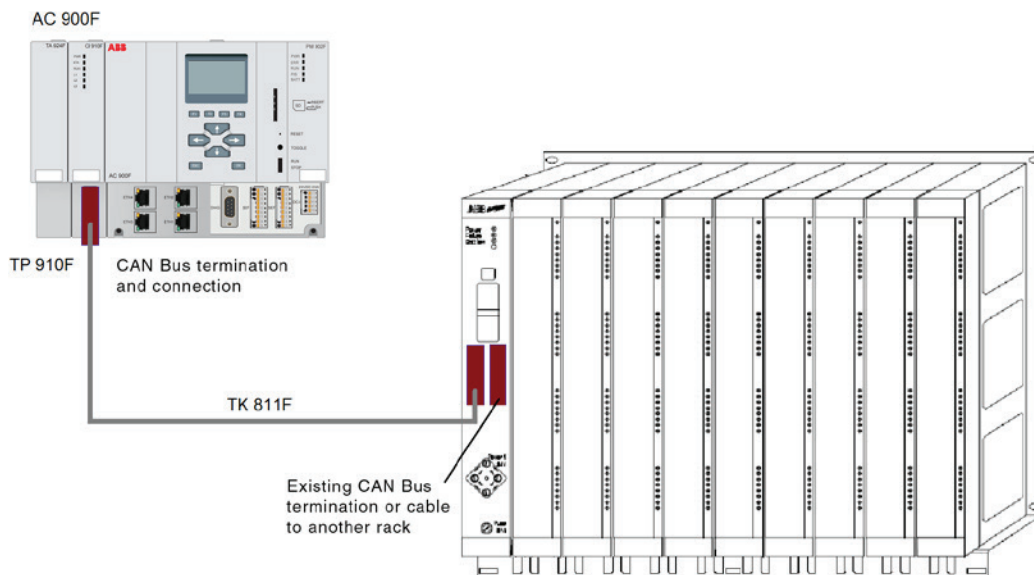
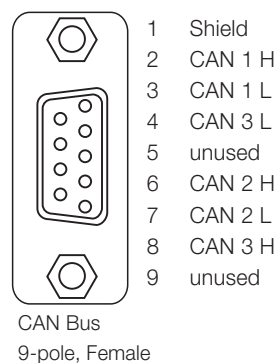
| Technical data CI 910F            |                                                                            |
|-----------------------------------|----------------------------------------------------------------------------|
| Support controller redundancy     | yes                                                                        |
| Hotplug, hot configuration in run | yes                                                                        |
| Status display                    | PWR, STA, L0, L1, L2                                                       |
| Protection                        | IP20                                                                       |
| Weight                            | 178 g (0.39 lbs)                                                           |
| Dimensions                        | Width: 28 mm (1.1 inch)                                                    |
|                                   | Height: 152 mm (5.98 inch)                                                 |
|                                   | Depth: 75 mm (2.95 inch)                                                   |
| Ambient temperature               | Operation: -20 .. +70 °C (-4 °F .. 158 °F)                                 |
|                                   | Storage: -40 °C .. +85 °C (-40 °F .. 185 °F)                               |
| Certificates / Approvals          | CE<br>ANSI/ISA 71.04-1985 G3, cULus, UL Class 1 Div 2 (Group A,B,C,D), EAC |

### LED Status Displays

After having been switched on, the CI 910F CAN Bus module performs a self-test during power-up. During initialization, with newly configured modules or after a change of the operating mode, all LEDs may light up briefly before reaching the defined status.

### CAN Bus connector

The CAN Bus connector of CI 910F features the following pin assignment:



### Connection of Freelance Rack I/O

When connecting the AC 900F controller to a Freelance rack, you will have to remove the DCP 02/10 CPU modules.

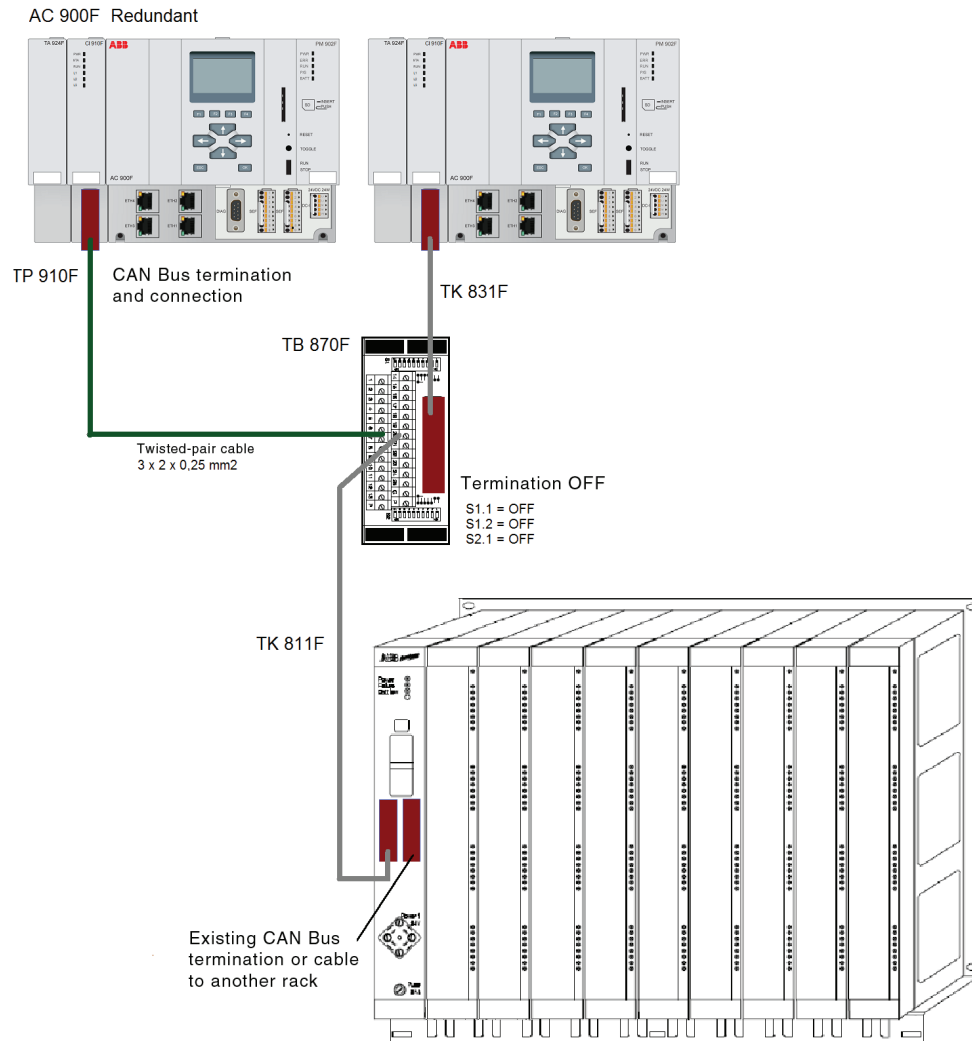
### AC 900F controller at the beginning (end) of the CAN Bus

The TP 910F CAN Bus termination plug is used for terminating the three CAN buses directly at the controller at the beginning (end) of the bus lines. The open end of the TK 811F CAN cable is connected to the screw terminals of the TP 910F plug.

### Redundant AC 900F controller at the beginning (end) of the CAN Bus

The terminating resistors integrated into the TP 910F termination plug ensure that the termination and, thus, the function of the three CAN Bus lines is preserved even if a CAN bus module or controller is replaced. TB 870F is used for connecting the CAN bus between controllers and to the I/O rack.

The TK 831F cable contains feed and return lines. When replacing a CI 910F module or controller, only disconnect the 9-pole connector. Disconnecting the 25-pole connector will interrupt the CAN Bus.



3.3.7 Ethernet Communication Interface



The CI 940F module is a high-speed Ethernet fieldbus module that is suitable for fast data exchange in process control technology with decentralized peripherals.

The CI 940F has two Ethernet lines. The lines are galvanically separated from the system. The CI 940F is designed for redundancy operation with redundant AC 900F. In conjunction with Freelance Engineering, FOUNDATION Fieldbus HSE can be projected and configured on ETH1. With Freelance 2024 it can be used also for Profinet.

The module-internal coupler bus connects the CI 940F with the CPU module. The data exchange takes place via a dual port RAM. The module can be used in any of the fieldbus slots C1 ... C4.

| Technical data CI 940F                |                                                                                                                                                   |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Protocol                              | FOUNDATION Fieldbus HSE, Profinet with Freelance 2024                                                                                             |
| Ethernet interfaces                   | Acc. to IEEE 802.3u                                                                                                                               |
| Channels/lines                        | 2x 100Base-TX Fast Ethernet ports, ETH1 and ETH2                                                                                                  |
| Transmission rate                     | 10/100 Mbit/s (full and half duplex)<br>Auto-Negotiation and Auto MDI-X                                                                           |
| Number of FF communication interfaces | Each CI 940F module supports either FOUNDATION Fieldbus or PROFINET protocols<br>Max. 4 CI 940F for PM 904F<br>Max. 2 CI 940F for PM 901F/PM 902F |
| Fieldbus connector                    | RJ-45 plug                                                                                                                                        |
| Power supply                          | Via coupler bus                                                                                                                                   |
| LEDs                                  | Five LEDs for status display                                                                                                                      |
| Used with                             | AC 900F                                                                                                                                           |
| Controller redundancy support         | Yes                                                                                                                                               |
| Hot plug                              | Yes                                                                                                                                               |

**LED status displays**

After having been switched on, the CI 940F Ethernet module performs a self-test during power-up. During initialization, with newly

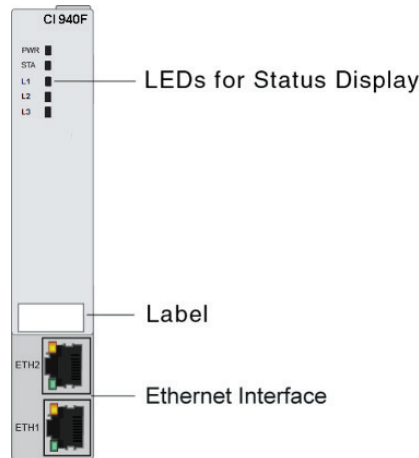
configured modules or after a change of the operating mode, all LEDs may light up briefly before reaching the defined status.

| LED | Color  | Status | Meaning                                                      |
|-----|--------|--------|--------------------------------------------------------------|
| PWR | Green  | ON     | Module in operation and must not be removed                  |
|     |        | OFF    | Module not in operation and may be removed, if required      |
| STA | Green  | ON     | Active module operating properly                             |
|     |        | OFF    | Module start-up                                              |
|     | Orange | ON     | Module identified by the CPU module, but inactive            |
|     | Red    | OFF    | Module under power but not yet identified, or module failure |
| L1  |        |        | not used                                                     |
| L2  |        |        |                                                              |
| L3  |        |        |                                                              |

**Ethernet connection**

The following pin assignment applies to the Ethernet connection on the CI 940F:

Two single-color LEDs are integrated on the RJ45 connector, which show the current communication status. The unlabeled LEDs are clearly identifiable by their color. The lower, green LED indicates the status of the connection, while the upper, yellow LED indicates the transmission speed.

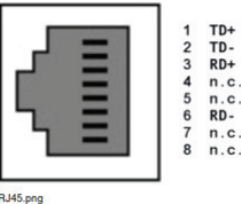


**Cabling**

FF/HSE cabling is always a point-to-point connection. This means that you must provide appropriate network switches and network hubs to set up a network with more than two participants. Due to the Auto MDI-X capability of the CI 940F, it is not necessary to use a crossover cable for a direct connection.

**Pin assignment of the connector**

| Pin | Signal | Meaning         |
|-----|--------|-----------------|
| 1   | TD+    | Transmit data + |
| 2   | TD-    | Transmit data - |
| 3   | RD+    | Receive data +  |
| 4   | n.c.   | Not used        |
| 5   | n.c.   | Not used        |
| 6   | RD-    | Receive data -  |
| 7   | n.c.   | Not used        |
| 8   | n.c.   | Not used        |



### 3.3.8 Accessories

#### TD 951F Display Unit

This is an optional accessory. It provides a dot matrix LCD with 128 x 64 pixel resolution, keypad with six predefined and four function keys. The display unit allows the following functions:

- Network settings
- Backup/Restore application
- Status display
- Display of process variables
- Module exchange
- Firmware update
- Lock/unlock the controller against firmware and application downloads



| Name    | Short description                          | Article no.     |
|---------|--------------------------------------------|-----------------|
| TD 951F | 64 x 128 Dot Matrix LCD.<br>White housing. | 3BDH001020R0001 |

#### TA 951F Battery for RAM buffering

TA 951F contains a 2/3A size Lithium battery with cable connection. The battery is sealed within a plastic pack. It is possible to exchange this battery without stopping the CPU module. In the event of power failure, the TA 951F Lithium battery supplies power to store the SRAM contents (e.g. process and configuration data) and to back-up the real time clock. The CPU module is supplied without a Lithium battery.

Although the CPU module can work without a battery, its use is still recommended in order to avoid losing process data. The CPU module monitors the discharge status of the battery. An pre-warning indication is displayed before (at least two weeks in advance) the battery status

becomes critical. The battery should be replaced in fixed intervals or as soon as possible after this error indication is displayed. The TA 951F Lithium battery is the only battery that can be used with CPU module PM 901F, PM 902F or PM 904F. It is a primary cell and cannot be recharged.

#### Technical data:

- Lithium cylindrical cell
- 3 V, 1200 mAh
- Primary cell, non rechargeable
- Protection against reverse polarity is by mechanical coding of the plug

| Name                              | Short description                                                                                                                                                                                                                | Article no.     |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| TA 951F Battery for RAM buffering | 2/3A Size, Lithium metal.<br>Do not order more than three batteries for each module which requires a battery, due to air freight regulations.<br>Please pay attention to the instruction in section 'General' of the price list. | 3BDH001030R0001 |

### Dummy coupler Modules

| Name    | Short description                                                                            | Article no.     |
|---------|----------------------------------------------------------------------------------------------|-----------------|
| TA 724F | Empty housing for covering unused coupler bus slots.                                         | 3BDH000367R0001 |
| TA 924F | Empty housing for covering unused coupler bus slots.<br>For use with the AC 900F CPU module. | 3BDH001031R0001 |

TA 924F



### White Plastic Markers

| Name  | Short description                                                                                | Article no.     |
|-------|--------------------------------------------------------------------------------------------------|-----------------|
| TA525 | Set(10) of white Plastic Markers.<br>For labeling the modules, waterproof felt pins can be used. | 1SAP180700R0001 |

### Accessories for AC 900F CAN Bus installation

| Name    | Short description                                                                                                                       | Article no.     |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| TP 910F | CAN Bus Termination Plug<br>Integrated termination resistors.<br>Screw type clamps.<br>Connection of the Freelance rack based I/O.      | 3BDH001033R0001 |
| TB 870F | Terminal Block, for serial interface.                                                                                                   | 3BDM000160R1    |
| TK 811F | CAN Cable, open end, 3 m<br>3 x 2 x 0.25 mm <sup>2</sup> .<br>Connection FI 8x0F to Terminal Block TB 870F.                             | 3BDM000103R1    |
| TK 831F | CAN Cable (3 channel), connectors, 0.5 m<br>3 x 2 x 0.25 mm <sup>2</sup> .<br>Connection FI 810F to Terminal Block TB 870F (3 channel). | 3BDM000100R1    |



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### 3.3.9 Cables

| Name    | Short description                                                                                                                    | Article no.  |
|---------|--------------------------------------------------------------------------------------------------------------------------------------|--------------|
| TK 831F | CAN Cable (3 channel), integral connectors, 0.5 m<br>3 x 2 x 0.25 mm <sup>2</sup> ,<br>Connection FI 810F to Terminal Block TB 870F. | 3BDM000100R1 |
| TK 811F | CAN Cable, open end, ferrules, 3 m<br>3 x 2 x 0.25 mm <sup>2</sup> ,<br>Connection FI 8x0F to Terminal Block TB 870F.                | 3BDM000103R1 |
| TK 821F | Serial Cable (2 channel), integral connectors, 0.5 m<br>Connection FI 820F to Terminal Block TB 870F.                                | 3BDM000150R1 |
| TK 891F | Diagnostics Cable, 5 m                                                                                                               | 3BDM000201R1 |
| TK 890F | Diagnostics Cable, 10 m                                                                                                              | 3BDM000202R1 |

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## 3.4 The AC 700F controller



The AC 700F controller comes in a really small footprint and high signal density of S700 I/O. The S700 I/O modules are directly plugged to the CPU module or can be used as remote I/O via PROFIBUS. A maximum of eight modules can be connected to one controller. AC 700F offers expanded flexibility via a pluggable SD card for controller backup and firmware update.

---

### 3.4.1 Hardware and certificates

AC 700F comes with a modular design. The base elements are different types of terminal units, for the CPU module and for S700 I/O modules. Both, screw type and spring type terminal units are available. The modules can be easily plugged to the terminal units and then the terminal units can be plugged one to the other. The entire controller is then mounted on a DIN rail.

---

#### Certificates

The AC 700F controller has the following certificates:

- CE, GL, UL, ISO 9001.

---

#### Technical data

The CPU and the direct S700 I/O modules communicate very fast. I/O scan times of 2 ms are possible. Short circuit and line break detection can be realized for each channel.

### Environmental conditions

The temperature range of AC 700F and S700 I/O extends from 0 °C to 60 °C / 32-140 °F.

| Temperature ranges and other environmental conditions |            |                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ambient temperature                                   | Operating: | Temperature range: 0 °C (32 °F) ..+60 °C (140 °F)<br><br>Highly recommended mounting: horizontally<br><br><b>Vertical mounting:</b> is possible, however, derating considerations should be made to avoid problems with poor air circulation and the potential for excessive temperatures.<br>Temperature range: 0 °C (32 °F) ..+40 °C / 104 °F<br>50% output load derating |
|                                                       | Storage:   | -25 °C (-13 °F)...+75 °C (167 °F)                                                                                                                                                                                                                                                                                                                                           |
|                                                       | Transport: | -25 °C (-13 °F)...+75 °C (167 °F)                                                                                                                                                                                                                                                                                                                                           |
|                                                       |            |                                                                                                                                                                                                                                                                                                                                                                             |
| Ambient temperature for the battery                   | Operating  | 0 °C (32 °F)...+60 °C (140 °F)                                                                                                                                                                                                                                                                                                                                              |
|                                                       | Storage:   | -20 °C (-4 °F)...+60 °C (140 °F)                                                                                                                                                                                                                                                                                                                                            |
|                                                       | Storage:   | -20 °C (-4 °F)...+60 °C (140 °F)                                                                                                                                                                                                                                                                                                                                            |
| Humidity                                              |            | Maximum 95%, without condensation                                                                                                                                                                                                                                                                                                                                           |
| Air pressure                                          | Operating: | > 800 hPa / < 2000 m                                                                                                                                                                                                                                                                                                                                                        |
|                                                       | Storage:   | > 660 hPa / < 3500 m                                                                                                                                                                                                                                                                                                                                                        |

### Mechanical stress

| Mechanical stress and mounting               |                                                                                                                                                                               |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mounting                                     | Horizontal                                                                                                                                                                    |
| Degree of protection                         | IP 20                                                                                                                                                                         |
| Housing                                      | According to UL 94                                                                                                                                                            |
| Vibration resistance according to EN 61131-2 | All three axes<br>2 Hz...15 Hz, continuous 3.5 mm (0.1379 inch)<br>15 Hz...150 Hz, continuous 1 g (0.04 oz) (4 g (0.14 oz) in preparation)                                    |
| Shock test                                   | All three axes<br>15 g (0.53 oz), 11 ms, half-sinusoidal                                                                                                                      |
| Mounting of the modules                      | DIN-rail according to DIN EN 50022,<br>35 mm (1.38 inch),<br>depth 7.5 mm (0.2955 inch) or 15 mm (0.591 inch),<br>mounting with screws of type M4,<br>fastening torque 1.2 Nm |

### Product compliance

| Electromagnetic compatibility and other directives |                                                                                                                                                                                                    |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2014/30/EU                                         | EMC Directive                                                                                                                                                                                      |
| EN 61131-2:2007                                    | Functional, electrical, mechanical, environmental and construction characteristics, service conditions, safety, EMC, user programming and tests applicable to PLCs and the associated peripherals. |
| 2011/65/EU                                         | RoHS Directive (6.2011)                                                                                                                                                                            |

## Electric data

| Electric data                                                                               |                                                               |
|---------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| Voltages according to EN 61131-2                                                            |                                                               |
| Process- and Supply-voltage                                                                 | 24 VDC (-15 %, +20 % without ripple)                          |
| Absolute limits                                                                             | 19.2 V...30 V incl. Ripple (see below)                        |
| Ripple                                                                                      | < 5 %                                                         |
| Protection against reverse polarity                                                         | 10 s                                                          |
| Permissible interruptions of power supply as per EN 61131-2                                 |                                                               |
| DC supply                                                                                   | Interruption < 10 ms, time between 2 interruptions > 1 s, PS2 |
| Creepage distances and clearances                                                           |                                                               |
| The creepage distances and clearances meet the overvoltage category II, pollution degree 2. |                                                               |
| Power supply units                                                                          |                                                               |
| Power supply units meeting the PELV specification should be used for powering the modules.  |                                                               |

## Insulation test voltages

| Routine Test, according to EN 61131-2                                                                     |           |        |                              |
|-----------------------------------------------------------------------------------------------------------|-----------|--------|------------------------------|
| Circuits against other circuitry                                                                          | 230 V     | 2500 V | High voltage pulse 1.2/50 µs |
|                                                                                                           | 120 V     | 1500 V |                              |
|                                                                                                           | 120-240 V | 2500 V |                              |
| 24 V circuits (supply, 24 V inputs / outputs), if they are electrically isolated against other circuitry. |           | 500 V  |                              |
| COM interfaces, electrically isolated                                                                     |           | 500 V  |                              |
| Ethernet                                                                                                  |           | 500 V  |                              |
| 24 V circuits (supply, 24 inputs / outputs), if they are electrically isolated against other circuitry    |           | 350 V  | AC voltage during 2 seconds  |
| COM interfaces, electrically isolated                                                                     |           | 350 V  |                              |
| Ethernet                                                                                                  |           | 350 V  |                              |

## 3.4.2 Central processing unit PM 783F

| Name    | Short description                                                                                                                                                                                                                                                                                                                                                                                                               | Article no.     |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| PM 783F | <p>Central Processing Unit (2 MB)</p> <p>Without operating system. The operating system has to be loaded during software installation.</p> <p>Needs external 24 VDC power supply.</p> <p>Software version 2013 SP1 RU04, 2016 SP1 RU03 or higher is mandatory.</p> <p>For details, refer to the Freelance AC 700F Compatibility Matrix (2PAA106303D0002 C).</p> <p>Terminal Base TB 711F and Battery TA521 are not included</p> | 3BDH000364R0005 |



The Central Processing Unit (CPU) module is equipped with a high-performance processor for fast loop cycle times. It comes with on-board 100 Mbit/s Ethernet network connection used for communication between controllers, operator stations, and engineering tool. Two serial line interfaces complement the connectivity. One interface can be used for Modbus

communication, while the other is used for diagnostics. For demanding applications, eight cyclic and priority driven tasks with adjustable cycle time can be configured, as well as a cyclic PLC type task, which runs as fast as possible. This multi-tasking scenario enables engineers to design applications that reflect all demands of process control, while at the same time balancing the CPU load. This keeps the resources needed in a project at the minimum.

The small front panel display shows status and diagnostic information directly at the module. Furthermore, you can lock the controller via the keys. This means, the controller can be blocked for downloads of application and firmware to enhance security. The status, if the controller is locked or unlocked is shown on the display.

## Technical data

| Technical data PM 783F                                                     |                              |                                                                                                             |
|----------------------------------------------------------------------------|------------------------------|-------------------------------------------------------------------------------------------------------------|
| CPU                                                                        |                              | Freescale PowerPCTM                                                                                         |
| RAM                                                                        |                              | Program memory (battery backed up) 2 MB SRAM<br>Internal memory 8 MB SDRAM, 4 MB FLASH ROM                  |
| Processing time for 1000 instructions                                      |                              | 0.71 ms for binary instructions<br>0.84 ms for word instructions<br>1.36 ms for floating point instructions |
| Max. number of I/O modules on I/O bus (direct I/O)                         |                              | 8                                                                                                           |
| Power supply                                                               |                              | 24 V DC                                                                                                     |
| Max. power dissipation within the module                                   |                              | 10 W                                                                                                        |
| Current consumption from 24 VDC                                            |                              | 80 mA (max)                                                                                                 |
| Inrush current at 24 VDC                                                   |                              | 1 A <sup>2</sup> s                                                                                          |
| Data backup source                                                         |                              | Lithium battery                                                                                             |
| Data buffering time at 25 °C / 77 °F                                       |                              | Approximately 1.5 years                                                                                     |
| Battery low indication                                                     |                              | Warning indication issued about 2 weeks before the battery charge becomes critical                          |
| Real-time clock, with battery backup                                       |                              | Yes                                                                                                         |
| Multitasking program execution                                             | Cyclic                       | 8 tasks                                                                                                     |
|                                                                            | Cyclic (as fast as possible) | 1 PLC type task                                                                                             |
|                                                                            | Event driven                 | Upon any of these events:<br>"Run, Stop, Warm start, Cold start, Error"                                     |
| Serial interface "SER" (COM1)<br>(See "Terminal Base TB 711F" on page 39)  | Physical link:               | Configurable for RS-232 or RS-485 (from 1200 bps to 38400 bps)                                              |
|                                                                            | Connection:                  | Pluggable terminal block, spring connection                                                                 |
|                                                                            | Usage:                       | Modbus<br>• ASCII (Master / Slave)<br>• RTU (Master / Slave)<br>• IEC 60870-5-101 Telecontrol protocol      |
| Serial interface "DIAG" (COM2)<br>(See "Terminal Base TB 711F" on page 39) | Physical link:               | RS-232                                                                                                      |
|                                                                            | Connection:                  | SUB-D female connector                                                                                      |
|                                                                            | Usage:                       | For diagnostics                                                                                             |
| Onboard network interface                                                  | Connection:                  | 1 x Ethernet (RJ45) 100 Mbit/s                                                                              |
|                                                                            | Usage:                       | • Modbus TCP<br>• Telecontrol IEC 60870-5-104                                                               |
| LEDs, LCD display, 8 function keys                                         |                              | For RUN / STOP switch-over, status displays and diagnostics                                                 |
| Weight (CPU without Terminal Base)                                         |                              | 150 g / 5.29 oz.                                                                                            |
| Dimensions (CPU without Terminal Base)                                     | Width                        | 67.5 mm, 2.66 inches                                                                                        |
|                                                                            | Height                       | 76 mm, 2.99 inches                                                                                          |
|                                                                            | Depth                        | 54 mm, 2.13 inches                                                                                          |

### 3.4.3 PROFIBUS module CI 773F

| Name    | Short description                                                                                                                                                                                                                                                      | Article no.     |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| CI 773F | Communication Interface, PROFIBUS DP Master<br>DP-V0/V1, 12 MBit/s<br>D-Sub terminal, 9-pole<br>Software version 2013SP1 or higher is mandatory<br>Requires one coupler bus slot on the CPU module on PM 904F, PM 902F, PM 901F or AC 700F with Terminal Base TB 711F. | 3BDH000395R0001 |

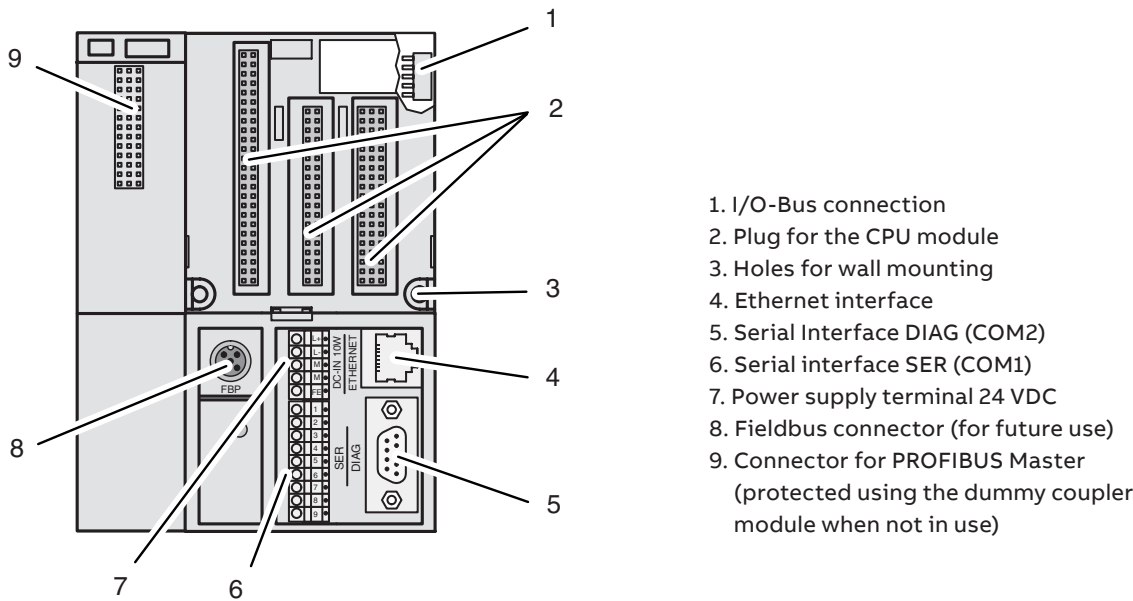


For more details please see "Communication Interface CI 773F" on page 26.

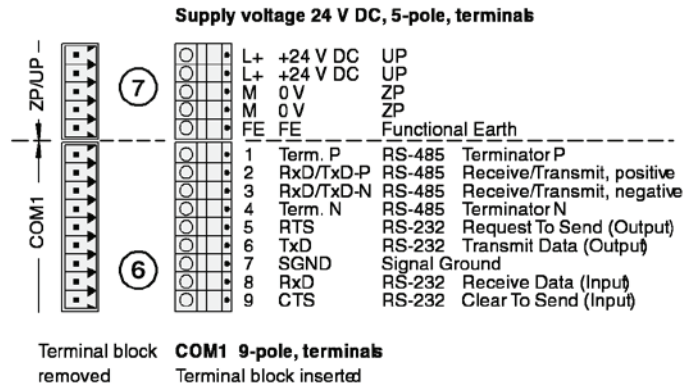
### 3.4.4 CPU terminal base TB 711F

| Name    | Short description                                             | Article no.     |
|---------|---------------------------------------------------------------|-----------------|
| TB 711F | CPU Terminal Base<br>24 VDC, 1x Coupler slots, Ethernet RJ45. | 3BDH000365R0001 |

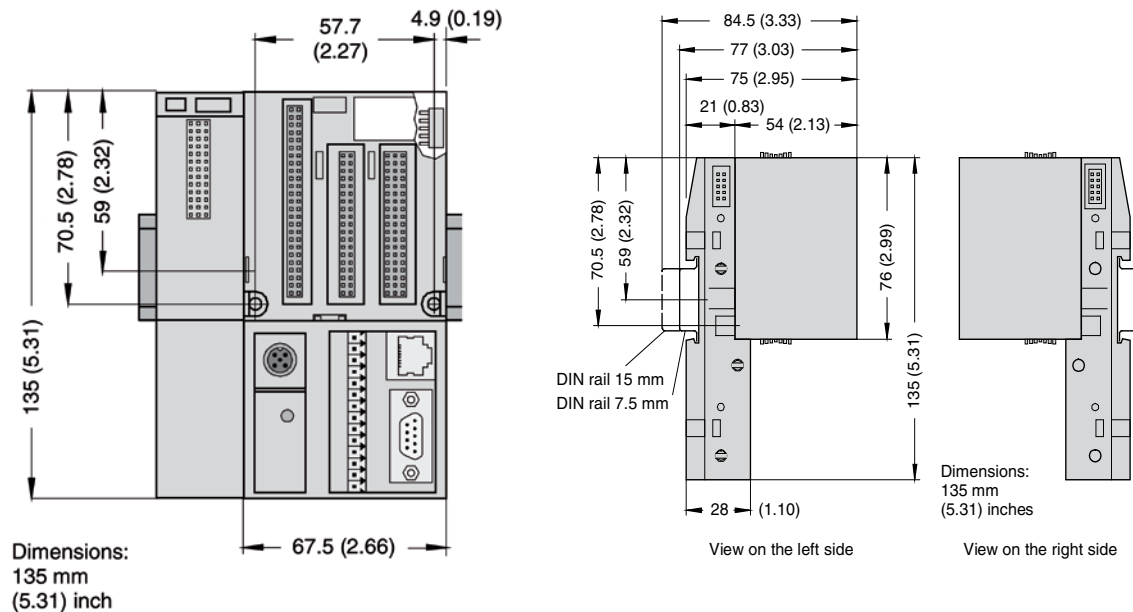
| Technical data TB 711F                   |                                                                                                                                    |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Connection of the 24 VDC process voltage | With a 5-pole removable terminal block                                                                                             |
| Slots                                    | 1 CPU, 1 Communication module                                                                                                      |
| Interfaces                               | Field I/O: 1 for I/O-Bus<br>Serial ports: 2 ("SER" (COM1), "DIAG" (COM2))<br>Networking: 1 Ethernet (RJ45)<br>PROFIBUS Master port |
| Weight                                   | 175 g / 6.17 oz.                                                                                                                   |
| Dimensions (with CPU inserted)           | Width 95.5 mm, 3.75 inches<br>Height 135 mm, 5.31 inches<br>Depth 75 mm, 2.95 inches                                               |



Terminal assignment for supply voltage (24 VDC) and the serial interface SER (COM1)



3.4.4.1. Dimensional drawings CPU Terminal Base





3.4.5 Accessories for CPU module

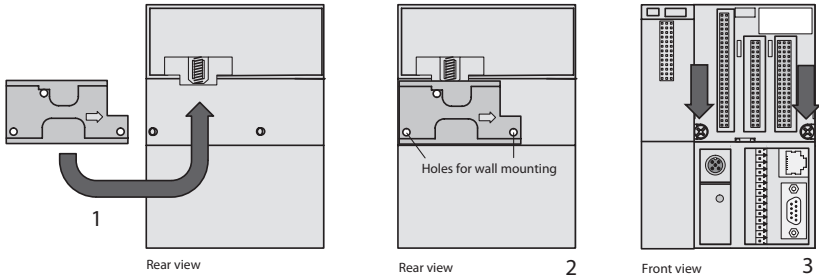
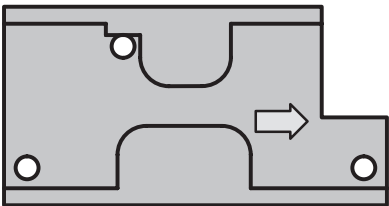
| Name    | Short description                                      | Article no.     |
|---------|--------------------------------------------------------|-----------------|
| TK 701F | Diagnostic Serial Cable, Sub-D / Sub-D, 5 m / 16.4 ft. | 3BDH000366R0001 |

| Name  | Short description                                                | Article no.     |
|-------|------------------------------------------------------------------|-----------------|
| TA521 | Battery for RAM buffering<br>Button Cell, Lithium<br>For PM 783F | 1SAP180300R0001 |

| Name    | Short description                                                                                                                                                                                  | Article no.     |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| TA 724F | Dummy Coupler Module<br>Empty module, to protect an unused coupler slot from dust and touch when AC 700F is used without a PROFIBUS Master module.<br>Is mounted on the CPU Terminal Base TB 711F. | 3BDH000367R0001 |



| Name  | Short description                                                                                        | Article no.     |
|-------|----------------------------------------------------------------------------------------------------------|-----------------|
| TA526 | Accessories for back-plate mounting, 10 pcs.<br>With wall mounting of Terminal Bases and Terminal Units. | 1SAP180800R0001 |



## 4. Power supplies for AC 900F, AC 700F and S700 I/O

The following power supplies are compatible with AC 900F, AC 700F and S700 I/O. They can be used to provide 24 V DC to CPU moduls, I/O modules and field devices. Accessories, such as voter-, redundancy- and messaging modules, enable the setup of a redundant power supply and its monitoring.

Alternatively, Power Supplies that supports the technical requirement described in the M&I manual can be used.

Further information on power supplies can be found in the related product documentation.

| Name   | Output current | Article no.  |
|--------|----------------|--------------|
| SD831* | 3 A            | 3BSC610064R1 |
| SD832* | 5 A            | 3BSC610065R1 |
| SD833* | 10 A           | 3BSC610066R1 |
| SD834* | 20 A           | 3BSC610067R1 |

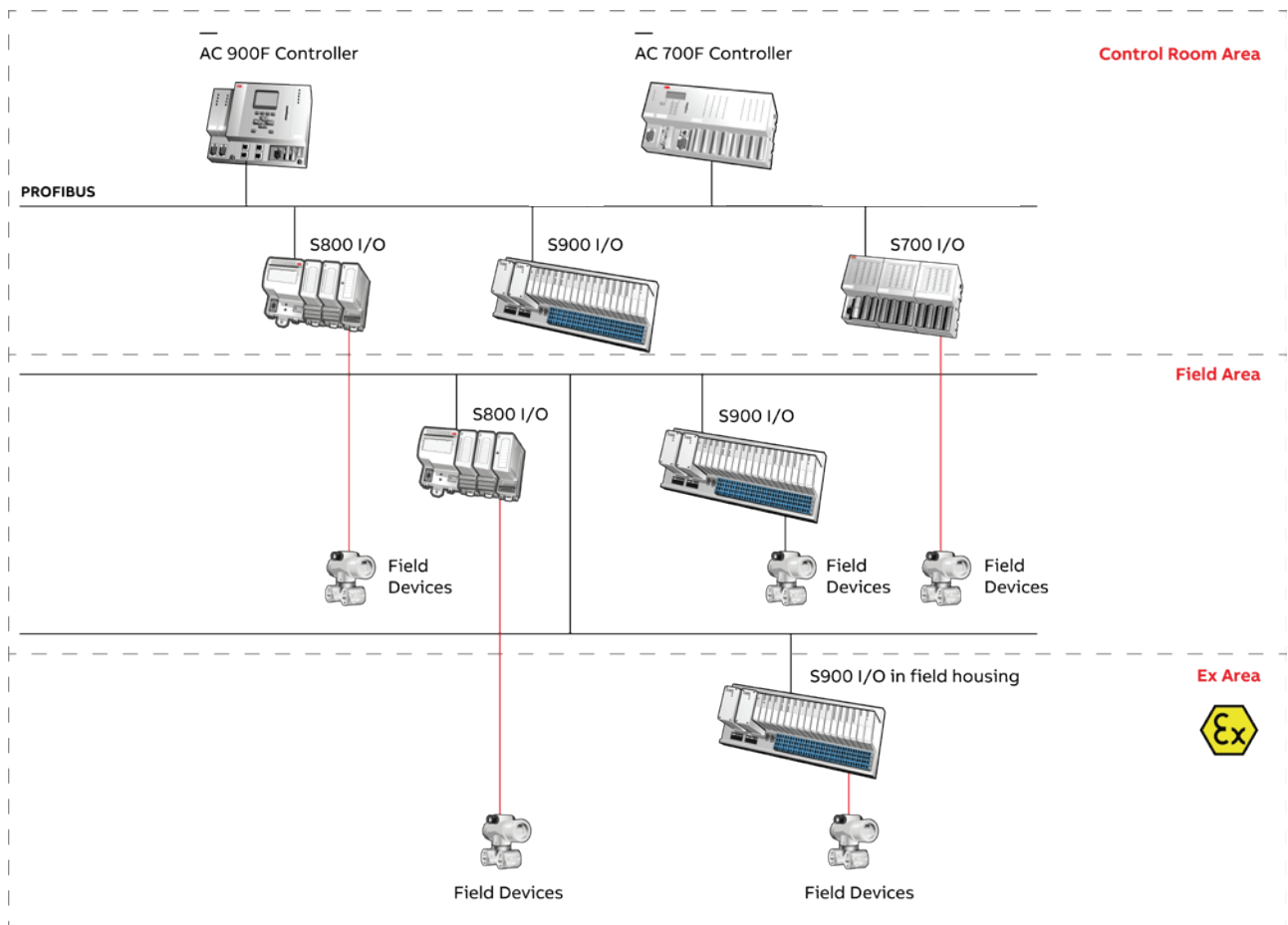
\*See also chapter 5.3.4 S800 Power supplies

## 5. I/Os

|                  |                                               |
|------------------|-----------------------------------------------|
| <b>066</b>       | <b>5.1 Introduction to I/Os for Freelance</b> |
| <b>067 – 102</b> | <b>5.2 S700 I/O</b>                           |
| 068              | 5.2.1 S700 I/O modules                        |
| 068              | 5.2.2 Fieldbus interface module CI 741F       |
| 070              | 5.2.3 Digital I/O Modules                     |
| 082              | 5.2.4 Analog I/O Modules                      |
| 093              | 5.2.5 Digital / analog I/O module             |
| 097              | 5.2.6 S700 I/O terminal units                 |
| 102              | 5.2.7 S 700 I/O Accessories                   |
| <b>102 – 112</b> | <b>5.3 S800 Remote I/O</b>                    |
| 103              | 5.3.1 Communication                           |
| 104              | 5.3.2 S800 I/O modules                        |
| 109              | 5.3.3 S800L modules                           |
| 112              | 5.3.4 Power supplies                          |
| 112              | 5.3.5 S800 I/O user documentation             |
| <b>113 – 122</b> | <b>5.4 S900 Remote I/O</b>                    |
| 113              | 5.4.1 Introduction to S900 I/O system         |
| 114              | 5.4.2 Redundant termination unit TU921S/B/N   |

|     |                               |
|-----|-------------------------------|
| 114 | 5.4.3 Power supply SA920S/B/N |
| 115 | 5.4.4 Digital I/O modules     |
| 116 | 5.4.5 Analog I/O modules      |
| 120 | 5.4.6 Field housing           |
| 121 | 5.4.7 Accessories for S900    |
| 122 | 5.4.8 Software                |

## 5.1 Introduction to I/Os for Freelance



The following chapter will give you a brief overview about the Remote I/O systems S700, S800 and S900.

The picture above shows a sketch of a possible PROFIBUS topology without going into detail. The controllers are assembled in the control room. Remote I/O systems can be assembled in the control room or directly in the field. Furthermore, S900 I/O can be placed locally in the field in hazardous area, depending on the customer's needs. Field devices are connected to the remote I/O systems. With AC 700F and AC 900F a subset of S700 I/O can be plugged as direct I/O to the right side of the controller.

Remote I/O systems can also be mounted locally in the field, near field devices. This type of installation reduces the costs for cabling from the field device to the system.

On-site assembly of the remote I/O systems is easy, as only a single cable is required for PROFIBUS communication and just a suitable field housing is needed for mounting. This field housing usually has the IP66 degree of

protection. Other devices such as fiber optic couplers, pneumatic valves, terminals, terminal blocks or additional electronical devices can also be mounted in such a field housing. This reduces both design, engineering and cabling costs.

In order for devices to be installed in hazardous areas, extra regulations and functional rules need to be considered in addition to the usual engineering rules.

All devices which are used in hazardous area have to be certified. The devices shall have a certificate for either Zone 1 or Zone 2. The S900 remote I/O system (S and B series) is suitable for installation in hazardous areas, see the table below:

| Series | Assembly                    | Field devices /signals                            | Hazardous area approval |
|--------|-----------------------------|---------------------------------------------------|-------------------------|
| S      | In Zone 1 (Blue TU921)      | In Zones 2, 1, and 0 (intrinsically safe signals) | ATEX Zone 1             |
| B      | In Zone 2 (Blue TU921)      | In Zones 2, 1, and 0 (intrinsically safe signals) | ATEX Zone 2             |
| N      | In safe areas (Black TU921) | In safe areas                                     | No                      |

## 5.2 S700 I/O



S700 I/O can be used as direct I/O for AC 700F and AC 900 or as PROFIBUS remote I/O for AC 700F, AC 800F, AC 900F or other PROFIBUS Masters. Up to ten I/O modules can be connected to the fieldbus interface module CI 741F.

One of the S700 I/O benefits is the small footprint – the modules are featured with a high packing density, several modules are available with inputs and outputs mixed in one module. Currently, 10 different module types are available covering a wide variety of applications

## 5.2.1 S700 I/O modules

The following table lists the entire set of S700 I/O modules. All modules can be used as remote I/O at PROFIBUS DP. The indicated subset can be used as direct I/O together with the AC 700F and AC 900F controller.

|                 | Module Name | Type<br>(Channel Groups)                    | Input Range                                                                                                                                                                                                                          | Output Range                                                                                                      |
|-----------------|-------------|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Direct I/O      | DC 732F     | 16 DI, 16 DI/DO configurable                | 24V DC, 1-wire, standard binary signals, all signals share common ground                                                                                                                                                             | 24 V DC, 0.5 A                                                                                                    |
|                 | AI 723F     | 16 AI, 12-Bit+Sign                          | 0...10 V, -10...+10 V, 0/4...20 mA, Pt100/1000, Ni1000, DI                                                                                                                                                                           | -                                                                                                                 |
|                 | AX 722F     | 8 AI + 8 AO (2x4), 12 Bit+Sign              | 0...10 V, -10...+10 V, 0/4...20 mA, Pt100/1000, Ni1000, DI                                                                                                                                                                           | 0...10 V, -10...+10 V, 0/4...20 mA, Pt100/1000, Ni1000, DI, Ch 0-3: -10...+10 V, 0/4...20 mA; Ch 4-7: -10...+10 V |
|                 | AO 723F     | 16 AO (2x8), 12 Bit+Sign                    | -                                                                                                                                                                                                                                    | Ch 0-3: & 8-11: -10...+10 V, 0/4...20 mA, Ch 4-7 & 12-15: -10...+10 V                                             |
|                 | DX 722F     | 8 DI, 8 DO Relay                            | 24 V DC                                                                                                                                                                                                                              | 24 V DC, 110 V/ 230 V AC                                                                                          |
|                 | DX 731F     | 8 DI, 4 DO Relay                            | 110 V/ 230 V AC                                                                                                                                                                                                                      | 24 V DC, 110 V/ 230 V AC                                                                                          |
|                 | AI 731F     | 8 AI, 15 Bit+Sign                           | -50 mV...+50 mV, -500 mV...+500 mV, -1 V...+1 V, 0...10 V, -10 V...+10 V, 0 V...+5 V, -5 V...+5 V, 0...20 mA, 4...20 mA, -20...+20 mA, Pt100/1000, Ni1000, Cu50 (1.426), Cu50 (1.428), 0...50 kOhm, Thermo-couple J K T N S Type, DI | -                                                                                                                 |
|                 | DI 724F     | 32 DI                                       | 24 V DC, 1-wire, standard binary signals, all signals share common ground                                                                                                                                                            | -                                                                                                                 |
|                 | DA 701F     | 16 DI, 8 DC, 4 AI, 2 AO                     | 24 V DC (for DI), 0...10 V, -10...+10 V, 0/4...20 mA, Pt100/1000, Ni1000, DI                                                                                                                                                         | 24 V DC, 0.5 A (for DO), -10...+10 V, 0/4...20 mA                                                                 |
|                 | CI 741F     | PROFIBUS Interface + 8 DI, 8 DO, 2 AI, 2 AO | 24 V DC, ±10V, 0/4-20mA, 1-wire, this is the communication module for PROFIBUS                                                                                                                                                       | 24V DC, 0.5 A, ±10V, 0/4-20mA                                                                                     |
| S700 Remote I/O | DC 723F     | 24 DC, 24 V DC                              | 24 V DC (2/3-wire DI possible)                                                                                                                                                                                                       | 24 V DC, 0.5 A                                                                                                    |

## 5.2.2 S700 I/O modules

| Name    | Short description                                                                                                                                                                                                                                                                                        | Article no.     |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| CI 741F | Interface for S700 Remote I/O with Sub-D connector<br>8 DI: 24 V DC<br>8 DO: 24 V DC/0.5 A<br>2 AI: ±10 V, 0/4-20 mA, RTD, 24 V DC<br>2 AO: ±10 V, 0/4-20 mA<br>1-wire, 24 V DC, 100 W<br>Use with TU 709F/710F (terminal unit not included)<br><br>• Fieldbus Interface module<br>• PROFIBUS remote I/O | 3BDH000396R0005 |





The CI 741F is used as communication interface for PROFIBUS communication. The bus is connected by the Sub-D connector on the TU 709F/710F terminal block. The module is characterized by the following features:

- PROFIBUS DP interface
- 2 analog inputs in one group (2.0 ... 2.4)
- 2 analog outputs in one group (2.5 ... 2.7)
- 8 digital 24 V DC inputs in one group (3.0 ... 3.7)
- 8 digital outputs in one group (4.0 ... 4.7)

You can use the standard PROFIBUS plug to connect the PROFIBUS DB fieldbus to the CI 741F and/or the corresponding TU 709F/710F terminal block.

### Environmental Conditions

Please refer to "3.4.1 Hardware and certificates" on page 35.

### Technical data

| Functionality CI 741F                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fieldbus interface                                                | PROFIBUS DP, Sub-D female connector                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Power supply of the I/O electronics                               | UP = 24 V DC (except for DO0 to DO7)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Power supply of the outputs DO0 to DO7 expansion modules attached | UP3 = 24 V DC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Address switch                                                    | Setting of the fieldbus address (hexadecimal)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| LEDs                                                              | 32 for system status, signal status, error messages and power supply                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Power supply                                                      | UP, UP3 = 24 V DC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Potential separation                                              | Module-wise                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Digital inputs                                                    | 8 24 V DC inputs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Digital outputs                                                   | 8 outputs 24 V DC, 0.5 A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Analog inputs                                                     | 4 analog inputs that can be configured individually for: <ul style="list-style-type: none"> <li>• Unassigned (default setting)</li> <li>• 0 ... 10 V, -10 ... +10 V</li> <li>• 0/4 ... 20 mA</li> <li>• Pt100, -50 ... +400 °C (2-wire)</li> <li>• Pt100, -50 ... +400 °C (3-wire), requires 2 channels</li> <li>• Pt100, -50 ... +70 °C (2-wire)</li> <li>• Pt100, -50 ... +70 °C (3-wire), requires 2 channels</li> <li>• Pt1000, -50 ... +400 °C (2-wire)</li> <li>• Pt1000, -50 ... +400 °C (3-wire), requires 2 channels</li> <li>• Ni1000, -50 ... +150 °C (2-wire)</li> <li>• Ni1000, -50 ... +150 °C (3-wire), requires 2 channels</li> <li>• 0 ... 10 V via differential inputs, requires 2 channels</li> <li>• -10 ... +10 V via differential inputs, requires 2 channels</li> <li>• digital signals (digital input)</li> </ul> |
| Analog outputs                                                    | 2 analog outputs that can be configured individually for: <ul style="list-style-type: none"> <li>• Unassigned (default setting)</li> <li>• 0 ... 10 V, -10 ... +10 V</li> <li>• 0/4 ... 20 mA</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Resolution of the analog channels                                 | Current/voltage: 12 bits plus sign<br>Temperature: 0.1 °C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

## 5.2.3 Digital I/O Modules

### 5.2.3.1. Digital input/output module DC 723F

| Name    | Short description                                                                                                                                              | Article no.     |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| DC 723F | Digital input/output module<br>24 DI/DO: 24 VDC/0.5 A<br>1-wire, 24 VDC 300 W<br>TU 715F /TU 716F<br>(terminal unit not included)<br><br>• PROFIBUS remote I/O | 3BDH000373R0001 |



- As an input,
- As a transistor output with short-circuit and overload protection with 0.5 A rated current or
- As a re-readable output (combined input/output) and can be addressed accordingly.



This I/O module can only be used as PROFIBUS remote I/O and not as direct I/O.

It has 24 channels with the following features:

- One 24 V DC 0.5 A sensor power supply with short-circuit and overload protection
- 24 digital Inputs/Outputs 24 V DC in three groups (2.0...4.7), each of which can be used

The technical data correspond to the input and output values. The inputs and outputs are electrically isolated from the other electronic circuitry of the module. There is no potential separation between the channels.

#### Technical data

| Functionality DC 723F  |                                                                                                                            |
|------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Digital Inputs/Outputs | 24 digital Inputs/Outputs                                                                                                  |
| Supply voltage         | 24 V DC                                                                                                                    |
| High-speed counter     | Integrated, many configurable operating mode                                                                               |
| Power supply           | Internal: through the expansion bus interface (I/O-Bus)<br>external: via the terminals ZP and UP (process voltage 24 V DC) |
| Potential separation   | Module-wise                                                                                                                |
| LEDs                   | For indicating signal statuses, errors and supply voltage                                                                  |

| Technical data DC 723F                                                          |                                                               |
|---------------------------------------------------------------------------------|---------------------------------------------------------------|
| Process supply voltage UP                                                       |                                                               |
| Connections                                                                     | Terminals 1.8 – 4.8 for +24 V (UP) and 1.9 – 4.9 for 0 V (ZP) |
| Rated value                                                                     | 24 V DC                                                       |
| Max. ripple                                                                     | 5 %                                                           |
| Protection against reversed voltage                                             | Yes                                                           |
| Rated protection fuse on UP                                                     | 10 A fast                                                     |
| Electrical isolation                                                            | Yes, per module                                               |
| Current consumption                                                             |                                                               |
| From 24 V DC power supply at the terminals UP/L+ and ZP/M of the CPU/Bus Module | Approx. 1 mA                                                  |
| Current consumption via UP in case of normal operation                          | 50 mA + max. 8 mA per input + max. 0.5 A per output           |

| Technical data DC 723F                   |                                                                                                            |
|------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Current consumption                      |                                                                                                            |
| Inrush current from UP (at power-up)     | 0.008 A <sup>2</sup> s                                                                                     |
| Max. power dissipation within the module | 6 W (outputs not loaded)                                                                                   |
| Sensor power supply                      |                                                                                                            |
| Connections                              | Terminals 1.0...1.3 = +24 V, 1.4...1.7 = 0V                                                                |
| Voltage                                  | 24 V DC with short-circuit and overload protection                                                         |
| Loadability                              | Terminals 1.0...1.3, in total max. 0.5 A                                                                   |
| Dimensions                               | 67.5 x 76 x 54 mm / 2.66 x 2.99 x 2.13 inch (width x height x depth)                                       |
| Weight (without terminal unit)           | Approx. 125 g / 4.41 oz.                                                                                   |
| Mounting position                        | Horizontal or vertical with limitations (Output load per group is 50 % at 40°C (104°F))                    |
| Cooling                                  | The natural convection cooling must not be hindered by cable ducts or other parts in the mounting cabinet. |

| Technical data digital inputs/outputs                                                                                                                                                 |                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Number of channels per module                                                                                                                                                         | 24                                                                                                                                 |
| Distribution of the channels into groups                                                                                                                                              | 1 group of 24 channels                                                                                                             |
| If the channels are used as inputs                                                                                                                                                    |                                                                                                                                    |
| <ul style="list-style-type: none"> <li>Connections to the channels C0 to C7</li> <li>Connections to the channels C8 to C15</li> <li>Connections to the channels C16 to C23</li> </ul> | <ul style="list-style-type: none"> <li>Terminals 2.0 to 2.7</li> <li>Terminals 3.0 to 3.7</li> <li>Terminals 4.0 to 4.7</li> </ul> |
| If the channels are used as outputs                                                                                                                                                   |                                                                                                                                    |
| <ul style="list-style-type: none"> <li>Connections to the channels C0 to C7</li> <li>Connections to the channels C8 to C15</li> <li>Connections to the channels C16 to C23</li> </ul> | <ul style="list-style-type: none"> <li>Terminals 2.0 to 2.7</li> <li>Terminals 3.0 to 3.7</li> <li>Terminals 4.0 to 4.7</li> </ul> |
| Indication of the input/output signals                                                                                                                                                | One yellow LED per channel, the LED is ON when the input/output signal is high (signal 1)                                          |
| Electrical isolation                                                                                                                                                                  | From the rest of the module                                                                                                        |

| Technical data digital inputs/outputs if used as inputs                                                                                                            |                                                                                                                |                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|---------------------|
| Each of the configurable I/O channels is defined as input or output by the user program. This is done through scanning or allocation of the corresponding channel. |                                                                                                                |                     |
| Number of channels per module                                                                                                                                      | 24 inputs digital                                                                                              |                     |
| Reference potential for all inputs                                                                                                                                 | Terminals 1.9...4.9 ( minus pole of the process supply voltage, signal name ZP)                                |                     |
| Electrical isolation                                                                                                                                               | From the rest of the module                                                                                    |                     |
| Indication of the input signals                                                                                                                                    | One yellow LED per channel, the LED is ON when the input/output signal is high (signal 1)                      |                     |
| Input type according to EN 61131-2                                                                                                                                 | Type 1                                                                                                         |                     |
| Input delay (0->1 or 1->0)                                                                                                                                         | Typically 8 ms, configurable from 0.1 to 32 ms                                                                 |                     |
| Input signal voltage                                                                                                                                               | 24 V DC                                                                                                        |                     |
| <ul style="list-style-type: none"><li>• Signal 0</li><li>• Undefined signal</li><li>• Signal 1</li></ul>                                                           | <ul style="list-style-type: none"><li>• -3 V...+5 VP*</li><li>• +5 V...+15 V</li><li>• +15 V...+30 V</li></ul> |                     |
| Ripple with signal 0                                                                                                                                               | Within -3 V...+5 V*                                                                                            |                     |
| Ripple with signal 1                                                                                                                                               | Within +15 V...+30 V                                                                                           |                     |
| Input current per channel                                                                                                                                          | Input voltage +24 V                                                                                            | typically 5 mA      |
|                                                                                                                                                                    | Input voltage +5 V                                                                                             | > 1 mA              |
|                                                                                                                                                                    | Input voltage +15 V                                                                                            | > 5 mA              |
|                                                                                                                                                                    | Input voltage +30 V                                                                                            | < 8 mA              |
| Max. cable length                                                                                                                                                  | Shielded                                                                                                       | 1000 m (3280.83 ft) |
|                                                                                                                                                                    | Unshielded                                                                                                     | 600 m (1968.50 ft)  |

\* Due to the direct connection to the output, the demagnetizing varistor is also effective at the input. This is why the difference between UPx and the input signal may not exceed the clamp voltage of the varistor. The varistor limits the voltage to approx. 36 V. Following this, the input voltage must range from -12 V to +30 V when UPx = 24 V and from -6 V to +30 V when UPx = 30 V.

| Technical data digital inputs/outputs if used as outputs |                                                                                                |                          |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------|--------------------------|
| Number of channels per module                            | Max. 24 digital outputs                                                                        |                          |
| Reference potential for all outputs                      | Terminals 1.9...4.9 (minus pole of the process supply voltage, signal name ZP)                 |                          |
| Common power supply voltage                              | For all outputs: terminals 1.8...4.8 (plus pole of the process supply voltage, signal name UP) |                          |
| Output voltage for signal 1                              | UP (-0.8 V)                                                                                    |                          |
| Output current                                           | Rated value, per channel                                                                       | 500 mA at UP = 24 V      |
|                                                          | Maximum value (all channels)                                                                   | 8 A                      |
|                                                          | Leakage current with signal 0                                                                  | < 0.5 mA                 |
|                                                          | Rated protection fuse on UP                                                                    | 10 A fast                |
| Demagnetization when inductive loads are switched off    | Via varistors integrated in the module                                                         |                          |
| Switching frequency                                      | With inductive loads                                                                           | Max. 0.5 Hz              |
|                                                          | With lamp loads                                                                                | Max. 11 Hz with max. 5 W |
| Short-circuit proofed /overload proofed                  | Yes                                                                                            |                          |
| Overload message ( $I > 0,7 \text{ A}$ )                 | Yes, after approx. 100 ms                                                                      |                          |
| Output current limitation                                | Yes, automatic reactivation after short-circuit /overload                                      |                          |
| Resistance to feedback against 24 V signals              | Yes                                                                                            |                          |
| Max. cable length                                        | Shielded                                                                                       | 1000 m (3280.83 ft)      |
|                                                          | Unshielded                                                                                     | 600 m (1968.50 ft)       |

### 5.2.3.2. Digital input/output module DC 732F

| Name    | Short description                                                                                                                                                                                                                                  | Article no.     |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| DC 732F | Digital Input / Output Module<br><br>16 DI, 16 DI/DO, 24 VDC / 0.5 A, 1-Wire, 24 VDC 200 W.<br>Without terminal unit.<br><br><ul style="list-style-type: none"> <li>• PROFIBUS remote I/O</li> <li>• Direct I/O for AC 700F and AC 900F</li> </ul> | 3BDH000375R0001 |



The DC 732F module offers 32 channels. 16 channels are assigned as digital inputs, while the remaining 16 channels can be configured as input or as output.

#### Technical data

| Functionality DC 732F                   |                                                                                           |
|-----------------------------------------|-------------------------------------------------------------------------------------------|
| Digital inputs                          | 16 (24 VDC)                                                                               |
| Digital inputs / outputs (configurable) | 16 (24 VDC)                                                                               |
| LED displays                            | For signal statuses, errors and supply voltage                                            |
| External power supply                   | Via the terminals ZP and UP (process voltage 24 VDC) of the modules terminal unit TU 715F |

| Technical data DC 732F                                       |                                                                                                            |
|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Process supply voltage UP                                    |                                                                                                            |
| Connections                                                  | Terminals 1.8 - 4.8 for +24 V (UP) and 1.9 - 4.9 for 0 V (ZP)                                              |
| Rated value                                                  | 24 VDC                                                                                                     |
| Max. ripple                                                  | 5%                                                                                                         |
| Protection against reversed voltage                          | Yes                                                                                                        |
| Rated protection fuse on UP                                  | 10 A fast                                                                                                  |
| Electrical isolation                                         | Yes, per module                                                                                            |
| Current consumption                                          |                                                                                                            |
| Internal (via I/O-Bus)                                       | ca. 5 mA at 3.3 VDC                                                                                        |
| Current consumption from UP at normal operation/with outputs | 50 mA + max. 8 mA per input + max. 0.5 A per output                                                        |
| Inrush current from UP (at power up)                         | 0.007 A <sup>2</sup> s                                                                                     |
| Max. power dissipation within the module                     | 6 W (outputs unloaded)                                                                                     |
| Sensor power supply                                          |                                                                                                            |
| Dimensions (without Terminal Unit)                           | 67.5 x 76 x 54 mm / 2.66 x 2.99 x 2.13 inch (width x height x depth)                                       |
| Weight (without Terminal Unit)                               | Approx. 125 g / 4.41 Oz.                                                                                   |
| Cooling                                                      | The natural convection cooling must not be hindered by cable ducts or other parts in the mounting cabinet. |

| Technical data of the digital inputs DC 732F                                                                                                                   |                                                                                                                         |                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------|
| Number of channels per module                                                                                                                                  | 16                                                                                                                      |                   |
| Distribution of the channels into groups                                                                                                                       | 1 group of 16 channels                                                                                                  |                   |
| Terminals of the channels I0 to I7                                                                                                                             | 1.0 to 1.7                                                                                                              |                   |
| Terminals of the channels I8 to I15                                                                                                                            | 2.0 to 2.7                                                                                                              |                   |
| Reference potential for all inputs                                                                                                                             | Terminals 1.9...4.9 (minus pole of the process supply voltage, signal name ZP)                                          |                   |
| Electrical isolation                                                                                                                                           | From the rest of the module (I/O-Bus)                                                                                   |                   |
| Indication of the input signals                                                                                                                                | One yellow LED per channel, the LED is ON when the input signal is high (signal 1)                                      |                   |
| Input type acc. to EN 61131-2                                                                                                                                  | Type 1                                                                                                                  |                   |
| Input delay (0->1 or 1->0)                                                                                                                                     | Typ. 8 ms, configurable from 0.1 to 32 ms                                                                               |                   |
| Input signal voltage                                                                                                                                           | 24 VDC                                                                                                                  |                   |
| <ul style="list-style-type: none"><li>• Signal 0</li><li>• Undefined signal</li><li>• Signal 1</li></ul>                                                       | <ul style="list-style-type: none"><li>• -3 V...+5 V</li><li>• &gt; +5 V...&lt; +15 V</li><li>• +15 V...+30 V</li></ul>  |                   |
| Ripple with signal 0                                                                                                                                           | Within -3 V...+5 V                                                                                                      |                   |
| Ripple with signal 1                                                                                                                                           | Within +15 V...+30 V                                                                                                    |                   |
| Input current per channel                                                                                                                                      |                                                                                                                         |                   |
| <ul style="list-style-type: none"><li>• Input voltage +24 V</li><li>• Input voltage +5 V</li><li>• Input voltage +15 V</li><li>• Input voltage +30 V</li></ul> | <ul style="list-style-type: none"><li>• Typ. 5 mA</li><li>• &gt; 1 mA</li><li>• &gt; 5 mA</li><li>• &lt; 8 mA</li></ul> |                   |
| Max. cable length                                                                                                                                              | Shielded                                                                                                                | 1000 m / 3280 ft. |
|                                                                                                                                                                | Unshielded                                                                                                              | 600 m / 1968 ft.  |

| Technical data of the configurable digital inputs / outputs DC 732F                              |                                                                                                    |
|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Each of the configurable I/O channels can be wired as input or output by the user.               |                                                                                                    |
| Number of channels per module                                                                    | 16 inputs / outputs (with transistors)                                                             |
| Distribution of the channels into groups                                                         | 1 group of 16 channels                                                                             |
| If the channels are used as inputs                                                               |                                                                                                    |
| <ul style="list-style-type: none"> <li>Channels I16...I23</li> <li>Channels I24...I31</li> </ul> | <ul style="list-style-type: none"> <li>Terminals 3.0...3.7</li> <li>Terminals 4.0...4.7</li> </ul> |
| If the channels are used as outputs                                                              |                                                                                                    |
| <ul style="list-style-type: none"> <li>Channels O16...O23</li> <li>Channels O24...O31</li> </ul> | <ul style="list-style-type: none"> <li>Terminals 3.0...3.7</li> <li>Terminals 4.0...4.7</li> </ul> |
| Indication of the input / output signals                                                         | One yellow LED per channel, the LED is ON when the input / output signal is high (signal 1)        |
| Electrical isolation                                                                             | From the rest of the module                                                                        |

| Technical data of the digital inputs / outputs if used as outputs DC 732F |                                                                                                                                                                                                       |                   |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Number of channels per module                                             | Max. 16 transistor outputs                                                                                                                                                                            |                   |
| Reference potential for all outputs                                       | Terminals 1.9...4.9 (minus pole of the process supply voltage, signal name ZP)                                                                                                                        |                   |
| Common power supply voltage                                               | For all outputs: terminals 1.8...4.8 (plus pole of the process supply voltage, signal name UP)                                                                                                        |                   |
| Output voltage for signal 1                                               | UP -0.8 V                                                                                                                                                                                             |                   |
| Output current                                                            | <ul style="list-style-type: none"> <li>Rated value, per channel</li> <li>Maximum value (all channels together)</li> <li>Leakage current with signal 0</li> <li>Rated protection fuse on UP</li> </ul> |                   |
|                                                                           | <ul style="list-style-type: none"> <li>500 mA at UP = 24 V</li> <li>8 A</li> <li>&lt; 0.5 mA</li> <li>10 A fast</li> </ul>                                                                            |                   |
| De-magnetization when inductive loads are switched off                    | With varistors integrated in the module                                                                                                                                                               |                   |
| Short-circuit proof / overload proof                                      | Yes                                                                                                                                                                                                   |                   |
| Overload message (I > 0.7 A)                                              | Yes, after ca. 100 ms                                                                                                                                                                                 |                   |
| Output current limitation                                                 | Yes, automatic reactivation after short-circuit / overload                                                                                                                                            |                   |
| Resistance to feedback against 24 V signals                               | Yes                                                                                                                                                                                                   |                   |
| Max. cable length                                                         | Shielded                                                                                                                                                                                              | 1000 m / 3280 ft. |
|                                                                           | Unshielded                                                                                                                                                                                            | 600 m / 1968 ft.  |

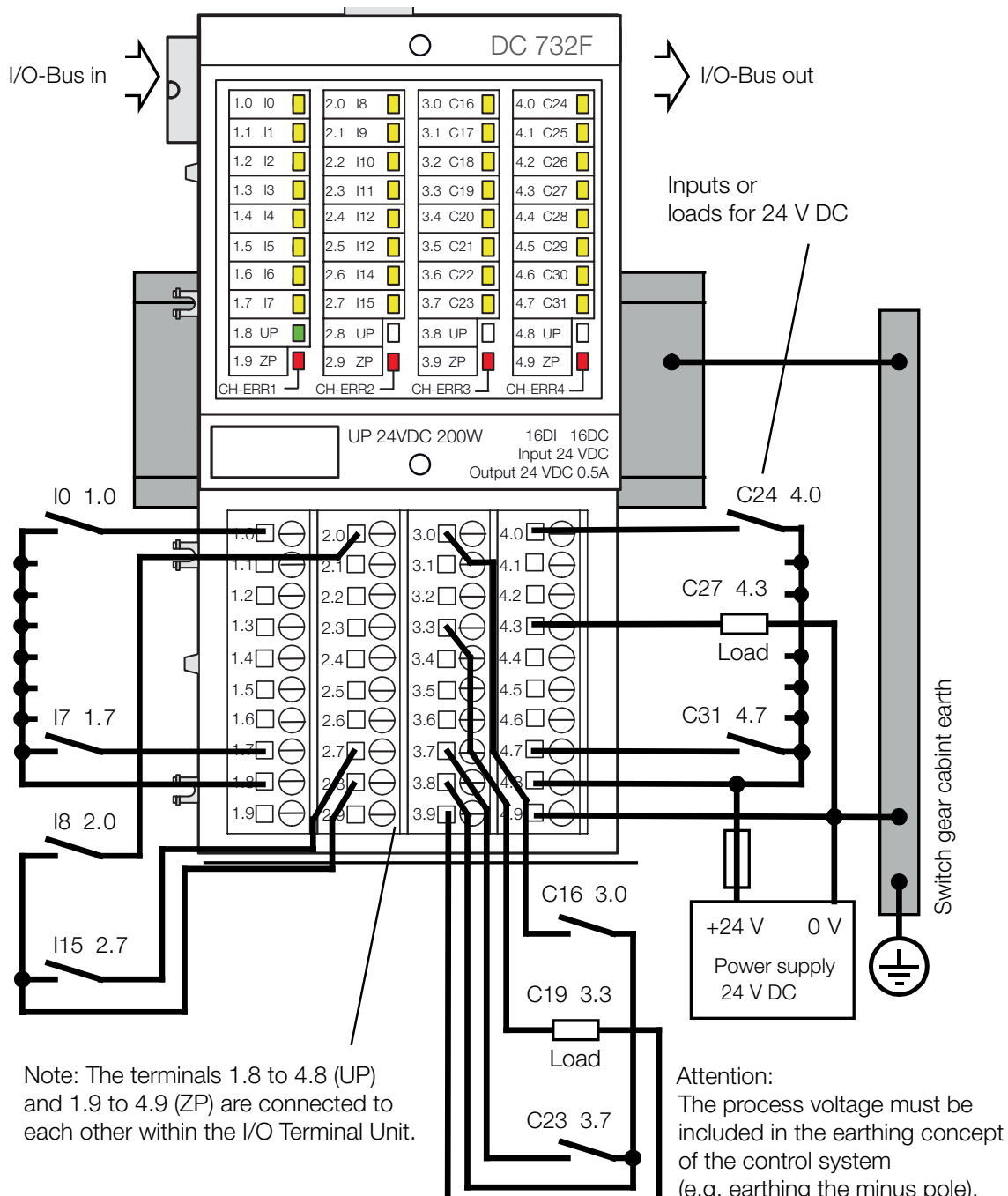
| Technical data of the digital inputs / outputs if used as inputs DC 732F                               |                                                                                                                        |                   |
|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-------------------|
| Number of channels per module                                                                          | Max. 16 digital inputs                                                                                                 |                   |
| Reference potential for all inputs                                                                     | Terminals 1.9...4.9 (minus pole of the process supply voltage, signal name ZP)                                         |                   |
| Input type acc. to EN 61131-2                                                                          | Type 1                                                                                                                 |                   |
| Input delay (0->1 or 1->0)                                                                             | Typ. 8 ms, configurable from 0.1 to 32 ms                                                                              |                   |
| Input signal voltage                                                                                   | 24 VDC                                                                                                                 |                   |
| <ul style="list-style-type: none"> <li>Signal 0</li> <li>Undefined signal</li> <li>Signal 1</li> </ul> | <ul style="list-style-type: none"> <li>-3 V...+5 V *</li> <li>&gt; +5 V...&lt; +15 V</li> <li>+15 V...+30 V</li> </ul> |                   |
| Ripple with signal 0                                                                                   | within -3 V...+5 V *                                                                                                   |                   |
| Ripple with signal 1                                                                                   | within +15 V...+30 V                                                                                                   |                   |
| Max. cable length                                                                                      | Shielded                                                                                                               | 1000 m / 3280 ft. |
|                                                                                                        | Unshielded                                                                                                             | 600 m / 1968 ft.  |

\* Due to the direct connection to the output, the demagnetizing varistor is also effective at the input. This is why the difference between UPx and the input signal may not exceed the clamp voltage of the varistor. The varistor limits the voltage to approx. 36 V. Following this, the input voltage must range from - 12 V to + 30 V when UPx = 24 V and from - 6 V to + 30 V when UPx = 30 V.

The configurable channels are defined by the wiring. As you can see from "Wiring of DC 732F", some of the first 16 input channels show the corresponding wiring. For the next 16 configurable channels you see some examples for inputs (channel 16, 23, 24, and 31) and some examples

for outputs (channel 19 and 27). Note that the power has to be supplied depending on the planned power consumption as indicated. The I/O bus supplies the power for the modules electronics only.

Wiring of DC 732F



### 5.2.3.3. Digital input module DI 724F

| Name    | Short description                                                                                                                                                                        | Article no.     |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| DI 724F | Digital input module<br><br>32 DI: 24 VDC<br>1-wire, 24 VDC 1 W<br>TU 715F /TU 716F<br>(terminal unit not included)<br><br>• PROFIBUS remote I/O<br>• Direct I/O for AC 700F and AC 900F | 3BDH000374R0001 |



It has 32 channels with the following features:

- 32 digital inputs 24V DC in four groups (1.0...4.7)

The technical data correspond to the input values. The inputs are electrically isolated from the other electronic circuitry of the module. There is no potential separation between the channels.

#### Technical data

| Functionality DI 724F |                                                                                                                            |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------|
| Digital Inputs        | 32 digital inputs                                                                                                          |
| Supply voltage        | 24 V DC                                                                                                                    |
| High-speed counter    | Integrated, many configurable operating mode                                                                               |
| Power supply          | Internal: through the expansion bus interface (I/O-Bus)<br>External: via the terminals ZP and UP (process voltage 24 V DC) |
| Potential separation  | Module-wise                                                                                                                |
| LEDs                  | For indicating signal statuses, errors and supply voltage                                                                  |

| Technical data DI 724F                                                          |                                                                                                            |
|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Process supply voltage UP                                                       |                                                                                                            |
| Connections                                                                     | Terminals 1.8 – 4.8 for +24 V (UP) and 1.9 – 4.9 for 0 V (ZP)                                              |
| Rated value                                                                     | 24 V DC                                                                                                    |
| Max. ripple                                                                     | 5 %                                                                                                        |
| Protection against reversed voltage                                             | Yes                                                                                                        |
| Rated protection fuse on UP                                                     | 10 A fast                                                                                                  |
| Electrical isolation                                                            | Yes, per module                                                                                            |
| Current consumption                                                             |                                                                                                            |
| From 24 V DC power supply at the terminals UP/L+ and ZP/M of the CPU/Bus Module | Approx. 1 mA                                                                                               |
| Current consumption via UP in case of normal operation                          | 50 mA + max. 8 mA per input                                                                                |
| Inrush current from UP (at power-up)                                            | 0.008 A²s                                                                                                  |
| Sensor power supply                                                             |                                                                                                            |
| Dimensions (Width x height x depth)                                             | 67.5 x 76 x 54 mm / 2.66 x 2.99 x 2.13 inch                                                                |
| Weight (without Terminal Unit)                                                  | Approx. 105 g / 3.7 oz.                                                                                    |
| Mounting position                                                               | Horizontal or vertical with limitations (output load per group is 50 % at 40°C (104°F))                    |
| Cooling                                                                         | The natural convection cooling must not be hindered by cable ducts or other parts in the mounting cabinet. |



| Technical data digital inputs                                                                          |                                                                                                                                                             |                     |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Number of channels per module                                                                          | 32                                                                                                                                                          |                     |
| Distribution of the channels into groups                                                               | 1 group of 32 channels                                                                                                                                      |                     |
| Connections to the channels I0 to I7                                                                   | Terminals 1.0 to 1.7                                                                                                                                        |                     |
| Connections to the channels I8 to I15                                                                  | Terminals 2.0 to 2.7                                                                                                                                        |                     |
| Connections to the channels I16 to I23                                                                 | Terminals 3.0 to 3.7                                                                                                                                        |                     |
| Connections to the channels I24 to I31                                                                 | Terminals 4.0 to 4.7                                                                                                                                        |                     |
| Reference potential for all inputs                                                                     | Terminal 1.9...4.9 (minus pole of the process supply voltage, signal name ZP)                                                                               |                     |
| Electrical isolation                                                                                   | From the rest of the module                                                                                                                                 |                     |
| Indication of the input signals                                                                        | One yellow LED per channel, the LED is ON when the input signal is high (signal 1)                                                                          |                     |
| Input type acc. to EN 61131-2                                                                          | Type 1                                                                                                                                                      |                     |
| Input delay (0->1 or 1->0)                                                                             | Typically 8 ms, configurable from 0.1 to 32 ms                                                                                                              |                     |
| Input signal voltage                                                                                   | 24 V DC                                                                                                                                                     |                     |
| <ul style="list-style-type: none"> <li>Signal 0</li> <li>Undefined signal</li> <li>Signal 1</li> </ul> | <ul style="list-style-type: none"> <li>-3 V...+5 V</li> <li>&gt; +5 V...&lt; +15 V</li> <li>+15 V...+30 V</li> </ul>                                        |                     |
| Ripple with signal 0                                                                                   | Within -3 V...+5 V                                                                                                                                          |                     |
| Ripple with signal 1                                                                                   | Within +15 V...+30 V                                                                                                                                        |                     |
| Input current per channel                                                                              | <ul style="list-style-type: none"> <li>Input voltage +24 V</li> <li>Input voltage +5 V</li> <li>Input voltage +15 V</li> <li>Input voltage +30 V</li> </ul> |                     |
|                                                                                                        | <ul style="list-style-type: none"> <li>typically 5 mA</li> <li>&gt; 1 mA</li> <li>&gt; 5 mA</li> <li>&lt; 8 mA</li> </ul>                                   |                     |
| Max. cable length                                                                                      | Shielded                                                                                                                                                    | 1000 m (3280.83 ft) |
|                                                                                                        | Unshielded                                                                                                                                                  | 600 m (1968.50 ft)  |

### 5.2.3.4. Digital input / output module DX 722F

| Name    | Short description                                                                                                                                                                                                                                                                        | Article no.     |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| DX 722F | Digital input / output module<br>8 DI: 24 VDC<br>8 DO: relay contacts, 24 VDC, 230 VAC<br>1/3-wire, 24 VDC 2 W<br>TU 731F /TU 732F (terminal unit not included)<br><br><ul style="list-style-type: none"> <li>PROFIBUS remote I/O</li> <li>Direct I/O for AC 700F and AC 900F</li> </ul> | 3BDH000383R0001 |



It has 16 channels with the following features:

- 8 digital inputs 24 V DC in one group (1.0...1.7)
- as well as 8 relay outputs (2.0...2.7), with one switch-over contact each

The technical data correspond to the input and output values. The inputs and outputs are electrically isolated from the other electronic circuitry of the module. There is no potential separation between the input channels.

## Technical data

| Functionality DX 722F        |                                                                                                                            |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Inputs/outputs               | 8 digital inputs<br>8 relay outputs with one switch-over contact each                                                      |
| Relay contact supply voltage | 24 V DC                                                                                                                    |
| Power supply                 | Internal: through the expansion bus interface (I/O Bus)<br>External: via the terminals ZP and UP (process voltage 24 V DC) |
| Potential separation         | Module-wise                                                                                                                |
| LEDs                         | For indicating signal statuses, errors and supply voltage                                                                  |

| Technical data DX 722F                                 |                                                                                                            |
|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Process supply voltage UP                              |                                                                                                            |
| Connections                                            | Terminals 1.8 – 4.8 for +24 V (UP) and 1.9 – 4.9 for 0 V (ZP)                                              |
| Rated value                                            | 24 V DC                                                                                                    |
| Max. ripple                                            | 5 %                                                                                                        |
| Protection against reversed voltage                    | Yes                                                                                                        |
| Rated protection fuse on UP                            | 10 A fast                                                                                                  |
| Electrical isolation                                   | Yes, per module                                                                                            |
| Current consumption                                    |                                                                                                            |
| Internal (via I/O-Bus)                                 | Approx. 1 mA at 24 V DCs                                                                                   |
| Current consumption via UP in case of normal operation | 0.05 A + output loads)                                                                                     |
| Inrush current from UP (at power-up)                   | 0.010 A <sup>2</sup> s                                                                                     |
| Max. power dissipation within the module               | 6 W (outputs not loaded)                                                                                   |
| Sensor power supply                                    |                                                                                                            |
| Dimensions (width x height x depth)                    | 67.5 x 76 x 54 mm / 2.66 x 2.99 x 2.13 inch                                                                |
| Weight (without terminal unit)                         | Approx. 300 g/10.58 oz.                                                                                    |
| Mounting position                                      | Horizontal or vertical with limitations<br>(output load per group 50 % at 40°C (104°F))                    |
| Cooling                                                | The natural convection cooling must not be hindered by cable ducts or other parts in the mounting cabinet. |

| Technical data digital inputs DX 722F                                                                    |                                                                                                                              |                     |
|----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Number of channels per module                                                                            | 8                                                                                                                            |                     |
| Distribution of the channels into groups                                                                 | 1 group of 8 channels                                                                                                        |                     |
| Connections to the channels I0 to I7                                                                     | Terminals 1.0 to 1.7                                                                                                         |                     |
| Reference potential for all inputs                                                                       | Terminal 1.9...4.9 (minus pole of the process supply voltage, signal name ZP)                                                |                     |
| Electrical isolation                                                                                     | From the rest of the module                                                                                                  |                     |
| Indication of the input signals                                                                          | One yellow LED per channel, the LED is ON when the input signal is high (signal 1)                                           |                     |
| Input type according to EN 61131-2                                                                       | Type 1                                                                                                                       |                     |
| Input delay (0->1 or 1->0)                                                                               | Typically 8 ms                                                                                                               |                     |
| Input signal voltage                                                                                     | 24 V DC                                                                                                                      |                     |
| <ul style="list-style-type: none"><li>• Signal 0</li><li>• Undefined signal</li><li>• Signal 1</li></ul> | <ul style="list-style-type: none"><li>• -3 V...+5 V</li><li>• +5 V... +15 V</li><li>• +15 V...+30 V</li></ul>                |                     |
| Ripple with signal 0                                                                                     | Within -3 V...+5 V                                                                                                           |                     |
| Ripple with signal 1                                                                                     | Within +15 V...+30 V                                                                                                         |                     |
| Input current per channel                                                                                | <ul style="list-style-type: none"><li>• Typically 5 mA</li><li>• &gt; 1 mA</li><li>• &gt; 5 mA</li><li>• &lt; 8 mA</li></ul> |                     |
| Maximal cable length                                                                                     | Shielded                                                                                                                     | 1000 m (3280.83 ft) |
|                                                                                                          | Unshielded                                                                                                                   | 600 m (1968.50 ft)  |

| Technical data relay outputs DX 722F                                                                                                                                                                |                                                                                                                                                                                                                                                                     |                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Number of channels per module                                                                                                                                                                       | 8 relay outputs                                                                                                                                                                                                                                                     |                     |
| Distribution of the channels into groups                                                                                                                                                            | 8 groups of 1 channel each                                                                                                                                                                                                                                          |                     |
| <ul style="list-style-type: none"><li>• Connection of the channel R0</li><li>• Connection of the channel R1</li><li>• Connection of the channel R6</li><li>• Connection of the channel R7</li></ul> | <ul style="list-style-type: none"><li>• Terminal 2.0 (common), 3.0 (NO) and 4.0 (NC)</li><li>• Terminal 2.1 (common), 3.1 (NO) and 4.1 (NC)</li><li>• Terminal 2.6 (common), 3.6 (NO) and 4.6 (NC)</li><li>• Terminal 2.7 (common), 3.7 (NO) and 4.7 (NC)</li></ul> |                     |
| Electrical isolation                                                                                                                                                                                | Between the channels and from the rest of the module                                                                                                                                                                                                                |                     |
| Indication of the output signals                                                                                                                                                                    | One yellow LED per channel, the LED is ON when the relay coil is energized                                                                                                                                                                                          |                     |
| Relay power supply                                                                                                                                                                                  | By UP process voltage                                                                                                                                                                                                                                               |                     |
| Relay outputs                                                                                                                                                                                       |                                                                                                                                                                                                                                                                     |                     |
| Output short-circuit protection                                                                                                                                                                     | Should be provided externally with a fuse or circuit breaker                                                                                                                                                                                                        |                     |
| Rated protection fuse                                                                                                                                                                               | 6A gL/gG per channel                                                                                                                                                                                                                                                |                     |
| Output switching capacity                                                                                                                                                                           |                                                                                                                                                                                                                                                                     |                     |
| <ul style="list-style-type: none"><li>• Resistive load max.</li><li>• Inductive load max.</li><li>• Lamp load</li></ul>                                                                             | <ul style="list-style-type: none"><li>• 3 A; 3A (120/230V AC), 2A (24 V DC)</li><li>• 1.5 A; 1.5A (120/230V AC), 1.5 A (24 V DC)</li><li>• 60 W (230V AC), 10 W (24 V DC)</li></ul>                                                                                 |                     |
| Life times (cycles)                                                                                                                                                                                 | Mechanical: 300 000;<br>under load: 300 000 (24 V DC at 2 A), 200 000 (120 V AC at 2 A), 100 000 (230 V AC at 3 A)                                                                                                                                                  |                     |
| Spark suppression with inductive AC load                                                                                                                                                            | Must be performed externally according to driven load specifications                                                                                                                                                                                                |                     |
| Demagnetization with inductive DC load                                                                                                                                                              | A free-wheeling diode must be circuited in parallel to the inductive load                                                                                                                                                                                           |                     |
| Switching frequency                                                                                                                                                                                 |                                                                                                                                                                                                                                                                     |                     |
| <ul style="list-style-type: none"><li>• With resistive load</li><li>• With inductive load</li></ul>                                                                                                 | <ul style="list-style-type: none"><li>• Max. 10 Hz</li><li>• Max. 2 Hz</li></ul>                                                                                                                                                                                    |                     |
| Maximal cable length                                                                                                                                                                                | Shielded                                                                                                                                                                                                                                                            | 1000 m (3280.83 ft) |
|                                                                                                                                                                                                     | Unshielded                                                                                                                                                                                                                                                          | 600 m (1968.50 ft)  |

### 5.2.3.5. Digital input/output module DX 731F

| Name    | Short description                                                                                                                                                                                                                                                                                       | Article no.     |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| DX 731F | Digital input / output module<br>8 DI: 120/230 VAC<br>4 DO: relay contacts, 24 VDC,<br>120/230 VAC<br>2-wire, 24 VDC 2 W<br>TU 731F / TU 732F (terminal unit not included)<br><br><ul style="list-style-type: none"> <li>• PROFIBUS remote I/O</li> <li>• Direct I/O for AC 700F and AC 900F</li> </ul> | 3BDH000387R0001 |



It has 12 channels with the following features:

- 8 digital inputs in two groups (2.0...3.3)
- as well as 4 relay outputs (2.4...2.7), with one switch-over contact each

The technical data correspond to the input and output values. The inputs and outputs are electrically isolated from the other electronic circuitry of the module.

## Technical data

| <b>Functionality DX 731F</b> |                                                                                                                            |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Inputs/outputs               | 8 digital inputs<br>4 relay outputs with one switch-over contact each                                                      |
| Supply voltage               | 230 V AC                                                                                                                   |
| Power supply                 | Internal: through the expansion bus interface (I/O Bus)<br>External: via the terminals ZP and UP (process voltage 24 V DC) |
| Potential separation         | Module-wise                                                                                                                |
| LEDs                         | For indicating signal statuses, errors and supply voltage                                                                  |

| <b>Technical data DX 731F</b>                          |                                                                                                            |
|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| <b>Process supply voltage UP</b>                       |                                                                                                            |
| Connections                                            | Terminals 1.8 – 4.8 for +24 V (UP) and 1.9 – 4.9 for 0 V (ZP)                                              |
| Rated value                                            | 24 V DC                                                                                                    |
| Max. ripple                                            | 5 %                                                                                                        |
| Protection against reversed voltage                    | Yes                                                                                                        |
| Rated protection fuse on UP                            | 10 A fast                                                                                                  |
| Electrical isolation                                   | Yes, per module                                                                                            |
| <b>Current consumption</b>                             |                                                                                                            |
| Internal (via I/O-Bus)                                 | Approx. 1 mA                                                                                               |
| Current consumption via UP in case of normal operation | 0.05 A + output loads)                                                                                     |
| Inrush current from UP (at power-up)                   | 0.004 A <sup>2</sup> s                                                                                     |
| Max. power dissipation within the module               | 6 W (outputs not loaded)                                                                                   |
| <b>Sensor power supply</b>                             |                                                                                                            |
| Dimensions (width x height x depth)                    | 67.5 x 76 x 54 mm / 2.66 x 2.99 x 2.13 inch                                                                |
| Weight (without terminal unit)                         | Approx. 300 g/10.58 oz.                                                                                    |
| Mounting position                                      | Horizontal or vertical with limitations<br>(output load per group 50 % at 40°C (104°F))                    |
| Cooling                                                | The natural convection cooling must not be hindered by cable ducts or other parts in the mounting cabinet. |

| Technical data digital inputs DX 731F                                                                    |                                                                                                                                 |                     |
|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Number of channels per module                                                                            | 8                                                                                                                               |                     |
| Distribution of the channels into groups                                                                 | 4 group of 2 channels                                                                                                           |                     |
| Terminals of the channels I0 to I7                                                                       | Terminals 2.0 to 2.3, 3.0 to 3.3, 4.0 to 4.3                                                                                    |                     |
| Electrical isolation                                                                                     | From the rest of the module                                                                                                     |                     |
| Indication of the input signals                                                                          | One yellow LED per channel, the LED is ON when the input signal is high (signal 1)                                              |                     |
| Input type acc. to EN 61131-2                                                                            | Type 2                                                                                                                          |                     |
| Input delay (0->1 or 1->0)                                                                               | Typically 20 ms                                                                                                                 |                     |
| Input signal voltage                                                                                     | 230 V AC or 120V AC                                                                                                             |                     |
| <ul style="list-style-type: none"><li>• Signal 0</li><li>• Undefined signal</li><li>• Signal 1</li></ul> | <ul style="list-style-type: none"><li>• 0 V...40 V AC</li><li>• &gt; 40 V AC...&lt; 74 V AC</li><li>• 74 V...265 V AC</li></ul> |                     |
| Input current per channel                                                                                |                                                                                                                                 |                     |
| <ul style="list-style-type: none"><li>• Input voltage 159 V AC</li><li>• Input voltage 40 V AC</li></ul> | <ul style="list-style-type: none"><li>• &gt; 7 mA</li><li>• &lt; 5 mA</li></ul>                                                 |                     |
| Max. cable length                                                                                        | Shielded                                                                                                                        | 1000 m (3280.83 ft) |
|                                                                                                          | Unshielded                                                                                                                      | 600 m (1968.50 ft)  |

| Technical data relay outputs DX 731F                                                                                                                                                                     |                                                                                                                                                                                                                                                                          |                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Number of channels per module                                                                                                                                                                            | 4 relay outputs                                                                                                                                                                                                                                                          |                     |
| Distribution of the channels into groups                                                                                                                                                                 | 4 groups of 1 channel each                                                                                                                                                                                                                                               |                     |
| <ul style="list-style-type: none"> <li>• Connection of the channel R0</li> <li>• Connection of the channel R1</li> <li>• Connection of the channel R2</li> <li>• Connection of the channel R3</li> </ul> | <ul style="list-style-type: none"> <li>• Terminal 2.4 (common), 3.4 (NO) and 4.4 (NC)</li> <li>• Terminal 2.5 (common), 3.5 (NO) and 4.5 (NC)</li> <li>• Terminal 2.6 (common), 3.6 (NO) and 4.6 (NC)</li> <li>• Terminal 2.7 (common), 3.7 (NO) and 4.7 (NC)</li> </ul> |                     |
| Electrical isolation                                                                                                                                                                                     | Between the channels and from the rest of the module                                                                                                                                                                                                                     |                     |
| Indication of the output signals                                                                                                                                                                         | One yellow LED per channel, the LED is ON when the relay coil is energized                                                                                                                                                                                               |                     |
| Relay power supply                                                                                                                                                                                       | By UP process voltage                                                                                                                                                                                                                                                    |                     |
| Relay outputs                                                                                                                                                                                            |                                                                                                                                                                                                                                                                          |                     |
| <ul style="list-style-type: none"> <li>• output short-circuit protection</li> </ul>                                                                                                                      | <ul style="list-style-type: none"> <li>• Should be provided externally with a fuse or circuit breaker</li> </ul>                                                                                                                                                         |                     |
| Rated protection fuse                                                                                                                                                                                    | 6A gL/gG per channel                                                                                                                                                                                                                                                     |                     |
| Output switching capacity                                                                                                                                                                                |                                                                                                                                                                                                                                                                          |                     |
| <ul style="list-style-type: none"> <li>• resistive load max.</li> <li>• inductive load max.</li> <li>• lamp load</li> </ul>                                                                              | <ul style="list-style-type: none"> <li>• 3 A; 3A (230V AC), 2A (24 V DC)</li> <li>• 1.5 A; 1.5A (230V AC), 1.5 A (24 V DC)</li> <li>• 60 W (230V AC), 10 W (24 V DC)</li> </ul>                                                                                          |                     |
| Life times (cycles)                                                                                                                                                                                      | Mechanical: 300 000;<br>Under load: 300 000 (24 V DC at 2 A), 200 000 (120 V AC at 2 A), 100 000 (230 V AC at 3 A)                                                                                                                                                       |                     |
| Spark suppression with inductive AC load                                                                                                                                                                 | Must be performed externally according to driven load specifications                                                                                                                                                                                                     |                     |
| Demagnetization with inductive DC load                                                                                                                                                                   | A free-wheeling diode must be circuited in parallel to the inductive load                                                                                                                                                                                                |                     |
| Switching frequency                                                                                                                                                                                      |                                                                                                                                                                                                                                                                          |                     |
| <ul style="list-style-type: none"> <li>• with resistive load</li> <li>• with inductive load</li> </ul>                                                                                                   | <ul style="list-style-type: none"> <li>• max. 10 Hz</li> <li>• max. 2 Hz</li> </ul>                                                                                                                                                                                      |                     |
| Max. cable length                                                                                                                                                                                        | Shielded                                                                                                                                                                                                                                                                 | 1000 m (3280.83 ft) |
|                                                                                                                                                                                                          | Unshielded                                                                                                                                                                                                                                                               | 600 m (1968.50 ft)  |

5.2.4 Analog I/O Modules

5.2.4.1. Analog input module AI 723F

| Name    | Short description                                                                                                                                                                                                                                   | Article no.     |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| AI 723F | Analog input module<br>16 AI: +10 V, 0/4-20 mA 24 VDC, Pt100 12 bit + Sign, 2-wire, 24 VDC 5 W.<br>Without terminal unit.<br><br><ul style="list-style-type: none"><li>• PROFIBUS remote I/O</li><li>• Direct I/O for AC 700F and AC 900F</li></ul> | 3BDH000376R0001 |



The AI 723F module comes with 16 input channels. Each of these channels can be individually configured depending on its intended usage.

- Possible applications are:**
- Sensing a voltage (0...10 V or -10...+10 V)
  - Sensing a current (0...20 mA or 4...20 mA)
  - Temperature measurement (platinum or nickel resistance thermometers Pt100, Pt1000, Ni1000)
  - For 3-wired connections two channels are required

Technical data

| Functionality AI 723F           |                                                                                    |
|---------------------------------|------------------------------------------------------------------------------------|
| Inputs                          | 16 analog inputs, individually configurable for Unused (default setting)           |
|                                 | 0...10 V                                                                           |
|                                 | -10 V...+10 V                                                                      |
|                                 | 0...20 mA                                                                          |
|                                 | 4...20 mA                                                                          |
|                                 | Pt100, -50 °C (-58 °F)...+400 °C (+752 °F), 2-wire or 3-wire, requires 2 channels  |
|                                 | Pt100, -50 °C (-58 °F)...+70 °C (+158 °F), 2-wire or 3-wire, requires 2 channels   |
|                                 | Ni1000, -50 °C (-58 °F)...+150 °C (+302 °F), 2-wire or 3-wire, requires 2 channels |
|                                 | 0...10 V with differential inputs, requires 2 channels                             |
|                                 | -10 V...+10 V with differential inputs, requires 2 channels                        |
| Digital signals (digital input) |                                                                                    |

| Technical data AI 723F                                                                                                           |                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| LED displays                                                                                                                     | 19 LEDs for signals and error indication                                                                   |
| Internal power supply                                                                                                            | Through the expansion bus interface (I/O-Bus)                                                              |
| External power supply                                                                                                            | Via the terminals ZP and UP (process voltage 24 VDC) of TU 715F                                            |
| <b>Process voltage</b>                                                                                                           |                                                                                                            |
| Connections                                                                                                                      | Terminals 1.8 - 4.8 for +24 V (UP) and 1.9 - 4.9 for 0 V (ZP)                                              |
| Rated value                                                                                                                      | 24 VDC                                                                                                     |
| Max. ripple                                                                                                                      | 5%                                                                                                         |
| Protection against reversed voltage                                                                                              | Yes                                                                                                        |
| Rated protection fuse on UP                                                                                                      | 10 A fast                                                                                                  |
| Electrical isolation                                                                                                             | Per module                                                                                                 |
| <b>Current consumption</b>                                                                                                       |                                                                                                            |
| Current consumption from UP at normal operation                                                                                  | 0.15 A                                                                                                     |
| Inrush current from UP (at power up)                                                                                             | 0.050 A <sup>2</sup> s                                                                                     |
| Max. length of analog cables, conductor cross section > 0.14 mm <sup>2</sup> (~26 AWG)                                           | 100 m / 328 ft.                                                                                            |
| <b>Sensor power supply</b>                                                                                                       |                                                                                                            |
| Conversion error of the analog values caused by nonlinearity, adjustment error at factory and resolution within the normal range | Typ. 0.5 %, max. 1 %                                                                                       |
| Dimensions (without the Terminal Unit)                                                                                           | 67.5 x 76 x 54 mm / 2.66 x 2.99 x 2.13 inch (Width x height x depth)                                       |
| Weight                                                                                                                           | 300 g / 10.52 oz                                                                                           |
| Cooling                                                                                                                          | The natural convection cooling must not be hindered by cable ducts or other parts in the mounting cabinet. |

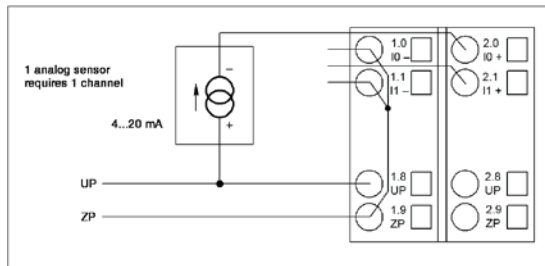
| Technical data of the analog inputs AI 723F                                                                                                                                                                                                        |                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of channels per module                                                                                                                                                                                                                      | 16                                                                                                                                                                       |
| Distribution of channels into groups                                                                                                                                                                                                               | 2 groups of 8 channels each                                                                                                                                              |
| <ul style="list-style-type: none"> <li>• Connections of the channels I0- to I7-</li> <li>• Connections of the channels I0+ to I7+</li> <li>• Connections of the channels I8- to I15-</li> <li>• Connections of the channels I8+ to I15+</li> </ul> | <ul style="list-style-type: none"> <li>• Terminals 1.0 to 1.7</li> <li>• Terminals 2.0 to 2.7</li> <li>• Terminals 3.0 to 3.7</li> <li>• Terminals 4.0 to 4.7</li> </ul> |
| Electrical isolation                                                                                                                                                                                                                               | Against internal supply and other modules                                                                                                                                |
| Configuration                                                                                                                                                                                                                                      | 0...10 V, -10...+10 V, 0/4...20 mA, Pt100/1000, Ni1000 (each channel can be configured individually)                                                                     |
| Channel input resistance                                                                                                                                                                                                                           | Voltage: > 100 kOhm, current: ca. 330 Ohm                                                                                                                                |
| Time constant of the input filter                                                                                                                                                                                                                  | Voltage: 100 µs, current: 100 µs                                                                                                                                         |
| Indication of the input signals                                                                                                                                                                                                                    | One LED per channel                                                                                                                                                      |
| Resolution                                                                                                                                                                                                                                         | Range 0...10 V: 12 bits<br>Range -10...+10 V: 12 bits + sign<br>Range 0...20 mA: 12 bits<br>Range 4...20 mA: 12 bits<br>Temperature: 0.1 °C / 0.18 °F                    |
| Overvoltage protection                                                                                                                                                                                                                             | Yes                                                                                                                                                                      |

| Technical data of the analog inputs, if they are used as digital inputs AI 723F  |                               |
|----------------------------------------------------------------------------------|-------------------------------|
| Number of channels per module                                                    | Max. 16                       |
| Distribution of channels into groups                                             | 2 groups of 8 channels each   |
| Connections of the channels I0+ to I7+                                           | Terminals 2.0 to 2.7          |
| Connections of the channels I8+ to I15+                                          | Terminals 4.0 to 4.7          |
| Reference potential for the inputs                                               | Terminals 1.8 to 4.8 (ZP)     |
| Input signal delay                                                               | Typ. 8 ms                     |
| Indication of the input signals                                                  | One LED per channel           |
| Input signal voltage                                                             | 24 VDC                        |
| <ul style="list-style-type: none"> <li>• Signal 0</li> <li>• Signal 1</li> </ul> | -30 V...+5 V<br>+13 V...+30 V |

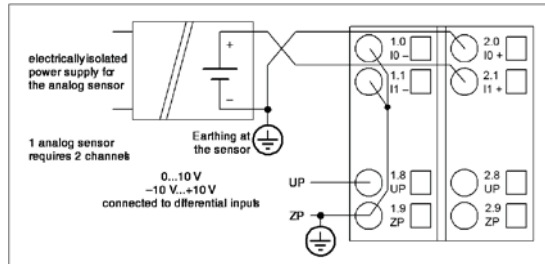
—  
01 Connection of passive-type analog sensors (current)

—  
02 Connection of active-type analog sensors (voltage) to differential inputs

—  
03 wire RTC

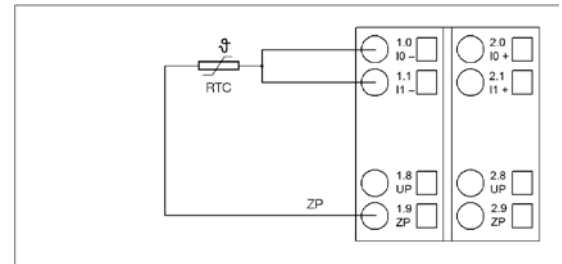


01



02

Two examples of wiring are shown with the following figures. Figure 01 shows wiring for a current input for 4...20 mA while figure 02 shows a voltage sensor with differential inputs. Note that the latter one needs two adjacent channels, starting with an even channel number.



03

### 5.2.4.2. Analog input module AI 731F (Thermocouple)

| Name    | Short description                                                                                                                                                                                                                      | Article no.     |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| AI 731F | Analog input module<br>8 AI: TC, RTD, mV/V, mA, kOhm and 24 VDC 15 Bit + sign, 2-, 3- and 4-wire,<br>24 VDC 5 W<br>TU 715F / TU 716F (terminal unit not included)<br><br>• PROFIBUS Remote I/O<br>• Direct I/O for AC 700F and AC 900F | 3BDH000385R0001 |



It has 8 channels with the following features:

- 8 configurable analog inputs in two groups (1.0...2.7 and 2.0...2.7 as well as 3.0...3.7 and 4.0...4.7)



## Technical data

| Functionality AI 731F             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input                             | <p>8 analog inputs, individually configurable for: unused (default setting)</p> <p>0...5V, 0...10 V</p> <p>-50...+50 mV, -500...+500 mV</p> <p>-1...+1 V, -5...+5 V, -10 V...+10 V</p> <p>0...20 mA</p> <p>4...20 mA</p> <p>-20...+20 mA</p> <p>Pt100, -50 °C (-58 °F)...+70 °C (+158 °F) (2-wire)</p> <p>Pt100, -50 °C (-58 °F)...+70 °C (+158 °F) (3-wire)</p> <p>Pt100, -50 °C (-58 °F)...+70 °C (+158 °F) (4-wire)</p> <p>Pt100, -50 °C (-58 °F)...+70 °C (+158 °F) (2-wire), resolution 0.01 K</p> <p>Pt100, -50 °C (-58 °F)...+70 °C (+158 °F) (3-wire), resolution 0.01 K</p> <p>Pt100, -50 °C (-58 °F)...+70 °C (+158 °F) (4-wire), resolution 0.01 K</p> <p>Pt100, -50 °C (-58 °F)...+400 °C (+752 °F) (2-wire)</p> <p>Pt100, -50 °C (-58 °F)...+400 °C (+752 °F) (3-wire)</p> <p>Pt100, -50 °C (-58 °F)...+400 °C (+752 °F) (4-wire)</p> <p>Pt100, -200 °C (-328 °F)...+850 °C (+1562 °F) (2-wire)</p> <p>Pt100, -200 °C (-328 °F)...+850 °C (+1562 °F) (3-wire)</p> <p>Pt100, -200 °C (-328 °F)...+850 °C (+1562 °F) (4-wire)</p> <p>Pt1000, -50 °C (-58 °F)...+400 °C (+752 °F) (2-wire)</p> <p>Pt1000, -50 °C (-58 °F)...+400 °C (+752 °F) (3-wire)</p> <p>Pt1000, -50 °C (-58 °F)...+400 °C (+752 °F) (4-wire)</p> <p>Ni1000, -50 °C (-58 °F)...+150 °C (+302 °F) (2-wire)</p> <p>Ni1000, -50 °C (-58 °F)...+150 °C (+302 °F) (3-wire)</p> <p>Ni1000, -50 °C (-58 °F)...+150 °C (+302 °F) (4-wire)</p> <p>Cu50 1.426, -50 °C (-58 °F)...+200 °C (+392 °F) (2-wire)</p> <p>Cu50 1.426, -50 °C (-58 °F)...+200 °C (+392 °F) (3-wire)</p> <p>Cu50 1.426, -50 °C (-58 °F)...+200 °C (+392 °F) (4-wire)</p> <p>Cu50 1.428, -200 °C (-328 °F)...+200 °C (+392 °F) (2-wire)</p> <p>Cu50 1.428, -200 °C (-328 °F)...+200 °C (+392 °F) (3-wire)</p> <p>Cu50 1.428, -200 °C (-328 °F)...+200 °C (+392 °F) (4-wire)</p> <p>0...50 kOhm</p> <p>Thermocouples of types J, K, T, N, S</p> <p>Digital signals (digital input)</p> |
| Resolution of the analog channels | <p>Voltage -1...+1V, -5...+5V, -10 V...+10 V: 15 bits plus sign</p> <p>Voltage 0...5 V, 0...10 V: 15 bits</p> <p>Current 0...20 mA, 4...20 mA, -20...+20 mA: 15 bits</p> <p>Temperature: 0.1 °C (0.18 °F), 0.01 °C at Pt100 -50 °C...+70 °C</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Power supply                      | <p>Internal: through the expansion bus interface (I/O Bus)</p> <p>External: via the terminals (process voltage 24 V DC)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Potential separation              | Module-wise                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| LEDs                              | 11 LEDs for signals and error messages                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

| <b>Technical data AI 731F</b>                                                                                                     |                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| <b>Process voltage</b>                                                                                                            |                                                                                                            |
| Rated value                                                                                                                       | 24 V DC                                                                                                    |
| Max. ripple                                                                                                                       | 5 %                                                                                                        |
| Protection against reversed voltage                                                                                               | Yes                                                                                                        |
| Rated protection fuse on UP                                                                                                       | 10 A fast                                                                                                  |
| Electrical isolation                                                                                                              | Yes, per module                                                                                            |
| Power consumption through UP during normal operation                                                                              | 130 mA (depending on output loads)                                                                         |
| Connections                                                                                                                       | Terminals 1.8, 2.8, 3.8, and 4.8 for +24 V (UP)<br>as well as 1.9, 2.9, 3.9 and 4.9 for 0 V (ZP))          |
| <b>Current consumption</b>                                                                                                        |                                                                                                            |
| Max. length of analog cables, conductor cross section > 0.14 mm <sup>2</sup> (~26 AWG)                                            | 100 m (328.08 ft)                                                                                          |
| <b>Sensor power supply</b>                                                                                                        |                                                                                                            |
| Conversion error of the analog values caused by non-linearity, adjustment error at factory and resolution within the normal range | Typically 0.5 %, max. 1 %                                                                                  |
| Dimensions                                                                                                                        | 67.5 x 76 x 54 mm / 2.66 x 2.99 x 2.13 inch (width x height x depth)                                       |
| Weight                                                                                                                            | Approx. 130 g / 4.6 oz                                                                                     |
| Mounting position                                                                                                                 | Horizontal or vertical with limitations (output load per group 50 % at 40°C (104°F))                       |
| Cooling                                                                                                                           | The natural convection cooling must not be hindered by cable ducts or other parts in the mounting cabinet. |

| <b>Technical data analog inputs AI 731F</b> |                                                                                                                                                                                                                                            |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of channels per module               | 8                                                                                                                                                                                                                                          |
| Distribution of channels into groups        | 2 groups of 4 channels each                                                                                                                                                                                                                |
| Connections to the channels I0- to I3       | Terminals 1.0 to 1.7 and terminals 2.0 to 2.7                                                                                                                                                                                              |
| Connections to the channels I4- to I7-      | Terminals 3.0 to 3.7 and Terminals 4.0 to 4.7                                                                                                                                                                                              |
| Type of inputs                              | Bipolar (not in the case of current or Pt100/Pt1000/Ni1000/Cu50/resistor)                                                                                                                                                                  |
| Electrical isolation                        | Against internal supply and other modules                                                                                                                                                                                                  |
| Configurability                             | Digital input, -50...+50 mV, -500...+500 mV, -1...+1V, -5...+5V, -10...+10V, 0...+5V, 0...+10V, -20...+20mA, 0/4...20 mA, Pt100/1000, Ni1000, Cu50, resistor, thermocouple types J, K, N, S, T (each input can be configured individually) |
| Channel input resistance                    | Voltage: > 100 kOhm, current: approx. 330 Ohm                                                                                                                                                                                              |
| Time constant of the input filter           | Line-frequency suppression 50 Hz, 60 Hz, none                                                                                                                                                                                              |
| Indication of the input signals             | one yellow LED per channel                                                                                                                                                                                                                 |
| Conversion cycle                            | 1ms (none), 100ms (60 Hz), 120ms(50 Hz) per channel                                                                                                                                                                                        |
| Resolution                                  | Range unipolar 15 bits                                                                                                                                                                                                                     |
|                                             | Range bipolar 15 Bit + sign                                                                                                                                                                                                                |
| Unused voltage inputs                       | Are configured as "unused"                                                                                                                                                                                                                 |
| Unused current inputs                       | Have a low resistance, can be left open-circuited                                                                                                                                                                                          |
| Surge protection                            | Yes                                                                                                                                                                                                                                        |

| <b>Technical data analog inputs AI 731F, if used as digital inputs</b>                                       |                                      |                  |
|--------------------------------------------------------------------------------------------------------------|--------------------------------------|------------------|
| Number of channels per module                                                                                | Max. 8                               |                  |
| Distribution of channels into groups                                                                         | 2 groups of 4 channels each          |                  |
| Connections to channels I0+ to I3+                                                                           | Terminals 2.0, 2.2, 2.4, 2.6         |                  |
| Connections to channels I4+ to I7+                                                                           | Terminals 4.0, 4.2, 4.4, 4.6         |                  |
| Reference potential for the inputs                                                                           | Terminals 1.8, 2.8, 3.8 and 4.8 (ZP) |                  |
| Input signal delay                                                                                           | Typically 2 ms                       |                  |
| Indication of the input signals                                                                              | One LED per channel                  |                  |
| Input signal voltage                                                                                         | 24 V DC                              |                  |
| <ul style="list-style-type: none"> <li>• Signal 0</li> <li>• Undefined signal</li> <li>• Signal 1</li> </ul> | • -30 V...+5 V                       |                  |
|                                                                                                              | • +5 V...+13 V                       |                  |
|                                                                                                              | • +13 V...+30 V                      |                  |
|                                                                                                              |                                      |                  |
| Input current per channel                                                                                    | Input voltage +24 V                  | Typically 5mA    |
|                                                                                                              | Input voltage +5 V                   | Typically 1mA    |
|                                                                                                              | Input voltage +15 V                  | Typically 3.1 mA |
|                                                                                                              | Input voltage +30 V                  | < 7 mA           |
|                                                                                                              | Input resistance                     | Tpprox. 4.8 kOhm |

5.2.4.3. Analog output module AO 723F

| Name    | Short description                                                                                                                                                                                                                                                                                      | Article no.     |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| AO 723F | Analog output module<br>16 AO: +10 V, 0/4-20 mA<br>max. 8 AO usable as current outputs<br>12 Bit + sign, 2-wire, 24 VDC 8 W<br>TU 715F /TU 716F (terminal unit not included)<br><br><ul style="list-style-type: none"><li>• PROFIBUS Remote I/O</li><li>• Direct I/O for AC 700F and AC 900F</li></ul> | 3BDH000384R0001 |



It has 16 channels with the following features:

- 16 configurable analog outputs in two groups (1.0...2.7 and 3.0...4.7)

01 AO 723F output configuration using predefined template; configurable channels

02 Output group 2 with voltage only channels

01

Parameters: Profibus Slave Module PROF\_S\_MOD

General data

Name: AO723

Short text:

Long text:

Module data

User

DPV1

Force/Sub

Module Parameters

Outputs 0-3

Outputs 4-7

Outputs 8-11

Out

Channel 0

OutChannel 0 configuration

Analog output -10V...+10V

OutChannel 0 checks

Plausib, cut wire, short circ.

Channel 1

OutChannel 1 configuration

Analog output 4...20mA

OutChannel 1 checks

Plausib, cut wire, short circ.

Channel 2

OutChannel 2 configuration

Not used

OutChannel 2 checks

Plausib, cut wire, short circ.

Channel 3

OutChannel 3 configuration

Analog output 4...20mA

OutChannel 3 checks

Plausib, cut wire, short circ.

OK

Cancel

Save

Reset

Check

Help

02

Parameters: Profibus Slave Module PROF\_S\_MOD

General data

Name: AO723

Short text:

Long text:

Module data

User

DPV1

Force/Sub

Module Parameters

Outputs 0-3

Outputs 4-7

Outputs 8-11

Out

Channel 4

OutChannel 4 configuration

Analog output -10V...+10V

OutChannel 4 checks

Plausib, cut wire, short circ.

Channel 5

OutChannel 5 configuration

Analog output -10V...+10V

OutChannel 5 checks

Plausib, cut wire, short circ.

Channel 6

OutChannel 6 configuration

Not used

OutChannel 6 checks

Not used

Channel 7

OutChannel 7 configuration

Not used

OutChannel 7 checks

Plausib, cut wire, short circ.

OK

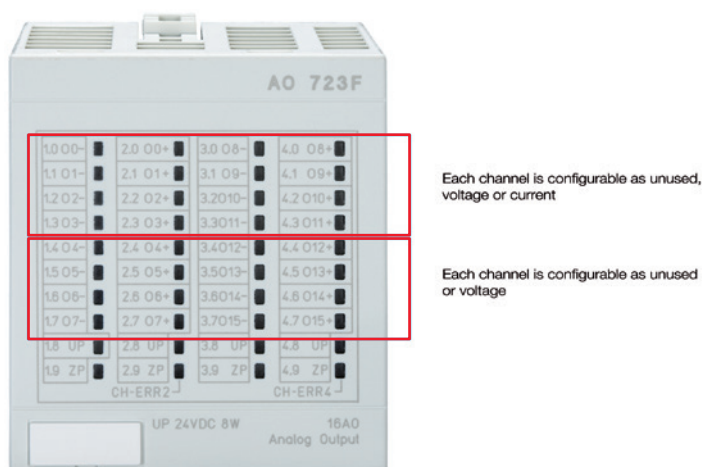
Cancel

Save

Reset

Check

Help



## Technical data

### Functionality AO 723F

|                                   |                                                                                                                            |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Outputs                           | 16 analog outputs, individually configurable for:<br>Unused (default setting)<br>-10 V...+10 V<br>0...20 mA<br>4...20 mA   |
| Resolution of the analog channels | Voltage 10 V... +10 V: 12 bits plus sign<br>Current 0...20 mA, 4...20 mA: 12 bits<br>Temperature: 0.1 °C (0.18 °F)         |
| Power supply                      | Internal: through the expansion bus interface (I/O Bus)<br>External: via the terminals ZP and UP (process voltage 24 V DC) |
| Potential separation              | Module-wise                                                                                                                |
| LEDs                              | 19 LEDs for signals and error messages                                                                                     |

### Technical data AO 723F

#### Process voltage

|                                     |                                                               |
|-------------------------------------|---------------------------------------------------------------|
| Connections                         | Terminals 1.8 – 4.8 for +24 V (UP) and 1.9 - 4.9 for 0 V (ZP) |
| Rated value                         | 24 V DC                                                       |
| Max. ripple                         | 5 %                                                           |
| Protection against reversed voltage | Yes                                                           |
| Rated protection fuse on UP         | 10 A fast                                                     |
| Electrical isolation                | Yes, per module                                               |

#### Current consumption

|                                                                            |                      |
|----------------------------------------------------------------------------|----------------------|
| Current consumption from UP at normal operation                            | 0.15 A + output load |
| Inrush current from UP (at power up)                                       | 0.020 A²s            |
| Max. length of analog cables, conductor cross section > 0.14 mm² (~26 AWG) | 100 m (328.08 ft)    |

#### Sensor power supply

|                                                                                                                                   |                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Conversion error of the analog values caused by non-linearity, adjustment error at factory and resolution within the normal range | Typically 0.5 %, max. 1 %                                                                                  |
| Dimensions                                                                                                                        | 67.5 x 76 x 54 mm / 2.66 x 2.99 x 2.13 inch (width x height x depth)                                       |
| Weight (without the terminal unit)                                                                                                | Approx. 300 g/10.58 oz.                                                                                    |
| Mounting position                                                                                                                 | Horizontal or vertical with limitations (output load per group 50 % at 40°C (104°F))                       |
| Cooling                                                                                                                           | The natural convection cooling must not be hindered by cable ducts or other parts in the mounting cabinet. |

| Technical data of analog outputs AO 723F    |                                                                                                                       |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Number of channels per module               | 16, O0...O3 and O8...O11 for voltage and current, and channels O4...7 and O12...15 only for voltage                   |
| Distribution of channels into groups        | 2 group of 8 channels                                                                                                 |
| Channels O0-...O7-                          | Terminals 1.0...1.7                                                                                                   |
| Channels O0+...O7+                          | Terminals 2.0...2.7                                                                                                   |
| Channels O8-...O15-                         | Terminals 3.0...3.7                                                                                                   |
| Channels O8+...O15+                         | Terminals 4.0...4.7                                                                                                   |
| Output type                                 | Bipolar with voltage, unipolar with current                                                                           |
| Electrical isolation                        | Against internal supply and other modules                                                                             |
| Configurability                             | -10...+10 V, 0...20 mA, 4...20 mA (each output can be configured individually), current output in channels 0...3 only |
| Output resistance (load), as current output | 0...500 $\Omega$                                                                                                      |
| Output load capacity, as voltage output     | Max. $\pm 10$ mA                                                                                                      |
| Indication of the output signals            | One LED per channel                                                                                                   |
| Resolution                                  | 12 bits (+ sign)                                                                                                      |
| Unused outputs                              | can be left open circuited                                                                                            |

5.2.4.4. Analog input / output module AX 722F

| Name    | Short description                                                                                                                                                                                                                                                                                                                                                | Article no.     |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| AX 722F | Analog input / output module<br>8 AI: +-10 V 0/4-20 mA 24 VDC, Pt100.<br>8 AO: +-10 V 0/4-20 mA 24 VDC.<br>12 bit + Sign, 2-wire, 24 VDC 5 W.<br>Software version 2013 SP1 RU04 or higher is mandatory.<br>Use with TU 715F / TU 716F.<br><br><ul style="list-style-type: none"><li>• PROFIBUS Remote I/O</li><li>• Direct I/O for AC 700F and AC 900F</li></ul> | 3BDH000377R0001 |



The AX 722F module offers even more flexibility, as it combines analog input and output channels in one module with 16 channels. Eight of these channels can be individually configured as inputs, which can again sense voltage, current, or temperatures.

Furthermore four channels can be configured as analog voltage outputs (-10 V to +10 V) or analog current outputs (0 ... 20 mA or 4 ... 20 mA) and the remaining four channels can provide voltage signals in the range from -10 V to +10 V.

AX 722F options

AX 722F Analog Input/Output: 8 AI/DI, 8 AO

General data

Name: **AX722F\_3\_L1** Short text:

Long text:

Module Configuration Input 0 - 7 Output 0 - 7 Force/Substitute

| Channel | Type      | Range       | Scale Start / End | Monitoring                          |
|---------|-----------|-------------|-------------------|-------------------------------------|
| O0:     | Analog UI | -10V...+10V | 0.0 100.0         | <input checked="" type="checkbox"/> |
| O1:     | Analog I  | 4...20mA    | 0.0 100.0         | <input type="checkbox"/>            |
| O2:     | Analog I  | 0...20mA    | 0.0 100.0         | <input type="checkbox"/>            |
| O3:     | Not used  |             | 0.0 0.0           | <input type="checkbox"/>            |
| O4:     | Not used  |             | 0.0 0.0           | <input type="checkbox"/>            |
| O5:     | Not used  |             | 0.0 0.0           | <input type="checkbox"/>            |
| O6:     | Not used  |             | 0.0 0.0           | <input type="checkbox"/>            |
| O7:     | Not used  |             | 0.0 0.0           | <input type="checkbox"/>            |

Behavior on communication errors

All channels: **Output OFF** ☐ Channel 0 changes to substitute value: 0.0

OK Cancel Save Reset Check Help

Parameters: Profibus Slave Module PROFIS\_MOD

General data

Name: **AO223** Short text:

Long text:

Module data User DPV/1 Force/Sub Module Parameters Outputs 0-3 Outputs 4-7 Outputs 8-11 Out

Channel 4

OutChannel 4 configuration: Analog output -10V...+10V

OutChannel 4 checks: Plausib, cut wire, short circ.

Channel 5

OutChannel 5 configuration: Analog output -10V...+10V

OutChannel 5 checks: Plausib, cut wire, short circ.

Channel 6

OutChannel 6 configuration: **Not used**

OutChannel 6 checks: **Not used**

Channel 7

OutChannel 7 configuration: Not used

OutChannel 7 checks: Plausib, cut wire, short circ.

## Technical data

| Functionality AX 722F                                                                                                             |                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| 8 analog inputs, (channels I0 - I7)<br>individually configurable for                                                              | Unused (default setting)                                                                                   |
|                                                                                                                                   | 0...10 V                                                                                                   |
|                                                                                                                                   | -10 V...+10 V                                                                                              |
|                                                                                                                                   | 0...20 mA                                                                                                  |
|                                                                                                                                   | 4...20 mA                                                                                                  |
|                                                                                                                                   | Pt100, -50 °C (-58 °F)...+400 °C (+752 °F)<br>2-wire or 3-wire, requires 2 channels                        |
|                                                                                                                                   | Pt100, -50 °C (-58 °F)...+70 °C (+158 °F)<br>2-wire or 3-wire, requires 2 channels                         |
|                                                                                                                                   | Pt1000, -50 °C (-58 °F)...+400 °C (+752 °F)<br>2-wire or 3-wire, requires 2 channels                       |
|                                                                                                                                   | Ni1000, -50 °C (-58 °F)...+150 °C (+302 °F)<br>2-wire or 3-wire, requires 2 channels                       |
|                                                                                                                                   | 0...10 V with differential inputs, requires 2 channels                                                     |
|                                                                                                                                   | -10 V...+10 V with differential inputs, requires 2 channels                                                |
|                                                                                                                                   | Digital signals (digital input)                                                                            |
| 4 analog outputs, (channels O0 - O3)<br>individually configurable for                                                             | Unused (default setting)                                                                                   |
|                                                                                                                                   | -10 V...+10 V                                                                                              |
|                                                                                                                                   | 0...20 mA                                                                                                  |
|                                                                                                                                   | 4...20 mA                                                                                                  |
| 4 analog outputs, (channels O4 - O7)<br>individually configurable for                                                             | Unused (default setting)                                                                                   |
|                                                                                                                                   | -10 V...+10 V                                                                                              |
| Technical data AX 722F                                                                                                            |                                                                                                            |
| LED displays                                                                                                                      | 19 LEDs for signals and error indication, where the brightness depends on the current (or signal level)    |
| Internal power supply                                                                                                             | Through the expansion bus interface (I/O-Bus)                                                              |
| External power supply                                                                                                             | Via the terminals ZP and UP (process voltage 24 VDC) of TU 715F                                            |
| Process voltage                                                                                                                   |                                                                                                            |
| Connections                                                                                                                       | Terminals 1.8 - 4.8 for +24 V (UP) and 1.9 - 4.9 for 0 V (ZP)                                              |
| Rated value                                                                                                                       | 24 VDC                                                                                                     |
| Max. ripple                                                                                                                       | 5%                                                                                                         |
| Protection against reversed voltage                                                                                               | Yes                                                                                                        |
| Rated protection fuse on UP                                                                                                       | 10 A fast                                                                                                  |
| Electrical isolation                                                                                                              | Yes, per module                                                                                            |
| Current consumption                                                                                                               |                                                                                                            |
| Current consumption from UP at normal operation                                                                                   | 0.10 A output loads                                                                                        |
| Inrush current from UP (at power up)                                                                                              | 0.020 A²s                                                                                                  |
| Max. length of analog cables, conductor cross section > 0.14 mm² (~26 AWG)                                                        | 100 m / 328 ft.                                                                                            |
| Sensor power supply                                                                                                               |                                                                                                            |
| Conversion error of the analog values caused by non-linearity, adjustment error at factory and resolution within the normal range | Typ. 0.5 %, max. 1 %                                                                                       |
| Dimensions (Width x height x depth)                                                                                               | 67.5 x 76 x 54 mm / 2.66 x 2.99 x 2.13 inches                                                              |
| Weight (without the Terminal Unit)                                                                                                | Approx. 300 g / 10.58 oz.                                                                                  |
| Cooling                                                                                                                           | The natural convection cooling must not be hindered by cable ducts or other parts in the mounting cabinet. |

| <b>Technical data of the analog inputs AX 722F</b> |                                                                                                                                                        |
|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of channels per module                      | 8                                                                                                                                                      |
| Distribution of the channels into groups           | 1 group of 8 channels                                                                                                                                  |
| Connections of the channels I0- to I7-             | Terminals 1.0 to 1.7                                                                                                                                   |
| Connections of the channels I0+ to I7+             | Terminals 2.0 to 2.7                                                                                                                                   |
| Electrical isolation                               | Against internal supply and other modules                                                                                                              |
| Configuration                                      | 0...10 V, -10...+10 V, 0/4...20 mA, Pt100/1000, Ni1000 (each channel can be configured individually)                                                   |
| Channel input resistance                           | Voltage: > 100 kOhm, current: ca. 330 Ohm                                                                                                              |
| Time constant of the input filter                  | Voltage: 100 µs, current: 100 µs                                                                                                                       |
| Indication of the input signals                    | One LED per channel                                                                                                                                    |
| Conversion cycle                                   | 2 ms (for 8 inputs + 8 outputs), with Pt / Ni...1 s                                                                                                    |
| Resolution                                         | Range 0...10 V: 12 bits<br>Range -10...+10 V: 12 bits + sign<br>Range 0...20 mA: 12 bits<br>Range 4...20 mA: 12 bits<br>Temperature : 0.1 °C / 0.18 °F |
| Unused voltage inputs                              | Are configured as "unused"                                                                                                                             |
| Unused current inputs                              | Have a low resistance, can be left open-circuited                                                                                                      |
| Overvoltage protection                             | Yes                                                                                                                                                    |

| <b>Technical data of the analog inputs, if they are used as digital inputs AX 722F</b> |                           |
|----------------------------------------------------------------------------------------|---------------------------|
| Number of channels per module                                                          | Max. 8                    |
| Distribution of channels into groups                                                   | 1 group of 8 channels     |
| Connections of the channels I0+ to I7+                                                 | Terminals 2.0 to 2.7      |
| Reference potential for the inputs                                                     | Terminals 1.8 to 4.8 (ZP) |
| Input signal delay                                                                     | Typ. 8 ms                 |
| Indication of the input signals                                                        | One LED per channel       |
| Input signal voltage                                                                   | 24 VDC                    |
| • Signal 0                                                                             | • -30 V...+5 V            |
| • Signal 1                                                                             | • +13 V...+30 V           |

| <b>Technical data of the analog outputs AX 722F</b> |                                                                                                                     |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Number of channels per module                       | 8, all channels for voltage, the first 4 channels also for current                                                  |
| Distribution of channels into groups                | 1 group of 8 channels                                                                                               |
| • Channels O0-...O7-                                | • Terminals 3.0...3.7                                                                                               |
| • Channels O0+...O7+                                | • Terminals 4.0...4.7                                                                                               |
| Output type                                         | Bipolar with voltage, unipolar with current                                                                         |
| Electrical isolation                                | Against internal supply and other modules                                                                           |
| Configurability                                     | -10...+10 V, 0...20 mA, 4...20 mA (each output can be configured individually), current outputs only channels 0...3 |
| Output resistance (load), as current output         | 0...500 Ohm                                                                                                         |
| Output loadability, as voltage output               | max. ±10 mA                                                                                                         |
| Indication of the output signals                    | One LED per channel, where the brightness depends on the current (or signal level)                                  |
| Resolution                                          | 12 bits (+ sign)                                                                                                    |
| Unused outputs                                      | Can be left open-circuited                                                                                          |



## 5.2.5 Digital/analog I/O module

### 5.2.5.1. Digital/analog module DA 701F

| Name    | Short description                                                                                                                                                                                                                                                                         | Article no.     |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| DA 701F | Digital / analog module<br>16 DI: 24 VDC<br>8 DI/DO: 24 VDC/0.5 A<br>4 AI: +-10 V 0/4-20 mA, RTD , 24 VDC<br>2 AO: +-10 V, 0/4-20 mA<br>12 Bit + sign, 1-wire, 24 VDC 200 W<br>TU 715F /TU 716F<br>(terminal unit not included)<br>Software version 2013 SP1 RU04 or higher is mandatory. | 3BDH000371R0005 |
|         | <ul style="list-style-type: none"> <li>• PROFIBUS Remote I/O</li> <li>• Direct I/O for AC 700F and AC 900F</li> </ul>                                                                                                                                                                     |                 |



It has 30 channels with the following features:

- 16 digital inputs, 24 V DC
- 8 configurable digital inputs/outputs 24 V DC, 0.5 A max.
- 4 analog inputs, voltage, current and RTD, resolution 12 bits plus sign
- 2 analog outputs, voltage and current, resolution 12 bits plus sign

The technical data correspond to the input and output values. The inputs and outputs are electrically isolated from the other electronic circuitry of the module. There is no potential separation between the channels.

#### Technical data

| Functionality DA 701F               |                                                                                                                            |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Digital Inputs                      | 16 (24 V DC; delay time configurable via software)                                                                         |
| Configurable digital inputs/outputs | 8 (24 V DC, 0.5 A max)                                                                                                     |
| Analog inputs                       | 4 (configurable via software), resolution 12 bits plus sign, voltage, current and RTD input                                |
| Analog outputs                      | 2 (configurable via software), resolution 12 bits plus sign, voltage, current and RTD output                               |
| Power supply                        | Internal: through the expansion bus interface (I/O-Bus)<br>External: via the terminals ZP and UP (process voltage 24 V DC) |
| Potential separation                | Module-wise                                                                                                                |
| LEDs                                | For system displays, indicating signal statuses, errors and power supply                                                   |
| Process supply voltage UP           |                                                                                                                            |
| Connections                         | Terminals 1.8, 2.8, 3.8 and 4.8 for +24 V (UP) and 1.9, 2.9, 3.9 and 4.9 for 0 V (ZP)                                      |
| Rated value                         | 24 V DC                                                                                                                    |
| Max. ripple                         | 5 %                                                                                                                        |
| Protection against reversed voltage | Yes                                                                                                                        |
| Rated protection fuse on UP         | 10 A fast                                                                                                                  |
| Electrical isolation                | Yes, per module                                                                                                            |
| Current consumption                 |                                                                                                                            |
| Current consumption                 | 0.07 A + max. 0.5 A per output                                                                                             |
| From UP                             | Approx. 1 mA at 24 V DC                                                                                                    |

**Functionality DA 701F**

|                                                                                 |                          |
|---------------------------------------------------------------------------------|--------------------------|
| From 24 V DC power supply at the terminals UP/L+ and ZP/M of the CPU/Bus Module | Approx. 5 mA             |
| Inrush current from UP (at power-up)                                            | 0.04 A <sup>2</sup> s    |
| Max. power dissipation within the module                                        | 6 W (outputs not loaded) |

**Sensor power supply**

|                                     |                                                                                                            |
|-------------------------------------|------------------------------------------------------------------------------------------------------------|
| Dimensions (width x height x depth) | 67.5 x 76 x 54 mm / 2.66 x 2.99 x 2.13 inch                                                                |
| Weight (without Terminal Unit)      | Approx. 125g / 4.41 oz.                                                                                    |
| Mounting position                   | Horizontal or vertical with limitations (Output load per group is 50 % at 40°C (104°F))                    |
| Cooling                             | The natural convection cooling must not be hindered by cable ducts or other parts in the mounting cabinet. |

**Technical data digital inputs DA 701F**

|                                                                                                        |                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of channels per module                                                                          | 16                                                                                                                                                          |
| Distribution of the channels into groups                                                               | 2 group of 8 channels                                                                                                                                       |
| Connections to the channels DI0 to DI7                                                                 | Terminals 1.0 to 1.7                                                                                                                                        |
| Connections to the channels DI8 to DI15                                                                | Terminals 2.0 to 2.7                                                                                                                                        |
| Reference potential for all inputs                                                                     | Terminal 1.9...3.9 (minus pole of the process supply voltage, signal name ZP)                                                                               |
| Electrical isolation                                                                                   | From the rest of the module                                                                                                                                 |
| Indication of the input signals                                                                        | One yellow LED per channel, the LED is ON when the input signal is high (signal 1)                                                                          |
| Input type acc. to EN 61131-2                                                                          | Type 1                                                                                                                                                      |
| Input delay (0->1 or 1->0)                                                                             | Typically 0.1 ms, configurable from 0.1...32 ms                                                                                                             |
| Input signal voltage                                                                                   | 24 V DC                                                                                                                                                     |
| <ul style="list-style-type: none"> <li>Signal 0</li> <li>Undefined signal</li> <li>Signal 1</li> </ul> | <ul style="list-style-type: none"> <li>-3 V...+5 V</li> <li>&gt; +5 V...&lt; +15 V</li> <li>+15 V...+30 V</li> </ul>                                        |
| Ripple with signal 0                                                                                   | Within -3 V...+5 V                                                                                                                                          |
| Ripple with signal 1                                                                                   | Within +15 V...+30 V                                                                                                                                        |
| Input current per channel                                                                              | <ul style="list-style-type: none"> <li>Input voltage +24 V</li> <li>Input voltage +5 V</li> <li>Input voltage +15 V</li> <li>Input voltage +30 V</li> </ul> |
|                                                                                                        | <ul style="list-style-type: none"> <li>typically 5 mA</li> <li>&gt; 1 mA</li> <li>&gt; 2 mA</li> <li>&lt; 8 mA</li> </ul>                                   |
| Max. cable length                                                                                      | Shielded 1000 m (3280.83 ft)<br>Unshielded 600 m (1968.50 ft)                                                                                               |

**Technical data digital inputs / outputs DA 701F**

|                                                          |                                                                                         |
|----------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Number of channels per module                            | 8 inputs/outputs (with transistors)                                                     |
| Distribution of the channels into groups                 | 1 groups of 8 channel                                                                   |
| If channels are used as inputs:<br>Channels DC16...DC23  | Terminals 4.0...4.7                                                                     |
| If channels are used as outputs:<br>Channels DC16...DC23 | Terminals 4.0...4.7                                                                     |
| Indications of the input/output signals                  | 1 yellow LED per channel, the LED is ON when the input/output signal is high (signal 1) |
| Electrical isolation                                     | Yes, per module                                                                         |

| Technical data digital inputs / outputs DA 701F if used as inputs                                      |                                                                                                                                                             |                     |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Number of channels per module                                                                          | 8                                                                                                                                                           |                     |
| Distribution of the channels into groups                                                               | 1 groups of 8 channel                                                                                                                                       |                     |
| Channels DC16...DC23                                                                                   | Terminals 4.0...4.7                                                                                                                                         |                     |
| Reference potential for all inputs                                                                     | Terminals 1.9...4.9 (Minus pole of the supply voltage, signal name ZP)                                                                                      |                     |
| Indication of the input signals                                                                        | 1 yellow LED per channel, the LED is ON when the input signal is high (signal1)                                                                             |                     |
| Input type acc. to EN 61131-2                                                                          | Type 1                                                                                                                                                      |                     |
| Input delay (0->1 or 1->0)                                                                             | Typically 0.1 ms, configurable from 0.1...32 ms                                                                                                             |                     |
| Input signal voltage                                                                                   | 24 V DC                                                                                                                                                     |                     |
| <ul style="list-style-type: none"> <li>Signal 0</li> <li>Undefined signal</li> <li>Signal 1</li> </ul> | <ul style="list-style-type: none"> <li>-3 V...+5 V*</li> <li>&gt; +5 V...&lt; +15 V</li> <li>+15 V...+30 V</li> </ul>                                       |                     |
| Ripple with signal 0                                                                                   | Within -3 V...+5 V*                                                                                                                                         |                     |
| Ripple with signal 1                                                                                   | Within +15 V...+30 V                                                                                                                                        |                     |
| Input current per channel                                                                              | <ul style="list-style-type: none"> <li>Input voltage +24 V</li> <li>Input voltage +5 V</li> <li>Input voltage +15 V</li> <li>Input voltage +30 V</li> </ul> |                     |
|                                                                                                        | <ul style="list-style-type: none"> <li>Typically 5 mA</li> <li>&gt; 1 mA</li> <li>&gt; 2 mA</li> <li>&lt; 8 mA</li> </ul>                                   |                     |
| Max. cable length                                                                                      | Shielded                                                                                                                                                    | 1000 m (3280.83 ft) |
|                                                                                                        | Unshielded                                                                                                                                                  | 600 m (1968.50 ft)  |

\*Due to the direct connection to the output, the demagnetizing varistor is also effective at the input. This is why the difference between UPx and the input signal may not exceed the clamp voltage of the varistor. The varistor limits the voltage to approx. 36 V. Following this, the input voltage must range from -12 V to +30 V when UPx = 24 V and from -6 V to +30 V when UPx = 30 V.

| Technical data digital inputs / outputs DA 701F if used as outputs |                                                                                                                                                                                   |                     |
|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Number of channels per module                                      | 8                                                                                                                                                                                 |                     |
| Distribution of the channels into groups                           | 1 groups of 8 channel                                                                                                                                                             |                     |
| Channels DC16...DC23                                               | Terminals 4.0...4.7                                                                                                                                                               |                     |
| Reference potential for all outputs                                | Terminals 1.9...4.9 (Minus pole of the supply voltage, signal name ZP)                                                                                                            |                     |
| Common power supply voltage                                        | For all output terminals 1.8, 2.8, 3.8 and 4.8 (plus pole of the supply voltage, signal name UP)                                                                                  |                     |
| Output voltage for signal 1                                        | UP (-0.8 V)                                                                                                                                                                       |                     |
| Output current                                                     | <ul style="list-style-type: none"> <li>Rated value per channel</li> <li>Max. value (all channels together)</li> <li>Leakage current with signal 0</li> <li>Fuse for UP</li> </ul> |                     |
|                                                                    | <ul style="list-style-type: none"> <li>500 mA @ UP = 24 V</li> <li>4 A</li> <li>&lt;0.5 mA</li> <li>10 A fast</li> </ul>                                                          |                     |
| Demagnetization with inductive DC load                             | Via internal varistors                                                                                                                                                            |                     |
| Output switching frequency                                         | <ul style="list-style-type: none"> <li>With inductive loads</li> <li>With lamp loads</li> </ul>                                                                                   |                     |
|                                                                    | <ul style="list-style-type: none"> <li>Max. 0.5 Hz</li> <li>11Hz max. @ 5W max.</li> </ul>                                                                                        |                     |
| Overload message (I > 0.7 A)                                       | Yes                                                                                                                                                                               |                     |
| Output current limitation                                          | Yes, after approx. 100 ms                                                                                                                                                         |                     |
| Resistance to feedback against 24 V signals                        | Yes (Software controlled supervision)                                                                                                                                             |                     |
| Max. cable length                                                  | Shielded                                                                                                                                                                          | 1000 m (3280.83 ft) |
|                                                                    | Unshielded                                                                                                                                                                        | 600 m (1968.50 ft)  |

| <b>Technical data analog inputs DA 701F</b> |                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of channels per module               | 4                                                                                                                                                                                                                                                                                                                                                            |
| Distribution of the channels into groups    | 1 groups of 4 channel                                                                                                                                                                                                                                                                                                                                        |
| Channels AI0+...AI3+                        | Terminals 3.0...3.3                                                                                                                                                                                                                                                                                                                                          |
| Reference potential for AI0+...AI3+         | Terminals 3.4 (AI-) for voltage and RTD measurement                                                                                                                                                                                                                                                                                                          |
|                                             | Terminal 1.9, 2.9, 3.9 and 4.9 for current measurement                                                                                                                                                                                                                                                                                                       |
| Input type                                  | <ul style="list-style-type: none"> <li>• Unipolar</li> <li>• Bipolar</li> <li>• Configurability</li> </ul> <ul style="list-style-type: none"> <li>• Voltage 0...10 V, current or Pt100/Pt1000/Ni1000</li> <li>• Voltage -10...+10V</li> <li>• 0...10 V, -10...+10 V, 0/4...20 mA, Pt1000/1000, Ni1000 (each input can be configured individually)</li> </ul> |
| Channel input resistance                    | Voltage: >100 k $\Omega$ , current: approx. 330 $\Omega$                                                                                                                                                                                                                                                                                                     |
| Time constant of the input filter           | Voltage: 100 $\mu$ s, current: 100 $\mu$ s                                                                                                                                                                                                                                                                                                                   |
| Indication of the input signals             | 1 LED per channel (brightness depends on the value of the analog signal)                                                                                                                                                                                                                                                                                     |
| Conversion cycle                            | 1 ms (for 4 inputs + 2 outputs); with RTDs Pt/Ni... 1s                                                                                                                                                                                                                                                                                                       |
| Resolution                                  | Range 0...10 V: 12 Bits                                                                                                                                                                                                                                                                                                                                      |
|                                             | Range -10...+10 V: 12 Bits +sign                                                                                                                                                                                                                                                                                                                             |
|                                             | Range 0...20 mA: 12 Bits                                                                                                                                                                                                                                                                                                                                     |
|                                             | Range 4...20 mA: 12 Bits                                                                                                                                                                                                                                                                                                                                     |
|                                             | Range RTD (Pt100, Pt1000, Ni1000): 0.1°C (°F)                                                                                                                                                                                                                                                                                                                |
| Unused inputs                               | Configured as 'unused'                                                                                                                                                                                                                                                                                                                                       |
| Overvoltage protection                      | Yes                                                                                                                                                                                                                                                                                                                                                          |

| <b>Technical data analog inputs DA 701F if used as digital inputs</b>                                        |                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of channels per module                                                                                | Max. 4                                                                                                                                                                                                                                                                                                                                                                                      |
| Distribution of the channels into groups                                                                     | 1 groups of 4 channel                                                                                                                                                                                                                                                                                                                                                                       |
| Channels AI0+...AI3+                                                                                         | Terminals 3.0...3.3                                                                                                                                                                                                                                                                                                                                                                         |
| Reference potential for all inputs                                                                           | Terminals 1.9, 2.9, 3.9 and 4.9 (ZP)                                                                                                                                                                                                                                                                                                                                                        |
| Indication of the input signals                                                                              | 1 LED per channel                                                                                                                                                                                                                                                                                                                                                                           |
| Input signal voltage                                                                                         | 24 V DC                                                                                                                                                                                                                                                                                                                                                                                     |
| <ul style="list-style-type: none"> <li>• Signal 0</li> <li>• Undefined signal</li> <li>• Signal 1</li> </ul> | <ul style="list-style-type: none"> <li>• -30 V...+5 V</li> <li>• +5 V...+13 V</li> <li>• +13 V...+30 V</li> </ul>                                                                                                                                                                                                                                                                           |
| Input current per channel                                                                                    | <ul style="list-style-type: none"> <li>• Input voltage +24 V</li> <li>• Input voltage +5 V</li> <li>• Input voltage +15 V</li> <li>• Input voltage +30 V</li> <li>• Input resistance</li> </ul> <ul style="list-style-type: none"> <li>• Typically 7 mA</li> <li>• Typically 1.4 mA</li> <li>• Typically 3.7 mA</li> <li>• &lt; 9 mA</li> <li>• Approx. 3.5 k<math>\Omega</math></li> </ul> |

## 5.2.6 S700 I/O terminal units

| Name    | Short description                                             | Article no.     |
|---------|---------------------------------------------------------------|-----------------|
| TU 709F | PROFIBUS terminal unit 24 VDC.<br>Screw type terminals        | 3BDH000397R0001 |
| TU 710F | PROFIBUS terminal unit 24 VDC<br>Spring type terminals        | 3BDH000398R0001 |
| TU 715F | I/O terminal unit, 24 VDC<br>Screw type terminals, 1/2 wire.  | 3BDH000378R0001 |
| TU 716F | I/O terminal unit, 24 VDC<br>Spring type terminals, 1/2 wire. | 3BDH000382R0001 |
| TU 731F | I/O terminal unit, 230 VAC<br>Screw type terminals            | 3BDH000380R0001 |
| TU 732F | I/O terminal unit, 230 VAC<br>Spring type terminals           | 3BDH000381R0001 |

The upper area of a terminal block is designed for the connection of an I/O module or a PROFIBUS communication interface. In the lower area, the field cables are connected to up to 32 I/O terminals. The terminal blocks ensure the electrical connection of sensors and actuators. I/O modules can thus be removed or replaced without detaching the field wiring.

The I/O Bus in the upper terminal block area transmits I/O data and diagnostic data between a CPU module or a PROFIBUS communication interface and the I/O modules. This I/O Bus can be extended using the terminal blocks TU 715F/716F and TU 731F/732F in order to increase the number of I/O modules.

The maximum number of I/O terminal blocks depends on the application and/or configuration:

- AC 700F with direct I/O: max. 8 I/O modules
- AC 900F with direct I/O: max. 10 I/O modules
- PROFIBUS remote I/O: number of I/O modules determined by the PROFIBUS communication interface and the type of I/O modules used

Terminal blocks for PROFIBUS communication interfaces are additionally provided with a PROFIBUS connection or a fieldbus plug connection to connect the PROFIBUS either directly or via the PDP22 fieldbus plug (FieldBusPlug).

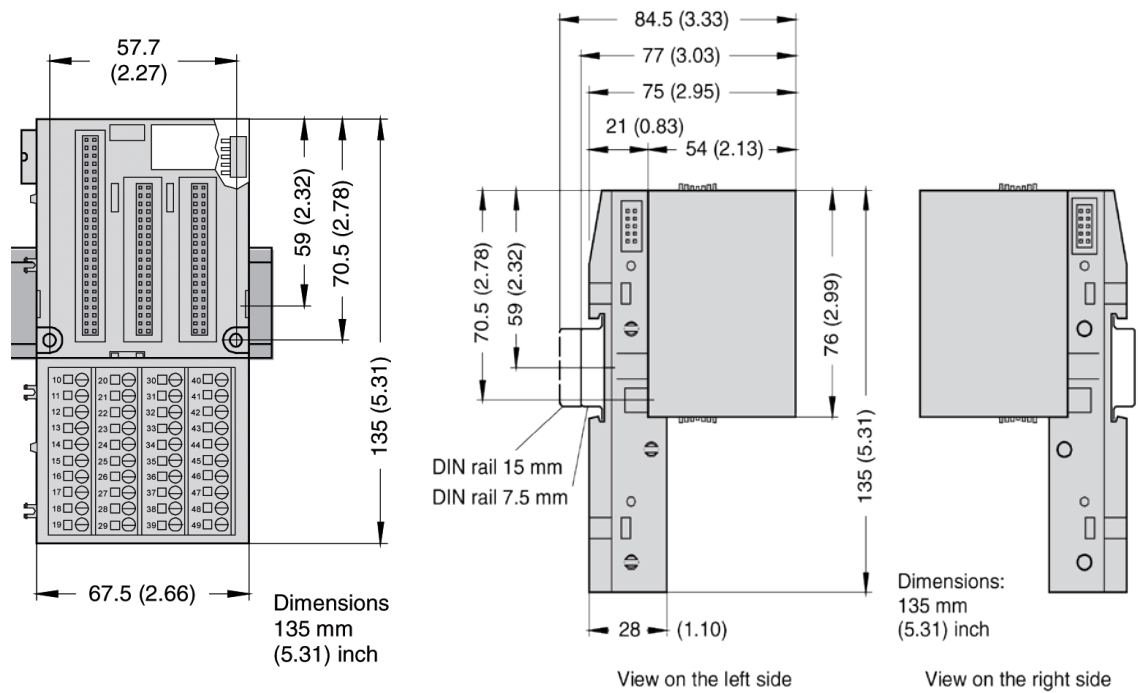
The I/O module or the communication interface is plugged to the terminal block and locked in place by two mechanical locks. The terminal block is then mounted to a DIN rail together with the module. Wall mounting of the terminal block using the TA526 accessory for wall mounting and two screws is alternatively possible.

The terminal blocks are available either with screw terminals or spring-cage terminals. The information provided in the following table applies to both versions.

### 5.2.6.1. Screw/spring-cage terminals

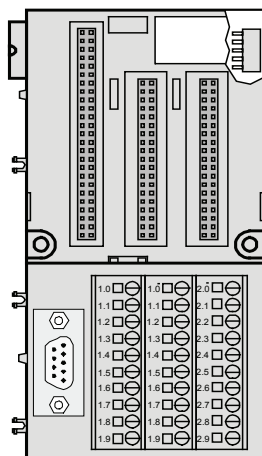
| Number of conductors per terminal | Conductor type | Cross-section                |
|-----------------------------------|----------------|------------------------------|
| 1                                 | Solid          | 0.08 ... 2.5 mm <sup>2</sup> |
| 1                                 | Flexible       | 0.08 ... 2.5 mm <sup>2</sup> |
| 1 with wire end ferrule           | Flexible       | 0.25 ... 1.5 mm <sup>2</sup> |

### 5.2.6.2. Dimensional drawings I/O terminal units



## 5.2.6.3. TU 709F/TU 710F

| Name    | Short description                                       | Article no.     |
|---------|---------------------------------------------------------|-----------------|
| TU 709F | PROFIBUS terminal unit, 24 VDC<br>Screw type terminals  | 3BDH000397R0001 |
| TU 710F | PROFIBUS terminal unit, 24 VDC<br>Spring type terminals | 3BDH000398R0001 |



The TU 709F/710F terminal block serves as a base for the PROFIBUS communication interface CI 741F. The terminal block is rated for 24 V I/O signals. The following terminals are connected with each other inside the terminal block:

- Terminals 2.8 and 3.8: supply voltage UP = +24 V DC
- Terminals 2.9 to 4.9: reference potential ZP = 0 V for UP and UP3

The digital outputs DO0 to DO7 are equipped with an own power supply connection UP3 (4.8) and can thus be separately protected and supplied. The power supply of the PROFIBUS interface, the I/O Bus and the other inputs/outputs is ensured by the UP.

### Technical data

| Technical data TU 709F / TU 710F |                                                                |
|----------------------------------|----------------------------------------------------------------|
| Design                           | Screw terminals / spring-cage terminals                        |
| PROFIBUS DP interface            | 9 pin Sub-D female connector (F)                               |
| Number of channels per module    | 24                                                             |
| Subdivision into groups          | 3 groups of 8 channels each<br>2.0...2.7, 3.0...3.7, 4.0...4.7 |
| Rated voltage                    | 24 V DC                                                        |
| Max. admissible total current    | 10 A, via terminals 2.8, 3.8, 4.8 and between 2.9...4.9        |

5.2.6.4. TU 715F/TU 716F

| Name    | Short description                                             | Article no.     |
|---------|---------------------------------------------------------------|-----------------|
| TU 715F | I/O terminal unit, 24 VDC<br>Screw type terminals, 1/2 wire.  | 3BDH000378R0001 |
| TU 716F | I/O terminal unit, 24 VDC<br>Spring type terminals, 1/2 wire. | 3BDH000382R0001 |

—  
01 TU 715F

—  
02 TU 716F



The I/O Terminal Units TU 715F (screw type terminal) and TU 716F (spring type terminal) are used as a socket for the I/O module, which exclusively incorporates inputs and outputs for 24V DC digital or analog signals. The I/O modules (I/O expansion modules) are placed on the I/O Terminal Unit and locked into place using two mechanical locks. To loosen this connection a screw driver should be inserted in the recess provided and the Terminal Units are carefully pulled away. All electrical connections are made through the Terminal Unit, which allows removal and replacement of the I/O units without disturbing the wiring at the terminal unit.

- The terminals 1.8 to 4.8 and 1.9 to 4.9 are electrically interconnected within the I/O Terminal Unit and always have the same assignment irrespective of which I/O expansion module is inserted:
- Terminals 1.8 to 4.8: Process voltage UP = +24 V DC
  - Terminals 1.9 to 4.9: Process voltage ZP = 0 V

The assignment of other terminals is dependent on the I/O expansion module that is inserted. The supply voltage of +24 V DC device-voltage for the electronic circuitry of the device comes from the I/O expansion bus (I/O Bus) and from the CPU respectively.

Technical data

| Technical data TU 715F / TU 716F |                                                                           |
|----------------------------------|---------------------------------------------------------------------------|
| Design                           | Screw terminals / spring-cage terminals                                   |
| Number of I/O channels           | 32                                                                        |
| Subdivision into groups          | 4 groups of 8 channels each<br>1.0...1.7, 2.0...2.7, 3.0...3.7, 4.0...4.7 |
| Rated voltage                    | 24 V DC                                                                   |
| Max. admissible total current    | 10 A, between the terminals 1.8...4.8 and 1.9...4.9                       |



5.2.6.5. TU 731F/TU 732F

| Name    | Short description                                   | Article no.     |
|---------|-----------------------------------------------------|-----------------|
| TU 731F | I/O terminal unit, 230 VAC<br>Screw type terminals  | 3BDH000380R0001 |
| TU 732F | I/O terminal unit, 230 VAC<br>Spring type terminals | 3BDH000381R0001 |

—  
01 TU 715F

—  
02 TU 716F



The I/O Terminal Units TU 731F (with screw type terminals) and TU 732F (with spring type terminals) are specifically designed for use with AC 700F/AC 900F/S700 I/O modules that incorporate 115-230 V AC inputs and/or 115-230 V AC relay outputs.

The input/output modules (I/O expansion modules) plug into the I/O terminal Unit. When properly seated, they are secured with two mechanical locks. All the electrical connections are made through the Terminal Unit, which allows removal and replacement of the I/O modules without disturbing the wiring at the Terminal Unit.

The terminals 1.8 to 4.8 and 1.9 to 4.9 are electrically interconnected within the I/O Terminal Unit and have always the same assignment, irrespective of which I/O expansion module is inserted:

- Terminals 1.8 to 4.8: Process voltage UP = +24 V DC
- Terminals 1.9 to 4.9: Process voltage ZP = 0 V

The assignment of the other terminals is dependent on the inserted expansion module (see the description of the used expansion module). The supply voltage 24 V DC for the module's electronic circuitry comes from the I/O expansion bus (I/O-Bus) or from the FieldBusPlug or from the AC 700F or AC 900F CPU.

Technical data

| Technical data TU 731F / TU 732 F        |                                                                             |
|------------------------------------------|-----------------------------------------------------------------------------|
| Design                                   | Screw terminals / spring-cage terminals                                     |
| Number of terminals                      | 32                                                                          |
| Distribution of the channels into groups | 4 groups of 8 channels each<br>(1.0...1.7, 2.0...2.7, 3.0...3.7, 4.0...4.7) |
| Rated voltage                            | 230 V AC                                                                    |
| Max. permitted total current             | 10 A, between the terminals 1.8...4.8 and 1.9...4.9                         |

## 5.2.7 S700 I/O Accessories

### 5.2.7.1. Markers for I/O modules

| Name  | Short description                                                                                                                                                               | Article no.     |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| TA523 | Pluggable Marker Holder for I/O modules, 10 pcs.<br>For labelling channels of I/O modules. The marking slips can be printed by users separately using a MS-Word based template. | 1SAP180500R0001 |
| TA525 | White Plastic Markers, 10 pcs.<br>For labelling CPU and I/O modules in AC 700F.                                                                                                 | 1SAP180700R0001 |

## 5.3 S800 Remote I/O



S800 I/O is a comprehensive, distributed and modular process I/O system that communicates with parent controllers via PROFIBUS. Thanks to its broad connectivity, the system is able to communicate with a wide range of process control systems from both ABB and other suppliers. By permitting installation in the field, close to sensors and actuators, S800 I/O greatly reduces the installation cost by reducing the cost of cabling. It is possible to exchange modules and reconfigure the system during operation. Redundancy options allow a high degree of availability.

With its cost-effective design and just 59 mm depth installation, S800L I/O modules are the perfect choice for PLC applications. Robust mechanics, one-piece handling, easy mounting and smart connections save your time in all phases of installation.

Furthermore, S800L I/O with a cost-effective design and smaller footprint is available. To withstand harsh environments, all S800 modules are compliant to G3 severity level ISA-S71.04 , Environmental Conditions for Process Measurement and Control Systems.

**Note:** The S800 modules that can be used with Freelance are listed here.

## 5.3.1 Communication

### 5.3.1.1. Field communication interfaces

| Name                   | Short description                                                                                                                                                                                                                                                                 | Article no.     |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| CI801                  | PROFIBUS DP-V1 Communication Interface<br>Including:<br>1x Power Supply Connector<br>1x TB807 ModuleBus Terminator<br>The basic system software loaded in CI801 does not support the following I/O modules: DI830, DI831, DI885, AI880A, DI880 and DO880.                         | 3BSE022366R1    |
| CI801 Engineering kit  | SW 1.3<br>Including:<br>1x CD with GSD file, Memory Maps and Release Note.<br>1x Reference Manual Memory Maps for CI801.                                                                                                                                                          | 3BSE038540R1300 |
| CI840A                 | PROFIBUS DP-V1 Communication Interface. For 1+1 redundant operation.<br>Two CI840A and one TU847 or one TU846 must be ordered.<br>The basic system software loaded in CI840 does not support the following I/O modules: DI830, DI831, DI885, AI880A, DI880, DO880 and ABB Drives. | 3BSE041882R1    |
| CI840 Engineering kit  | SW 4.0<br>Including:<br>1x CD with GSD file, Memory Maps and Release Notes.<br>1x Reference Manual Memory Maps for CI840.                                                                                                                                                         | 3BSE031694R4000 |
| TU846                  | Module Termination Unit, MTU, for 1+1 CI840. Support for redundant I/O<br>Vertical mounting of modules.<br>Including:<br>1x Power Supply Connector<br>2x TB807 ModuleBus Terminator.                                                                                              | 3BSE022460R1    |
| TU847                  | Module Termination Unit for 1+1 CI840. Support for non-redundant I/O<br>Vertical mounting of modules.<br>Including:<br>1x Power Supply Connector<br>1x TB807 ModuleBus Terminator.                                                                                                | 3BSE022462R1    |
| Front label set        | FCI / AC 70 / TB<br>Sheet with 12 labels. For CI810, CI820, CI830, and TB820.                                                                                                                                                                                                     | 3BSC970089R1    |
| Label set, item design | FCI / AC 70 / TB<br>Sheet with 40 labels. For CI810, CI820, CI830, and TB820.                                                                                                                                                                                                     | 3BSC970091R1    |
| Mounting kit           | For vertical mounting of CI801, CI840 and TB840 on a vertical DIN rail                                                                                                                                                                                                            | 3BSE040749R1    |
| Mounting profile 1800  | 2 DIN rails and 1 cable duct<br>DIN rail length : 1650mm + 210mm (65") + (8.3")                                                                                                                                                                                                   | 3BSE049768R1    |
| Al-profile             | Al-profile with DIN Rail and Cable Duct, mounting 465 mm (19")<br>DIN rail length 429mm (16,9")                                                                                                                                                                                   | 3BSE022255R1    |
| Al-profile             | Al-profile with DIN Rail and Cable Duct for RM550, mounting 592 mm (24")<br>DIN rail length 556mm (21,9")                                                                                                                                                                         | 3BSE022256R1    |

### 5.3.1.2. Upgrade kit and tool cables

Upgrading of CI801 or CI840A to latest software version are available for download from ABB Library/SolutionsBank. Item TK212A is cable

connecting a PC to CI840A for download of software. CI801 requires items TK212A and FS801K01 for download of software.

| Name     | Short description                                                                                                                               | Article no.  |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| TK212A   | Tool cable<br>RJ45 (male) to Dsub-9 (female), length 3 m.<br>RJ45 8P8C plug (with shell).<br>Cable : UL2464 26 AWG x 8C.                        | 3BSC630197R1 |
| FS801K01 | Service adapter kit<br>Including:<br>1x Service adapter FS801<br>1x cable TK802<br>For connection of CI801 to PC. A cable TK812 is also needed. | 3BSE038407R1 |

## 5.3.2 S800 I/O modules

### 5.3.2.1. S800 I/O Analog input modules

| Name   | Short description                                                                                                                                                                                                                                                                                                                 | Article no.  |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| AI810  | Analog Input, 1x8 channels<br>0(4)...20 mA, 0...10 V, 12 bit, single ended, 0.1%, Rated isolation 50 V.<br>Use Module Termination Unit TU810, TU812, TU814, TU830, TU833, TU835, TU838.                                                                                                                                           | 3BSE008516R1 |
| AI815  | Analog Input, 1x8 channels, HART<br>0(4)...20mA, 0(1)..5V, 12bit, single ended, 0.1%, Rated isolation 50V. Current limited transmitter power distribution.<br>Use Module Termination Unit TU810, TU812, TU814, TU830, TU833, TU835 or TU838.                                                                                      | 3BSE052604R1 |
| AI820  | Analog Input, 4x1 channel<br>+-20 mA, 0(4)..20 mA, +-10 V, +-5 V, 0(1)..5 V, diff., 5 0V CMV, 14 bit +sign.<br>Rin(curr)250 Ohm, Rated isolation 50 V.<br>Use Module Termination Unit TU810, TU812, TU814, TU830, TU833.                                                                                                          | 3BSE008544R1 |
| AI825  | Analog Input, 4x1 channel, galvanically isolated<br>-20..20 mA, 0(4)..20 mA, -10...10 V, 0(2)...10 V,<br>Galvanically isolated channels.<br>14 bit+sign, 0.1%, Rated isolation 250 V.<br>Use Module Termination Unit TU811, TU813, TU831.                                                                                         | 3BSE036456R1 |
| AI830A | Analog Input, 1x8 channels RTD<br>Pt100, Ni100/120, Cu10, R, Rated isolation 50 V.<br>Use Module Termination Unit TU810, TU812, TU814, TU830, TU833.                                                                                                                                                                              | 3BSE040662R1 |
| AI835A | Analog Input, 8 channels, Thermocouple / mV<br>Rated isolation 50 V.<br>Use Module Termination Unit TU810, TU812, TU814, TU830, TU833.                                                                                                                                                                                            | 3BSE051306R1 |
| AI843  | Analog Input, Redundant or Single 1x8 channels, Thermocouple / mV<br>Rated isolation 50 V.<br>Use Modules Termination Unit TU818, TU830, TU833, TU842, TU843 and TU852.                                                                                                                                                           | 3BSE028925R1 |
| AI845  | Analog Input, redundant or single, 1x8 channels HART<br>0(4)...20 mA, 0(1)...5 V, 12 bit, single ended, 0.1%, Rated isolation 50 V.<br>Current limited transmitter power distribution. Advanced on-board diagnostics.<br>Use Module Termination Unit TU810, TU812, TU814, TU818, TU830, TU833, TU835, TU838, TU844, TU845, TU854. | 3BSE023675R1 |
| AI890  | Analog Input, 1x8 channels with Intrinsic Safety Interface<br>(4)..20 mA single ended 0.1%. Rated isolation 50 V.<br>Use Module Termination Unit TU890 or TU891                                                                                                                                                                   | 3BSC690071R1 |

| Name  | Short description                                                                                                                                                                                                    | Article no.  |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| AI893 | Analog Input 8 channels, temperature measuring. Intrinsic Safety Interface, G3 compliant<br><br>For TC and RTD sensors. Rated isolation 50 V.<br>Protection class G3.<br>Use Module Termination Unit TU890 or TU891. | 3BSC690141R1 |
| AI895 | Analog Input, 1x8 channels with Intrinsic Safety and HART, G3 compliant.<br><br>4..20 mA single ended 0,1%. Rated isolation 50 V.<br>Protection class G3.<br>Use Module Termination Unit TU890 or TU891.             | 3BSC690086R1 |

### 5.3.2.2. S800 I/O Analog output modules

| Name    | Short description                                                                                                                                                                                                                                                                       | Article no.  |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| AO810V2 | Analog Output, 1x8 channels, 0(4)..20 mA<br><br>0(4)...20 mA, 14 bit RLmax 500/850 Ohm,<br>Rated isolation 50 V.<br>Use module Termination Unit TU810, TU812, TU814, TU830 or TU833.                                                                                                    | 3BSE038415R1 |
| AO815   | Analog Output, 1x8 channels, HART<br><br>4..20mA, 12bit, 0.1%, RLmax 750 ohm, Rated isol. 50V.<br>Use Module Termination Unit TU810, TU812, TU814, TU830 or TU833.                                                                                                                      | 3BSE052605R1 |
| AO820   | Analog Output, 4x1 channel<br><br>+-20 mA, 0(4)..20 mA, +-10 V, 12 bit+sign. Indiv. isolation channels. RL max 500 Ohm, Rated isolation 50 V.<br>Use Module Termination Unit TU810, TU812, TU814, TU830, TU833.                                                                         | 3BSE008546R1 |
| AO845A  | Analog Output, redundant or single, 1x8 channels, HART<br><br>4...20 mA, 12 bit, 0.1%, RLmax 750 ohm,<br>Rated isolation 50 V.<br>Advanced on-board diagnostics.<br>Loop supervised DI function.<br>Use Module Termination Unit TU810, TU812, TU814, TU830, TU833, TU842, TU843, TU852. | 3BSE045584R1 |
| AO890   | Analog Output, 1x8 channels with Intrinsic Safety Interface<br><br>0 (4)..20 mA 0,1%. RL max 750 Ohm Rated isolation 50 V.<br>Use Module Termination Unit TU890 or TU891.                                                                                                               | 3BSC690072R1 |
| AO895   | Analog Output 1x8 channels with Intrinsic Safety and HART. G3 compliant<br><br>4..20 mA 0,1%. RL max 750 Ohm Rated isolation 50 V.<br>Protection class G3.<br>Use Module Termination Unit TU890 or TU891.                                                                               | 3BSC690087R1 |

## 5.3.2.3. S800 I/O Digital input modules

| Name  | Short description                                                                                                                                      | Article no.  |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| DI810 | Digital Input, 24 VDC, 2x8 channels                                                                                                                    | 3BSE008508R1 |
|       | Rated isolation 50 V. Use Module Termination Unit TU810, TU812, TU814, TU818, TU830, TU833, TU838, TU850.                                              |              |
| DI811 | Digital Input, 48 VDC, 2x8 channels                                                                                                                    | 3BSE008552R1 |
|       | Rated isolation 50 V. Use Module Termination Unit TU810, TU812, TU814, TU818, TU830, TU833, TU838, TU850.                                              |              |
| DI814 | Digital Input, 24 VDC, 2x8 channels                                                                                                                    | 3BUR001454R1 |
|       | Rated isolation 50 V. Use Module Termination Unit TU810, TU812, TU814, TU830, TU833, TU838.                                                            |              |
| DI818 | Digital Input, 24 VDC, 2x16 channels                                                                                                                   | 3BSE069052R1 |
|       | Rated isolation 50 V. Use Module Termination Unit TU818, TU819, TU830.                                                                                 |              |
| DI820 | Digital Input, 120 VAC, 8x1 channel                                                                                                                    | 3BSE008512R1 |
|       | Rated isolation 250 V. Use Module Termination Unit TU811, TU813, TU831, TU839, TU851.                                                                  |              |
| DI821 | Digital Input, 230 VAC, 8x1 channel                                                                                                                    | 3BSE008550R1 |
|       | Rated isolation 250 V. Individually galvanic isolated channels. Use Module Termination Unit TU811, TU813, TU831, TU839, TU851.                         |              |
| DI828 | Digital Input, 120 V AC/DC, 16x1 channel                                                                                                               | 3BSE069054R1 |
|       | Rated isolation 250 V. Use Module Termination Unit TU851. Individually galvanic isolated channels.                                                     |              |
| DI840 | Digital Input, redundant or single, 24 VDC, 1x16 channels                                                                                              | 3BSE020836R1 |
|       | Advanced On-Board diagnostics. Rated isolation 50 V. Use Module Termination Unit TU810, TU812, TU814, TU818, TU830, TU833, TU838, TU842, TU843, TU852. |              |
| DI890 | Digital Input, 8x1 channel with Intrinsic Safety Interface                                                                                             | 3BSC690073R1 |
|       | Rated isolation 50 V. Use Module Termination Unit TU890 or TU891.                                                                                      |              |

### 5.3.2.4. S800 I/O Digital output modules

| Name  | Short description                                                                                                                                                                                                                        | Article no.  |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| DO810 | Digital Output, 24 VDC, 2x8 channels<br>0.5 A, Short circuit proof, Rated isolation 50 V.<br>Use Module Termination Unit TU810, TU812, TU814, TU830, TU833.                                                                              | 3BSE008510R1 |
| DO814 | Digital Output, current sinking, 2x8 channels<br>0,5 A, shortcut circuit proof, Rated isolation 50 V.<br>Use Module Termination Unit TU810, TU812, TU814, TU830, TU833, TU838.                                                           | 3BUR001455R1 |
| DO815 | Digital Output, 24 VDC, 2x4 channels<br>2.0 A short circuit proof. Rated isolation 50 V.<br>Use Module Termination Unit TU810, TU812, TU814, TU830, TU833.                                                                               | 3BSE013258R1 |
| DO818 | Digital Output, 24 VDC, 2x16 channels<br>0.5A, Short circuit proof, Rated isolation 50V<br>Use Module Termination Unit TU818, TU819, TU830.                                                                                              | 3BSE069053R1 |
| DO820 | Digital Output, Relay, normal open, 8x1 channel<br>24-230 VAC 3 A, cos phi>0.4, d.c. 42 W, Rated isolation 250 V.<br>Individually galvanic isolated channels.<br>Use Module Termination Unit TU811, TU813, TU831, TU836, TU837, TU851.   | 3BSE008514R1 |
| DO821 | Digital Output, Relay, normal closed, 8x1 channel<br>24-230 VAC 3 A, cos phi>0.4, d.c. 42 W. Rated isolation 250 V.<br>Individually galvanic isolated channels.<br>Use Module Termination Unit TU811, TU813, TU831, TU836, TU837, TU851. | 3BSE013250R1 |
| DO828 | DO828 Digital Output, Relay Normally Open, 16x1 channel<br>5-250VAC and 5-125VDC, max 2A, Rated isolation 250V.<br>Use Module Termination Unit TU851.                                                                                    | 3BSE069055R1 |
| DO840 | Digital Output, redundant or single, 2x8 channels<br>Isolated in two groups of 8 channels.<br>0.5A. Advanced On-board diagnostics.<br>Use Module Termination Unit TU810, TU812, TU814, TU830, TU833, TU842, TU843, TU852.                | 3BSE020838R1 |
| DO890 | Digital Output, 4x1 channel with Intrinsic Safety Interface<br>Rated isolation 50 V.<br>Individually galvanic isolated channels.<br>Use Module Termination Unit TU890 or TU891.                                                          | 3BSC690074R1 |

### 5.3.2.5. S800 I/O Pulse counting modules

| Name  | Short description                                                                                                                                                                                                                     | Article no.  |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| DP820 | Pulse Counter RS-422, Current, 5 V, (12 V), 24 V<br>2 channels bidirectional pulse counters and frequency measurement. 1,5 MHz Rated isolation 50 V.<br>Use Module Termination Unit TU810, TU812, TU814, TU830, TU833.                | 3BSE013228R1 |
| DP840 | Pulse Counter or Frequency Measurement Module, redundant or single, 1x8 channels.<br>20 kHz. Rated isolation 50 V.<br>Use Module Termination Unit TU810, TU812, TU814, TU818, TU830, TU833, TU842, TU843, TU844, TU845, TU852, TU854. | 3BSE028926R1 |

### 5.3.2.6. Label sets for S800 I/O modules

| Name                               | Short description                                                                     | Article no.  |
|------------------------------------|---------------------------------------------------------------------------------------|--------------|
| Transparent film fronts            | Set of 12 transparent plastic film fronts.<br>To be used with ordinary paper quality. | 3BSE072159R1 |
| White colored plastic coated paper | One sheet of size A4. Original paper quality. No need to use transparent films.       | 3BSE072160R1 |

## 5.3.2.7. Module termination units for S800

| Name     | Short description                                                                                                                                                                                        | Article no.  |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| TU805K01 | Termination Units<br>Termination Units for two or three wire connection of DI801 and DO801.<br>Include 10 pcs of Termination Unit TU805.                                                                 | 3BSE035990R1 |
| TU810V1  | Compact Module Termination Unit 50 V<br>2x8 signal terminals, rated isolation 50 V.                                                                                                                      | 3BSE013230R1 |
| TU811V1  | Compact Module Termination Unit 250 V<br>1x8 signal terminals rated isolation 250 V.                                                                                                                     | 3BSE013231R1 |
| TU812V1  | Compact Module Termination Unit 50 V<br>With 25 pin D-sub connector, rated isolation 50 V. D-sub (female) connector is not enclosed.                                                                     | 3BSE013232R1 |
| TU813    | Compact Module Termination Unit 250 V<br>2x8 Signal terminals, Rated isolation 250 V. Detachable (pluggable) connectors are enclosed.<br>Crimped snap-in connectors.                                     | 3BSE036714R1 |
| TU814V1  | Compact Module Termination Unit 50 V<br>2x8 Signal terminals, rated isolation 50V. For crimped snap-in connectors. Detachable (pluggable) connectors are enclosed.                                       | 3BSE013233R1 |
| TU818    | Compact Module Termination Unit, MTU, 50V<br>1x32 (and 2x16) signal terminals, Rated isol. 50V                                                                                                           | 3BSE069209R1 |
| TU819    | Compact Module Termination Unit, MTU, 50V<br>With 2x25 pin D-sub connector, Rated isol. 50V, D-sub (female) connector is not enclosed                                                                    | 3BSE068891R1 |
| TU830V1  | Extended Module Termination Unit 50 V<br>2x16 signal terminals rated isolation 50 V.                                                                                                                     | 3BSE013234R1 |
| TU831V1  | Extended Module Termination Unit 250 V<br>2x8 signal terminals rated isolation 250 V.                                                                                                                    | 3BSE013235R1 |
| TU833    | Extended Module Termination Unit 50 V<br>2x16 signal terminals, Rated isolation 50 V. Spring-cage terminals.                                                                                             | 3BSE038726R1 |
| TU835V1  | Extended Module Termination Unit 50 V<br>8 fused power outlets, 8 signal terminals, rated isolation 50 V                                                                                                 | 3BSE013236R1 |
| TU836V1  | Extended Module Termination Unit 250 V<br>2x4 fused signals, 2x4 return terminals, 2x2 L terminals, 2x2 N terminals. Rated isolation 250 V.                                                              | 3BSE013237R1 |
| TU837V1  | Extended Module Termination Unit 250 V<br>8x1 fused isolated signals, 8x1 L terminals, 2x6 N terminals. Rated isolation 250 V.                                                                           | 3BSE013238R1 |
| TU838    | Extended Module Termination Unit, MTU, 50V.<br>2x4 fused transducer power outlets, 16 signal terminals, 2x4 return terminals, 2x2 L+, 2x2 L- terminals, rated isol. 50V. Module is mounted horizontally. | 3BSE008572R1 |
| TU839    | Extended Module Termination Unit, 250V<br>2x8 signal terminals, 2x4 fused sensor power, Rated isolation 250V.                                                                                            | 3BSE046966R1 |
| TU842    | Module Termination Unit, MTU, for redundant applications, 50V.<br>Used with redundant I/O. Horizontal mounted DIN rail. Rated isolation 50V                                                              | 3BSE020850R1 |
| TU843    | Module Termination Unit, MTU, for redundant applications, 50V.<br>Used with redundant I/O. Vertical mounted DIN rail. Rated isolation 50V.                                                               | 3BSE021443R1 |
| TU844    | Module Termination Unit, MTU, for redundant applications, 50V.<br>Used with redundant I/O. Horizontal mounted DIN rail. Rated isolation 50V. Shunt Stick not included.                                   | 3BSE021445R1 |
| TU845    | Module Termination Unit, MTU, for redundant applications, 50V.<br>Used with redundant I/O. Vertical mounted DIN rail. Rated isolation 50V. Shunt Stick not included.                                     | 3BSE021447R1 |



| Name     | Short description                                                                                                                                                                                           | Article no.  |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| TU850    | Extended Module Termination Unit, MTU, 50V<br>2x8 signal terminals and 2x8 disconnetable current limited sensor/transmitter outlet power terminals. Rated isolation 50V.                                    | 3BSE050930R1 |
| TU851    | Extended Module Termination Unit, MTU, 250V<br>2x16 signal terminals, Rated isolation 250V                                                                                                                  | 3BSE068782R1 |
| TU852    | Module Termination Unit, MTU, for redundant applications, 50V<br>Horizontal mounted DIN rail, used with redundnat I/O modules, with 2x25 pin D-sub connector, Rated isolation 50V                           | 3BSE069964R1 |
| TU854    | Module Termination Unit, MTU, for redundant applications, 50V<br>Horizontal mounted DIN rail, used with redundnat I/O modules, with 1x25 pin D-sub connector, Rated isolation 50V, Shunt Stick not included | 3BSE069966R1 |
| TU890    | Module Termination Unit for Intrinsic Safety applications<br>3x9 signal terminals Rated isol. 50V.                                                                                                          | 3BSC690075R1 |
| TU891    | Module Termination Unit for non Intrinsic Safety applications<br>3x9 signal terminals Rated isol. 50V.                                                                                                      | 3BSC840157R1 |
| TY801K01 | 8pcs Shunt Stick TY801<br>125 + 125 ohms shunt. Used for AI845 and AI880A on TU834, TU844, TU845, TU854.                                                                                                    | 3BSE023607R1 |
| TY804K01 | 8pcs Shunt Stick TY804<br>1000 Ohm shunt. Used for DP840 on TU844, TU845, TU854                                                                                                                             | 3BSE033670R1 |
| TY805K01 | 8pcs Shunt Stick<br>125 + 125 ohms shunt with current limitation on transmitter power. Used for AI845 and AI880A on TU834, TU844, TU845, TU854.                                                             | 3BSE081160R1 |
| TY820K01 | 10pcs Temperature Sensor TY820<br>TY820 is a temperature sensor with a PT 100 element. Can be used with AI835/AI835A and AI843 to measure cold junction Temperature.                                        | 3BSE056980R1 |

## 5.4 S800 I/O modules

### 5.4.2.1. S800 I/O Analog input modules



| Name  | Short description                                                      | Article no.  |
|-------|------------------------------------------------------------------------|--------------|
| AI801 | Analog Input, 1x8 channels<br>0(4)..20 mA, 12 bit, single ended, 0.1%. | 3BSE020512R1 |

### 5.4.2.2. S800L Analog output modules

| Name  | Short description                                                  | Article no.  |
|-------|--------------------------------------------------------------------|--------------|
| AO801 | Analog Output, 1x8 channels<br>0(4)..20 mA, 12 bit, RLmax 850 Ohm. | 3BSE020514R1 |

### 5.4.2.3. S800L Digital input modules

| Name  | Short description                                                                    | Article no.  |
|-------|--------------------------------------------------------------------------------------|--------------|
| DI801 | Digital Input, 24 VDC, 1x16 channels<br>Current sink.                                | 3BSE020508R1 |
| DI802 | Digital Input, 120 VAC / DC, 8x1 channel<br>Individually galvanic isolated channels. | 3BSE022360R1 |
| DI803 | Digital Input, 230 VAC / DC, 8x1 channel<br>Individually galvanic isolated channels. | 3BSE022362R1 |

### 5.4.2.4. S800L Digital output modules

| Name  | Short description                                                                                        | Article no.  |
|-------|----------------------------------------------------------------------------------------------------------|--------------|
| DO801 | Digital Output, 24 VDC, 16 channels<br>0.5 A. Short circuit proof.                                       | 3BSE020510R1 |
| DO802 | Digital Output, Relay, normal open, 8x1 channel<br>24-230 V AC. Individually galvanic isolated channels. | 3BSE022364R1 |

### 5.4.2.5. Label sets for S800L I/O modules

| Name            | Short description                                                                                                                                                             | Article no.  |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Label Set S800L | 16 channels<br>Text colour: Black , Text style: Helv. reg., Text height: 2mm,<br>Material: Polyesterfilm Xeroperm t=0,12 Sheet with 12 labels for 16 channels<br>I/O modules. | 3BSE019419R1 |
| Label Set S800L | 8 channels<br>Text colour: Black , Text style: Helv. reg., Text height: 2mm,<br>Material: Polyesterfilm Xeroperm t=0,12 Sheet with 12 labels<br>for 8 channels I/O modules.   | 3BSE019419R2 |

### 5.4.2.6. S800L ModuleBus communication parts

| Name  | Short description                                                                                                 | Article no.  |
|-------|-------------------------------------------------------------------------------------------------------------------|--------------|
| TB805 | Bus Outlet<br>ModuleBus extension cable adaptor D-sub 25, female.<br>One required per extension cable TK801.      | 3BSE008534R1 |
| TB845 | Dual ModuleBus outlet<br>ModuleBus extension cable adaptor two D-sub, female.<br>Two TK801 cables for redundancy. | 3BSE021437R1 |

| Name      | Short description                                                                                                                                                                                             | Article no.  |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| TB806     | Bus Inlet<br>ModuleBus extension cable adaptor D-sub 25, male.<br>One required per extension cable TK801.                                                                                                     | 3BSE008536R1 |
| TB846     | Dual ModuleBus inlet<br>ModuleBus extension cable adaptor two D-sub, male.<br>Two TK801 cables for redundancy.                                                                                                | 3BSE021439R1 |
| TK801V003 | TK801V003 Cable<br>ModuleBus Extension Shielded Cable 0.3m D-sub 25, male-female.<br>G3 compliant.                                                                                                            | 3BSC950089R1 |
| TK801V006 | TK801V006 Cable<br>ModuleBus Extension Shielded Cable 0.6m D-sub 25, male-female.<br>G3 compliant.                                                                                                            | 3BSC950089R2 |
| TK801V012 | TK801V012 Cable<br>ModuleBus Extension Shielded Cable 1.2m D-sub 25, male-female.<br>G3 compliant.                                                                                                            | 3BSC950089R3 |
| TB807     | ModuleBus terminator<br>G3 compliant.                                                                                                                                                                         | 3BSE008538R1 |
| TB820V2   | ModuleBus Cluster Modem<br>Optical cluster modem for non redundant operation. Including:<br>1x Power Supply Connector<br>1x TB807 ModuleBus Terminator.                                                       | 3BSE013208R1 |
| TB840A    | ModuleBus Cluster Modem<br>Optical cluster modem for 1+1 redundant operation.                                                                                                                                 | 3BSE037760R1 |
| TB842     | ModuleBus Optical Port<br>Used together with CI801 and CI840, connected via TB806 or TB846.<br>10 Mbits driver.                                                                                               | 3BSE022464R1 |
| TU807     | Termination Unit for TB840/TB840A<br>Support for single modulebus I/O.<br>Including: 1 pcs TB807                                                                                                              | 3BSE039025R1 |
| TU840     | Termination Unit for 1+1 TB840. Support for redundant I/O<br>Including:<br>1 pcs Power Supply Connector<br>2 pcs TB807 Modulebus Terminator                                                                   | 3BSE020846R1 |
| TU841     | Termination unit for 1+1 TB840. Support for non-redundant I/O<br>Including:<br>1 pcs Power Supply Connector<br>1 pcs TB807 Modulebus Terminator                                                               | 3BSE020848R1 |
| TU848     | MTU with individual power supply for red. TB840/TB840A.<br>TU848 Termination Unit for 1+1 TB840. Support for redundant I/O.<br>Including:<br>1 pcs Power Supply Connector<br>2 pcs TB807 Modulebus Terminator | 3BSE042558R1 |
| TU849     | Termination Unit for 1+1 TB840<br>MTU with individual power supply. Support for non-redundant I/O.<br>Including:<br>1 pcs Power Supply Connector<br>1 pcs TB807 Modulebus Terminator                          | 3BSE042560R1 |
| TK811V015 | POF Cable, 1.5 m, Duplex<br>L = 1.5 m latching duplex connector Duplex plastic fibre.                                                                                                                         | 3BSC950107R1 |
| TK811V050 | POF Cable, 5 m, Duplex<br>L = 5 m latching duplex connector Duplex plastic fibre.                                                                                                                             | 3BSC950107R2 |
| TK811V150 | POF Cable, 15 m, Duplex<br>L = 15 m latching duplex connector Duplex plastic fibre.                                                                                                                           | 3BSC950107R3 |
| TK812V015 | POF Cable, 1.5 m, Simplex<br>L = 1.5 m latching connector Simplex plastic fibre.                                                                                                                              | 3BSC950118R1 |
| TK812V050 | POF Cable, 5 m, Simplex<br>L = 5.0 m latching connector Simplex plastic fibre.                                                                                                                                | 3BSC950118R2 |
| TK812V150 | POF Cable, 15 m, Simplex<br>L = 15 m latching connector Simplex plastic fibre.                                                                                                                                | 3BSC950118R3 |

## 5.4.1 Power supplies

| Name   | Short description                                                                                                                                                                                                                          | Article no.  |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| SD822Z | Power Supply Device, G3 Compliant<br>Input 115/230V a.c. switch selectable, output 24V d.c., 5A.<br>If redundant power application is required connect to SS822Z Voting Unit.<br>Width = 65mm. DIN rail mounted.                           | 3BSC610054R1 |
| SS822Z | Power Voting Unit, G3 Compliant<br>With dual 24V d.c 20A inputs, single 24V d.c. 20A output. Each power input supervised. Used if redundant power supply is required. For use with power supply SD822Z.<br>Width = 50mm. DIN rail mounted. | 3BSC610055R1 |
| SD831  | Power Supply Device, G2 Compliant<br>Input 100-240 VAC or 110-300 VDC. Output 24 VDC, 3 A. If redundant power application is required connect to SS8XX Voting unit.<br>Width = 35 mm. DIN rail mounted.                                    | 3BSC610064R1 |
| SD832  | Power Supply Device, G2 Compliant<br>Input 100-120 / 200-240 VAC. Output 24 VDC, 5 A, auto-select input. If redundant power application is required connect to SD8XX Voting unit.<br>Width = 35 mm. DIN rail mounted.                      | 3BSC610065R1 |
| SD833  | Power Supply Device, G2 Compliant<br>Input 100-120 / 200-240 VAC, auto-select input. Output 24 VDC, 10 A. If redundant power application is required connect to SD8XX Voting unit.<br>Width = 60 mm. DIN rail mounted.                     | 3BSC610066R1 |
| SD834  | Power Supply Device, G2 Compliant<br>Input 100-240 VAC or 110-300 VDC. Output 24 VDC, 20 A. If redundant power application is required connect to SS8XX Voting unit.<br>Width = 85 mm. DIN rail mounted.                                   | 3BSC610067R1 |
| SD853  | Power Supply 10A, G3 Compliant<br>10A Power Supply Module. Input AC 100-240V. Input DC 110-150V. Output DC 24-28V.<br>Width = 39mm. Mounting on horizontal DIN rail.                                                                       | 3BSE088188R1 |
| SD854  | Power Supply 20A, G3 Compliant<br>20A Power Supply Module. Input AC 100-240V. Input DC 110-150V. Output DC 24-28V.<br>Width = 48mm. Mounting on horizontal DIN rail.                                                                       | 3BSE088189R1 |
| SS832  | Voting Device, G2 Compliant<br>Input 24 VDC. Dual 24 V to single 24 V, 2x 10 A.<br>Width = 35 mm. DIN rail mounted.                                                                                                                        | 3BSC610068R1 |
| SS855  | Power Voting Unit 40A, G3 compliant<br>Input DC 24V. 2x20A in and 1x40A out.<br>Width = 36mm. Mounting on horizontal DIN rail.                                                                                                             | 2PAA125624R1 |

## 5.4.2 S800 I/O user documentation

| Name     | Short description                                                              | Article no.    |
|----------|--------------------------------------------------------------------------------|----------------|
| S800 I/O | Getting Started<br>User's Guide.                                               | 3BSE020923-600 |
| S800 I/O | Modules and Termination Units<br>User's Guide.                                 | 3BSE020924-600 |
| S800 I/O | Fieldbus Communication Interface for PROFIBUS DP/DPV1<br>User's Guide.         | 3BSE020926-600 |
| S800 I/O | Modules and Termination Units with Intrinsic Safety Interface<br>User's Guide. | 3BSE020927-600 |

## 5.5 S900 Remote I/O

TU 921N



TU 921S/B



### 5.5.1 Introduction to S900 I/O system

S900 provides the input and output modules needed for intrinsically safe field signal connection. The field signals are digitized in every S900 functional module, electrically isolated, and then output via an internal serial bus. The communication interface converts the signals to adapt them to the standardized PROFIBUS-DP V1 fieldbus protocol.

Supervisory process control systems, DCS or SCADA systems use an intrinsically safe fieldbus to communicate with the communication interface. A PROFIBUS connect allows the configuration of the individual S900 stations with cyclic data exchange, acyclic services and communication with HART-compatible field instruments. All functional modules can be replaced easily and quickly, which is an advantage especially in the installation or maintenance phase in hazardous area. The functional modules and the – optionally redundant – communication interface modules placed in Zone 1 can be removed and plugged in while operation is running.

Integrated encapsulated switch-off mechanisms allow for hot swapping of the power supplies. Due to its little space requirements and robust design and its environmentally ruggedized case,

the S900 Remote I/O System is a cost-saving solution for use on site, in hazardous Zone 1 or Zone 2 areas (ATEX).

#### No external signal adaptation or routing required

S900 provides various input and output modules: Analog input modules with or without integral transmitter supply, or with direct temperature measuring input for 2-, 3- or 4-wire resistance thermometers or thermocouples with internal cold junction compensation. Analog output modules for direct positioner or actuator control. Solenoid driver units or NAMUR inputs for intrinsically safe and short-circuit-proof power supply of digital field instruments.

Additionally, options are available for critical applications, allowing for channel-wise electrical isolation of the inputs and outputs. S900 permits direct connection of the entire field level through only 2 lines. As no separate routing, power supply or fusing is needed, the installation cost is reduced considerably.

Three different series with different use and with different approvals are available.

| Series | Assembly      | Field devices / signals                           | Hazardous area approval   |
|--------|---------------|---------------------------------------------------|---------------------------|
| S      | In Zone 1     | In Zones 2, 1, and 0 (intrinsically safe signals) | ATEX Zone 1 (Blue TU921S) |
| B      | In Zone 2     | In Zones 2, 1, and 0 (intrinsically safe signals) | ATEX Zone 2 (Blue TU921B) |
| N      | In safe areas | In safe areas                                     | No (Black TU921N)         |

For details about S900 I/O please refer to the S900 catalog, document number 3BDD010420.

## 5.5.2 Redundant termination unit TU921S/B/N

- Termination unit for up to 16 I/O modules
- Prepared for redundant system power and communication
- Up to 4 terminals per channel
- Preselection of fieldbus address
- Prepared for certified field housing
- Mounting in Zone 1 or Zone 2 possible



| Name   | Short description                                                                                                          | Article no.     |
|--------|----------------------------------------------------------------------------------------------------------------------------|-----------------|
| TU921S | Redundant Termination Unit (TU16R-Ex)<br>For 16 I/O-modules. Redundant communication and power. (Delivery includes CD910). | 3KDE175111L9210 |
| TU921B | Redundant Termination Unit (TU16R-B)<br>For 16 I/O-modules. Redundant communication and power. (Delivery includes CD910).  | 3KDE175112L9210 |
| TU921N | Redundant Termination Unit (TU16R)<br>For 16 I/O-modules. Redundant communication and power. (Delivery includes CD910).    | 3KDE175113L9210 |

## 5.5.3 Power supplies SA920S/B/N

The remote S900 I/O system, type B and type S must be equipped in such way that total power consumption of all S900 I/O modules and S900 Communication Interfaces does not exceed 55 watts.

SA920S, Power Supply for 24 V DC. Compared to previously used power supply SA910S (45 W) the SA920S (55 W) has a 10 W higher output power.

SA920B, Power supply for redundant termination unit TU921B (TU16R-B) in S900 I/O. For installation in hazardous area Zone 2. For connecting intrinsically safe field devices installed in Zone 2 or Zone 1 or Zone 0.

With an S900 I/O System of type N, the total power consumption of the power units SA920N in an S900 I/O System station must not exceed the power limit of 70 watts.



| Name   | Short description                                                                                                                                                                                               | Article no.  |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| SA920S | Power Supply<br>For 24 VDC.<br>The power supply filter type BP901S is not required.<br>Do not mix SA910S with SA920S for redundancy (observe Release Notes).                                                    | 3BDH000602R1 |
| SA920B | Power Supply<br>For 24 VDC.<br>The power supply filter type BP901S is not required.<br>SA920B is the functional replacement for SA910B<br>Do not mix SA910B with SA920B for redundancy (observe Release Notes). | 3BDH000601R1 |
| SA920N | Power Supply<br>For 24 VDC.<br>The power supply filter type BP901S is not required.<br>SA920N is the functional replacement for SA910N<br>Do not mix SA910N with SA920N for redundancy (observe Release Notes). | 3BDH000600R1 |

## 5.5.4 Digital I/O modules

### Digital I/O modules DX910S/B/N

- Input for dry contacts or proximity switches (NAMUR)
- Output for low power intrinsically safe valves
- Short and break detection
- Electrical isolation between input / bus and input / power
- Common return for all inputs / outputs
- Configurable as a mixture of inputs and outputs
- 8 I/O channel



| Name   | Short description                                                                                                             | Article no.     |
|--------|-------------------------------------------------------------------------------------------------------------------------------|-----------------|
| DX910S | Digital Input or Output (DIO8-Ex)<br>Input for dry contact or NAMUR initiator.<br>Output for low power intrinsic safe valves. | 3KDE175311L9100 |
| DX910B | Digital Input or Output (DIO8-B)<br>Input for dry contact or NAMUR initiator.<br>Output for low power intrinsic safe valves.  | 3KDE175312L9100 |
| DX910N | Digital Input or Output (DIO8)<br>Input for dry contact or NAMUR initiator.<br>Output for low power valves.                   | 3KDE175313L9100 |

### Solenoid driver DO910S/B/N

- Output for intrinsically safe valves or alarms
- Integrated driving power
- Short and break detection
- Electrical isolation between output / bus and output / power
- Electrical isolation channel to channel
- 4 channels



| Name   | Short description                                            | Article no.     |
|--------|--------------------------------------------------------------|-----------------|
| DO910S | Digital Output (DO4-Ex)<br>Output for intrinsic safe valves. | 3KDE175321L9100 |
| DO910B | Digital Output (DO4-B)<br>Output for intrinsic safe valves.  | 3KDE175322L9100 |
| DO910N | Digital Output (DO4)<br>Output for valves.                   | 3KDE175323L9100 |

**Frequency input DP910S/B/N**

- Frequency input for dry contacts or proximity switches
- Short and break detection
- Electrical isolation between input / bus and input / power
- Frequency measurement or counting applications
- 2 Function blocks
- Reset via fieldbus or control input
- Status outputs / Direction recognition



| Name   | Short description                                                     | Article no.     |
|--------|-----------------------------------------------------------------------|-----------------|
| DP910S | Frequency Input (FI2-Ex)<br>Input for dry contact or NAMUR initiator. | 3KDE175361L9100 |
| DP910B | Frequency Input (FI2-B)<br>Input for dry contact or NAMUR initiator.  | 3KDE175362L9100 |
| DP910N | Frequency Input (FI2)<br>Input for dry contact or NAMUR initiator.    | 3KDE175363L9100 |

**5.5.5 Analog I/O modules****Analog input AI910S/B/N**

- Power supply for 4...20 mA loop powered 2-wire transmitters
- Short and break detection
- Electrical isolation between input / bus and input / power
- Common return for all inputs
- 4 channels



| Name   | Short description                                             | Article no.     |
|--------|---------------------------------------------------------------|-----------------|
| AI910S | Analog Input (AI4-Ex)<br>Transmitter power supply, 4...20 mA. | 3KDE175511L9100 |
| AI910B | Analog Input (AI4-B)<br>Transmitter power supply, 4...20 mA.  | 3KDE175512L9100 |
| AI910N | Analog Input (AI4)<br>Transmitter power supply, 4...20 mA.    | 3KDE175513L9100 |



**Analog input, HART, AI930S/B/N**

- Power supply for 4...20 mA loop powered 2-wire transmitters
- Short and break detection
- Electrical isolation between input / bus and input / power
- Common return for all inputs
- 4 channels
- Transmission of HART frames via the fieldbus
- Cyclic HART variables



| Name   | Short description                                                   | Article no.     |
|--------|---------------------------------------------------------------------|-----------------|
| AI930S | Analog Input, HART (AI4H-Ex)<br>Transmitter power supply, 4..20 mA. | 3KDE175511L9300 |
| AI930B | Analog Input, HART (AI4H-B)<br>Transmitter power supply, 4..20 mA.  | 3KDE175512L9300 |
| AI930N | Analog Input, HART (AI4H)<br>Transmitter power supply, 4..20 mA.    | 3KDE175513L9300 |

**Analog input, HART, passive, AI931S/B/N**

- Passive inputs for 0/4...20 mA
- Short and break detection
- Electrical isolation between input / bus and input / power
- Common return for all inputs
- 4 channels
- Transmission of HART frames via the fieldbus
- Cyclic HART variables



| Name   | Short description                                          | Article no.     |
|--------|------------------------------------------------------------|-----------------|
| AI931S | Analog Input, HART (AI4H-Ex)<br>Passive input, 0/4..20 mA. | 3KDE175511L9310 |
| AI931B | Analog Input, HART (AI4H-B)<br>Passive input, 0/4..20 mA.  | 3KDE175512L9310 |
| AI931N | Analog Input, HART (AI4H)<br>Passive input, 0/4..20 mA.    | 3KDE175513L9310 |

**Temperature input AI950S/B/N**

- Pt 100, Pt 1000, Ni 100, 0...3 kOhm in 2-/3-/4-wire technique
- Thermocouple Type B, E, J, K, L, N, R, S, T, U, mV
- Internal or external cold junction compensation
- Short and break detection
- Electrical isolation between input / bus and input / power
- Electrical isolation channel to channel
- 4 channels



| Name   | Short description                                                                                                                                       | Article no.     |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| AI950S | Temperature (TI4-Ex)<br>Pt100, Pt1000, Ni100 in 2-/3-/4-wire technique thermocouples type B, E, J, K, L, N, R, S, T isolated inputs channel by channel. | 3KDE175521L9500 |
| AI950B | Temperature (TI4-B)<br>Pt100, Pt1000, Ni100 in 2-/3-/4-wire technique thermocouples type B, E, J, K, L, N, R, S, T isolated inputs channel by channel.  | 3KDE175522L9500 |
| AI950N | Temperature (TI4)<br>Pt100, Pt1000, Ni100 in 2-/3-/4-wire technique thermocouples type B, E, J, K, L, N, R, S, T isolated inputs channel by channel.    | 3KDE175523L9500 |

**Analog output AO910S/B/N**

- Output signal 0/4...20 mA for actuators
- Short and break detection
- Electrical isolation between output / bus and output / power
- Output with common ground
- 4 channels



| Name   | Short description                             | Article no.     |
|--------|-----------------------------------------------|-----------------|
| AO910S | Analog Output (AO4-Ex)<br>Output 0/4...20 mA. | 3KDE175531L9100 |
| AO910B | Analog Output (AO4-B)<br>Output 0/4...20 mA.  | 3KDE175532L9100 |
| AO910N | Analog Output (AO4)<br>Output 0/4...20 mA.    | 3KDE175533L9100 |

**Analog output, isolated AO920S/B/N**

- Output signal 0/4...20 mA for actuators
- Short and break detection
- Electrical isolation between output / bus and output / power
- Electrical isolation channel to channel
- 4 channels



| Name   | Short description                                                                                | Article no.     |
|--------|--------------------------------------------------------------------------------------------------|-----------------|
| AO920S | Analog Output, isolated (AO4I-Ex)<br>Output 0/4...20 mA.<br>Isolated outputs channel by channel. | 3KDE175531L9200 |
| AO920B | Analog Output, isolated (AO4I-B)<br>Output 0/4...20 mA.<br>Isolated outputs channel by channel.  | 3KDE175532L9200 |
| AO920N | Analog Output, isolated (AO4I)<br>Output 0/4...20 mA.<br>Isolated outputs channel by channel.    | 3KDE175533L9200 |

**Analog output, HART, AO930S/B/N**

- Output signal 0/4...20 mA for actuators
- Short and break detection
- Electrical isolation between output / bus and output / power
- Output with common ground
- 4 channels
- Transmission of HART frames via the fieldbus
- Cyclic HART variables



| Name   | Short description                                    | Article no.     |
|--------|------------------------------------------------------|-----------------|
| AO930S | Analog Output, HART (AO4H-Ex)<br>Output 0/4...20 mA. | 3KDE175531L9300 |
| AO930B | Analog Output, HART (AO4H-B)<br>Output 0/4...20 mA.  | 3KDE175532L9300 |
| AO930N | Analog Output, HART (AO4H)<br>Output 0/4...20 mA.    | 3KDE175533L9300 |

## 5.5.6 Field housing

### Field housing FH660S, FH680S

Stainless steel field housing for extended termination unit

- Prepared for wall mounting
- Mounting in Zone 1 or Zone 2



| Name          | Short description                                                                                                                                                                                                                                     | Article no.     |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| FH660S - 2000 | Field housing<br>Termination Unit (backplane) TU921S<br>4 Terminals (UK10N)<br>Field housings are delivered without cable glands.<br>Cable glands have to be ordered separately (see General information and Product Update 2PAA112874)               | 3KDE175804V2000 |
| FH660S - 2020 | Field housing<br>Termination Unit (backplane) TU921S<br>4 Terminals (UK10N)<br>2 Switches<br>Field housings are delivered without cable glands.<br>Cable glands have to be ordered separately (see General information and Product Update 2PAA112874) | 3KDE175804V2020 |
| FH680S - 2020 | Field housing<br>Termination Unit (backplane) TU921S<br>4 Terminals (UK10N)<br>2 Switches<br>Field housings are delivered without cable glands.<br>Cable glands have to be ordered separately (see General information and Product Update 2PAA112874) | 3KDE175811V2020 |

### Field Housing roof

| Name         | Short description                                                       | Article no.     |
|--------------|-------------------------------------------------------------------------|-----------------|
| S900 - BI100 | Field Housing roof<br>Weather protection.<br>Fits to all field housing. | 3KDE175831L1000 |

## 5.5.7 Accessories for S900

### Fieldbus isolating repeater

| Name   | Short description                                                                                                                                                                                                                                           | Article no.  |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| BI914S | Fieldbus isolating repeater<br><br>separates an intrinsically safe RS485 fieldbus from a non intrinsically safe RS485 fieldbus with bus termination mounted in DIN rail mounted housing with IP20 protection one channel version BARTEC - 07-7311-97WP/K1E0 | 3BDH000649R1 |

### Ring-coupler

| Name   | Short description                                                                                                                                                                                                                                                                   | Article no.     |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| BI923S | Ring-coupler RS485 / FO - intrinsically safe - Slave<br><br>Separates an intrinsically safe fibre optic ring from a non intrinsically safe RS485 interface<br>BARTEC - 07-7311-97WP5400<br>integrated in DIN rail mounted housing with IP20 protection<br>Optical Plug FSMA (Slave) | 3KDE175831L9230 |
| BI924S | Ring-coupler RS485 / FO intrinsically safe - Master<br><br>Separates an intrinsically safe fibre optic ring from a non intrinsically safe RS485 interface<br>BARTEC - 07-7311-97WP5400<br>integrated in DIN rail mounted housing with IP20 protection<br>Optical Plug FSMA (Master) | 3KDE175831L9240 |
| BI934S | Ring-coupler RS485 / FO intrinsically safe (slave)<br><br>Separates an intrinsically safe fibre optic ring from one intrinsically RS485 fieldbus segment integrated in separate field housing<br>BARTEC - 07-3103-2512/9003<br>Optical Plug FSMA                                    | 3BDH000674R0001 |

### Additional accessories

| Name   | Short description                                                                                                                                                                                                                                                                                                                                                                                                           | Article no.     |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| IP920  | Module housing<br><br>IP20 protection for empty slots on the termination unit.<br>For use in S900 S, B, and N systems.                                                                                                                                                                                                                                                                                                      | 3KDE175831L9200 |
| IL910  | Insert labels<br><br>380 pcs.                                                                                                                                                                                                                                                                                                                                                                                               | 3KDE175839L9101 |
| BP914S | D-SUB Connector (color blue) for operating the intrinsically safe PROFIBUS-DP with CI920AS and CI920AB.<br>Siemens 6ES7972-0DA60-0XA0<br>Connector can only be used with CI920AS and CI920AB.<br>Do not use in combination with CI920S or CI920B.<br>This would violate the explosion protection and could cause destruction of CI920S or CI920B.<br>For CI920S and CI920B connector BP910S has to be ordered as spare part | 3BSE067082R1    |



## 5.5.8 Software

| Name  | Short description                                            | Article no.     |
|-------|--------------------------------------------------------------|-----------------|
| CD910 | Additional Software                                          | 3KDE175839L9100 |
|       | CD ROM incl. S900 Documentation, Certificates, GSD (file)    |                 |
|       | ABB DTM S900 DP and Software Tools                           |                 |
|       | CD ROM will be delivered with all TU921 and CB220 deliveries |                 |

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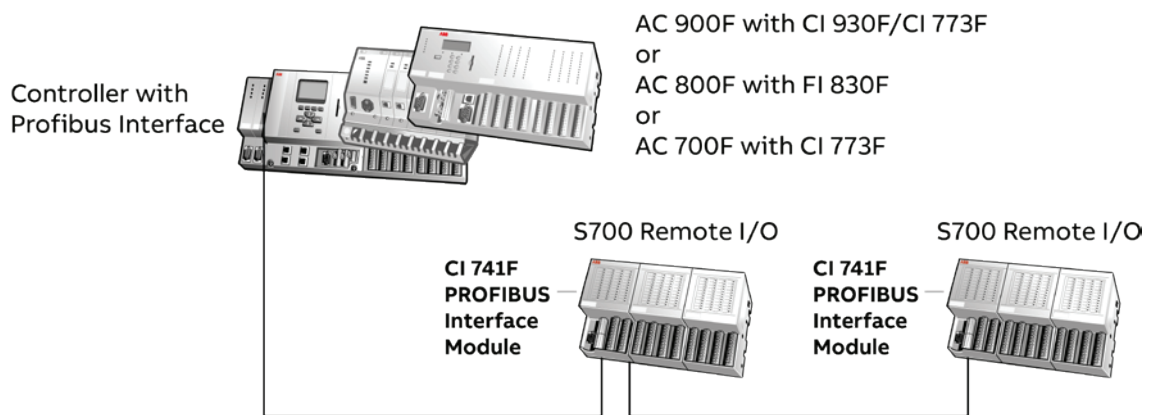
## 6. Fieldbus network components and PROFIBUS configuration for S700

|     |                                            |
|-----|--------------------------------------------|
| 124 | 6.1 PROFIBUS DP configuration for S700     |
| 125 | 6.2 PROFIBUS network components            |
| 126 | 6.3 FOUNDATION Fieldbus network components |

## 6.1 PROFIBUS DP configuration for S700

When the Freelance controllers are equipped with the appropriate PROFIBUS Master module they can communicate over a single PROFIBUS DP segment with several remote I/O stations.

**Please note:** Standard PROFIBUS cables and plugs can be used with the fieldbus interface module CI 741F for S700.



PROFIBUS configuration with AC 900F, AC 700F, S700 remote I/O and standard PROFIBUS cable and plugs



6.2 PROFIBUS network components

| Name    | Short description                                                                                                                                           | Article no.  |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| RLM02   | PROFIBUS Redundancy Link Module for PROFIBUS line redundancy<br>Converts a non-redundant PROFIBUS line to two redundant RS485 lines or vice versa.          | 3BSE091723R1 |
| PCO 011 | PROFIBUS DP connector with bus termination<br>Max. 12 Mbit/s, 35° cable outlet, IP40, switchable bus termination.                                           | 3BDZ000371R1 |
| PCO 012 | PROFIBUS DP connector with bus termination and adapter<br>Max. 12 Mbit/s, 35° cable outlet, IP40, switchable bus termination, programming connection SUB-D. | 3BDZ000372R1 |

RLM02



## 6.3 FOUNDATION Fieldbus network components

| Name         | Short description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Article no.  |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| LD 810HSE EX | <p>LD 810 HSE EX Linking Device</p> <p>LD 810 HSE EX module for DIN rail mounting with 4 H1 links and one HSE connector. The module itself needs external 24 VDC power supply. H1 links must be powered separately.</p> <p>Restrictions: Linking Device LD 810HSE Ex is not suitable for replacing one of the LD 800 Linking Devices in a redundant pair.</p> <p>To clarify, both devices in the redundant pair must be replaced with LD 810HSE Ex. Redundancy cable for LD 810HSE Ex can be made / procured by the end customer directly &amp; need not be ordered through ABB.</p> | 3BSE091722R1 |

LD 810HSE EX



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## 7. Freelance Operations

|           |                                          |
|-----------|------------------------------------------|
| 128 – 131 | 7.1 Overview                             |
| 132 – 133 | 7.2 Messages & operator hints            |
| 134       | 7.3 Automation Software Maintenance      |
| 134       | 7.4 Freelance Software languages         |
| 135       | 7.5 Freelance Operations license         |
| 135       | 7.6 Connectivity                         |
| 135       | 7.7 Freelance Operations License options |
| 136       | 7.8 Freelance Operations hardkeys        |

## 7.1 Freelance Operations – Overview

Freelance Operations, enhances the ease of use and the performance of plant operation. In addition, you can also use any PC peripherals such as monitors, printers, mice and keyboards that are available on the market for Windows compliant PCs. The Freelance Operations software supports wide-screen formats.

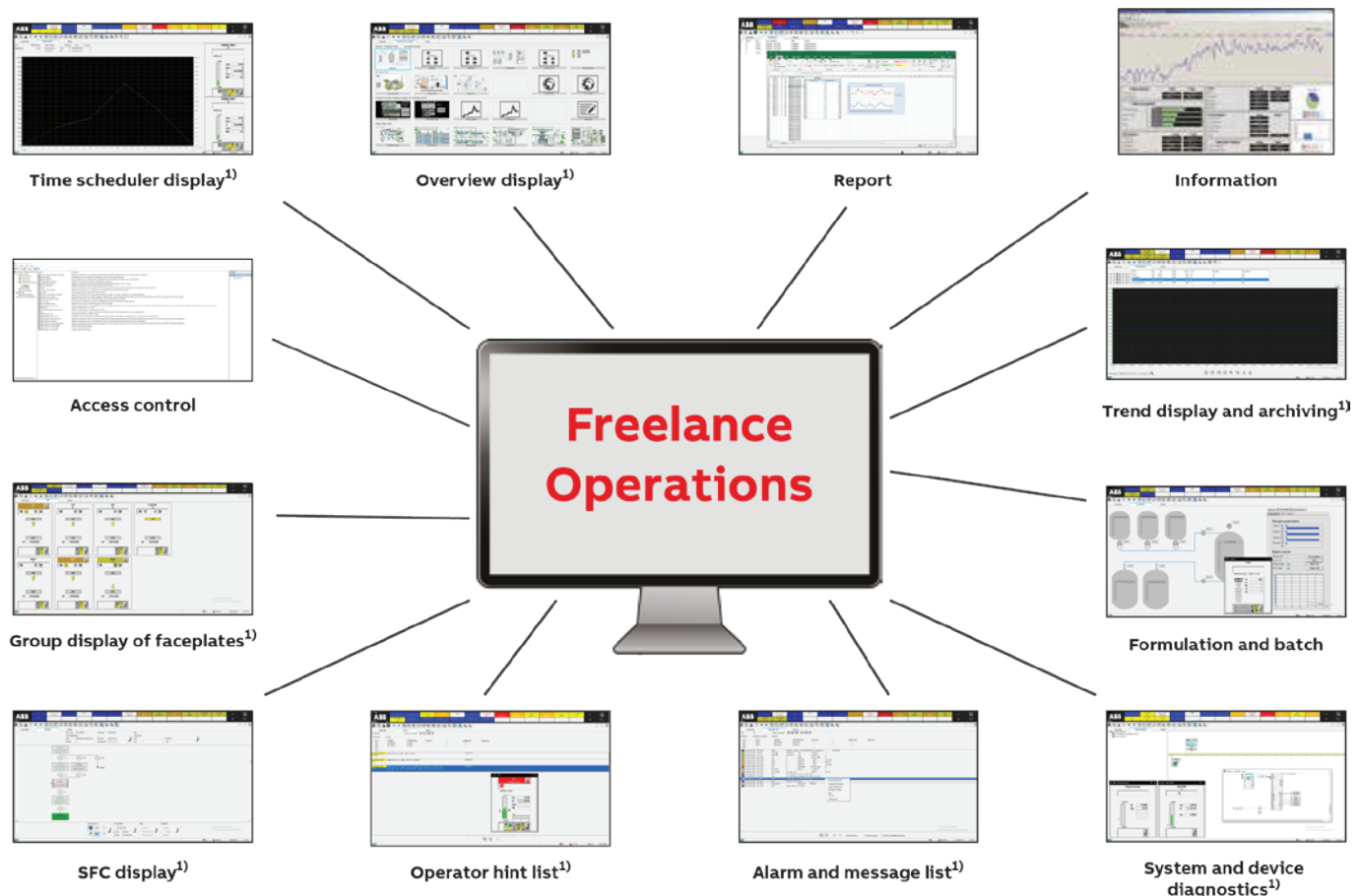
Freelance extends its User Management capabilities known from “Security Lock” by an alternative solution, the so called “Extended User Management”. This new options make use of Windows User accounts, local as well as domain accounts are supported. With that central password management and rules for password complexity or password aging can be fulfilled.

For compatibility reasons the former known “Security Lock” is still supported as an option. Customer now have the possibility to choose between these options. ”

The operation and engineering functions can also be performed together on just one PC. Freelance Operations offers the following features:

- Transparent and rapid operation due to a clearly structured information hierarchy
- User-specific function key assignment for fast display selection
- A large number of pre-engineered displays
- Rapid and secure action in case of process alarms
- Trend displays with archiving
- Logging of all operator actions, including name and timestamp
- System diagnostics, even down to the field device, allowing extended field device diagnostics
- Uniform process alarm and message concept and clearly arranged display of messages and operator hints
- Up to 16 user groups / access profiles, with up to 1000 users, specific password for each user

<sup>1)</sup> Pre-engineered and ready-to-use displays



- Various language versions: English, Chinese, German, Brazilian Portuguese, Swedish, Russian, Polish, French and Japanese
- A control aspect, providing access to automatically generated dynamic interlocking displays for the selected tag (in connection with OPC or trend server)
- External aspects, providing access to additional information such as PDF documentation, live videos from the plant, standard operational procedures (SOPs), etc.
- Configurable voice output on the PC for process alarms
- Support up to 4 monitors with Freelance Operation on a single PC with one mouse and one keyboard.

The process visualization is supported by plant-specific custom graphic displays, faceplates for tags and up to 15 plant areas with plain text labeling.

### Plant-specific displays

Plant-specific displays can be configured to depict process activities.

Static sections of the graphic displays can be created using the graphics editor. In addition,

you also have the option of inserting such static sections in the form of bitmaps, created by any other graphic editor, scanner, or digital photograph. Current process data or process states can be animated at every suitable position using elements such as bar graphs, level indicators and trend windows.

Depending on process states, graphic symbols can flash, change color and position or be replaced in the graphic display. Tags can be viewed either via faceplates on top of the graphic displays or via the standard group displays.

Display selector fields or buttons can be used to setup a specific selection hierarchy within custom graphics for operation. The number of custom graphics available in Freelance Operations is limited only by the hard disk capacity.

### Pre-engineered, ready-to-use displays

Pre-engineered displays are adapted to the needs of process control engineering with regard to structure and information content.

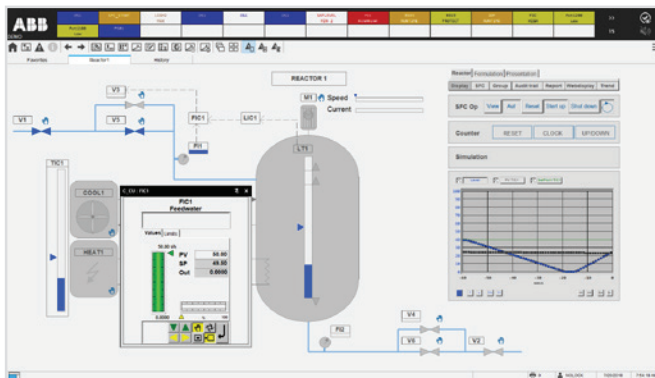
The following displays are available:

- Overview display
- Group display
- Faceplate
- Sequential Function Cart (SFC) display
- Time scheduler display
- Trend display
- Web display
- Message list and operator hint list
- Logs
- System display for hardware diagnostics

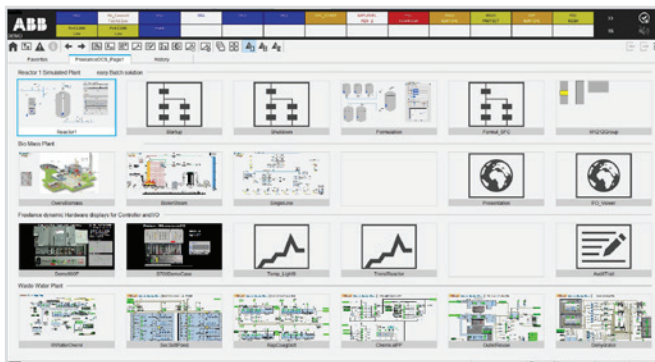
Therefore, most functions already have fully prepared displays for operation and observation, and can be used without additional work.

### Overview display

The process information for the entire plant is presented in a condensed manner in a single overview display. It offers facilities for selecting the group, graphic, SFC, Web, time scheduler and trend displays. Logs can also be called up directly from the overview display. Up to 96 displays can be shown in the overview display. The group display symbols within the overview display also feature dynamic updating of tags, allowing disturbance states to be detected rapidly through appropriate symbols and colors. If required, you can also set a graphic display of your choice as overview display. It then replaces the standardized overview display.



Graphic display with faceplates



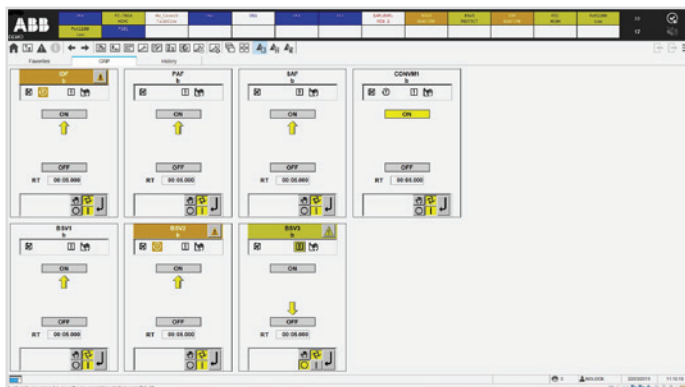
Overview display

## Faceplates

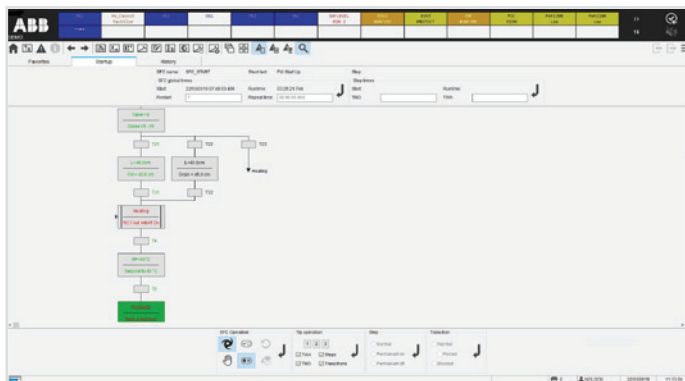
Faceplates allow both overview and detailed information to be obtained simultaneously. Since faceplates are predefined, they are available immediately in the system following the definition of a tag, without any additional programming. This is also the case for user-defined faceplates. Therefore, faceplates can be displayed together with standardized and freely designed displays.



Faceplates



Group display



SFC display

## Group display

The group display is a combination of several faceplates and contains detailed information about associated tags. All functions, including controllers, PID-loops, time and monitoring functions as well as open-loop control functions, can be displayed and operated.

To provide a quick source of information, analog values are displayed as colored bars. To allow more precise reading, they are also shown as alphanumeric values. Pending disturbance states in the respective variables can be detected immediately through a change in color and flashing, and can be acknowledged directly in the faceplate or message list. Configured limits can be additionally displayed as symbols. You can create your own faceplates for user-defined function blocks.

## SFC display

The sequential function chart (SFC) based on the IEC 61131-3 standard is viewed in a standardized SFC display showing the current program state of the sequential function chart. In the SFC display, you see the actual processing status, where already finished and coming steps are marked with different colors. Disturbance states, such as non-fulfilled process criteria or time outs can be easily detected by a color change within a criteria window for steps and transitions.

Furthermore, a display selection can be configured for each step and transition. The variables shown in the criteria window can be operated.

An SFC overview display allows direct access to a step or transition, and the desired information can be selected immediately. This is particularly beneficial in the case of complex open-loop control structures, when rapid intervention by the operator is essential. The Control Aspect allows the animated display of the transition program, similar to the commissioning display in Freelance Engineering.

The display is generated automatically and is an alternative to the criteria window, which allows you to configure a standardized, reduced display of the criterias.

### Time scheduler display

The time scheduler module makes it possible to define analog variables during a pre-defined time by default, e.g. as a set point value for a connected controller. The current set point is determined from a series of up to 32 configured values describing a set point curve. The time scheduler display is easy to operate. Apart from enabling the switching of operation modes, it also permits the modification of the current set point. Manual alterations to the set point are displayed in a separate curve.

A manual set point can be defined by offsetting the configured set point. A return (time-delayed) to the original value is possible at any time. A program can be executed cyclically or by stating a certain number of runs.

### Web display

The Web display provides a simple way to display web pages on the operator station, without covering the message line. For example, this allows you to observe the picture of a camera using a built-in Web server, making it easy to monitor flames or observe chimneys. However, in addition to showing Web pages, it is also

possible to start other applications and display documents using this display type.

### Trend display and archiving

The chronological sequence of analog and binary process variables can be displayed as a trend display. The following can be shown in one trend display:

- Up to six signals in different colors
- The associated measuring point name with short text
- The current measured value with scale and unit used

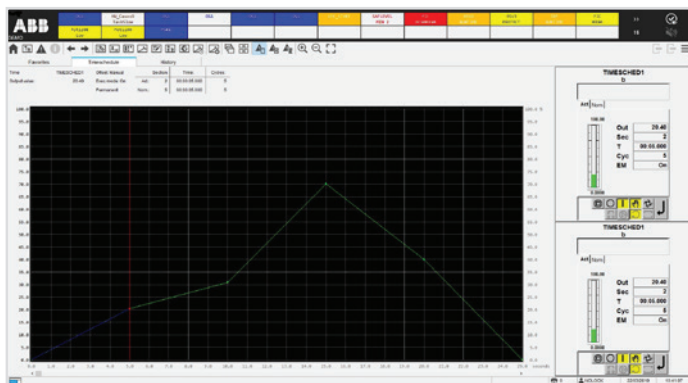
The trend display can be altered by:

- Moving the time axis to show previous values
- Hiding trends
- Increasing and decreasing the signal range
- Selecting specific settings for each trend progression (e.g. color or interpolation)
- Highlighting individual trend curves
- Using a variable time range (seconds through to weeks)

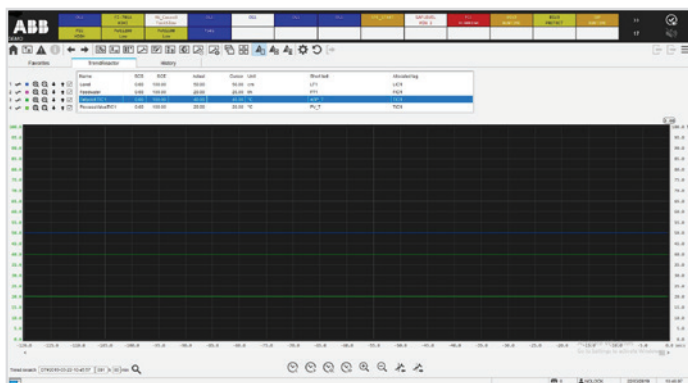
If a trend display is configured with archiving, the measured values are recorded as a cyclical function of the operator station. The archived values can be backed up on any data medium or sent via file transfer protocol (FTP) to any subscriber on the Ethernet. They are then available for further evaluations and can be exported in CSV<sup>1</sup> format using the separate Archive Browser software. The original data is binary coded and therefore protected against manipulation.

### User-defined trend displays

Operators can compile any process values in a trend display themselves by selecting the required process values from a list of all variable names. No additional engineering effort is necessary. The task of archiving this trend data on the hard disk of the operator station PC can also be carried out easily in the same way. A prerequisite for user-defined trends is that the system contains a trend server.



Time scheduler display



Trend display

<sup>1</sup> CSV = Comma Separated Value, a format in which data can easily be imported into Microsoft Excel and evaluated.



## 7.2 Messages & operator hints

Process disturbances are detected by the controllers and forwarded to the operator stations with a timestamp.

The Freelance system allows the following message types: system alarm (S1-S3), process alarm (P1-P4) fault message and operator hint message (P5). Process alarms are divided into fault messages (P1-P3) and switching messages (P4). When parameterizing the function blocks, it is possible to assign up to 4 messages to its limit monitoring units integrated into the block. Whereas the internal controller time is generally used for the timestamp for messages, you also have the option of using a special function block to assign external timestamps to alarms. In this way, for example, you can generate an alarm from a device connected via Modbus in the correct chronological order with the device's timestamp. Different methods of acknowledgement can be selected for each priority level. Incoming messages are displayed in different colors, along with the name and disturbed status of the tag in accordance with their priority.

### Message line

The upper area of the display is always reserved as a message line for the higher-level display of all message types from the entire process.

The message line optionally displays either the newest or oldest messages, as well as buttons for acknowledging messages and viewing operator hints. There is also a field for indicating overflow, a field for acknowledging alarms and a field showing the number of unacknowledged messages in the message list. For quick operation, the faceplate of the disturbed tag can be accessed directly from the message line.

Operators can choose between three different message line views:

#### Standard view



#### Area view



#### List view

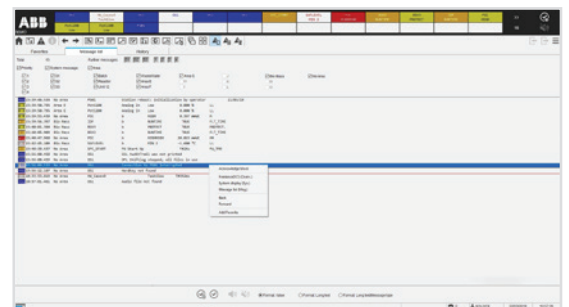


### Message list

The message list offers an overview of all pending messages. It features a chronological list of fault, switch and system alarm messages. The latest message is placed at the beginning or end of the list, as configured. This message sequence can be altered by configuration.

Just as in the message line, different priorities are color-coded. Messages can be acknowledged both by block and by page. To provide a better overview, the user can filter certain priorities or plant areas on the screen display.

Other displays belonging to the tag, such as faceplates, graphic or trend displays, can be selected via tag specific aspect navigation from the message list simply by a right-click.



Message list



### Operator hint list

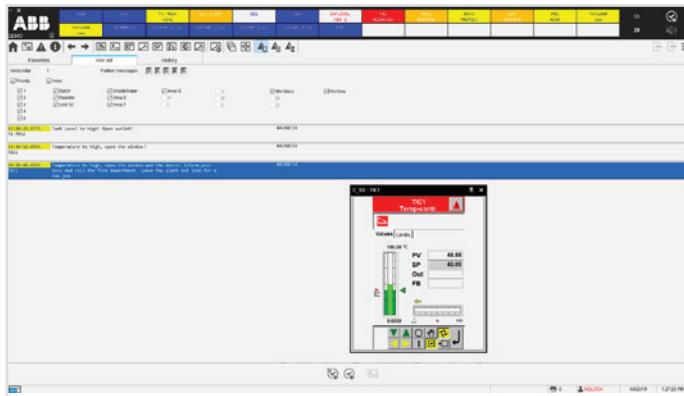
A hint for the operator can be configured for each process alarm or event. Hints are intended to inform the operator about the cause of the message or about the procedure to be adopted for eliminating a process alarm. If necessary, hints can also provide further user help.

All configured hints are displayed in the hint list. Faceplates or other displays can also be called up directly from the hint list to operate a tag or analyze critical process situations.

### Logging

Logs are used to document events, states and sequences from the process. Log files can be displayed on the screen, printed, and saved for further evaluation.

In addition, the archived files can be automatically sent to any subscriber on the Ethernet via the file transfer protocol. The Archive Browser software makes it possible to view the data and to convert it into ASCII (CSV file) for further evaluation, for instance using Excel.



Operator hint list

The Freelance system features the following log types:

### Signal sequence log

The signal sequence log is used for logging events such as process and system messages, switching messages and hints. Even operator intervention can be logged in detail together with the user name and timestamp. The user can determine which message priorities are to be logged. Process messages and alarms are logged with time stamps of 1 ms resolution. "Signal sequence log 1" allows the operation of a line printer in order to immediately print every alarm when it is received.

### Operation log

At certain intervals or in certain situations, the plant log records the current values or states of process variables. It can run cyclically, or can be started and stopped manually or by an event. The output format is freely configurable as table or fill-in-the-blanks text.

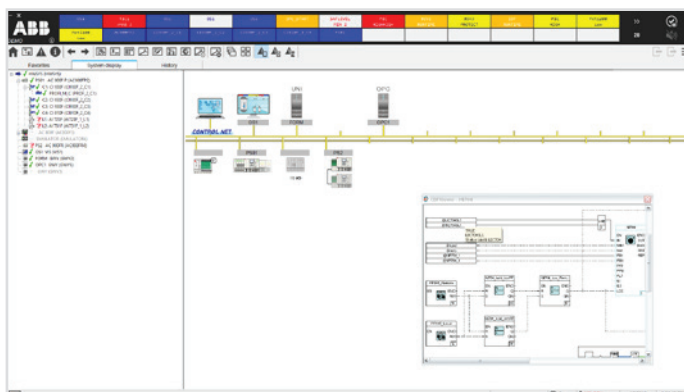
### Disturbance course log

The disturbance course log is used to examine the course of disturbances. The process values before and after a disturbance are recorded with a high time resolution and archived in an operator station. Four logs of each type can be configured in one operator station.

### System diagnostics

The current state of the hardware and software of a Freelance system is shown in the automatically generated system display. Here, information can be obtained in various degrees of detail about the status of an individual controller to a specific field device.

The simple system display is available to all operators of a Freelance operator station. Additional information is also available for field devices on PROFIBUS or FOUNDATION Fieldbus.



Easy system diagnostics with the system display

## 7.3 Automation Software Maintenance

| Name                                                         | Short description                                                                                                                                                                               | Article no.   |
|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Add to existing Automation Software Maintenance Subscription | Select this item if an existing system/project is to be extended. Indicate the System ID.  Select this item if an existing system/project is to be extended by DigiVis. Indicate the System ID. | 3BDS008515R09 |

## 7.4 Freelance Software languages

| Name                          | Short description                                                    | Article no.     |
|-------------------------------|----------------------------------------------------------------------|-----------------|
| Changing the current language | Indicate the Freelance hardkey number and the new language.          | 3BDS008503R10   |
| English language              | Indicating the language is mandatory. Only one language is possible. | 3BDS008502R1001 |
| Swedish language              | Indicating the language is mandatory. Only one language is possible. | 3BDS008502R1002 |
| German language               | Indicating the language is mandatory. Only one language is possible. | 3BDS008502R1003 |
| Spanish language              | Indicating the language is mandatory. Only one language is possible. | 3BDS008502R1006 |
| French language               | Indicating the language is mandatory. Only one language is possible. | 3BDS008502R1007 |
| Chinese language              | Indicating the language is mandatory. Only one language is possible. | 3BDS008502R1021 |
| Russian language              | Indicating the language is mandatory. Only one language is possible. | 3BDS008502R1022 |
| Japanese language             | Indicating the language is mandatory. Only one language is possible. | 3BDS008502R1023 |
| Polish language               | Indicating the language is mandatory. Only one language is possible. | 3BDS008502R1024 |
| Portuguese (Brazil) language  | Indicating the language is mandatory. Only one language is possible. | 3BDS008502R1026 |
| Hungarian language            | Indicating the language is mandatory. Only one language is possible. | 3BDS008502R1027 |
| Czech language                | Indicating the language is mandatory. Only one language is possible. | 3BDS008502R1041 |

## 7.5 Freelance Operations license

| Name                               | Short description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Article no.   |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Freelance 2019 Operations Standard | Freelance Operations (Standard) supports <ul style="list-style-type: none"> <li>• Control of all Tags</li> <li>• Graphical Displays, Trends, Faceplates</li> <li>• Historian, Reports, Operator Logs</li> <li>• SFC Display, Time Scheduler</li> </ul> Included in this license <ul style="list-style-type: none"> <li>• Extended Diagnostic</li> <li>• WEB display (runtime license)</li> <li>• Archive Browser</li> </ul> No server required. Order one Operations hardkey for each operator workplace | 3BDS008790R10 |
| Freelance 2019 Operations Lite     | Freelance Operations (Lite) supports <ul style="list-style-type: none"> <li>• All features of Freelance Operations (Standard)</li> <li>• Limited number user defined graphic displays (max. 5 FGR)</li> <li>• No license options available</li> </ul> No server required. Order one Operations hardkey for each operator workplace.                                                                                                                                                                      | 2PAA114214R10 |
| Combined Workplace Standard        | Extends an Engineering workplace to a combined workplace. Freelance Operations (Standard) and Freelance Engineering can be used on the same workplace.<br>Only in combination with an Engineering License. Order one Combi hardkey for each combined workplace.                                                                                                                                                                                                                                          | 3BDS008794R10 |
| Combined Workplace Lite            | Extends an Engineering workplace to a combined workplace. Freelance Operations (Lite) and Freelance Engineering can be used on the same workplace.<br>Only in combination with an Engineering License. Order one Combi hardkey for each combined workplace.                                                                                                                                                                                                                                              | 2PAA116842R10 |

## 7.6 Connectivity

| Name                        | Short description                                                                                                                          | Article no.   |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Generic OPC                 | OPC Server                                                                                                                                 | 2PAA110434R10 |
| OPC for Extended Automation | OPC Server<br>Connection to 800xA Operation<br>(Windows 7, Windows 10, Windows Server 2016 , Windows Server 2019)                          | 2PAA110435R10 |
| Trend Server Package        | For trending data on Freelance Operations without using trend acquisition function block.<br>Only one Trend Server is possible per system. | 3BDS008755R10 |

## 7.7 Freelance Operations License options

| Name                  | Short description                                                                                                                                                         | Article no.   |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Multi Monitor Support | Freelance 2019 supports up to four monitors for one operator workplace. Order this license for each additional monitor (e.g. 3 Multi Monitor Licenses for four monitors). | 3BDS008784R10 |
| Control Aspect        | Display (read only) of function block diagrams on a Freelance operator workplace.                                                                                         | 3BDS009973R10 |



## 7.8 Freelance Operations hardkeys

| Name               | Short description                                                                                      | Article no.  |
|--------------------|--------------------------------------------------------------------------------------------------------|--------------|
| Combi Hardkey      | Combi Hardkey for USB Port<br>Windows 10, and Windows 7<br>The Archive Browser doesn't need a hardkey. | 3BDH000196R2 |
| Operations Hardkey | Operations Hardkey for USB Port<br>Windows 10, and Windows 7                                           | 3BDH000197R2 |

## 8. Freelance Engineering

|                  |                                               |
|------------------|-----------------------------------------------|
| <b>139 – 140</b> | <b>8.1 Overview</b>                           |
| <b>141 – 146</b> | <b>8.2 Configuration of functions</b>         |
| 141              | 8.2.1 IEC 61131-3                             |
| 143              | 8.2.2 Other Functions                         |
| 144              | 8.2.3 Fieldbus and field device configuration |
| <b>146 – 147</b> | <b>8.3 Commissioning</b>                      |
| 147              | 8.3.1 Commissioning the fieldbus lines        |
| <b>148</b>       | <b>8.4 Freelance Software languages</b>       |
| <b>148</b>       | <b>8.5 Freelance Engineering license</b>      |
| <b>148</b>       | <b>8.6 Freelance Engineering hardkeys</b>     |
| <b>149 – 150</b> | <b>8.7 Control - Software license</b>         |
| 149              | 8.7.1 Base License                            |
| 149              | 8.7.2 Additional basic I/Os                   |
| 150              | 8.7.3 Controller license options              |
| 150              | 8.7.4 Batch                                   |
| <b>150 – 151</b> | <b>8.8 Control - Software license</b>         |
| 150              | 8.8.1 Connectivity                            |
| 151              | 8.8.2 Operations                              |

151      8.8.3 Engineering

151      8.8.4 Control

151      8.8.5 Batch

## 8.1 Freelance Engineering – Overview

With Freelance, all engineering work is performed with one single tool, Freelance Engineering, which works hand in hand with the visualization and operation tool Freelance Operations. Configuration of all plant objects – ranging from process graphics to field devices and operation of the entire plant – is easy and intuitive to perform.

The entire Freelance system can be configured either online, while the engineering tool is connected to a controller, or offline. For offline configuration, no controller is necessary. The application program, that was created during offline configuration, can later on be downloaded to a controller.

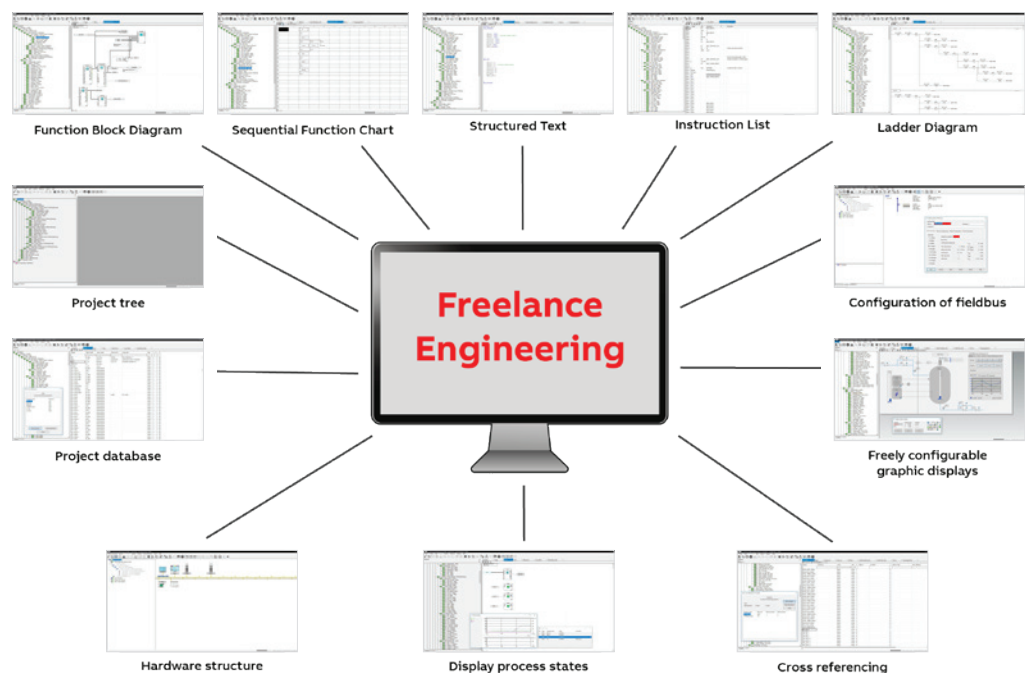
In particular, this is also true for FOUNDATION Fieldbus configuration, whereby Freelance Engineering can be used to generate the control-in-the-field application even without any devices being available.

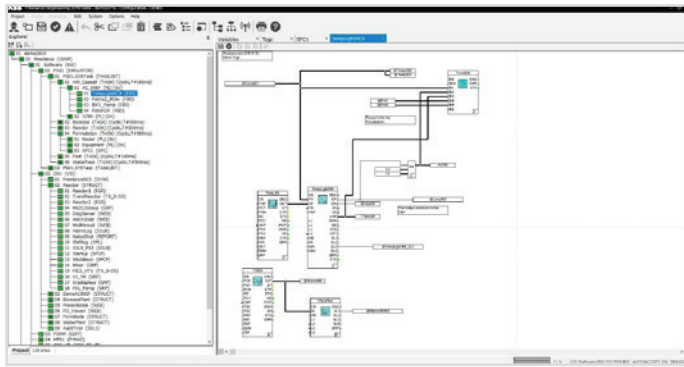
Freelance Engineering offers the following features for configuration, parameterization and commissioning:

- A single software tool for configuration of the automation functions, the operator interface with displays and logs, and fieldbus parameters.
- Graphical configuration with powerful editors according to IEC 61131-3: Function block diagram (FBD); Instruction List (IL); Ladder diagram (LD); Sequential function chart (SFC) and Structured text (ST).
- A function block library with more than 220 tried and tested functions, greatly exceeding the basic ones outlined in IEC 61131-3.

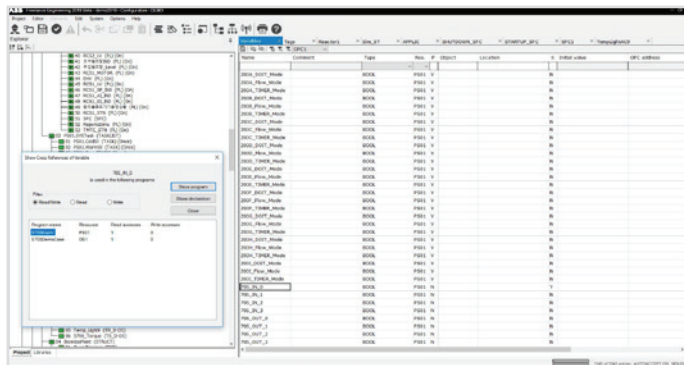
- An extensive macro library containing more than 200 graphic symbols, which can be extended by the user.
- A project tree for flexible program generation and transparent program structuring.
- Verification of automation functions, with the chance to find and remove errors quickly and easily.
- Cross-reference function allowing variables and tags to be found easily in any editor right up to the graphic display.
- Importing and exporting of programs, displays, variables, tags and parts of the project tree.
- Password protection to prevent unauthorized project modification.
- Password protection for user-defined function blocks.
- Uniform and auto-generated system-wide graphical documentation of the entire user program, system communication and all field device parameters.
- Project file backup on any data medium (hard disk, SD-card, memory stick, etc.). The project file includes the complete project with all programs, graphics, controllers, and field device parameters. Freelance 2019, project backup on SD card of controller (AC 900F and AC 700F).
- Testing and simulation of user programs (e.g. interlocks) even without connected hardware using the controller emulator.

Bulk data manager allows to import signal lists from planning tools via Excel and fast duplicating of typical solutions.





## Project Tree with Function Block Diagram



### Tag list with cross references

## Project tree

The project tree is the central instrument for managing the entire user program and commissioning. All project configuration data is displayed as a tree structure.

Within the project tree:

- The configuration data in a project is structured
- Task levels and cycle times are defined
- Programs are assigned to the task levels
- Programs, displays and logs can be opened for editing, copied and moved
- Programs are checked for plausibility and their processing status displayed
- Project configuration data is exported and imported
- User programs are loaded into the process and operator stations

## Project data base

All configured signals, variables and tags are managed in the Freelance system as lists in a common project database:

- List of variables (inputs, outputs, internal variables)
- Tag list (function blocks)
- Graphics
- Programs

Because the database is system-wide, data only needs to be entered once, avoiding further potential errors during configuration. The single project database file makes archiving or backup ease of use.

The list of variables and tags is created automatically when a user program is generated.

Other list functions include:

- Project-wide modification of name, comments, data or module type
- Search and display based on specified search criteria
- Cross-reference function permitting rapid, system-wide location of all programs and displays in which a selected variable or tag is used. This makes debugging very easy to do.



## 8.2 Configuration of functions

### 8.2.1 IEC 61131-3

#### Function block diagrams

The function block diagram (FBD) is a graphical programming language. It keeps one or several function blocks. The inputs and outputs of the function blocks can be connected to create the signal flow. Freelance Engineering checks if the terminals of two function blocks can be connected.

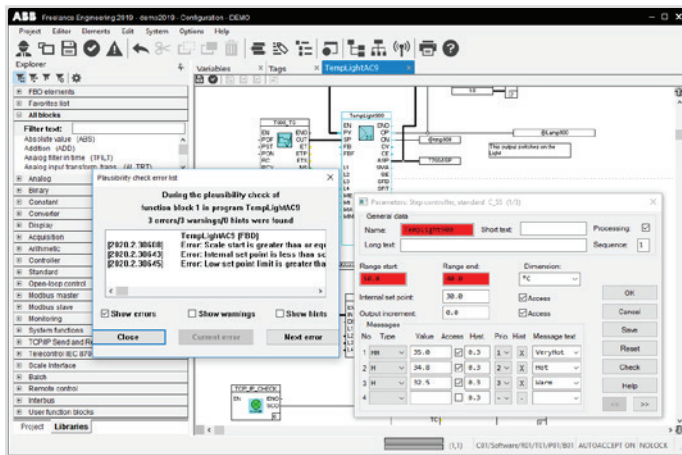
Inputs are always displayed on the left and outputs always on the right of a function block. With variables, values can be referenced from one diagram to another one. Two different access types to variables are available: read and write access. While write variables are written by a single function block, read variables can be used by several blocks.

The layout of the terminals and the color of signal flow lines provide information about the data type. All parameters of the function blocks are defined in the function block diagram. Clearly structured and easy to understand parameter dialogs, in which all block-specific entries can be made, are available. Once completed, the function block diagram can be verified using a plausibility check for errors or syntactic accuracy. Any errors or warnings are displayed in a list, and it is possible to navigate directly to the source of the error by simply clicking on the relevant line in that list.

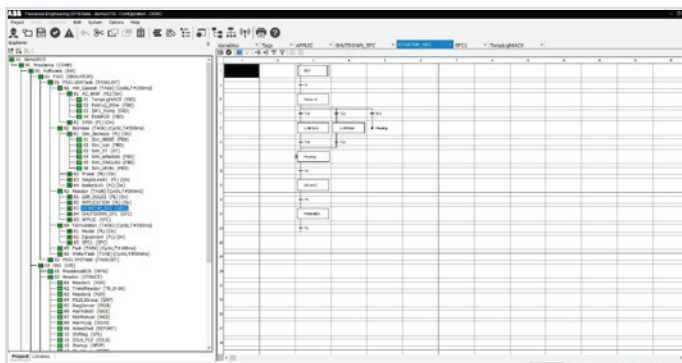
The cross references in a program can be displayed for the whole system. The corresponding displays or programs can be called up directly in order to gain easy access to the variables or tags referred to.

A function block diagram (FBD program), is configured as follows:

- Define name for FBD program
- Open editor for FBD program
- Select function blocks - position in the graphic area
- Connect functions with the signal flow lines
- Enter input and output variables
- Define parameters for the functions
- Check FBD program for plausibility
- Correct any syntax errors



Program with parameterization screen and plausibility check



SFC program

#### Sequential function charts

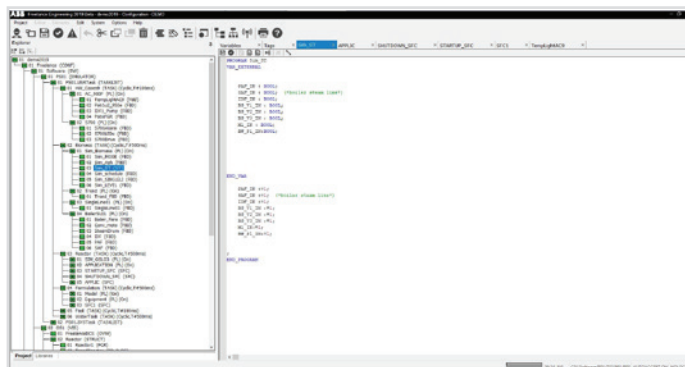
The Sequential Function Chart (SFC) readily allows transparent, graphical creation of sequential control programs. To create an SFC program, steps are configured with assigned actions (commands) and transitions with step-enabling conditions. Programs (function block diagram, ladder diagram, structured text, or instruction list) can be assigned to the steps and transitions. A further feature of the sequential function chart is the facility for creating alternative and parallel branches as well as the synchronization of these sequential structures. At the same time as the sequential function chart is configured, the SFC display for operation and observation on the operator station is generated automatically.

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### Structured text

Structured text (ST) is one of the text-oriented programming languages of IEC 61131-3, in which program processing is determined by instructions. All functions and function blocks can also be used in ST programs. The scope of the functions is partly covered by the ST operands. Function blocks can be used in the ST program following declaration.

Parameter definition of the function blocks also takes place in the same way as in the ladder diagram or function block diagram. In contrast to that of the function block diagram (FBD), the scope of functions of the structured text also includes conditional commands and loop commands, which are called using appropriate key words. The processing sequence is determined from the order of the commands in the ST editor. The only way to specifically change the order is to insert loop commands.



Structured text

---

### Instruction lists

All Freelance processing functions can be defined by the instruction list (IL). The scope of the instruction list exceeds that of the function block diagram and sequential function chart, as jump commands and program loops can also be programmed.

The operands can be displayed and entered with a selection list according to IEC 61131-3.

Parameter definition of the function blocks also uses the same parameter definition screens as those used in the function block diagram.

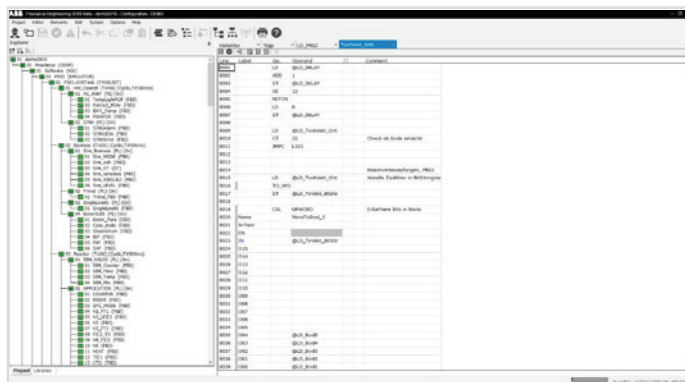
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### Ladder diagrams

Along with the function block diagram (FBD) and sequential function chart (SFC), the ladder diagram (LD) is also one of the graphical languages of the IEC 61131-3.

The ladder diagram language originates from the area of electromagnetic relay systems and describes the flow of current through individual rungs. The boundaries of a rung are defined on the right and left side by devices known as power rails, which have the logical state 1 (current is flowing). A rung is created with the elements of the ladder diagram (links, contacts and coils).

Functions and function blocks in the ladder diagram can be called up and used in the same way as in the function block diagram. Parameters are also defined for function blocks using the same parameter screens.



IL program

## 8.2.2 Other Functions

### Operation and observation functions

The following functions can be configured for operation and display:

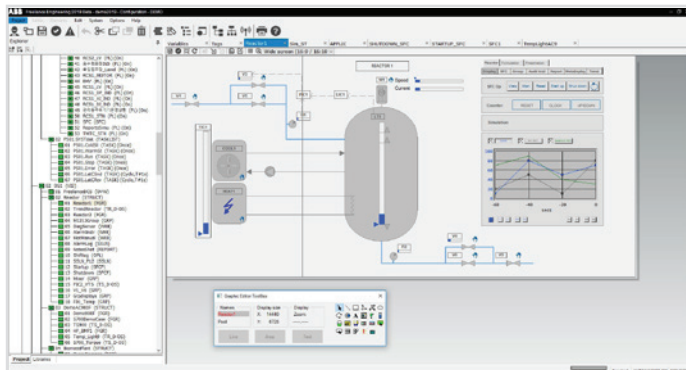
- Custom graphic displays
- Web displays
- Standard display types: overview display, group display, trend display, time scheduler display
- SFC display
- Signal sequence, disturbance course and plant log
- Message list and message line
- Operator hint list.

Since the common system database is automatically accessed while configuring these functions, there is no need to re-enter the data.

### Standardized displays (pre-engineered)

Standard displays can be configured very easily using Freelance Engineering. To configure a group display, for example, it is only necessary to select the tags via the selection list. The entry is made automatically.

In this manner, up to 10 large analog faceplate tags can be entered per group display. The configuration procedure for the overview display is equally simple, as the containing displays are entered from a selection list.



Graphics Editor

### Freely configurable graphic displays

Plant-specific graphic displays can be constructed for displaying the process. The graphic displays contain static and dynamic display elements.

The static part of the plant display – the background display – is composed of separate graphic elements which can be modified in color, line type and filling pattern and can, for example, display the schematic plant layout.

The following constructional aids in the system make it easier to create displays:

- Static elements such as lines, polylines, rectangles, polygons, ellipses, arcs and texts are created, for example, by specifying the start and end points
- Display sections already created can be duplicated, moved, rotated in 90° steps, transposed or superimposed
- The combination of several graphic elements can be saved as a macro and stored in libraries to be used when desired
- The zoom function facilitates precise construction of the individual graphic display elements
- Import of bitmap files facilitates the generation of static background displays

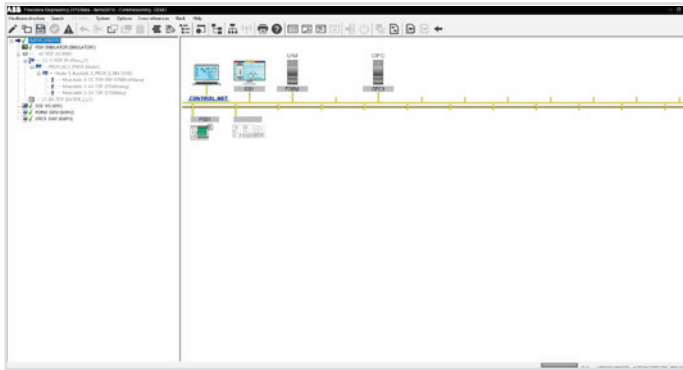
The process variables are displayed in the dynamic section of the display – the foreground display. Specific process variables can be visualized simply by making the display elements dynamic.

The following types of dynamic elements can be used:

Bar graphs and dynamic filling set to operate in different directions

- Superimposed numerical values and text variables
- Trend window
- Color change or symbol change to depict states
- Continuous or discrete position modifications of the graphic symbol
- Keys (buttons) for the direct execution of actions (e.g. write value or similar)
- Animated objects, e.g. mixers that turn realistically
- Tool tips

Selection fields can be defined at any position so that the operator can access any other displays using the mouse or keyboard.



Definition of the hardware structure

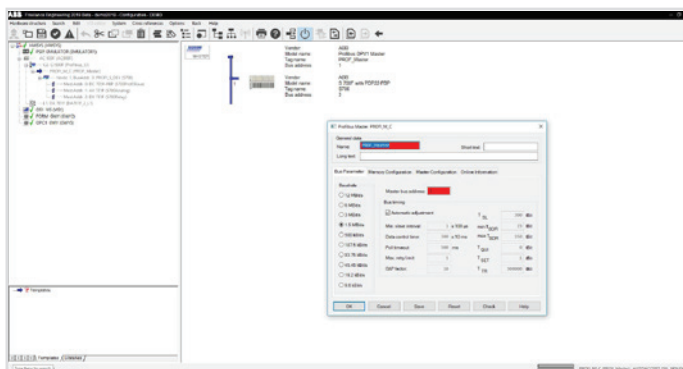
### Hardware structure

The required hardware structure can be configured in a graphical system overview and the system communication can also be defined there. It is possible to assign particular Freelance operator stations to specific controllers. Furthermore, detailed information can be obtained on the operator and process stations, together with their modules and the controllers with their connected fieldbus lines. In the station overview display, the operator and process stations can be equipped using selection lists. Specifications for processing, display and I/O channel assignment can be made for the individual modules of the controllers.

And all this with just a few clicks.

## 8.2.3 Fieldbus and field device configuration

The respective bus parameters, for instance the baud rate, number of subscribers and time constants, can be set for each fieldbus module. Freelance Engineering also suggests a setting for the bus parameters in line with how the fieldbus is equipped. This makes work easier for those new to the subject.



Configuration of the fieldbus line (PROFIBUS)

### PROFIBUS

In the configuration view of the fieldbus line, new PROFIBUS slaves can be integrated into the fieldbus line using a GSD-file or FDT technology.

Using the template concept, it is also possible to integrate completely pre-configurable PROFIBUS slaves by means of drag and drop. The intelligent DP / PA Linking Device is transparent with regard to configuration, allowing PA devices to be viewed as if they were connected to the PROFIBUS DP. Parameter definition screens are then available in the device display for defining parameters for both remote I/O and PA field devices.

### HART

HART devices connected to the S800 or S900 Remote I/O can be configured with the aid of HART DTMs. For S900, also HART templates can be used. They consist of preconfigured DPV1 services which tunnel a HART command via the PROFIBUS to the HART device on the analog channel of a particular S900 I/O module. Users can also create HART templates themselves.

### FOUNDATION Fieldbus

The devices are configured in the feedforward part by linking the Device Description (DD) files. This makes it possible to configure the FF without the field devices being physically connected to the controllers.

The devices are configured on the H1 links of the LD 810HSE Linking Devices. As Freelance Engineering supports control in the field for FF devices, it is possible to configure function charts that interconnect the function blocks in the individual FF devices. Freelance Engineering then automatically generates a process that is passed on to the Link Active Scheduler (LAS). Redundant Link Active Schedulers are also supported. However, it is also possible to use the FF devices “only” as I/O suppliers and use the function blocks in the controllers.

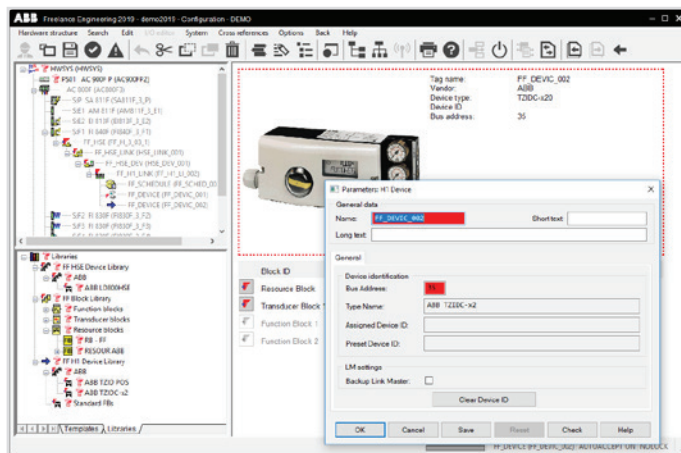
### Graphical documentation

The fully graphical forward documentation allows configured programs and displays to be printed. The documentation is always up-to-date, as the current configuration data is accessed. Various sorting criteria, such as drawing numbers, assure an orderly and transparent output of the data to be documented.

The scope of documentation can be specified as desired by the user, such as:

- Program and display contents, cross references, parameter definition data and comments
- System overview and hardware configuration

The documentation specification can be stored for future use. The FBD, IL, LD, SFC and ST programs, displays, etc. are documented in the form in which they appear on the screen. Using Freelance documentation management, complete or partial project documentation can be produced without effort. It is also possible to include bitmaps (such as customer logos) in the drawing footer.

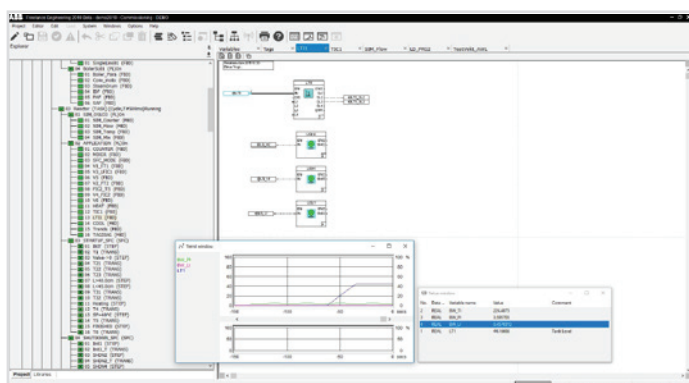


Configuration of the fieldbus line (FF)

## 8.3 Commissioning

During commissioning, the user programs are loaded into the operator and process stations. It is also possible to:

- Load modifications
- Start and stop process stations
- Start, stop or reset tasks
- Define and activate parameters for function blocks
- Define and activate parameters for field devices
- Display, set and track process values
- Combine any process values at any time in a trend window
- Perform version and status checks
- Perform system diagnoses right up to the field device



Trend and value window during commissioning

### Displaying process states

The editors for displaying the configured programs can also be accessed during commissioning. As opposed to during configuration, the process states of the I/O variables are also displayed in the program.

The status of the binary process signals is displayed in the FBD display by a change in the graphical representation of the signal flow lines. Value and trend windows are available for displaying process values. They offer an optimal overview of the current process values for commissioning and test purposes.

Here, the user is not restricted to the display of I/O variables for the program currently shown on the screen. Variables from other programs and / or controllers can also be displayed, as well as values from connections between various function blocks of the current program.

### Modifying parameters

Parameters can also be modified during the commissioning phase, allowing optimal program settings for the process. These parameters can be altered from either the engineering station or the operator station.

Whether the changes made are retained permanently or only temporarily is decided by the commissioner.

Through a parameter upload, it is possible to view all parameter modifications made in a particular period of time and to select those which are to be saved in order to be used at the next cold start. Other features allow you to force inputs and outputs and to specify new values for simulation purposes.



### 8.3.1 Commissioning the fieldbus lines

#### PROFIBUS

The fieldbus line overview shows whether the configured PROFIBUS I/O and PA devices are available. In addition, the bus can be scanned using Freelance Engineering in order to detect new or incorrectly configured devices. Such devices can then be given the correct address from Freelance Engineering via the PROFIBUS.

During commissioning, Freelance allows you to compare configured parameters with the parameters that exist in the device. This makes it possible to detect device parameters that have been changed locally and transfer them to the configuration by means of uploading. When the PROFIBUS device transmits diagnoses, they can be displayed by Freelance Engineering. When FDT / DTM technology is used, specific diagnostic options can be used, provided that the device manufacturer has incorporated such options in the DTM.

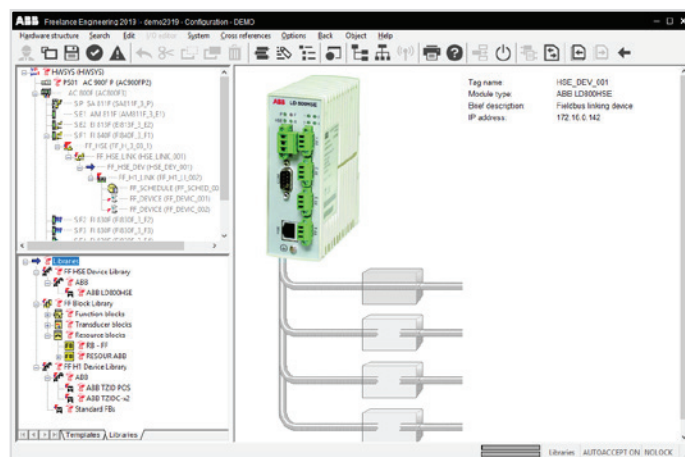
Individual PROFIBUS devices can be removed from cyclical data traffic in order to perform maintenance without it being necessary to stop the fieldbus.

#### FOUNDATION Fieldbus

Live lists displaying which devices exist are available for HSE and H1.

During commissioning, Freelance allows you to compare configured parameters for the device modules with the parameters that exist in the device. This makes it possible to detect device parameters that have been changed locally and transfer them to the configuration by means of uploading.

The Link Active Scheduler (LAS) can be stopped in order to interrupt processing of the control loops in a H1 link.



Online diagnosis of fieldbus components

## 8.4 Freelance Software languages

| Name                          | Short description                                                                                                                                                                             | Article no.    |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Changing the current language | Changing the current language<br>Indicate the Engineering hardkey number and the new language.<br>Software media and the user documentation in the chosen language are to order additionally. | 3BDS008503R09  |
| Available languages           | The Freelance Software is available in various languages.<br>For article numbers see the price list.                                                                                          | see price list |

## 8.5 Freelance Engineering license

Engineering license for one workplace supporting the following controllers:

- AC 900F, AC 800F, AC 700F
- DCP 02/10, DFC 01/02

For engineering at least one software media, one license (Standard or Professional), one hardkey and a language selection are required.

| Name                                  | Short description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Article no.   |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Freelance 2019 Engineering (Standard) | Software License<br>Order one Engineering hardkey for each engineering workplace<br>Freelance Engineering (Standard) supports <ul style="list-style-type: none"> <li>• 16 Character Tag Names</li> <li>• User Defined Function Blocks (runtime license)</li> <li>• OPC Function Block Classes (runtime license) Included in this license</li> <li>• WEB Display Configuration</li> </ul>                                                                                                                                                                 | 3BDS008510R10 |
| Engineering (Professional)            | Software License<br>Order one Engineering hardkey for each engineering workplace<br>Freelance Engineering (Professional) supports <ul style="list-style-type: none"> <li>• All features of Freelance Engineering (Standard)</li> <li>• Security Lock</li> <li>• User Defined Function Blocks (developer license)</li> <li>• OPC Function Block Classes (developer license)</li> <li>• FDT Technology</li> <li>• DTM Device Driver</li> </ul> Please check the list of DTMs which are approved by ABB for use with Freelance Engineering in version 2019. | 3BDS008520R10 |

## 8.6 Freelance Engineering hardkeys

| Name                        | Short description         | Article no.  |
|-----------------------------|---------------------------|--------------|
| Engineering Hardkey for USB | Windows 10, and Windows 7 | 3BDH000198R2 |



## 8.7 Control - Software license

Here you find software licenses for the following controllers:

- AC 900F
- AC 700F
- and all older once

This license releases the specified number of controllers (process stations) in the Freelance project tree.

For every used controller one license is needed:  
One redundancy couple = 1 controller = 1 control software license;  
Gateway (e.g. OPC) = no controller = no control software license.

Control Software license supports:

- IEC 61131-3, binary and analog
- PROFIBUS
- Closed loop control
- Freelance Operations
- 800xA Operation (requires item "OPC for Extended Automation")

Included in a controller license

- 50 IOs
- Tune (Self tune PID)
- Sequence of Events (only Rack I/O)
- Phase Logic Interface PLI
- Programming Interface API
- Modbus Serial (RTU)
- Modbus TCP
- Foundation Fieldbus

### 8.7.1 Base License

| Name                                     | Short description                                                                                  | Article no.   |
|------------------------------------------|----------------------------------------------------------------------------------------------------|---------------|
| Number of CPU Modules, incl. 50 IOs each | This license releases the specified number of Freelance controllers in the Freelance project tree. | 2PAA110432R10 |

### 8.7.2 Additional I/Os

The maximum number of I/O license depends on CPU type and application. Please use DigiSize for load calculation. The number of I/Os relevant for licensing is determined by counting only those I/Os that are in use in the field.

| Name                                 | Short description                                                                                                | Article no.   |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------|---------------|
| Set of 50 I/Os                       | The number of I/Os relevant for licensing is determined by counting only those I/Os that are in use in the field | 2PAA110433R10 |
| Freelance used for AC 500 Controller | If Freelance Operations and Engineering is used exclusively for AC 500 Controller, please select item E150.      | 2PAA116037R10 |

## 8.7.3 Controller license options

Additional option to Control Software. This option must be ordered for every controller, where you want to use it.

| Name        | Short description                                                                                                                                                                                     | Article no.   |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| TeleControl | Support for IEC 60870-5-101 and -104<br><br>Check whether the implemented subset of functionality meets your requirements.<br>IEC 60870-5-104 is currently not released with DCP 02/10 and DFC 01/02. | 3BDS008758R10 |

## 8.7.4 Batch

Interfaces to Batch applications. The Batch application has to be ordered separately.

| Name                          | Short description                                                                                                         | Article no.   |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------|---------------|
| Freelance Formulation         | Essential Recipe Manager. German and English user interfaces.                                                             | 2PAA110436R10 |
| Freelance Batch               | Interface to Freelance Batch                                                                                              | 2PAA110437R10 |
| Batch for Extended Automation | Interface to 800xA Batch<br><br>Please refer to Extended Automation 800xA price list for the batch application (license). | 2PAA110438R10 |

# 8.8 Expansion License 2019

## 8.8.1 Connectivity

| Name                        | Short description                                                                                                                                                                  | Article no.   |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Generic OPC                 | OPC Server                                                                                                                                                                         | 2PAA114242R10 |
| OPC for Extended Automation | Expands an Engineering workplace to a combined workplace. Freelance Operations (Standard) and Freelance Engineering can be used on the same workplace. Indicate the hardkey number | 2PAA114243R10 |
| Trend Server Package        | For trending data on Freelance Operations without using trend acquisition function block. Only one Trend Server is possible per system. Indicate the hardkey number                | 2PAA114244R10 |

## 8.8.2 Operations

| Name                                   | Short description                                                                                                                                                                                                                                           | Article no.   |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Operations Expansion, Lite to Standard | Indicate the hardkey number                                                                                                                                                                                                                                 | 2PAA114218R10 |
| Combined Workplace Standard            | Expands an Engineering workplace to a combined workplace. Freelance Operations (Standard) and Freelance Engineering can be used on the same workplace.<br>Indicate the hardkey number                                                                       | 2PAA114245R10 |
| Combined Workplace Lite                | Expands an Engineering workplace to a combined workplace. Freelance Operations (Lite) and Freelance Engineering can be used on the same workplace.<br>Only in combination with an Engineering License. Order one Combi hardkey for each combined workplace. | 2PAA116872R10 |
| Multi Monitor Support                  | Freelance 2019 supports up to four monitors for one operator workplace. Order this license for each additional monitor (e.g. 3 Multi Monitor Licenses for four monitors).<br>Indicate the hardkey number                                                    | 2PAA114246R10 |
| Control Aspect                         | Display (read only) of function block diagrams on an Freelance operator workplace.<br>Indicate the hardkey number                                                                                                                                           | 2PAA114247R10 |

## 8.8.3 Engineering

| Name                                     | Short description           | Article no.   |
|------------------------------------------|-----------------------------|---------------|
| Engineering Expansion, Standard to Prof. | Indicate the hardkey number | 3BDS008514R10 |

## 8.8.4 Control

| Name                                     | Short description                                                                                                     | Article no.   |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|---------------|
| Number of CPU Modules, incl. 50 IOs each | This license releases the specified number of Freelance controllers (process stations) in the Freelance project tree. | 2PAA114248R10 |
| Set of 50 I/Os                           | The number of I/Os relevant for licensing is determined by counting only those I/Os that are in use in the field      | 2PAA114249R10 |
| TeleControl                              | Support for IEC 60870-5-101 and -104                                                                                  | 2PAA114250R10 |

## 8.8.5 Batch

| Name                          | Short description                                                                                                                              | Article no.   |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Freelance Formulation         | Essential Recipe Manager. German and English user interfaces. This license includes a license for the Freelance Formulation batch application. | 2PAA114251R10 |
| Freelance Batch               | Interface to Freelance Batch                                                                                                                   | 2PAA114252R10 |
| Batch for Extended Automation | Interface to 800xA Batch<br>Please refer to Extended Automation 800xA price list for the batch application (license).                          | 2PAA114253R10 |



## 9. Freelance 2019 Media and documentation

|            |                                                |
|------------|------------------------------------------------|
| <b>153</b> | <b>9.1 Freelance 2019, General Information</b> |
| <b>153</b> | <b>9.2 Freelance Software 2019</b>             |

## 9.1 Freelance 2019, General Information

With this price list you can order product box and software media. Please refer to ABB library (Products and Services / Control Systems / Freelance / System / System Versions) for the current status and availability of localized software and associated service packs.

## 9.2 Freelance Software 2019

| Name                           | Short description                                                                                                                                                                                                                                              | Article no.  |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Freelance 2019 USB flash drive | Includes Freelance software of version 2019 (Engineering, Operations, Formulation, Extended user management, Online Help, PROFIBUS FDT Library, Foundation Fieldbus, Archive Browser, OPC Server, Trend Server, CBF Viewer and Freelance Controller Emulator). | 3BSE093041R1 |



## 10. Add-ons, extensions, and service

|            |                                             |
|------------|---------------------------------------------|
| <b>155</b> | <b>10.1 Automation Software Maintenance</b> |
| <b>156</b> | <b>10.2 Asset Management</b>                |
| <b>156</b> | <b>10.3 System Integration</b>              |
| <b>157</b> | <b>10.4 Training</b>                        |
| <b>157</b> | <b>10.5 Repair Services</b>                 |

A full range of lifecycle services from spare parts, repair, training and technical support to upgrades and evolution to help you keep production running, maximize system lifecycle, optimize processes and deliver operational excellence.

#### Comprehensive customer service

Service means a profitable investment in continually maximizing and optimizing the availability, performance, quality and security of a plant. ABB's support covers the following areas:

- Customer Support Services
- Training
- Spare Parts & Logistics, Repair
- Process, Application & Consulting Services
- Service agreements
- Extensions, upgrades and retrofits

## 10.1 Automation Software Maintenance

Control system life cycle management and investment protection have always been cornerstones of ABB's development programs. Over the last 30 years, ABB has built a large installed base across diverse industries. ABB looks after its installed base by crafting solutions that ensure the continued productivity, reliability and capability of all installed ABB assets.

With this 30 year track record, ABB has established a history of 'Evolution through enhancement' developing new products in a way that allows for incremental adoption, minimum risk to operations and maximum investment protection. In support of this mission is Automation Software Maintenance, ABB's control system life cycle management and support program. With this program, customers can keep control software up-to-date and maintain a flexible path forward to new system software technology. Automation Software Maintenance provides the fundamental software support deliverables required to

maintain operation and maximize the availability of the installed ABB control system.

Automation assists system owners in actively managing their ABB control system software life cycle costs. It provides:

- Optimal operation and availability of installed ABB assets through 24/7 support and maintenance services
- Better productivity through enhanced software functionality
- Lower support cost and more predictable software management budgeting as a result of annual subscription fee
- Access to the most current system documentation
- Evolution to more advanced human system interface, control platform, information management and connectivity
- A way to stay current with the latest technology standards

The Automation Program provides solutions for the main challenges system owner face to achieve maximum availability and reliability of the control system:

- Software maintenance and upgrades
- Cyber and IT security
- Online access to relevant information
- Control system software and performance checks

It also provides an evolution path to newer technology system enhancements to improve plant effectiveness and long-term support through annual maintenance subscription budgeting.

#### Benefits

- **Maintain operation and avoid loss of production:** Higher productivity through enhanced software functionality
- **Continuous optimization of your process operations:** Improves system availability, performance and reliability with predictable costs
- **Reduces overall maintenance costs:** Yearly subscription provides predictability for plant budgeting
- **Complete flexibility:** Improve your control system over time. Always the best, lowest risk path forward
- **Protection of intellectual property:** Your operator graphics and control programs are protected when new technology is implemented

For more information please refer to the Automation Software Maintenance - Lifecycle Management Program for Control Systems 3BDD015294. Read more about our Automation Software Maintenance Program and its many valuable services here:

<http://new.abb.com/control-systems/service-offerings/service-agreements>







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## 10.2 Asset Management

If you want to keep your production plant up and running in the long term, you need information about the availability and degree of wear and tear of your equipment. All of the information necessary for this is available; integrated and included in the basic software package of the Freelance control system. As a result, several customers have been able to avoid making investments that appeared essential but were in fact unnecessary. Freelance allows the use of modern asset management methods for more efficient maintenance and optimization – helping for instance to make optimum use of plant capacity.

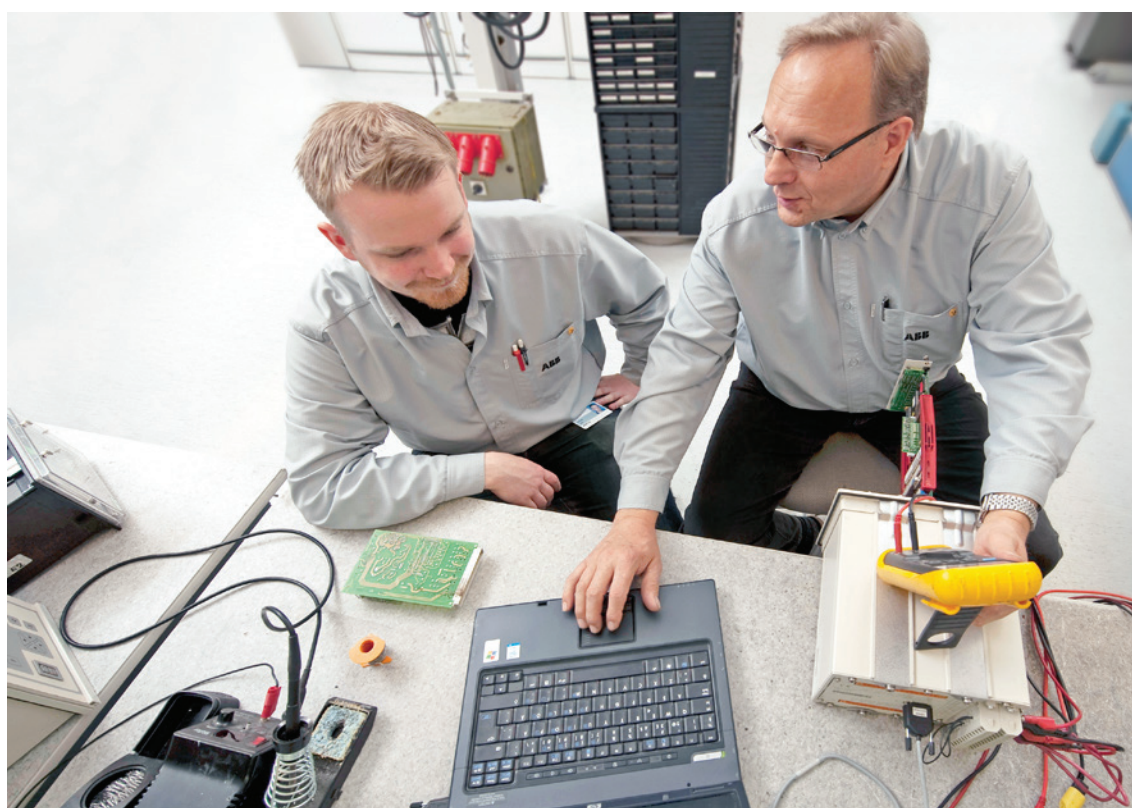
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## 10.3 System Integration

Our instrumentation and control specialists, or our certified partners in system integration, will be happy to assist you in planning and implementing your automation project. ABB Automation's staff can also work with you to plan and implement the installation of a Freelance system in your plant.

Under this arrangement, the ABB Engineering Department will compile the specific project documentation for you. This can include functional diagrams, circuit diagrams, configuration documentation, and operating documentation including system descriptions and instructions for operation, modes of operation and plant maintenance.

At many sites, ABB has its own commissioning engineers who work together with planning engineers, process instructors and operators to commission your plant, optimize it, perform a test run and hand over the system to the operator.







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## 10.4 Training

To make sure your operators are fully knowledgeable in the operation of the Freelance distributed control system, we offer a range of technical training courses.

In addition, we offer a computer-based training program for Freelance in this package. This will provide you with the basic knowledge you need for configuration, therefore allowing you to start using the system very quickly and efficiently.

[Solutions.abb/freelance](https://solutions.abb/freelance)

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## 10.5 Repair Services

ABB repair and troubleshooting support services are available throughout the life cycles of the plant and its process control systems.

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### **We repair and return your unique unit**

Our repair network provides repairs that meet original equipment specifications. Our world-class turnaround time for repairs is typically less than two weeks. We include a repair report in every return shipment.

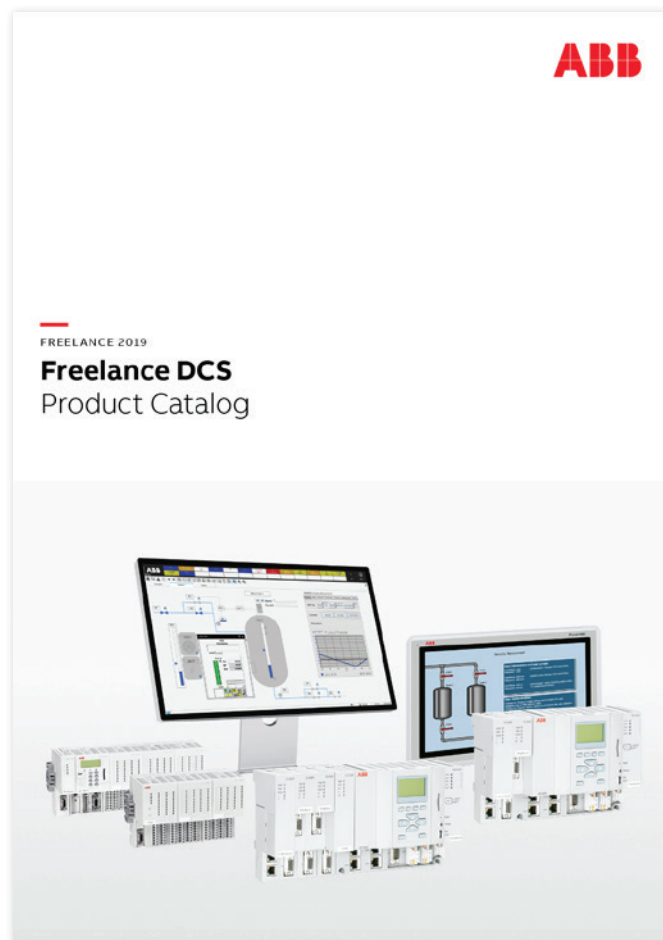
Please contact us for more information about our Repair Services or visit our web page:

[solutions.abb/freelance](https://solutions.abb/freelance)

You will find the information under “Services”.

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# 11. References



| Title                                                                  | Article No.    |
|------------------------------------------------------------------------|----------------|
| Introduction - Getting Started                                         | 3BDD012560     |
| Introduction - New Features History                                    | 3BDD011933     |
| Mounting and Installation Instructions, Safety Instructions            | 2PAA109317     |
| Mounting and Installation Instructions, AC 900F Controller             | 2PAA109295     |
| Mounting and Installation Instructions, AC 800F Controller             | 3BDD012501     |
| Mounting and Installation Instructions, AC 700F Controller             | 2PAA103858     |
| Mounting and Installation Instructions, Rack System                    | 3BDD012603     |
| Mounting and Installation Instructions, I/O Modules for AC 700F / 900F | 2PAA109294     |
| Engineering Manual, Process Stations                                   | 2PAA113009     |
| Engineering Manual, S700 I/O Modules                                   | 2PAA105800     |
| Engineering Manual, System Configuration                               | 3BDD012503     |
| Engineering Manual, IEC 61131-3 Programming                            | 3BDD012504     |
| Engineering Manual, Functions and Function Blocks                      | 3BDD012514     |
| Engineering Manual, Operator Station Configuration                     | 3BDD012518     |
| Engineering Manual, Communication and Fieldbuses                       | 3BDD012515     |
| Engineering Manual, IEC 60870-5 Telecontrol Library                    | 3BDD012509     |
| Engineering Manual, User Access                                        | 3BDD012513     |
| Engineering Manual, Trend Server                                       | 3BDD012527     |
| Engineering Manual, OPC Server F                                       | 3BDD012511     |
| Reference Manual, DMS / API                                            | 3BDD012508     |
| Engineering Manual, Buld Data Manager                                  | 2PAA105801     |
| Operator Manual, Freelance Operations                                  | 3BDD011932     |
| Operator Manual, Archive Browser                                       | 3BDD012601     |
| Engineering Manual, Process Station - Rack System                      | 3BDD012520     |
| Engineering Manual, I/O Modules for AC 700F / AC 900F                  | 2PAA109292     |
| Engineering Manual, Formulation                                        | 2PAA110024     |
| Engineering Manual, OPC Tunnel                                         | 2PAA106899     |
| System 800xA for Freelance 6.0 Installation                            | 3BDD011810-600 |
| System 800xA for Freelance 6.1 Operations                              | 3BDD011811-610 |
| System 800xA for Freelance 6.1 Configuration                           | 3BDD011812-610 |
| Automation Software Maintenance Program Guide                          | 3BSE047996     |

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# Index

| Type                                         | Page |
|----------------------------------------------|------|
| Accessories                                  |      |
| • TD 951F Display Unit                       | 29   |
| Accessories for AC 900F CAN Bus installation |      |
| • TB 870F Terminal Block                     | 30   |
| • TK 811F, CAN Cable                         | 30   |
| • TK 831F, CAN Cable                         | 30   |
| • TP 910F CAN Bus Termination Plug           | 30   |
| Accessories for S900                         | 121  |
| Additional basic I/Os                        |      |
| • Set of 50 I/Os                             | 149  |
| • Freelance used for AC 500 Controller       | 149  |
| AI-profile                                   | 103  |
| AM 810F-Z                                    | 53   |
| AM 895F                                      | 54   |
| Analog Input Modules                         |      |
| • AI 723F                                    | 82   |
| • AI 731F                                    | 84   |
| • AI801                                      | 109  |
| • AI810                                      | 104  |
| • AI815                                      | 104  |
| • AI820                                      | 104  |
| • AI825                                      | 104  |
| • AI830A                                     | 104  |
| • AI835A                                     | 104  |
| • AI843                                      | 104  |
| • AI845                                      | 104  |
| • AI890                                      | 104  |
| • AI893                                      | 105  |
| • AI895                                      | 105  |
| • AI910                                      | 116  |
| • AI930                                      | 117  |
| • AI931                                      | 117  |
| • AI950                                      | 118  |
| Analog Output Modules                        |      |
| • AO 723F                                    | 87   |
| • AO801                                      | 109  |
| • AO810V2                                    | 105  |

| Type                        | Page     |
|-----------------------------|----------|
| • AO815                     | 105      |
| • AO820                     | 105      |
| • AO845A                    | 105      |
| • AO890                     | 105      |
| • AO895                     | 105      |
| • AO910                     | 118      |
| • AO920                     | 119      |
| • AO930                     | 119      |
| Analog input/output module  |          |
| • AX 722F                   | 90       |
| Batch                       |          |
| • Extended Automation Batch | 150, 151 |
| • Freelance Batch           | 150, 151 |
| • Freelance Formulation     | 150, 151 |
| Battery                     |          |
| • TA 951F                   | 29       |
| Battery Modules             |          |
| • AM 811F/AM811F-Z          | 53       |
| • SB 808F                   | 53       |
| • SY 809F                   | 53       |
| • TA521                     | 62       |
| BI100                       |          |
| • Field Housing roof        | 120      |
| BI923S                      | 121      |
| BI924S                      | 121      |
| BI934S                      | 121      |
| BP914S                      | 121      |
| Cables                      |          |
| • TK 701F                   | 62       |
| • TK 802F                   | 55       |
| • TK 807F                   | 55       |
| • TK 808F                   | 55       |
| • TK 809F                   | 55       |
| • TK 811F                   | 55       |
| • TK 821F                   | 55       |
| • TK 831F                   | 55       |
| • TK 890F                   | 55       |

| Type                                    | Page     |
|-----------------------------------------|----------|
| • TK 891F                               | 55       |
| CAN Communication Interface for AC 900F | 26       |
| CD910                                   | 122      |
| Changing the current language           | 134, 148 |
| CI 741F                                 | 68       |
| CI801                                   | 103      |
| CI840A                                  | 103      |
| Clamps                                  | 55       |
| Clips                                   | 55       |
| Commissioning                           | 146      |
| Communication Interface                 |          |
| • CI801                                 | 103      |
| • CI840A                                | 103      |
| • CI 930F                               | 24       |
| • CI 773F                               | 25       |
| • CI 910F                               | 26       |
| Control Aspect                          | 135, 151 |
| Controller license options              | 150      |
| Controllers                             |          |
| • AC 700F                               | 56       |
| • AC 900F                               | 14       |
| • Overview                              | 12       |
| • PM 783F                               | 58       |
| • PM 803F                               | 38, 52   |
| • PM 901F                               | 22       |
| • PM 902F                               | 19       |
| • PM 904F                               | 19       |
| Control Software License                | 149      |
| Control Software Option                 |          |
| • TeleControl                           | 150, 151 |
| CP-C                                    | 63       |
| Digital Input Modules                   |          |
| • DI 724F                               | 76       |
| • DI801                                 | 110      |
| • DI802                                 | 110      |
| • DI803                                 | 110      |

# Index

| Type                         | Page |
|------------------------------|------|
| • DI810                      | 106  |
| • DI811                      | 106  |
| • DI814                      | 106  |
| • DI818                      | 106  |
| • DI820                      | 106  |
| • DI821                      | 106  |
| • DI828                      | 106  |
| • DI840                      | 106  |
| • DI890                      | 106  |
| • DP910                      | 116  |
| Digital Input/Output Modules |      |
| • DA 701F                    | 93   |
| • DC 723F                    | 70   |
| • DC 732F                    | 72   |
| • DX 722F                    | 77   |
| • DX 731F                    | 79   |
| • DX910                      | 115  |
| Digital Output Modules       |      |
| • DO801                      | 110  |
| • DO802                      | 110  |
| • DO810                      | 107  |
| • DO814                      | 107  |
| • DO815                      | 107  |
| • DO818                      | 107  |
| • DO820                      | 107  |
| • DO821                      | 107  |
| • DO828                      | 107  |
| • DO840                      | 107  |
| • DO890                      | 107  |
| • DO910                      | 115  |
| Dimensional drawings         |      |
| • CPU Terminal Base          | 61   |
| • I/O terminal units         | 97   |
| Display Unit                 |      |
| • TD 951F                    | 29   |
| DP820                        | 107  |
| DP840                        | 107  |
| Dummy coupler Modules        |      |
| • TA 924F                    | 30   |

| Type                                                   | Page     |
|--------------------------------------------------------|----------|
| • TA 724F                                              | 30       |
| Engineering                                            |          |
| • Engineering (Professional)                           | 148      |
| • Engineering (Standard)                               | 148      |
| • Engineering Expansion, Standard to Prof.             | 151      |
| Faceplates                                             | 130      |
| FH660S                                                 |          |
| • Field Housing                                        | 120      |
| FH680S                                                 |          |
| • Field Housing                                        | 120      |
| • FI 810                                               | 46       |
| • FI 820F                                              | 47       |
| • FI 830F                                              | 48       |
| • FI 840F                                              | 50       |
| Fieldbus and field device configuration                | 144      |
| Field Housing                                          |          |
| • IP920                                                | 121      |
| Field Housing roof                                     | 120      |
| FOUNDATION Fieldbus network components                 |          |
| • LD 800HSE EX                                         | 126      |
| • LD 810HSE EX                                         | 126      |
| • Redundancy Link Cable                                | 126      |
| • Media CD, LD 800HSE                                  | 126      |
| • Media CD, LD 800HSE and LD 800HSE EX                 | 126      |
| • Printed User Instructions LD 800HSE                  | 126      |
| • Printed User Instructions LD 800HSE and LD 800HSE EX | 126      |
| Freelance Engineering                                  |          |
| • Languages                                            | 148      |
| • License                                              | 148      |
| Freelance Rack I/O                                     |          |
| • How to connect                                       | 27       |
| FS801K01                                               | 104      |
| Function block diagrams                                | 141      |
| Generic OPC                                            | 135, 150 |
| Group display                                          | 130      |

| Type                     | Page |
|--------------------------|------|
| Hardkey                  |      |
| • Combi                  | 136  |
| • Freelance Engineering  | 139  |
| • Freelance Operations   | 128  |
| Hardware structure       |      |
| • Engineering            | 144  |
| IEC 61131-3 languages    | 141  |
| Instruction lists        | 142  |
| Interface Modules        |      |
| • BI914S                 | 121  |
| • CI 930F                | 24   |
| • EI 813F                | 44   |
| • EI 813F-Z              | 52   |
| • FI 810F                | 46   |
| • FI 810F-Z              | 53   |
| • FI 820F                | 47   |
| • FI 820F-Z              | 53   |
| • FI 830F                | 48   |
| • FI 830F-Z              | 53   |
| • FI 840F                | 50   |
| • FI 840F-Z              | 53   |
| • RLM01                  | 125  |
| • S700                   | 124  |
| Labels                   |      |
| • Front label set        | 103  |
| • Insert labels, IL910   | 121  |
| • Label set, item design | 103  |
| • Label Sets S800        | 107  |
| • Label Set S800L        | 110  |
| • TA525                  | 30   |
| Ladder diagrams          | 142  |
| License                  |      |
| • Freelance Engineering  | 148  |
| • Freelance Operations   | 135  |
| • Base License           | 149  |
| Markers for I/O Modules  |      |
| • TA523                  | 102  |
| • TA525                  | 102  |
| Message line             | 132  |

# Index

| Type                               | Page     |
|------------------------------------|----------|
| Message list                       | 132      |
| Mounting kit                       | 103      |
| Mounting profile 1800              | 103      |
| Multi Monitor Support              | 135      |
| Network Components                 |          |
| • FOUNDATION Fieldbus              | 126      |
| • PROFIBUS                         | 125      |
| OPC for Extended Automation        | 135, 150 |
| Operations (Lite)                  |          |
| • License                          | 135      |
| Operations (Standard)              |          |
| • License                          | 135      |
| Operator hint list                 | 133      |
| Overview display                   | 129      |
| Plant-specific displays            | 129      |
| PM 803F                            | 38       |
| PM 803F-Z                          | 52       |
| Power Supplies                     |          |
| • SA 811F                          | 40       |
| • SA 811F-Z                        | 52       |
| • SA920                            | 114      |
| • SD 812F                          | 42       |
| • SD 812F-Z                        | 52       |
| • SD822Z                           | 112      |
| • SD831                            | 63, 112  |
| • SD832                            | 63, 112  |
| • SD833                            | 63, 112  |
| • SD834                            | 63, 112  |
| • SS822Z                           | 112      |
| • SS832                            | 112      |
| • CP-C.1 24/5.0                    | 63       |
| • CP-C.1 24/10.0                   | 63       |
| Power supplies for S800 I/O        | 112      |
| PROFIBUS DP configuration for S700 | 124      |
| PROFIBUS network components        |          |

| Type                              | Page |
|-----------------------------------|------|
| • RLM01                           | 125  |
| • Power Supply Filter             | 125  |
| • PCO 010                         | 125  |
| • PCO 011                         | 125  |
| • PCO 012                         | 125  |
| Project data base                 | 140  |
| Project tree                      | 140  |
| Repair Services                   | 157  |
| RW 856F                           | 55   |
| RY 885F                           | 55   |
| S700 I/O                          | 67   |
| S700 I/O terminal units           | 97   |
| S800 I/O user documentation       |      |
| • User documentation, S800 I/O    | 112  |
| S800 Remote I/O                   | 102  |
| S900 - BI100                      | 120  |
| S900 Remote I/O                   | 113  |
| Sequential function charts        | 141  |
| SFC display                       | 130  |
| Software/Documentation            |      |
| • Automation Software Maintenance | 134  |
| • Batch for Extended Automation   | 150  |
| • Changing the current language   | 148  |
| • Combined Workplace              | 135  |
| • Control Software license        | 149  |
| • English language                | 134  |
| • Freelance Batch                 | 150  |
| • Freelance 2019 USB flash drive  | 153  |
| • Freelance 2019 Product Box      | 153  |
| • German language                 | 134  |
| • Other languages                 | 134  |
| • S800 I/O                        | 112  |
| • TeleControl                     | 150  |
| Structured text                   | 142  |
| TA521                             | 62   |
| TA523                             | 102  |
| TA525                             | 102  |
| TA526                             | 62   |

| Type                      | Page   |
|---------------------------|--------|
| TA 724F                   | 30, 62 |
| TA 924F                   | 30     |
| TA 951F                   | 29     |
| TB805                     | 111    |
| TB806                     | 111    |
| TB807                     | 111    |
| TB820V2                   | 111    |
| TB840A                    | 111    |
| TB842                     | 111    |
| TB845                     | 111    |
| TB846                     | 111    |
| TB 870F                   | 30, 55 |
| TD 951F                   | 29     |
| TeleControl               |        |
| • Control Software Option | 150    |
| Terminal Units            |        |
| • TB 711F                 | 60     |
| • TU 709F                 | 99     |
| • TU 710F                 | 99     |
| • TU 715F                 | 100    |
| • TU 716F                 | 100    |
| • TU 731F                 | 101    |
| • TU 732F                 | 101    |
| • TU805K01                | 108    |
| • TU810V1                 | 108    |
| • TU811V1                 | 108    |
| • TU812V1                 | 108    |
| • TU813                   | 108    |
| • TU814V1                 | 108    |
| • TU818                   | 108    |
| • TU819                   | 108    |
| • TU830V1                 | 108    |
| • TU831V1                 | 108    |
| • TU833                   | 108    |
| • TU834                   | 108    |
| • TU835V1                 | 108    |
| • TU836V1                 | 108    |
| • TU837V1                 | 108    |
| • TU838                   | 108    |

| Type                        | Page        |
|-----------------------------|-------------|
| • TU839                     | 108         |
| • TU842                     | 108         |
| • TU843                     | 108         |
| • TU844                     | 108         |
| • TU845                     | 108         |
| • TU846                     | 103         |
| • TU847                     | 103         |
| • TU850                     | 109         |
| • TU851                     | 109         |
| • TU852                     | 109         |
| • TU854                     | 109         |
| • TU890                     | 109         |
| • TU891                     | 109         |
| • TU921                     | 114         |
| • TY801K01                  | 109         |
| • TY804K01                  | 109         |
| • TY820K01                  | 109         |
| Terminal Units for S700 I/O | 97          |
| Time scheduler display      | 131         |
| TK212A                      | 104         |
| TK801                       | 111         |
| TK811                       | 111         |
| TK 811F                     | 30, 55      |
| TK812                       | 112         |
| TK 831F                     | 30, 55      |
| TP 910F                     | 30          |
| Trend display               | 131         |
| Trend Server Package        | 135,<br>150 |
| TU 709F                     | 99          |
| TU 710F                     | 99          |
| TU807                       | 111         |
| TU840                       | 111         |
| TU841                       | 111         |
| TU848                       | 111         |
| TU849                       | 111         |
| TV 821F                     | 55          |
| TV 822F                     | 55          |
| TV 823F                     | 55          |

| Type                  | Page |
|-----------------------|------|
| TV 824F               | 55   |
| TV 825F               | 55   |
| TV 831F               | 55   |
| TV 832F               | 55   |
| White Plastic Markers | 30   |





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