ABB CONTROL SYSTEMS

Freelance DCS

Product Catalog



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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	• Input and output conversion • Linearization • Delay and dead-time filter • Average / extreme value determination in time • Setpoint adjustment • Counter with analog input • Time scheduler
Binary value processing	• Binary output, monostable • Input and output delay • Pulse / Time Counter, pushbutton
Closed-loop control	• Continuous controllers (PID), Step controllers • On / Off controller, three-position controller • Ratio controller • Basic functions • Auto-tuning
Open-loop control	• Individual drive functions • Sequence control, dosing circuits
Logic functions	• Logic processing • Average / Extreme value determination • Comparator, binary switch • Multiplexer • Converter (data type & code) • Flip-flop, edge detection • String blocks • Radio controlled adjustment of daylight-saving time
Monitoring	• Analog and binary monitoring • Event monitoring • Audible alarm control • Connection monitoring
Acquisition functions	• Disturbance course acquisition, trend acquisition
Arithmetic functions	• Basic arithmetic functions, numerical functions • Logarithmic functions • Trigonometric functions • Analog value and time limitation
Modbus functions	• Master and slave functions
PROFIBUS	• DPV1 master functions
Telecontrol functions	• Master and slave functions
Phase logic processing	• Interface module for batch applications

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.

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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

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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

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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, 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.

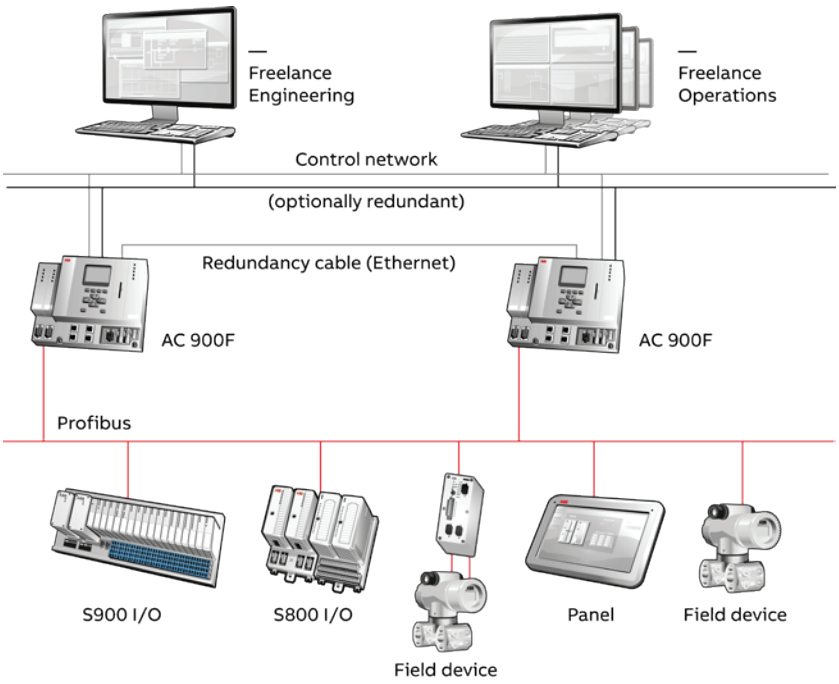
The data for the modules contain the combined power consumption from internal and external supply sources. For detailed information see the Mounting and Installation Instructions, AC 900F manual.

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.



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

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

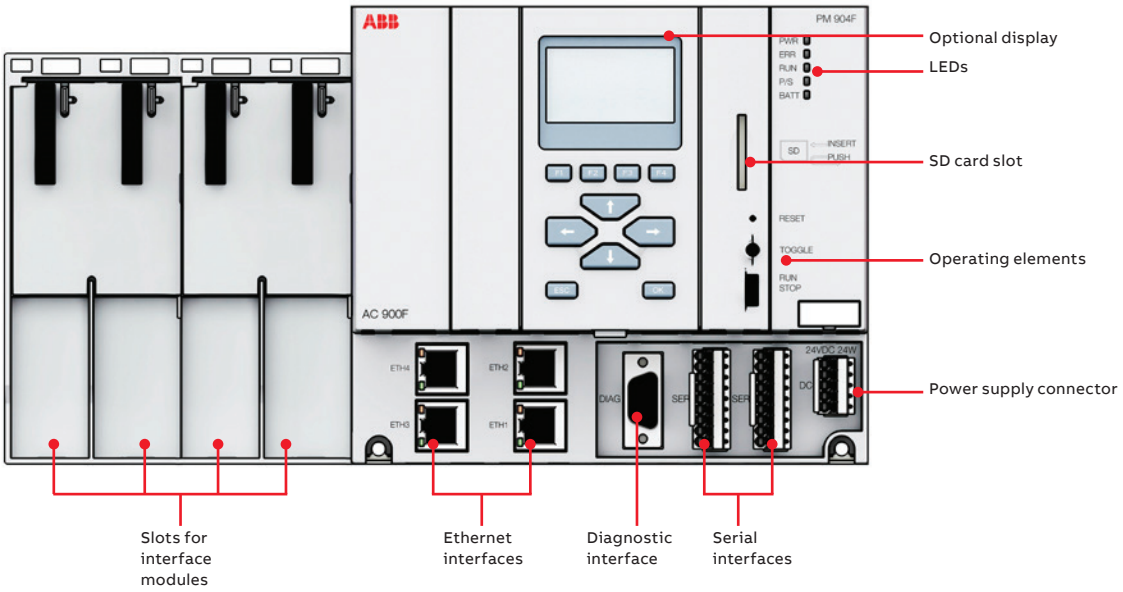
The CPU and the local S700 I/O modules communicate very fast. I/O scan times of 2 ms are possible. Short circuit and line break detection can be realized for each channel. Coupler bus slots on the left side can be assigned with fieldbus interface modules.

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.



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CPU module PM 904F

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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 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 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: • Cyclic (equidistant) • Cyclic (as fast as possible) • Event driven	 • Configurable cycle times from 5 ms • PLC mode • Predefined events
Serial interfaces (SER1 and SER2) • Physical link: • Connection: • Usage:	 • Configurable for RS-232 or RS-485 (from 600 bps to 38400 bps), Pluggable terminal block with spring connection • Modbus RTU • Telecontrol IEC 60870-5-101
Onboard network interface 4 Ethernet interfaces (RJ45) • Ethernet 1: • Ethernet 2: • Ethernet 3 & 4:	 • for ControlNet (optional Modbus TCP and Telecontrol IEC 60870-5-104) • for redundancy link • for Modbus TCP and Telecontrol IEC 60870-5-104 or for ControlNet redundancy
Weight	1.1 kg (2.43 lbs)
Dimensions	Width 285 mm (11.22 inch) Height 152 mm (5.98 inch) Depth 95 mm (3.74 inch)