2014

System overview

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System overview

Content

M1 controller hardware - industrial controller with a future

Individual requirements can be met easily with a wide range of powerful CPUs based on industrial (Pentium) processors and with an extensive range of I/O modules. Real-time capable bus systems enable the automation to be decentralized without any loss of performance.

The M1 controller perfectly combines the openness of a PC-based controller with the reliability of industrial hardware platforms. Designed for the toughest ambient conditions, they guarantee fault-free operation with a fanless installation up to an ambient temperature of 60 °C.

State of the art system architecture designed for seamless networking capability enables the M1 to be integrated easily in the area of the controller and system peripherals. Real-time Ethernet enables real-time controller networking and the support of all currently available fieldbus systems enables external components to be connected via standard interfaces.

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Processor modules

Maximum performance and unrivalled robustness.

The processor modules of the M1 automation system stand out on account of their optimum performance and unrivalled robustness. Integrated into Bachmann CPU boards and I/O systems, industrial Pentium processors in an embedded design ensure absolute deterministic real-time behavior.

Even the most rigorous demands in terms of flexible data exchange and networking can be met without costly additional modules: M1 processor modules offer the full range of interfaces already »on-board«. This offers the automation engineer total freedom and ensures cost efficient and compact design. Ample power reserves for networking and communication-intensive applications are provided as basic features. The mass storage of the device is also fully scalable.

As Programmable Automation Controllers (PAC), M1 CPUs combine flexibility, open standards and the performance of the PC / IT-world with the industrial robustness of classical PLC.
The comprehensive scope of Bachmann electronic software enables it to be used as a PLC, motion controller or communication and data centre.

Consistent compatibility of the PACs application software protects the user's investments for future expansions.

Processor modules
ME203 series

Features
Intel 80386 EX, 33 MHz
Integrated power supply, 17 W / 24 V
SRAM: 512 kB (battery backed)
DRAM: 8 MB
FLASH: 8 MB file-flash, 2 MB boot flash
1x Ethernet 10 / 100 Mbit /s or 1x CAN/CANopen
1x RS232, 1x RS232/422/485
Slots: PCC201/xx

Processor modules MX200 series

Features
CPU x86 66 MHz / CPU 133 MHz / CPU 200 MHz Pentium class
Integrated power supply 17 W / 24 V
nvRAM: 512 kB, DRAM: 256 MB, FLASH: 16 MB internal
2x Ethernet 10 / 100 Mbit / s
1x CAN/CANopen
1x USB, 1x RS232, 1x RS232/422/485
Slots: PCC201/xx, CF200/xx

Processor modules MPC200 series

Features
CPU 400 / 650 / 700 / 933 MHz Pentium class
SRAM: to 512 kB (battery backed)
DRAM: 64 or 128 MB, FLASH: 8 MB internal
nvRAM-0: 64 kB (no battery necessary)
1x USB, 1x RS232, 1x RS232/422/485
2x Ethernet 10 / 100 Mbit / s
Slots: PCC201/xx, CF200/xx

Processor modules MC200 series

Features
CPU 600 MHz ATOM E620 / 1,6 GHz ATOM E680
DRAM: 1 GB DDR2
nvRAM0 (data memory): 512 kB
1x USB-Host, 1x Service USB interface, 1x RS232, 1x RS232/422/485
2x Ethernet 10 / 100 / 1000 Mbit / s with IEEE1588
Slots: CFast200/xx
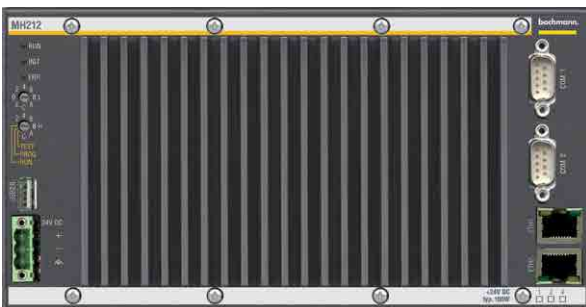
Processor modules MH200 series

Features
CPU 1.2 GHz Celeron
nvRAM: 512 kB
FLASH: 16 MB internal
2x Ethernet 10/100/1000 Mbit/s
1x RS232, 1x RS232/422/485
1x USB 2.0
Internal mass memory: CFast card
Slot: CFA200/xx
Integrated power supply

Processor modules

Processor modules ME203 series

The processor modules of the ME203 series extend the range of the M1 controller family in terms of reduced power consumption and moderate cycle times. With an extremely slim design of only one module width, ME203 CPUs offer all the essential features of larger type series but with a lower power consumption.

Several networking and power supply options scale the module ideally for smaller applications. As fully-fledged M1 CPUs, ME203 processor modules are not only configured with the same tools as the high-end families MX and MPC, but are also fully code and application compatible, although they have less memory and fewer interfaces.

All modules have two serial interfaces and a front slot for one PC card. The optional Ethernet interface allows integration in 10 / 100 Mbit / s networks at full data rate. With the retentive program and data storage devices, also larger projects can be handled without the need for external media. In addition to the supply of the processor module, an integrated optional power supply provides 17 W for extra I/O modules.

- 80386 EX processor
- 2 serial interfaces
- Optional integrated power supply, 17 W / 24 V DC
- Optional CAN bus interface
  or Ethernet 100 Mbit 100 Mbit / s interface
- RAM 8 MB DRAM
- Data memory 512 kB SRAM, (battery backed)
- Integrated program memory
- Removable memory:
  PC cards with 8 / 16 / 32 / 64 MB
- Battery backed real-time clock (RTC)
- Status displays for RUN, INIT and ERROR
- Watchdog

Item	Item no.
ME203/EN	00013177-00
ME203/EN❄	00015985-00
ME203/CN	00013176-00
ME203/CNW	00013191-00
ME203/CN❄	00016336-00

ME203 series	
Processor + memory	
CPU	Intel 80386 EX, 33 MHz
SRAM (data memory)	512 kB (battery backed)
DRAM (working memory)	8 MB
PC card **	PCC201 / xx with 16 / 32 / 64 MB
Boot FLASH	2 MB (reserved by system software)
Program FLASH ***	8 MB
Interfaces	
Serial (standard)	1x RS232 + 1x RS232 / 422 / 485, 64 byte FIFO
Ethernet (optional)	1x 10/100 Mbit / s
CAN (optional)	1x 10 k .. 1 MBaud*
Power supply	
External power supply module**	5 V, ±15 V via backplane
Internal power supply module (optional)	Own supply and 17 W for I/Os modules: +5 V / 2 A, +15 V / 250 mA, -15 V / 200 mA supply voltage: 24 V DC (18 .. 34 V)
Galvanic isolation	Supply to the system 500 V
Additional features	
Watchdog	
Real-time clock with battery	
Status indication via 3 LEDs	
CPU-ID selectable with rotary hexadecimal switches	

Ambient conditions	Standard	Cold Weather (W)	ColdClimate (❄)
Operating temperature	-30 .. +60 °C fanless		
Rel. humidity operation	5 .. 95 % without condensation		5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C		
Rel. humidity storage	5 .. 95 % without condensation	5 .. 95 % with condensation	

Execution variants	
ME203/EN	CPU module 386EX (33MHz); 8MB DRAM; 512kB SRAM; 8MB file-flash; 1x Eth100; 1x RS232; 1x RS232/422/485; integrated power supply 17W; PCC slot
ME203/EN❄	Like ME203/EN; ColdClimate (❄)
ME203/CN	CPU module 386EX (33MHz); 8MB DRAM; 512kB SRAM; 8MB file-flash; 1x CAN/CANopen; 1x RS232; 1x RS232/422/485; integrated power supply 17W; PCC slot
ME203/CNW	CPU module 386EX (33MHz); 8MB DRAM; 512kB SRAM; 8MB file-flash; 1x CAN/CANopen; 1x RS232; 1x RS232/422/485; integrated power supply 17W; PCC slot; Cold Weather (W)
ME203/CN❄	Like ME203/CN; ColdClimate (❄)

*   TCP / IP protocol can also be run via CAN

**   not included in delivery

*** depending on the configuration, a part of the program memory is reserved for the system software
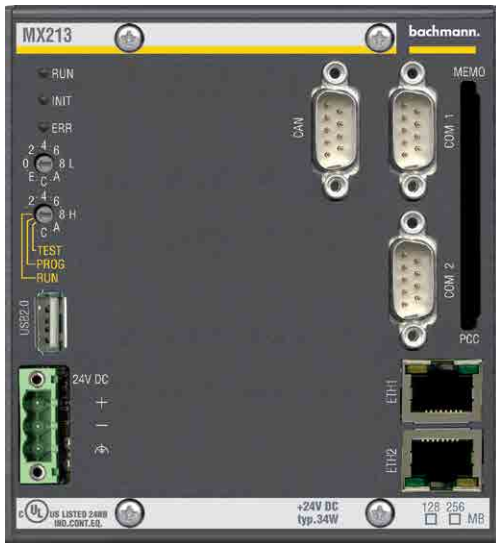
Processor modules

Processor modules MX200 series

The processor modules of the MX200 series are Module based on PC technology for the M1 controller system. Depending on the type, the modules are equipped with a power supply and an integrated CAN master, and have 100 Mbit Ethernet ports that allow the simple integration of the controller in physically separated networks. The processor module with integrated floating point unit (FPU) is suitable for control applications. The MX200 modules are equipped with non-volatile RAM which provides maximum data security for more than 10 years without battery back-up.

Depending on type, the following features are:
• 2 serial interfaces
• 2 Ethernet-interfaces 10 / 100 Mbit / s
  with status displays
• 1 CAN interface
• 1 USB interface
• Status indicating LEDs for RUN, INIT and ERROR
• Mass storage (Compact Flash)
• RAM 256 MB DRAM
• Data memory 512 kB nvRAM
• Program memory of 16 / 32 / 64 MB FLASH on
  PC card and 16 MB internal FLASH (4 MB for
  system software, 12 MB for applications)
• Integrated power supply

Item	Device	Item no.
MX207		00014445-00
MX213	CF512MB	00018594-00
MX213	CF4GB	00018594-10
MX213❈	CF512MB	00018597-00
MX213❈	CF4GB	00018597-10
MX220	CF512MB	00018593-00
MX220	CF4GB	00018593-10
MX220❈		00019210-00
MX220❈	CF512MB	00017689-00
MX220❈	CF4GB	00017689-10

MX200 series	MX207	MX213/x	MX220/x
Processor + memory			
CPU	x86	x86	x86
Performance (Pentium equivalent)	66 MHz	133 MHz	200 MHz
CF (mass storage)	-	Without restriction	
nvRAM (data memory)	512 kB		
DRAM (working memory)	256 MB		
PC card (program memory)**	-	PCC201 / xx with 16 / 32 / 64 MB FLASH	
FLASH (program memory)**	16 MB internal		
Interfaces			
Serial	1x RS232	1x RS232 + 1x RS232 / 422 / 485	
Ethernet	1x 10 / 100 base-Tx	2x 10 / 100 base-Tx	
USB	1x USB 2.0		
CAN	1x 10 k .. 1 Mbit/s		
Power supply for I/O			
Supply voltage	24 VDC (18 .. 34 V)		
Nominal power	17 W for I/O		
Module	+5 V / 2000 mA; +15 V / 250 mA; -15 V / 200 mA		
Additional features			
Watchdog			
Synchronizing pulse also for Ethernet and fieldbuses SERCOS and CAN			
Real-time clock with battery			
Status indication via 3 LEDs			
CPU-ID selectable with rotary hexadecimal switches			
Operating system VxWorks with Bachmann system extensions on internal FLASH			
Ambient conditions	Standard	ColdClimate (❄)	
Operating temperature	-30 .. +60 °C fanless		
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation	
Storage temperature	-40 .. +85 °C		
Rel. humidity storage	5 .. 95 % without condensation	5 .. 95 % with condensation	

*   not included in delivery

*** depending on the configuration, a part of the program memory is reserved for the system software

Processor modules

MX200 series	
Execution variants	
MX220	CPU module LX700 (433MHz); 256MB DRAM; 512kB nvRAM; 16MB file-flash; 2x Eth100; 1x CAN/CANopen; 1x RS232; 1x RS232/422/485; 1x USB2.0; integrated power supply 17W; PCC slot; CF slot
MX220❄	Like MX220; ColdClimate (❄)
MX213	CPU module LX700 (266MHz); 256MB DRAM; 512kB nvRAM; 16MB file-flash; 2x Eth100; 1x CAN/CANopen; 1x RS232; 1x RS232/422/485; 1x USB2.0; integrated power supply 17W; PCC slot; CF slot
MX213❄	Like MX213; ColdClimate (❄)
MX207	CPU module LX700 (266MHz); without Cache; 256MB DRAM; 512kB nvRAM; 16MB file-flash; 1x Eth100; 1x CAN/CANopen; 1x RS232; 1x USB2.0; integrated power supply 17W

Processor modules MPC200 series

The processor modules of the MPC200 series are modules for the M1 Controller System with Pentium class III processors, based on PC technology. They are available with various processor clock rates and in several configurations.

- Flexibility thanks to PC technology
- Pentium III class processors
- Various processor clock rates
- 2 serial interfaces
- 2 Ethernet-interfaces 10 / 100 Mbit/s with status displays
- 1 USB interface V1.1 functionality
- Real time clock, status displays for RUN, INIT, ERROR
- Mass storage Compact Flash type I
- RAM 128 MB DRAM
- Data memory 512 kB SRAM, battery backed
- Data memory 64 kB nvRAM
- Program memory 32 / 64 MB FLASH on PC card

Item	Device	Item no.
MPC240		00012711-40
MPC240	CF512MB	00018591-00
MPC240	CF4GB	00018591-10
MPC240❋		00016338-40
MPC240❋	CF512MB	00020547-00
MPC240❋	CF4GB	00020547-10
MPC240/W		00013127-40
MPC240/W	CF512MB	00021018-00
MPC240/W	CF4GB	00018372-00
MPC265		00012708-40
MPC265	CF512MB	00018587-00
MPC265	CF4GB	00018587-10
MPC270		00012710-40
MPC270	CF512MB	00018589-00
MPC270	CF4GB	00018589-10
MPC270❋		00016180-40
MPC270❋	CF512MB	00020413-00
MPC270❋	CF4GB	00020413-10
MPC270/W		00013129-40
MPC270/W	CF512MB	00023264-00
MPC270/W	CF4GB	auf Anfrage
MPC293		00014274-40
MPC293	CF512MB	00017629-00
MPC293	CF4GB	auf Anfrage
MPC293/W		00017332-40
MPC293/W	CF512MB	00020575-00

Processor modules

MPC200 series	MPC240	MPC265	MPC270	MPC293
Processor + memory				
CPU	Celeron / Pentium III architecture (embedded), 400 / 650 / 700 MHz			
	400 MHz	650 MHz	700 MHz	933 MHz
CF (mass storage)	Without restriction			
nvRAM-0 (data memory)	512 kB SRAM, battery backed			
nvRAM-1 (data memory)	64 kB nvRAM (no battery necessary)			
DRAM (working memory)	128 MB			
PC card (program memory)**	PCC201 / xx with 32 / 64 MB FLASH			
Internal FLASH (program memory)**	8 MB, 4 MB for system software			
Interfaces				
Serial	1x RS232 + 1x RS232 / 422 / 485			
Ethernet	2x 10 / 100 base-TX			
USB	1x			
Power supply				
External power supply module	5 V, ±15 V via backplane			
Additional features				
Watchdog				
Synchronizing pulse also for SERCOS and CAN, Ethernet fieldbus				
Real-time clock with battery				
Status indication via 3 LEDs				
CPU-ID selectable with rotary hexadecimal switches				

Ambient conditions	Standard	Cold weather	ColdClimate (❄)
Operating temperature	0 .. +60 °C fanless		-30 .. +60 °C fanless
Rel. humidity operation	5 .. 95 % without condensation		5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C		
Rel. humidity storage	5 .. 95 % without condensation	5 .. 95 % with condensation	

Execution variants	
MPC240	CPU module P III (400MHz); 512kB SRAM; 64kB nvRAM; 8MB file-flash; 2x Eth100; 1x RS232; 1x RS232/422/485; 1x USB1.1; PCC slot; CF slot
MPC265	CPU module Cel (650MHz); 512kB SRAM; 64kB nvRAM; 8MB file-flash; 2x Eth100; 1x RS232; 1x RS232/422/485; 1x USB1.1; PCC slot; CF slot
MPC270	CPU module P III (700MHz); 512kB SRAM; 64kB nvRAM; 8MB file-flash; 2x Eth100; 1x RS232; 1x RS232/422/485; 1x USB1.1; PCC slot; CF slot
MPC240/W	CPU module P III (400MHz); 512kB SRAM; 64kB nvRAM; 8MB file-flash; 2x Eth100; 1x RS232; 1x RS232/422/485; 1x USB1.1; PCC slot; CF slot; Cold Weather (W)
MPC240❄	Like MPC240; ColdClimate (❄)
MPC270❄	Like MPC270; ColdClimate (❄)
MPC293	CPU module P III (933MHz); 512kB SRAM; 64kB nvRAM; 8MB file-flash; 2x Eth100; 1x RS232; 1x RS232/422/485; 1x USB1.1; PCC slot; CF slot
MPC293❄	Like MPC293; ColdClimate (❄)

*   not included in delivery
** depending on the configuration, a part of the program memory is reserved for the system software

Processor module MC200 series

The powerful processor modules of the MC200 series offer maximum performance for demanding applications of your M1 control system. The CPUs are based on the latest embedded ATOM technology, consequently they are ideally suited for the most demanding regulating tasks, process control, signal processing and complex communication protocols. Through the use of state-of-the-art technology in a robust design, a compact powerhouse with a long service life and a broad temperature range (-30 to +60 °C) is available. The supplemental integrated, autonomous process image controller significantly offloads the processor and the I/O bus. This enables a new dimension in data transmission speed to the inputs and outputs for the fastest possible process cycles. Fast single accesses in the µs range for precise control and regulating tasks are also available. For efficient networking and state-of-the-art fieldbuses, two independent Gigabit Ethernet interfaces, including IEEE-1588 hardware support, are available. An internal CFast card enables fastest access speeds via the modern SATA (Serial Advanced Technology Attachment). Non-volatile memory of 512 kB is available as a drive and securely stores machine data for longer than 10 years, without an external energy supply or battery.

- 2 serial interfaces
- USB 2.0 host interface
- USB device service interface
- 2 Ethernet interfaces 10/100/1000 Mbit/s with IEEE 1588
- Process image controller
- 1 GB DRAM DDR2
- Data memory 512 kB non-volatile
- Internal mass storage CFast card
- internal 64 MB program memory

Item	Device	Item no.
MC205		00018805-10
MC205	CFA4GB	00018805-12
MC205❄		00020513-10
MC205❄	CFA4GB	00020513-12
MC210		00018806-10
MC210	CFA4GB	00018806-12
MC210❄		00020514-10
MC210❄	CFA4GB	00020514-12

Processor modules

MC200 series	MC210, MC210❄	MC205, MC205❄
Processor + memory		
CPU	1.6 GHz ATOM E680	600 MHz ATOM E620
I/O bus	Process image controller	
CFast (mass storage)	1 x integrated (accessible from the side) / > 8 GB	
RAM	1 GB DRAM DDR2	
nvRAM-0 (data memory)	512 kB	
Internal FLASH (program memory)	64 MB, 40 MB free for application program	
Interfaces		
Serial	1x RS232 + 1x RS232 / 422 / 485 (SW configurable)	
Ethernet	2x 10 / 100 / 1000 Base-T with IEEE1588	
USB host	1x USB 2.0	
Service USB interface	1x USB device	
Additional features		
Watchdog		
Synchronizing pulse also for I/O bus, fieldbuses SERCOS and CAN, Ethernet		
Real-time clock with battery		
Status indication via 3 LEDs		
CPU ID selectable with rotary hexadecimal switches		
Operating system VxWorks with Bachmann system extensions on internal FLASH		
Ambient conditions	Standard	ColdClimate (❄)
Operating temperature	-30 .. +60 °C, fan-free	
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % without condensation	5 .. 95 % with condensation
Design variants		
MC210	CPU module ATOM E680 (1,6GHz); 1GB DRAM, 512kB nvRAM; 64MB file-flash; 2x Eth100/1000; 1x RS232; 1x RS232/422/485; 1x USB2.0; 1x USB2.0 Device; CFast slot	
MC205	CPU module ATOM E620 (600MHz); 1GB DRAM, 512kB nvRAM; 64MB file-flash; 2x Eth100/1000; 1x RS232; 1x RS232/422/485; 1x USB2.0; 1x USB2.0 Device; CFast slot	
MC210❄	Like MC210; ColdClimate (❄)	
MC205❄	Like MC205; ColdClimate (❄)	
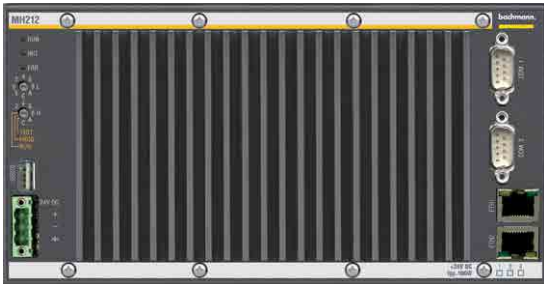
Processor modules MH200 series

The high-performance MH212/S processor module Celeron M offer maximum performance for demanding applications with an M1 controller. The CPU is based on the latest PC technology, consequently it is ideally suited for demanding computation tasks, databases, signal processing or extensive network applications. With integration of the power supply and the generously dimensioned passive cooling system, a compact powerhouse with long service life and an extensive temperature range (-30 °C to +60 °C) is ready. The additional integrated autonomous process image controller results in a significant offload of the processor and enables a new speed dimension for data transmission to the inputs and outputs for the fastest process cycles. For efficient networking and the state-of-the-art fieldbusses, two independent Gigabit Ethernet interfaces including IEEE-1588 hardware support are ready. An internal CFast card enables fastest access speeds via the modern SATA (Serial Advanced Technology Attachment). Non-volatile memory of 512 kB is available as a drive and stores machine data for longer that 10 years, without an external energy supply or battery.

- 2 serial interfaces
- USB 2.0 interface
- 2 Ethernet interfaces 10/100/1000 Mbit/s with IEEE 1588
- Process image controller
- Data memory 512 kB non-volatile
- Program memory intertal 16 MB Flash
- Internal mass storage CFast card
- Power supply 100 watt, power for I/O modules 30 watt

Item	Device	Item no.
MH212/S		00016370-00
MH212/S	CFA4GB	00016370-02
MH212/S❄		00018652-00
MH212/S❄	CFA4GB	00018652-02

Processor modules

MH200 series	MH212/S, MH212/S❄	
Processor + memory		
CPU	1.2 GHz Celeron M ULV 722	
I/O processor	process image controller	
CFast (mass storage)	1 x integrated (accessible via side cover)	
nvRAM-0 (data memory)	512 kB	
DRAM	2 GB	
Internal FLASH (program memory)	16 MB	
Interfaces		
Serial	1x RS232 + 1x RS232 / 422 / 485 (SW configurable)	
Ethernet	2x 10 / 100 / 1000 base-T	
USB	1x USB 2.0	
Power supply		
Internal power supply module	CPU supply and 30 watt for I/Os	
Supply voltage	24 V DC (18 V ... 34 V)	
Nominal power	17 W	
Module	+5 V / 3 A; +15 V / 500 mA; -15 V / 500 mA	
Additional features		
Watchdog		
Synchronizing pulse also for I/O busses, fieldbusses SERCOS and CAN, Ethernet		
Real-time clock with battery		
Status indication via 3 LEDs		
CPU-ID selectable with rotary hexadecimal switches		
Operating system VxWorks with Bachmann system extensions on internal FLASH		
Ambient conditions	Standard	ColdClimate (❄)
Operating temperature	0 .. +60 °C	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % without condensation	5 .. 95 % with condensation
Execution variants		
MH212/S	CPU module Celeron M ULV 722 (1,2GHz); 2GB DDR; 512kB nvRAM; 16MB file-flash; 2x Eth100/1000; 1x RS232; 1x RS232/422/485 isolated; 1x USB2.0; integrated power supply 30W; CFast slot	
MH212/S❄	Like MH212/S; ColdClimate (❄)	

Digital input/output modules

Efficiency for all channel types.

The M1 Automation System's wide range of digital I/O modules means there is a module for any channel type. A selection from the standard 6-channel variant up to the ultra-compact 80-channel module guarantees the right module for every purpose.

Combined I/O modules allow the operating mode (DI / DO) of each individual channel to be configured by the user. As well as the global standard 24 V DC input signal, 48 V DC modules are also available for the power station sector.

Bachmann electronic's M1 I /O modules not only allow the process image access typical of PLCs but also direct access at any point in the program. This makes it possible to configure individual digital inputs and their status changes as interrupt sources so that programs can respond to process-controlled inputs. All modules support transmission via FASTBUS (fiber optic cable), CAN or PROFINET and offer a high degree of flexibility in the design of sophisticated automation solutions.

Digital input modules DI212/216/232

Features
Number of inputs: 12 / 16 / 32
Input voltage: nom. 24 V DC / nom. 48 V DC
Separate single groups
Interrupt inputs: max. 2
Sink/source inputs
Galvanic isolation
Status display for each channel via LED

Digital output modules DO216/232

Features

Number of outputs: 16 / 32
Output voltage: nom. 24 V DC / nom. 48 V DC
Output current: depends on type 2.5 / 1 / 0.5 A
Total current depends on type: 8 / 16 A
Galvanic isolation
Status display for each channel via LED

Digital relay output modules DOR206/230

Features

6 relays
Standard socket for SIL relays
Electromechanical or solid state relays
Mechanically locked relays
Galvanic isolation measured for system to chanal 2500 V AC
Status display for each channel via LED
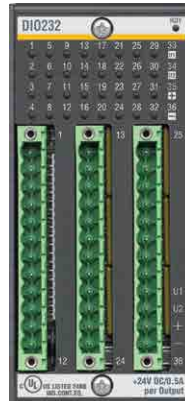
Digital input/output modules DIO216/232

Features

Total channel number: 16 / 32, nom. 24 V DC
Number configurable inputs/outputs: 16
Number of inputs: 8 / 16 / 32
Number of outputs: 16
Configurable interrupt inputs
Galvanic isolation from system
Status display for each channel via LED

Digital input/output modules DIO248/264/280

Features

Total channel number: 16 / 32 / 48 / 64 / 80, nom. 24 V DC
Number configurable inputs/outputs: 16
Number of inputs: 16 / 32 / 48
Number of outputs: 16/ 32 / 48
Configurable interrupt inputs
Configurable 32 Bit counter
PDM output mode
Galvanic isolation from system
Status display for each channel via LED

Digital input/output modules
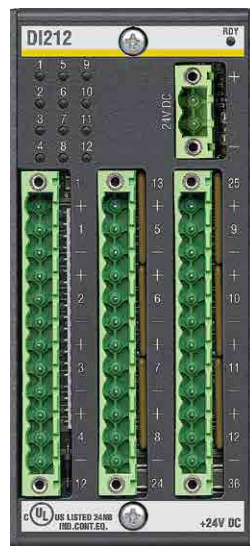
Digital input modules DI212/216/232

The digital input modules DI212, DI216, DI232, DI232❄, DI232 /np1 and DI232 /48 are used to connect up to 12, 16 or 32 digital sensors to the M1 controller.

- Digital input modules with 12, 16 or 32 inputs
- Current sinking logic > 2 mA acc. to EN61132 type 1
- DI212, DI216, DI232, DI232❄, DI232 / np: input voltage: nom. 24 V DC (18 .. 34 V DC)
- DI232 /48: input voltage: nom. 48 V DC (30 .. 58 V DC)
- Inputs 1 and 2 configurable as interrupt inputs
- Galvanic isolation of inputs from the system
- Status display for each channel via LED
- Sink / source inputs (DI232 /np1)

Item	Item no.
DI212	00010281-00
DI216	00009002-00
DI232	00008997-00
DI232❄	00016411-00
DI232/np1	00011516-00
DI232/48	00012162-00

	DI212	DI216	DI232, DI232❄
Inputs			
Number of inputs	12	16	32
Isolated input groups	1 (1-12)	2 (1-8 / 9-16)	2 (1-16 / 17-32)
Input voltage	24 V DC	24 V DC	24 V DC
Internal resistance	Approx. 6 kΩ	Approx. 6 kΩ	Approx. 6 kΩ
Low level	-34 V .. +5 V	-34 V .. +5 V	-34 V .. +5 V
High level	+15 V .. +34 V	+15 V .. +34 V	+15 V .. +34 V
Input delay (normally via filter)	3 ms	3 ms	3 ms
Interrupt inputs	Max. 2	Max. 2	Max. 2
Input delay (normally)	50 µs	50 µs	50 µs
Galvanic isolation from system	500 V	300 V	300 V
Galvanic isolation of groups	-	500 V	500 V

	DI232/np1	DI232/48
Inputs		
Number of inputs	32	32
Isolated input group	4 (1-8/9-16), (17-24/25-32)	2 (1-16/17-32)
Input voltage	24 V DC	48 V DC
Internal resistance	< 4,7 kΩ	< 7,5 kΩ
Low level	$|U_C\text{-}U_{IN}| < 5\ V$	-34 V .. +10 V
High level	$|U_C\text{-}U_{IN}| > 15\ V$	+30 V .. +58 V
Input delay (normally via filter)	100 µs	3 ms
Interrupt inputs	Max. 2	Max. 2
Input delay (normally)	50 µs	20 µs
Galvanic isolation from system	500 V	500 V
Galvanic isolation of groups	500 V	500 V
Current consumption (via BS2xx)	80 mA at 5 V	88 mA at 5 V

Ambient conditions	Standard	ColdClimate (❄)
Operating temperature	-30 .. +60 °C	
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % with condensation	

Execution variants	
DI212	Digital input module; 12x 24V; 3ms filter; 1 group; 2 interrupt channels; 50µs delay; 3-wire system; isolated
DI216	Digital input module; 16x 24V; 3ms filter; 2 groups; 2 interrupt channels; 50µs delay; isolated
DI232	Digital input module; 32x 24V; 3ms filter; 2 groups; 2 interrupt channels; 50µs delay; isolated
DI232❄	Like DI232; ColdClimate (❄)
DI232/np1	Digital input module; 32x 24V; 100µs filter; sink / source; 4 groups; 2 interrupt channels; 50µs delay; isolated
DI232/48	Digital input module; 32x 48V; 3ms filter; 2 groups; 2 interrupt channels; isolated

Digital input/output modules
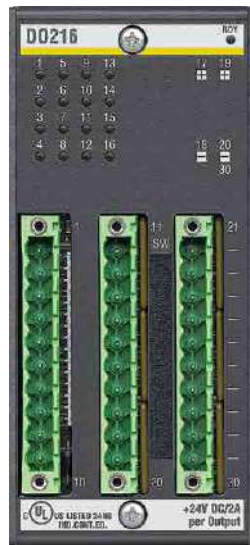
Digital output modules DO216/232

The digital output modules DO216, DO232, DO232❄ and DO232/48 are suitable for connecting up to 16 or 32 digital signal receivers (relays, contactors, signal lamps, valves, etc.) to the M1 controller.

- Digital output modules with 16 or 32 outputs
- Outputs 24 V DC (DO216, DO232, DO232❄)
- Outputs 48 V DC (DO232 / 48)
- 16 outputs with 2.5 A or 32 outputs
  with 1 A / 0.5 A
- Outputs parallel connectable
- Monitoring of short circuit, wire break
  and overload
- Compact design
- Status display for each channel via LED

Item	Item no.
DO216	00009004-00
DO232	00009003-00
DO232❄	00016414-00
DO232/48	00012176-00

	DO216	DO232, DO232❄	DO232/48
Description			
Number of outputs	16	32	32
Output current / channel*	2.5 A	1 A	0.5 A
Groups with different power supplies	2 (1-8 / 9-16)	2 (1-16 / 17-32)	2 (1-16 / 17-32)
Total current / group	Max. 8 A	Max. 8 A	Max. 8 A
Switching delay (resistive load)			
0 -> 1	Normally 80 µs (at 1 A)	Normally 80 µs (at 1 A)	Normally 25 µs (at 0.5 A)
1 -> 0	Normally 250 µs (at 1 A)	Normally 250 µs (at 1 A)	Normally 25 µs (at 0.5 A)
Galvanic isolation from system	500 V	500 V	
Ambient conditions		Standard	ColdClimate (❄)
Operating temperature		-30 .. +60 °C	
Rel. humidity operation		5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature		-40 .. +85 °C	
Rel. humidity storage		5 .. 95 % with condensation	
Execution variants			
DO216		Digital output module; 16x 2.5A / 24V DC outputs; 2 groups; isolated	
DO232		Digital output module; 32x 1A / 24V DC outputs; 2 groups; isolated	
DO232❄		Like DO232; ColdClimate (❄)	
DO232/48		Digital output module; 32x 0.5A / 48V DC outputs; 2 groups; isolated	

* rated

Digital input/output modules

Digital relay output modules DOR206/230

Relays are the simplest way of controlling galvanically isolated power circuits. The output module's direct plugability relays drastically reduce wiring work, save valuable control cabinet space and facilicate troubleshooting. The locking mechanism keeps the relay in place even when subjected to shocks and vibrations. The relays offer maximum flexibility for implementation in control cabinets thanks to possibilities offered by standard relay types with a voltage range from 24 V/48 V DC or 230 V AC, a broad power range and the selection of valuable electro-mechanical relays or solid state for high make-and-break cycles.
Quick and easy serviceability without the use of tools is won by availability, clear status and error display (thanks to LED) and a locking/ejecting mechanism of relays as service parts.

- 6 relays
- Normally open contact (NO), normally closed contact (NC), change-over contact (CO)
- Standard socket for SIL relays
- Electromechanical or solid state relays
- Mechanically locked relays
- Coil current monitoring
- Status display for each channel via LED
- Galvanic isolation measured for voltages from system to channel 2500 V AC
- Backplanes BS2xx/S with protection class 1 for other voltages than SELV are available
- Cost effective and space saving through direct wiring to the consumer without relay and terminal

Item	Item no.
DOR206/230	00014497-10

DOR206/230	
Output relays	
Quantity	6 relay outputs; 3 groups with 2 output relays each are together on an output plug
Relay socket	For SIL relays 28 x 5 x 15 mm
relay coil	Coil voltage 24 V DC, power rating 170 mW
Relay contact	230 V AC, 24 V DC depending on relay type
Switching capacity per channel (max.)	Ohm resistive load up to 2 A AC AC 15 230 VA (230 V AC / 1 A AC) DC 13 12 W (24 V DC / 0.5 A DC)
Status indication (LED)	Green
Switching rate (max. load in Ohms)	1 Hz
RC circuit	Depending on relay and load complete externally
Input voltage, rated	230 V AC, 24 V DC depending on relay type (current consumption not allowed)
Internal power supply	
Galvanic isolation relay outputs to the system	2500 V AC / 5.5 mm
Galvanic isolation between the groups	1500 V AC / 3 mm (between the three relays output groups and to the Cabinet)
Galvanic isolation between relay outputs	800 V AC / 1 mm (between every two relay outputs)
Ambient conditions	
Operating temperature	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % with condensation
Execution variants	
DOR206/230	Digital relay output module 6x sockets with relay 24V/230V; AC15 230 VA; DC13 12W; change-over contact; BS2xx protection class 1 necessary with 230V working voltage

Safety instruction for operation

If higher voltages than safe low voltages are connected, then a backplane with BS2xx/S protective grounding for protection class 1 must be used. Safe low voltages and dangerous voltages may not be connected together on a relay module. In addition a suitable safeguard against accidental contact must be provided: for example, installation in a control cabinet. While in operation all sockets must have a relay plugged in. Cage clamps are the best method for protecting against accidental contact by technicians. It is not permissible to use these relays as safety relays or for safety related applications.

Digital input/output modules
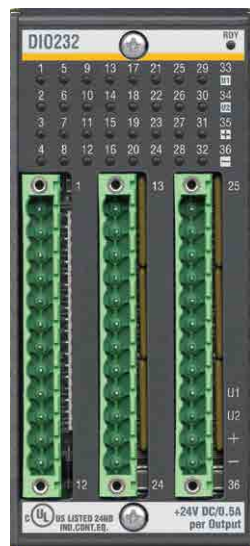
Digital input / output modules DIO216/232

The digital input / output modules DIO2xx/x can be used to operate receivers of digital control devices such as contactors, relays, pneumatic and hydraulic valves as well as for reading signals from digitally operating sources such as sensors, photocells or switches.

- 16 / 32 / 48 / 64 or 80 digital channels
- 16 channels can be configured as input or output
- Configurable interrupt inputs
- Status display for each channel via LED
- Supply voltage 18 .. 34 V DC
- Supply voltage protected against reverse polarity
- Cost effective and space saving
- Full wiring without extra potential rails (3-wire, only DIO216)

Item	Item no.
DIO216	00010615-00
DIO216/4	00010892-00
DIO216/4❄	00016141-00
DIO232	00013034-00
DIO232❄	00019502-00

Digital input/output modules

	DIO216	DIO216/4 DIO216/4❄	DIO232 DIO232❄
Inputs			
Quantity	Max. 16	Max. 16	16 .. 32
Input voltage range (H)	15 .. 34 V DC		
Input voltage range (L)	0 .. 5 V DC		
Input delay (normally)	600 µs	600 µs	0 .. 365 ms
Internal resistance	6.8 kOhm		
Status indication (LED)	Green		
Interrupt inputs	1	1	8
Outputs			
Quantity	Max. 16	Max. 16	16 .. 32
Output voltage range	18 .. 34 V DC		
Output current per channel (max.)	1 A	1 A	0.5 A
Total current (max.)	12 A	16 A	8 A
Status indication (LED)	green		
Switching frequency (max., ohmic load)	1 kHz		
External power supply			
Reverse polarity protection	Yes		
Galvanic isolation from system	500 V		
Ambient conditions	Standard		ColdClimate (❄)
Operating temperature	-30 .. +60 °C		
Rel. humidity operation	5 .. 95 % without condensation		5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C		
Rel. humidity storage	5 .. 95 % with condensation		
Execution variants			
DIO216	Digital input/output module; 16x DIO; 24V / 1A; 600µs filter; 1 group; 3-wire system; 1 interrupt channel; 50µs delay; isolated		
DIO216/4	Digital input/output module; 16x DIO; 24V / 1A; 600µs filter; 4 groups; 3-wire system; 1 interrupt channel; 50µs delay; isolated		
DIO216/4❄	Like DIO216/4; ColdClimate (❄)		
DIO232	Digital input/output module; 16x DI; 40µs..365ms filter configurable; 16x DIO; 24V / 0.5A; 2 groups; 8 interrupt channel; 35µs delay; isolated		
DIO232❄	Like DIO232; ColdClimate (❄)		

Digital input/output modules
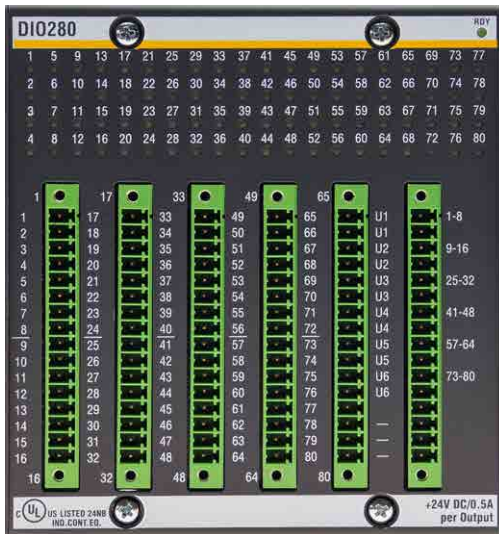
Digital input / output modules DIO248/264/280

The input/output module DIO2xx are used for controlling digital consumer like contactors, relays, pneumatic and hydraulic valves, as well as for reading signals of digital working sensors, detectors or switches. On events can be reacted expressly via 8 available interrupt inputs. Alternatively there are available up to four counters, for detecting e.g. positions or counting goods. For the energy-saving operation of inductivities all outputs can be operated as PWM. Especially for the PWM operation of valves a hold time is additionaly configurable between 0 up to 2s. Outputs are parallel connectable, in case it is operated in the same operation mode.

- 16 / 32 / 48 / 64 or 80 digital channels
- 16 channels can be configured as input or output
- Configurable interrupt inputs
- Configurable 32 bit counter
- Mode: event counter, incremental encoder, gate measurement, cycle time or frequency measurement
- PWM output mode for e.g. valve economy mode
- Status display for each channel via LED
- Supply voltage 18 .. 34 V DC
- Supply voltage protected against reverse polarity
- Cost effective and space saving

Item	Item no.
DIO248	00019116-00
DIO264	00019115-00
DIO280	00019114-00
DIO280❄	00019119-00

	DIO248	DIO264	DIO280 DIO280❄
Inputs			
Quantity	16 .. 32	24 .. 40	32 .. 48
Input voltage range (H)	15 .. 34 V DC		
Input voltage range (L)	0 .. 5 V DC		
Input delay (normally)	Standard: 600 µs Settable 10 µs ... 270 ms		
Internal resistance	8 kOhm		
Status indication (LED)	Green		
Interrupt inputs	8, configurable as counter inputs or interrupt inputs		
Counter			
Quantity	up to 4		
Resolution	32 Bit		
Operating mode	event counter, incremental encoder, gate measurement, cycle time or frequency measurement		
Encoder types	incremental encoder with A and B channel and one-channel pulse encoder		
Input signal	A, B, Initator (interrupt inputs configurable)		
Signal evaluation	1 / 2 / 4-fold edge evaluation or pulse direction mode		
Max. input frequency	one-channel: 50 kHz	dual-channel (A/B): 20 kHz	
Outputs			
Quantity	16 .. 32	24 .. 40	32 .. 48
Output voltage range	18 .. 34 V DC		
Output current per channel (max.)	0,5 A		
Total current (max.)	16 A	20 A	24 A
Status indication (LED)	Green		
Switching frequency (max., ohmic load)	1 kHz		
Inductive breaking capacity	1,15 H		
PWM			
Quantity	Like outputs		
Pulse duty ratio / resolution	0 .. 100 % / 13 Bit		
Frequency	1 Hz .. 1 kHz		
Holding time (valve mode)	0 .. 2s configurable		
Start/Stopp	By dedicated output		
Internal power supply			
Galvanic isolation from system	500 V		
Internal power supply	BS2xx		
Internal current consumption (at 5 V)	180 mA		

Digital input/output modules

	DIO248	DIO264	DIO280 DIO280❄
External power supply			
Reverse polarity protection	Yes		
Energetic recovery	Sensor energetic recovery of DIO by switched-off supply		
Input voltage	Nominal 24 V DC		
Ambient conditions	Standard		ColdClimate (❄)
Operating temperature	-30 .. +60 °C		
Working temperature	-40 .. +60 °C		
Rel. humidity operation	5 .. 95 % without condensation		5 .. 95 % with condensation
Storage temperature	-40 .. +60 °C		
Rel. humidity storage	5 .. 95 % with condensation		
Design variants			
DIO248	Digital input/output module; 16x DI; 600µs filter; 16x DIO; 16x DO; 24V / 0.5A; 4 groups, 600µs filter; 8 interrupt channel; 50µs delay; isolated		
DIO264	Digital input/output module; 24x DI; 600µs filter; 16x DIO; 24x DO; 24V / 0.5A; 5 groups; 600µs filter; 8 interrupt channel; 50µs delay; isolated		
DIO280	Digital input/output module; 32x DI; 600µs filter; 16x DIO; 32x DO; 24V / 0.5A; 6 groups; 600µs filter; 8 interrupt channel; 50µs delay; isolated		
DIO280❄	Like DIO280; ColdClimate (❄)		

Digital input/output modules

Analog input / output modules

The appropriate accuracy for each task.

The diverse requirements of industrial and plant automation in the field of analog signal processing can be ideally covered by the M1 Automation System's signal modules.

Pt100 temperature sensors or DMS sensors with perfectly scalable channel quantities, modules of various standard levels for general analog transmission are available. Beside commonly supplied modules, the scope of products also comprises models with single channel isolation, wire break detection and much more. Resolutions from 12-bit to 16-bit offer perfect accuracy for every task. Fast sampling times in some cases adjustable input filters and support of spontaneous single accesses are also ideally suited for dynamic applications.

Universal input/output module GIO212

Features
Number of in- and outputs: 12 (analog und digital)
Resolution: input 16 Bit, output 14 Bit
Input voltage: to ±10 mV
Input current: 0(4) .. 20 mA
Digital input 24 V
Digital 32-bit counter
Digital output 100 mA
Filter from 4 kHz to 0.5 Hz
Temperature sensor Pt 2-,3-,4-wire
Thermoelements J, K, T, N, E, R, S, B
Galvanic isolation from system: 500 V
Condensation-proof ColdClimate design (❄)

Universal input/output module AIO208/216

Features
Number of in- and outputs: 8 (AIO208) / 16 (AIO216)
Resolution: input 16 Bit, output 14 Bit
Input voltage: ±10 V to ±10 mV
Input current: 0(4) .. 20 mA
Filter from 4 kHz to 0.5 Hz
Temperature sensor Pt 2-,3-,4-wire
Thermoelements J, K, T, N, E, R, S, B
Galvanic isolation from system: 500 V
Condensation-proof ColdClimate design (❄)

Analog input modules AI202/SI, AI204/SI

Features
Number of inputs: 2 / 8
Input current: 0 .. 20 mA
Differential inputs
Resolution: 13...16 bit
Galvanic isolation from system: 500 V
Galvanic isolation of channels: 500 V

Analog input module AI208/SI

Features
Number of inputs: 8
Input current: 4 .. 20 mA, 0 .. 20 mA, -20 .. +20 mA
Resolution: 13...16 bit
Galvanic isolation from system: 500 V
Galvanic isolation of channels: 500 V

Analog input / output modules

Analog input modules AI204/x

Features

Number of inputs: 1 / 2 / 4	
Input voltage: ±10 V DC	
Differential inputs	
Resolution: 16 bit	
Inputs can be synchronized	
Galvanic isolation from system: 500 V	
Galvanic isolation of channels: 500 V	

Analog output module AO208/I

Features

Number of outputs: 8	
Output current: 0 .. 20 mA or 4 .. 20 mA	
Resolution: 13 bit	
Galvanic isolation from system: 500 V	
Galvanic isolation of channels: 500 V	

Analog output module AO202

Features

Number of outputs: 2	
Output voltage: ±10 V DC	
Differential and short circuit proof outputs	
Resolution: 16 bit	
Outputs can be synchronized	
Galvanic isolation from system: 500 V	
Galvanic isolation of channels: 500 V	

Analog output modules AO202/SI, AO204/SI

Features

Number of outputs: 2 / 4	
Output current: 0 .. 20 mA	
Differential outputs	
Short circuit proof outputs	
Resolution: 16 bit	
Galvanic isolation from system: 500 V	
Galvanic isolation of channels: 500 V	

Analog input/output modules AIO288/x

Features

Number of inputs: 8 (±10 V DC / ±1 V DC or 0 .. 20 mA)	
Number of outputs: 8 (±10 V DC)	
Resolution: 14 bit	
Connection: single-ended or differential	
Number of Pt100 sensors: 4	
Connection: 2- or 4-wire technology	
Optional galvanic isolation from system: 500 V	

Temperature recording module PTAI216

Features

Number of inputs: 4 (±10 V DC / ±1 V DC or 0 .. 20 mA)	
Connection: single-ended or differential	
Resolution: 14 bit at AI	
Number of Pt100/Pt1000 sensors: 12	
Connection: 2-wire technology	
Resolution: 12 bits with Pt100/Pt1000	
Galvanic isolation from system: 500 V	

Analog input / output modules

Temperature recording modules TI214/x

Features
TI214: 14 inputs for Pt100 / Pt1000 sensors as well as type J or K thermocouples
TI214/2: thermal couples type N or S
Resolution 14 bit (16 bit with measured value filtering)
Wire break detection on the measurement inputs
Galvanic isolation from system: 500 V

Strain gauge module DMS202

Features
Number of strain gauge (DMS) measuring inputs: 2 (full bridge)
Industrial connectors (LEMO)
Analog measuring outputs: 2
Automatic measuring range selection
Wire break detection on the measurement inputs
Resolution: 12 bit
Galvanic isolation from system: 500 V

Universal input/output module GIO212

The GIO212 is a module that can measure and output various types of signals. Each channel can be used as analog or digital output or input. With the standard signals current (0..20 mA and 4..20 mA) and Voltage (±10 V), various sensors and actuators can be connected. A resolution of at least 14 bits allows measurement results from signals that do not completely use the measuring range (e.g. 0.. 5 V). Temperatures are playing a significant role in ever more processes, which is why this module supports Pt1000, Pt100 in 2-, 3-, and 4-wire measurement, as well as all standard type thermoelements. Similarly, the channels can be used as digital inputs, which can also be configured as interrupt input and digital 32-bit counters. The quick digital 24V output can be selected as Push-Pull, High-Side or Low-Side. The output can be controlled as simple output or as PWM.

Up to two signal types can be used simultaneously per channel. Analog sensors can be supplied via the digital output (short circuit-proof and monitored), actuator signals read back and digital signals monitored analog. Thus, this is a single universal module for countless applications instead of different modules for each signal type. A cost-effective solution that simplifies logistics and service.

Various modes can be combined and set easily via a configuration wizard in the SolutionCenter engineering tool.

Item	Item no.
GIO212	00020620-00
GIO212❄	00020623-00

- 12 channels
- Analog and digital inputs and outputs
- Modes that can be selected per channel:
  - Analog voltage input to ±10 mV
  - Analog current input 0(4) .. 20 mA
  - Temperature sensor Pt elements as 2-,3-,4-wire
  - Thermoelements type J, K, T, N, E, R, S, B
  - Analog voltage output ±10 V
  - Analog current output 0(4) .. 20 mA
  - Digital input 24 V
  - Digital 32-bit counter, A and A/B operation
  - Digital output 100 mA
    - Low-Side, High-Side, Push-Pull
    - Digital output as 16-bit PWM

- Resolution: Input 16-bit with filter, output 14-bit
- Filter adjustable from 4 kHz to 0.5 Hz per channel
- Digital status display for analog channels
- Digital inputs in accordance with IEC 61131 Type 1,2,3
- Digital outputs up to 10 kHz
- All outputs overload, short circuit and external voltage-proof
- Measuring range monitoring freely adjustable (±105 %)
- Error message on overload and overtemperature and undervoltage of the supply
- Galvanic isolation from the system 500 V
- Condensation-proof ColdClimate design (❄)

Analog input / output modules

GIO212		
Inputs/Outputs		
Quantity		12 channels, individually configurable as input or output
Modes per channel		Analog input
		Temperature measurement input for Pt elements and thermoelements
		Analog output
		Digital input
		Counter input
		Digital output
		PWM output
SYNC signal	In	Analog input, digital input, temperature measurement, counter (depending on the mode)
	Out	Analog output, digital output
Analog inputs in general		
Digital resolution		16-bit
Measuring range		±105 % of nominal range
Measuring range monitoring		Lower and upper measuring range limit, error message as status or measuring range monitoring
Allowed common mode voltage		Max. ±1 V
Refresh cycle time		100 µs
Cut-off frequency (3 dB)		4 kHz to 0.5 Hz adjustable channel by channel
Filtering slope		> 80 dB/decade
Voltage inputs		
Input voltage		±10 V, ±1 V, ±100 mV, ±10 mV
Basic accuracy at 25 °C		Max. ±0.05 % of output voltage range
Current inputs		
Input current		±20 mA or 0 .. 20 mA or 4 .. 20 mA
Basic accuracy at 25 °C		Max. ±0.2 % of output voltage range
Input impedance		Max. 300 Ohm
Shunt short-circuit proof		To +24 V
Interference voltage strength		+24 V
Temperature inputs PTC		
Temperature inputs PTC		Pt100, Pt1000 selectable
Connection type		2-, 3- or 4-wire, optional
Input impedance		> 100 kOhm
Temperature range		-100 .. +800 °C
Basic accuracy at 25 °C		Up to 300 °C ±0.25 % precisely of the input range
Value of the LSB		0.1 K, measurement values in 1/10 Kelvin

GIO212		
Temperature inputs TE		
Temperature elements		Types J, K, T, N, E, R, S, B can be selected
Temperature ranges per type	J	-100 .. +1200 °C
	K	-100 .. +1370 °C
	T	-100 .. +400 °C
	N	-100 .. +1300 °C
	E	-100 .. +1000 °C
	R	-50 .. +1768 °C
	S	-50 .. +1768 °C
	B	+600 .. +1820 °C
Ground		Up to ±3 V
Basic accuracy at 25 °C		Input range max. ±0.15 % of input current range (S, R, T max. ±0.3 %)
Value of the LSB		0.1 K, measurement values in 1/10 Kelvin
Analog outputs in general		
Digital resolution		14-bit
Output signal range		±105 % nominal range
Voltage outputs		
Output voltage		±10 V
Output current		Max. 10 mA
Basic accuracy at 25 °C		Min. 1 kOhm, max. ±0.05 % of output current range
Current outputs		
Output current		0(4) .. 20 mA
Basic accuracy at 25 °C		Max. ±0.25 % of the output current range
Apparent ohmic resistance		Up to 600 Ohm
Digital inputs		
Input voltage		Nom. 24 VDC
Low level		0 V .. 5 V
High-level		+11 V .. +34 V
According to IEC61131-2 Input current at 24 V	Type 1	2 mA .. 6 mA
	Type 2	6 mA .. 10 mA
	Type 3	2 mA .. 6 mA
Input type "source"		2 mA .. 6 mA
Input type "comparator"		Typ. 2.5 V
Prof. filter for digital inputs		16 µs .. 262 ms, default 1 ms
Digital counter		
Modes		Count direction
		1, 2, 4x evaluation
		Period duration measurement
		Pulse duration measurement
		Combination with 2nd channel: pulse/direction mode or quadrature encoder

Analog input / output modules

GIO212	
Digital counter	
Counter	Counter up or down (in combination with 2nd channel)
	32-bit
Input type	24 V, like digital input
Trigger (2nd channel)	Save value
Reset (2nd channel)	Reset counter
Digital output	
Output type	Low-Side, High-Side or Push-Pull (half bridge)
Output current / channel*	0.1 A (briefly 0.5 A for < 10 s)
Short-circuit current/channel	800 mA
Max. switching frequency	10 kHz
Broken wire detection	Yes
Short circuit, overload	Yes
PWM output	
Output	Specification like digital output
Frequency range	0.95 Hz .. 10 kHz
Pulse range	100 µs (10 µs) .. 8.192 ms
Frequency resolution	16 bit (LSB is 125 ns or 16 µs)
Internal power supply	
Supply internal	Via backplane BS2xx
Current consumption internal	80 mA
Power supply external	
Voltage range external	18 .. 34 VDC
Current consumption external 24 V	Typically 200 mA without external load
Galvanic isolation from the system	500 V

Ambient conditions	Standard	ColdClimate (❄)
Operating temperature	-30 .. +60 °C	
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % with condensation	5 .. 95 % with condensation

Design variants	
GIO212	Universal input/output module; 12x analog In ±10V ±20mA Pt TC; 16bit; analog Out ±10V 20mA; 14bit; digital In DI 5V / 24V, 125kHz, sink/source, counter; digital Out 24V/100mA, 10kHz, highside/lowside/pushpull, pwm; configurable DI/AI filter; 100µs sample and refresh time; threshold monitoring; isolated
GIO212❄	Like GIO212; ColdClimate (❄)

Analog input / output modules
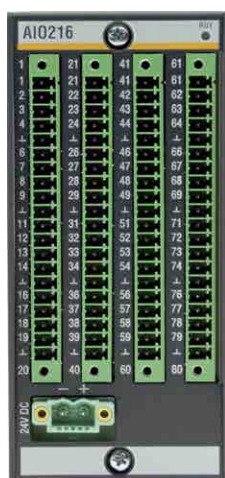
Universal input/output module AIO208/216

The AIO208 and AIO216 modules enable the measuring or output of all standard analog signals. The AIO208 offers 8 channels and the AIO216 16 channels compactly in a single module. The standard signal types for current (0 .. 20 mA and 4 .. 20 mA) and voltage ranges (±10 V .. ±10 mV) allow the connection of a wide range of sensors and actuators. A minimum 14-bit resolution makes it possible to also measure signals that do not fully utilize the measuring range (e.g. 0 .. 5 V) with a sufficiently high resolution. Temperatures are playing an important role in an increasing number of processes. These modules therefore also support Pt100, Pt1000 in 2, 3 and 4-wire measuring circuits, as well as all standard thermocouples. For each channel, a second channel with unused signal types can be used in addition to the primary configured signal type. For example, a current output can be assigned to a voltage input so that up to twice the number of channels per module are provided.

This enables one module to cover virtually all analog signal measuring tasks instead of having to use many different modules for each signal type. A cost-effective solution that simplifies logistics and servicing. Different modes can be combined and set simply using a configuration wizard in the Solution-Center engineering tool.

Item	Item no.
AIO208	00020628-00
AIO208❄	00020632-00
AIO216	00020627-00
AIO216❄	00020631-00

- 16 channels AIO216, 8 channels AIO208
  - Analog inputs and outputs
- Modes that can be selected per channel:
  - Analog voltage input ±10 V to ±10 mV
  - Analog current input 0(4) .. 20 mA
  - Temperature sensor Pt elements as 2-,3-,4-wire
  - Thermo couples type J, K, T, N, E, R, S, B
  - Analog voltage output ±10 V
  - Analog current output 0(4) .. 20mA
- Resolution: 16-bit input with filter, 14-bit output
- Filter adjustable from 4 kHz to 0.5 Hz per channel
- All outputs overload, short circuit and external voltage-proof
- Measuring range monitoring freely adjustable (±105 %)
- Error message on overload and overtemperature and undervoltage of the supply
- Galvanic isolation from the system 500 V
- Optional condensation-proof ColdClimate (❄)

Analog input / output modules

AIO208/216			
Inputs/Outputs		AIO208	AIO216
Quantity		8 channels	16 channels
Modes per channel		Analog input	
		Temperature measurement input for Pt elements and thermo couples	
		Analog output	
SYNC signal	In	Analog input, temperature measurement	
	Out	Analog output	
Analog inputs in general			
Digital resolution		16-bit	
Measuring range		±105 % of nominal range	
Measuring range monitoring		Lower and upper measuring range limit, error message as status or measuring range monitoring	
Allowed common mode voltage		Max. ±1 V	
Refresh cycle time		100 µs	
Cut-off frequency (3 dB)		4 kHz to 0.5 Hz adjustable channel by channel	
Filtering slope		> 80 dB/decade	
Voltage inputs			
Input voltage		±10 V, ±1 V, ±100 mV, ±10 mV	
Basic accuracy at 25 °C		Max. ±0.05 % of input voltage range	
Current inputs			
Input current		±20 mA or 0 .. 20 mA or 4 .. 20 mA	
Basic accuracy at 25 °C		Max. ±0.2 % of input voltage range	
Input impedance		Max. 300 Ohm	
Shunt short-circuit proof		Up to +24 V	
Interference voltage strength		+24 V	
Temperature inputs PTC			
Temperature inputs PTC		Pt100, Pt1000	
Connection type		2-, 3- or 4-wire	
Input impedance		> 100 kOhm	
Temperature range		-100 .. +800 °C	
Basic accuracy at 25 °C		Up to 300 °C ±0.25 % of input range	
Value of the LSB		0.1 K, measurement values in 1/10 Kelvin	
Temperature inputs TE			
Temperature elements		Types J, K, T, N, E, R, S, B can be selected	
Temperature ranges per type	J	-100 .. +1200 °C	
	K	-100 .. +1370 °C	
	T	-100 .. +400 °C	
	N	-100 .. +1300 °C	
	E	-100 .. +1000 °C	
	R	-50 .. +1768 °C	
	S	-50 .. +1768 °C	
	B	+600 .. +1820 °C	

AIO208/216	
Temperature inputs	
Ground	Up to ±3 V
Basic accuracy at 25 °C	Max. ±0.15 % of input current range (S, R, T max. ±0.3 %)
Value of the LSB	0.1 K; measurement values in 1/10 Kelvin
Analog outputs in general	
Digital resolution	14-bit
Output signal range	±105 % nominal range
Voltage outputs	
Output voltage	±10 V
Output current	Max. 10 mA
Basic accuracy at 25 °C	Min. 1 kOhm, max. ±0.05 % of output range
Current outputs	
Output current	0(4) .. 20 mA
Basic accuracy at 25 °C	Max. ±0.25 % of the output range
Apparent ohmic resistance	Up to 600 Ohm
Power supply	
Supply internal	Via backplane BS2xx
Current consumption internal	80 mA
Voltage range external	18 .. 34 VDC
Current consumption external 24 V	Typically 200 mA without external load
Galvanic isolation I/O to system	500 V

Ambient conditions	Standard	ColdClimate (❄)
Operating temperature	-30 .. +60 °C	
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % with condensation	5 .. 95 % with condensation

Design variants	
AIO208	Universal analog input/output module; 8x analog In ±10V ±20mA Pt TC; 16bit;analog Out ±10V 20mA; 14bit; configurable analog filter; 100µs sample and refresh time; threshold monitoring; isolated
AIO208❄	Like AIO208; ColdClimate (❄)
AIO216	Universal analog input/output module; 16x analog In ±10V ±20mA Pt TC; 16bit; analog Out ±10V 20mA; 14bit; configurable analog filter; 100µs sample and refresh time; threshold monitoring; isolated
AIO216❄	Like AIO216; ColdClimate (❄)

Analog input / output modules

Analog input modules
AI202/SI, AI204/SI

The analog input module AI20x / SI offers two or four high resolution analog 16 bit current input channels. Single channel isolation, high immunity to interference, as well as integrated signal filtering (delta-sigma converter) make this module particularly interesting for process technology.

- 2 or 4 analog inputs
- Input current 0 .. 20 mA
- Input impedance 75 Ω
- Resolution: 16 bit
- Refresh cycle time 250 ms/channel
- Galvanic isolation of channels
- Galvanic isolation from system
- Monitoring of internal voltages

Item	Item no.
AI202/SI	00012245-10
AI204/SI	00012245-00

AI202/SI, AI204/SI	
Current inputs	
Quantity	2 (AI202 / SI) or 4 (AI204 / SI)
Input current range	0 .. 20 mA
Input impedance	75 Ω
Digital resolution	16 bit
Value of the LSB	509 nA (Vref = 2.5 V to 75 Ω)
Cross-talk attenuation	> 100 dB between the channels
Signal suppression 50 Hz / 60 Hz	> 60 dB
Error at 25 °C	±0,1%
Error at the entire temperature range	±0.5 %
Sample frequency	4 measurements per second / channel
Input filter	fg (3dB) delay time 1ms, Low-pass filter: 1st order
Galvanic isolation of channels	500 V
Galvanic isolation from system	500 V
Ambient conditions	
Operating temperature	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % with condensation
Execution variants	
AI202/SI	Analog input module; 2x In 20mA; 16bit; 0.1%; single isolated
AI204/SI	Analog input module; 4x In 20mA; 16bit; 0.1%; single isolated

Analog input / output modules

Analog input modules AI208/SI

The compact analog input module AI208 / SI offers eight individual galvanically isolated current inputs. The measuring range is +/- 24.6 mA and covers standards 4 .. 20 mA, 0 .. 20 mA and -20 .. +20 mA.

Via adjustable measuring range limits errors, such as short circuit, sensor defect or wire break can be easily detected. Threshold values that can be configured within the measuring range permit monitoring of the process factor without having to sample it. The shunt is protected against short circuit of the 24 V supply, which can easily occur with the sensor wiring. Robustness and above-average diagnostic capabilities are the outstanding characteristics of this input module.

- 8 analog inputs
- Input current 0 .. 20 mA, 4 .. 20 mA, -20 .. +20 mA
- Input impedance approx. 200 Ω
- Resolution: 13 .. 16 bit
- Adjustable input filter 2.5 kHz .. 2.5 Hz

Item	Item no.
AI208/SI	00017772-00
AI208/SI❄	00018843-00

AI208/SI	
Current inputs	
Quantity	8
Input current range	0 .. 20 mA, 4 .. 20 mA, -20 .. +20 mA
Measuring range	±24.6 mA
Input impedance	Normally 200 Ω
Digital resolution	13 bit (2.5 kHz filter) .. 16 bit (10 Hz filter)
Value of the LSB	751,202 nA
Cross-talk attenuation	> 80 dB between the channels
Signal suppression 50 Hz / 60 Hz	75 dB / 80 dB at 2.5 Hz filter
Sample frequency	Maximum 10 kHz (filter 2.5 kHz)
Filtering slope	From cutoff frequency (3 dB) with 60 dB/decade
Input filter	Adjustable: 2.5 kHz, 1.2 kHz, 640 Hz, 320 Hz, 160 Hz, 80 Hz, 40 Hz, 20 Hz, 10 Hz, 5 Hz, 2.5 Hz
Galvanic isolation of channels	500 V
Galvanic isolation from system	500 V

Ambient conditions	Standard	ColdClimate(❄)
Operating temperature	-30 .. +60 °C	
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % with condensation	

Execution variants	
AI208/SI	Analog input module 8x IN; +-20 mA /13 .. 16bit; 0.1%; sample time configurable up to 100µs; threshold; single isolated
AI208/SI❄	Like AI208/SI; ColdClimate (❄)

Analog input / output modules

Analog input modules
AI204/x

The analog input module AI204/x offers two or four high-resolution 16 bit analog input channels depending on the model. The extraordinarily high accuracy with integrated temperature calibration predestine this unit for demanding measurement applications for industrial processes.

- 1, 2, or 4 analog inputs
- Input voltage -10 V .. +10 V
- Resolution: 16 bit
- Sample time from 20 µs
- Inputs can be synchronized
- Galvanic isolation of channels
- Galvanic isolation from system
- Temperature calibration
- Connection possibility differential
- Internal voltage generation is monitored

Item	Item no.
AI204/1	00010693-20
AI204/2	00010693-10
AI204/4	00010693-00
AI204/4※	00017447-00

AI204/x		
Voltage inputs		
Quantity	1, 2 or 4	
Input voltage	±10 V	
Input impedance	> 33 kΩ	
Digital resolution	16 bit	
Value of the LSB	305 µV	
Allowed common mode voltage	Max. ±2 V	
Cross-talk attenuation	> 66 dB	
Cross-talk attenuation	> 120 dB between the channels	
Error at 25 °C	±1mV (±0.005 %)	
Error at the entire temperature range	±1mV (±0.005 %)	
Sample time	20 / 160 / 320 / 640 µs at 1- / 8- / 16- / 32-times sampling	
Temperature calibration	Normally 500 µs per calibration	
Input filter	0.33 kHz / 4 kHz selectable by software	
Galvanic isolation of channels	500 V	
Galvanic isolation from system	500 V	
Ambient conditions	**Standard**	**ColdClimate (❄)**
Operating temperature	-30 .. +60 °C	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % with condensation	5 .. 95 % with condensation
Execution variants		
AI204/1	Analog input module; 1x In +-10V; 16bit; high precision 0.005 %; 20µs sampling time; digital averaging; single isolated	
AI204/2	Analog input module; 2x In +-10V; 16bit; high precision 0.005 %; 20µs sampling time; digital averaging; single isolated	
AI204/4	Analog input module; 4x In +-10V; 16bit; high precision 0.005 %; 20µs sampling time; digital averaging; single isolated	
AI204/4 ❄	Like AI204/4; ColdClimate (❄)	

Analog input / output modules

Analog output module AO202

The analog output module AO202 offers two high-precision 16 bit analog output channels.

- 2 analog outputs
- Output voltage -10 V .. +10 V
- Resolution: 16 bit
- Outputs can be synchronized
- Galvanic isolation of channels
- Galvanic isolation from system
- Differential connection
- Short circuit proof
- Monitoring of internal power supply

Item	Item no.
AO202	00010692-00

AO202	
Voltage outputs	
Quantity	2
Output voltage	±10 V
Output impedance	output is corrected to ±2 mA
Digital resolution	16 bit
Value of the LSB	305 µV
Cross-talk attenuation	> 120 dB between the channels
Error at 25 °C	±2.5 mV (±0.0125 %)
Error in the entire temperature range	±12 mV (±0.06%)
Refresh cycle time	10 µs per channel
Galvanic isolation of channels	500 V
Galvanic isolation from system	500 V
Ambient conditions	
Operating temperature	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % with condensation
Execution variants	
AO202	Analog output module; 2x Out +-10V; 16bit; high precision 0.0125%; 10µs refresh cycle; single isolated

Analog output module AO208/I

The analog output module AO208/I offers eight 13 bit current outputs.

- 8 analog outputs
- Output current 0 .. 20 mA or 4 .. 20 mA
- Resolution: 13 bit
- Apparent ohmic resistance ≤ 500Ω
- Galvanic isolation from system
- Monitoring of internal voltages
- Short circuit proof

Item	Item no.
AO208/I	00011244-00
AO208/I❅	00017441-00

AO208/I		
Current outputs		
Quantity	8	
Output current	0 .. 20 mA / 4 .. 20 mA	
Digital resolution	13 bit	
Apparent ohmic resistance	≤500Ω	
Value of the LSB	2.44 µA	
Cross-talk attenuation	> 70 dB between the channels	
Error at 25 °C	±100 µA (±0.5 %)	
Error at the entire temperature range	±160 µA (±0.8%)	
Setting time of 1% of the output current range	Max. 500 µs	
Refresh cycle time	500 µs	
Galvanic isolation of channels	No isolation	
Galvanic isolation from system	500 V	
Ambient conditions	**Standard**	**ColdClimate (❅)**
Operating temperature	-30 .. +60 °C	
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % with condensation	5 .. 95 % with condensation
Execution variants		
AO208/I	Analog output module; 8x Out 20mA; 13bit; 0,5%; 500µs refresh cycle; isolated	
AO208/I❅	Like AO208/I; ColdClimate (❅)	

Analog input / output modules

Analog output modules AO202/SI, AO204/SI

The analog input module AO20x / SI offers two or four high resolution analog 16 bit current output channels.

- 2 or 4 analog outputs
- Output current 0 .. 20 mA
- Resolution: 16 bit
- Galvanic isolation of channels
- Galvanic isolation from system
- Short circuit proof outputs

Item	Item no.
AO202/SI	00012246-10
AO204/SI	00012246-00

AO202/SI, AO204/SI	
Analog outputs	
Quantity	2 (AO202 / SI) or 4 (AO204 / SI)
Output current	0 .. 20 mA
Apparent ohmic resistance	Up to 500 Ω
Digital resolution	16 bit
Value of the LSB	305 nA
Cross-talk attenuation	> 100 dB between the channels (50 .. 60 Hz)
Error at 25 °C	±0,2%
Error at the entire temperature range	±0,6%
Setting time of 0.1 % of the output current range	Max. 3 ms
Galvanic isolation of channels	500 V
Galvanic isolation from system	500 V
Ambient conditions	
Operating temperature	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % with condensation
Execution variants	
AO202/SI	Analog output module; 2x Out 20mA; 16bit; 0.2%; single isolated
AO204/SI	Analog output module; 4x Out 20mA; 16bit; 0.2%; single isolated
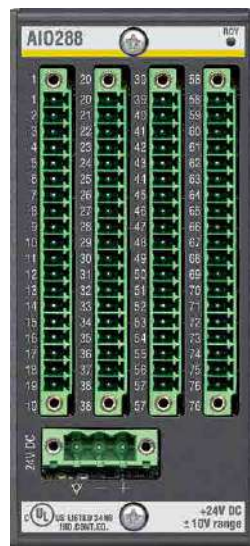
Analog input/output modules AIO288/x

The analog input/output module AIO288/x offers eight analog input channels as well as eight analog output channels.

- 8 analog inputs
- 8 analog outputs
- Connection possibility single-ended or differential
- Power supply for up to 4 potentiometers
- Temperature inputs for up to 4 Pt100/Pt1000 sensors
- 2-wire or 4-wire inputs for Pt100/Pt1000 sensors
- Wire break detection for the inputs (for voltage and temperature)
- Short circuit proof outputs
- Overload detection for potentiometer power supplies
- Monitoring of the external supply voltage

Item	Item no.
AIO288	00014470-00
AIO288❋	00016157-00
AIO288/1	00014470-10

AIO288/x	
Voltage inputs	
Quantity	Max. 8
Input voltage	±1 V or ±10 V
Input impedance	> 100 kΩ
Digital resolution	14 bit
Allowed common mode voltage	Max. ±1 V
Basic accuracy at 25 °C	Max. ±0.05 % of input voltage range
Input cutoff frequency	1.5 kHz (3 dB)
Cross-talk attenuation	> 60 dB
Sample time	200 µs

Analog input / output modules

AIO288/x	
Voltage outputs	
Quantity	Max. 8
Output voltage	±10 V
Digital resolution	14 bit
Allowed common mode voltage	Max. ±1 V
Basic accuracy at 25 °C	Max. ±0.025 % of output voltage range
Settling time of 1 % of the output current range	Max. 400 µs
Cross-talk attenuation	> 60 dB
Refresh cycle time	200 µs
Current inputs	
Quantity	Max. 8
Input current	0 .. 20 mA
Input impedance	243 Ω
Digital resolution	14 bit
Max. input current	35 mA (destruction limit)
Basic accuracy at 25 °C	Max. ±0.1 % of input current range
Input cutoff frequency	1.5 kHz (3 dB)
Sample time	200 µs
Temperature inputs	
Temperature inputs	Pt100, Pt1000 selectable
Quantity	Max. 4
Connection type	2- or 4-wire, optional
Temperature range	-100 .. +500 °C
Input impedance	> 100 kΩ
Basic accuracy at 25 °C	Max. ±0.1 % of input current range
Input cutoff frequency	1.5 kHz (3 dB)
Value of the LSB	0.1 K
Sample time	200 µs
Galvanic isolation from system	500 V
Potentiometer power supply	
Quantity	Max. 4
Voltage range	±10 V
Error at 25 °C	Max. ±100 mV
Load	Max. 40 mA
External power supply	Voltage range 18 .. 34 V DC
	Current consumption 230 mA at +5 V DC
	Galvanic isolation from system 500 V (only AIO288)

AIO288/x		
Ambient conditions	Standard	ColdClimate (❄)
Operating temperature	-30 .. +60 °C	
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % with condensation	
Execution variants		
AIO288	Analog input/output module; 8x In +-10V +-1V 20mA 4x Pt100/1000; 14bit; 0.1%; 200µs sample time; 8x Out +-10V; 4x Poti supply; isolated	
AIO288❄	Like AIO288; ColdClimate (❄)	
AIO288/1	Analog input/output module; 8x In +-10V +-1V 20mA 4x Pt100/1000; 14bit; 0.1%; 200µs sample time; 8x Out +-10V; 4x Poti supply; NOT isolated	

Analog input / output modules
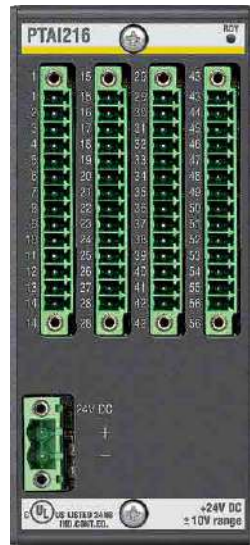
Temperature input module PTAI216

The temperature recording module PTAI216 has four analog input channels and 12 inputs for Pt100/Pt1000 sensors.

- 4 analog inputs ±10 V / ±1 V / 0 .. 20 mA
- 12 inputs for Pt100/Pt1000 sensors
- Single-ended or differential inputs for analog signals
- 2-wire inputs for Pt100/Pt1000 sensors
- Resolution 14 bit (AI) / 12 bit (Pt100/Pt1000)
- Sample time 2.5 ms (AI) / 480 ms (Pt100/ Pt1000)
- Channels galvanically isolated from system
- wire break detection for the inputs
- Monitoring of the external power supply

Item	Item no.
PTAI216	00010708-00
PTAI216✳	00017456-00

PTAI216	
Voltage inputs	
Quantity	Max. 4
Input type	Single-ended or differential
Input voltage	±1 V or ±10 V
Input impedance	> 33 kΩ
Input filter	170 Hz (low pass 1st order)
Digital resolution	14 bit
Allowed common mode voltage	Max. ±1 V
Cross-talk attenuation	> 60 dB
Sample time	2.5 ms
Current inputs	
Quantity	Max. 4
Input current	0 .. 20 mA
Input impedance	243 Ω
Digital resolution	14 bit
Max. input current	35 mA (destruction limit)
Error at operating temperature	-30 ... +60°C -> ±0.3%*
Sample time	2.5 ms
Pt100/Pt1000* inputs	
Quantity	12
Input type	2-wire technology
Temperature range	-100 .. +300 °C
Constant current via sensor	Pt100: 3 mA Pt1000: 0.3 mA
Digital resolution	12 bit
Value of the LSB	0.1 K
Averaging	Over 16 values per 480 ms
External power supply	
Galvanic isolation from system	500 V
Voltage range	18 .. 34 V DC
Current consumption internal	Normally 70 mA at 24 V DC

Ambient conditions	**Standard**	**ColdClimate (❈)**
Operating temperature	-30 .. +60 °C	
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % with condensation	

Execution variants	
PTAI216	Temp.-recording module; 12x Pt100/1000; 4x In +-10V +-1V 20mA; 14bit; 0.25 %; isolated
PTAI216❈	Like PTAI216; ColdClimate (❈)

* only applies for DC in the input current range 20 mA

Analog input / output modules
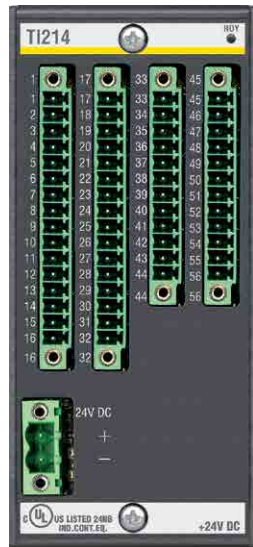
Temperature input modules TI214/x

The temperature recording modules TI214/x provide 14 temperature measuring channels in a single module width. With the TI214 either Pt100/Pt1000 sensors in 2 and 3 wire technology or type J or K thermocouples can be connected to each measuring channel. The TI214/2 module allows for the connection of type N or S thermocouples. The sensor type can be individually selected for each channel. In this way, the most effective and cost-efficient solution can be implemented for the application. The average determination of the measured value can be set between 16 fold and 64 fold for easy an reliable interference suppression.

With the module version TI214 the temperature of the switching cabinet can be measured on the same module with an inexpensive Pt100 sensor, while for example the temperature control systems are fitted with thermocouples. The new 3-wire measuring evaluation of the Pt100/Pt1000 sensor compensates the voltage error of both symmetrical cable runs and enables the precision of complex 4-wire measuring technology to be implemented in inexpensive 3-wire technology. The Pt sensors can also be connected in simple 2-wire technology and this is sufficient for many applications with short measuring lines.

TI214/x

- Resolution 14 bit (16 bit measured value averaging)
- Averaging of measured values for interference suppression
- Wire break detection the inputs
- Channels isolated against the system
- Monitoring of the external power supply
- Cold junction temperature compensated

TI214

- 14 inputs for Pt100 / Pt1000 sensors as well as type J or K thermocouples
- 2-wire or 3-wire input for Pt100 / Pt1000 sensors

TI214/2

- 14 inputs for thermocouplers type N or S

Item	Item no.
TI214	00014008-00
TI214/2	00014008-20
TI214❄	00018808-00

	TI214 / TI214❅	TI214/2
Temperature measuring inputs		
Quantity	14	14
Connection type Pt100/Pt1000	3-wire or 2-wire technology	-
Input filter	Low pass filter 1st order cutoff frequency (3 dB) 17 kHz	Low pass filter 1st order cutoff frequency (3 dB) 8Hz
Sensor types thermocouples	J or K in insulated or uninsulated design in accordance with DIN IEC584 each input can be programmed for different types	N or S in insulated or uninsulated design in accordance with DIN IEC584 each input can be pro-grammed for different types
Temperature range Pt100/Pt1000	-100 .. +800 °C	-
Temperature range thermocouples	J/K: -30 .. +1000 °C	N: -30 .. +1300 °C S: -30 .. +1600 °C
Constant current Pt sensor	2 mA (Pt100), 200 µA (Pt1000)	-
Digital resolution	14 bits (16 bits representation with measured value averaging)	
Value of the LSB	0.055 K (Pt100 / Pt1000) 0.062 K (thermocouple -30 .. +1000 °C)	0.08 K (thermocouple N -30 .. +1300 °C) 0.098 K (thermocouple S -30 .. +1600 °C)
Base accuracy	0.1 % of measuring range at 25 °C (Pt100 / Pt1000)* 0.15 % of measuring range at +25 °C (thermocouples J / K)**	0.15 % for type N and 0.25 % for type S of measuring range at +25 °C (thermocouples N / S)**
Conversion time	80 ms at 16 fold averaging 320 ms at 64 fold averaging	1 ms without averaging 80 ms at 16 fold averaging 320 ms at 64 fold averaging
Thermocouples linearization	Polynomial to IEC60584 part 1, for sensor types J or K	Polynomial to IEC60584 part 1, for sensor types N or S
Error detection	Wire break	
Interference voltage strength	-36 V .. +36 V	
External power supply		
Galvanic isolation from system	500 V	
Voltage range	18 .. 34 V DC	
Current consumption internal	normally 160 mA at + 24 V DC	
Reverse polarity protection	Yes	
Ambient conditions	Standard	ColdClimate (❅)
Operating temperature	-30 .. +60 °C	
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % with condensation	
Models		
TI214	Temperature recording module; 14x thermocouple type J,K (FeCo/NiCrNi); Pt100/1000; 14bit; 0.15%; isolated	
TI214/2	Temp.-recording module; 14x thermocouple type N,S; 14 bit; 0.15%; isolated	
TI214❅	Like TI214; ColdClimate (❅)	

*   only applies for 3-conductor technology
** without consideration of cold point compensation

Analog input / output modules

Strain gauge input module DMS202

The strain gauge module DMS202 is a two-channel, micro controller operated measuring module to read quickly changing DMS signals up approx. 1 kHz with a sample time of only 12.5 µs.

- 2 DMS measurement inputs
- High-quality plug-in connector
- 2 analog measurement outputs
- Automatic measuring range selection (input)
- Wire break detection on the measurement inputs
- Monitoring of the external supply voltage

Item	Item no.
DMS202	00009884-00

DMS202	
Bridge supply	
Carrier frequency	5 kHz ±2 %
Amplitude	4 Veff ±2 %
Synchronization of the carrier frequency	Optional
Synchronization range	5 kHz ±2 %
DMS amplifier input	
Input resistance	> 5 MΩ
Desired signal bandwidth	1 kHz
Resolution	12 bit
max. input common mode voltage	10 V (no overdrive)
CMRR (0 .. 5 kHz)	> 80 dB
Wire break monitoring	Yes, error message
Galvanic isolation from system	500 V
Monitoring of the ext. voltage	Yes, power-fail signal
Conversion time	12.5 µs for one channel, 25 µs for two-channel operation
Measurement range selection	2.0 / 4.0 / 8.0 / 16.0 mV or Auto Range
Measurement range switchover	Automatic or via software
Measurement outputs	
Output voltage	0 .. 10 V
Internal resistance	< 2 Ω
Load resistor	> 2.5 kΩ
Special functions	Peak value capture Electronic capacity comparison Carrier frequency synchronization
External power supply	
Voltage range	18 .. 34 V DC
Current consumption external	100 mA at 24 V DC
Reverse polarity protection	Yes
Galvanic isolation from system	500 V
Ambient conditions	
Operating temperature	0 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % without condensation
Execution variants	
DMS202	Strain gauge measuremet, 2x full bridge; +-2/4/8/16mV; 25µs sampling time; 5 kHz carrier frequency, 12bit; isolated

Function modules

Flexibility and precision in soft motion control.

As the leading provider in the field of soft motion control, Bachmann electronic offers a flexible line of modules for directly wired motion control.

Bachmann modules cover all types of data acquisition, from fast pulse and incremental encoder cards with bandwidths up to 8 MHz to SSI (Serial Synchronous Inter-face). The possibility of controlling the drives with analog signals (voltage), step motor outputs or PWM output channels allows flexible configuration.

All encoder interface modules of the M1 system offer precise synchronizability as well as comprehensive functional support for the programmer.

Counter modules
CNT204 / x

Features
Number of counter inputs: 4 (for single-channel pulse encoders, zero initiators, triggers)
Number of incremental encoders: 2 input channels (HTL and / or RS422)
Encoder power supply direct from the module via the connectors
Inputs can be synchronized

Encoder interface modules
ISI222 / x

Features
Input channels for incremental or SSI encoder: 2
Output channels analog: 2 (±10 V DC)
Input channels digital: 4 (reference, trigger)
Encoder power supply directly from the module via the connectors
Monitoring of all external supply voltages
Max. input frequency: 1 MHz / 8 MHz

Pulse width modulation module PWM202

Features
Pulse width modulated output channels: 2
18 .. 48 V DC external supply TTL
Integrated current control
Output current: to 2 A
Resolution: 10 / 16 bit
Monitoring of the load current
Monitoring of all external supply voltages

Axis controller module ACR222 / 2

Features
Interfaces for stepping motor output stages up to 150 kHz: 2
Interfaces for incremental encoders to 1 MHz: 2
Encoder power supply direct from the module via the connectors
Monitoring of all external supply voltages
Linear or sine shaped acceleration profiles
External set or integrated profiles

Function modules

Counter modules CNT204/x

The counter module CNT204/x contains four counters for single line pulse generators. Two of the channels can optionally be used as inputs for incremental encoders.

- 4 counter inputs for single line pulse generators
- Status indication: LED (green) per counter/ initiator input
- 2 input channels for incremental encoders
- Encoder power supply directly from the module via the connectors
- Inputs can be synchronized
- Monitoring of all supply voltages
- Period measurement with 42 ns resolution
- Differential measurement (phase shift between C1 and C3 or C2 and C4) with 42 ns resolution

Item	Item no.
CNT204/H	00010709-10
CNT204/H❋	00016407-10
CNT204/R	00010709-20

CNT204/x	
Incremental encoder inputs	
Quantity	2
Counter resolution	32 bit
Input signals	A-, A+ / B-, B+ / N-, N+
Signal evaluation	1-/2-/4-edge evaluation or pulse direction mode
Max. input frequency	1 MHz (RS422)/300 kHz (HTL)
Input filter	185 kHz .. 6 MHz adjustable, default 6 MHz
Counter inputs	
Quantity	4 (2 if INC inputs are used)
Counter resolution	32 bit
max. input frequency	20 kHz
min. pulse length	25 µs
Input filter	183 Hz .. 46.88 kHz adjustable, default off (fg=100 kHz)

Encoder power supply	+5 V	+24 V
voltage	+5 V	U_{ext} -1 V
Tolerance	±5 %	like U_{ext}
max. current/encoder	200 mA	300 mA
Ripple	< 150 mV_{ss}	like U_{ext}
Short circuit proof	Yes, permanent	Yes, permanent

External power supply	
Power supply	18 .. 34 V DC
Current consumption internal	40 mA at 24 V + 1.2x current consumption of the encoders
Reverse polarity protection	Yes

Ambient conditions	Standard	ColdClimate (❄)
Operating temperature	-30 .. +60 °C	
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % with condensation	

Execution variants	
CNT204/H	Counter module; 2x INC HTL 300kHz + 2x counter HTL 20kHz oder 4x counter HTL 20kHz; HTL=24V; 32bit; INC A,A/B/N; position; phase difference; period; trigger; isolated
CNT204/H❄	Like CNT204/H; ColdClimate (❄)
CNT204/R	Counter module; 2x INC RS422 1MHz + 2x counter HTL 20kHz oder 4x counter HTL 20kHz; HTL=24V; 32bit; INC A,A/B/N; position; phase difference; period; trigger; isolated

Function modules

Positioning modules ISI222/x

Especially designed for sophisticated motion control applications the ISI222 module offers compact equipment and optimum precision. Equipped for the total control of two motion axes, the module features a number of encoder interfaces for position acquisition, analog outputs for the application of manipulated variables, as well as digital inputs for the initiator or trigger. Furthermore, due to the central communication concept, all I/Os of the remaining M1 system can also be incorporated into the motion control (limit switches, etc.).
Input frequencies up to 8 MHz and the integrated synchronization (IO-Bus-Sync) with the total system allow highly dynamic and precise movements.

Beside the full compatibility to the well proven controller modules M-SMC, M-CNC and M-SHAFT, also the user own programs and individually designed control tasks can utilize the extensive integrated functions of the module simply via the known standard interfaces (SVI, MIO). The extensive integrated error monitoring with ongoing checking of the encoder resolution identifies hard-to-see wiring or ESD problems and allows the application especially under difficult environmental conditions.

- 2 input channels for incremental and SSI encoders
- Full 32 bit counter
- 2 analog outputs (14 bit)
- 4 fast digital input channels for initiator and trigger
- Position measurement/ position storage can be initiated via triggers
- Virtual for use in applications: zero pulse, speed, etc.
- Synchronization via SYNC/PreSYNC
- Encoder supply via module
- Monitoring of the encoder voltage
- Wire break monitoring (encoder)

Item	Item no.
ISI222	00013737-00
ISI222✳	00016421-00
ISI222/8	00014127-00

ISI222 / x			
Encoder interface module			
Quantity	2		
Counter resolution	32 bit		
Input signals	A-, A+ / B-, B+ / N-, N+		
Signal evaluation	1-/2-/4-edge evaluation or pulse direction mode		
Input frequency	Max. 1 MHz (ISI222), max. 8 MHz (ISI222/8)		
Synchronization	By means of SYNC signal		
Modes	Reference value monitoring Conditional storage of counter value Conditional load/rest of counter value Speed measurement		
Error detection	Wire break, encoder resolution monitoring		
Galvanic isolation of channels*	500 V		
SSI encoder interface*			
Quantity	2		
Data word length	programmable up to 32 bits		
Input signals	D-, D+		
Output signals	T-, T+		
Data format	Graycode and binary format, others can be evaluated by SW		
Transfer clock rate	100 kHz .. 2 MHz		
Synchronization	Via preSYNC function		
Encoder power supply			
Output voltage ranges	+5 V and +15 V selectable with jumper, 24 V looped through		
Output voltage	+5 V	+15 V	-1 V
Tolerance	±5 %	±3 %	like U_{ext}
max. current/encoder	250 mA	100 mA	300 mA
Short circuit proof	Yes, permanent	Yes, permanent	Yes, permanent (PTC)
Ripple	< 150 mV$_{ss}$ at +5 V and +15 V		
Galvanic isolation of channels	500 V		
Analog outputs			
Quantity	2		
Output voltage	±10 V		
Resolution	14 bit		
Output current	Max. ±2 mA		
Conversion time	<40 µs		
Basic accuracy at 25 °C	0.025 %		
Error at the entire Temperature range	±0.1%		
Setting time of 1% of the output current range	Max. 500 µs		
Error detection	Wire break		
Short circuit proof	Yes, permanent		
Synchronization	By means of SYNC signal		

* only for ISI222

Function modules

ISI222 / x		
Digital inputs		
Quantity	4 (2 INIT, 2 TRIG)	
voltage	18 .. 34 V DC	
Input delay	30 µs default, filter adjustable	
Acc. to IEC 61131	Type 1	
Function	INIT: initiator, trigger for strobe register, digital input TRIG: trigger for strobe register, digital input	
Connection type		
Connection for analog and digital I/O	Phoenix Contact MINICOMBICON connector RM 3.5 with flange	
Connection type	Screw clamp, spring tension clamp plug codable, labeling by channels	
Operating conditions		
Supply voltage	18 .. 34 V DC	
Mounting	Mountable on backplane BS2xx	
Mounting position	Horizontal (vertical at -20 .. +55 °C operating temperature)	Horizontal (vertical at -30 .. +55 °C operating temperature)
Ambient conditions	Standard	ColdClimate (❄)
Operating temperature	-30 .. +60 °C	
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % with condensation	
Execution variants		
ISI222	Positioning module; 2x In INC/SSI; 1MHz; 32bit; RS422 level; INC A, A/B/N; position; gate time; period; velocity; encoder supply 5V / 15V / 24V; 2x Out +-10V; 14bit; 0.025 %; 40µs; synchronized; PreSYNC; 4x DI 24V; trigger; homing	
ISI222❄	Like ISI222; ColdClimate (❄)	
ISI222/8	Positioning module; 2x In INC; 8MHz; 32bit; RS422 level; INC A, A/B/N; position; gate time; period; velocity; encoder supply 5V / 15V / 24V; 2x Out +-10V; 14bit; 0.025 %; 40µs; synchronized; PreSYNC; 4x DI 24V; trigger; homing; SSI-Encoder not supported	

Pulse Width Modulation Module PWM202

The pulse width modulation module PWM202 has two power outputs for direct activation of inductive or ohmic loads, such as DC motors, immersion coils, etc. with pulse width modulated signals.

- 2 pulse-width modulated output channels
- 2 shielded DSub connectors for output channels
- Status indication: LED (green) per output
- Choice of high-power or TTL output level
- Monitoring of the load current
- Monitoring of the external supply voltage
- Monitoring of the internal temperature

Item	Item no.
PWM202	00011056-00

PWM202	
Outputs	
Quantity	2
State indicating LEDs	RDY yellow, OUT-1 / OUT-2 green
Output voltage	18 .. 48 V (= $U_{external}$) or TTL level
Output current	0 .. 2 A at f ≤ 40 kHz and U_{out} ≤ 48 V (T_A = +60 °C)
Frequency	Channel 1: 3 Hz .. 40 kHz adjustable
	Channel 2: 155 Hz .. 40 kHz adjustable
Duty cycle	0 .. 100 % individually adjustable for each channel
Resolution channel 1	16 bit, edge aligned or center aligned
Resolution channel 2	10 bit, edge aligned
Galvanic isolation from system	500 V
Load resistor	Normally 20 Ω
External power supply	
Voltage range	18 .. 48 V DC
Power consumption	Max. 10 W + load
Reverse polarity protection	Yes
Monitoring	
External power supply	Yes, power-fail signal + interrupt
Overvoltage	Yes
Undervoltage	Yes
Overcurrent (channel)	Yes
Ambient conditions	
Operating temperature	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % with condensation
Execution variants	
PWM202	Pulse width modulation module; 2 channels each 2A/48V or TTL; actuator or current regulation; isolated

Function modules

Axis controller module ACR222/2

The axis controller module ACR222/2 is a encoder interface module to operate one / two (micro) stepping motor output stages with stepper frequencies of up to 150 kHz.

- 2 interfaces for stepping motor output stages to 150 kHz
- 2 interfaces for incremental encoders up to 1 MHz
- Encoder power supply directly from the module via the connectors
- Inputs for home, abort and 2 limit switches per channel
- Monitoring of the external supply voltage
- Linear, sine^2 or parabolic acceleration
- Two-step linear speed profiles

Item	Item no.
ACR222/2	00009928-10

| ACR222/2	
Encoder interface	
Counter resolution	24 bit
Counter modes	1-/2-/4-edge evaluation
Encoder frequency	Max. 1 MHz
Inputs	HEDL (HP/AVAGO interface)/RS422
Galvanic isolation from system	500 V
Encoder power supply	+5 V or +15 V selectable with jumper
Motor controller interface	
Stepper frequency	Max. 150 kHz
Number of steps (range)	1 .. 16 777 215
Acceleration type	Linear, sin^2- or parabolic
Acceleration time/braking time	8 ms .. 131 s
Output voltage	Low: 0 .. 2 V, high: 3 .. 34 V, I_{max} = 10 mA
Input voltage	Low: 0 .. 3 V, high: 4 .. 30 V
Voltage range	18 .. 34 V DC
Current consumption internal	Normally 400 mA at 24 VDC + Σ current consumption of the encoders and sensors
Galvanic isolation from system	500 V
Reverse polarity protection	Yes
Ambient conditions	
Operating temperature	0 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % without condensation
Execution variants	
ACR222/2	Stepper motor module; 2x Out 150kHz; 2x In INC; 1MHz; RS422; 8x DI 24V; acceleration modes linear/sine²/parable; without power amplifier; encoder supply 5/15V
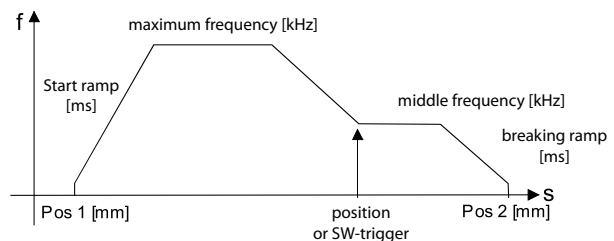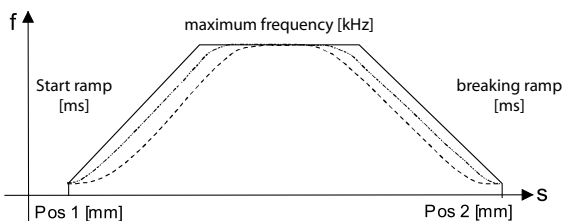
Grid measurement module

Safety and efficiency of the electrical energy supply.

The safety and efficiency of the electrical energy supply are placing increasing demands on the generator units, transmission systems and consumers. A new generation of systems for measuring, monitoring and protection provides an essential technical basis. Our grid modules supply the latest state-of-the-art technology as a fully integrated solution in the automation units of the M200 system. This provides modular expansion capability, data storage and communication over several fieldbus and telecontrol interfaces that are simple and affordable.
High resolution and fast acquisition of all grid variables forms the indispensable basis of all grid modules. The integrated energy metering simplifies handling in engineering and operation. In order to ensure network stability, generator units must be able to guarantee a defined response according to the relevant grid codes. Faults in the grid or in the plant must lead to defined responses such as the provision of control power or grid
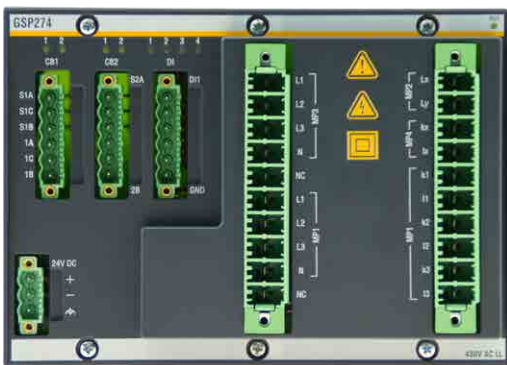
Grid measurement, protection and synchronization module GSP274

Features
Measures current, voltage, frequency, power and power quality
Synchronism-check relay
Monitoring functions to ensure safe generator operations
Controls two circuit breakers
Integrated fault recorder
Provides grid measurement simulation
Integrated sequence of events recorder
4Q energy counter
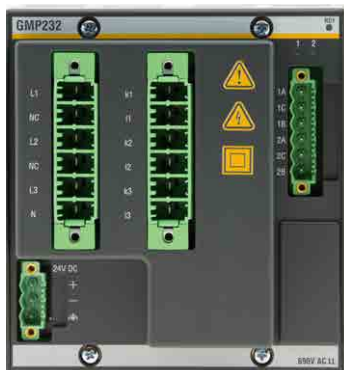
Grid measurement and protection module GMP232

Features
Measures current, voltage, frequency, power and power quality
Input voltage up to 690 VL-L, RMS
Numerous monitoring functions
Integrated fault recorder
Sequence of events recorder with real time stamp
Two integrated relays
Grid measurement simulation
Monitoring functions are independent of PLC status

disconnection. The GSP274 and GMP232 module series offer for this configurable protection and monitoring functions in accordance with the latest standards. The integrated harmonics analysis function deals with the problems of power quality caused by increasingly larger power electronic components. Precise, time-stamped event logging and integrated real-time data recorders provide a convenient basis for commissioning or fault analysis. Furthermore, the GSP274 modules also provide a synchronization unit for the automatic grid coupling of generators. GM260 modules impress with their particularly compact design and simple handling for consumption optimization and energy monitoring.

Grid measurement module GM260

Features
Current, voltage, frequency and grid measurement
Remanent four-quadrant power counter
Rated voltage up to 480 VL-L, RMS
Robust and reliable hardware

Grid measurement module
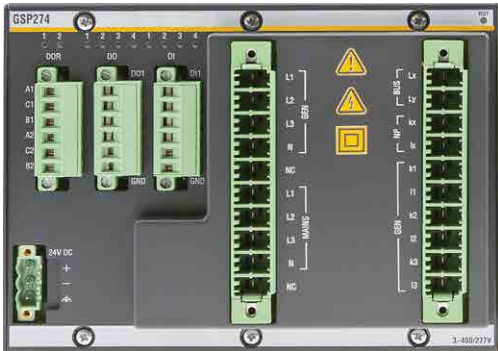
Item	Item No.
GSP274	00019756-00

Grid measurement, protection and synchronization module GSP274

The GSP274 enables the safe, reliable and automatic synchronization of generator units to the power supply grid. It also provides a number of monitoring functions for generator and grid protection. The circuit-breakers are tripped by the module directly via digital outputs and relays. Additional digital inputs enable the monitoring of the relevant switching state. The continuous monitoring of grid harmonics up to the 50th harmonic can be used for direct responses as well as for evaluating the power quality.

The module is provided with an integrated real-time data recorder for the high-precision recording of up to 16 measuring channels during protective tripping or synchronization. Error events are recorded continuously and stored permanently with a high resolution time entry. The internal time base of the module can be synchronized to an external time source (e.g. IEEE 1588 Precision Time Protocol), which supports the analysis of the data from spatially separated measurement and protection devices.

The GSP274 is fully integrated in the Bachmann SolutionCenter. Configurations can be created simply and stored for later reuse. Both the measured channel values and also the derived values are made available directly in the user interface. Commissioning and fault analysis are simplified with tabular, phasor and time sequence displays. Event logs and recorded time sequences can be exported in CSV respectively COMTRADE format. The integrated simulation function simplifies the configuration of protection and monitoring functions.

- Measurement of current, voltage, frequency, power, power factor, phase angle
- Measurement of grid harmonics up to the 50th (power quality)
- Synchronization monitoring / Synchro-check
- Monitoring/Protection functions for grid and generator protection
- Controls two circuit-breakers
- Integrated real-time data recorder
- Integrated event logging
- 4Q energy counter
- Measured value simulation

GSP274 - Grid measurement	
Current/voltage measurement	
Measuring method	True RMS (incl. harmonics)
Sampling rate	50 µs (20 kHz)
Measurement interval	50 Hz: 10 ms 60 Hz: 8.33 ms
Voltage measurement	
Number	7 (generator: L1,L2,L3,N / grid: L1,L2,L3,N / busbar Lx,Ly)
Maximum rated voltage	$U_{L-L, RMS}$: 480 VAC $U_{L-N, RMS}$: 277 VAC
Voltage measuring range	$U_{L-L, RMS}$: 17.3 – 728 VAC, $U_{L-N, RMS}$: 10 – 420 VAC
Accuracy*	±0.1 %
Continuous overload	$U_{L-L, RMS}$: 675 VAC, $U_{L-N, RMS}$: 390 VAC
Short-term overload (10x10 s, Interval 10 s)	$U_{L-L, RMS}$: 1143 VAC, $U_{L-N, RMS}$: 660 VAC
Input impedance	>2 MΩ
Current measurement	
Number	4 (generator: 3x, Generator star/neutral-point: X 1)
Accuracy*	±0.1 %
Current transformer rated current	5 A
Current measuring range	0 – 10 AAC
Continuous overload	10 AAC
Short-term overload (5x1 s, interval 300 s)	100 AAC
Frequency measurement	
Rated frequency	50 / 60 Hz
Reference range	50 Hz: 35 to 65 Hz 60 Hz: 45 to 75 Hz
Accuracy*	±0.01 Hz
Measurement interval	Between two zero crossings 50 Hz: 10 ms 60 Hz: 8.33 ms
Frequency change measurement	Yes
Maximum frequency change	±1 Hz/s
Power measurement – active, reactive and apparent power	
Measured values	P, Q, S per phase and as total
Accuracy*	±0.2 %
Calculation method	DIN 40110-2, IEC61400-21
Measurement interval	Calculation over one period 50 Hz: 20 ms 60 Hz: 16.67 ms

* Accuracy values as a percentage of the nominal value at 25 °C

Grid measurement module

GSP274 - Grid measurement	
Energy	
Accuracy*	±0.2 %
Resolution	1 Ws
Active energy	Supplied (positive), drawn (negative)
Reactive energy	Supplied (positive), drawn (negative)
Type of memory	Nonvolatile (on the module)
Measurement interval	Calculation over one period 50 Hz: 20 ms 60 Hz: 16.67 ms
Power quality	
Voltage	Total harmonic distortion (THD) per phase
Current	Total demand distortion (TDD) per phase
Voltage harmonics	Amplitudes of harmonics up to 50th harmonic per phase
Current harmonics	Amplitudes of harmonics up to 50th harmonic per phase
Calculation method	EN 61000-4-7
Measurement interval	50 Hz: Calculation over 10 periods 60 Hz: Calculation over 12 periods
Digital inputs – Switch position indication	
Number	4
Signal rated voltages	24 V DC (type 1 acc. to DIN EN 61131-2)
Input voltage range (H)	15 to 34 V DC
Input voltage range (L)	-34 to 5 V DC
Internal resistance	6.8 kOhm
Input delay (typically)	1 ms
Status display (LED)	Green
Digital outputs – Synchronization and alarming	
Number	4
Signal rated voltages	24 V DC (type 1 acc. to DIN EN 61131-2)
Output voltage range (H)	18 to 34 V DC
Output current max.	0.5 A
Status display (LED)	Green
Digital relay outputs – Grid and system protection	
Number/type	2 changeover contacts
Signal rated voltages	230 V AC, 48 V DC, 24 V DC (not mixed)
Output current max.	Nominal 0.5 A at +24 VDC, DC-13 Nominal 0.5 A at +24 VDC, resistive load Nominal 1 A at 230 VAC, AC-15 Nominal 2 A at 230 VAC, resistive load
Output current overload	4 A
Status display (LED)	Green

GSP274 limit value monitoring
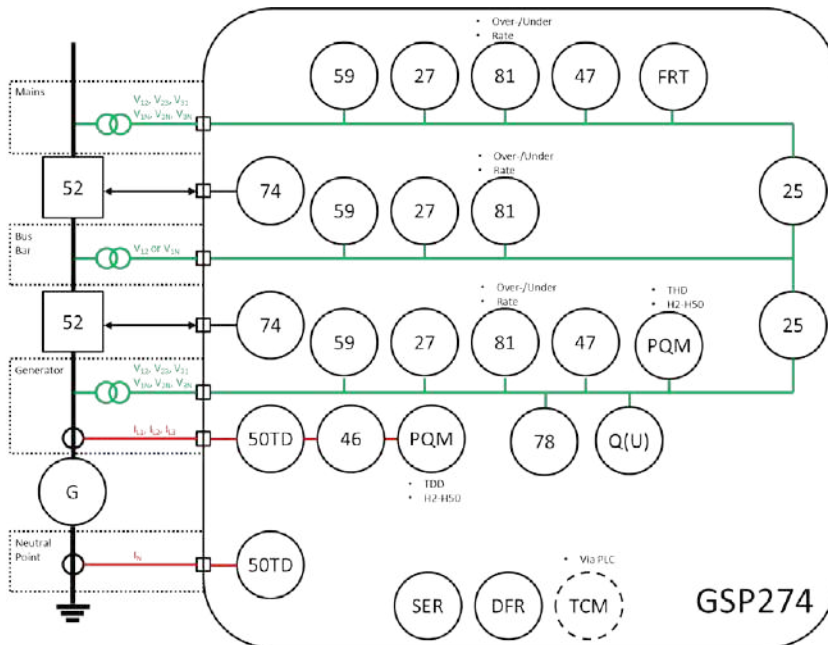
Figure 1: Available protection elements acc. to ANSI IEEE Std C37.2 – 2008 – overview

GSP274 - Limit value monitoring		
Undervoltage/overvoltage (ANSI 27/59)		
Accuracy*	±0.1 % full scale	
Resolution	0.1 % U_{Rated}	
Delay	0 to 65535 ms	
Evaluated potentials	Phase-to-phase or phase-to-neutral	
Protection elements	U<	Undervoltage warning
	U<<	Undervoltage error
	U>	Overvoltage warning
	U>>	Overvoltage error
Underfrequency/overfrequency (ANSI 81 U/O)		
Accuracy*	±0.01 Hz	
Delay	0 to 65535 ms	
Protection elements	f<	Underfrequency inner band
	f<<	Underfrequency middle band
	f<<<	Underfrequency outer band
	f>	Overfrequency inner band
	f>>	Overfrequency middle band
	f>>>	Overfrequency outer band

Grid measurement module

GSP274 - Limit value monitoring	
Q(U)	
Description	Voltage dependent directional reactive power protection. Used to support the voltage during grid faults. Trips if all three evaluated voltages are below a certain limit (e.g. 0.85 U_{Rated}) and inductive reactive power is drawn from the power supply grid.
Rate of change of frequency – ROCOF (ANSI 81 R)	
Description	To calculate the frequency change over time the last 10 (50 Hz) or 12 (60 Hz) frequency samples are linearly interpolated.
Vector jump (ANSI 78)	
Description	Monitoring of sudden phase shifts for detection of sudden load changes or islanding.
Overcurrent (ANSI 50TD)	
Accuracy*	±0.1 % full scale
Resolution	0.1 % of I_{Rated}
Delay	0 to 65535 ms
Protection elements	I> Overcurrent warning I>> Overcurrent error
Time-dependent undervoltage monitoring – FRT (Fault Ride Through)	
Description	Time-dependent undervoltage monitoring is triggered if one of the three evaluated voltages falls below a curve U(t) configured via inter-polation points. Up to 10 time/voltage pairs are available to calculate a grid-code dependent limit curve.
Voltage asymmetry (ANSI 47)	
Description	EN 50160: Asymmetry is defined as the ratio of negative sequence components to positive sequence components. The reference value is the current basic oscillation component.
Current asymmetry (ANSI 46)	
Description	EN 50160: Asymmetry is defined as the ratio of negative sequence components to positive sequence components. The reference value is the current basic oscillation component.
Power quality monitoring – PQM	
Description	Monitors voltage and current harmonics up to the 50th harmonic. Trips if one of the pre-defined limits is exceeded (evaluation per phase).
Protection elements	THD Total harmonic distortion TDD Total demand distortion H_2 to H_{50} Individual amplitudes of voltage harmonics H_2 to H_{50} Individual amplitudes of current harmonics

GSP274 - Limit value monitoring	
Alarm relays (ANSI 74)	
Description	Two relays for actuating the circuit-breakers are provided for single fault tolerant grid and system protection acc. to VDE-AR-4105. See Digital relay outputs
Synchronization test relays (ANSI 25)	
Description	Digital outputs control up to two circuit-breakers (2 DO per circuit-breaker). They are activated by the GSP module if the synchronization criteria are fulfilled. Pulse or continuous signal can be configured for the actuation. See Digital outputs
Trip circuit monitoring – TCM	
Description	Digital inputs are provided to monitor the actual switching state of the circuit-breakers. See Digital inputs
Time synchronization	
Basic principle	GSP module is synchronized automatically with the real-time clock of the PLC-CPU. This can be synchronized via the network.
Physical medium	Ethernet (CPU)
Protocols	IEEE 1588 PTP (Precision Time Protocol) SNTP (Simple Network Time Protocol)
Event logging with real-time stamp – SER (sequence of events recorder)	
Description	Monitoring events (configured alarm/protection functions) are stored with a precise time reference when they occur.
Type of memory	nonvolatile (on the module)
Size	1000 entries
Real-time data recorder / digital fault recorder – DFR	
Description	The GSP module is provided with 3 integrated real-time data recorders. One data recorder can be used for recording the synchronization sequence between the generator and busbar and one for busbar and grid. Another data recorder can carry out recordings when triggered by a monitoring function.
Number of channels	16 channels (measured values, digital I/O, calculated values)
Memory depth per channel	40,960 sampling values (4 s at 100 µs sampling rate)
Sampling rate	100 µs, 200 µs, 400 µs, 800 µs, 1.6 ms
Pre-trigger	Yes

Grid measurement module

GSP274 - Module properties	
Electrical safety	
Product standard	IEC/EN61131-2
Generic standard	IEC/EN60664-1
Pollution degree	2
Overvoltage category	3
Test surge voltage	4 kV
Protection class	2
Approvals / certificates	
General	CE, UL/cUL, CCC
Medium voltage directive	BDEW:2008, FGW TR3:2011 (Rev. 22), FGW TR8:2011 (Rev. 5)
Low-voltage directive	VDE AR-N-4105:2011
Marine	GL, DNV, LR, ABS, BV
Others	In preparation: G59/2:2010, IEEE 37.90:2006
Ambient conditions	
Operating temperature	-30 to +60 °C
Rel. air humidity, operation	5 to 95 % no condensation
Storage temperature	-40 to +85 °C
Rel. air humidity, storage	5 to 95 % no condensation
Maximum operating height	2,000 m above sea level (operation up to 4,500 m on request)
Power supply	
Via backplane	+5 V | ≤ 316 mA, +15 V| ≤ 21 mA, -15 V | ≤ 23 mA
External on the module	24 V | 110 mA
System requirements	
Hardware	All M1 CPU families apart from ME203, SK1 backplane not required
Software	M-Base 3.90 / SolutionCenter 1.90 or higher
Models	
GSP274	Grid measurement, protection and synchronization module; 7x In 480V, 4x In 5A; 4x In 5A; 4x In 24V; 4x Out 24V; 2x Out Relay 24/48V DC, 230V AC; U-, I-, P-, Q-, f-measurement; 4Q-energy metering, integrated monitoring/protection functions, harmonic analysis, integrated realtime data recorder (16 channels); sequence of event log with realtime stamp
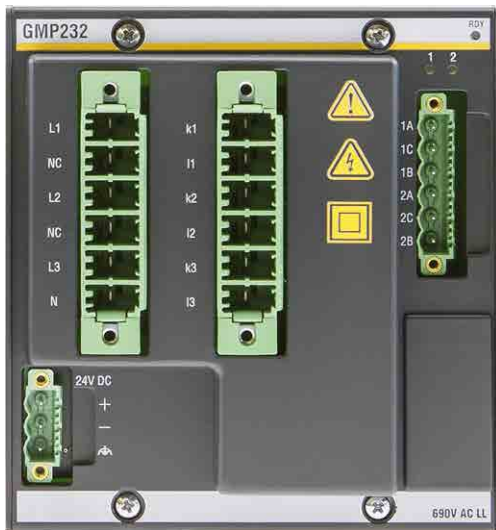
Item	Item No.
GMP232	00017829-00
GMP232❄	00019063-00

Grid measurement and protection module GMP232

The GMP232 module enables the safe, reliable and fast measuring of all relevant values for three-phase electrical networks. It also provides a number of monitoring functions for generator and grid protection. Up to two circuit-breakers/trip circuits are triggered by the module directly via relay outputs. The continuous monitoring of grid harmonics up to the 50th harmonic can be used for direct responses as well as for evaluating the power quality.

The module is provided with an integrated real-time data recorder for the high-precision recording of up to 16 measuring channels during alarm/protection events. Error events are recorded continuously and stored permanently with a high resolution time entry. The internal time base of the module can be synchronized to an external time source (e.g. IEEE 1588 Precision Time Protocol), which supports the analysis of the data from spatially separated measurement and protection devices.

The GMP232 is fully integrated in the Bachmann SolutionCenter. Configurations can be created simply and stored for later reuse. Both the measured channel values and also the derived values are made available directly in the user interface. Commissioning and fault analysis are simplified with tabular, phasor and time sequence displays. Event logs and recorded time sequences can be exported in CSV respectively COMTRADE format. The integrated simulation function simplifies the configuration of protection and monitoring functions.

- Measurement of current, voltage, frequency, power, power factor, phase angle
- Direct connection to input voltages up to 690 $V_{L-L, RMS}$
- Measurement of grid harmonics up to the 50th (power quality)
- Monitoring/Protection functions for grid and generator protection
- Direct relay outputs for circuit-breaker/trip circuits
- Integrated real-time data recorder
- Integrated event logging
- 4Q energy counter
- Measured value simulation

Grid measurement module

GMP232 – Grid measurement	
Current/voltage measurement	
Measuring method	True RMS (incl. harmonics)
Sampling rate	50 µs (20 kHz)
Measurement interval (RMS values)	50 Hz: 20 ms 60 Hz: 16.67 ms
Individual sampling values	Intervals that can be called via function calls in the user application: 100 µs, 200 µs, 400 µs, 800 µs, 1.6 ms (via block access)
Voltage measurement	
Number	3
Maximum rated voltage	$U_{L\text{-}L, RMS}$: 690 VAC $U_{L\text{-}N, RMS}$: 400 VAC
Voltage measuring range	$U_{L\text{-}L, RMS}$: 17.3 – 1195 VAC, $U_{L\text{-}N, RMS}$: 10 - 690 VAC
Accuracy*	±0.1 %
Continuous overload	$U_{L\text{-}L, RMS}$: 1437 VAC, $U_{L\text{-}N, RMS}$: 830 VAC
Short-term overload(10x1 s, interval 10 s)	$U_{L\text{-}L, RMS}$: 2390 VAC, $U_{L\text{-}N, RMS}$: 1380 VAC
Input impedance	>2 MΩ
Current measurement	
Number	3
Accuracy*	±0.1 %
Current transformer rated current	5 A
Current measuring range	0 – 10 AAC
Continuous overload	10 AAC
Short-term overload (5x1 s, interval 300 s)	100 AAC
Frequency measurement	
Rated frequency	50 / 60 Hz
Reference range	50 Hz: 35 to 65 Hz 60 Hz: 45 to 75 Hz
Accuracy*	±0.01 Hz
Measurement interval	Between two zero crossings 50 Hz: 20 ms 60 Hz: 16.67 ms
Frequency change measurement	Yes
Maximum frequency change	±1 Hz/s
Power measurement – active, reactive and apparent power	
Measured values	P, Q, S per phase and as total
Accuracy*	±0.2 %
Calculation method	DIN 40110-2, IEC61400-21
Measurement interval	Calculation over one period 50 Hz: 20 ms 60 Hz: 16.67 ms

* Accuracy values as a percentage of the nominal value at 25 °C

GMP232 – Grid measurement	
Energy	
Accuracy*	±0.2 %
Resolution	1 Ws
Active energy	Supplied (positive), drawn (negative)
Reactive energy	Supplied (positive), drawn (negative)
Type of memory	Nonvolatile (on the module)
Measurement interval	Calculation over one period 50 Hz: 20 ms 60 Hz: 16.67 ms
Power quality	
Voltage	Total harmonic distortion (THD) per phase
Current	Total demand distortion (TDD) per phase
Voltage harmonics	Amplitudes of harmonics up to 50th harmonic per phase
Current harmonics	Amplitudes of harmonics up to 50th harmonic per phase
Calculation method	EN 61000-4-7
Measurement interval	50 Hz: Calculation over 10 periods 60 Hz: Calculation over 12 periods
Digital relay outputs	
Number/type	2 changeover contacts
Signal rated voltages	230 V AC, 48 V DC, 24 V DC (not mixed)
Output current max.	Nominal 0.5 A at +24 VDC, DC-13 Nominal 0.5 A at +24 VDC, resistive load Nominal 1 A at 230 VAC, AC-15 Nominal 2 A at 230 VAC, resistive load
Output current overload	4 A
Status display (LED)	Green

Grid measurement module

GMP232 – Limit value monitoring		
Undervoltage/overvoltage (ANSI 27/59)		
Accuracy*	±0.1 % full scale	
Resolution	0.1 % U_{Rated}	
Delay	0 to 65535 ms	
Evaluated potentials	Phase-to-phase or phase-to-neutral	
Protection elements	U<	Undervoltage warning
	U<<	Undervoltage error
	U>	Overvoltage warning
	U>>	Overvoltage error
Underfrequency/overfrequency (ANSI 81 U/O)		
Accuracy*	±0.01 Hz	
Delay	0 to 65535 ms	
Protection elements	f<	Underfrequency inner band
	f<<	Underfrequency middle band
	f<<<	Underfrequency outer band
	f>	Overfrequency inner band
	f>>	Overfrequency middle band
	f>>>	Overfrequency outer band
Q(U)		
Description	Voltage dependent directional reactive power protection. Used to support the voltage during grid faults. Trips if all three evaluated voltages are below a certain limit (e.g. 0.85 U_{Rated}) and inductive reactive power is drawn from the power supply grid.	
Rate of change of frequency – ROCOF (ANSI 81 R)		
Description	To calculate the frequency change over time the last 10 (50 Hz) or 12 (60 Hz) frequency samples are linearly interpolated.	
Vector jump (ANSI 78)		
Description	Monitoring of sudden phase shifts for detection of sudden load changes or islanding.	
Overcurrent (ANSI 50TD)		
Accuracy*	±0.1 % full scale	
Resolution	0.1 % of I_{Rated}	
Delay	0 to 65535 ms	
Protection elements	I>	Overcurrent warning
	I>>	Overcurrent error
Time-dependent undervoltage monitoring – FRT (Fault Ride Through)		
Description	Time-dependent undervoltage monitoring is triggered if one of the three evaluated voltages falls below a curve U(t) configured via interpolation points. Up to 10 time/voltage pairs are available to calculate a grid-code dependent limit curve.	
Voltage asymmetry (ANSI 47)		
Description	EN 50160: Asymmetry is defined as the ratio of negative sequence components to positive sequence components. The reference value is the current basic oscillation component.	

GMP232 – Limit value monitoring

Current asymmetry (ANSI 46)

|	
Description	EN 50160: Asymmetry is defined as the ratio of negative sequence components to positive sequence components. The reference value is the current basic oscillation component.

Power quality monitoring – PQM

Description	Monitors voltage and current harmonics up to the 50th harmonic. Trips if one of the pre-defined limits is exceeded (evaluation per phase).	
Protection elements	THD	Total harmonic distortion
	TDD	Total demand distortion
	H_2 to H_{50}	Individual amplitudes of voltage harmonics
	H_2 to H_{50}	Individual amplitudes of current harmonics

Time synchronization

Basic principle	The GMP module is synchronized automatically with the real-time clock of the PLC-CPU. This can be synchronized via the network.
Physical medium	Ethernet (CPU)
Protocols	IEEE 1588 PTP (Precision Time Protocol) SNTP (Simple Network Time Protocol)

Event logging with real-time stamp – SER (sequence of events recorder)

Description	Monitoring events (configured alarm/protection functions) are stored with a precise time reference when they occur.
Type of memory	Nonvolatile (on the module)
Size	1000 entries

Real-time data recorder / digital fault recorder – DFR

Description	A high resolution time sequence recording can be started automatically when a monitoring function is triggered.
Number of channels	16 channels (measured values, digital I/O, calculated values)
Memory depth per channel	40,960 sampling values (4 s at 100 µs sampling rate)
Sampling rate	100 µs, 200 µs, 400 µs, 800 µs, 1.6 ms
Pre-trigger	Yes

Grid measurement module

GMP232 – Module properties	
Electrical safety	
Product standard	IEC/EN61131-2
Generic standard	IEC/EN60664-1
Pollution degree	2
Overvoltage category	3
Test surge voltage	6 kV
Protection class	2
Approvals / certificates	
General	CE, UL/cUL, CCC
Medium voltage directive	BDEW:2008, FGW TR3:2011 (Rev. 22), FGW TR8:2011 (Rev. 5)
Marine	GL, DNV, LR, ABS, BV
Others	In preparation: G59/2:2010, IEEE 37.90:2006

Ambient conditions	Standard	ColdClimate (❄)
Operating temperature	-30 to +60 °C	
Rel. air humidity, operation	5 to 95 % no condensation	5 to 95 % with condensation
Storage temperature	-40 to +85 °C	
Rel. air humidity, storage	5 to 95 % no condensation	5 to 95 % with condensation
Maximum operating height	2,000 m above sea level (operation up to 4,500 m on request)	

| Power supply	
Via backplane	+5 V | ≤ 260 mA, +15 V| ≤ 20 mA, -15 V | ≤ 16 mA
External on the module	24 V | ≤ 87 mA
System requirements	
Hardware	All M1 CPU families apart from ME203, SK1 backplane not required
Software	M-Base 3.85 / SolutionCenter 1.85 or higher
Models	
GMP232	Grid measurement and protection module; 3x In 690V, 3x In 5A; 2x Out Relay 24/48V DC, 230V AC; U-, I-, P-, Q-, f-measurement; 4Q-energy metering, integrated monitoring/protection functions, harmonic analysis, integrated realtime data recorder (16 channels); sequence of event log with realtime stamp
GMP232 CC	Like GMP232; ColdClimate (❄)
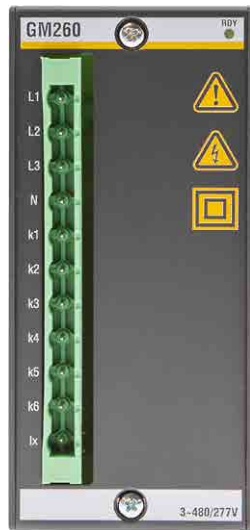
Grid measurement module GM260

The GM260 module enables the safe, reliable and fast measuring of all relevant values for three-phase electrical networks. Two separate three-phase branches can be measured if there is a common voltage measuring point. The grid variables are calculated online in the module as TrueRMS values including harmonics up to the 40th harmonic. This is particularly useful for applications such as for operational measurement on machines or the energy monitoring in plants and buildings. As well as functions for determining the active, apparent and reactive power for each phase, two separate 4-quadrant energy counters are directly integrated in the module.

The GM260 module is fully integrated in the Bachmann SolutionCenter. Both the measured channel values and also the derived values are made available directly in the user interface.

- Measurement of current, voltage, frequency, power, power factor, phase angle
- Direct connection to input voltages up to 480 $V_{L\text{-}L,\ RMS}$
- TrueRMS calculation online
- 2 independent 4Q energy counters
- Compact design for 2 three-phase branches

Item	Item No.
GM260	00022162-00
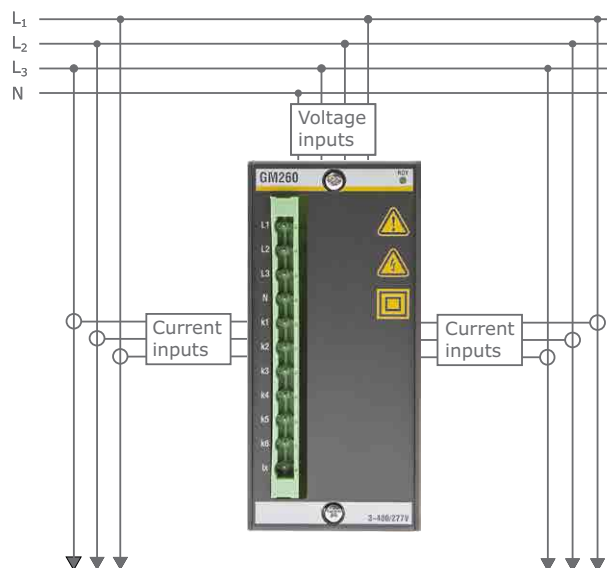
Application example: Power measurement with common voltage input

Grid measurement module

GM260 – Grid measurement	
Current/voltage measurement	
Measuring method	True RMS (incl. harmonics)
Measurement interval	50 Hz: 20 ms 60 Hz: 16.67 ms
Voltage measurement	
Number	3
Maximum rated voltage	$U_{L-L, RMS}$: 480 VAC, $U_{L-N, RMS}$: 277 VAC
Voltage measuring range	$U_{L-L, RMS}$: 69.3 - 625 VAC, $U_{L-N, RMS}$: 36 - 361 VAC
Accuracy*	±0.3 %
Continuous overload	$U_{L-L, RMS}$: 675 VAC, $U_{L-N, RMS}$: 390 VAC
Short-term overload(10x1 s, interval 10 s)	$U_{L-L, RMS}$: 1039 VAC, $U_{L-N, RMS}$: 600 VAC
Input impedance	>2 MΩ
Current measurement	
Number	6
Accuracy*	±0.5 %
Current transformer rated current	1 A
Current measuring range	0.01 - 1.2 AAC
Continuous overload	1.2 AAC
Short-term overload (5x1 s, interval 300 s)	3 AAC
Frequency measurement	
Rated frequency	50 / 60 Hz
Reference range	45 to 65 Hz
Accuracy*	±0.02 Hz
Measurement interval	Between two zero crossings 50 Hz: 20 ms 60 Hz: 16.67 ms
Power measurement – active, reactive and apparent power	
Measured values	P, Q, S per phase and as total
Accuracy*	±0.8 %
Calculation method	DIN 40110-2
Measurement interval	Calculation over one period 50 Hz: 20 ms 60 Hz: 16.67 ms

* Accuracy values as a percentage of the nominal value at 25 °C

Grid measurement module

GM260 – Grid measurement	
Energy	
Number of energy counters	2
Accuracy*	±0.8 %
Resolution	1 Wh
Active energy	Supplied (positive), drawn (negative)
Reactive energy	Supplied (positive), drawn (negative)
Measurement interval	Calculation over one period 50 Hz: 20 ms 60 Hz: 16.67 ms
Type of memory	Nonvolatile (on the module)
Memory cycle	1 sec
Electrical safety	
Product standard	IEC/EN 61131-2
Generic standard	IEC/EN 60664-1
Pollution degree	2
Overvoltage category	3
Test surge voltage	4 kV
Protection class	2
Approvals / certificates	
General	CE, CCC (UL on request)
Ambient conditions	
Operating temperature	-30 to +60 °C
Rel. air humidity, operation	5 to 95 % no condensation
Storage temperature	-40 to +85 °C
Rel. air humidity, storage	5 to 95 % no condensation
Maximum operating height	2,000 m above sea level (operation up to 4,500 m on request)
Power supply	
Via backplane	+5 V | ≤ 130 mA, +15 V| ≤ 45 mA
System requirements	
Hardware	All M1 CPU families apart from ME203, SK1 backplane not required
Software	M-Base 3.91 / SolutionCenter 1.91 or higher (recommended) (if the release driver is installed manually, also executable from the system software of the CPU ≥ M-Base 3.90)
Models	
GM260	Grid measurement module; 3x In 480V, 6x In 1A; U-, I-, P-, Q-, f-measurement; 4Q-energy metering

System modules

Systematic perfection.

The M1 automation system is based on an ingenious and field-tested modular concept. Precisely matched to the respective requirements, automation engineers can assemble the technically and economically optimized configuration from a broad selection of modules.

Extremely space-saving standardized module sizes, robust and absolutely maintenance-free mechanical design as well as immunity to external influences particularly characterize the M1 system concept from Bachmann electronics.

Power supply module NT255

Features
Power supply of modules via backplane
Supply voltage: 18 .. 34 V DC
Monitoring of supply voltage
Power-fail signal for processor module
Galvanic isolation
Output power: 45 W (55 W)
Buffer time: 18 ms

Power supply module NT250/48

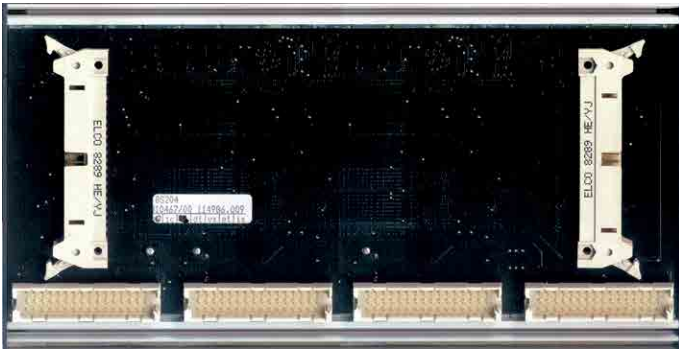| Features |
| --- |
| Power supply of modules via backplane |
| Supply voltage: 38 .. 58 V DC |
| Monitoring of supply voltage |
| Power-fail signal for processor module |
| Galvanic isolation |
| Output power: 45 W |
| Buffer time: 10 ms |
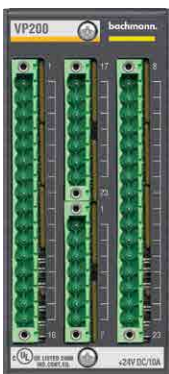
Distribution modules VP200 / x

Features
Distributor module for backplanes
2 potentials up to 24 V or 48 V with 23 pins each
12 A per pin

Dummy module LM201

Features
Placeholder for one module slot as a reserve for future extension
No electronics
Used to protect the backplane

Backplanes BS2xx

Features
1 .. 16 module slots
Seamless connection possible
Vibration proof fixing of modules
Snappable on backplane
Stabile mechanical design

Backplane BS2xx/❄

Features
1 .. 16 module slots
Seamless connection possible
Vibration proof fixing of modules
Snappable on backplane
Stabile mechanical design
ColdClimate design (protected against temporary condensation)

Backplanes BS2xx/S

Features
1 .. 16 module slots
Seamless connection possible
Vibration proof fixing of modules
Snappable on backplane
Stabile mechanical design
For protection class 1
Grounding tab for protective conductor connection

Rail adapter S202

Features
2 module slots
Can be snapped on EN 60715 DIN rail
Vibration proof fixing of modules

Bus bar Adapters BS200/ET

Features
2 .. 8 module slots
Optimized thermal connection
Stabile mechanics / compact design
Vibration proof fixing of modules

System modules

Power supply module NT255

With the NT255 Bachmann electronic sets new standards for the power supplies of CPUs and backplane-supplied modules. As a result of intensive development work and in consideration of field experiences with several thousand supply modules, the NT255 combines long term knowledge with the latest technologies.

Best possible, selected components and lifetime optimized design form the reliable base for the module. Recent planar transformer technologies ensure a significantly increased efficiency, the integrated heat dissipation in the circuit board (»coolPCB technology«) prevents even minimal local warming and thus the early ageing of components. Moreover, because of the extremely reduced weight of the parts, the module is even more robust against shock and vibrations.

In spite of the primary design focus on a long service life and robust design, the NT255 also offers outstanding technical features: up to 80 % longer buffer time at short voltage drops and generous power reserves (55 W peak power) for temporary overload ensure safety and reliability in every respect.

• Input voltage range 18 .. 34 V DC
• Provides all the necessary CPU voltages as well as supply for modules on backplanes
• 45 W output power (55 W peak power)
• Galvanic isolation input/ground
• Galvanic isolation input/system
• Electronic reverse polarity protection
• 2 state indicators allow differentiation between supply failures and internal errors
• Monitored supply voltage
• Monitored output voltages
• Power-fail signal and state information for CPU module (processable from application)

Item	Item no.
NT255	00013251-00
NT255❄	00016158-00

NT255	
Input	
Voltage range	18 .. 34 V DC
Input voltage, peak value	+40 V at t < 1 s/min
Power consumption	Max. 68 W
Reverse polarity protection	Electronic
Starting current limitation	Max. 8 A after 5 ms
Fuse	SMD wire fuse 7 A at device defect
Input voltage monitoring	Yes, for power fail message
Output	
Output power	45 W (55 W)
Output voltage / output current	+5 V/ 6 A (8 A peak) +15 V / 0.5 A -15 V / 0.5 A
Power-fail bypass	18 ms, power-fail message after 3 ms
Monitoring	
State indication	Power-fail on processor
State display	LEDs (Power, Error, Ready)
Galvanic isolation	500 V (input/system), 100 V (input/ground)

Ambient conditions	Standard	ColdClimate (❄)
Operating temperature	-30 .. +60 °C	
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % without condensation	5 .. 95 % with condensation

Execution variants	
NT255	Power supply 45W (55W); 24V; 5V 6A; +-15V 0.5A
NT255❄	Like NT255; ColdClimate (❄)

System modules

## Power supply module NT250/48

The power supply module NT250/48 is suitable for operation on 48 V DC input voltage. It supplies all M1 modules with all voltages required.

- Power supply for M1 controller systems
- State indicating LED
- Supply voltage 38 .. 58 V DC
- Monitoring of supply voltage
- Power fail signal for processor module
- Galvanic isolation input/bus
- Galvanic isolation input/ground

Item	Item no.
NT250/48	00012754-00

NT250/48	
Power supply unit	
Voltage range	38 .. 58 V DC
Input voltage, peak value	+60 V at t < 1 s/min
Inrush current	Max. 7 A after < 0.5 s
Output voltage/output current	+5 V/6.0 A +15 V/0.5 A -15 V/0.5 A
Output power	42 W
Galvanic isolation	500 V (input/bus), 100 V (input/ground)
Ambient conditions	
Operating temperature	0 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % without condensation
Execution variants	
NT250/48	Power supply 42W (55W); 48V; 5V 6A; +-15V 0.5A
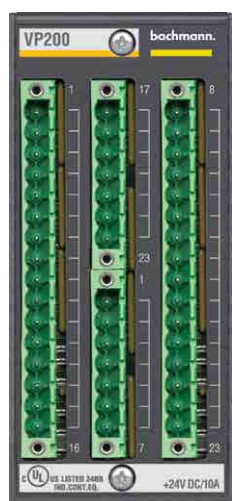
Distribution module VP200 / x

The distribution module VP200/x is used as back-plane to distribute the supply voltage to sensors, switches etc.

• Distributor module for backplanes
• 2 potentials up to 24 V with 23 pins each
• 12 A per pin
• Can be snapped on backplanes as stand-alone module or can be integrated on an M1 backplane

Item	Item no.
VP200	00009496-00
VP200 / S	00009498-00

VP200 / x	
Distribution modules	
Quantity of potentials	2
Quantity of pins	23 per common potential
Current	Max. 12 A per pin
voltage	18 .. 34 V DC
Ambient conditions	
Operating temperature	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % without condensation
Execution variants	
VP200	Supply voltage distribution module
VP200 / S	Supply voltage distribution module (potential rails) with mounting plate

System modules

Dummy module LM201

The dummy module LM201 is used as fill-in for later extensions and does not contain any electronic components. Used to protect the backplane.

• Placeholder for one module slot
• No electronics
• Used to protect the backplane

Item	Item no.
LM201	00009494-00

| LM201	
Execution variants	
LM201	Dummy module (cover)

Rail adapter S202

The DIN rail adapter S202 serves as a mounting element for individual modules on a top-hat rail per DIN 60715.

- 2 module slots
- Can be snapped on EN 60715 DIN rail
- Vibration proof fixing of modules

Item	Item no.
S202	00021588-00

S202	
Dimensions	
Number of module slots	2
Width	110 mm
Depth	15 mm
Height	119 mm
Ambient conditions	
Operating temperature	Corresponding to the combined M200-module
Rel. humidity operation	Corresponding to the combined M200-module
Storage temperature	Corresponding to the combined M200-module
Rel. humidity storage	Corresponding to the combined M200-module
Design variants	
S202	Backplane with 2 module slot, without circuit board

System modules
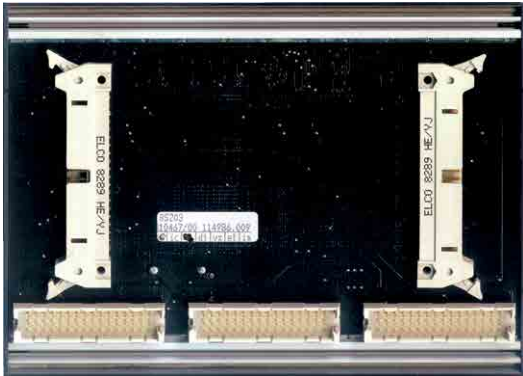
Backplanes BS200 series

The backplanes BS201 to BS216 interconnect the M1 controller hardware modules, such as power supplies, CPU modules and input/output modules, mechanically and electrically.
They are the backbone of the controller.

- 1 .. 16 module slots
- Seamless connection/possible
- Stabile mechanics/compact design
- Vibration proof fixing of modules
- Can be snapped on EN 60715 DIN rail

Item	Item no.
S201	00009542-00
BS201	00010507-00
BS202	00009802-00
BS203	00009313-00
BS204	00009752-00
BS205	00009206-00
BS206	00009792-00
BS207	00009207-00
BS208	00009793-00
BS209	00009634-00
BS210	00009794-00
BS211	00009795-00
BS212	00009796-00
BS213	00009797-00
BS214	00009798-00
BS215	00009799-00
BS216	00009800-00

BS200 series	
Dimensions	
Number of module slots	1 .. 16
Width	55 mm x number of module slots
Depth	23 mm incl. connector
Height	119 mm
Ambient conditions	
Operating temperature	-30 .. +60 °C (vertical: -30 .. +55 °C)
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % without condensation
Execution variants	
BS201	Backplane with 1 module slot
BS202	Backplane with 2 module slots
..	..
BS216	Backplane with 16 module slots
S201	Backplane with 1 module slot, without circuit board
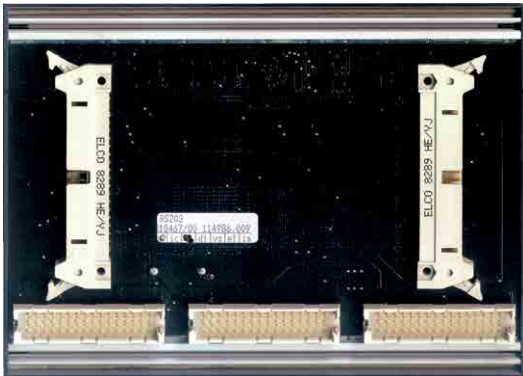
Backplanes BS200❄ series

The backplanes for BS200/W❄ for cold weather and protection class 1 interconnect the M1 controller hardware modules, such as power supplies, CPU modules and I/O modules, mechanically and electrically. They are the backbone of the controller.

- 1 .. 16 module slots
- Seamless connection/possible
- Stabile mechanics/compact design
- Vibration proof fixing of modules
- Can be snapped on EN 60715 DIN rail
- ColdClimate design (protected against temporary condensation)

Item	Item no.
BS203❄	00015947-00
BS204❄	00015948-00
BS205❄	00015949-00
BS206❄	00015950-00
BS207❄	00015951-00
BS208❄	00015952-00
BS209❄	00015953-00
BS210❄	00015954-00
BS211❄	00015955-00
BS212❄	00015956-00
BS213❄	00015957-00
BS214❄	00015958-00
BS215❄	00018623-00
BS216❄	00018624-00

BS200❄ series	
Dimensions	
Number of module slots	3 .. 16
Width	55 mm x number of module slots
Depth	23 mm incl. connector
Height	119 mm
Ambient conditions	ColdClimate (❄)
Operating temperature	-30 .. +60 °C (vertical: -30 .. +55 °C)
Rel. humidity operation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % with condensation
Execution variants	
BS203❄	Backplane with 3 module slots; ColdClimate (❄)
BS204❄	Backplane with 4 module slots; ColdClimate (❄)
..	..
BS216❄	Backplane with 16 module slots; ColdClimate (❄)

System modules

Backplanes BS200/S series

The backplanes of the series BS200/S for protection class 1 interconnect the M1 controller hardware modules, such as power supplies, CPU modules and input/output modules, mechanically and electrically. They are the backbone of the controller.

- 3 .. 16 module slots
- Seamless connection/possible
- Stabile mechanics/compact design
- Vibration proof fixing of modules
- Can be snapped on EN 60715 DIN rail
- For protection class 1
- Grounding tab (item no. 00016115-00) for protective conductor connection, necessary for use of voltages other than SELV

Item	Item no.
BS203/S	00016785-00
BS204/S	00016786-00
BS205/S	00016787-00
BS206/S	00016788-00
BS207/S	00016789-00
BS208/S	00016790-00
BS209/S	00016791-00
BS210/S	00016792-00
BS211/S	00016793-00
BS212/S	00016794-00
BS213/S	00016795-00
BS214/S	00016796-00
BS215/S	00016797-00
BS216/S	00016798-00
Protective conductor connection set	00016115-00

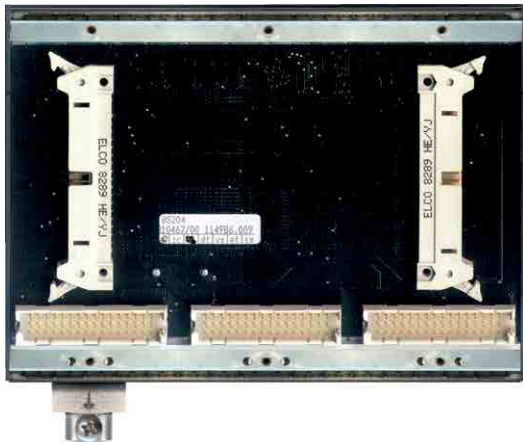| BS200/S	
Dimensions	
Number of module slots	3 .. 16
Width	55 mm x number of module slots
Depth	23 mm incl. connector
Height	119 mm without protective conductor connection 137 mm with protective conductor connection
Ambient conditions	
Operating temperature	-30 .. +60 °C (vertical: -30 .. +55 °C)
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % without condensation
Execution variants	
BS203/S	Backplane with 3 module slots, Protection Class 1
BS204/S	Backplane with 4 module slots, Protection Class 1
..	..
BS216/S	Backplane with 16 module slots, Protection Class 1

Bus bar Adapters BS200/ET

The busbar adapters of the BS200/ET family are used to optimize thermal and robust Controller connection to e.g. the cabinet back panel. Through this application-specific coupling, the heat can be specifically removed through the rear wall of the cabinet housing, in which the cooling of the interior becomes much easier. Frequently, a maintenance-intensive active cooling of the components in the interior can therefore be avoided.
This adapter also allows for direct mounting without a top-hat rail, if this is beneficial for structural reasons, like in the case of a vertical mount or increased mechanical loads.
These accessories can be used for the bus bar-series BS200.

Bus bar adapter with fitted M1 controller

- 2 .. 8 module slots
- Optimized thermal connection
- Stabile mechanics / compact design
- Vibration proof fixing of modules

Item	Item no.
BS202/ET	on request
BS203/ET	on request
BS204/ET	00021791-00
BS205/ET	00021558-00
BS206/ET	00021792-00
BS207/ET	00021793-00
BS208/ET	00021794-00

| BS200/ET	
Dimensions	
Number of module slots	2 .. 8
Width	55 mm x number of module slots
Depth	10 mm
Height	150 mm
Ambient conditions	
Operating temperature	Corresponding to the installed bus bar family
Rel. humidity operation	Corresponding to the installed bus bar family
Storage temperature	Corresponding to the installed bus bar family
Rel. humidity storage	Corresponding to the installed bus bar family
Design variants	
BS202/ET	Backplane adapter with 2 module slots; for heat dissipation to the rear panel
BS203/ET	Backplane adapter with 3 module slots; for heat dissipation to the rear panel
..	..
BS208/ET	Backplane adapter with 8 module slots; for heat dissipation to the rear panel

Storage media

Robust in every detail.

To safely satisfy the high availability requirements imposed on the entire automation system, program memory and data memory should also be selected with the utmost care. The PCC201, CF200, as well as the latest CFA200 families are specially selected industrial types that meet the special requirements imposed by the harsh everyday conditions.

Due to the extended ambient conditions, the high number of supported write cycles and the exchange of experience with suppliers these memory cards are strongly recommended for use both in the controller system as well as in the operating and monitoring devices, and in industrial PCs.
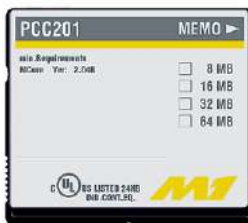
PC cards PCC201/xx

Features
Memory capacity 32 / 64 MB
Access width 16 bits
Designed as 5 V card
Program voltage of 12 Vpp
Write protection via operating software

Compact Flash Memory CF200/xx

Features
Compact Flash type I according to Compact Flash specification
Memory capacity 512 MB, 4 GB, 8 GB
Fast data transfer with ATA
Write protection via operating software
Extended temperature range
Long service life / MTTF

CFast Memory CFA200/xx

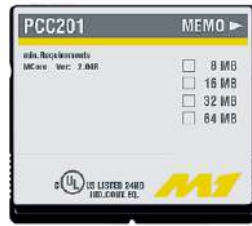| Features |
| --- |
| CFast type I |
| Memory capacity 4/8 GB |
| Fast data transfer with SATA |
| Write protection via operating software |
| Extended temperature range |
| Long service life / MTTF |

Bachmann System Maintenance Stick

Features
USB stick with backup and restore program
For operator terminals and industrial PCs with Linux and Windows
Memory capacity 8 GB

PC cards PCC201/xx

The PCC201/xx PC cards serve as a storage medium of the M1 controller. Depending on the memory extension, the PC cards may contain source codes and pieces of documentation in addition to the operating system, the drivers and the application software.

The PCC201 cards can directly be written to and formatted in all processor modules of the M1 controller. With an A-PCC200 adapter it is possible to use the PC cards in the PCMCIA slots of PCs and notebooks.

The PCC201 series is produced entirely in-house and therefore long-term supply is guaranteed.

- Memory capacity 32 / 64 MB
- Access width 16 bits
- Designed as 5 V card
- Program voltage of 12 V_{SS}
- Write protection via operating software

Item	Item no.
PCC201/32	00012081-30
PCC201/64	00012081-40
A-PCC200	00009540-00

| PCC201/xx	
Basic data	
Register	No CMR (Component Management Register)
Powerdown mode	Not possible
Information	All information is stored in CIS (Card Information Structure)
Operating voltages	
Operating voltage	5 V (min. 3 V for FLASH memory)
Program voltage	12 V
Ambient conditions	Standard
Operating temperature	0 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % without condensation
Execution variants	
PCC201/32	PC Card 32MB
PCC201/64	PC Card 64MB
A-PCC200	Adapter for PCC-Card

Storage media

Compact Flash memory CF200/xx

Given the high availability demands placed on automation systems, program and data memory must be selected with particular care. The Compact Flash memory cards CF200/xx are therefore especially selected industrial types that can cope with the requirements of harsh daily working routines. Use of the CF200/xx both in CPUs of the M1 family and in CT and WT devices is strongly recommended due to the extreme environmental conditions, the large number of supported write cycles and the many years of lasting experience with suppliers.

Item	Item no.
CF200/512	00012759-00
CF200/4GB	00013556-00
CF200/8GB	00014321-00

- Compact Flash type I
  according to Compact Flash specification
- Memory capacity 512 MB, 2/4 GB
- Fast data transfer
- Write protection via operating software
- Extended temperature range
- Long service life / MTTF

| CF200/xx	
Technical data	
Memory type	Compact Flash type I
Memory capacity	512 MB, 4 GB, 8 GB
Data transfer rate	Up to 8 MB/s
Operating voltage	3.3 V / 5 V (automatic adaptation)
Read / write cycles	2,000,000
MTBF at 25 °C	> 4,000,000 h (depending on free memory)
Data retention	10 years
Data reliability	< 1 unrecoverable errors in 10^{14} bits read accesses
Vibration	2 G 10 Hz .. 2 kHz
Shock	2000 G half cycle 0.5 ms
Ambient conditions	
Operating temperature	-40 .. +85 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % without condensation
Execution variants	
CF200/512	Compact Flash Card 512MB
CF200/4GB	Compact Flash Card 4GB
CF200/8GB	Compact Flash Card 8GB
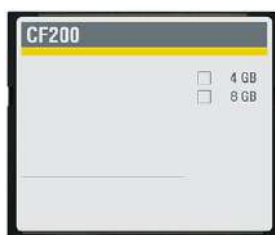
CFast memory CFA200/xx

The full speed of the SATA interface is available with the CFAST Flash memory card for powerful controllers. Up to 30x the transmission rates of the CF cards can be reached. Given the high availability demands placed on automation systems, program and data memory must be selected with particular care. The CFast memory cards CFA200 / xx are therefore especially selected industrial types that can cope with the requirements of harsh daily working routines. Use of the CFA200/xx both in CPUs of the M1 family as well as in our visualization devices is strongly recommended due to the extreme environmental conditions, the large number of supported write cycles and the many years of lasting experience with suppliers. The robustness was significantly increased in comparison with a CF card via a stable edge connector.

- CFast type I
- Memory capacity 4/8/16 GB
- Fast data transfer
- Write protection via software
- Extended temperature range
- Long service life / MTTF

Item	Item no.
CFA200/4GB	00017355-00
CFA200/8GB	on request
CFA200/16GB	00019082-00

CFA200/xx	
Technical data	
Memory type	CFast type I
Memory capacity	4 / 8/16 GB
Data transfer rate	up to 100 MB / s
Operating voltage	3.3
Read / write cycles	> 3,000,000
MTBF at 25 °C	> 2,500,000 h (depending on free memory)
Data retention	10 years
Vibration	20 G 10 Hz .. 2 kHz
Shock	1500 G half cycle 0.5 ms
Ambient conditions	
Operating temperature	-40 .. +85 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % without condensation
Execution variants	
CFA200/4GB	CFast Card 4GB
CFA200/16GB	CFast Card 16GB

Storage media
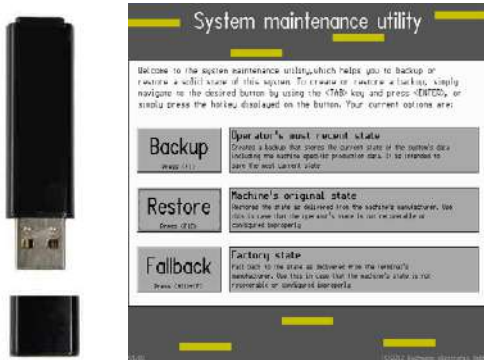
Bachmann System Maintenance Stick
for Linux and Windows devices

The Bachmann System Maintenance Stick (BSM Stick) is a combination of an 8 GB USB stick and an easy-to-operate, graphic backup and restore program for operator terminals and industrial PCs with Linux and Windows. Using the BSM Stick you can conveniently create complete backups of the operating system on a USB stick, or restore a complete backup from the stick.

The operating philosophy of the Bachmann System Maintenance Utility is based on the easiest possible operation via a standard PC keyboard, so that a corrupt operating system of an operator terminal or IPC can be quickly restored in the field, even by unexperienced operating personnel (one-click recovery). With the aid of the BSM Stick the end customer can keep machine downtimes to a minimum; this makes "repairs" of the visualization hardware, due to an operating system defect, unnecessary. Also the end customer can save the high expenses associated with keeping a pool of replacement devices on hand for these kinds of service cases. Thus the BSM Stick directly helps to reduce costs and optimizes availability of the terminal or of the IPC, and thus it helps to optimize availability of the system or machine, and contributes to increased acceptance of a machine on the part of the end customer.

The Bachmann System Maintenance Stick supports all series OT200, and series OT1300 operator terminals, as well as the series IPC1400 and IPC300 IPCs.

System prerequisites
• Free USB port
• System BIOS that supports booting from the USB port
• External standard PC keyboard

Scope of delivery
• 8 GB USB with pre-installed Bachmann System Maintenance Utility

Item	Item no.
BSM Stick	on request

Networking – the backbone of the automation solution

As an automation specialist in the area of distributed energy generation plants, we know the significance of a powerful, scalable, and absolutely reliable networking solution. Networking as the backbone of every automation solution has the task of connecting different sub-components according to their requirements in terms of signaling. In this regard rigorous requirements are imposed on real-time capability, manipulation security, as well as availability.

To meet these high requirements, Bachmann electronic provides an extensive offering of different networking components. For example, our offering enables a central control room connection adapted to the particular customer requirements via Ethernet, or a machine-internal, flexible connection of the individual machine components on the controller via real-time capable fieldbuses. You decide which of the networking possibilities established on the market best fits your automation task. Bachmann electronic is guaranteed to have a suitable solution in its product line.
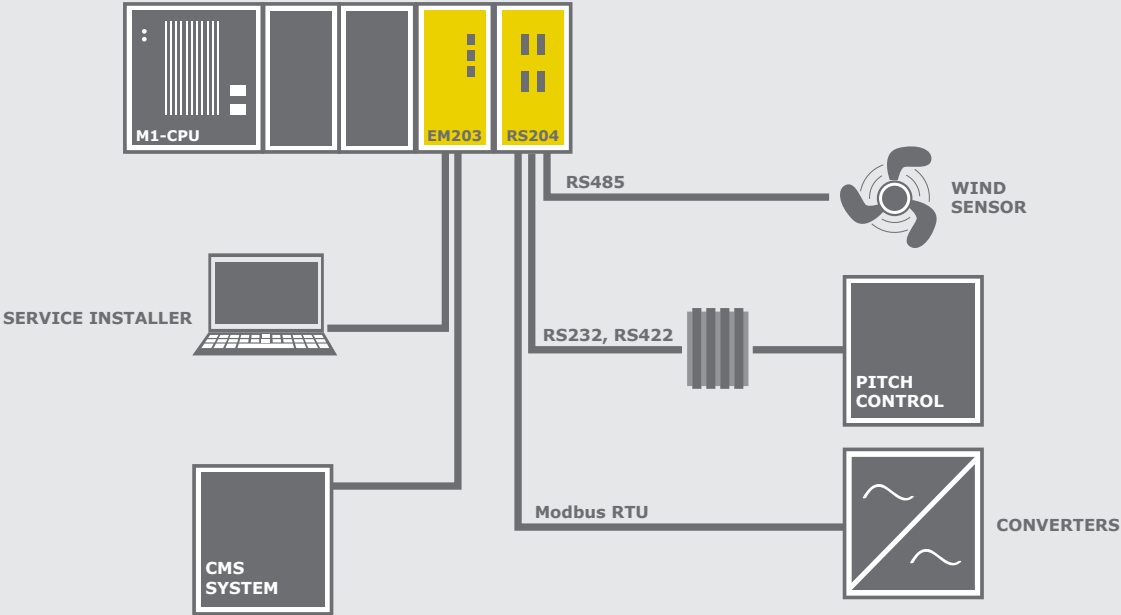
System networking – Interfaces

Numerous upgrade possibilities.

The M1-CPU already offers hardware interfaces for Ethernet and serial connections. If needed the number of these interfaces can be increased by placement of appropriate hardware modules on the backplane. The RS204 module offers additional serial ports with 9-pin D-Sub connectors. In addition the EM203 module extends the system by additional network adapters with three RJ45 ports. This means that the interface extensions can also be used on Fastbus substations.

Topology: Interface

M1-CPU | EM203 | RS204

SERVICE INSTALLER

CMS SYSTEM

RS485 — WIND SENSOR

RS232, RS422 — PITCH CONTROL

Modbus RTU — CONVERTERS

Industrie Ethernet master
EM203, EM213, EM213❄

Features
Additional Ethernet port (separate IP address)
Cable length to 100 m per line
RJ45 connections: 3
Status display via LED
Integrated switch
Transfer rate to M1 CPU: max. 2.4 Mbit/s user data
Transfer rate as switch: max. 100 Mbit/s

Interface modules
RS204 ❄

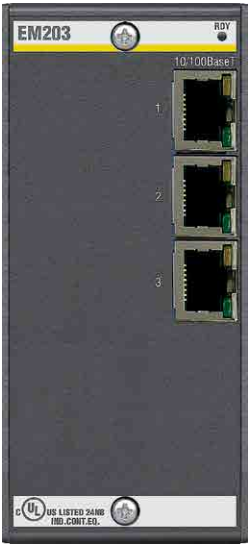| Features |
| --- |
| 4 interfaces on one module |
| Several interface modules per controller possible |
| RS232/RS422/RS485 can be combined |
| High-speed interfaces up to 1.5 Mbit/s |
| Switchable terminating resistors |

Interfaces

Industrie Ethernet master EM2x3

The module EM2x3 extends the control system with an additional Ethernet adapter with 3 ports for 10/100 MBit. Thus Ethernet ports for connection of a service laptop or for other Ethernet-based networking are also available on FASTBUS substations.

- Cable length to 100 m per line
- Status display via LED
- 3xRJ45 connections
- Integrated switch

Item	Item no.
EM203	00012671-00
EM213	00017321-00
EM213❋	00017470-00

VISUALIZATION

CMS

EM

FO (FASTBUS)

M1-CPU
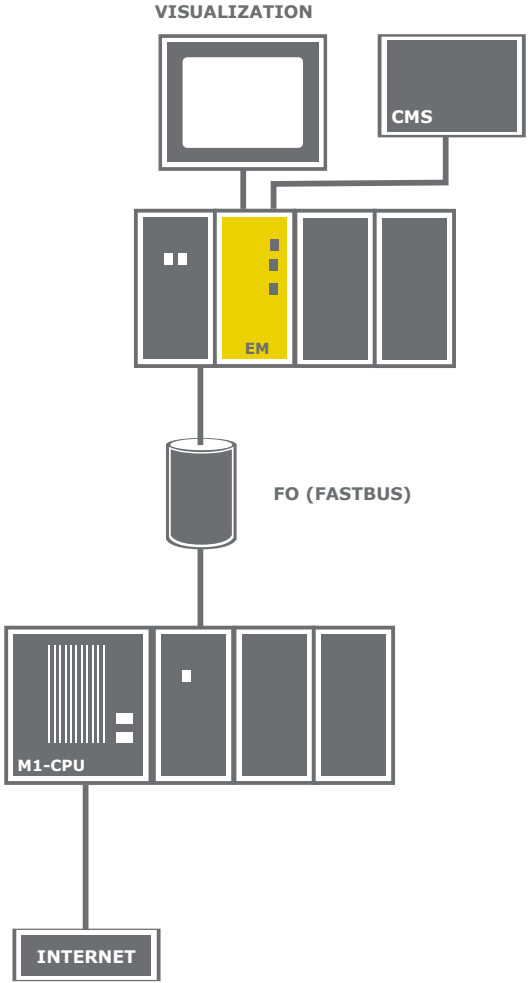
INTERNET

| EM2x3			
Ethernet master			
Number of transceivers	3x 10/100BaseT		
Connectors	3x RJ45/crossed and uncrossed cables can be used (autocross detection)		
Line length	max. 100 m/line		
Transfer rate to M1 CPU	max. 2.4 Mbit/s user data		
Transfer rate as switch	max. 100 Mbit/s		
Line impedance	100 Ω		
Status display	LEDs for power, collision + 4x LinkPuls, 3x speed (10/100 Mbit/s)		
Ambient conditions	Standard EM203	Standard EM213	ColdClimate (❄)
Operating temperature	0 .. +60 °C	-30 .. +60 °C	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation		5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C		
Rel. humidity storage	5 .. 95 % without condensation	5 .. 95 % with condensation	5 .. 95 % with condensation
Model variants			
EM203	Ethernet interface module; RJ45; 3 Ports; Eth100		
EM213	Ethernet interface module; RJ45; 3 Ports; Eth100		
EM213❄	like EM213; ColdClimate (❄)		

Interfaces
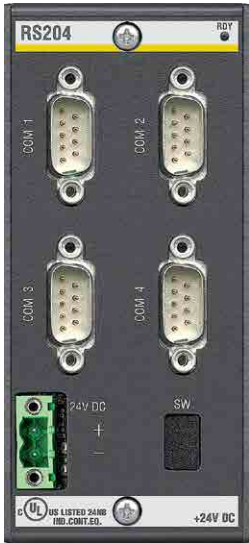
Interface modules RS204/x

The interface module RS204 is used to
connect four asynchronous serial interfaces
to the M1 controller.

- 4 interfaces on one module
- Any number of interfaces possible per controller
- RS232/RS422/RS485 and TTY can be combined
- High speed interfaces with up to 1.5 Mbaud
- Auto-flow control for automatic handshake
- Integrated terminating resistors
  (connect/disconnect)
- Interfaces galvanically isolated from the system

Item	Item no.
RS204	00009918-00
RS204✳	00016169-00
RS204/R	00009918-01
RS204/T	00009918-20

RS204/x				
Description	RS232	RS422	RS485	TTY
Transfer rate* (max.)	115,2 Kbaud	921,6 Kbaud	921,6 Kbaud	9,6 Kbaud
Signal level	RS232	RS422	RS485	
Terminating resistance	-	Yes, adjustable via DIP switch		-
Operating mode	Full duplex	Full duplex	Half duplex	TX active/RX active TX active/RX passive TX passive/RX active TX passive/RX passive
External power supply				
Voltage range	18 .. 34 V DC			
Current consumption	125 mA bei 24 V DC			
Galvanic isolation from system	500 V			
Ambient conditions	Standard		ColdClimate (❄)	
Operating temperature	-30 .. +60 °C			
Rel. humidity operation	5 .. 95 % without condensation		5 .. 95 % with condensation	
Storage temperature	-40 .. +85 °C			
Rel. humidity storage	5 .. 95 % with condensation			
Model variants				
RS204	Serial interface, 4x RS232 / 422 / 485, 128 byte FIFO, isolated			
RS204❄	like RS204, ColdClimate (❄)			
RS204/T	Serial interface, 3x RS232 / 422 / 485, 1x TTY, 128 byte FIFO, insulated			
RS204/R	Serial interface, 3x RS232 / 422 / 485, 1x RS232, 128 byte FIFO, insolated			

* The following transfer rates [bit / s] can be set via software: 110, 300, 1.2 k, 2.4 k,
   4.8 k, 9.6 k, 19.2 k, 38.4 k, 57.6 k, 115.2 k, 230.4 k, 460.8 k, 921.6 k

System networking – Ethernet

For the safest connections.

A secure, powerful and robust Ethernet connection is gaining ever greater significance. Whether as a simple switch like the SWl205, or as a media converter with switch functionality, like the FCS214, Bachmann electronic offers Ethernet networking components in recognized and proven quality. In addition, with the FCS additional diagnostic functions are available. This means that the states of the optical components and of the fiber optic cable can be constantly monitored in diagnostic tools, as well as in the controller-side software. Thus deficient connection quality due to installation errors or due to aging of the components can be detected and corrected in a timely manner – even before a failure occurs.

Topology: Ethernet
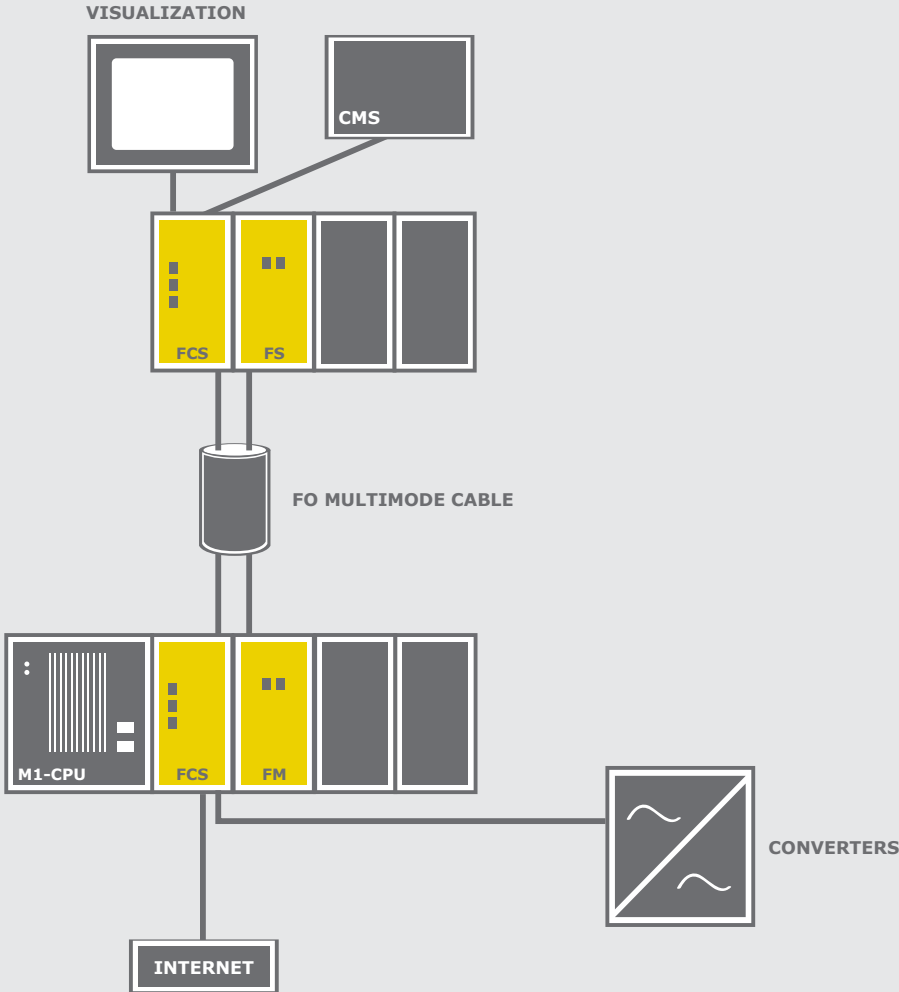
Industrial Ethernet switch
SWI205

Features
Cable length to 100 m per line
RJ45 connections: 5
Status display via LED
Transfer rate: max. 100 Mbit/s
Line impedance: 100 Ω
QoS (IEEE 802.1Q,p)

Ethernet Remote Station
ERS202

Features
1 serial interface
2 Ethernet-interfaces 10 / 100 Mbit / s with status displays
1 USB interface
RAM 256 MB DRAM
Data memory 512 kB NVRAM
Integrated power supply

Media converter unmanaged switch
FCS214

Features
Implementation copper – FO
Up to 1 Gbit/s throughput
Unmanaged – easy commissioning
Reliable hardware
Detailed, integrated diagnostic possibilities

Industrial Ethernet switch SWI205

The module SWI205 is a powerful and industry
compliant Ethernet switch and is used to connect
M1 control systems, laptops and networks
with the Ethernet 10//100BaseT technology.

• Cable length to 100 m per line
• Status display via LED
• 5xRJ45 connections

Item	Item no.
SWI205/S	00012672-00

SWI205	
Ethernet switch	
Number of transceivers	5x 10/100BaseT
Connectors	5x RJ45/crossed and uncrossed cables can be used (autocross detection)
Line length	max. 100 m/line
Transfer rate	max. 100 Mbit/s
Line impedance	100 Ω
Status display	LEDs for power, collision + 5x LinkPuls, 5x speed (10/100 Mbit/s)
External power supply	
Supply voltage	18 .. 34 V DC
Current consumption	normally 100 mA at 24 V DC
Reverse polarity protection	yes
Ambient conditions	
Operating temperature	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % without condensation
Model variants	
SWI205/S	Ethernet switch; RJ45; 5 Ports; Eth100; integrated power supply 24V; DIN rail mounting

Ethernet
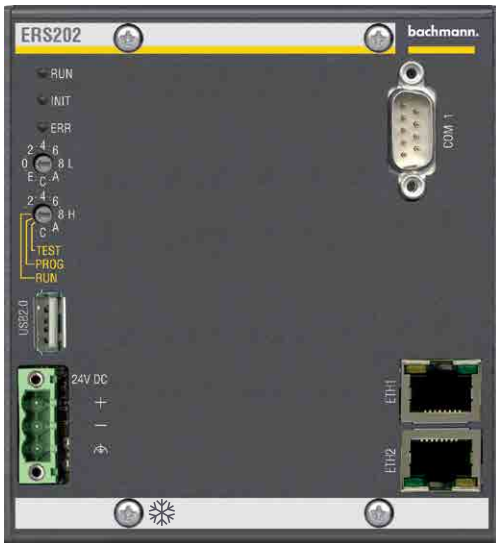
Ethernet Remote Station ERS202

The module ERS202 serves as a remote slave mo-
dule for sub-stations (e.g. redundant networks).
It manages the local data and the exchange
of two Ethernet ports to the for example red-
undant master controllers. Easy configuration
and efficient data exchange allows for safe ope-
ration with the fastest possible switchover.
The robust design as a cold climate versi-
on provides protection even under hard en-
vironmental conditions. An integrated po-
wer supply simplifies the construction.
The module offers the following features:

• 1 Serial interface
• 2 Ethernet-interfaces 10 / 100 Mbit / s
  with status displays
• 1 USB interface
• Status indicating LEDs for RUN, INIT and ERROR
• RAM 256 MB DRAM
• Data memory 512 Kb NVRAM
• Program memory of 16 MB and inter-
  nal FLASH (4 MB for system software,
  12 MB for redundancy configuration)
• Integrated power supply

Item	Item no.
ERS202❄	00021244-00

ERS202	
Processor + memory	
CPU	x86
NVRAM (data memory)	512 kB
DRAM (working memory)	256 MB
FLASH (program memory)*	16 MB internal
Interfaces	
Serial	1x RS232
Ethernet	2x 10 / 100 base-Tx
USB	1x USB 2.0
Power supply	
Voltage range	18 .. 34 V DC
Nominal power	17 W
Current consumption at + 5 V	2000 mA
Current consumption at + 15 V	250 mA
Current consumption at - 15 V	200 mA
Additional features	
Watchdog	
Synchronization pulse for Ethernet	
Real-time clock with battery	
Status indication via 3 LEDs	
CPU ID selectable with rotary hexadecimal switches	
Operating system VxWorks with Bachmann system extensions on internal FLASH	
Ambient conditions	ColdClimate (❄)
Operating temperature	-30 .. +60 °C, fan-free
Rel. humidity operation	5 .. 95% with condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95% with condensation
Model variants	
ERS202❄	Ethernet Remote Station; 2x Eth100; 1x RS232; 1x USB2.0; inegrated power supply 17W; ColdClimate (❄)

* depending on the configuration, a part of the program memory is reserved for the system software

Media convertor – unmanaged switch FCS214 series

The FCS214/x combines media convertor and gigabit switch in a single module. With a fiber optic connection and four RJ45 ports, it is optimally suited for data transmission over long distances. Selected diagnostic capabilities for the fiber optic link and the Ethernet data traffic can be directly integrated into existing PLC applications. The flexible connector concept allows easy connection via a patch cable or an industrial grade push-pull plug connection via an adapter.

• 4x RJ45, 1x FO-connection
• Up to 1 Gbit/s throughput
• Unmanaged – easy commissioning
• Reliable hardware
• Connection via Harting PushPull® connector or
   LC patch cable
• Integrated FO and Ethernet diagnostis

Item	Item no.
FCS214/F	00017192-10
FCS214/G	00017192-00
FCS214/F❊	00019104-10
FCS214/G❊	00019104-00

Screwable adapter for using PushPull connector

Item	Item no.
Adapter	00016682-00

FCS214	FCS214/F	FCS214/G
Ports		
RJ45	4x 10/100/1000 MBit/s	4x 10/100/1000 MBit/s
Fiber optic cable	1x 100 MBit/s	1x 1000 MBit/s
	FOC transmission medium Multimode Fibre (50/125 µm and 62,5/125 µm) max. 2000 m FOC connector type LC FOC guide wavelength 1310 nm	
Diagnostic possibilities		
Fiber optic cable – received light output	HW: three-color status LED SW: 0 – 100%	
Ethernet – throughput	number of data packets	
Ethernet – quality of communication	good/bad frames, bad size, CRC error,…	
Ethernet – mirror port	configurable	
Ambient conditions	Standard	ColdClimate (❄)
Operating temperature	-30 .. +60°C	
Rel. humidity operation	5 .. 95% without condensation	5 .. 95% with condensation
Storage temperature	-40 .. +85°C	
Rel. humidity storage	5 .. 95% with condensation	
Model variants		
FCS214/F	Ethernet fibre optic converter and switch; 100Mbit/s; 5 ports; 1x LC Connector; 4x RJ45; pluggable on backplanes	
FCS214/G	Ethernet fibre optic converter and switch; 100/1000Mbit/s; 5 ports; 1x LC Connector; 4x RJ45; pluggable on backplanes	
FCS214/F❄	like FCS214/F; ColdClimate (❄)	
FCS214/G❄	like FCS214/G; ColdClimate (❄)	

Accessories*			
Item	**Order designation**	**Manufacturer**	**Description**
LC connector	SXLC-DK0-56-0010	LEONI	LC connector duplex uniboot multimode type 2 for multimode fibers with 125 µm cladding
Harting connectors	09 57 402 0500 020	HARTING	HARTING PushPull LC duplex plastic Multi Mode SFP
Harting connectors	09 57 409 0500 020	HARTING	HARTING PushPull LC duplex metal Multi Mode SFP

*Information without guarantee, order directly from the manufacturer

System networking – Bus expansion

Standardized performance.

With the bus expansion modules from Bachmann electronic for the CPU station, additional backplanes with I/O modules can be added. A configuration is not required to do this; at system start all stations and modules will be automatically detected and initialized. All I/O modules can be reached transparently; the physical structure of the control system does not need to be considered. Organization of the controller in multiple stations permits both spatial adaptation to the control cabinet, as well as wide-area distribution of I/O modules for extended machines and plants. There is no restriction for the user in terms of performance and convenience. The interconnected backplanes behave as if they were connected on a single, large backplane.

Topology: bus expansion

M1   BEM   <3m   BES   BES
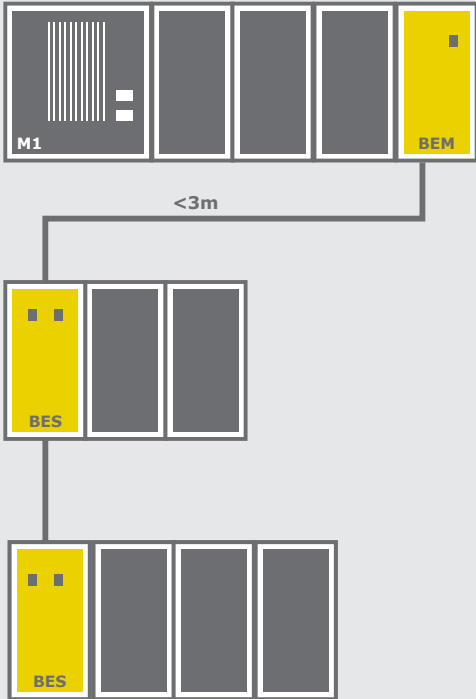
Bus extension modules
BEx200 series

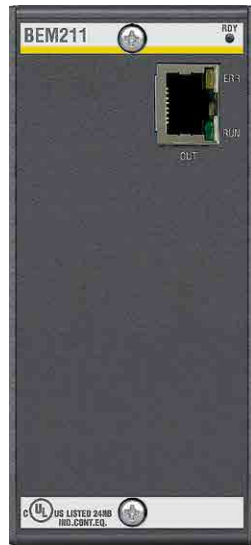| Features |
| --- |
| Bus expansion master module: |
| 1 interface |
| Bus expansion slave module: |
| 2 interfaces (cascadable) |
| Up to 6 or 15 substations |
| Minimal signal delay |
| Distances of up to 3 m between stations |
| Integrated watchdog on slave modules |

Bus expansion

Bus expansion modules BEx200 series

With the bus extension modules BEM21x and BES21x a »high speed« connection up to 3 m away is possible with less than 1.5 µs access time to distributed I/O units. Up to six distributed substations can be directly interconnected in a daisy chain topology. Each substation can in turn handle up to 15 M1 standard modules. The wiring using RJ45 connectors is one advantage of this new technology. Thus wiring is significantly facilitated. A special protocol is not required to use the I/Os with the bus expansion. The user can access these modules directly: As if they were local. The bus expansion module BES21x/N with integrated 24 V power supply provides power for the substation. If more than six substations are required, BES222/x can be used, which enables a special signal conditioning for up to 15 substations.

- Bus expansion master module with 1 interface
- Bus expansion slave module with 2 interfaces
- Bus expansion slave module optionally with integrated power supply
- Up to 6 or 15 local substations
- Minimal signal delay
- Distances of up to 3 m between 2 stations
- Integrated watchdog on slave modules

Item	Item no.
BEM211	00012846-00
BES212	00012847-00
BES212/N	00012848-00
BES222	00013502-00
BES222/N	00013503-00

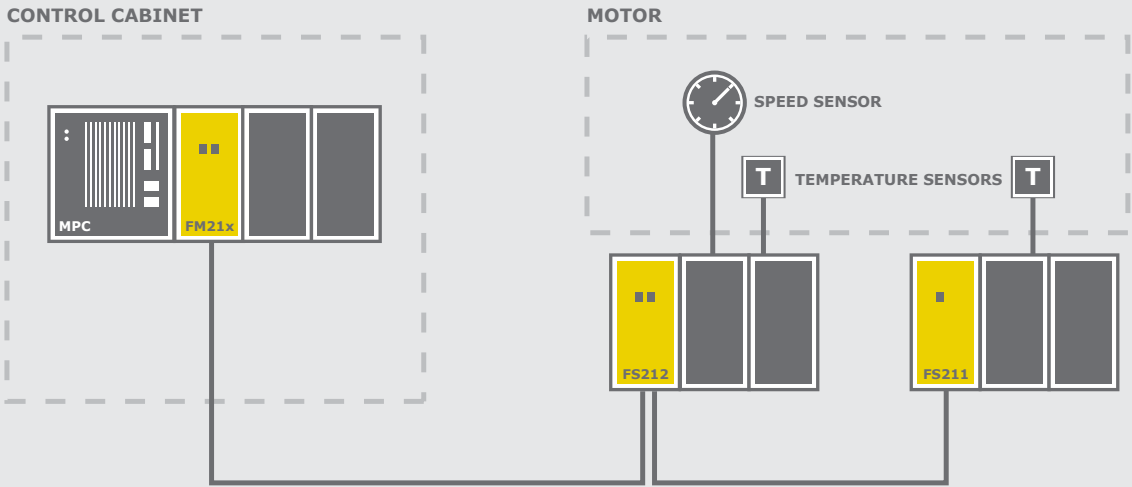| BEx200 series	
Bus expansion interface	
Line length	3 m
Transmission medium	CAT7 special cable
Max. number of stations	6 (BES212/x) or 15 (BES222/x)
Integrated power supply (optional)	
Voltage range	18 .. 34 V DC
Current consumption	max. 1.2 A at 24 V
Nominal power	17 W
Output current at +5 V	2 A
Output current at +15 V	250 mA
Output current at -15 V	200 mA
Reverse polarity protection	yes
Ambient conditions	
Operating temperature	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % without condensation
Model variants	
BEM211	Bus extension master module with 1 interface
BES212	Bus extension slave module with 2 interfaces (up to 6 stations)
BES212/N	Bus extension slave module with 2 interfaces and integrated power supply 17W (up to 6 stations)
BES222	Bus extension slave module with 2 interfaces (up to 15 stations)
BES222/N	Bus extension slave module with 2 interfaces; integrated power supply 17W (up to 15 stations)"

System networking – FASTBUS

Extensive networking possibilities.

With the aid of FO-based FASTBUS solutions numerous distributed tasks can be executed easily and reliably. FASTBUS permits a mixed topology of star and linear networking. In order to design distributed stations even more compact, FASTBUS slaves with integrated power supplies are available. These stations are capable of supplying the I/O modules on the substations. Between the individual stations distances of up to 2000 m can be bridged with no problems, in this regard the galvanic separation is ensured by the fiber optic connection. Use of the FASTBUS does not require a configuration, or other special handling in the software, but rather functions in accordance with the »plug and play« principle.

Topology: FASTBUS

CONTROL CABINET

MPC FM21x

MOTOR

SPEED SENSOR

T TEMPERATURE SENSORS T

FS212 FS211

FASTBUS modules Fx210 series

Features
Fast, fail-safe distribution via fibre optic cables (up to 200 m)
Master modules with 1 or 2 FO interfaces
Slave modules with 1 or 2 FO interfaces
Up to 15 remote substations, cascadable
Group isolation: 500 V

FASTBUS modules Fx220 series

Features
Distances to 2000 m via multimode cable
Master modules with 1 or 2 FO interfaces
Slave modules with integrated power supply
Up to 15 remote substations, cascadable
Connection technology via robust Harting PushPull® connector or LC patch cable

FASTBUS

FASTBUS modules Fx210 series

The FASTBUS modules, FM211, FM212, FS211, and FS212 are designed to enable distribution of substations over long distances with a very low signal delay. The power supply integrated in the FASTBUS slave modules, FS211/N and FS212/N can supply the I/O modules of a substation.

- FASTBUS master modules with
  1 or 2 FO interfaces
- FASTBUS slave modules with
  1 or 2 FO interfaces
- FASTBUS slave modules with
  integrated power supply
- Up to 15 distributed substations
- Distances to 50 m for POF cable,
  150 m for HCS cables or 200 m for special
  HCS cables between 2 stations
- Minimal signal delay

Item	Item no.
FM211	00010495-00
FM212	00010496-00
FS211/N	00010498-00
FS212/N	00010500-00

Fx210 series	
FASTBUS interface	
Line length	50/150/200 m between the stations, Total length max: 1000 m
Transmission medium	Plastic Optical Fiber (POF) max. 50 m Hard Cladded Silica (HCS) max. 150 m HCS sometimes also referred to as Plastic Silica Fiber (PCF), Special HCS cable 200 m
Number of stations	max. 16
Integrated power supply	
Input voltage	24 V DC (18 .. 34 V)
Current consumption	max. 1.2 A at 24 V
Nominal power	17 W
Output current at +5 V	2 A
Output current at +15 V	250 mA
Output current at -15 V	200 mA
Galvanic isolation from the system	500 V
Reverse polarity protection	yes
Ambient conditions	
Operating temperature	0 .. +60 °C
Rel. humidity operation	5 .. 95% without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95% without condensation
Model variants	
FM211	FASTBUS master module with 1 FO interface; HCS/PCF 150m or PMMA 50m
FM212	FASTBUS master module with 2 FO interfaces; HCS/PCF 150m or PMMA 50m
FS211/N	FASTBUS slave module with 1 FO interface; HCS/PCF 150m or PMMA 50m; integrated power supply 17W
FS212/N	FASTBUS slave module with 2 FO interfaces; HCS/PCF 150m or PMMA 50m; integrated power supply 17W

FASTBUS modules Fx220 series

The FASTBUS modules FM221, FM222, FS221 and FS222 are designed to enable distribution of substations over long distances with a very low signal delay. The power supply integrated in the FASTBUS slave modules FS221/N and FS222/N can supply the I/O modules of a substation. The flexible connector concept allows easy connection via a patch cable or an industrial grade push-pull plug connection via an adapter.

- FASTBUS master modules with 1 or 2 FO interfaces
- FASTBUS slave modules with integrated power supply
- Up to 15 distributed substations
- Connection technology via robust Harting PushPull® connector or LC patch cable
- Distances to 2000 m via multimode cable
- Minimal signal delay
- ColdClimate models (❄)

Item	Item no.
FM221	00016747-10
FM221❄	00018091-10
FM222	00016747-00
FS221/N	00016749-10
FS221/N❄	00018092-10
FS222/N	00016749-00

Screwable adapter for using PushPull connector

Item	Item no.
Adapter	00016682-00

Fx220 series

FASTBUS interface

Line length	2000 m between the stations, Total length max: 2300 m
Transmission medium	Multimode fiber (50/125 µm and 62.5/125 µm) max. 2000 m FOC connector type LC FOC guide wavelength 1310 nm
Number of stations	max. 16 (max. 10 per line)
Link budget	> 8 dB (3 dB Reserve)

Diagnostic possibilities

Fiber optic cable – received light output	HW: three-color status LED SW: 0 – 100 %

Integrated power supply

Input voltage	24 V DC (18 .. 34 V)
Nominal power	17 W
Output current at +5 V	2 A
Output current at +15 V	250 mA
Output current at -15 V	200 mA

Ambient conditions

Ambient conditions	Standard	ColdClimate ❄
Operating temperature	-30 .. +60 °C	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % with condensation	5 .. 95 % with condensation

Model variants

FM221	FASTBUS master module with 1 FO-port; 50/62.5µm multi mode fiber; up to 2000m; LC connector
FM221❄	like FM221; ColdClimate (❄)
FM222	FASTBUS master with 2 FO-ports; 50/62.5µm multi mode fiber; up to 2000m; LC connector
FS221/N	FASTBUS slave 1 FO-port; 50/62.5µm multi mode fiber; up to 2000m; LC connector; integrated power supply 17W
FS221/N❄	like FS221/N; ColdClimate (❄)
FS222/N	FASTBUS slave 2 FO-ports; 50/62.5µm multi mode fiber; up to 2000m; LC connector; integrated power supply 17W

Accessories*

Item	Order designation	Manufacturer	Description
LC connector	SXLC-DK0-56-0010	LEONI	LC connector duplex uniboot multimode type2 for multimode fibers with 125 µm outer diameter (Minibreakout-cable)
Harting connectors	09 57 402 0500 020	HARTING	HARTING PushPull LC duplex plastic Multi Mode SFP (Breakout-cable)
Harting connectors	09 57 409 0500 020	HARTING	HARTING PushPull LC duplex metal Multi Mode SFP (Breakout-cable)
Fiber optic cable** (multimode)	8421801LG000	LEONI	AT-V(ZN)Y(ZN)Y 2G50/125 TB900L 2,2 (Breakout-cable)
Fiber optic cable** (multimode)	84950785G222	LEONI	I-V(ZN)Y 2G50/125 TB900L 2,8 (Minibreakout-cable)

*Information without guarantee, order directly from the manufacturer

**When using the cables of other manufacturers observe any changes to the specifications such as attenuation or minimum bending radius. Fibers with a core diameter of 50 µm or 62.5 µm can be used. The outer diameter of the FO cable depends on the connector used.
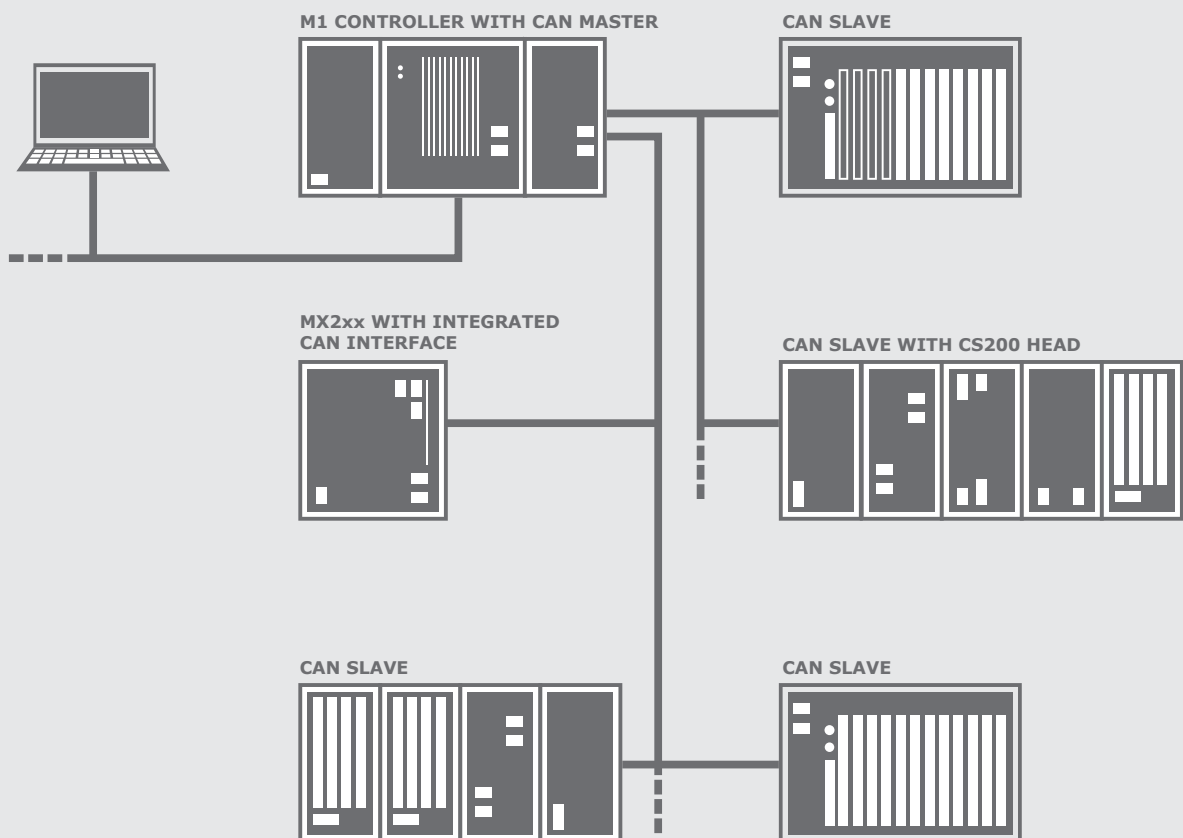
Fieldbuses – CANopen

Proven millions of times over.

The Controller Area Network (CAN) in the CANopen specification has now developed to become the leading fieldbus system for industrial automation. Proven millions of times over and perfectly mature, it offers the ideal basis for safe, easy, and yet flexible networking tasks. By using only one fieldbus, the compact CAN I/O modules from Bachmann electronic facilitate the homogeneous design of an automation system with high efficiency and packing density. Galvanic separation from the main station, the scalable range, and the extremely low-cost wiring make the modules particularly attractive for the users.

Possible topology: CANopen

M1 CONTROLLER WITH CAN MASTER

CAN SLAVE

MX2xx WITH INTEGRATED CAN INTERFACE

CAN SLAVE WITH CS200 HEAD

CAN SLAVE

CAN SLAVE

CAN master CM202

Features
Up to 4 CM202 modules per M1 controller
2 independent CAN buses per CANopen master module
Can be used either as NMT master or NMT slave
Transfer rate: 10 kbit/s to 1 Mbit/s

CANopen

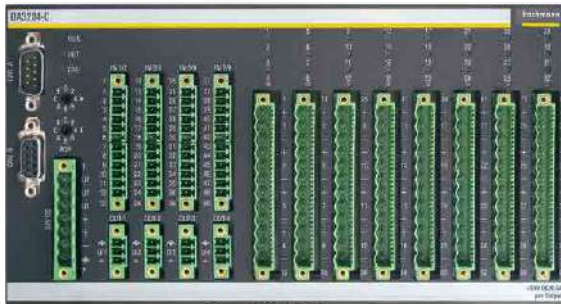## CAN slave CS200 / x

Features
Head module for CANopen slave stations
Up to 30 I/O modules per slave station
Optional integrated power supply
Transfer rate: 10 kbit/s to 1 Mbit/s

CANopen

CANopen

Analog/digital I/O module DA3284-C

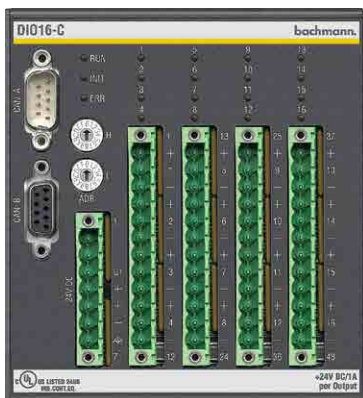| Features |
| --- |
| Compact CAN slave I/O module |
| 8 analog inputs: ±10 V, ±1 V, Pt100, Pt1000, 0 (4) .. 20 mA |
| 4 analog outputs ±10 V, either ±10 V, 0 (4) .. 20 mA configurable |
| 16 digital inputs |
| 16 digital inputs or outputs (can be configured individually), 2 integrated counter inputs |

Digital I/O modules DIOxxx-C

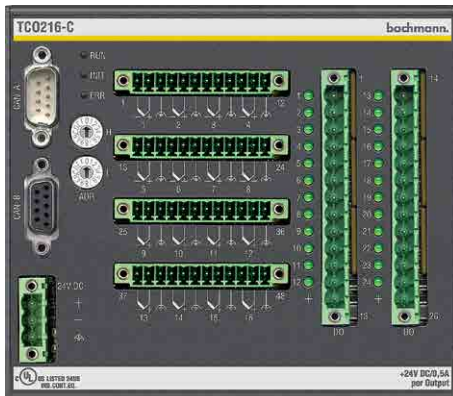| Features |
| --- |
| Stand-alone, compact CAN slave module |
| 16/32/48 input channels, of which 16/32/32 free can be configured as output (DIO) |
| Digital outputs each with 1 A continuous current |
| Supply voltage: 18 .. 34 V DC |
| 3-wire connection technology |

CANopen

CANopen

Digital I/O modules
TCO2xx-C

Features
Stand-alone, compact CAN slave module
8/16 temperature sensor inputs
for temperature sensor types J and K
Measuring range: 0 .. 500/800 °C
12/24 digital each with max. 1 A

CANopen configurator

Features
Graphic configurator
Easy integration of the DCF files
Multiple networks
(up to 8 CAN networks per CPU)
CANSync for synchronization of drives*
CAN monitor for commissioning
and diagnostics
IP-based access to CAN nodes
with »IP over CAN« in accordance with
CiA Draft 301 / 405

* CANSync synchronization also via
  the SYNC mechanism of the CPU

[i] Note: There are processor modules
    with integrated CAN interface
    (see the processor modules section)

CANopen

CANopen master module CM202

The CAN master module CM202 can operate either one or two separated networks. Both connections can be configured independently as NMT master or slave. In an M1 controller up to four CANopen master modules CM202 can be operated.

- Up to 4 CANopen master modules per M1 controller
- 2 independent CAN buses per CANopen master module
- Can be used as NMT master or slave
- Transfer rate 10 Kbaud to 1 Mbaud
- Bus length to 5000 m (signal repeater required)
- Galvanic isolation
- Short circuit proof

Item	Item no.
CM202	00009698-00
CM202❄	00016404-00

CM202	
CANopen master	
Max. number of masters	4 per M1 controller
Number of CAN buses	2 per module
Max. number of nodes	64 per CAN bus
Protocol	CANopen to CiA DS 301
Device profile	in accordance with CiA DS 405
Firmware	reloadable (FLASH technology)
Current consumption	320 mA / 5 V DC
CAN interface	
Transfer rate	10 k .. 1 Mbaud
Bus length	max. 5000 m
Connection	2x 9-pin D-Sub female connectors
Pin assignment	in accordance with CiA DS 102/4
Signal level	in accordance with CiA DS 102/4
Galvanic isolation, interfaces to the system	500 V
CANopen features in compliance with CiA Product Guide	
CANopen master	yes
CANopen slave	yes
Extended boot-up	no
Minimum boot-up	yes
COB ID distribution	per SDO, no DBT
Node ID distribution	yes (no LMT)
No. of TxPDOs	128
No. of RxPDOs	128
PDO modes	sync, async, RTR, event
Variable PDO mapping	yes
Emergency message	yes client (master), server (slave)
Life guarding	yes (heartbeat and/or node guarding)
No. of SDOs	4 server, 64 client
Device profile	301, 302, 405

Ambient conditions	Standard	ColdClimate (❄)
Operating temperature	-30 .. +60 °C	
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % with condensation	

Model variants	
CM202	CAN fieldbus master module; 2x CAN/CANopen; up to 1Mbit/s; Master/Slave configurable; CANsync; isolated
CM202❄	like CM202; ColdClimate (❄)

CANopen

CANopen slave modules CS200 / x

The CANopen slave module CS200/x is the head module for CANopen slave stations. The CANopen slave module CS200/x allows modular CANopen slave stations to be set up from the M1 modules. The same modules that are used for local stations can be used to design a slave station, which simplifies stock-keeping and consistently ensures the same technical data.

- Head module for CANopen slave stations
- Up to 30 I/O modules per slave station
- Optional integrated power supply
- Transfer rate 10 Kbaud to 1 Mbaud
- Bus length to 5000 m (signal repeater required)
- Two internally connected CAN interfaces for loop-through of the cable
- Galvanic isolation between CAN interfaces and control electronics
- Node address can be set via rotary switch
- 2 serial interfaces (COM 1/2)
- External 24 V power supply (CS200/N)

Item	Item no.
CS200	00013178-00
CS200 / N	00013179-00

CS200 / x	
CANopen slave	
Node ID	1 .. 254 selectable via rotary switch
Protocol	CANopen to CiA DS 301 V3.0
Device profile	in accordance with CiA DS 401 for I/O, in accordance with CiA DS 402 for ACR
Firmware	reloadable (FLASH technology)
Number of I/O modules	15 per station, 30 using bus extension modules BES/BEM or FASTBUS
Current consumption	600 mA/5 V, 15 mA/+ 15 V, 40 mA/- 15 V
Serial interfaces	COM1: RS232, COM2: RS232/422/485

CS200 / x	
CAN interface	
Transfer rate	10 k .. 1 Mbaud
Bus length	max. 5000 m
Connection	2x 9-pin D-Sub female connectors
Pin assignment	in accordance with CiA DS 102 / 4
Signal level	in accordance with CiA DS 102 / 4
Terminating resistance	123 ohm, external
Galvanic isolation, Interfaces to the system	500 V
CANopen features in compliance with CiA Product Guide	
CANopen master	N
CANopen slave	Y
Extended boot-up	N
Minimum boot-up	Y
COB ID distribution	per SDO, no DBT
Node ID distribution	N, (no LMT)
No. of TxPDOs / RxPDOs	128 / 128
PDO modes	sync, async, RTR, event
Variable PDO mapping	Y
Emergency message	Y
Life guarding	yes (heartbeat / node guarding)
No. of SDOs	4 servers
Device profile	301, 401, 402
Optional integrated power supply (optional) CS200 / N	
Voltage range	18 .. 34 V DC
Current consumption	max. 1.2 A at 24 V
Nominal power	17 W
Current consumption at + 5 V	2000 mA
Current consumption at + 15 V	250 mA
Current consumption at − 15 V	200 mA
Ambient conditions	
Operating temperature	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % without condensation
Model variants	
CS200	CAN bus master 1 line 1 Mbit/s, processor system, isolated
CS200 / N	CAN fieldbus slave module; 1x CAN/CANopen; 1Mbit/s; isolated; integrated power supply 17W
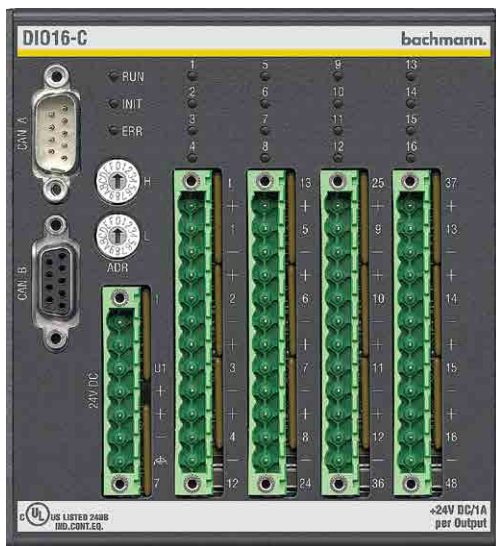
CANopen

Digital input/output modules DIOxxx-C

The digital I/O modules DIO16-C, DIO32-C, DIO48-C or DIO264-C are stand-alone CAN slave modules with 16, 32, 48 or 64 digital input/output channels.

- Stand-alone, compact CAN slave module
- 16/32 channels can be freely configured as input or output
- Digital outputs each with 1 A continuous current
- Two internally connected CAN interfaces for loop-through of the cable
- Galvanic isolation between CAN interfaces and control electronics
- Baud rate and node ID can be set via rotary switch
- Supply voltage 18 .. 34 V DC
- Operating range 0 .. +60 °C without additional cooling
- Full wiring without additional backplanes
- Snappable on EN 50022 backplanes

Item	Item no.
DIO16-C	00010285-00
DIO16-C❄	00017453-00
DIO32-C	00010129-00
DIO48-C	00010526-00
DIO264-C	00009205-00

DIOxxx-C	DIO16-C DIO16-C❋	DIO32-C	DIO48-C	DIO264-C
Inputs				
Quantity	max. 16	max. 32	max. 48	max. 64
Input delay	< 3.5 ms	< 3.5 ms	< 3.5 ms	< 3.5 ms
Internal resistance	6 kΩ	6 kΩ	6 kΩ	6 kΩ
Status display	green LED	green LED	green LED	green LED
Outputs				
Quantity	max. 16	max. 32	max. 32	max. 32
Supply voltage	18 .. 34 V DC	18 .. 34 V DC	18 .. 34 V DC	18 .. 34 V DC
Isolated output blocks	1-16	1-16, 17-32	1-16, 17-32	1-16, 17-32
Nominal output current	1 A	1 A	1 A	1 A
Output current (sum/block)	max. 12 A	max. 12 A	max. 12 A	max. 12 A
Switching frequency	max. 500 Hz	max. 500 Hz	max. 500 Hz	max. 500 Hz
Short-circuit proof	yes	yes	yes	yes
Status display	green LED	green LED	green LED	green LED
CAN interface				
Transfer rate (Kbaud)	10 .. 1000	10 .. 1000	10 .. 1000	10 .. 1000
Connection	2x 9-pin D-Sub	2x 9-pin D-Sub	2x 9-pin D-Sub	2x 9-pin D-Sub
Module ID	1 .. 254	1 .. 254	1 .. 254	1 .. 254
Galvanic isolation	500 V	500 V	500 V	500 V
Terminating resistance	123 Ω, external	123 Ω, external	123 Ω, external	123 Ω, external
External power supply				
Voltage range	18 .. 34 V DC			
Current consumption (without I/O)	normally 100 mA at 24 V DC			
Reverse polarity protection	yes			
CAN protocols				
CAL/CANopen	DS 301 communication profile, DS 401 device profile			
Status LEDs	RUN (guarding), INIT, ERROR			
Ambient conditions	Standard		ColdClimate (❋)	
Operating temperature	-30 .. +60 °C			
Rel. humidity operation	5 .. 95 % without condensation		5 .. 95 % with condensation	
Storage temperature	-40 .. +85 °C			
Rel. humidity storage	5 .. 95 % with condensation			
Model variants				
DIO16-C	CAN slave - digital input/output module; 16x DIO; 24V / 1A; 1 group; CAN/CANopen; 2x DSUB 9 (In/Out); up to 1Mbit/s; isolated			
DIO16-C❋	like DIO16-C; ColdClimate (❋)			
DIO32-C	CAN Slave - Digital IO module; 32x DIO, 24V / 1A; 2 groups; CAN/CANopen; 2x DSUB 9 (In/Out); up to 1Mbit/s; isolated			
DIO48-C	CAN Slave - Digital IO module; 16x DI; 32x DIO, 24V / 1A; 2 groups; CAN/CANopen; 2x DSUB 9 (In/Out); up to 1Mbit/s; isolated			
DIO264-C	CAN Slave - Digital IO module; 32x DI; 32x DIO, 24V / 1A; 2 groups; CAN/CANopen; 2x DSUB 9 (In/Out); up to 1Mbit/s; isolated			
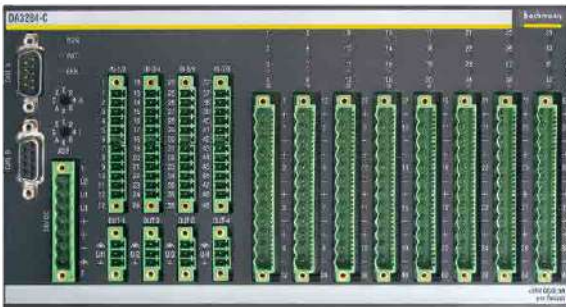
Analog and digital input/output module DA3284-C

Noteworthy compactness and a clever mix of possible signal types are offered by the CAN bus compact module DA3284-C. As a stand-alone fieldbus module (CANopen), the module offers the complete I/O spectrum already integrated for small applications or distributed signal connection points. It is the ideal addition to the familiar family of CAN digital modules and is an optimum »all-in-one« peripheral for small applications, e. g. such as those based on the control terminals CT300/CT200 from Bachmann electronic. The channel-specific programmable mode (on/off or applied standard signal) enables the unit to be adapted ideally to a wide range of applications without any interface converter. The robust design and processing quality, its outstanding technical specifications, seldom available from the usual fieldbus peripherals, are very impressive.
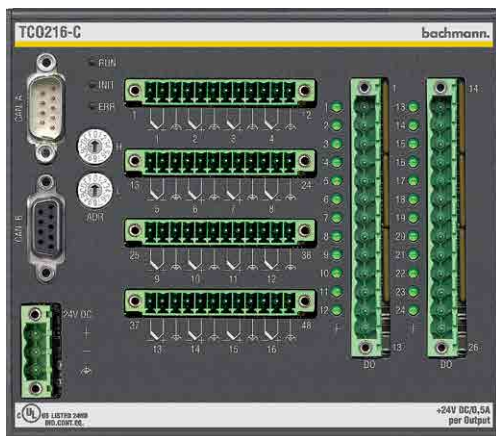
- Compact CAN slave I/O module
- 8 analog inputs ±10 V, ±1 V, Pt100, Pt1000, 0 (4) .. 20 mA
- 4 analog outputs ±10 V or 0 (4) .. 20 mA configurable
- 16 digital inputs
- 16 digital inputs or outputs (individually configurable)
- 2 integrated counter inputs
- Digital outputs each with 0.5 A continuous current
- Error detection for digital and analog channels
- Full wiring without additional backplanes
- Powerful 32-bit processor for fast cycle times

Item	Item no.
DA3284-C	00013597-00
DA3284-C❄	00017450-00

DA3284-C

Analog inputs	
Quantity	8
Measuring ranges, selectable by channel	±10 V, ±1V Pt100, Pt1000: -100 °C .. +500 °C 0 (4) .. 20 mA
Resolution	14 bit
Sampling rate	< 1 ms for all channels (500 µs)
Input cutoff frequency	750 Hz (3 dB)
Basic accuracy at 25 °C	voltage 0.05 % current / Pt100 / Pt1000 0.1 %
Error at the entire temperature range	voltage 0.2 % current/Pt100/Pt1000 0.2 %
Error detection	cable break (at voltage), current or temperature error
Analog outputs	
Quantity	4
Measuring ranges, selectable by channel	±10 V, 0 (4) .. 20 mA configurable
Resolution	14 bit
Conversion time	depends on CAN protocol
Basic accuracy at 25 °C	voltage 0.05 % current 0.2 %
Error at the entire temperature range	voltage 0.1 % current 0.4 %
Error detection	Load error
Digital inputs	
Quantity	16 (max. 32)
Input delay	500 µs default value, filter adjustable
Input current	normally 3 mA at +24 V DC
Input type	current consumption, type 1 in accordance with IEC61131
Status display	green LED
Connection technology	3-wire (+/-/signal)
Counter	
Counting channels	2 (digital input channels 1 and 2)
Counter frequency	max. 5 kHz
Counter functions	counting, speed measurement (period duration, gate time) measurement)
Counting modes	- infinite up/down - one-time up/down to/from reference value - periodic up/down to/from reference value
Digital outputs	
Quantity	16
Supply voltage	18 .. 34 V DC
Isolated output blocks	1 .. 12, 13 .. 24
Nominal output voltage	0.5 A
Output current sum/block	max. 8 A/4 A per block
Switching frequency	500 Hz (with purely resistive load)
Short-circuit proof	yes

CANopen

DA3284-C	
Digital outputs	
Error detection	short circuit / excess temperature by block power supply per block ≤ 16.5 V
Status display	green LED
Connection technology	3-wire (+ / - / signal)
CAN interface	
CANopen	DS 301 communication profile, DS 401 device profile
Status LEDs	RUN (guarding), INIT, ERROR
Transfer rate (Kbaud)	10 .. 1000 (adjustable via rotary switch)
Connection	2x 9-pin D-Sub
Module ID	1 .. 127 (configurable via rotary switch or SW)
Galvanic isolation	500
Terminating resistance	123 ohm, external
Input / output connection technology	
Connection for digital inputs / outputs and supply	Phoenix Contact MINICOMBICON connector RM 5.8 with flange
Connection technology for digital inputs / outputs and supply	screw clamp, spring tension clamp, crimp
Connection for analog inputs / outputs	Phoenix Contact MINI COMBICON RM 3.5 connector with flange
Connection technology for analog inputs / outputs	screw clamp, spring tension clamp
Connection general	plug codable, labeling by channels
Operating conditions	
Voltage range	18 .. 34 V DC
Current consumption	≤ 270 mA at +24 VDC for module supply + load
Reverse polarity protection	yes
Galvanic isolation CAN bus module	500 V_{RMS}
Galvanic isolation I/O channels	none

Ambient conditions	Standard	ColdClimate (❄)
Operating temperature	-30 .. +60 °C	
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % with condensation	

Model variants	
DA3284-C	CAN slave universal input/output module; 16x DI; 16x DIO; 24V/0.5A; 4x AO +-10V 20mA; 8x AI +-10V +-1V 20mA Pt100/1000; CAN/CANopen; 2x DSUB 9 (In/Out); up to 1Mbit/s
DA3284-C❄	like DA3284-C; ColdClimate (❄)

Temperature I/O modules TCO2xx-C

The temperature I/O modules, TCO204-C, TCO208-C and TCO216-C are stand-alone CAN slave modules with 8 or 16 thermo-couple inputs and 12 or 24 digital outputs.

- Stand-alone, compact CAN slave module
- Thermocouple inputs for thermocouple types J and K
- Measuring range 0 .. +500 °C/+800 °C configurable
- Sensor break detection
- Digital outputs each with 1 A
- Supply voltage 18 .. 34 V DC
- Operating range 0 .. +60 °C
- Snappable on EN 50022 backplanes
- CAN node ID can be set (hex switch)
- Baud rate is adjustable (hex switch)

Item	Item no.
TCO208-C	00010850-00
TCO216-C	00008673-00

| TCO2xx-C	
Temperature sensor inputs	
Quantity	8/16
Sensor types	J or K, selectable per input
Measuring range	0 .. +500 °C/+800 °C configurable
Resolution	12 bit
Linearization	Polynomial in accordance with DIN IEC 584
Cold junction compensation	0 .. +133 °C (K)
Sampling period	16 ms
Sensor break detection	yes
Digital outputs	
Quantity	12/24
Supply voltage	18 .. 34 V DC
Output current per channel	0.5 A (max. 1 A)
Output current (sum)	max. 12 A
Switching frequency	max. 500 Hz at 1 kOhm ohmic load
Short-circuit proof	yes
Status display	green LEDs

CANopen

TCO2xx-C	
CAN interface	
Transfer rate	10 k .. 1 Mbaud
Connection	2x 9-pin D-Sub female connectors
Module ID	1 .. 254
Galvanic isolation via interfaces	500 V
Terminating resistance	123 ohm, external
Status LEDs	RUN (guarding), INIT, ERROR
Communication profile	CiA DS 301
Device profile	CiA DS 401
External power supply	
Supply voltage	18 .. 34 V DC
Current consumption (without I/O)	normally 105/110/120 mA at 24 V DC
Ambient conditions	
Operating temperature	0 .. +60°C
Rel. humidity operation	5 .. 95% without condensation
Storage temperature	-40 .. +85°C
Rel. humidity storage	5 .. 95% without condensation
Model variants	
TCO208-C	CAN slave temperature input/digital output module; 8x thermocouple type J, K; 12x digital Out 24V / 0,5A; CAN/CANopen; 2x DSUB 9 (In/Out); up to 1Mbit/s; isolated
TCO216-C	CAN slave temperature input/digital output module; 16x thermocouple type J, K; 24x digital Out 24V / 0,5A; CAN/CANopen; 2x DSUB 9 (In/Out); up to 1Mbit/s; isolated

CANopen configurator

The Bachmann SolutionCenter supports the commissioning and diagnostics of CAN and CANopen networks with integrated tools. With a few mouse clicks a network can be configured from standard EDS files and transferred to the controller. Thanks to the easy interface to the application and to the commissioning tools a signal test can be executed immediately.

- Managing EDS files in the device catalog
- Online and offline configuration of networks
- Bus scan of online networks for convenient creation of a configuration
- Graphic network presentation
- Graphic presentation of the PDO mapping
- Tabular editor for network parameters
- Editors for specific device parameters
- Tabular editor for the object directory enables adding, changing, and deleting of network variables
- Fast workflow for the creation of standard configurations
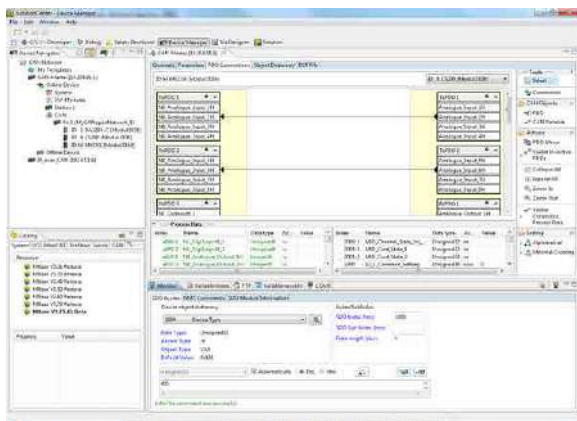
The CAN monitor in the SolutionCenter enables more extensive diagnostics. It offers dialogs for:
- Direct SDO access
- NMT and LSS commands
- PDO triggering
- Access to emergency lists

Fieldbuses – DeviceNet

Proven basis, new view.

DeviceNet is based on the same physical layer as CAN, however it has an object-oriented view of the process data and uses monitored point-to-point connections. The bus system is standardized through the ODVA (Open DeviceNet Vendor Association).

The DeviceNet master module and its software equipment enable operation of the M1 controller as DeviceNet master and DeviceNet slave, as well as simultaneous operation in two networks in combined master/slave mode.

The cyclic data is available to the application program via the process image. Acyclic accesses and status commands are possible via libraries for M-PLC and C/C++. The configuration is executed via the Bachmann SolutionCenter.

DeviceNet master DNM201

The DNM201 fieldbus master module allows the M1 controller to be used as bus master in DeviceNet networks. The DNM201 module is used to connect drives and input/output interfaces. The system bus of an M1 supports up to 8 separate networks, each with a maximum of 64 nodes that can be operated with different cycle times. Thus the bus architecture allows up to 512 DeviceNet stations (nodes) to be controlled individually.

- 1 DeviceNet module for up to 64 nodes
- 8 separate networks with max. 512 nodes (requires 8 DNM201 modules in one M1 system)
- Support of »Multi-Master« mode
- 5-pin connector (in acc. with open DeviceNet standard)
- Isolation voltage from DNM201 to case 100 V
- Isolation voltage from DeviceNet bus to system voltages of the controller 500 V
- Baud rates 125/250/500 kbit/s
- Extensive status LEDs
- Modes: Master (multi-master capable), slave, master/slave
- Module and network status LEDs (MS/NS)
- Error detection: Duplicate MAC-ID check, device heartbeat, device shutdown message
- Automatic resumption of communication after failure

*Device**Net**™*

Item	Item no.
DNM201	00012696-00

| DNM201	
Technical data	
Maximum number of stations	64 nodes
Number of independent DeviceNet lines	up to 8 DNM201 modules per M1 system (equals 512 nodes)
Bus connection	5-pin DeviceNet connector
Galvanic isolation via interfaces	500 V
Baud rates	125 / 250 / 500 kbit / s
DPRAM size	4 or 8 kByte
Protocol conformity	ODVA specification release 2.0
Access libraries	for C or IEC 61131
Modes	master (multi-master ability – multiple masters on the same CAN bus possible), slave, master / slave
Supported communication services	I/O communication bit-strobe, polling, change of state, cyclic to 448 byte connection size, support of »Group2Server« as slaves, no multicast polling, explicit message, fragmentation protocol, UCMM, message forwarding
LEDs	
RDY	yellow off: Controller cannot initialize the DNM module yellow on: Controller has successfully initialized the module
MS RUN (MS=Module State)	green on: DNM ready green flashing: DNM is being configured
MS ERR (MS=Module State)	red on: DNM not ready
NS RUN (NS=Net State)	green on: DNM online and connected green flashing: DNM online, but not connected/ not completely configured
NS ERR (NS=Net State)	red on: no network connection possible green flashing: Connection in timeout
Ambient conditions	
Operating temperature	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % with condensation
Model variants	
DNM201	Device Net master module; 1x device net interface; 500 kbit/s; isolated

Fieldbuses – EtherCAT

The fast communication path.

The EtherCAT bus system is outstandingly suited for the activation of servo-electric drives. As a pure software solution, the EtherCAT master from Bachmann electronic uses the available Ethernet ports on the controller CPU.
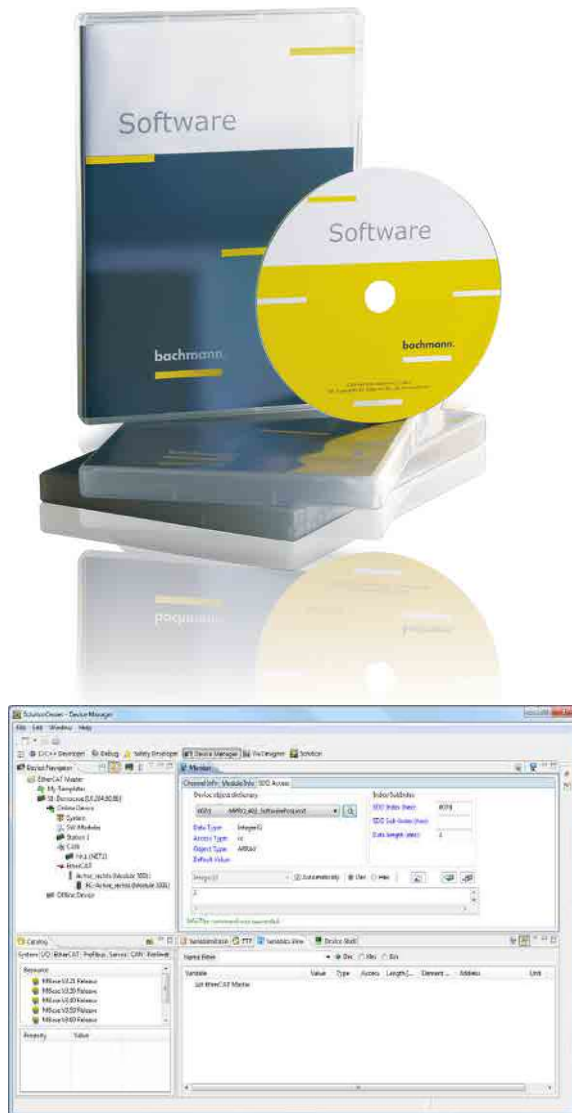
The configurator for EtherCAT networks is integrated in the SolutionCenter and generates an operable configuration on the controller based on the XML description files of the various slave manufacturers.

Possible topology: EtherCAT

SOLUTIONCENTER

M1-CPU
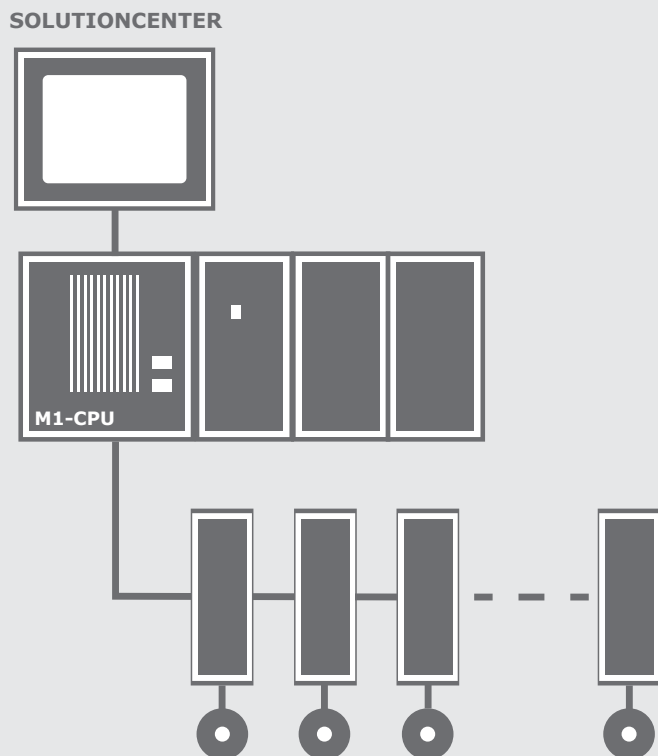
EtherCAT®

EtherCAT master

The EtherCAT master is a pure software solution and uses an Ethernet port on the controller CPU. The motion software packages from Bachmann electronic and any other application programs can be synchronized precisely to the timing of the EtherCAT bus to ensure the synchronization of setpoint calculation and transmission. The SolutionCenter supports commissioning and diagnostics through a configurator and monitor.

The Drive Middleware as the connecting link between motion software and EtherCAT drive directly operates the functions and the status model of the drive so that the user no longer needs to program out the specific sequences in the application software.

- Software solution for operation on standard controller CPUs
- Addressing the slaves via autoincrement or alias address
- Allocating and checking alias addresses
- Supports optional nodes
- Supports slaves with distributed clock
- Synchronization of application programs and fieldbus is possible
- Cyclic data exchange via PDO mapping
- Display of process values as logical I/O modules and in the PLC process image
- Acyclic data exchange for application via SDO function interface is available
- Function interface for network and slave status
- Extensive diagnostics via system variables
- Quality is ensured through regular participation in ETG Plug Fests

ECS200 EtherCAT Slave Module

The EtherCAT slave module ECS200 allows connecting a M1 controller system as slave device to an external EtherCAT network. The goal is to use the M1 to control an autonomous intelligent subsystem within a complex system or machine. The application programs (PLC, C/C++) have full access to the incoming and outgoing cyclic process data via the MIO and SVI interfaces and via the process image. The slave state and the connection state can be recognized by the user programs. Thus, emergency situations like network problems or failures of the external EtherCAT Master can be handled individually in dedicated emergency routines. The application programs at the slave station can be accurately synchronized to the external EtherCAT bus for closed-loop control operations. The execution cycle of the user programs can be maintained also in emergency situations. Distributed Clocks are supported. Amount and size of the incoming and outgoing cyclic data are confi gured on the slave station, and then a dedicated ESI fi le is generated to confi gure the master system. The PDO mapping can be defi ned statically or can be created by the EC Master dynamically. As EtherCAT slave, the M1 is a module device with a static object dictionary that does not need to be further confi gured by the master. Diagnostic is supported by several LED indications on the module, by log messages and by a monitor in the Bachmann SolutionCenter.

- 2 EtherCAT Ports IN, OUT
- Max. 700 Bytes cyclic data for Rx und Tx each
- Bus interval 125 µs to 10 ms
- Distributed Clock
- User programs can be synchronised to EtherCAT
- Connection- and network state
  visible for user programs
- Behavior in case of network
  problems confi gurable
- LED for display of slave state
- Error-LEDs for In- and Out-Port
- Galvanic isolation from the system
- Condensation-proof ColdClimate
  design on request

Item	Item no.
ECS200	00018548-00
ECS200❄	00019206-00

ECS200	
EtherCAT data	
EtherCAT Device Type	Module device
Object dictionary	statical (depends on configuration of the slave station)
PDO Mapping	statical or dynamical
Distributed Clock	available
EtherCAT data types	BOOL, BIT, USINT, SINT, UINT, INT, UDINT, DINT, REAL, ULINT, LINT, LREAL
Number of cyclic data	max. 700 Byte respectively in Tx and Rx
Cycle time	≥ 125 µs, depend on CPU and data volume, max. 10 ms
Interface to user program	
Access of cyclic data	process image, UFB channel view, SVI view
Slave Status	readable, settable through functional interface
Connection quality to network	view as module and channel state of UFB, request by user software
Time-base synchronization	adapted to synchronization by user software of EC network
Behaviour in the event of network break	further completion of the user software by intervall possible
Mailbox data	on request
Diagnostic	
LED Run	Run (permanent light for operational, blinking codes for other slave state)
LEDs Parity Error 1, 2	failure in the physical receive layer of in or out ports
LEDs EtherCAT Ports	standard LED's for activity (green) and data rate (orange)
Monitor in SolutionCenter	value view of state information
Logbook entries	Information host via debug level selectable
Configuration	
SolutionCenter	setting of object directories via UFB channel configurator
System requirements	
M-Base	V3.80 or higher
Processor module	recommended MX207 or higher
Electrical data	
Number EtherCAT Ports	2 (In/out)
Supply	internal via bus rail BS2xx
Current consumption	internal 270 mA
Galvanic isolation from the system	500 V

Ambient conditions	Standard	ColdClimate (❄)
Operating temperature	-30 .. +60 °C	
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	
Rel. humidity storage	5 .. 95 % without condensation	5 .. 95 % with condensation

Model variants	
ECS200	EtherCAT slave module; 2x Eth100 (In/Out); operation only with CPU module
ECS200❄	like ECS200; ColdClimate (❄)

EtherCAT

EtherCAT configurator

The Device Manager includes an integrated EtherCAT configurator that creates a complete network configuration (ENI – EtherCAT Network Information) from the standardized slave description files (ESI - EtherCAT Slave Information) and transfers it to the controller. For access to the process data, in addition, logical I/O modules are generated on the master that enable an immediate diagnosis and signal test in the Device Manager.

The configuration project will be automatically stored on the controller, so that even without manual transmission of project files, opening, testing, and changing the existing configuration is possible in the service PC.

- Managing the slaves in the catalog
- Online and offline creation of network configurations
- Busscan of the online controller also in the case of configuration errors with display of the discrepancies for quick error detection
- Direct transfer of pre-configured PDOs
- Browser for object directory of the slave (if supported by the slave)
- Automatic generation of logical I/O modules for access to cyclic process data
- Immediate wiring test without user software is possible
- Monitor for SDO read and write access for the running network
- Monitor for setting and checking the alias address

Fieldbuses – PROFIBUS

Widely used, esteemed everywhere.

PROFIBUS is a field bus that is widely used, particularly in the area of mechanical engineering and plant engineering and even today – in spite of all Ethernet-based fieldbuses – it continues to show increasing quantities. A broad palette of peripheral components and an active user organization will also ensure long-term availability of

PROFIBUS components in the future. Bachmann electronic offers a fieldbus interface module for the backplane that can be used both as master, as well as slave. The SolutionCenter contains a complete configurator that enables interfaces to the engineering tools of other manufacturers through the consistent application of standards.

PROFIBUS DP master DPM200

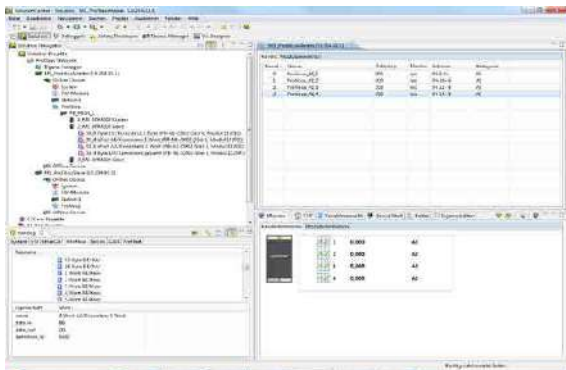| Features |
|---|
| Fast ASIC technology |
| Transfer rate: 9.6 kbit/s .. 12 Mbit/s |
| Up to 3 masters per M1 controller |
| Maximum 125 slave stations (with repeater) |

Features
Multiple networks (multiple networks per CPU)
Convenient integration of the GSD files
PROFIBUS DP class 1 master
Support of all baud rates (9.6 Kbaud to 12 Mbaud) defined in the standard
Transparent access to IO and process variables

PROFIBUS DP master module DPM200

The interface module for Profibus DP (Distributed Peripherals) can be operated as DP master, DP slave or as combined master/slave, which in a multi-master network offers variables for another master. The process data is available to the application program as logical I/O module and thus can be reached via the process image or via the function interface.

- Up to 3 DPM200 modules per M1 controller
- Transfer rate 9.6 Kbaud to 12 Mbaud
- 8 kByte shared memory for process data image
- Consistency lock for data blocks
  is configurable
- Two internal bridged connections for
  loop-through of the cable
- Galvanic isolation between fieldbus
  and controller

Item	Item no.
DPM200	00010555-00
DPM200✳	00018032-00

PROFIBUS

| DPM200		
PROFIBUS DP master		
Large process image	8 Kb x 16 DPM	
Firmware	update via SolutionCenter is possible	
Max. number of masters	3 per M1 controller	
Max. number of slaves	32 without repeater, 125 with repeater	
PROFIBUS Standard	V0	
Data length in the DPM	732 bytes per slave	
Current consumption	400 mA / 5 V DC	
Interface		
Transfer rate	9.6 k .. 12 Mbaud	
Connection	2x 9-pin D-Sub female connectors	
Pin assignment	in accordance with EN 50170	
Signal level	in accordance with RS485 standard	
Galvanic isolation, Interfaces to the system	500 V	
Ambient conditions	**Standard**	**ColdClimate ❄**
Operating temperature	-30 .. +60 °C	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % with condensation	5 .. 95 % with condensation
Model variants		
DPM200	Profibus master/slave module; 12Mbit/s; Profibus V0; isolated	
DPM200❄	like DPM200; ColdClimate (❄)	

PROFIBUS configurator

The Device Manager contains a complete configuration tool for creation of PROFIBUS configurations for master and slave applications of the M1 system. Devices from any manufacturer can be added to the catalog via their standardized device description file in GSD format, and integrated in the configuration.

The PROFIBUS configurator enables creation of networks with an M1 controller as master station and multiple slave stations. Likewise, M1 DP slave stations can either be configured together with an M1 master, or a pure slave configuration can be created for an M1.
In this regard the slaves can be additional M1 controllers or also standard-conformant slave devices from other manufacturers. For an M1 controller a pure slave configuration can also be created. For this station a GSD file can be exported that facilitates integration in a different configuration tool.
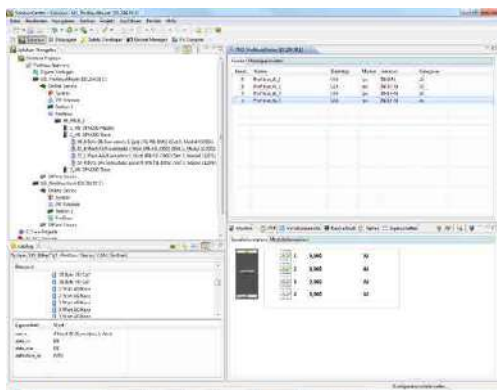
On the master and slave station the configurator automatically generates logical I/O modules for access to the process data that permit an immediate diagnosis and signal test via the Device Manager and enable easy integration into the process image. Bit-coded values can in this manner be conveniently split into the individual DI or DO signals and given symbolic channel names, without the necessity of masking out the bits in the application program.

- Graphic network configuration
- Catalog for managing device descriptions files in GSD format
- Generates complete network configurations for applications with M1 as master
- Generates reduced configuration for applications with M1 as slave, if a master from a different manufacturer is used
- Exports GSD files for configured M1 slaves for use in other tools
- Flexible creation of access channels that organize the byte stream of the PROFIBUS in handy process values

Fieldbuses – PROFINET

More flexibility, a more efficient network.

The Ethernet-based fieldbus system, PROFINET IO RT, is the technical successor of PROFIBUS DP. The advantage of Ethernet as a media is the flexibilty of the network topology, as standard Ethernet switches can be used. Moreover, the network infrastructure can be used in parallel for other traffic. Thanks to the prioritized transmission of PROFINET, other protocols, such as FTP, HTML, visualization, etc. can be operated on the same physical network.
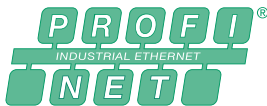
| Features |
|---|
| Mode controller (master) and device (slave) |
| Transmission of I/O channel values of the device to and from the controller |
| Transmission of process values (SVI) of the device to and from the controller via data blocks |
| Configuration data for I/O channels on the device (measuring range, signal direction, etc.) are stored on the controller and transmitted to the devices when the system boots |
| Standardized GSDML file available for configuration in other configuration tools |
| Minimum bus cycle 1 ms |
| Data rate 10/100 Mbit |
| Other TCP/IP data traffic on the same network is possible |
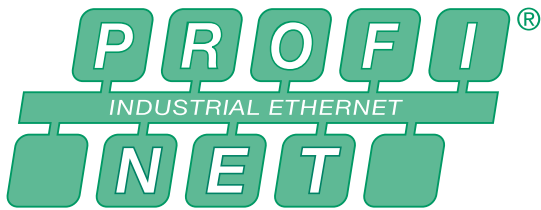
PROFINET IO (RT)

At Bachmann electronic PROFINET RT is a pure software solution that can be started on the available Ethernet ports of the controller. The control system can be operated as PROFINET controller (master) and as PROFINET device (slave). The PROFINET device offers access to its I/O channels to the PROFINET controller. Each module on the device can be assigned to another controller, or input values can be read by several controllers (Shared Device). Moreover, the PROFINET device offers also access to process variables of its local application programs. Thus it is not only possible to create I/O-Slaves but also devices with local intelligence (I-Device). An I-Device works directly on its I/O-Signals and synchronizes itself with a superior controller.
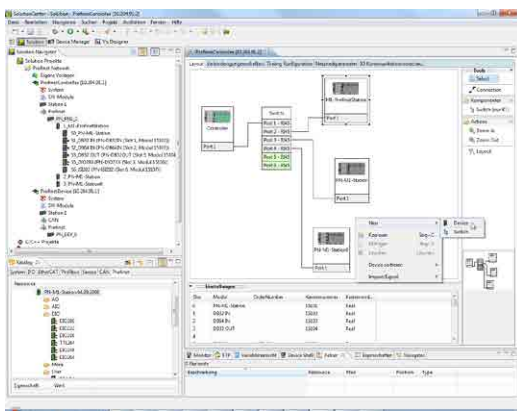
- Transmission of I/O channel values from and to the controller
- I-Device: Transmission of process variables (SVI) for coupling between CPUs (intelligent device)
- Shared Device: Modules of a device can be assigned to several controllers
- Automatic handling of transmission errors, different switch-on sequences, and network failures
- Extensive diagnostics
- Parallel operation with other Ethernet traffic in the same network
- Cycle times >= 1 ms
- Adjustable reduction ratio for individual process values that should be transmitted less frequently, e.g. for analog inputs

PROFINET

PROFINET configurator

The grapical configurator for PROFINET networks is part of the Device Manager in the SolutionCenter. It enables the design of the network topology, including all switches and cables. The devices are managed via the standardized GSDML files in the PROFINET catalog.

On the devices, modules can be assigned to slots according to the information in the GSDML files. For configuration of I-Devices, the communication of process variables between M1 PROFINET devices and the PROFINET controller is organized with data blocks. SVI variables of the application software are assigned to the data blocks and can then be exchanged with a PROFINET controller.

On the M1 PROFINET controller, the I/O and process valuess of its devices are represented as logical I/O modules which enable convenient access to the process data for application software and diagnostic tools. Network parameters such as timeout limits, optional stations, assignment of process values to communication relations, and further settings are available in parameter tables.

The controller- and device-configurations are automatically distributed to all participtating M1 systems. Additionally, the configuration project is stored on the controllers, so the configuration can be directly opened for verification or change. This grants that the maintenance engineer always works on the current network configuration.

- Complete network configurations
  for the PROFINET controller
- Partial network configuratons
  for M1 PROFINET devices
- Device catalog for managing
  GSDML description files
- Free arrangement of the devices in the
  graphical network layout editor
- Assignment of the modules to the slots
  on the device
- Convenient processing of network
  and device parameters in tables
- Generation of logical I/O modules
  on the controller
- Direct opening of the existing
  configuration from the controller

Fieldbus - M-BUS

Standardized basis, integrated solution.

Energy meters (gas, heat, output, water,..) are required in power plants, and in combined heat and power generation in particular, for regulation, as well as accounting. The M-Bus standardized in EN 61334-4-1 is highly prevalent in Europe for the connection of these meters. The OSI model, if M-Bus is the physical layer, the data link according to IEC 870 and the application layer according to EN 1434-3 are specified for this protocol.

An integrated solution is provided by a rugged and easily installable M-Bus adapter and its convenient integration as a fieldbus in software communication.

MBUS201 master

The MBUS201 master enables easy connection of a serial RS232 interface on M-Bus via an adapter. The M-Bus is a widely used fieldbus in accordance with EN 13757 for reading out consumption data from meters (electricity, water, gas, heat). Transmission is serial via voltage and current modulation on a two-wire line that is protected against polarity reversal.
The M-Bus protocol is integrated as an intuitively configurable fieldbus, and is addressed via the UFB (Unified FieldBus) software interface.

• max. 4 MBUS201 masters per M1 controller
• M-Bus protocol implemented as fieldbus
• max. 5 meters (slaves) per master
• Adapter can be inserted directly
  on the DSUB connector
• Integrated M-Bus power supply
• Interfaces M-Bus and RS232 are galvanic isolated
• LED display for collision detection
  and power supply
• Data transmission at 300 to 9600 bps

Item	Item no.
MBUS201	00019766-00

MBUS201		
Interfaces		
M-Bus		In accordance with DIN EN 13757-2
	Connection	Spring-force terminal in housing, shield support
	Number of nodes	max. 5 counters (slaves) per master
	Data rate	300 to 9600 bps
RS232		In accordance with EIA-232, D-Sub 9-pin, socket, no hardware handshake
Power supply		24 V (20 .. 30 V DC)
Current consumption		max. 0.25 A
Reverse polarity protection		yes
Status displays		
Power supply		LED green
Collision detection- M-Bus		LED yellow
Housing		
Dimensions (W x H x D)		32 x 60 x 15 mm
Nickel-plated zinc die-cast		
Mounting		Hex socket (size 2.5) with ball head
Operating temperature		-30 .. +60 °C
Rel. humidity, operation		5 .. 95 % without condensation
Storage temperature		-40 .. +85 °C
Rel. Humidity, storage		5 .. 95 % without condensation
Model variants		
MBUS201		M-Bus master adapter; energy measurement fieldbus EN13757; M-Bus interface to RS232 DSUB 9; 24V power supply; up to 9,6kbit/s

Fieldbuses – MODBUS TCP/UDP/RTU

Simply proven, proven simple.

Modbus is a very simple, but proven fieldbus system. In principle it only knows the two data types, bool and integer, and a set of queries that are always posed by the master and answered by the slaves. Modbus RTU was originally developed for serial interfaces, later the principles were then extended to Ethernet with Modbus TCP and Modbus UPD.

Thanks to its simplicity and its inter operability, Modbus is widely used in older, as well as in new applications.
Bachmann electronic offers Modbus master and slave as a pure software solution. Special hardware is not required. Both the Ethernet ports and COM ports of all controller CPUs, as well as the ports of the corresponding bus modules EM203 and RS204 can be used.

Modbus master / Modbus slave

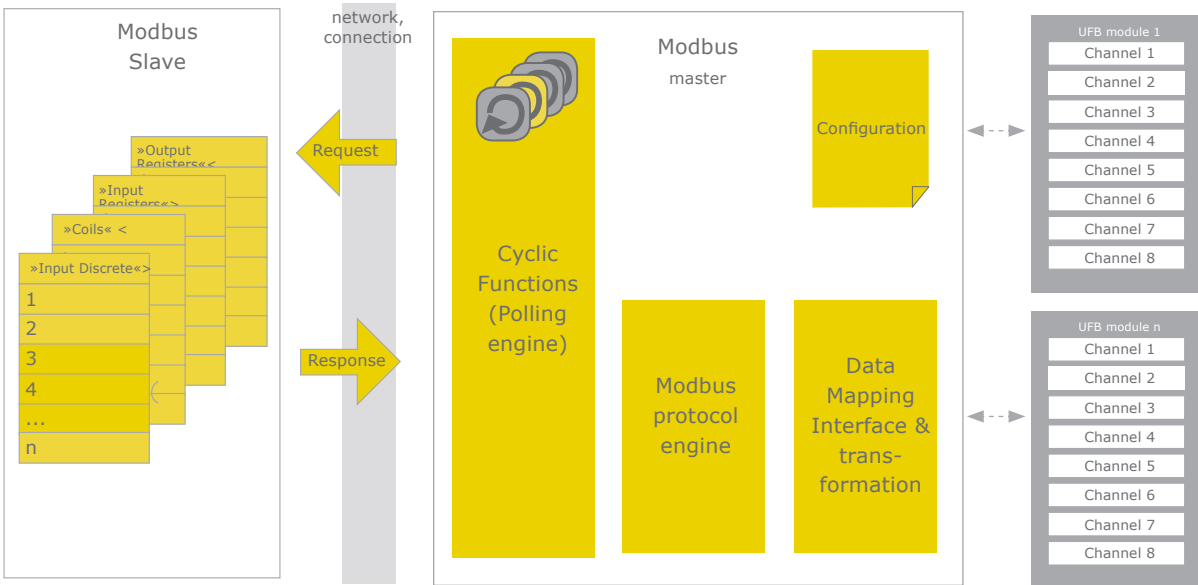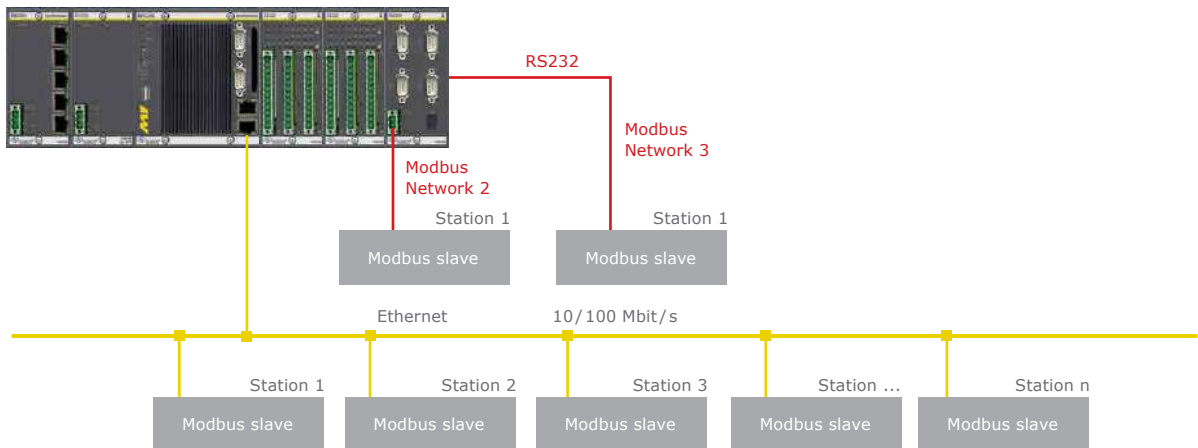| Features |
|---|
| Modbus master and slave available |
| Supported protocols: Modbus TCP, Modbus UDP and Modbus RTU |
| Multiple protocols can be used simultaneously |
| Uses existing interfaces of the controller, special hardware is not required |
| Interfaces can be spatially distributed on FASTBUS or BES substations. |
| Configuration via Device Manager |

Modbus master

With the Bachmann M1 Modbus master read/write access to the data from any external standard-conformant Modbus slave device is possible. The registers, coils and discrete inputs of the external device are mapped to logical hardware modules of the control system per hardware modules. The cyclic update is executed automatically, the values remain available in the process image. Queries to the slaves are summarized automatically in this process to reduce the load. In addition, the Modbus master offers a function interface via which any Modbus requests can be sent to the slaves. The error messages of the Modbus system (Modbus exceptions) are passed through to the application software. All Ethernet ports for Modbus TCP and UDP, as well as all serial interfaces for Modbus TCP, are available. These can also be distributed spatially to substations of the control system.

- Supported protocols:
  Modbus TCP, Modbus UDP and Modbus RTU
- Use of the onboard interfaces of the CPUs
- Possibility of spatial distribution of the interfaces via FAST substations and EM203 or RS204 module
- Mapping of the contents of the »Modbus Primary Tables« to virtual channel values
- Multiple networks parallel (also for different modes)
- Gateway functionality (also to other bus systems)
- Investment protection thanks to extremely wide distribution
- Compatibility and openness
- Easy handling

MODBUS TCP/UDP/RTU

Modbus Slave

»Output Registers« <
»Input Registers« >
»Coils« <
»Input Discrete« >
1
2
3
4
...
n

network, connection

Request

Response

Modbus master

Cyclic Functions (Polling engine)

Modbus protocol engine

Data Mapping Interface & trans- formation

Configuration

UFB module 1
Channel 1
Channel 2
Channel 3
Channel 4
Channel 5
Channel 6
Channel 7
Channel 8

UFB module n
Channel 1
Channel 2
Channel 3
Channel 4
Channel 5
Channel 6
Channel 7
Channel 8

Modbus TCP master

RS232

Modbus Network 3

Modbus Network 2

Station 1
Modbus slave

Station 1
Modbus slave

Ethernet   10/100 Mbit/s

Station 1
Modbus slave

Station 2
Modbus slave

Station 3
Modbus slave

Station ...
Modbus slave

Station n
Modbus slave

Protocol	
Protocols	Modbus RTU Modbus TCP, Modbus UDP
Protocol version	Modbus Application Protocol Specification V1.1a
Supported function codes	1, 2, 3, 4, 15, 16 (are used automatically purely through configuration). Via a function interface any function codes can be called directly from the application program.
Interfaces	
Physical layer – Modbus RTU	RS232, RS422, RS485
Interfaces – Modbus RTU	serial interfaces to M1-CPUs, CT300 series, CT200 series
Distributability – Modbus RTU	yes (FASTBUS or BEM / BES substation with RS204 module)*
Physical layer – Modbus TCP	Ethernet 10 / 100 MBit in accordance with IEEE 802.b
Interfaces – Modbus TCP	ETH0 and ETH1 to M1-CPUs, CT200 series
Distributability – Modbus TCP	yes (FASTBUS or BEM / BES substation with EM203 module)*
Performance data	
Multiple Modbus networks simultaneously	yes (up to 8 networks per CPU)
Nominal transfer rates serial (RTU)	38400, 19200, 9600, 4800 bits/s (gross)
Nominal transfer rates Ethernet (TCP)	10 / 100 Mbit /s (gross)
Parallel traffic to Modbus TCP	yes (normal IP traffic via the same interface)
Word order	configurable
Optimization	automatic summary of requests
Diagnostics and safety	
Log book support	yes (with adjustable debug level)
Online diagnostics	yes
Implementation	
Form of delivery	IO driver (modbus.m)
Interface to the application	virtual modules in accordance with the »Unified Fieldbus Model« for access via MIO or process image
Configuration data format	mconfig.ini (ASCII)
System prerequisites	
Supported devices	all controller CPUs

* Substation operation via RS204 at reduced data rate/overall performance depends on overall application
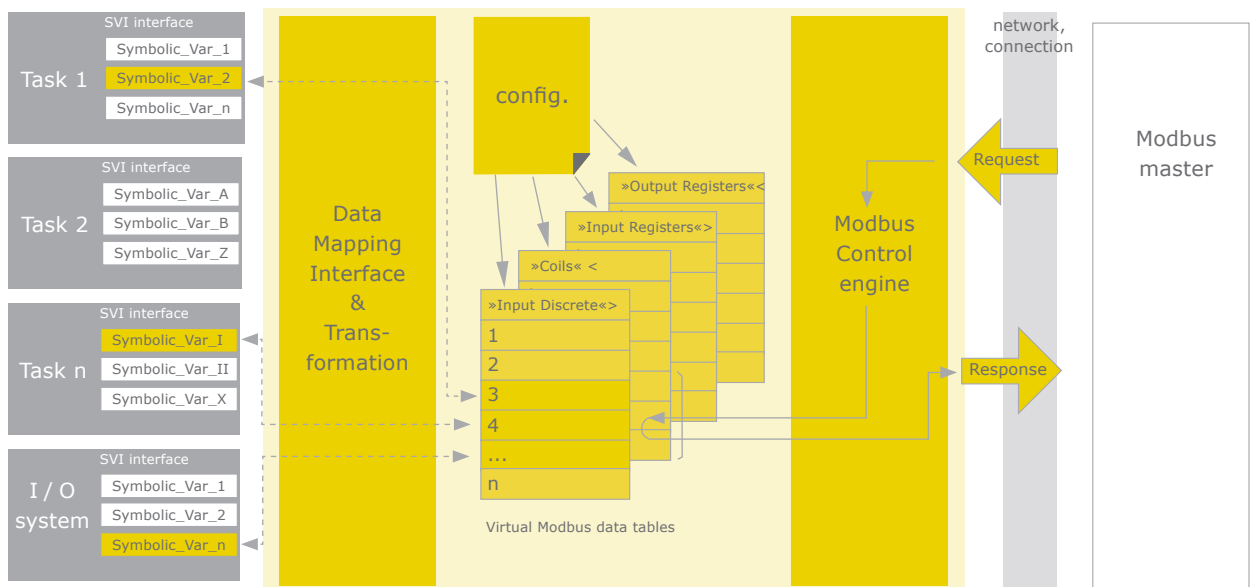
MODBUS TCP/UDP/RTU

Modbus slave

The Modbus slave can be installed as a software module on every controller CPU. Controlled through a mapping table, it reads variables of the system and makes them available on Modbus registers, where they can be read by every standard-conformant Modbus master. Write accesses of the master are appropriately forwarded by the Modbus slave to the mapped variables. In this manner process variables of the user software, direct I/O signals, as well as system variables, such as time of the controller, can be transparently presented for the external Modbus master.

All Ethernet ports for Modbus TCP and UDP, as well as all serial interfaces for Modbus TCP, are available. These can also be distributed spatially to substations of the control system.

- Supported protocols: Modbus TCP/UDP/RTU
- Use of the onboard interfaces of the CPUs
- Possibility of spatial distribution of the interfaces via FASTBUS substations and EM203 or RS204 module
- Mapping of any SVI variables in the Modbus Primary Tables
- Mapping of any I / O channels in the Modbus Primary Tables
- Easy data access through applications (bidirectional)

Virtual Modbus data tables

Protocol	
Protocols	Modbus RTU, Modbus UDP, Modbus TCP
Protocol version	Modbus Application Protocol Specification V1.1a
Data direction	bidirectional
Supported function codes	1, 2, 3, 4, 5, 6, 15, 16
Interfaces	
Physical layer – Modbus RTU	RS232, RS422, RS485
Interfaces – Modbus RTU	serial interfaces on controller CPUs
Distributability – Modbus RTU	yes (FASTBUS or BEM / BES substation with RS204 module)*
Physical layer – Modbus UDP	Ethernet 10 / 100 MBit in accordance with IEEE 802.b
Interfaces – Modbus TCP	all Ethernet interfaces of the controller CPUs
Distributability – Modbus TCP	yes (FASTBUS or BEM / BES substation with EM203 module)*
TCP / IP Port	adjustable, preset: 502
Performance data	
Multiple slave instances simultaneously	yes up to 4 instances per CPU for concurrent operation in multiple Modbus networks.
Nominal transfer rates serial (RTU)	38400, 19200, 9600, 4800 bits / s (gross)
Nominal transfer rates Ethernet (TCP)	10 / 100 Mbit / s (gross)
Multiple master connections simultaneously	yes, for Modbus TCP configurable, number of simultaneous master connections (default 10). For UDP no limitation.
Parallel traffic to Modbus TCP	yes (normal IP traffic via the same interface)
Diagnostics and safety	
Log book support	yes (with adjustable debug level)
Online diagnostics	yes
Online connection statistics	yes
Access limitation	yes (configurable list of allowed IP addresses)
Implementation	
Form of delivery	Software module (modus.m)
Connection to process data	SVI variables, flags and I/O signals
Configuration data format	mconfig.ini (ASCII)
System prerequisites	
Supported devices	all controller CPUs

* Substation operation via RS204 at reduced data rate / overall performance depends on overall application

Telecontrol/field level

Standard communication in energy plants/substation automation.

Facilities for energy generation, transmission and distribution require a particularly high level of availability and are therefore critical infrastructures. Communication systems for control facilities and substation automation have therefore become established that are specially adapted to the additional requirements involved. A high level of standardization as well as a particularly robust design are essential for worldwide use in networks covering several regions.

Time stamps and other meta data in addition to the actual values and special transmission types are often provided. The M1 automation system offers telecontrol/substation protocols as ready-to-use, installable software packages that can be combined as required. A key benefit is the fact that available application logic that has already been tested does not have to be modified selectively for each protocol. It is only necessary to configure the variables (SVI) to be exchanged.

MMS client (IEC61850 / IEC61400-25)

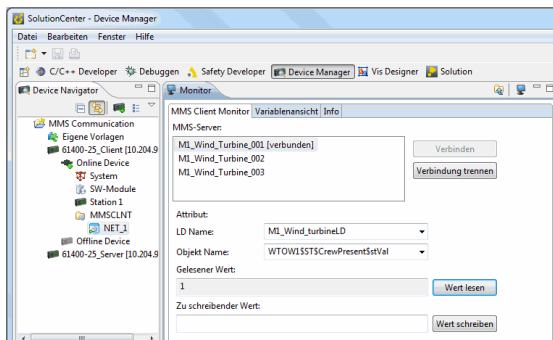| Features |
| --- |
| Communication in accordance with standards IEC61400-25 or IEC61850 |
| Pure software solution, special additional hardware is unnecessary |
| Shared operation with other protocols on the same Ethernet interface |
| Enables access from outside to variables of the controller |

MMS client
(IEC61850 / IEC61400-25)
Manufacturing Message Specification client

Numerous switching, protective, and measurement devices in the energy technology area are equipped with an Ethernet interface and offer communication in accordance with the IEC61850 standard. Via this interface parameters can be assigned for the devices, and the devices can be diagnosed, and actual values can be picked up through polling or received per report. Previously this interface has been primarily served by SCADA and control room systems. Through the Bachmann MMS client the control system is capable of directly using the IEC61580 interface of such peripheral devices. The MMS client behaves on the controller in a manner similar to a fieldbus driver: It supplies actual values and reports of the peripheral devices directly into the application software. Inversely, switch commands, setpoints and parameters for the peripheral device can be set directly from the application program.

- Pure software solution, special additional hardware is unnecessary
- It is started as a stand-alone service directly from the application software
- Common operation with other protocols on the same Ethernet port and in the same network
- Configuration via SolutionCenter, no external tools are required
- Operates devices in accordance with IEC61850 and/or IEC61400-25 in the same network
- Operating interface for sequential programs (IEC61131-3, C/C++) via SMI for temporal decoupling
- Library for PLC programming in accordance with IEC61131-3
- Header file for C/C++ programming
- Disclosed interface for tools and visualizations
- Report data is available via logical I/O modules for application programs and tools
- Commissioning and diagnostics monitor in the SolutionCenter
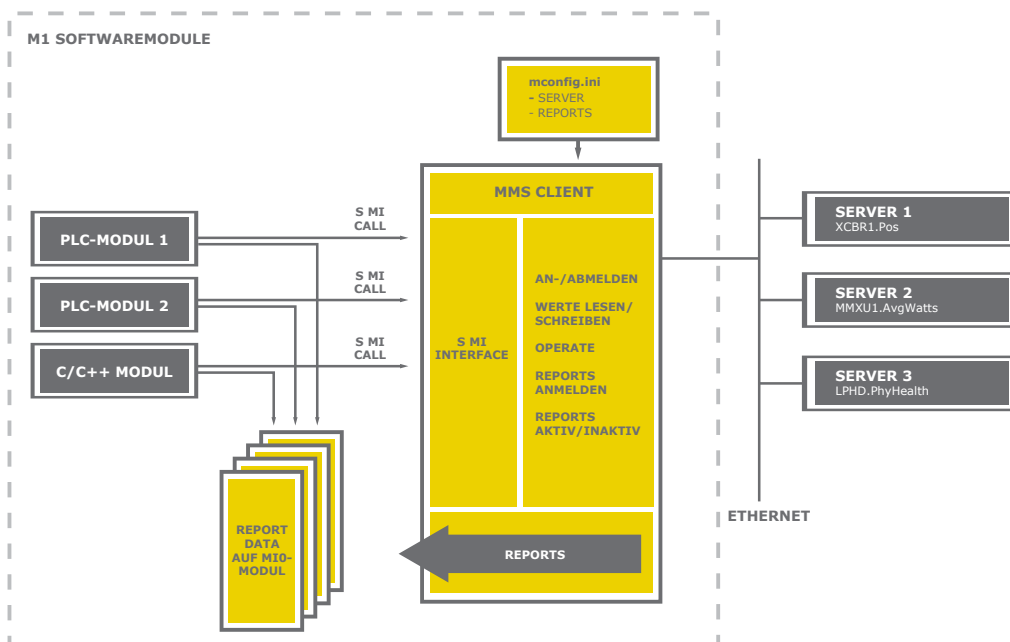
Telecontrol/field level

| MMS client (IEC61850 / IEC61400-25)	
Usability	
Implementation areas	wind power in accordance with IEC61400-25
	distributed energy resources: CHP, photovoltaic, Heat accumulators in accordance with IEC61850-7-420
	switchgear and protective devices in accordance with IEC61850-7
Scope of delivery	software components for the controller
	PLC library and C-defines for operation of the API
	test and diagnostics monitor in the SolutionCenter
	user manual
	sample configuration
	PCS sample project
User interface	Individual read and write commands via non-blocking PLC modules (PLC) or non-blocking calls (C/C++). Incoming report data on logical IO modules and in the process image.
Capabilities in accordance with IEC 61400-25 / IEC 61850	
Login/logout on the external server with or without password	Associate, Abort, Release
Check connection status	MMS status request
Read value from data attributes	GetDataValues
Write value from data attributes	GetDataValues
Write value from data attributes	SetDataValues
Activation and configuration – buffered and unbuffered reports (BR, UR)	Get/SetBRCBValues, Get/SetURCBValues, BRCB…buffered report control block
Generating, deleting and reading of datasets	CreateDataSet, DeleteDataSet, GetDataSetDirectory
Issuing of switch commands (operates)	Select, Select with value, Operate, Cancel, TimeActivatedOperate
Receipt of information reports as reaction to operates	

Fieldbuses – SERCOS

Specialized for rigorous requirements.

SERCOS (SErial Realtime COmmunication System) is a dedicated bus system for activation of high-quality electric drives and servo amplifiers. Communication is configured on the controller and distributed to the drives when the system boots. The process data of the drive is available in standardized form and makes not only the numeric values available via appropriate services, but it also makes meta information, such as symbolic names, input limits and units, available. Via service channel accesses, in addition to the cyclic process data, acyclic parameters at runtime from the application program can also be changed or transferred from a list of initial parameters at system start.

Possible topology: SERCOS

ENGINEERING PC

ETHERNET

NT250 MPC240 DI216 DO216 AIO288 SEM201
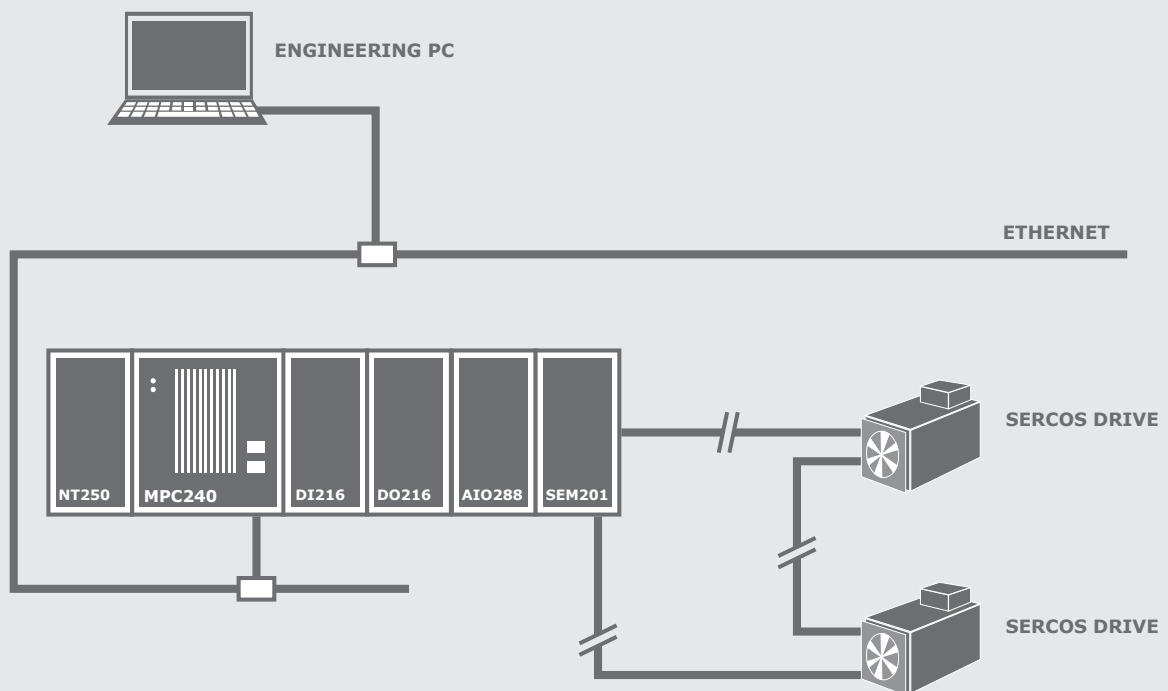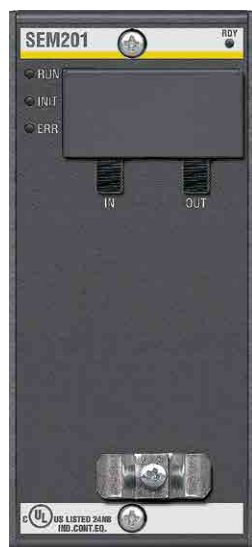
SERCOS DRIVE

SERCOS DRIVE

SERCOS master module SEM201

The SERCOS (Serial Real-time Communication System) master module SEM201 is capable of controlling up to 32 drives. The bus has a ring structure and offers a high level of interference immunity thanks to the fibre optic technology.

- SERCOS 2 Standard IEC 61491
- Fiber optic technology
- Bus with ring structure
- 2 Kb x 32 DPRAM
- Transfer rates: 2/4/8/16 Mbaud
- Cycle times: 62.5 µs .. 65 ms
- Multiple masters can be synchronized

Item	Item no.
SEM201	00011756-00

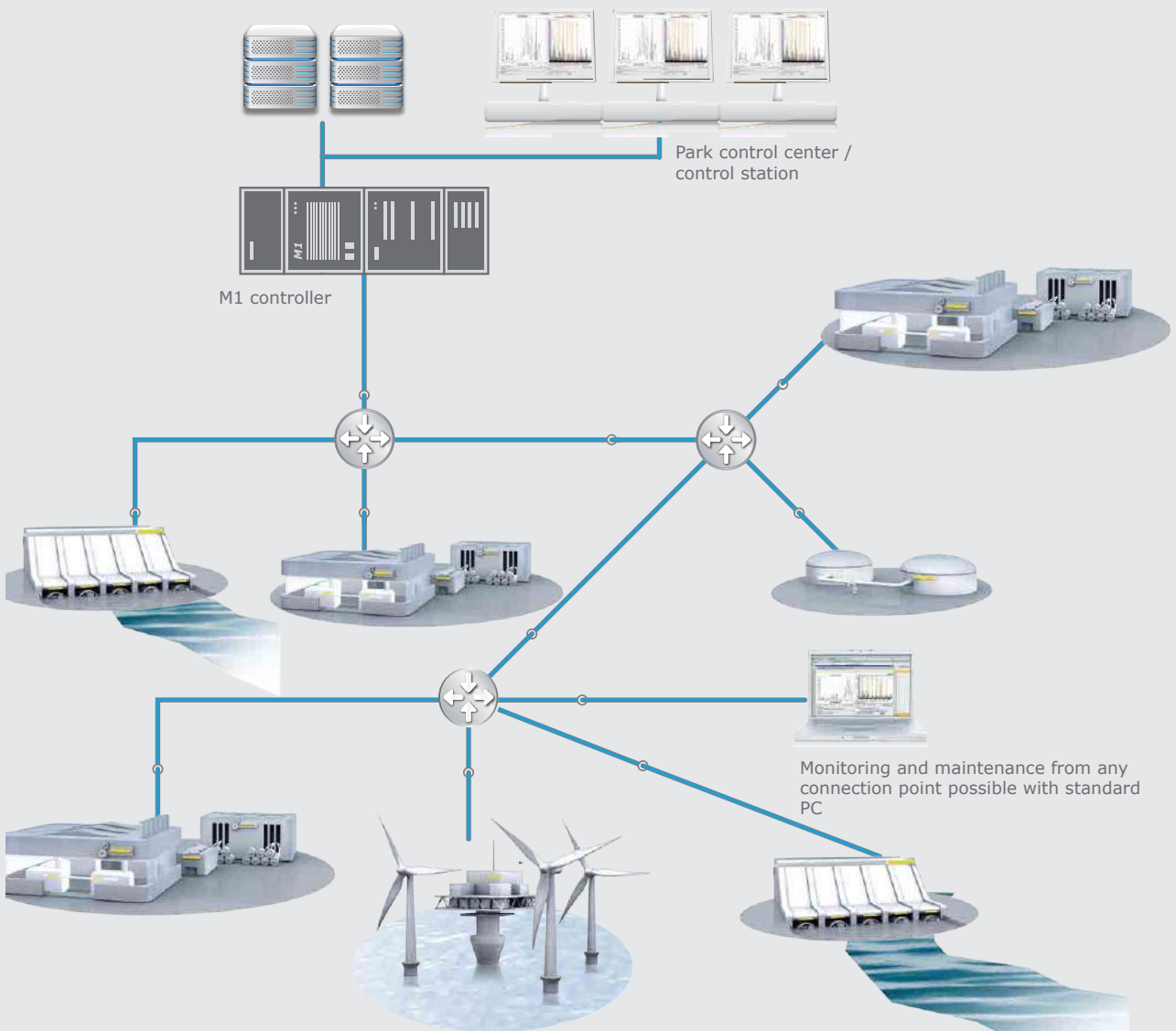| SEM201	
Description	
Channels / drives	fiber optic ring with max. 32 drives, 2 kB x 32 DPRAM
Modules per controller	max. 12
Transfer rate	2/4/8/16 Mbaud
Cycle times	62.5 µs .. 65 ms
Synchronization	multiple masters can be synchronized
Certified by	SI – Sercos International (formerly IGS)
Galvanic isolation from system	yes, via fiber optic cable
Ambient conditions	
Operating temperature	0 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % without condensation
Model variants	
SEM201	Sercos master module; 2/4/8/16MBaud; SERCOS II; FO interface 2x FSMA (In/Out)

bluecom

The real-time communication solution for large projects

Renewable energy sources like solar and wind power stations exist in ranges and dimensions that vary considerably. Beginning with separate installations at a distance of a few hundred meters up to hundreds of participants spread across several square kilometers, the installations have to maintain contact among themselves and with a monitoring and control center. Operators are placing ever higher demands on the controllability of such virtual power stations. In order to be able to react positively to errors like LVRT and FRT, there has to be a swift and reliable real-

time connection to every separate power station. Diagnostic and remote maintenance tasks, e.g state-of-the-art condition monitoring analyses, should be possible parallel to time-sensitive communications.

bluecom provides reliable real-time communication technology for the highest performance requirements, specifically optimized for renewable energy systems' rapid exchange of information. Top reliability, easy maintenance and diagnosability, as well as adaptability to existing networks, have been achieved. As a software-only solution absent with special

bluecom - energy park/virtual power station networking model

Park control center / control station

M1 controller

Monitoring and maintenance from any connection point possible with standard PC

requirements for CPU and compatible to a broad spectrum of network hardware, applications in user-defined topologies can be put into effect, having up to 500 participants and saves resources. Library functions for cyclic and acyclic communication in IEC 61131-3, C and C++ make for the greatest easy development. The configuration, monitoring and diagnostic analysis are executed via the SolutionCenter.

Thanks to its compatibility with Ethernet standard IEEE 802.3, bluecom provides a sustainable solution for the networking tasks of modern power stations. bluecom at once predefines the optimization of performance with lower CPU and network load for master-master communication at the machine and plant level too.

bluecom

Features
Networking of more than 500 subscribers in a free network topology with bidirectional transmission of at least 250 bytes in a real-time cycle of 20 ms.
Continuous additions of stations and entire network segments during real-time operation
Optimization of speed and bandwidth utilization ensure high data throughput with low CPU and network load
Monitoring and analysis of the state of the network and the fastest location of errors possible with no extra effort via integrated diagnostic and monitoring interfaces
Standards-compliant implementation is the basis for the influence-free coexistence of real-time communication parallel to other Ethernet-based protocols and services

bluecom

bluecom

bluecom defines an open real-time transmission protocol optimized for the requirements of diverse Ethernet based network structures that have grown over time. Structures such as these can be found in the networking of alternative energy plants, for instance, the so-called virtual power stations.

bluecom connects hundreds of network devices deterministically and is not assigned to proprietary extensions of Ethernet standard IEEE 802.3. The user is free to choose the topology, the transmission medium and the transmission rate. As a result, bluecom render the most cost-efficient real-time networking of new and pre-existing systems possible.

- Real-time networking of more than 500 sub-stations with cycle time of less than 20 ms at 250 bytes of bidirectional data transmission
- Compatible with every MX, MPC, MH and MC series processor module
- Ethernet-based real-time protocol without specific requirements for networking topology
- Optimized for speed and bandwidth utilization
- Efficiency by design (low CPU and networking utilization)
- Hot-plug functionality when removing and adding network stations

Item		Item no.
bluecom CL	License to operate the bluecom communication software on any number of Bachmann controller CPUs (Redustribution exclusively together with CPU modules).	00019331-61
bluecom CL AMT	One year extension of product support and update delivery for the bluecom Company License.	00019331-71
bluecom RT	Runtime License to operate the bluecom communication software on one controller CPU. Enables the communication with one or several bluecom compliant devices. Extension of product support and update delivery is covered by a valid M-Base Annual Maintenance.	00019331-63
bluecom DL	License to develop bluecom compatible products on third party devices by any number of employees in one location (Porting License).	00020721-64
bluecom DL AMT	One year extension of product support and update delivery for the bluecom Porting License.	00020721-74

- Parallel communication via the same interfaces and media, without impact on real-time capabilities (HTTP, FTP, video, VoIP, …)
- Priorization of Ethernet traffic acc. to IEEE 802.3q
- Configurable bandwidth limit
- Subnet formation and cascading

- Multi-master functionality
- Integrated error detection and diagnostics functionality
- Configurable I/O mapping of network variables
- Programming and diagnostic interface in IEC 61131-3 and C/C++

bluecom	
Rationale / Type / Compatibility	
Protocol type	Ethernet-based real-time protocol
Ethernet compatibility	yes, as per IEEE 802.3q (ISO/OSI layer 1+2)
Registered IEEE Ethertype	0x892D
Transmission medium	independent of transmission medium wireless communication (802.11) permissible once the jitter requirements have been taken care of
Gateway functionality	Interface of different network types on the application level
Fieldbus	CAN, Profibus DP, Profinet, Modbus UDP + TCP, EtherCAT
Control station level	Standard protocols: IEC61850, IEC61400-25, IEC60870-5-104, OPC DA, Modbus TCP/UDP Application development: communication library M1Com and M1Com.NET
Topology / Networking	
Topologies	Star, bus, ring*, mesh network
Dimension	in compliance with IEEE 802.3 - max. 2000 m per network section via fiber optic connection (FCS214)
Transfer rates supported	100 Mbit/s, 1 Gbit/s
Time synchronization	via PTP (IEEE 1588) **
Switches / infrastructure	Standard Ethernet IEEE 802.3q
Parallel data traffic	yes, possible Ethernet-based protocols and services, e.g. HTTP(S), FTP(S), SNTP, SMTP, video stream, Modbus, OPC, MMS, …

* employing appropriate network hardware
** accuracy achievable subject to CPU type used and master clock used

bluecom

bluecom	
Configuration / Programming	
Configuration	SolutionCenter (support via wizards)
Remote configuration	yes (Ethernet LAN, Internet)
Network configuration	SolutionCenter (support via wizards)
Programming	IEC 61131-3, C/C++ user interfaces integrated, Library functions
Software interfaces	API for sending and receiving and for monitoring and checking the full and proper delivery of packets, as well as the management of I/O stations
Network variables	yes (configuration of variables at the endpoints automatically generates bluecom communication channel)
Adding/removing slaves	yes, possible (hot plug)
Diagnostics / Monitoring	
I/O live display	yes (SolutionCenter, IEC 61131-3, C, C++)
I/O network variables	yes, for every I/O channel (status, value)
Channel status	yes, for every bluecom channel
Error status	yes (SolutionCenter, IEC 61131-3, C, C++)
Diagnostics	yes (SolutionCenter, IEC 61131-3, C, C++)
Statistics	yes (SolutionCenter, IEC 61131-3, C, C++)
Network monitor	SolutionCenter
Network analysis	yes (by Wireshark plug-in, Wireshark data are generated automatically on the controller)
Bandwidth limitation	Monitoring and limitation of real-time communication bandwidth use included (adjustable, pre-configured: 35 Mbit/s)
Jitter monitoring	yes
QoS	yes (IEEE 802.3q)
Performance data	
Number of I/O stations	max. 500 *** (restricted by software)
Cycle time	200 µs .. 1 s *** (any intermediate values configurable)
Transmission frame cyclic	0 .. 1400 bytes per payload unit
Transmission frame acyclic	32000 bytes per payload unit
Capacity under test conditions	Master CPU: MPC293, slave CPU: MX213, 10 ms cycle, 96 slaves, 50-byte cyclic data exchange bidirectional to each I/O station, transmission medium copper
CPU load only Protocol	Master: 17%, slave: 1,7%
CPU load (Protocol, GetData + SetData)	Master: 27%, slave: 3%
Network load	Master: 9 Mbit/s, slave: 0.082 Mbit/s

***   Limit value is subject to the power of the controller and the network, as well as the controller capacity utilization and the network topology/load

bluecom	
Installation	
Installation medium	CD ROM or network
Installation tool	SolutionCenter
Upgrading existing systems	by software possible / licence required
System prerequisites	
Automation equipment	M1 CPUs of the MX200 series or better (application licence) Porting information is available for implementation on external equipment (developer licence)
Software	MSys / MxCCore / M-BASE V3.80 or higher
Network	industrial standard managed switch (unmanaged switch with appropriate configuration)

Communication – Control room networking

A suitable system for every industry.

Machines and plants usually work as a composite and are coupled to a central data acquisition system, a control room, or a PDA/MES system. Regardless of whether this involves aggregates of a wind park, or production machines of a manufacturing shop – Bachmann electronic has a suitable communication system for every industry in its product line. A powerful, laboratory-certified OPC server is available in two variants, as well as an MMS server tailored to the energy industry for communication in accordance with IEC61850 and IEC61400-25.

OPC UA Server

Features
Operation on the controller without additional Windows PC
OPC UA data access (DA) for accessing process variables
Read and write access to process variables can be controlled via user groups
Login can be requested by configuration
Signing by TLS certificate can be requested by configuration
Communication encryption can be requested by TLS up to 256 bits

M1 OPC standard server

Features
OPC Data Access 1.0, 2.04, 2.05, 3.0
Connection to M1 or CT via Ethernet
Secure SSL connection to the controllers
Up to 5 automation devices per server
Up to 10,000 information points
Operation under Microsoft Windows 7, Vista, XP

M1 OPC enterprise server

Features
OPC Data Access 1.0, 2.04, 2.05, 3.0
Connection to M1 or CT via Ethernet
Secure SSL connection to the controllers
No limitation of connected M1 systems
No restriction of data quantity
Simulation of clients
Operation under Microsoft Windows 7, Vista, XP, Server 2003, Server 2008

The telecontrol protocol, according to IEC60870-5-104, is widely used in power generation, power distribution and infrastructure areas. It allows the control and monitoring of intelligent sub-components and sub-stations through a superordinate control center. The palette of these sub-components ranges from circuit breakers, converters, and energy meters to cogeneration units up to complete power plants.

MMS Server (IEC61850 / IEC61400-25)

Features
Communication in accordance with standards IEC 61400-25 or IEC 61850
Pure software solution, special additional hardware is unnecessary
Shared operation with other protocols on the same Ethernet interface
Enables access from outside to variables of the controller

IEC60870-5 Server (Slave)

| Features |
| --- |
| Standard compliant implementation of IEC60870-5-101, -103, -104 Server |
| Service/software solution that can be subsequently installed |
| No changes to the application logic required |
| Fully configurable/no application-specific processing via PLC libraries required |
| Configurator for commissioning and diagnostic monitor in the SolutionCenter |
| Import/export in CSV format for exchange with other manufacturers |
| Reducing the amount of data via configurable threshold filters |

Communication – Control room networking

OPC UA Server
(Openness, Productivity and Connectivity)

The OPC UA Server is a pure software solution and can be executed directly on the controller CPU without additional hardware. It offers full and transparent access to the process values of the control application. Systems for visualization, Scada or data logging can use OPC UA as manufacturer independent interface. An additional Windows® PC for execution of the OPC server software is no longer required. More benefits from the direct execution on the controller are the automatic recognition of process data without the need to create a configuration, and the accurate source time stamps. If requested, the communication is encrypted, and the communication partners can be identified unambiguously by TLS certificates. Plain communication without login data and the certification check are of course still possible.

- Data Access according to OPC UA specification
- Is installed as additional service on the controller
- Displays the process values of the controller in its address space without additional configuration steps
- Considers access permissions on variables at reading and writing
- Write access can be logged
- Quality is granted by participation at Interop workshops and conformance tests

Item	Item no.
OPC UA Server (installation DVD)	00022170-00
OPC UA Server (Lizence)	00022170-63

Communication – Control room networking
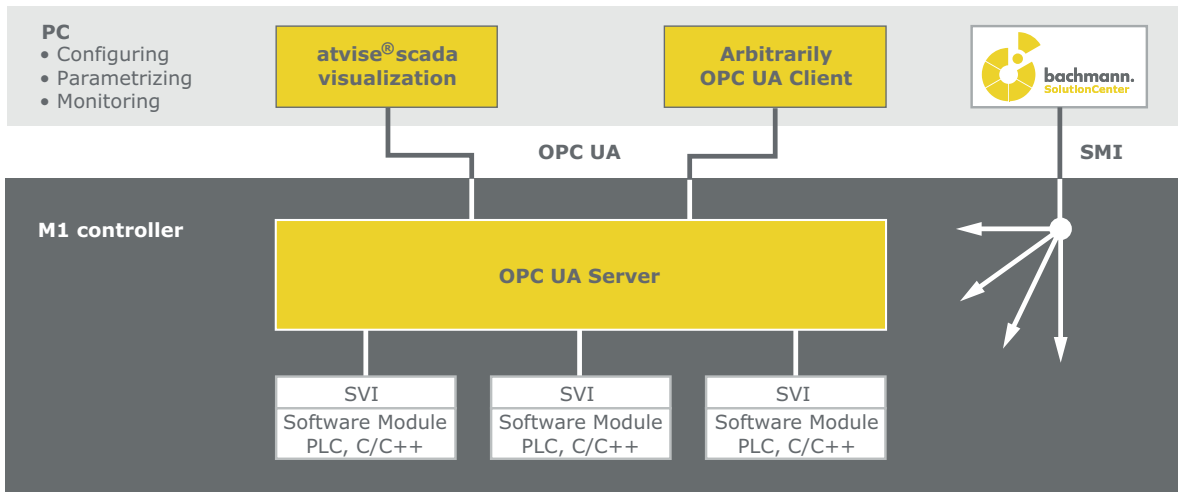
Functionality of OPC UA server

Communication – Control room networking

OPC UA Server		
Supported OPC UA Profiles		
Security Profile	Security Policy - None	
	Security Policy - Basic128Rsa15	
	Security Policy - Basic 256	
Transport Profile	UA-TCP UA-SC UA Binary	
Server Profiles	Base Server Behaviour Facet	
	Basic DataChange Subscription Server Facet	
	Core Server Facet	
	Embedded UA Server	
	Enhanced DataChange Subscription Server Facet	
	Low End Embedded Device Driver Facet	
Supported OPC UA Information Models		
Information models	Data Access (DA)	
Supported OPC UA Service Sets		
Discovery Service Set	FindServers	
	GetEndpoints	
SecureChannel Service Set	OpenSecureChannel	
	CloseSecureChannel	
Session Service Set	CreateSession	
	ActivateSession	
	CloseSession	
	Cancel	
View Service Set	Browse	
	BrowseNext	
	TranslateBrowsePathToNodeIds	
	RegisterNodes	
	UnregisterNodes	
Attribute Service Set	Read	
	Write	
MonitoredItem Service Set	CreateMonitoredItems	
	ModifyMonitoredItems	
	SetMonitoringMode	
	SetTriggering	
	DeleteMonitoredItems	
Subscription Service Set	CreateSubscription	
	ModifySubscription	
	SetPublishingMode	
	Publish	
	Republish	
	DeleteSubscriptions	

OPC UA Server	
Security features	
Encryption	see Security Profile
Protection against overload (DoS)	CPU overload caused by clients can be avoided by limiting the minimum sample rate
Public Key Infrastructure	file based on the controller
Access logging	connections and write operations are stored in the security log of the controller
Diagnose	
State variables	number of active sessions
	number of active subscriptions
	number of items monitored by subscription
Show functions	list of sessions
	list of all software modules in the address space
	list of all items in subscriptions
Logbook messages	amount and type of messages can be selected by debug levels
Installation	
Shipping	as DVD oder by download
Installation	via SolutionCenter; Can be installed separately as service on the controller
License	needs a runtime license for each controller CPU, independant of number of items or clients
License protection	license file depending on hardware
System requirements	
CPU Hardware	all M1 CPU types except ME203 (MH2xx, MC2xx, MPC2xx, MX2xx)
Memory	minimum 64 MB, recommended 128 MB
System software version	M-Base 3.85 or better
Order information	
OPC UA Server (DVD)	OPC UA Server installation DVD. Contains executable software for installation on the controller and the user documentation.
OPC UA Server (Licence)	licence for operating one installation of the OPC UA Server on one M1 controller system

Communication – Control room networking

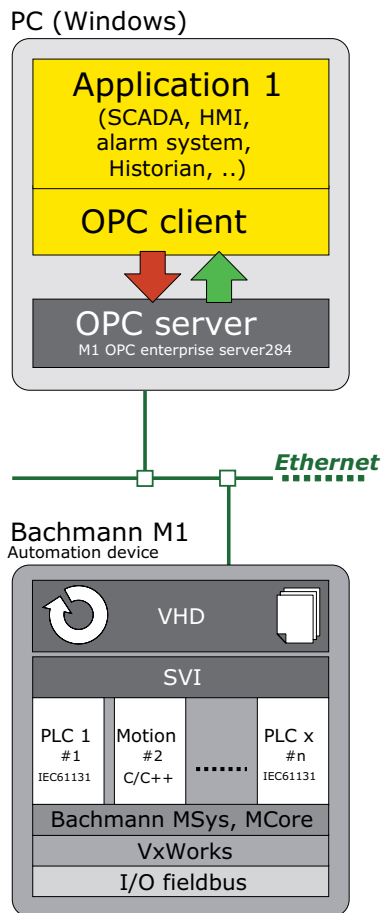## M1 OPC standard server (Openness, Productivity and Connectivity)

OPC defines a number of manufacturer-neutral software interfaces for automation (www.opcfoundation.org). With OPC data access actual states and values (online data) can be exchanged between controllers and software applications, such as visualizations, control systems or production data acquisition. As a pure software interface OPC runs on a PC or IPC under Windows and communicates with the M1 automation systems via Ethernet. Any standard-conformant OPC clients will then either be operated on the PC of the server, or in the network and permit data exchange in both directions.

The integrated configuration tool supports the selective disclosure of any variables from the control system under a freely selectable item name for the clients. Configurations can either be created directly in the graphic interface, or transferred from other tools via the import/export function. Inversely a test client that is also integrated in the »OPC Configurator« configuration tool allows checking of the data exchange with underlying controllers without a completely set-up OPC client application.

- OPC conformant data server – manufacturer-neutral interface
- Specifications – OPC Data Access 1.0, 2.04, 2.05 and 3.0
- Connection to M1 or CT via Ethernet
- Secure SSL connection to the controllers
- Up to 5 automation devices per server
- Up to 10,000 information points (items/field elements)
- Multi-processor support (depending on operating system)
- Graphic configuration tool
- Flat and hierarchical browsing
- Integrated test client (configuration tool)
- Operation under Microsoft Windows Vista, XP, 2000

Communication – Control room networking

PC (Windows)

Application 1
(SCADA, HMI,
alarm system,
Historian, ..)

OPC client

OPC server
M1 OPC enterprise server284

Ethernet

Bachmann M1
Automation device

VHD

SVI

| PLC 1 #1 IEC61131 | Motion #2 C/C++ | .... | PLC x #n IEC61131 |

Bachmann MSys, MCore

VxWorks

I/O fieldbus

OPC standard server		
Server		
Protocol for client application	OPC data access	
Supported specifications	V1.0, 2.04, 2.05a, 3.0	
Data exchange direction	bidirectional	
Supported data types	basis types	UINT1, UINT8, SINT8, UINT16, SINT16, UINT32, SINT32, REAL32, BOOL8, CHAR8, CHAR16, MIXED, REAL64, UINT64, SINT64
	block types	all basis types; basis type BLK (e.g. CHAR8 + BLK = STRING)
Data type mapping	SVI on OPC (automatic)	
Number of variables (items)	10,000 (individual variables or field elements)	
Time stamp on the server	yes	
Time stamp from controller	yes (per group one time item possible)	
Quality attribute on the server	yes	
Quality attribute from controller	yes (per group one quality item possible)	

Communication – Control room networking

M1 OPC standard server	
Server	
Display of connection loss	yes (affected items show quality=BAD)
Server type	OUT_PROCESS
Operation without GUI	yes
Flat browsing	yes
Hierarchical browsing	yes
Refresh rates	dynamically adjustable per group (from 50 ms)*
Multi-processor support	yes
Interfaces to the controller	
Physical interface to the M1	Ethernet IEEE 802.3 (10/100 Mbit/s full-duplex)
Basis protocols	TCP/IP UDP/IP QSOAP
Protocol	SMI / VHD
Multiple connections per controller	yes
Simultaneous queries	yes
Number of connected controllers	5 (maximum)
Access protection	yes, configurable
Supported security levels	0 to 4
Encryption	SSL (configurable)
Configuration	
Graphic interface	yes (OPC configurator)
Browsing of controllers	yes
Browsing of controller variables (SVI)	yes
Import/export	yes (CSV)
Templates	yes
Clones (with enumeration)	yes
Restricted access	yes (only on configured items)
Item names	OPC-side can be freely configured (»renaming«)
Item access rights	OPC side can be freely restricted
Integrated test client	yes
Configurations can be saved	yes
Access protection on configuration	yes (different user levels)
Diagnostics	
Error logging	yes (log file)
Debug mode	yes (several can be set)
Diagnosis on items	yes (static items)
Statistics on items	yes (static items)

* Refresh rates depend on the data volume and the computer performance,
  (Free) controller performance and network topology/network load.

M1 OPC standard server	
Installation	
Installation medium	CD ROM or network (See standard package M-Base and M-COM)
Installation can be automated (»silent«)	yes
System prerequisites – server	
Computer	IBM-compatible PC (Intel x86 architecture)
Processor	minimum: Intel Pentium 500 MHz or comparable (Windows 2000) recommended: Intel Core2Duo or Core2Quad with >2 GHz
RAM	minimum: 256 MB RAM (Windows 2000) recommended: >1 GB RAM
Network card	at least 1x Ethernet 802.3
Hard disk	>300 MB free
Graphic	1024 x 768 or better (only for configuration)
Input devices	keyboard, 2-button mouse (only for configuration)
Operating system (OPC Server)	Windows Vista Windows XP Windows 2000
Other software	Text editor or MS Excel recommended for external configuration
System prerequisites M1	
M1 automation devices	families ME, MX, MPC, MPE, as well as CT/WT200 , CT/WT300 (achievable performance is type-dependent)
System software	MSys V2.11 or higher (for full function scope)

Communication – Control room networking

M1 OPC enterprise server (Openness, Productivity and Connectivity)

OPC defines a number of manufacturer-neutral software interfaces for automation (www.opcfoundation.org). With OPC data access, actual states and values (online data) can be exchanged between controllers and software applications, such as visualizations, control systems or production data acquisition. As a pure software interface OPC runs on a PC or IPC under Windows and communicates with the M1 automation systems via Ethernet. Any standard-conformant OPC clients will then either be operated on the PC of the server, or in the network and permit data exchange in both directions.

The integrated configuration tool supports the selective disclosure of any variables from the control system under a freely selectable item name for the clients. Configurations can either be created directly in the graphic interface, or transferred from other tools via the import/export function. Convenient copy functions accelerate the configuration or management even for large installations with many connected controllers.

The integrated simulation enables communication tests with client applications even without connected M1 systems. Inversely a test client that is likewise integrated in the »OPC Configurator« configuration tool allows checking of the data exchange with underlying controllers without a completely set-up OPC client application. The Bachmann M1 OPC enterprise server has been specially developed for large installations with a variety of automation devices, i.e. for large data volumes. In addition to the possibility of handling multiple network connections simultaneously, here the parallelization of queries and the multi-processor support have a particular effect.

Item	Item no.
OPC Enterprise Server (Installation-DVD)	00015632-xx
OPC Enterprise Server (Runtime license)	00015632-63

Communication – Control room networking

- OPC-conformant data server – manufacturer-neutral interface
- Specifications: OPC Data Access 1.0, 2.04, 2.05 and 3.0
- Connection to M1 or CT via Ethernet
- Secure SSL connection to the controllers
- No restriction of the connected M1 systems*
- No restriction of data quantity (items)*
- Multi-processor support (depending on operating system)
- Powerful configuration tool
- Flat and hierarchical browsing
- Simulation for clients (configuration tool)
- Integrated test client (configuration tool)
- Operation under Microsoft Windows 7, Vista, XP, 2000, Server 2003 and Server 2008

PC1 (Windows)

Application 1
(SCADA, HMI, Alarm-System, Historian, ..)
OPC Client

OPC Server
M1 OPC Enterprise Server

PC2 (Windows)

Application 2
(SCADA, HMI, Alarm-System, Historian, ..)
OPC Client

Ethernet

VHD
SVI
M1 Controller 1

VHD
SVI
M1 Controller 2

VHD
SVI
M1 Controller 3

VHD
SVI
M1 Controller n
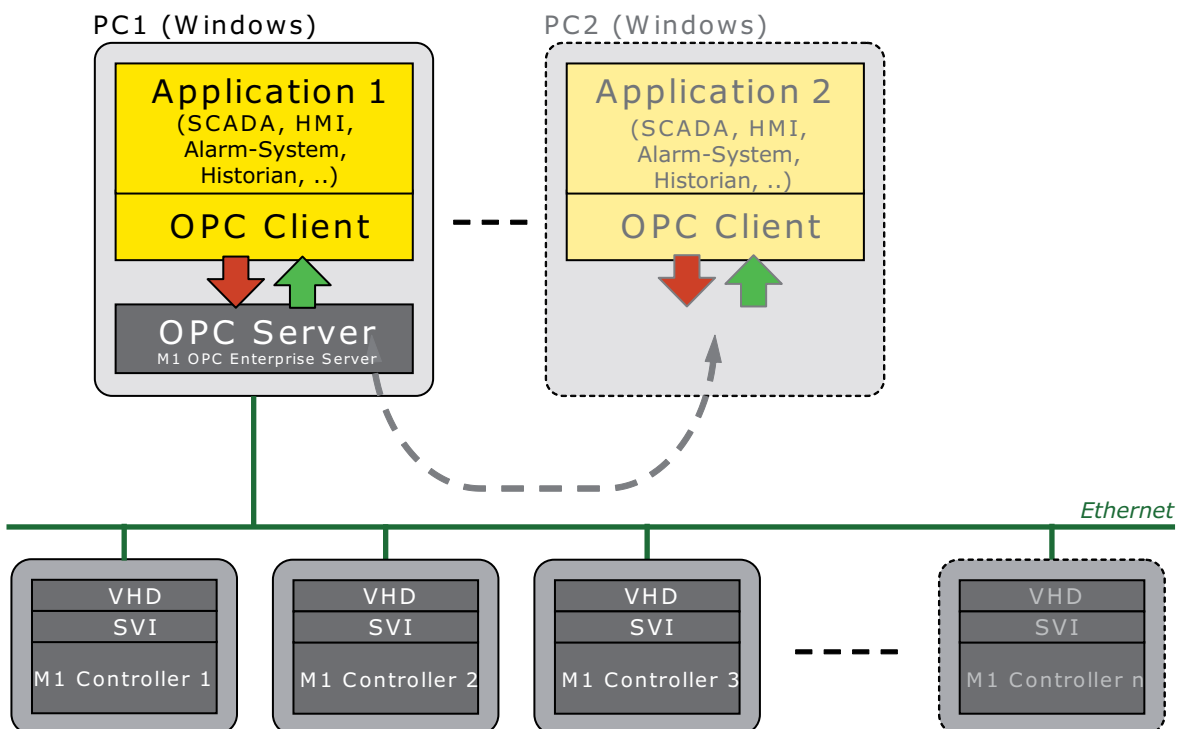
* However there is restriction due to computer performance, network capacity and communication load on the M1 system. The actual achievable throughput depends on the application case.

Communication – Control room networking

M1 OPC enterprise server		
Server		
Protocol for client application	OPC data access	
Supported specifications	V1.0, 2.04, 2.05a, 3.0	
Data exchange direction	bidirectional	
Supported data types	basis types	UINT1, UINT8, SINT8, UINT16, SINT16, UINT32, SINT32, REAL32, BOOL8, CHAR8, CHAR16, MIXED, REAL64, UINT64, SINT64
	block types	all basis types; basis type + BLK (e.g. CHAR8 + BLK = STRING)
Data type mapping	SVI on OPC (automatic)	
Number of variables (items)	user-defined**	
Time stamp on the server	yes	
Time stamp from controller	yes (per group one time item possible)	
Quality attribute on the server	yes	
Quality attribute from controller	yes (per group one quality item possible)	
Display of connection loss	yes (affected items show quality=BAD)	
Server type	OUT_PROCESS or SERVICE (configurable)	
Operation without GUI	yes	
Flat browsing	yes	
Hierarchical browsing	yes	
Refresh rates	dynamically adjustable per group (from 50 ms)**	
Multi-processor support	yes	
Simulation mode	yes	
Interfaces to the controller		
Physical interface to the M1	Ethernet IEEE 802.3 (10/100 Mbit/s full-duplex)	
Basis protocols	TCP/IP UDP/IP QSOAP	
Protocol	SMI/VHD	
Multiple connections per controller	yes	
Simultaneous queries	yes	
Number of connected controllers	user-defined**	
Access protection	yes, configurable	
Supported security levels	0 to 4	
Encryption	SSL (configurable)	
Configuration		
Graphic interface	yes (OPC configurator)	
Browsing of controllers	yes	
Browsing of controller variables (SVI)	yes	

** Refresh rates depend on the data volume and the computer performance,
   (Free) controller performance and network topology/network load.
*** No program-technical restriction. Limit value depends on performance
    of the computer, the network and the capacity utilization of the controllers.

M1 OPC enterprise server	
Configuration	
Import/export	yes (CSV)
Templates	yes
Clones (with enumeration)	yes
Restricted access	yes (only on configured items)
Item names	OPC-side can be freely configured (»renaming«)
Item access rights	OPC side can be freely restricted
Integrated test client	yes
Configurations can be saved	yes
Access protection on configuration	yes (different user levels)
Diagnostics	
Error logging	yes (log file)
Debug mode	yes (several can be set)
Diagnosis on items	yes (static items)
Statistics on items	yes (static items)
Installation	
Installation medium	CD ROM or network
Installation can be automated (»silent«)	yes
License basis	per installation (single-license obligation)
License protection	hardware-dependent software key
Configured installation	yes (items/controller configuration, as well as configuration users can be preset)
System prerequisites – server	
Computer	IBM-compatible PC (Intel x86 architecture)
Processor	minimum: Intel Pentium 500 MHz or comparable (Windows 2000) recommended: Intel Core2Duo or Core2Quad with >2 GHz
RAM	minimum: 256 MB RAM (Windows 2000) recommended: >1 GB RAM
Network card	at least 1x Ethernet 802.3
Hard disk	>300 MB free
Graphic	1024 x 768 or better (only for configuration)
Input devices	keyboard, 2-button mouse (only for configuration)
Operating system (OPC Server)	Windows 7 Windows Vista Windows XP Windows 2000 Windows Server 2003 Windows Server 2008
Other software	Text editor or MS Excel recommended for external configuration
System prerequisites M1	
M1 automation devices	families ME, MX, MPC, MPE, as well as CT/WT200 , CT/WT300 (achievable performance is type-dependent)
System software	MSys V2.11 or higher (for full function scope)

Communication – Control room networking

MMS server
Manufacturing Message Specification Server

The MMS server equips the M1 controller with the capability of communicating in accordance with the standards IEC 61400-25 or IEC 61850. These are two communication standards that have been created to correspond to the needs of the energy industry and the grid operators.
The standardization makes it possible to seamlessly integrate an ever-increasing number of heterogeneous plants, such as wind turbines or CHPs, in a control room or in a mixed network.

The standards, IEC61400-25 and IEC61850, extend far beyond pure data communication. They also define the data modeling and thus offer an object-oriented view of the system. Objects, such as generator, circuit breaker, transformer, rotor, etc. are defined. For each of these objects the additional characteristics, their designations, the data types and the associated services are specified.
The MMS server from Bachmann electronic depicts the variables that are available from the plant control programs (e. g. PLC) in the SVI (**S**tandard **V**ariable **I**nterface) on an IEC conformant communication. The user of the MMS server determines the standardized ICD file (ICD = **I**ntelligent Electronic Device **C**apability **D**escription), what information of the plant is represented, and is therefore visible to the client (e. g. the control station). This enables individual adaptation to different plants or modular expansion stages.

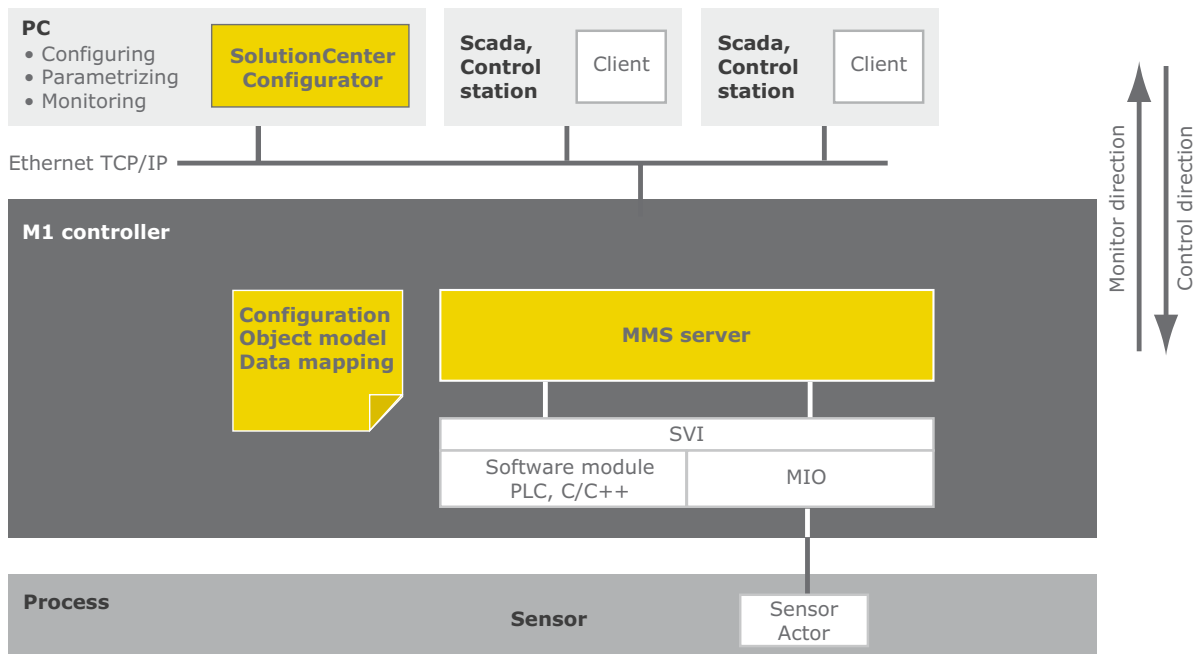| Item		Item no.
MMS server RT	License to operate the MMS Server on one controller CPU. Allows communication over the ethernet interface with standards-compliant client software using the IEC61850 or IEC61400-25 protocol in accordance with the documentation.	00014547-63
MMS server DVD	Software and documentation for the MMS Server. Provides communication over the ethernet interface according to the standards IEC61850 or IEC61400-25. Without a valid Runtime License the MMS Server runs only temporarily for 2h in demo mode.	00014547-xx

Features

- It is started as a stand-alone software module
- No special hardware required, pure software solution for all M1 CPU types except ME203
- Configuration of the variable set via standardized ICD file (XML format)
- Mapping of the SVI variables to IEC variables in a readable ASCII file, that can be automatically generated
- Automatic deadband calculation (db, zeroDb) for analog values (MV, CMV)
- Integrated into the access control features of the controller system
- Optional entry points for additional preprocessing and post-processing of values, e. g. logging of write accesses
- Can be operated together with other protocols (OPC, QSOAP, Telnet, etc.) on the same Ethernet interface of the M1
- Number of clients, reports, etc. can be limited
- Automatic limitation of CPU load

Capabilities in accordance with IEC61400-25 / IEC61850

- Unterstützt Ed. 1 und Ed. 2 der IEC61850
- The object definition decides between IEC61850 or IEC61400-25
- Transport layer MMS (Manufacturing Message Specification) in accordance with ISO 9506
- Browsing of variables / objects with presentation of structures and elements in plain text (self-describing system)
- Reading and writing of values (Get / Set Data Values)
- Summarizing of data (datasets)
- Generation of reports, e. g. if there is a value change
- Command issue with command preselect (Select – Operate)
- File transfer

PC
- Configuring
- Parametrizing
- Monitoring

SolutionCenter Configurator

Scada, Control station — Client

Scada, Control station — Client

Ethernet TCP/IP

Monitor direction

Control direction

M1 controller

Configuration Object model Data mapping

MMS server

SVI

Software module PLC, C/C++ | MIO

Process

Sensor

Sensor Actor

Communication – Control room networking

MMS server – Available services				
Functional group	Description	Services	IEC 61850	IEC 61400-25
Server	Represents the visible outwards appearance of a device. All other functional groups are part of the server.	ServerDirectory	M	O
Application association	Service for connection with a client. Allows restricted access to information and functions of the server.	Associate	M	M
		Abort	M	O
		Release	M	O
Logical device	Represents a group of functions with each function defined as logical node.	GetLogical-DeviceDirectory	M	O
Logical node	Represents a certain function, e.g. the overvoltage protection.	LogicalNode-Directory	M	O
		GetAllDataValues	M	X
Data	Allows specification of typified information, such as the position of a switch with quality information and timestamp.	GetDataValues	M	M
		SetDataValues	O	M
		GetDataDefinition	M	O
		GetDataDirectory	M	O
Data set	Allows grouping of different data.	GetDataSetValues	M	M
		CreateDataSet	O	O
		DeleteDataSet	O	O
		GetDataSet-Directory	O	O
Reporting	Describes the conditions for reporting based on client-defined parameters. Reporting can be triggered by change of process data (e.g. data change) or by quality changes. The reports can be sent immediately or delayed. The reports contain information on status changes and events, data update excepted.	Report (BRCB)	C	O
		GetBRCBValues		
		SetBRCBValues		
		Report (URCB)		
		GetURCBValues		
		SetURCBValues		
Control	Describes the service for the control of devices or groups for parameter specification, for instance.	Select	O	O
		SelectWithValue		
		Cancel		
		Operate	M	M
		Command-Termination	O	O

MMS server – Available services				
Functional group	Description	Services	IEC 61850	IEC 61400-25
File	Defines the exchange of files.	GetFile	O	O
		SetFile	M	
		DeleteFile	O	X
		GetFileAttribute-Values	M	

M = mandatory

O = optional

C = conditional, at least one of them should be supported (BRCB or URCB)

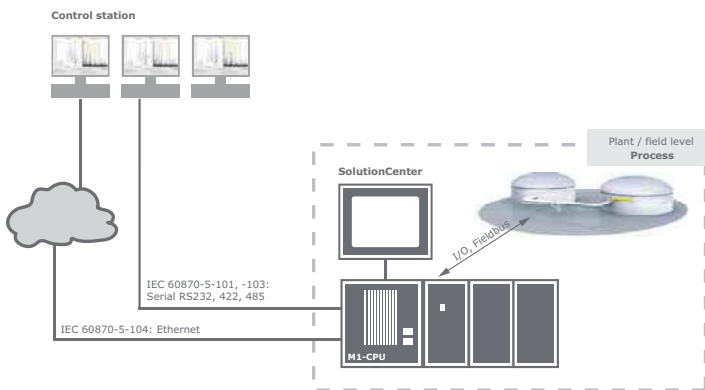X = not part of the standard

Communication – Control room networking

IEC60870-5 Server (Slave)
For communication in accordance with IEC60870-5-101, -103 and -104

Application areas
The telecontrol protocol, according to standards IEC60870-5-101 IEC60870-5-104, is widely used in power generation, power distribution and infrastructure areas. They enable the control and monitoring of intelligent sub-components and sub-stations through a superordinate control center. The palette of these sub-components ranges from circuit breakers, converters, and energy meters to cogeneration units up to complete power plants. The IEC60870-5-103 standard was defined especially for communication with protective devices.

Product features
The IEC60870-5 Server is installed purely as a software component on the controller and requires no special hardware. It uses the serial interfaces (-101, 103) or the Ethernet ports (-104) available on the controller. Through configuration of multiple instances, simultaneous operation of -101, -103, and/or -104 is possible; multiple masters can communicate simultaneously with the controller. The information objects that the server offers in the control and monitoring direction, are created and linked to the controller's existing process variables via the configuration. Different data models can be created for different masters. The login of masters can be restricted by specifying a permitted IP address, and the number of simultaneous connections can also be limited. Write accesses can be captured in the security log of the controller.

Item		Item no.
IEC60870-5-Server RT	License to operate the IEC 60870-5 server on one controller CPU. Provides communication over the ethernet or serial interfaces with standards-compliant clients using the IEC60875-5-101, -103 and -104 protocol in accordance with the compatibility documentation.	00022127-63
IEC60870-5-Server DVD	Software and documentation for the IEC60870-5 server. Provides access to process data according to the standards IEC 60870-5-101 and 103 - 104. Without a valid Runtime License the IEC60870-5 server runs only temporarily for 2h in demo mode.	00022127-xx

Communication – Control room networking

To save bandwidth, a threshold filter can be enabled. Values that are outside of defined Min/Max limits are marked as invalid and will only be transferred again when they return to the valid range. No implementation by the user is necessary for this.

Engineering

For the generation of externally visible information objects, a convenient tool is available in the SolutionCenter that supports the user with dialogs and wizards, and validates the entries immediately. Thus, inconsistent or incorrect configurations can be avoided. The link to the process data takes place by selecting the corresponding SVI variables from a variable browser. To exchange the configuration with other manufacturers, import and export in a generic CSV format is available. A monitor in the SolutionCenter shows the current configuration of information objects used in the server, and the value most recently transmitted to the client.
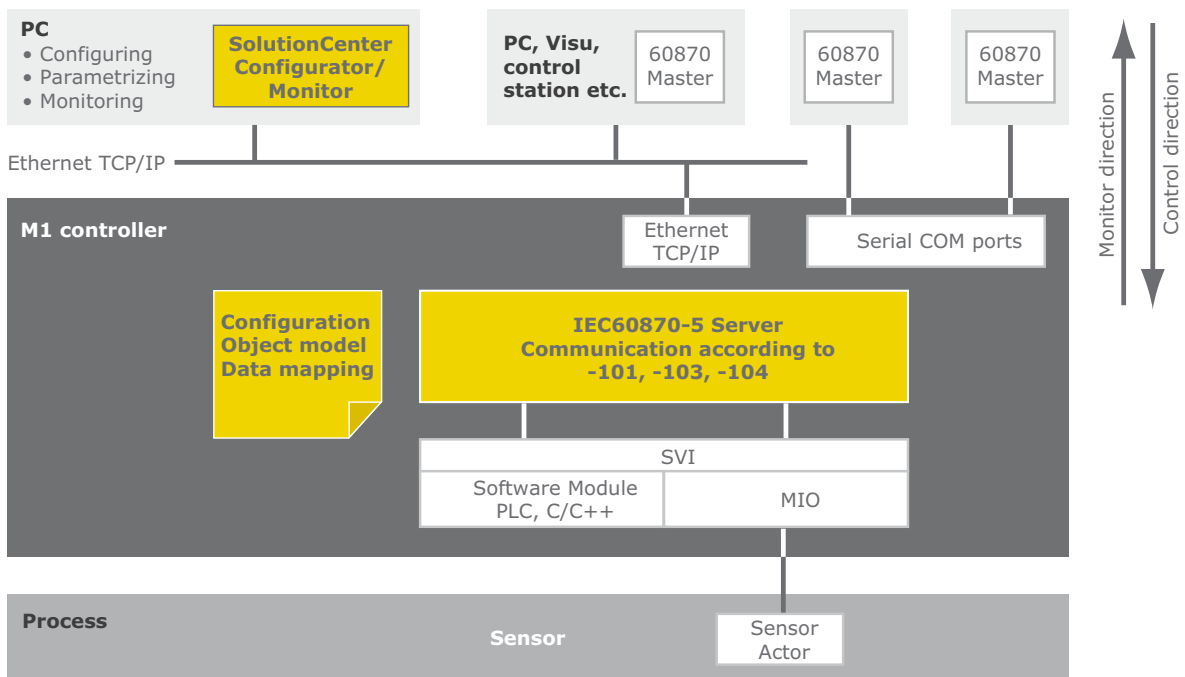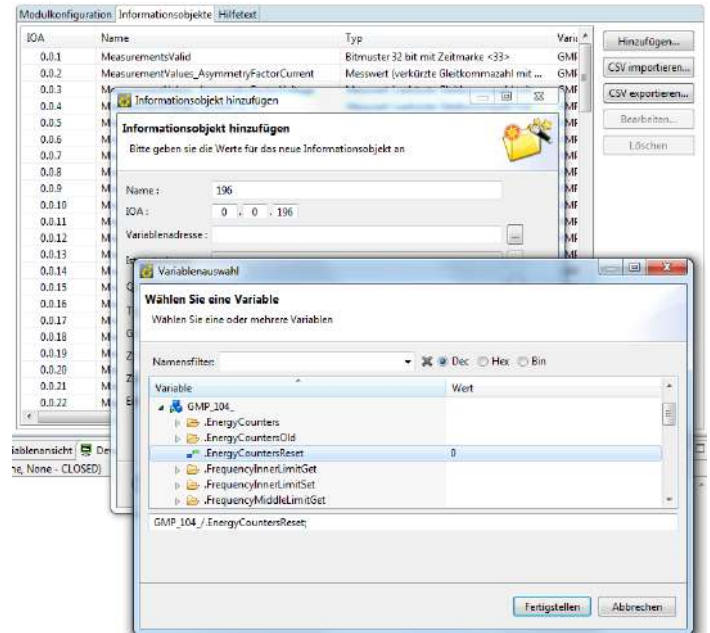
Communication – Control room networking

Advantage

Existing software for sequence control and regulation does not need to be changed and will not be affected in its run time. This therefore enables a more flexible response to end customer requirements without having to change the existing tested software for controlling and regulating of the substation. Through realization as a finished server with integrated update- and threshold logic, tedious replication of the protocol functions via limiting PLC-libraries, and the associated training efforts in the standard, is eliminated. Thus engineering and testing time can be reduced. The integrated diagnostics shorten troubleshooting if there are malfunctions in running operation. The diverse communication possibilities via field busses and real-time Ethernet, the broad range of signal interfaces to grid measurement, as well as powerful mass storage, pre-destine the M1 system in conjunction with the telecontrol protocols according to IEC60870-5 for use as a control device, central control, data concentrator, datalogger, and gateway.

Technical data

- Standard compliant implementation of IEC60870-5-101, -103, -104 Server
- Service/software solution that can be subsequently installed
- No changes to the application logic required
- Fully configurable/no application-specific processing via PLC libraries required
- Configurator for commissioning and diagnostic monitor in the SolutionCenter
- Import/export in CSV format for exchange with other manufacturers
- Reducing the amount of data via configurable threshold filters
- Number and IP addresses of authorized clients can be limited
- Logging of write accesses in the security log of the controller

IEC60870-5 server

General product features	
Supported protocols	IEC60870-5-101, IEC60870-5-103, IEC60870-5-104 as slave (server)
Type	Licensable service for Bachmann M1 controls (software-only solution, subsequently installable) with configuration interface. Requires a valid license file for operation.
Parallel operation	Multiple independent server instances on one controller
Message types (ASDUs)	Comprehensive implementation of the essential application data service units, for example: single point information; single command; double-point information; double command; step position information; regulating step command; measured value, normalized; time synchronization; reset and many more. (See interoperability documents for details)
Data mapping	Per configuration each server instance is separately defined. Access to: - SVI variables of application programs (software modules) implementation-independent (IEC61131-3, C, C++) - Physical inputs/outputs direct (MIO) - Data from fieldbus/Ethernet protocols via UFB
Data type mapping	Implicit in the server (mapping SVI data types on IEC data types)
Query groups	Yes, information can be assigned to query groups 1 to 16 per configuration
Source time stamping	Implicitly possible through server, explicitly possible via application. Resolution in ms
Quality labeling	Implicitly possible through server, explicitly possible via application. Values outside of the configured Min/Max range are automatically marked as invalid.
Designation of the transmission cause (COT)	Implicitly through server
Cyclic transmission	Can be configured with individual cycle time per information object
Background scan	Can be configured with individual cycle time per server instance
Update rates	Configurable monitoring cycle for detection of spontaneous value changes. Additional triggering possible through software. Automatic protection against system overload. Minimum cycle limited through free capacity of the CPU
Threshold filters	With -101 and -104 one threshold value can be configured per information object, filtration is either absolute or integrating
Connection monitoring	Connection status can be detected via diagnostics variables for customer software
Access control and logging	Limiting of the number of clients, IP address specification for client, integration with M1 Access Control: Logging of connections and write accesses

Communication – Control room networking

IEC60870-5 server	
Configuration	
Configuration interface	Integrated in Bachmann SolutionCenter
Data configuration/mapping	Via configuration interface (with variable browser and consistency check) - open configuration format (ASCII) for automated creation
Exchange with other manufac-turers	Import and export of CSV format
Diagnostics	
Monitor for information objects	Bachmann SolutionCenter shows all information objects with the last transmitted value and time stamp
Connection statistics	Visible in the monitor and diagnostics variables
Status variables	Yes (server publishes essential operating characteristics and diagnostic information also as SVI variables – visible for all applications and via module "Scope" loggable over time)
Debugging	Yes (runtime shiftable levels of information output)
Logbook	Yes (essential operational information is displayed in the central logbook)
Write accesses	Yes (logging in the M1 security log)
Installation	
Delivery form	Separately installable product (service); delivery on CD-ROM or as download
Installation	Via SolutionCenter
Licensing	Subject to individual license per CPU (regardless of number of servers, client connections or points of information)
License protection	Hardware-dependent license file
System prerequisites – controller	
Device	All M1 CPU families (MH200, MC200, MPC200, MX200) except ME203
System version	Msys from version 3.85, Mcore from version 3.80
System prerequisites – configuration	
SolutionCenter	SolutionCenter from version 1.85 (M-Base 3.85) – see SolutionCenter product data sheets
IEC60870-5-101	
Physical interface	Serial ports of the M1 CPU or of RS204 modules in operating modes RS232, RS422 and RS485. Parallel operation of multiple protocols on the same port is not possible
Operating mode of the Link Layer	Either symmetric or asymmetric
Addressing	Device via address of the connection layer (Link Layer) and station address (Common Address). Information object address (IOA) either structured (28.7.16) or flat (1836816), can be freely assigned in the configuration.
Baud rates	No restriction through the IEC server

IEC60870-5 server	
IEC60870-5-103	
Physical interface	Same as for -101
Addressing	Device: Common station address. Information object: Via FUN, INF or via GIN
IEC60870-5-104	
Physical interface	Ethernet IEEE 802.3 (interfaces of the M1 CPUs and EM2131) Parallel operation with other TCP/IP based communication on the same interface is possible.
Addressing	Device: Via selection of the Ethernet interface, as well as assignment of the IP port (default 2404). IOA same as for -101
Variants	
IEC60870-5-Server RT	License to operate the IEC 60870-5 server on one controller CPU. Provides communication over the ethernet or serial interfaces with standards-compliant clients using the IEC60875-5-101, -103 and -104 protocol in accordance with the compatibility documentation.
IEC60870-5-Server DVD	Software and documentation for the IEC60870-5 server. Provides access to process data according to the standards IEC 60870-5-101 and 103 - 104. Without a valid Runtime License the IEC60870-5 server runs only temporarily for 2h in demo mode.

Know-how protection

Manipulation protection

Cryptographic functions

Security log

Monitoring of variables

Access control

Communication security

SSL/TLS

Security

Modern machines and production plants are deeply integrated in IT environ-ments, whether this is in corporate networks or in public communication networks, for example for remote maintenance. This results in information security requirements that often present plant builders and operators with new challenges.

Faced with the constantly increasing pressure from international competi-tion, machine and plant builders are increasingly concentrating their unique selling points in the software. The build quality of different vendors is simi-lar, and thus also the resulting production speed. Experience and knowledge about the process are what makes the difference between vendors. Know-how is increasingly being integrated in applications and data, for example, in the form of algorithms, closed-loop control parameters and recipes. New chances arising from the offering of new services such as online monitoring and maintenance require secure communication routes, separated access areas and manipulation-proof logging. Ultimately, the operator must protect his intellectual property from unauthorized modifications or misuse by third parties if he wants to ensure the responsible use of his own plant.

For some time now, the requirements of regulations and standards have forced application sectors, such as the energy and water supply and func-tional safety sectors, into taking concrete measures. Particularly in these critical areas, the devices and software from Bachmann electronic are the preferred solution. Different protective measures such as secured network connections, user and access control and security logging have been inte-gral elements of every Bachmann controller for several years. The existing security concept is constantly being examined according to the latest stan-dards and regulations and further developed jointly with our customers, not just since Stuxnet or Duqu.

Security

With Bachmann one decisive step ahead.

Machines and production plants are connected with private and public communication networks in many cases today. Applications in the energy and water supply sector belong to the so-called critical infrastructures and place particular demands on information security stipulated by law.

Bachmann controllers are used worldwide especially in cases where maximum availability, robustness and communication skills are called for. Many years of experience in critical applications offer each user the assuredness that he is working with proven functions that are being developed constantly.

With an extensive security package for machines and plants, Bachmann protects its units from unauthorized access and logs every write access up to variable level if necessary. Quite incidentally, the security measures increase the robustness against communication problems that are caused, for example, by faulty network devices.

Security

| Features |
| --- |
| Layer-based protection concept |
| Ethernet load limitation |
| Securing of network services and logging by means of authentication and end-to-end encryption (SSL) |
| Access control and logging |
| Protection functions at system level |
| Open interfaces for access control and cryptographic functions in user applications |
| Continuous, independent security log |
| Predefined security levels for basic protection |
| Integrated component of the M-Base |

Security

Communication and information security

The direct consequences of targeted, destructive access to a machine controller or an unintentional operating error are the same: standstill or even destruction of a machine or plant and thus production stoppage, loss of reputation and money. Therefore, the main objective is to ensure robustness against disturbances. Protection of data and communication as well as the logging of access are preventive measures which make unauthorized access more difficult and bring irregularities to light.

Targeted access

Exposed machines and plants are not subject to the same perimeter protection as enclosed industrial plants. Hence, wind power plants or biogas plants are relatively easy to access and the response times in the event of a detected break-in are high. High risk in production plants mainly emanates from legitimized persons. Service staff from the external service provider or a dismissed employee who in frustration succumbs to the temptation of a targeted act of damage to property are two classical examples.

The targets here are switches, routers and controllers with free ports. These can be used for inconspicuous disruption or for targeted interception of communications.
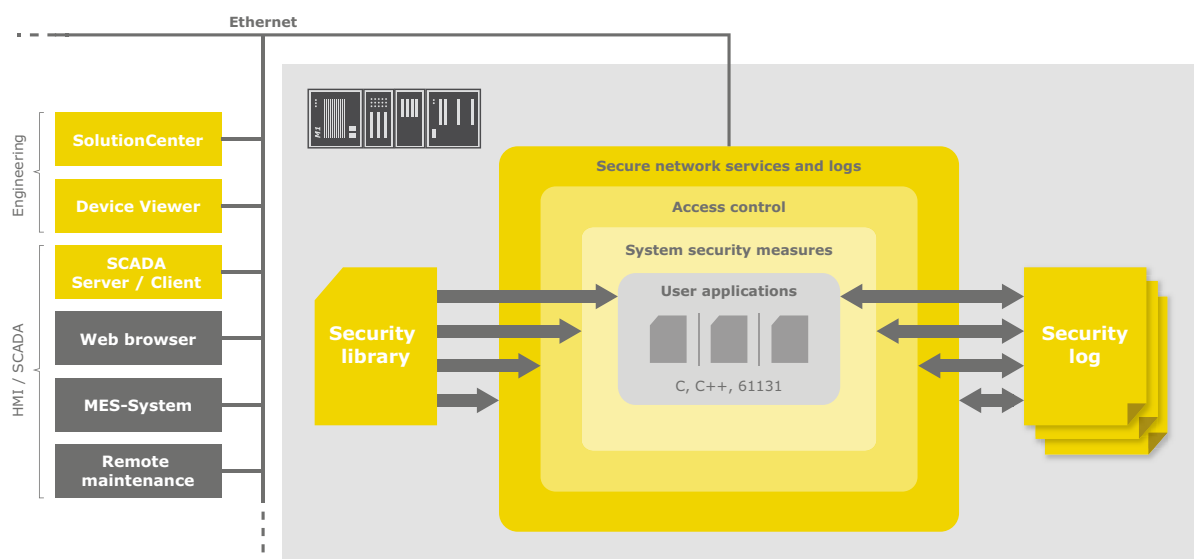
The layer-based security architecture forms multiple security walls around user applications. Each level includes specific security measures that can also be used in user-specific applications.

Security

Control components of Bachmann have various measures for counteracting targeted access. Effective mechanisms are in place for protecting against network overload which ensure stability of the application in the event of denial of service attacks. Vigorous implementation of end-to-end encryption of the communication by SSL renders eavesdropping ineffective. User programs use interfaces to current cryptographic procedures to encrypt data.

Critical infrastructures

Guided by national and international regulations, public utility companies are particularly sensitized in matters of security and are obligated to protect their plants accordingly. Comprehensive measures embedded in detailed security concepts at all organizational levels have long been established. Protective fencing, own surveillance staff and continuous access controls have been found in critical parts of these plants. Control networks and operating panels were strictly sealed off previously. In the meantime, modern business and service models require targeted access of other organizational components via Intranet and even externally via Internet.
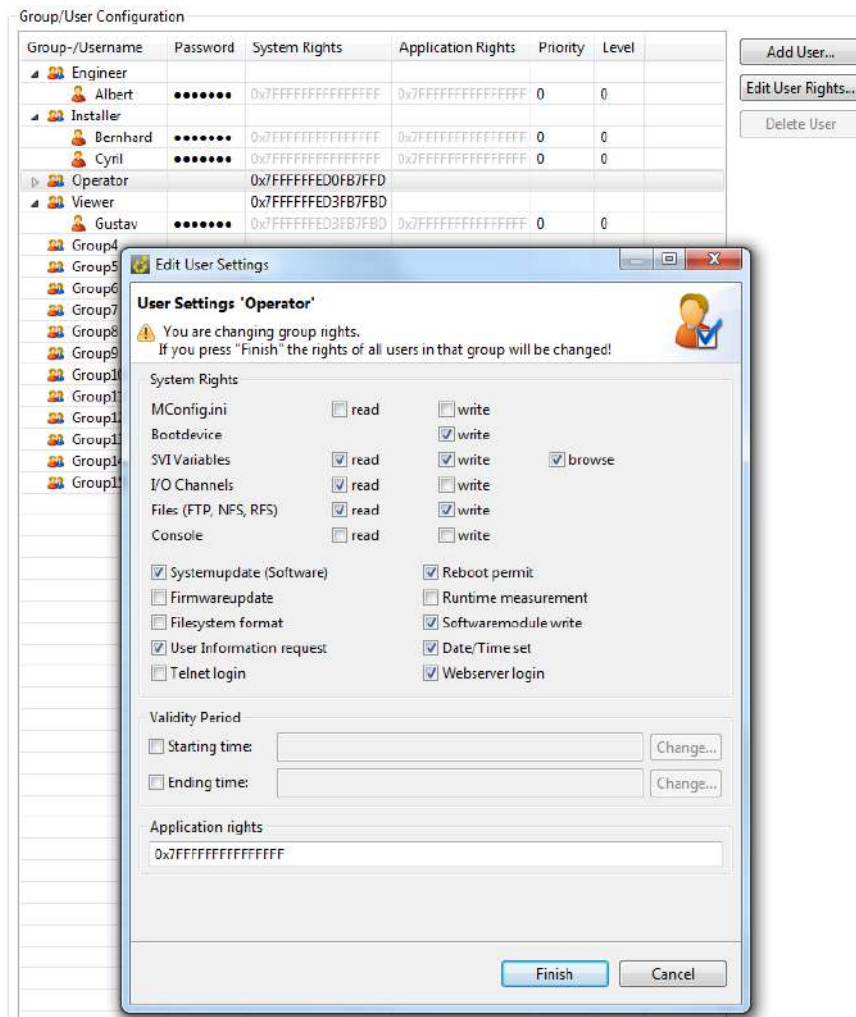
Access Control includes a powerful module for user and access control. Users and groups can be created by simple Copy&Paste as well as by integrated inheritance logic thus saving a great deal of time. The clear assignment of system rights allows the specific assignment of rights for each user.
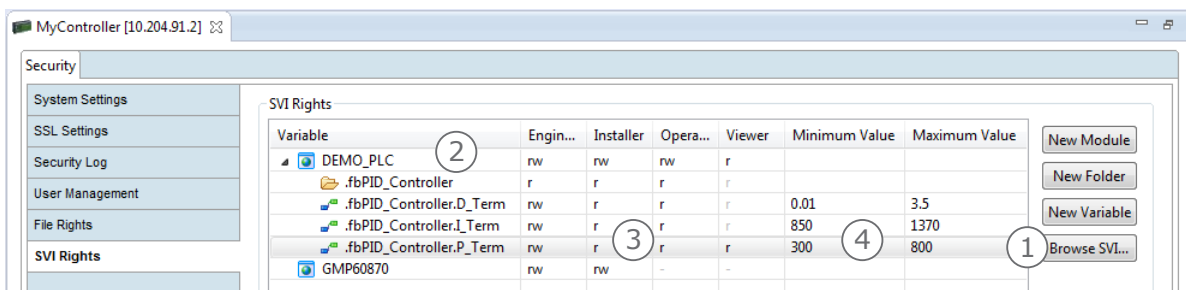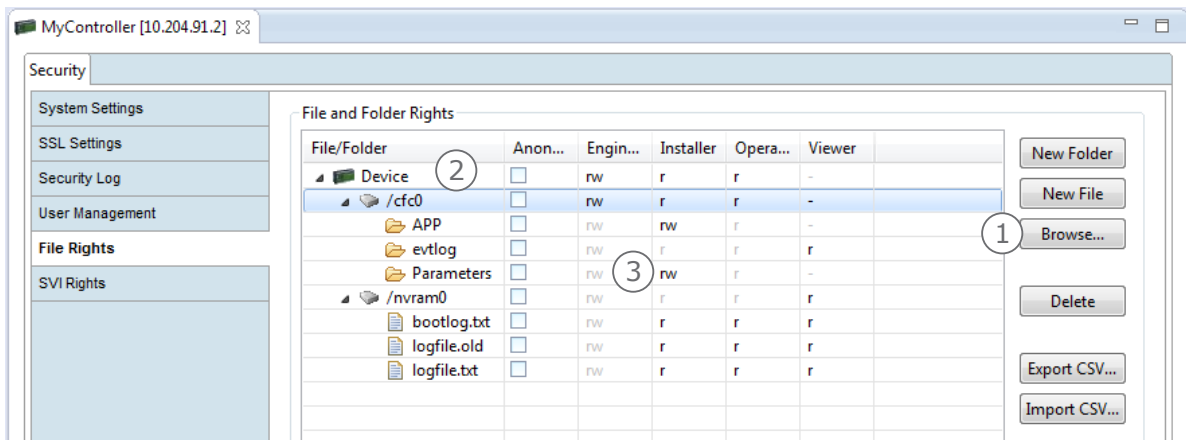
Management of file and variable rights:

(1) Individual files and variables or entire folders are selectable for the rights management using a browser.

(2) These are presented in a clear tree structure.

(3) Finely grained read and write permissions can be assigned user-related directly in the list using the Inline-Editing function.

(4) Additionally variables can be limited in the value range.

Defects and operating errors

Targeted security management only helps in the case of undesirable and potentially destructive access. Inadvertent changes to machine parameters, failures of network components or misconfigurations of the machine network are far more frequent, particularly in the protected environment of production plants, but pose the same security threats in terms of symptoms and effects. For example, a broadcast storm as a result of a faulty network switch, overloads connected network clients in the same way as a targeted denial of service attack.

Unlike other security measures, the added value of revealing defects can only be achieved if appropriate protective measures directly affect the controller.

Bachmann provides its controllers with functions for limiting the bandwidth of the ethernet ports in order to increase the robustness against intentional and unintentional network disturbances. Real-time processes are not disturbed by overloading of the network interface.

It is advisable to set up a user and access management system for each user via Access Control. This limits any possibilities of manipulation centrally according to the least privilege principle, and independent security logging allows changes to be allocated to individual users. Operating errors can thus be detected and warranty cases processed speedily.

Security

Safety and Security

Functional safety requires a high degree of security measures to prevent operating errors. Unnoticed changes to the safety programming as well as dangerous interferences during safe operation must be prevented and logged. Safety Control of Bachmann already warns about any malicious, manipulated code on the configuration computer and protects against inadvertent changes by means of functions for pinning software versions. A separate login system on each safety controller allows individually restrictable access. The continual logging is tamper-proof and imple-mented redundantly, so that even in the case of partial destruction of the module, it will be possible to reproduce the chain of events up to the failure with a high degree of probability.

Simply secure

Security measures are only effective if they are also applied. Bachmann sees it as its task to promote the total application and dissemination of security functions even when no comprehensive security concepts exist and the staff are still not security experts. Simple activation and operation of the extensive protective measures ensures that the dangers of careless operation and simple attacks are already minimized even at this early stage.

The central part is composed of four predefined security levels that can be selected in the security configurator. Behind this are templates which set the settings within the controller so that certain logs and functions are activated or even forbidden depending on the level.

Basic protection is gainable in three steps:

1 *Safeguarding the system and network*
- setting the **security level**
- deactivating unnecessary services
- activating **logging**

2 *Limiting access*
- **defining group rights**
- **creating users**
- **setting file rights**

3 *Securing user programs*
- Implementing **applications** while taking general security aspects into account
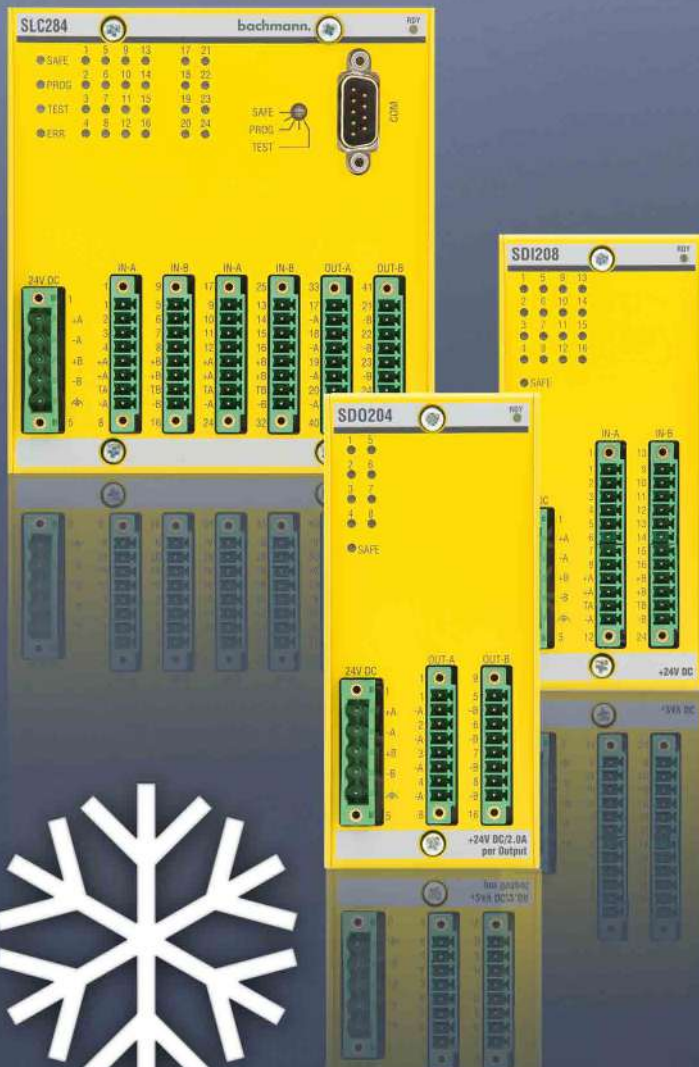
Recommended procedure for safeguarding the control

The online security monitor gives comfortable overview:

(1) Details according to logged in users and the token status

(2) Security log entries show details to connections and communication status, e.g. login/logout (3) or assignment of new values to variables (4)

Security

Security	
Ethernet	
Load limitation	Separately adjustable limitation of the read and write workload for each Ethernet interface; Protect the machine application against DDoS attacks (Distributed Denial of Service), Broadcast Storms and defects in the network infrastructure.
Network services and logs	
SSL/TLS based network communication	Security standard for the establishment of a secured communication channel at IP-level. Support (selection): *Bachmann products:* Configuration and programming tool SolutionCenter, WebMI Pro, M1COM, MJCOM *Manufacturer neutral:* OPC UA, webserver, file transfer
Server and client authentication	The M1 controller can be an SSL server as well as a client. The client authentication is also supported in server mode. This is used for certificate-based authentication of computers, services and users on the M1.
Secured and deactivatable services (webserver, OPC-server, FTP, NTP, SMTP …)	Unnecessary protocols can be deactivated by configuration. This ensures that only used ports are accessible thus reducing the area for attack.
Access Control	
User Administration	Password protected restrictions are configured on a group and user basis for system access and application rights. Time-restricted access is provided.
Token-based write access protection	The special mechanism guarantees that the token owner is granted exclusive write permission. Additionally, prioritization can be assigned based on the user role. Various degrees of priority can be assigned at user and group level.
File access	File access, i.e. authorization for the read or write operation as well as the visibility for browse requests can be set at group level. The configuration allows individual assignment of rights at directory and file level and facilitates this by means of the available inheritance logic.
Variable protection	The visibility, read and write access of online available process variables can be allocated to access rights of the individual user. Mechanism and configuration as with file permissions.
User specific extensions provided	User and access management system as well as the token mechanism can be replaced by user-specific applications. Thus, special policies and functions can be implemented and the controls can be integrated smoothly into existing systems.

Security	
System	
Enable/disable application development	Protection against installation of unauthorized programs.
Memory protection	Application programs are protected at memory level against write access from other applications. Protection against malware that want to eavesdrop and manipulate data at operating system level. Protection against buffer overflows.
Null pointer protection	Special protection to prevent manipulations via null pointer exception handling.
Security log with archiving function	Login and logout of users as well as each write access are logged at variable level, security-relevant modifications are noted. Timestamp, user, group, old and new value as well as further details are stored in continuously generated file archives. Access is offline, e.g. via a central archiving system, but online is also possible via application programs or SCADA systems.
Predefined security levels	Four templates for simplifying and shortening the security configuration.
User Application	
Access Control	The information for logged in users, their session status and security protocols can be accessed from user programs.
Security Library	Symmetric, asymmetric encryption procedures, signature and authentication procedures, block and stream ciphers, SSL/TLS are available to the application programs by means of openSSL library. These functions can be used in PLC in the form of library functions.
Examples of important cryptographic procedures and secure methods for network communication	Symmetric encryption: AES, 3DES Asymmetric encryption: RSA hash functions: SHA, RIPEMD, MD5 MAC functions: CBC-MAC, HMAC Signature algorithms: RSA-PSS, ECDSA Key transfer process: SSL/TLS (TLS 1.2, TLS 1.1, TLS 1.0, SSL 3.0) Certificate variants, data encoding: PKS7, PKS12, x509
Standards, regulations and recommendations	
Security in Control Systems	The security measures were implemented while taking the following standards, regulations and recommendations into account: IEC 62351, IEC 62443, ISA 99, VDI/VDE 2182, FIPS 140, NIST 800 series
Publisher	BSI, BDEW, NERC
System prerequisites	
Automation equipment	M1 CPUs of the MX200 series or better
Engineering PC	For system prerequisites see SolutionCenter
Runtime software	M-Sys / MxCCore ≥ V3.80
Engineering software	M-Base ≥ 3.80
Installation medium	Included in M-Base (runtime and engineering components)

Safety Control

Safety technology

Safety – for man as well as machine – plays an increasingly important role in the world of automation: Machines and plants are becoming ever more complex and the requirements imposed on functional safety continuously increase.

Bachmann electronic offers a safety package that is consistently integrated in the M1 automation system that is designed for the most rigorous safety requirements. It consists of the programmable SLC284 safety module, digital I/O modules, and the Safety Developer, and it can be extended to meet individual needs in accordance with the latest safety standards (PL e, SIL3, Cat 4). And best of all: In addition to safety, efficiency is also increased; the intelligent safety technology helps to significantly lower engineering costs. Through specific diagnostic possibilities and the fastest possible intervention, availability of the machine/system is increased and downtimes are reduced.

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Safety module & Safety Developer

Integrated safety.

With the safety modules for realization of functional safety, Bachmann electronic is setting a clear signal for a holistic and integrated automation solution. The systems presented here not only offer the best-possible safety, they also guarantee continuity and investment protection.

The new programmable safety module, SLC284, and the digital I/O safety modules, SDI208 or SDO204, make it possible to set up a solution that is integrated in the M1 Automation System. This solution can be adapted to the individual requirements and satisfies the latest safety standards.

Safety processor module SLC284

Features
16 digital inputs / 8 digital outputs – can be used redundantly in pairs (PL e / SIL3 / Cat 4)
Programmable in function block language in accordance with IEC 61131-3
Programming, configuration, monitoring and debugging per SolutionCenter
Manipulation protection thanks to configurable user schemes with access and function restrictions
1x RS232 for on-site maintenance access without developer tools

Digital input module SDI208

Features
Digital input module with two galvanically separated input groups
16 digital input channels – can be used redundantly in pairs (PL e / SIL3 / Cat 4)
Each channel can be optionally tested per test clocking
Cross-circuit detection
Autonomously safe – robust against network breakdowns

For the subsequent safety-relevant safety engineering steps the SolutionCenter contains the Safety Developer, which includes all the required tools for safety-oriented programming in accordance with FBD acc. to IEC61131-3 and PLCopen, and has been developed and certified in close cooperation with TÜV.

Digital output signal SDO204

Features
Digital output module with two galvanically separated output groups
8 digital output channels – can be used redundantly in pairs (PL e / SIL3 / Cat 4)
Autonomously safe – robust against network breakdowns
Output voltage range +18 .. 34 V DC
2 A per channel
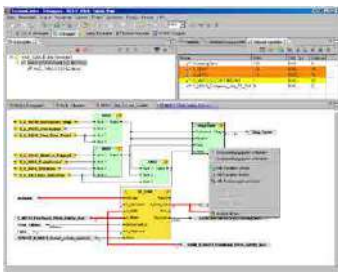
Safety Developer Engineering tool

Features
Integrated in the SolutionCenter all-in-one engineering tool
Full-graphic function plan editor with autorouting
Certified safety modules in accordance with PLCopen Safety
Standard modules for logical links, timers and arithmetic operations in accordancen with EN61131-3
Integrated debugger and monitor - online monitoring in safe operation

Safety modules
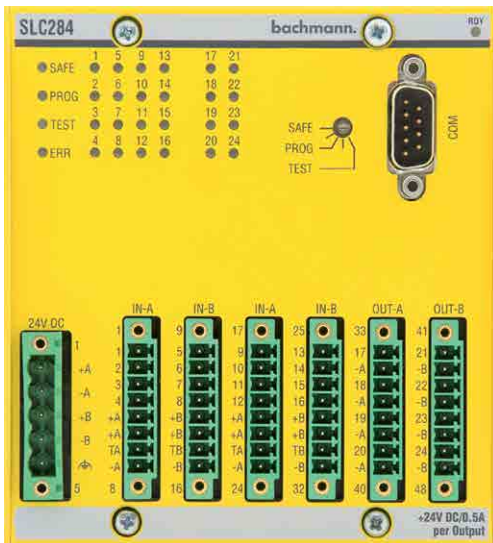
Safety Control

Safety processor module SLC284

The programmable safety controller SCL284
– ideally integrated in the M1 controller – is
presented as an independent, safe, and modern
safety controller. The Safety Logic Controller is
approved in accordance with the latest safety
norm, IEC61508.

No additional cabling is needed for communication
between the Safety Logic Controller SLC284 and
the safety I/O modules SDI208 and SDO204.
The modules can be separated by several hundred
meters and operated in a distributed manner via
the bus expansion or a FASTBUS.

- 16 digital inputs / 8 digital outputs – can be
  used redundantly in pairs (PL e/SIL3/Cat 4)
- Each output with emergency delay is
  configurable in the event of communication lost
- Safety Controller with two independent 32-bit
  microcontrollers
- Fastest program cycle 5 ms
- Decentralized I/O via FASTBUS or bus expansion
  with SDI208 or SDO204
- All safety I/O states can be used by the M1
  controller
- Safety programming via SolutionCenter
- Galvanic isolation between the groups
- Galvanic isolation from the system bus
- Operating mode selector switch
- Operating status display »SAFE«, »PROG«,
  »TEST«, »ERROR«
- Status display for each channel via LED
- Programming via independent serial interface or
  via controller

Item	Item no.
SLC284	00014273-00
SLC284❄	00017465-00

SLC284	
Processor	
CPU	2x LPC2468, 72 MHz, 32 bit
Controller	
Programming	via controller (I/O bus) or serial interface (COM)
Number of independent safety programs per SLC	1
Program cycle	minimal 5 ms
I/O expansion	via SDI208 or SDO204 modules
Digital inputs	
Quantity	16 digital inputs - can be used redundantly in pairs (PL e/SIL3/Cat 4)
Input voltage range (H)	15 .. 34 V DC
Input voltage range (L)	-34 .. +5 V DC
Input delay (normally) HW	300 µs
Input delay (normally) SW	1 ms with deactivated test clocking
Input type according to IEC61131-2 input current at least	type 1 3.5 mA at 24 V DC
Status display (LED)	green
Error monitoring	internal function monitoring external test clocking optional
Digital outputs	
Quantity	8 digital outputs - can be used redundantly in pairs (PL e/SIL3/Cat 4)
Output voltage range	18 .. 34 V DC
Output current per channel (max.)	0.5 A nominal
Total current per group (max.)	2 A
Delay 0 to 1	max. 35 µs at full load
Delay 1 to 0	max. 155 µs at full load
Output groups	2, electronic fuse
Status display (LED)	green
Switching frequency (max., ohmic load)	500 Hz
Error monitoring	short circuit, overload, inadequate or excess voltage of the power supply
Time-delayed emergency shut-off	each output individual from 0 .. 1800 s configurable (resolution 100 ms); Emergency shut-off is activated in the event of communication lost e.g. cable break or failure in the supply voltage

Safety modules

SLC284	
Internal power supply	
Galvanic isolation from the system	500 V
Galvanic isolation between groups	500 V
Internal power supply	Backplanes BS2xx
Current consumption internal	5 V / 600 mA via backplane
External power supply	
Reverse polarity protection	yes
Input voltage	24 V DC (18 .. 34 V)
Current consumption	normally 95 mA at +24 VDC + Σ current consumption of the encoders and sensors
Connection technology	
Connection technology	screw or spring terminal, writable and codable plug
Standards	
Machine safety	IEC61508: Functional safety – draft of complex E/E/PE safety components
Approved for	ISO13849: Safety of Machinery IEC62061: Functional safety machine-related E/E/PE systems IEC61511: Functional safety equipment and process industry EN954
Product standard	IEC61131-2 UL508
Additional features	
Status display via LEDs	
Operating mode adjustable via hex switch	

Ambient conditions	Standard	ColdClimate (❅)
Operating temperature	-20 .. +60 °C fanless	-30 .. +60 °C fanless
Relative humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	-40 .. +85 °C
Relative humidity storage	5 .. 95 % without condensation	5 .. 95 % with condensation

Model variants	
SLC284	Safety CPU module; integrated digital input/output; SIL3/PLe: 8x DI 24V; 4x DO 24V / 0.5A; (SIL2/PLd: 16x DI, 8x DO); 6ms cycle time; RS232; operating standalone or with CPU modul
SLC284❅	like SLC284; ColdClimate (❅)
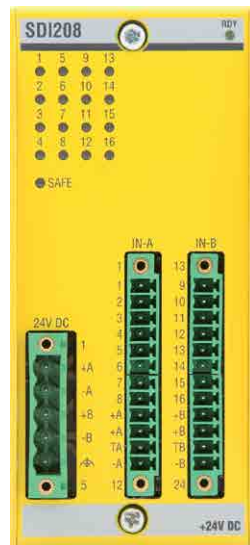
Safety input modules
SDI208

The safety input module SDI208 adds an additional 8 input channels to the safety logic controller SLC284. A homogeneous total system is created through independent and safe integration in the M1 controller. Through the free choice of the slot – either directly beside the safety controller, through bus expansion, or several hundred meters away through the FASTBUS – the safety system can be optimally adapted to the distributed requirements and existing infrastructure of the system.
The input module, SDI208, is approved under the latest safety standard IEC61508. The input module can be easily integrated in the safety application, comparable with a standard I/O module – as the proven »SolutionCenter« development platform offers the easiest configuration, most flexible type of programming, and a safe simulation via easily combinable PLC-Open function modules. All variables, and states of the SDI208 safety input module are accessible in all other machine program languages (PLC, C/C++, Java); visualization is also available and makes cumbersome parallel wiring unnecessary.

- 16 digital inputs – can be used redundantly in pairs (PL e/SIL3/Cat 4)
- Safe monitoring of the inputs with redundant 32-bit microcontrollers
- Several SDI208 modules per controller possible
- All safety I/O states can be used by M1 controller
- Safety programming via SolutionCenter
- Galvanic isolation between the groups
- Galvanic isolation from the system
- Operating state display »SAFE«
- Status display for each channel via LED

Safety Control

Item	Item no.
SDI208	00014544-00
SDI208❄	00017459-00

Safety modules

SDI208		
Digital inputs		
Quantity	16 digital inputs - can be used redundantly in pairs (PL e/SIL3/Cat 4)	
Input voltage range (H)	15 .. 34 V DC	
Input voltage range (L)	-34 .. +5 V DC	
Input delay (normally) HW	300 µs	
Input delay (normally) SW	1 ms with deactivated test clocking	
Input type according to IEC61131-2	type 1	
Input current at least	3.5 mA at 24 V DC	
Status display (LED)	green	
Error monitoring	internal function monitoring external test clocking optional	
Internal power supply		
Galvanic isolation from the system	500 V	
Galvanic isolation between groups	500 V	
Internal power supply	Backplanes BS2xx	
Current consumption internal	5 V / 600 mA via backplane	
External power supply		
Reverse polarity protection	yes	
Input voltage	24 V DC (18 .. 34 V)	
Current consumption	normally 65 mA at 24 VDC + Σ current consumption of the encoders and sensors	
Connection technology		
Connection technology	screw or spring terminal writable and codable plug	
Standards		
Machine safety	IEC61508 Functional safety draft of complex E/E/PE safety components	
Approved for	ISO13849: Safety of Machinery IEC62061: Functional safety machine-related E/E/PE systems IEC61511: Functional safety equipment and process industry EN954	
Product standard	IEC 61131-2 ... UL508	
Additional features		
Status display via LEDs		
Ambient conditions	Standard	ColdClimate (❄)
Operating temperature	-20 .. +60 °C fanless	-30 .. +60 °C fanless
Relative humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	-40 .. +85 °C
Relative humidity storage	5 .. 95 % without condensation	5 .. 95 % with condensation
Model variants		
SDI208	Safety digital input module; SIL3/PLe: 8x DI 24V; (SIL2/PLd: 16x DI)	
SDI208❄	like SDI208; ColdClimate (❄)	

Safety output modules SDO204

The safety output module, SDO204, adds an additional 4 output channels to the safety logic controller, SLC284, and a homogeneous overall system is created through the independent and safe inclusion in the M1 controller. Through the free choice of the slot – either directly beside the safety controller, through bus expansion, or several hundred meters away through the FASTBUS – the safety system can be optimally adapted to the distributed requirements and existing infrastructure of the system.
The input module, SDO204, is approved under the latest safety standard IEC61508.
The input module can be easily integrated in the overall safety application, comparable with a standard I/O module – as the proven »SolutionCenter« development platform offers the easiest configuration, most flexible type of programming, and a safe simulation via easily combinable PLC-Open function modules. All variables and states of the SDO204 safety output module are accessible in other machine program languages (PLC, C/C++, Java), however the visualization is also available and makes bothersome parallel wiring unnecessary.

- 8 digital outputs – can be used redundantly in pairs (PL e/SIL3/Cat 4)
- Each output with emergency delay is configurable in the event of communication lost
- Safe monitoring of the inputs with redundant 32-bit microcontrollers
- Several SDO208 units per controller possible
- All safety I/O states can be used by M1 controller
- Safety programming via SolutionCenter
- Galvanic isolation between the groups
- Galvanic isolation from the system
- Operating state display »SAFE«
- Status display for each channel via LED

Safety Control

Item	Item no.
SDO204	00014545-00
SDO204✺	00017462-00

Safety modules

SDO204	
Digital outputs	
Quantity	8 digital outputs - can be used redundantly in pairs (PL e/SIL3/Cat 4)
Output voltage range	18 .. 34 V DC
Output current per channel	2 A nominal
Total current per group (max.)	8 A (derating from 40 °C ambient temperature)
Delay 0 to 1	max. 35 µs at full load
Delay 1 to 0	max. 155 µs at full load
Output groups	2, electronic fuse
Status display (LED)	green
Switching frequency (max., ohmic load)	500 Hz
Error monitoring	short circuit, overload, inadequate or excess voltage of the power supply
Time-delayed emergency shut-off	each output individual from 0 .. 1800 s configurable (resolution 100 ms); Emergency shut-off is activated in the event of communication lost e.g. cable break or failure in the supply voltage
Internal power supply	
Galvanic isolation from the system	500 V
Galvanic isolation between groups	500 V
Internal power supply	Backplanes BS2xx
Current consumption internal	5 V / 250 mA via backplane
External power supply	
Reverse polarity protection	yes
Input voltage	24 V DC (18 .. 34 V)
Voltage range	18 .. 34 V DC
Current consumption	normally 70 mA at +24 VDC + Σ current consumption of the encoders
Connection technology	
Connection technology	screw or spring terminal writable and codable plug
Standards	
Machine safety	IEC61508 Functional safety draft of complex E/E/PE safety components
Approved for	ISO13849: Safety of Machinery IEC62061: Functional safety machine-related E/E/PE systems IEC61511: Functional safety equipment and process industry EN954
Product standard	IEC 61131-2 UL508

SDO204		
Additional features		
Status display via LEDs		
Ambient conditions	Standard	ColdClimate (❆)
Operating temperature	-20 .. +60 °C fanless	-30 .. +60 °C fanless
Relative humidity operation	5 .. 95 % without condensation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C	-40 .. +85 °C
Relative humidity storage	5 .. 95 % without condensation	5 .. 95 % with condensation
Elevation limit	2000 m above sea level (use), 3000 m above sea level (storage & transport)	
Model variants		
SDO204	Safety digital output module; SIL3/PLe: 4x DO 24V / 2A; (SIL2/PLd: 8x DO)	
SDO204❆	like SDO204; ColdClimate (❆)	

* Derating of 40°C ambient temperature
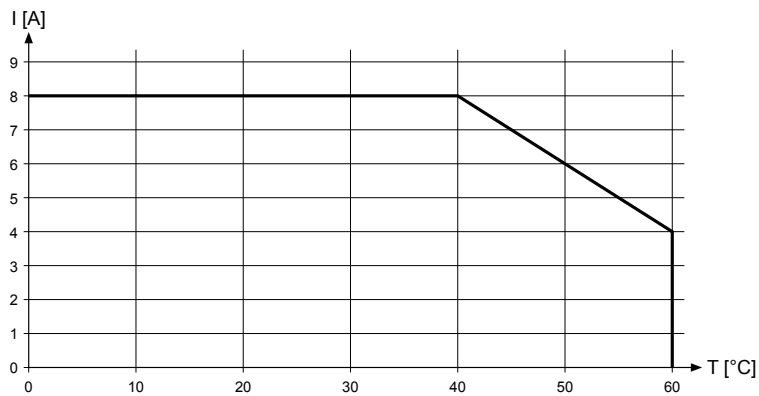
Safety Developer

Safety Developer Engineering tool

For the more safety-relevant, engineering steps the SolutionCenter contains the Safety Developer that includes all tools required for safety-conformant programming in accordance with EN61508 andb PLCopen. Safety Developer has been developed and certified in close collaboration with TÜV. All methods required for logging and the verification obligation of the machine manufacturer are integral components: password management, fail-safe program transmission, tamper-proof logging on the target device, documentation of the safety program, and all software components used, unique identification of the safety modules, and the programming itself.

- Integrated in the SolutionCenter all-in-one engineering tool
- Full-graphic function plan editor with autorouting
- Certified safety modules in accordance with PLCopen Safety
- Standard modules for logical links, timers and arithmetic operations in accordancen with EN61131-3
- Color coding of secure and unsecure signal flow
- Grouping of circuitry parts for repeat use (compound)
- Adjustable test depth for the project translation
- Variable monitoring, value simulation and break points
- Open programming interfaces (PLC, C, C++) for e.g. online monitoring

- Bidirectional exchange of values between secure and non-secure controller
- Unique identification of the safe hardware
- Configuration of the clocked self-monitoring of inputs/outputs
- Communication to safe hardware via Ethernet (M1) or serial
- Certified redundant program download
- Logging of the acceptance state in PDF format
- Direct connection to version management
- Online monitorning of all I/Os also in safe operating mode
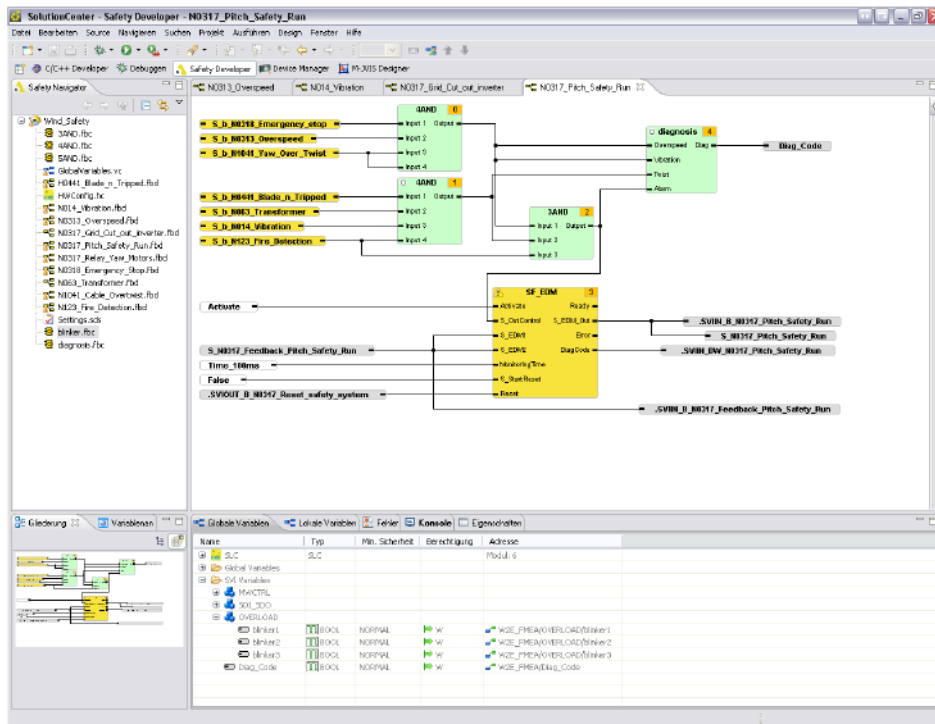
**Programming in accordance
with PLCopen Safety**

The safety application is programmed in a free-graphic function plan editor (Safety Editor) in accordance with EN61131-3. The module set includes a library of safety modules that have been strictly implemented, tested, and certified in accordance with the PLCopen safety standard. For the logic, additionally required standard modules, such as timers, arithmetic, and logical operations are available. The application can be organized in multiple separated functional units and sub programs in order to structure the program. Unsafe input and output signals from the control system can be added to the safety project via a browser. The execution sequence of the modules is presented graphically and can be corrected by the user. Redundant hardware inputs are summarized via equivalence or antivalence blocks and subsequently presented as a safe signal in the program. The data types, bool, integer, and time, are supported.

Safety Developer

Visibility in the standard program

The transparent exchange of signals functions in both directions. In the Safety Developer you configure which values – irrespective of the states of the safe I/Os – should also be visible in the unsafe world. Thus intermediate results in networks and the status of modules can be presented in a visualization, recorded with the Scope, or evaluated in a PLC program. Thus there are extensive diagnostic possibilities and a high level of operating convenience.

Safe and unsafe paths

Signals from the standard sequential program and from the I/O modules of the control system can be used in the safety program as unsafe input and output signals. The classification of a signal as safe or unsafe is presented with color coding.

User-specific templates

A logical circuit that is structured from a group of basic modules can be put together and given an interface in the project for a function group. Thus separate user-specific function blocks (templates) can be created and used in the project multiple times. These groups or even complete networks can also by transferrred from one project into the next project.

Tracking changes

In the Safety Developer version management is an integral component – regardless of the logging and verification obligation. The version management database is operated directly from the project navigator. A local history is always kept automatically, which enables reversal of changes even without a genuine version management system. Naturally Undo/Redo functions are also available.

Program verification

The program for execution on the target system is not compiled, but rather is translated into a script that is checked and executed redundantly by the firmware o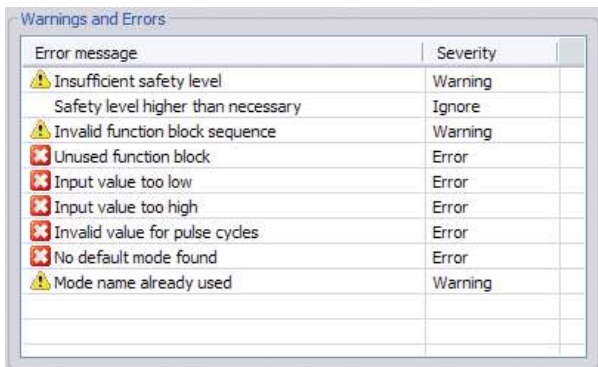f the target system. Nevertheless the Safety Developer can detect and display possible error sources in the code when the script is generated.

Modularity

Error message	Severity
⚠ Insufficient safety level	Warning
Safety level higher than necessary	Ignore
⚠ Invalid function block sequence	Warning
❌ Unused function block	Error
❌ Input value too low	Error
❌ Input value too high	Error
❌ Invalid value for pulse cycles	Error
❌ No default mode found	Error
⚠ Mode name already used	Warning

The Safety Developer takes the flexible requirements in today's industry into account through its modular project management. FBD networks, and also additional safe I/O modules of the project, can be activated depending on the expansion stage, signals can be connected to different sources and potentially susceptible equipment, thus a project for maximum machine expansion can be created and tested. Adaptation to the real degree of expansion is achieved through the bringing together of the desired parts. Commissioning of individual machine parts is also possible in this manner.

Logging

The verification obligation is supported in different ways. For logging of acceptance, a project report can be generated that also presents the entire program code graphically. The tamper-proof log book of the safety controller logs each safety-relevant change in the system, such as the download of a changed program. Thus any manipulation can be traced with user name, date, and time.

Optionally the safety program can be stored on the safety controller and can be opened and further processed from the controller. Additional user-specific information, such as author, version history, and additional comments can be stored for each network.

Hardware configuration

In addition to the tools for variable selection, programming, and logging, the safe hardware can also be directly configured in the Safety Developer. This includes not only assignment of unique channel names, but particularly also allocation of the controller to the project, the adding of additional safe I/O modules, and specification of test intervals for clocked lines, which then are tested automatically by the hardware for short circuit, cross-connection, and interference voltage.
Safety-relevant, required unique module identification that excludes the possibility of swapping modules after a service deployment is also executed directly in the Safety Developer. Communication between Safety Developer and the control system for program download, diagnosis and configuration is executed conveniently and in broadband via the Ethernet Interface of the M1 control system. Alternatively, communication can also be executed directly with the Safety Controller via a serial RS232 interface, which also enables use of the Safety Controller as a stand-alone solution without a surrounding control system.

Redundancy
Control

Redundancy – maximum availability ensures productivity

Automation devices from plant, transport and mechanical engineering are no longer unthinkable. They control and regulate mission critical systems - often entirely stand-alone or with requirements that manual operation can no longer perform. Maximum reliability and ranges of solutions for high-availability applications call for increasingly higher demands on productivity right up to 27/7 availability.
Proven ruggedness and exceptional service life data are are often insufficient here. Effective measures against network, sensor and wiring outages, as well as statistically rare component part failure, are required.

Bachmann electronic with its scalable redundancy products for the proven M1 automation system always provides the right solution. The redundancy product series upgrades the significant ruggedness and availability of the hardware modules universal fault tolerance. The software-only implementation based on redundant Ethernet real-time networking guarantees compatibility without special and expensive redundancy hardware and makes upgrading of existing applications possible.

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Redundancy

The right solution for each application

Hot-standby redundancy
Maximum reliability thanks to fully automatic variable exchange and bumpless application switchover. Ideal where outages are economically unacceptable and for technical challenges like in rapid control applications.

Warm-standby redundancy
Values interchange is supported by network redundancy. Adjusts to redundant data recording and for simple and less critical redundancy applications.

Network redundancy
Using the basic redundancy version, critical transmission links are protected against interruptions due to mechanical damage and network equipment outages.

Redundancy Control

Common features
Redundancy cycles up to 1 ms possible*
Automatic switchover between variables and process value sources within one PLC cycle
Support of fully autonomous, dual communication guarantees maximum reliability with freely selectable transmission medium (copper/optical fiber)
Integration of configuration, monitoring and programming in the engineering tool SolutionCenter
Redundancy networking on Ethernet basis, full support of TCP/IP-based parallel communication
Networking topology freely selectable: star, bus, ring and combinations ➔ easily adaptable to existing network
Master CPUs: all processor modules from the MPC, MC, MH series
Retrofitable and upgradable without CPU exchange, application of standard components
Support of standard applications in addition to redundancy applications, even with diverse cycle times
Standard operating range of -30°C … +60°C, with short-term Temperature peaks of -40°C … +70°C with condensation present when using cold climate modules

* tested with CPUs of the MPC series; limit value subject to CPU type, memory available, application size, number of exchangeable variables, network bandwidth available, network and CPU load via non-redundant applications
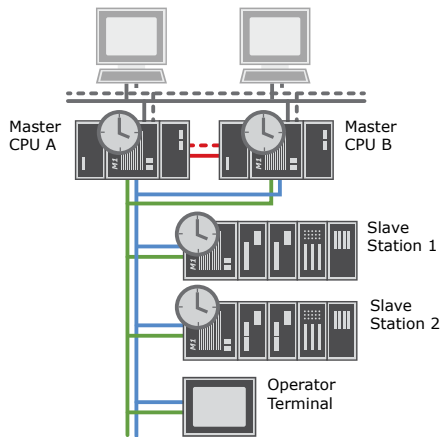
Hot-standby redundancy

Features
Two master CPUs
Automatic matching of the master CPUs
Bumpless switchover
Chronological synchronization of all stations
Configuration and monitoring in the SolutionCenter
Expanded diagnostic and programming interfaces for monitoring and analysis of redundancy status
Network redundancy included
Freely adjustable switchover time, automatic switchover in case of error
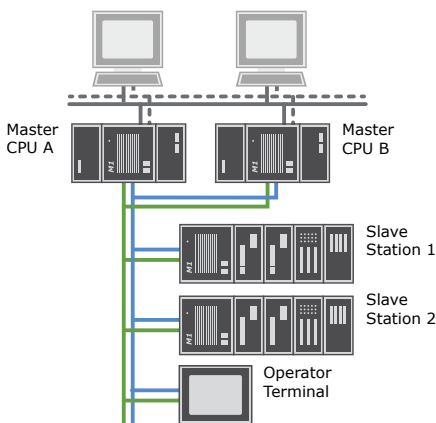
Warm-standby redundancy

Features
Two master CPUs
Diagnostic interface for monitoring and analyzing the redundancy status
Slaves decide from which CPU the data packet is applied (voter)
Switching time configurable
Matching of the master CPUs not integrated
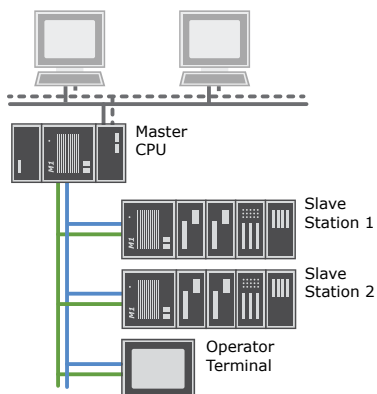
Network redundancy

Features
One master CPU
Redundant communication (cyclic and non-cyclic communication)
Easy configuration in development environment, integrated diagnostics (status, quality)
Programming interface, libraries and system variables for easy creation of applications
Slaves work as smart substations
Network switchover in the same PLC cycle

Redundancy

Master CPU A
Master CPU B
Slave Station 1
Slave Station 2
Operator Terminal

Redundancy Control
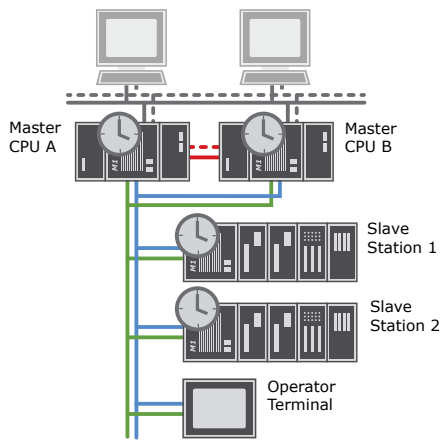
Hot-standby redundancy

Mission-critical systems, applications in harsh environments and facilities where even short outages, e.g. owing to cost restraints, are not tolerated are hot-standby redundancy's main fields of activity. In addition, control engineering applications with their requirement of smooth switchover, i.e. no deviation between values when switching the master CPU, are executable in this redundancy version too.

With redundancy on all system levels (i.e. hardware, system software, application programming and maintenance, monitoring interfaces) hot-standby redundancy provides maximum reliability with outstanding convenience at the same time.

The full integration of configuration, programming and monitoring in Bachmann tools shortens application creation and minimizes deviations with respect to everyday standard operating sequences. At the same time, risks in the course of maintenance operations, error corrections and application updates decrease during the process in operation.

Hot-standby redundancy combines the highest redundancy technology and the best performance possible with the customary ruggedness of every Bachmann module.

Hot-standby redundancy enhances network redundancy by the following attributes, among others:
• Fully automatic matching of process variables
• Automatic failover upon detecting internal errors
• Integrated self-tests for checking system status
• Automatic system matching (system software, configuration, applications)
• Automatic application synchronization (variance < 200 µs)

Item		Item no.
M-HS-REDU RT	License to operate a hot-standby redundancy on two controller CPUs as redundant main controllers (includes 2 licenses). Allows any number of IO stations (slaves) to connect redundantly to both main controllers (includes network redundancy).	00019829-63

- Millisecond-precise synchronization of all stations
- Network switching time freely
  configurable (0 … 10 PLC cycles)
- Blumpless switchover
- Redundancy programming support
  in M-PLC (IEC 61131-3)
- Debugging and forcing of variables in
  redundant applications (M-PLC)
- Resistant to single-fault events, additionally many
  multi-fault scenarios are overridden on a continuous
  basis

Integration in the SolutionCenter

- Applying, monitoring and deleting
  redundancy devices
- Extra support in Solution Navigator and
  Device Manager for configuring, monitoring
  and logging redundant applications
- Textual and graphical redundancy status displays
- Virtual redundancy devices with the option
  of applying and manipulating redundancy
  configurations and applications
- Redundancy master status information
  - Device designation
  - Current redundancy status of the entire system
  - CPU information
  - System software information
  - Network information
- Redundancy application status information
  - Current redundancy status
    (REDUNDANT/SINGLE/ERROR)
  - Runtime state (RUN/STOP/ERROR)
  - Error status codes
  - Synchronization status
  - Cycle time
- Maintenance interface for redundancy
  systems integrated (execution of commands
  on both master CPUs at the same time)
- All commands and monitoring mechanisms
  are available to the operator as open user
  interfaces and/or as system variables.
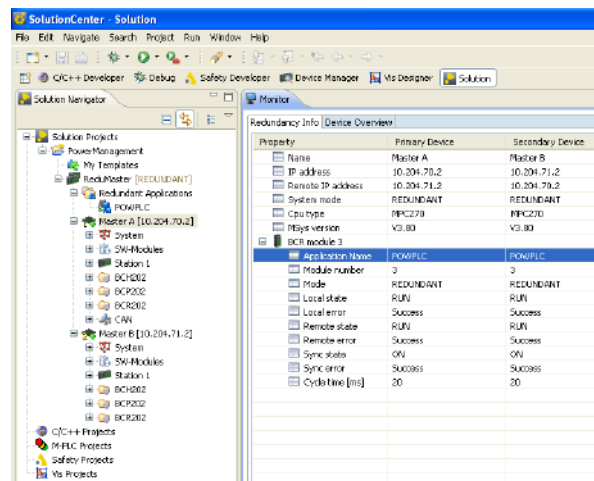
Redundancy

Hot-standby redundancy	
Rationale/Characteristic	
High availability system type	Hot-standby redundancy with local I/O stations (1oo2 voting integrated)
CPU redundancy	yes (synchronization and self-monitoring automatic)
Network redundancy	included
I/O redundancy	possible
Sensor redundancy	possible
Switchover	bumpless
Continuous dual-channel ability	yes
Communication redundancy	yes
Processing units (recommendation)	Master: M1 standard CPUs of the MPC, MC, MH families or better Slave: M1 standard CPUs of the MX, MPC, MC, MH families or better
I/O peripheral	via MX CPU all from M1 standard module portfolio
Use of special hardware	no (straight software solution and standard Ethernet)
Topology/Networking	
Protocol basis	Ethernet IEEE 802.3q, Ethertype 0x892D
Communication protocol	bluecom with redundancy enhancement (100% IEEE 802.3q compatible)
Media redundancy	yes (2-channel, galvanically separated Ethernet networks)
Switches	industrial standard managed switch (or unmanaged switch with appropriate configuration)
Topologies	Star, bus, ring, mesh
Ring redundancy	possible via parallel application of MRP, STP and RSTP
Dimension	in compliance with IEEE 802.3 - max. 2000 m per network section with fiber optic connection via FCS214 module
CPUs spatially separable	yes (see Dimension)
Time synchronization	integrated in network protocol
Number of I/O stations	more than 100
Smart substations	yes, for example, I/O stations can execute local applications for: emergency operation, load separation or local logging
Parallel data traffic	yes, possible (Ethernet-based protocols and services, e.g. HTTP, FTP, video stream, Modbus, OPC, MMS, ...)
Interfaces	
I/O peripheral	M1 standard module portfolio
Redundancy network	bluecom network variables
Field buses	Gateway function for CAN, Profibus DP, Profinet, Modbus, EtherCAT via application possible
SCADA / control station & PDA	Standard protocols: IEC61850, IEC61400-25, IEC60870-5-104, OPC DA, Modbus TCP/UDP Application development: communication library M1Com and M1Com.NET
IT protocols	see M1 software (FTP, HTTP, SNTP, SMTP, ... and security versions)
Configuration/Programming	
Configuration	SolutionCenter (support via wizards)
Remote configuration	yes (Ethernet LAN, Internet)
Network configuration	SolutionCenter (support via wizards)
Programming	M-PLC: IEC 61131-3 (IL, LD, FBD, ST, AS, SFC)

Hot-standby redundancy	
Configuration/Programming	
Editor	CoDeSys
Redundancy download	Automatic
Redundancy debugging	yes
Redundancy synchronization	automatic (process variables, system software)
Manual switchover	yes Switchover: triggering by user Failover: automatic via software
Multitasking	yes (one redundant task permissible per PLC application, total up to three independent redundancy tasks)
Mixed operation	yes (non-redundant, non-synchronized applications can run parallel to redundancy applications)
Diagnostics/Monitoring	
I/O live display	SolutionCenter
Redundancy status	yes
Error status	yes
Diagnostic user interface (API)	yes, integrated
Statistic user interface (API)	yes, integrated
Network monitor	SolutionCenter
Network analysis	yes (by Wireshark plug-in, Wireshark data are generated automatically on the controller)
Distributed logging	yes (synchronized, granularity 1 ms)
Performance data	
Master cycle time	1 … 1000 ms*
I/O cycle time	Minimum 200 µs for non-redundant applications 1 ms… 1000 ms for redundant applications*
I/O frame works	more than 100 stations* Number of channels unrestricted (*, **) - typically 400 .. 600 channels per station (1/3 analog, 2/3 digital)
Synchronization volume	max 120*1400 byte
Switching time	adjustable from 0 .. 10 cycles
Time precision	< 1ms *
Installation	
Installation medium	CD ROM or network
Installation tool	SolutionCenter
Upgrading existing systems	possible via software / new CF card required
License protection	Data CF of the master CPUs is integrated dongle
System prerequisites	
Controller equipment	M1 CPUs of the MX200 family or better (minimum 2 Ethernet interfaces onboard)
Network	2x Ethernet 100 MBit/s or Gbit/s, managed switch
Software	MSys / MxCCore / M-BASE V3.80 or higher

* Limit value subject to CPU type, memory available, application size, number of exchangeable variables, network bandwidth available and network and CPU load via non-redundant applications

** No program-technical restriction.

Redundancy

Master
CPU A

Master
CPU B

Slave
Station 1

Slave
Station 2

Operator
Terminal

**Redundancy
Control**
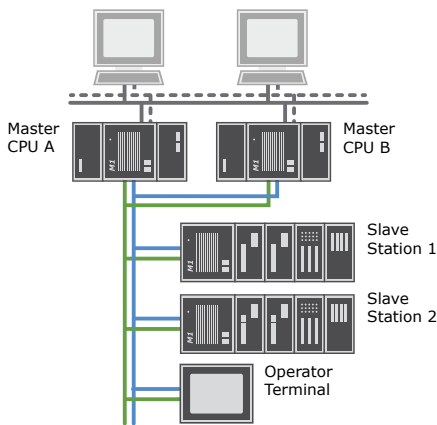
Warm-standby redundancy

For applications where reliable recording of critical data has priority, warm-standby redundancy is the preferred solution. Good support when configuring and monitoring the actual CPU redundancies helps during the rapid development of applications for which bumpless switchover is not required. Continuous operation during maintenance, system updating and application changes is also possible in this version.
If a master CPU for maintenance work is disconnected from the network, real-time processing is only affected to a minimum. The data transmission continues seamlessly and from the perspective of the receiving stations no packets are lost.
The matching of process variables in the master CPU has to be resolved on the application level, which means extra effort and expense and increased complexity vis-à-vis hot-standby redundancy (see Fig. 1).

Warm-standby redundancy provides the qualities of network redundancy and the following advantages as well:

- CPU redundancy
- Switching time freely configurable
  (0 … 10 PLC cycles)
- Selection of the data master integrated in end points (voter), the fastest switching times possible as a result
- Diagnostic interface for monitoring and analyzing the redundancy status in the SolutionCenter
- Automatic matching of the master CPUs not integrated ➔ switchover not bumpless

Item		Item no.
M-NW-REDU RT	License to operate a network redundancy communication master on one controller CPU. Allows any number of IO stations (slaves) to connect redundantly over the network. Two network redundancy licenses are necessary for warm-standby operation (for each master-cpu one license).	00019828-63
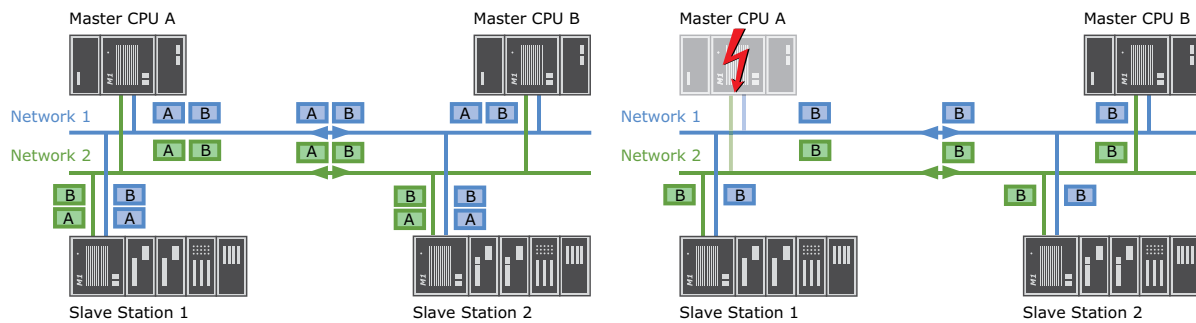
Fig.1 Switchover of the active CPU within a PLC cycle, e.g. cycle time 1 ms – switchover ≤ 1 ms

Warm-standby redundancy	
Rationale/Characteristic	
High availability system type	Warm-standby redundancy with decentral I/O (1oo2 voting integrated)
CPU redundancy	yes (no automatic synchronization and self-monitoring)
Network redundancy	included
I/O redundancy	possible
Sensor redundancy	possible
Switchover	not bumpless
Continuous dual-channel ability	yes
Communication redundancy	yes
Processing units (recommendation)	Master: M1 standard CPUs of the MPC, MC, MH families or better Slave: M1 standard CPUs of the MX, MPC, MC, MH families or better
I/O peripheral	via MX CPU all from M1 standard module portfolio
Use of special hardware	no (straight software solution and standard Ethernet)
Topology/Networking	
Protocol basis	Ethernet IEEE 802.3q, Ethertype 0x892D
Communication protocol	bluecom with redundancy enhancement (100% IEEE 802.3q compatible)
Media redundancy	yes (2-channel, galvanically separated Ethernet networks)
Switches	industrial standard managed switch (or unmanaged switch with appropriate configuration)
Topologies	Star, bus, ring, mesh
Ring redundancy	possible via parallel application of MRP, STP and RSTP
Dimension	in compliance with IEEE 802.3 - max. 2000 m per network section with fiber optic connection via FCS214 module
CPUs spatially separable	yes (see Dimension)
Time synchronization	integrated in network protocol
Number of I/O stations	more than 100
Smart substations	yes, for example I/O stations can execute local applications for: emergency operation or load separation or local logging
Parallel data traffic	yes, possible (Ethernet-based protocols and services, e.g. HTTP, FTP, video stream, Modbus, OPC, MMS, ...)

Redundancy

Warm-standby redundancy	
Interfaces	
I/O peripheral	M1 standard module portfolio
Redundancy network	bluecom network variables
Field buses	Gateway function for CAN, Profibus DP, Profinet, Modbus, EtherCAT via application possible
SCADA / control station & PDA	Standard protocols: IEC61850, IEC61400-25, IEC60870-5-104, OPC DA, Modbus TCP/UDP Application development: communication library M1Com and M1Com.NET
IT protocols	see M1 software (FTP, HTTP, SNTP, SMTP, … and security versions)
Configuration/Programming	
Configuration	SolutionCenter (support via wizards)
Remote configuration	yes (Ethernet LAN, Internet)
Network configuration	SolutionCenter (support via wizards)
Programming	M-PLC: IEC 61131-3 (IL, LD, FBD, ST, AS, SFC)
Editor	CoDeSys
Redundancy download	Automatic
Redundancy debugging	yes
Redundancy synchronization	manual
Manual switchover	to integrate by user
Multitasking	to integrate by user
Mixed operation	yes (non-redundant, non-synchronized applications can run parallel to redundancy applications)
Diagnostics/Monitoring	
I/O live display	SolutionCenter
Redundancy status	yes (restricted to network redundancy)
Error status	yes
Diagnostic user interface (API)	yes, integrated
Statistic user interface (API)	yes, integrated
Network monitor	SolutionCenter
Network analysis	yes (by Wireshark plug-in, Wireshark data are generated automatically on the controller)
Performance data	
Master cycle time	1…1000 ms*
I/O cycle time	Minimum 200 µs for non-redundant applications 1 ms… 1000 ms for redundant applications*
I/O frame works	more than 100 stations* Number of channels unrestricted (*, **) - typically 400 .. 600 channels per station (1/3 analog, 2/3 digital)
Switching time	adjustable from 0 .. 10 cycles

* Limit value subject to CPU type, memory available, application size, number of exchangeable variables, network bandwidth available and network and CPU load via non-redundant applications

** No program-technical restriction.

Warm-standby redundancy	
Installation	
Installation medium	CD ROM or network
Installation tool	SolutionCenter
Upgrading existing systems	possible via software / new CF card required
License protection	Data CF of the master CPUs is integrated dongle
System prerequisites	
Controller equipment	M1 CPUs of the MX200 series or better (min. 2 Ethernet interfaces onboard)
Network	2x Ethernet 100 MBit/s or Gbit/s, managed switch
Software	MSys / MxCCore / M-BASE V3.80 or higher

Redundancy

Master CPU

Slave Station 1

Slave Station 2

Operator Terminal

Redundancy Control
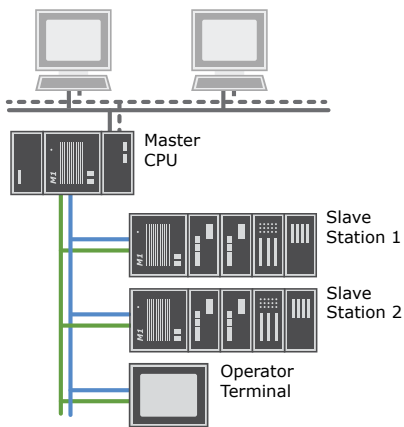
Network redundancy

Cable break and outage or misconfiguration of network equipment are frequent causes of failure in the daily automation routine. Searching for errors in the process often proves to be expensive and difficult. In doing so, however, little carelessnesses hide the risk of longer production stoppages and economically relevant outages. The introduction of redundant real-time networking makes separate cable routes possible. In conjunction with the simultaneous transmission of all data packets on both network lines, single failures on the transmission line no longer have the effect of disrupting communication and therefore automation.

The product „network redundancy" fulfills these qualities precisely by means of a combination of media and communication redundancies. Even in the case of an error, no data packets to the receiving stations (master or slave) are lost in the process (see Fig. 1). Integrated self-monitoring and diagnostic interfaces draw attention to transmission errors and make finding their location easier.

The network redundancy is optimized for real-time capabilities, compatibility, ruggedness and performance. Conformity with Ethernet standard IEEE 802.3 guarantees the cost-effective networking of more than one hundred redundancy stations*.

• Switch-over time ≤ 1 PLC cycle
• Real-time network fully Ethernet compatible (IEEE 802.3q)
• Monitoring and diagnostics of errors via SolutionCenter

Item		Item no.
M-NW-REDU RT	License to operate a network redundancy communication master on one controller CPU. Allows any number of IO stations (slaves) to connect redundantly over the network.	00019828-63

- Programming interfaces, libraries and system variables for data transmission and communication monitoring in IEC 61131-3
- Prioritized redundancy data transmission makes parallel communication via IP-based protocols possible
- Bandwidth limit integrated
- Connection of terminals via TCP/IP
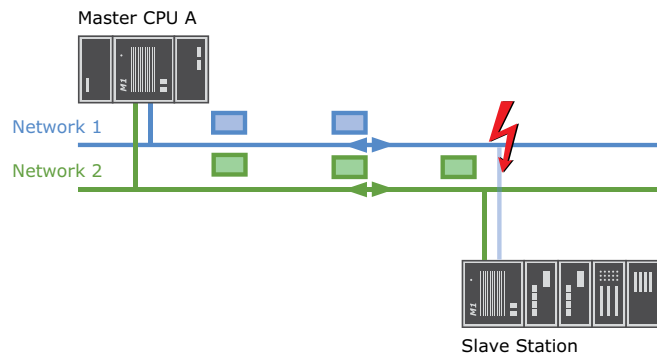
Fig. 1 In case of an error, no data packets to the receiving stations are lost.

Network redundancy	
Rationale/Characteristics	
High availability system type	Communication and media redundancy (1oo2 voting integrated)
CPU redundancy	no
Network redundancy	yes
Switchover	0 ms
Continuous dual-channel ability	yes
Communication redundancy	yes
Processing units (recommendation)	Master: M1 standard CPUs of the MPC, MC, MH families or better Slave: M1 standard CPUs of the MX, MPC, MC, MH families or better
I/O peripheral	via MX CPU all from M1 standard module portfolio
Use of special hardware	no (straight software solution and standard Ethernet)
Topology/Networking	
Protocol basis	Ethernet IEEE 802.3q, Ethertype 0x892D
Communication protocol	bluecom with redundancy enhancement (100% IEEE 802.3q compatible)
Media redundancy	yes (2-channel, galvanically separated Ethernet networks)
Switches	industrial standard managed switch (or unmanaged switch with appropriate configuration)
Topologies	Star, bus, ring, mesh
Ring redundancy	possible via parallel application of MRP, STP and RSTP
Dimension	in compliance with IEEE 802.3 - max. 2000 m per network section with fiber optic connection via FCS214 module
CPUs spatially separable	yes (see Dimension)
Time synchronization	integrated in network protocol
Number of I/O stations	more than 100
Smart substations	yes, I/O stations can execute local applications for: emergency operation, load separation or local logging
Parallel data traffic	yes, possible (Ethernet-based protocols and services, e.g. HTTP, FTP, video stream, Modbus, OPC, MMS, ...)

Redundancy

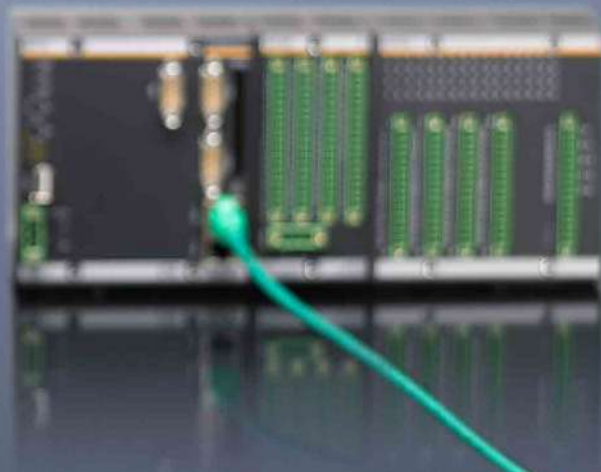| Network redundancy	
Interfaces	
I/O peripheral	M1 standard module portfolio
Redundancy network	bluecom network variables
Field buses	Gateway function for CAN, Profibus DP, Profinet, Modbus, EtherCAT via application possible
SCADA / control station & PDA	Standard protocols: IEC61850, IEC61400-25, IEC60870-5-104, OPC DA, Modbus TCP/UDP Application development: communication library M1Com and M1Com.NET
IT protocols	see M1 software (FTP, HTTP, SNTP, SMTP, … and security versions)
Configuration/Programming	
Configuration	SolutionCenter (support via wizards)
Remote configuration	yes (Ethernet LAN, Internet)
Network configuration	SolutionCenter (support via wizards)
Programming	M-PLC: IEC 61131-3 (IL, LD, FBD, ST, AS, SFC)
Editor	CoDeSys
Diagnostics/Monitoring	
Redundancy status	yes
Error status	yes
Diagnostic user interface (API)	yes, integrated
Statistic user interface (API)	yes, integrated
Network monitor	SolutionCenter
Network analysis	yes (by Wireshark plug-in, Wireshark data are generated automatically on the controller)
Performance data	
Master cycle time	1…1000 ms*
I/O cycle time	Minimum 200 µs for non-redundant applications 1 ms… 1000 ms for redundant applications*
I/O frame works	more than 100 stations* Number of channels unrestricted (*, **) - typically 400 .. 600 channels per station (1/3 analog, 2/3 digital)
Installation	
Installation medium	CD ROM or network
Installation tool	SolutionCenter
Upgrading existing systems	possible via software / new CF card required
License protection	Data CF of the master CPUs is integrated dongle
System prerequisites	
Automation equipment	M1 CPUs of the MX200 family or better (minimum 2 Ethernet interfaces onboard)
Network	2x Ethernet 100 MBit/s or Gbit/s, managed switch
Software	MSys / MxCCore / M-BASE V3.80 or higher

*   Limit value subject to CPU type, memory available, application size, number of exchangeable variables, network bandwidth available and network and CPU load via non-redundant applications

** No program-technical restriction

HMI devices

We have devoted 20 years of, what is now, our 40-year company history to the areas of »Human Machine Interfaces«, abbreviated as HMIs. Always oriented to the specific needs of our business partners and the target industries, Bachmann electronic offers a complete product line of visualization systems in different performance classes and for a wide variety of implementation areas.

All HMIs are developed and manufactured in our main facility in Feldkirch in Austria. In order to offer our customers the highest level of investment protection possible, all components are selected by our development team according to the premises of long-term availability and stablity.
To acheive this, the experienced engineers use industrial-grade components exclusively. In addition, every visualization device is subjected to a 48-hour run-in test in the climate chamber prior to delivery, and the specified operating temperature range is run through several times.

With M1 webMI pro Bachmann is offering a state-of-the-art visualization solution that supplements the HMIs. All compatible HMIs come as standard with the necessary interfaces and software components.

bachmann

Operator terminals

The optimal operator terminal for every application.

With the series OT100, OT200 and OT1300 operator terminals, Bachmann electronic offers operator terminals in different performance classes. The devices of the Essential class, OT100, are display devices that are primarily designed for simple text-based presentation in conjunction with a powerful M1 CPU. With the devices of the Intermediate class, OT200, the user gets a »self-contained«, i.e. full-fledged 5.7" terminal based on PC technology with embedded Linux as the operating system. The brand new Advanced class OT1300 series with the Intel's latest processors and integrated solid state disk (SSD) or alternatively with AMD G-T40E Dualcore processor – is the ideal application for requirements where high performance capability paired with

Operator terminal OT100 series

Features
Display: 4.2" STN Bluemode
Processor: 72 MHz 32 bit
RAM: 64 kB internal
Interfaces: RS232/422
Project planning: Vis Designer, PLC blocks

Operator terminal OT200 series

Features
Display: 5.7" QVGA, 5.7" VGA, color TFT, opt. touch screen
Processor: AMD Geode LX800, 500 MHz
RAM: 512 MB
Compact Flash: ≥ UDMA 2 GB
Operating system: embedded Linux
Interfaces: Ethernet, USB, RS232
Project planning: Vis Designer, Java programming

shallow mounting depth and different screen diagonals are demanded. For visualization under extreme climatic conditions, condensation-proof »ColdClimate« devices are available in all performance classes. Devices for use in marine applications (indicated in the product designation with »M«) have a galvanically isolated supply voltage and, depending on the model, they have typical marine features, such as internal signal encoders, a floating relay output, etc. In conjunction with Bachmann's own project planning tool, Vis Designer, visualizations can be quickly and easily implemented with all device series. Consistent application of industrial-grade components guarantees long-term availability and thus investment security.

Operator terminal
OT1300 series

Features
Display: 10.4" VGA / 12.1" SVGA / 15" XGA / 19" SXGA color TFT, opt. touch screen
Processor: Intel i7 2x 1.7 GHz Intel Celeron 847E 2x 1.1 GHz AMD G-T40E 2x 1.0 GHz
RAM: 2 GB DDR3 or 4 GB DDR3
Ultrafast CFast mass memory
Interfaces: 1x GBit Ethernet, 2x or 4x USB 2.0
Standard operating temperature: 0 ... 60 °C, fanless
Operating system: Linux embedded Windows 7 embedded
Project management: M1 webMI pro, custom

Operator terminals

Operator terminal OT100 series

The devices are equipped with a full graphic 4.2" STN display. With use of UTF-8 character coding many lines of Asiatic and Cryillic characters can be displayed. The brightness of the LED backlighting can be controlled with the PLC program or via the input elements. With the ability to operate at temperatures from -30° to +60 °C, these terminals are predestined for use under extreme conditions where dependability is a must. Communication with the M1 controller occurs through an integrated interface that can be programmed to either the RS232 or RS422 standard.
The arrangement and design of the control elements, including an alphanumeric multi-click keyboard are oriented to the familiar operating philosophy of mobile phones. For better tactile feel the keys are embossed and have integrated snap disks. The aluminum front panel with inlayed front foil underlines the sophisticated and robust character of the terminal.

- Full-graphic 4.2" STN Bluemode display with 240 x 64 pixels
- Model-dependent operating/display elements: 5x softkeys, alphanumeric multi-click keyboard, 1x Exit key, 1x Shift key, 1x keyboard entry lock/unlock key, 1x Backspace key, cursor directional pad with Enter key and 3 LEDs
- Convenient project planning via Vis Designer
- Character coding with UTF-8
- Operating temperature range from -30 .. +60 °C

Item	Item no.
OT115/R/BE1	00014569-00
OT115/R/BE2	00014570-00
OT115/R/BE2/CC	00017593-00

CC ... ColdClimate (❄) variant

OT100 series	OT115/R/BE1	OT115/R/BE2	OT115/R/BE2/CC
Display			
Diagonal/resolution	4.2" STN Bluemode (240 x 64 pixels)		
Display brightness	450 cd/m²		
Backlight	LED: dimmable via keyboard/PLC program		
Processor/RAM			
Processor	72 MHz 32 bit		
RAM	64 kB internal		
Control/display elements			
Front keyboard			
Softkeys	5x	5x	
Enter	1x	1x	
Cursor keys	4x	4x	
Multi-click keyboard	-	alphanumeric	
Exit	-	1x	
Shift	-	1x	
Keyboard entry	-	1x lock/unlock	
Backspace	-	1x	
Display elements	-	1x red LED 2x yellow LEDs	
Interface			
RS232/422 (switchable)	1x		
Power supply*	24 V DC (18 V .. 36 V), 10 ms buffering		
Certifications	CE, UL, GL; pending: ABS, BV, DNV, LR		
Ambient conditions	Standard		ColdClimate (❄)
Operating temperature	-20 .. +60 °C fanless		-30 .. +60 °C fanless
Storage temperature	-30 .. +80 °C		-40 .. +85 °C
Rel. humidity storage / operation	5.. 95 % without condensation		5.. 95 % with condensation
Certifications	CE, UL, GL; pending: ABS, BV, DNV, LR		
Degree of protection			
Front / Rear	IP65 / IP20		
Software			
Visualization	project planning: Vis Designer / programming: Java, C, PLC environment		
Dimensions and weights			
Dimensions (W x H x D)	170 x 128 x 50 mm	170 x 160 x 50 mm	170 x 160 x 50 mm
Weight	approx. 1 kg	approx. 1 kg	approx. 1 kg
Variants			
OT115/R/BE1	4.2" STN-Bluemode display (240x64 Pixel), 1x RS232, front panel with cross elements, operating temp. -20°C .. +60°C, storage temperature -30°C .. +80°C, rel. humidity operation 5 .. 95 % without condensation		
OT115/R/BE2	4.2" STN-Bluemode display (240x64 Pixel), 1x RS232, front panel with AlphaNum key, operating temp. -20°C .. +60°C, storage temperature -30°C .. +80°C, rel. humidity operation 5 .. 95 % without condensation		
OT115/R/BE2/CC	4.2" STN-Bluemode display (240x64 Pixel), 1x RS232, front panel with AlphaNum key, operating temp. -30°C .. +60°C, storage temperature -40°C .. +85°C, rel. humidity operation5 .. 95 % with condensation		

* In the case of OTs for marine applications the supply voltage is galvanically isolated.

Operator terminals
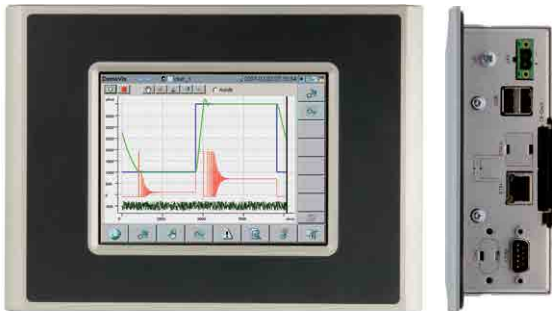
Operator terminal OT200 series

The OT200 operator terminal series offers an inexpensive entry into the world of visualization devices. Smaller visualization applications in the renewable energies, industry, and marine areas are the ideal implementation area of the operator terminals. The system is connected to the automation via Ethernet, in addition the device has two USB2.0 interfaces. The system is ideally designed for Java visualizations.

The operator terminal comes with a color TFT display and dimmable LED backlight in various screen resolutions. The operator terminal is operated via a touch screen and/or a keyboard integrated in the front panel. In the marine version, OT205V/M, the device has an internal signal encoder, as well as a floating relay output.

- Extremely compact and powerful
- Fanless operation up to +60°C
- Visualization with Bachmann Vis Designer
- 5.7" color TFT monitor with QVGA or VGA resolution
- Optionally with keyboard integrated in the front panel
- Marine approval and marine-typical special functions

Item	Item no.
OT205/BE1	00018216-00
OT205/V/BE1	00018218-00
OT205/V/BE2	00018221-00
OT205/M/BE1	00018217-00
OT205/V/BE1/CC	00018219-00

V	... VGA resolution
M	... maritime variant
CC	... ColdClimate (❄) variant

OT200 series	OT205/BE1	OT205/V/ BE1	OT205/M/ BE1	OT205/V/ BE2	OT205/V/ BE1/CC
Display					
Diagonal/resolution	5.7" QVGA (320 x 240)	5.7" VGA (640 x 480)			
Display type	Color TFT				
Display brightness	700 cd/m²				
Half-brightness	min. 50,000 h				
Processor/RAM					
Processor	AMD Geode LX800, 500 MHz				
RAM	512 MB				
Mass storage					
CF card	≥ UDMA 2 GB				
Control/display elements					
Touch screen type	analog resistive				
Front keyboard					
Softkeys	-			11x	-
Enter	-			1x	-
Cursor keys	-			4x	-
Multi-click keyboard	-			alpha-numeric	-
Exit	-			1x	-
Shift	-			1x	-
System LED	optional 5x			2	-
Status LED	Run, Init, Error				
Interfaces					
Ethernet 10/100	1x				
USB 2.0	2x				
RS232	1x				
Buzzer	-		1x		
Floating relay output	-		1x		
Power supply*	24 V DC (18 V .. 36 V)				
Certifications	CE, UL, CSA, CUL, CCC, GL, ABS, BV, DNV, LR				
Ambient conditions	Standard		Marine	Standard	ColdClimate (❄)
Operating temperature	0 .. +60°C fanless**		-15 .. +50°C	0 .. +60°C fanless**	-30 .. +60°C
Storage temperature	-20 .. +85°C				-40 .. +85°C
Rel. humidity storage / operation	5 .. 95 % without condensation				5 .. 95 % with condensation

Operator terminals

OT200 series	OT205/BE1	OT205/V/ BE1	OT205/M/ BE1	OT205/V/ BE2	OT205/V/ BE1/CC
Software					
Operating system	Linux embedded				
Visualization	Vis Designer / Java				
Dimensions and weight					
Dimensions (W x H x D)	212 x 156 x 49 mm				
Weight	approx. 2 kg				
Variants					
OT205/BE1	Display: 5,7"; QVGA (320x240); Touch; CPU: LX800@500 MHz; RAM: 512MB-DDR; CF-Card-Slot; 1xEth 10/100MBit; 2xUSB2.0; 1xRS232; operating temp. 0°C.. +60 °C; storage temp. -20°C..+85°C, rel. humidity 5 .. 95 % without condensation				
OT205/V/BE1	Display: 5,7"; VGA (640x480); Touch; CPU: LX800@500 MHz; RAM:512MB-DDR; CF-Card-Slot; 1xEth 10/100MBit; 2xUSB2.0; 1xRS232; operating temp. 0°C.. +60 °C; storage temp. -20°C..+85°C, rel. humidity 5 .. 95 % without condensation				
OT205/V/BE2	Display: 5,7"; VGA (640x480); AlphaNumKB; CPU: LX800@500 MHz; RAM: 512MB-DDR; CF-Card-Slot; 1xEth 10/100MBit; 2xUSB2.0; 1xRS232; operating temp. 0°C.. +60°C; storage temp. -20°C..+85 °C, rel. humidity 5 .. 95 % without condensation				
OT205/M/BE1	Display: 5,7"; VGA (640x480); Touch; CPU: LX800@500 MHz; RAM: 512MB-DDR; CF-Card-Slot; 1xEth 10/100MBit; 2xUSB2.0; 1x Buzzer; 1x potential free relay output; 1xRS232; operating temp -15°C.. +50 °C; storage temp. -20°C..+85 °C, rel. humidity 5 .. 95 % without condensation				
OT205/V/BE1/CC	Display: 5,7"; VGA (640x480); Touch; CPU: LX800@500 MHz; RAM: 512MB-DDR; CF-Card-Slot; 1xEth 10/100MBit; 2xUSB2.0; 1xRS232; operating temp. -30°C.. +60°C; rel. humitdity operation 5 .. 95 % with condensation; storage temp. -40°C..+85°C, 5 .. 95 % short-term condensation (≤60 min)				

*   In the case of OTs for marine applications the supply voltage is galvanically isolated.

**   For details regarding the maximum permissible ambient temperatures for different install positions and install types, see section, »Device dimensions and ambient temperatures«
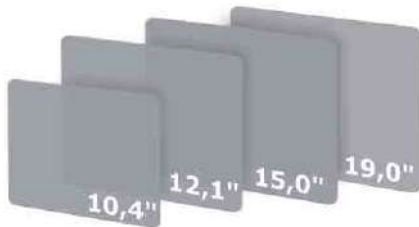
Operator terminal OT1300 series

The new OT1300 series combines the latest technology, performance and durability with an attractive and slim-line design. The OT1300 series is the ideal choice for visualization applications in the renewable energy and industrial sectors. Condensation-proof ColdClimate modules guarantee maximum availability, even in very demanding environments. The consistent use of industry standard components moreover guarantees long-term availability and thus investment protection. The large range of available systems in the OT1300 series ensures an optimum price performance ratio.

- Processor/RAM:
  AMD G-T40E (2x 1 GHz) / 2 GB DDR3 RAM
  Intel Celeron 847E (2x 1,1 GHz) / 2 GB DDR3 RAM
  Intel Core i7 (2x 1,7 GHz) / 4 GB DDR3 RAM
- Ultrafast CFast mass memory
- SATA HDD or SSD options for large volume storage
- Interfaces (standard device): 1x or 2x GBit Ethernet, 4x USB2.0, 1x RS232
- Standard operating temperature: 0 ... +60 °C, fanless
- Enhanced temperature range (ColdClimate): -30 .. +60 °C
- Operating systems: Linux Embedded, Windows Embedded Standard 7

Item	Item no.
OT1310/BE1/GT1G0/2G/4G0/LX	00022647-00
OT1312/BE1/GT1G0/2G/4G0/LX	00022646-00
OT1315/BE1/GT1G0/2G/4G0/LX	00022645-00
OT1319/BE1/GT1G0/2G/4G0/LX	00022644-00
OT1310/BE1/GT1G0/2G/4G0/WES7E	00023273-00
OT1312/BE1/GT1G0/2G/4G0/WES7E	00022882-00
OT1315/BE1/GT1G0/2G/4G0/WES7E	00023275-00
OT1319/BE1/GT1G0/2G/4G0/WES7E	00023276-00
OT1312/BE1/CE1G1/2G/SSD64/WES7P	00023501-00
OT1315/BE1/CE1G1/2G/SSD64/WES7P	00023502-00
OT1319/BE1/CE1G1/2G/SSD64/WES7P	00024295-00
OT1312/BE1/CO1G7/4G/SSD64/WES7P	00024293-00
OT1315/BE1/CO1G7/4G/SSD64/WES7P	00024294-00
OT1319/BE1/CO1G7/4G/SSD64/WES7P	00023870-00

CC   ... ColdClimate (❄)

other models on request

Operator terminals

OT1300 series	OT1310/BE1/ GT1G0	OT1312/BE1/ GT1G0	OT1315/BE1/ GT1G0	OT1319/BE1/ GT1G0
Display				
Diagonal	10.4" VGA (640x480)	12.1" SVGA (800x600)	15" XGA (1024x768)	19" SXGA (1280x1024)
Display type	Color TFT			
Display brightness	450 cd/m²	450 cd/m²	400 cd/m²	350 cd/m²
Half-brightness	min. 50,000 h			
Processor/RAM				
Processor	AMD G-T40E (2x 1 GHz)			
RAM	2 GB			
Mass storage				
SSD	-			
CFast card	≥ 4 GB			
Control/display elements				
Touch screen type*	analog resistive, membrane front			
System LEDs	Power, Diag, Act			
Interfaces				
Ethernet 10/100/1000 MBit	1x			
USB 2.0	4x			
Power supply	24 V DC (18 V .. 36 V), galvanically isolated			
Certifications	CE, UL, CSA, CUL, CCC			
Software				
Operating systems**	Linux Embedded Windows Embedded Standard 7			
Visualization***	atvise scada / M1 webMI pro			
Ambient conditions				
Operating temperature	0 .. +60 °C fanless			
Storage temperature	-20 .. +80 °C			
Rel. humidity operation / storage	5 .. 95 % without condensation			
Dimensions and weight				
Dimensions (W x H x D)	310 x 234 x 68 mm	341 x 253 x 68 mm	406 x 308 x 75 mm	471 x 375 x 76 mm
Weight	approx. 2.5 kg	approx. 3.0 kg	approx. 4.5 kg	approx. 6.0 kg

*   Customer-specific front panel on request
**   Windows Embedded Standard 8 on request
***   not included

OT1300 series	OT1310/BE1/CC GT1G0	OT1312/BE1/CC GT1G0
Display		
Diagonal	10.4" VGA (640x480)	12.1" SVGA (800x600)
Display type	Color TFT	
Display brightness	450 cd/m²	450 cd/m²
Half-brightness	min. 50,000 h	
Processor/RAM		
Processor	AMD G-T40E (2x 1 GHz)	
RAM	2 GB	
Mass storage		
SSD	-	
CFast card	≥ 4 GB	
Control/display elements		
Touch screen type*	analog resistive, membrane front	
System LEDs	Power, Diag, Act	
Interfaces		
Ethernet 10/100/1000 MBit	1x	
USB 2.0	4x	
Power supply	24 V DC (18 V .. 36 V), galvanically isolated	
Certifications	CE, UL, CSA, CUL, CCC	
Software		
Operating systems**	Linux Embedded Windows Embedded Standard 7	
Visualization***	atvise scada / M1 webMI pro	
Ambient conditions		
Operating temperature	-30 .. +60 °C fanless	
Storage temperature	-30 .. +80 °C	
Rel. humidity operation / storage	5 .. 95 % without condensation	
Dimensions and weight		
Dimensions (W x H x D)	310 x 234 x 68 mm	341 x 253 x 68 mm
Weight	approx. 2.5 kg	approx. 3.0 kg

*   Customer-specific front panel on request
**   Windows Embedded Standard 8 on request
***   not included

Operator terminals

OT1300 series	OT1312/BE1/ CE1G1 CO1G7	OT1315/BE1/ CE1G1 CO1G7	OT1319/BE1/ CE1G1 CO1G7
Display			
Diagonal	12.1" SVGA (800x600)	15" XGA (1024x768)	19" SXGA (1280x1024)
Display type	Farb-TFT		
Display brightness	450 cd/m²	400 cd/m²	350 cd/m²
Half-brightness	min. 50.000 h		
Processor/RAM			
Processor	Celeron 847E (2x 1,1 GHz) or Intel Core i7 (2x 1,7 GHz)		
RAM	2 GB	4 GB	
Mass storage			
SSD	≥ 64 GB		
CFast card	≥ 4 GB		
ontrol/display elements			
Touch screen type*	analog resistiv, Folienfront		
System LEDs	Power, Diag, Act		
Interfaces			
Ethernet 10 / 100 / 1000 MBit	2x		
USB 2.0	4x		
RS232	1x		
Power supply	24 V DC (18 V .. 36 V), galvanically isolated		
Certifications	CE, UL, CSA, CUL, CCC		
Software			
Operating systems**	Windows Embedded Standard 7		
Visualization***	atvise scada / M1 webMI pro		
Ambient conditions			
Operating temperature	0 .. +60 °C fanless		
Storage temperature	-20 .. +80 °C		
Rel. humidity operation / storage	5 .. 95 % without condensation		
Dimensions and weight			
Dimensions (W x H x D)	341 x 253 x 74 mm	406 x 308 x 81 mm	471 x 375 x 82 mm
Weight	approx. 3.5 kg	approx. 5.0 kg	approx. 6.5 kg

*   Customer-specific front panel on request
**   Windows Embedded Standard 8 on request
***   not included

OT1300 series	
Variants	
OT1310/BE1/GT1G0	Operator Terminal: 10,4"; VGA (640x480); Resistive Touch; AMD G-T40E (2x 1 GHz); 2 GB DDR3 RAM; 1x Eth10/100/1000; 4x USB2.0; CFast-Card 4 GB; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation
OT1312/BE1/GT1G0	Operator Terminal: 12,1"; SVGA (800x600); Resistive Touch; AMD G-T40E (2x 1 GHz); 2 GB DDR3 RAM; 1x Eth10/100/1000; 4x USB2.0; CFast-Card 4 GB; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation
OT1315/BE1/GT1G0	Operator Terminal: 15"; XGA (1024x768); Resistive Touch; AMD G-T40E (2x 1 GHz); 2 GB DDR3 RAM; 1x Eth10/100/1000; 4x USB2.0; CFast-Card 4 GB; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation
OT1319/BE1/GT1G0	Operator Terminal: 19"; SXGA (1280x1024); Resistive Touch; AMD G-T40E (2x 1 GHz); 2 GB DDR3 RAM; 1x Eth10/100/1000; 4x USB2.0; CFast-Card 4 GB; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation
OT1312/BE1/CE1G1	Operator Terminal: 12,1"; SVGA (800x600); Resistive Touch; Intel Celeron 847E (2x 1,1 GHz); 2 GB DDR3 RAM; 2x Eth10/100/1000; 4x USB2.0; 1x RS232; SSD 60/64 GB 2,5″ SATA; CFast-Card-Slot; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation
OT1315/BE1/CE1G1	Operator Terminal: 15"; XGA (1024x768); Resistive Touch; Intel Celeron 847E (2x 1,1 GHz); 2 GB DDR3 RAM; 2x Eth10/100/1000; 4x USB2.0; 1x RS232; SSD 60/64 GB 2,5'' SATA; CFast-Card-Slot; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation
OT1319/BE1/CE1G1	Operator Terminal: 19"; SXGA (1280x1024); Resistive Touch; Intel Celeron 847E (2x 1,1 GHz); 2 GB DDR3 RAM; 2x Eth10/100/1000; 4x USB2.0; 1x RS232; SSD 60/64 GB 2,5'' SATA; CFast-Card-Slot; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation
OT1312/BE1/CO1G7	Operator Terminal: 12,1"; SVGA (800x600); Resistive Touch; Intel Core i7 (2x 1,7 GHz); 4 GB DDR3 RAM; 2x Eth10/100/1000; 4x USB2.0; 1x RS232; SSD 60/64 GB 2,5'' SATA; CFast-Card-Slot; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation
OT1315/BE1/CO1G7	Operator Terminal: 15"; XGA (1024x768); Resistive Touch; Intel Core i7 (2x 1,7 GHz); 2 GB DDR3 RAM; 2x Eth10/100/1000; 4x USB2.0; 1x RS232; SSD 60/64 GB 2,5'' SATA; CFast-Card-Slot; operating temp. 0 .. +60 °C; torage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation
OT1319/BE1/CO1G7	Operator Terminal: 19"; SXGA (1280x1024); Resistive Touch; Intel Core i7 (2x 1,7 GHz); 2 GB DDR3 RAM; 2x Eth10/100/1000; 4x USB2.0; 1x RS232; SSD 60/64 GB 2,5'' SATA; CFast-Card-Slot; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation
OT1310/BE1/CC/GT1G0	Operator Terminal: 10,4"; VGA (640x480); Resistive Touch; AMD G-T40E (2x 1 GHz); 2 GB DDR3 RAM; 1x Eth10/100/1000; 4x USB2.0; CFast-Card-Slot; operating temp. -30 .. +60 °C; storage temp. -30 .. +80 °C; rel. humidity 5 .. 95 % with condensation
OT1312/BE1/CC/GT1G0	Operator Terminal: 12,1"; SVGA (800x600); Resistive Touch; AMD G-T40E (2x 1 GHz); 2 GB DDR3 RAM; 1x Eth10/100/1000; 4x USB2.0; CFast-Card-Slot; operating temp. -30 .. +60 °C; storage temp. -30 .. +80 °C; rel. humidity 5 .. 95 % with condensation

Industrial PCs

Robust industrial PCs are used in the automation sector for controlling machines, networking plant components as well as for data acquisition and image processing. Bachmann electronic's passively cooled IPC1400 panel PCs offer the ideal industrial PC for every task. The remote displays of the Dx900 series allow visualization to be implemented up to 100 m away from the central computer unit IPM1400. The front panels of the operator units are made from aluminum and their function, color and design can be adapted to customer requirements. The operating elements required can be implemented as real machine pushbuttons, with a foil keyboard or as touch screens. Whether complete standard system or customer-specific solution Bachmann electronic always delivers 100 % quality: precisely like the HMI devices all Bachman industrial PCs are subjected to a 48-hour run-in test in the climate chamber, in which the specified operating temperatures are run through multiple times. Naturally compliance with the applicable industrial/ product standards, as well as the legally prescribed standards is ensured.

bachmann

Industrial PC

Customized PC-based visualization devices – compact or modular.

The display diagonals, operating elements and design of the modular IPC1400 series devices can be adapted to the customer's needs and offers scalable processing performance. It can be factory fitted with a number of different interfaces or retrofitted quickly in the field.

Maximum flexibility for applications requiring a spatial separation between the controller and the display / operator unit is offered by the combination of IPM1400 with digital serial remote installation (DSA) and the remote display of the Dx900 series. The Dx900's display diagonals, operating elements and design can be adapted to individual requirements.

In order to ensure the lowest possible failure rate and maximum investment security, Bachmann electronic places considerable importance on the selection of the components used in terms of availability, mechanical resistance and suitability for industrial use.

Industrial PC IPC1400 series

Features
Display: 10.4" VGA / 12.1" SVGA / 15" XGA / 19" SXGA, color TFT, touch screen, customer-specific front panel*
Processor: Celeron M processor ULV 423 1.06 GHz Core Duo processor L2400 2x 1.66 GHz
RAM: 1 GB / 2GB
Compact Flash: 4GB / 8GB
Operating system: Windows XP Embedded, Windows 7
Slot system: PCI, HDD*
Interfaces: Ethernet, USB, PS/2, RS232, CF slot

* on request

Industrial PC IPC1400 series

The highly modular and compact IPC1400-series is suitable for demanding visualizations. The family relies on modularity,
Performance scalability and service friendly. The system with TFT screens is available with different diagonals to meet specific customer requirements. The modular slot system enables the implementation of a wide range of slots such as PCI and PICe, as well as the simultaneous use of different mass storage technologies.

- Scalable industrial PC based on a Celeron M or Core Duo processor
- Maximum reliability and maintenance friendly
- Modular slot system
- Customer-specific configuration and front panel design
- Compact unit or computer with remote display up to 100 m

Item	Item no.
IPC1410/CM	00016898-00
IPC1410/CD	00016902-00
IPC1412/CM	00016899-00
IPC1412/CD	00016903-00
IPC1415/CM	00016900-00
IPC1415/CD	00016904-00
IPC1419/CD	00016905-00

CM   processor Celeron M ULV 423 1.06GHz
CD   processor Core Duo L2400, 2x 1.66 GHz

Industrial PC

IPC1400 series	IPC1410	IPC1412
Display		
Diagonal/resolution	10.4" VGA (640x480)	12.1" SVGA (800x600)
Display type	color TFT	
Display brightness	450 cd / m²	350 cd / m²
Half-brightness	min. 50,000 h	
Processor/RAM		
Processor	Celeron M ULV 423 1.06 GHz Core Duo L2400, 2x 1.66 GHz	
RAM	1 GB / 2 GB	
Mass storage		
CF card type I+II	4 GB / 8 GB	
Control/display elements		
Touch screen type	analog resistive	
Front keyboard / Number of keys	on request / max. 128, 2-fold programmable	
System LEDs	Power, Diag, HDD	
Interfaces		
Network	2x Ethernet 10 / 100 MBit	
USB	3x USB 2.0 + 1x powered USB 2.0	
Serial	2x RS232 / 422 / (also configurable as full RS232)	
Mouse / keyboard	1x combined PS/2 connection	
Audio	AC97, 1x Line-In, 1x Line-Out, 1x MIC	
External monitor	1x RGB, 1x DVI	
Expansion modules		
2.5" hard disk (slot)	(optional) ≥ 160 GB or RAID1: 80 GB (24/7), other on request	
Slots* (module)	max. 2x PCI, max. 2x PCIexpress (on request)	
Power supply	24 V DC (18 V .. 36 V)	
Certifications	CE, UL, CSA, CUL, CCC	
Software		
Operating systems	Windows XP Embedded, Windows 7	
Visualization	Vis Designer / Java, other visualizations at customer's request	
Ambient conditions		
Operating temperature** Fanless with fan	0 .. 50 °C, 0 .. 50 °C***	
Storage temperature	-20 .. +60 °C	
Rel. humidity operation / storage	5 .. 95 % without condensation	
Dimensions and weights		
Dimensions (W x H x D)	314 x 237 x 110 mm****	337 x 256 x 110 mm****
Weight	approx. 5 kg	approx. 5 kg

*   in conjunction with RAID1 max. 1x PCI or 1x PCIe slot possible
**   other temperature ranges on request
***   for details regarding the maximum permissible ambient temperatures for different install positions
         and install types, see section, »Device dimensions and ambient temperatures«
****   without expansion / attachments (per expansion: +30 mm -> max. 2 expansions = +60 mm)

IPC1400 series	IPC1415	IPC1419
Diagonal/resolution	15" XGA (1024x768)	19" SXGA (1240x1024)
Display type	color TFT	
Display brightness	250 cd / m²	300 cd/m³
Half-brightness	min. 50,000 h	
Processor/RAM		
Processor	Celeron M ULV 423 1.06 GHz Core Duo L2400, 2x 1.66 GHz	Core Duo L2400, 2x 1.66 GHz
RAM	1 GB / 2 GB	
Mass storage		
CF card type I+II	4 GB / 8 GB	
Control/display elements		
Touch screen type	analog resistive	
Front keyboard / Number of keys	on request / max. 128, 2-fold programmable	
System LEDs	Power, Diag, HDD	
Status LEDs	optional: max. 64	
Interfaces		
Network	2x Ethernet 10 / 100 MBit	
USB	3x USB 2.0 + 1x powered USB 2.0	
Serial	2x RS232 / 422 / 485 (also configurable as full RS232)	
Mouse / keyboard	1x combined PS/2 connection	
Audio	AC97, 1x Line-In, 1x Line-Out, 1x MIC	
External monitor	1x RGB, 1x DVI	
Expansion modules		
2.5" hard disk (slot)	(optional) ≥ 40 GB or RAID1: 80 GB (24/7), on request	
Slots* (module)	max. 2x PCI, max. 2x PCIexpress (on request)	
Power supply	24 V DC (18 V .. 36 V)	
Certifications	CE, UL, CSA, CUL, CCC	
Software		
Operating systems****	Windows XP Embedded, Windows 7	
Visualization	Vis Designer / Java, other visualizations at customer's request	
Ambient conditions		
Operating temperature** Fanless with fan	0 .. 40 °C 0 .. 50 °C***	
Storage temperature	-20 .. +60°C	
Rel. humidity operation / storage	5 .. 95% without condensation	
Dimensions and weights		
Dimensions (W x H x D)	405 x 308 x 124 mm*****	470 (19") x 374.6 (9 U) x 121 mm*****
Weight	approx. 6 kg	approx. 12 kg

*	in conjunction with RAID1 max. 1x PCI or 1x PCIe slot possible
**	other temperature ranges on request
***	for details regarding the maximum permissible ambient temperatures for different install positions and install types, see section, »Device dimensions and ambient temperatures«
****	other operating systems on request
*****	without expansion / attachments (per expansion: +30 mm -> max. 2 expansions = +60 mm)

Industrial PC

IPC1400 series	
Variants	
IPC1410/BE1/CM1G1	Industrial PC: Display: 10,4"; VGA (640x480); Touch; CPU: Celeron M ULV 423 (1M Cache, 1.06 GHz, 533 MHz FSB); RAM:1GB-DDR2; CF-Card: 4GB- WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95 % without condensation
IPC1410/BE1/CD1G6	Industrial PC: Display: 10,4"; VGA (640x480); Touch; CPU: Core Duo Processor L2400 (2M Cache, 2x 1.66 GHz, 667 MHz FSB); RAM:2GB-DDR2; CF-Card: 8GB- WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95 % without condensation
IPC1412/BE1/CM1G1	Industrial PC: Display: 12,1"; SVGA (800x600); Touch; CPU: Celeron M ULV 423 (1M Cache, 1.06 GHz, 533 MHz FSB); RAM:1GB-DDR2; CF-Card: 4GB- WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C ..+60 °C; rel. humidity 5 .. 95 % without condensation
IPC1412/BE1/CD1G6	Industrial PC: Display: 12,1"; SVGA (800x600); Touch; CPU: Core Duo Processor L2400 (2M Cache, 2x 1.66 GHz, 667 MHz FSB); RAM:2GB-DDR2; CF-Card: 8GB- WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95 % without condensation
IPC1415/BE1/CM1G1	Industrial PC: Display: 15,1"; XGA (1024x768); Touch; CPU: Celeron M ULV 423 (1M Cache, 1.06 GHz, 533 MHz FSB); RAM:1GB-DDR2; CF-Card: 4GB- WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1xPS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95 % without condensation
IPC1415/BE1/CD1G6	Industrial PC: Display: 15,1"; XGA (1024x768); Touch; CPU: Core Duo Processor L2400 (2M Cache, 2x 1.66 GHz, 667 MHz FSB); RAM:2GB-DDR2; CF-Card: 8GB- WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95 % without condensation
IPC1419/BE1/CD1G6	Industrial PC: Display: 19"; SXGA (1240x1024); Touch; CPU: Core Duo Prozessor L2400 (2M Cache, 2x 1.66 GHz, 667 MHz FSB); RAM:2GB-DDR2; CF-Card: 8GB- WXPP-FES; 2x Eth 10/100MBit;3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95 % without condensation

Headless IPCs and remote displays

Displays with USB and CAN connectivity.

The Dx900 display series from Bachmann electronic enables the spatial separation between the display and operator unit and the controller. The remote display and the IPM1400 are connected via a 100 meter cable using the serial remote installation (DSA). The DSA itself is implemented as a module of the IPM1400 cassette system and ensures the interference free transfer of video, USB and CAN signals from the central unit to the Dx900 series display. USB terminals on the display enable a wide range of peripheral devices to be operated directly at the interface between the user and machine. CAN enables operating elements on the display to be connected directly with the controller hardware. A customized cable can be supplied on request.

Remote displays DD900 series

Features
Display: 15" XGA / 19" SXGA, color TFT, touch screen, customer spec. front panel*
Remote: 100 m, video, USB, CAN
Protection: front IP65 / rear IP54
Housing: stand-alone, aluminum housing, Support arm connection

*   on request

Remote displays DF900 series

Features
Display: 15" XGA / 19" SXGA, color TFT, touch screen, customer specific front panel*
Remote: 100 m, video, USB, CAN
Protection: front IP65 / rear IP20
Housing: control cabinet mounting

*   on request

The display diagonals, operating elements and design of the 900 series can also be adapted to individual requirements.

The control panels of the 900 series are available in two variants to meet different mounting requirements: the DD900 series comes with a modern aluminum housing with protection to IP65 at the front and IP54 at the rear. The DF900 devices are designed with a mounting depth less than 60 millimeters for control cabinet mounting. Aluminum frontpanels with a decorative film and an all-round seal also ensure protection to IP65 (front).

Cabinet PC IPM1400

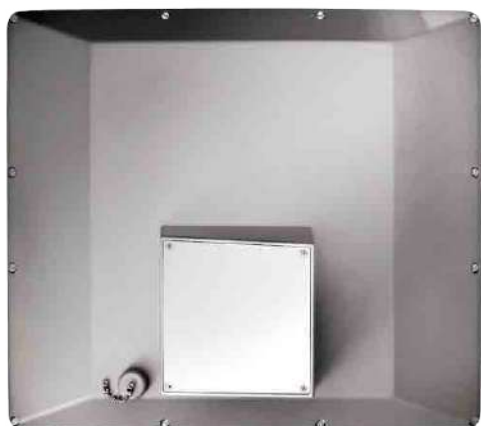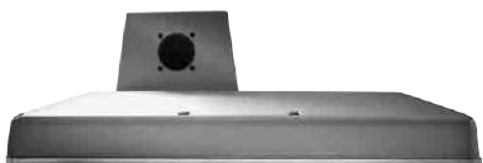| Features |
|---|
| Processor: Celeron M processor ULV 423 1.06 GHz
　　　　　　 Core Duo processor L2400 2x 1.66 GHz |
| RAM: 1 GB / 2GB |
| Operating system: Windows XP Embedded |
| Slot system: PCI, HDD* |
| Interfaces: Ethernet, USB, PS/2, RS232,
　　　　　　 CF slot |

* on request

Headless IPCs and remote displays

Remote displays
DD900 series

The DD900 remote display is an industrial control panel in a modern aluminum housing. The design and operating elements can be adapted to the customer's requirements.

The integrated USB interface enables a wide range of peripherals to be connected directly on the terminal. CAN enables operating elements on the remote display to be connected directly with the controller hardware without requiring any additional wiring.

- Remote installation between control panel and IPM up to 100 m
- Mounting on support arm
- Transfer of video, USB and CAN signals via one cable

Item	Item No.
DD915	on request
DD919	on request

DD900 series	DD915	DD919
Display		
Diagonal/resolution	15" XGA (1024x768)	19" SXGA (1280x1024)
Display type	color TFT	
Display brightness	300 cd / m²	
Half-brightness	min. 50,000 h	
Control/display elements		
Touch screen type	analog resistive	
Front keyboard / Number of keys	optional / max. 128, 2-fold programmable	
Interfaces	1x USB (rear)	
	CAN (rear)	
Power supply	24 V DC (18 V .. 36 V)	
Operating temperature	0 °C .. 40 °C, fan-free	
Certifications	CE, UL, CUL	
Housing	aluminum	
Degree of protection (front)	IP65	
Degree of protection (rear)	IP54	

Headless IPCs and remote displays

Remote displays
DF900 series

The remote display DF900 is an industrial terminal in flat design. Design and control elements of the front panel can be adapted to the customer's requirements.

The integrated USB interface enables a wide range of peripherals to be connected directly on the terminal. CAN enables operating elements on the remote display to be connected directly with the controller hardware without requiring any additional wiring.

- Remote installation between control panel and IPM up to 100 m
- Mounting in the cabinet
- Transfer of video, USB and CAN signals via one cable
- Slimline remote terminal

Item	Item No.
DF915	on request
DF919	on request

DF900 series	DF915	DF919
Display		
Diagonal/resolution	15" XGA (1024x768)	19" SXGA (1280x1024)
Display type	color TFT	
Display brightness	300 cd / m²	
Half-brightness	min. 50,000 h	
Control/display elements		
Touch screen type	analog resistive	
Front keyboard / Number of keys	optional / max. 128, 2-fold programmable	
System LEDs	Power, DIAG	
Interfaces	2x USB (rear) 1x CAN (rear)	
Power supply	24 V DC (18 V .. 36 V)	
Operating temperature	0 °C .. +50 °C, fan-free	0 °C .. +45 °C, fan-free
Certifications	CE, UL, CUL	
Housing	aluminum	
Degree of protection (front)	IP65	
Degree of protection (rear)	IP20	

Headless IPCs and remote displays
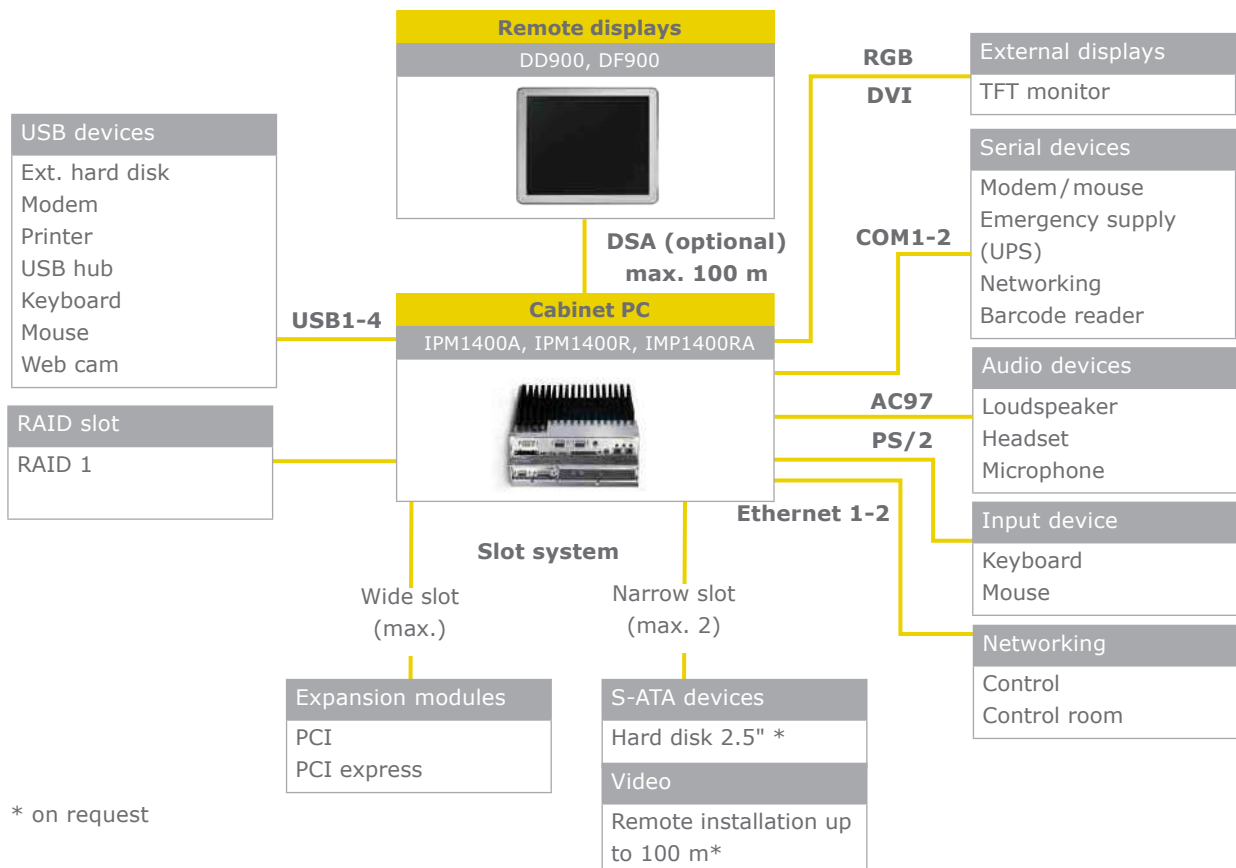
Cabinet PC
IPM1400

The IPM1400 cabinet PC while inconspicuous is the powerful and reliable brain of the well-designed Dx900 series terminals. The configuration varies depending on the application, and most I/Os as well as additional cards are individually arranged.

- Powerful and scalable cabinet PC based on Celeron M and Core Duo processors
- Individual configuration of the PC using expansion units

Item	Item No.
IPM1400/CM1G1/A	on request
IPM1400/CD1G6/X	on request
IPM1400/CD1G6/AX	on request

CM	...	processor Celeron M ULV 423 1.06GHz
CD	...	processor Core Duo L2400, 2x 1.66 GHz

Interfaces

Remote displays
DD900, DF900

USB devices
Ext. hard disk
Modem
Printer
USB hub
Keyboard
Mouse
Web cam

RAID slot
RAID 1

USB1-4

DSA (optional) max. 100 m

Cabinet PC
IPM1400A, IPM1400R, IMP1400RA

RGB
DVI

External displays
TFT monitor

Serial devices
Modem/mouse
Emergency supply (UPS)
Networking
Barcode reader

COM1-2

AC97
PS/2

Audio devices
Loudspeaker
Headset
Microphone

Ethernet 1-2

Input device
Keyboard
Mouse

Networking
Control
Control room

Slot system

Wide slot (max.)

Narrow slot (max. 2)

Expansion modules
PCI
PCI express

S-ATA devices
Hard disk 2.5" *

Video
Remote installation up to 100 m*

* on request

IPM1400 series	IPM1400/CM1G1/A	IPM1400/CD1G6/X	IPM1400/CD1G6/AX
Processor/RAM			
Processor system*	Celeron-M processor ULV 423 1.06 GHz	Core Duo processor L2400, 2x 1.66 GHz	
RAM	1 GB	2 GB	
Mass storage			
2.5" Flash disk	-		
CF card type I+II	4 GB	-	
Interfaces			
Network	2x Ethernet 10/100		
USB	3x USB 2.0 + 1x powered USB 2.0		
Serial	2x RS232 / 422 / (also configurable as full RS232)		
Mouse / keyboard	1x combined PS/2 connection		
Audio	AC97, 1x Line-In, 1x Line-Out, 1x MIC		
System LEDs	Power, Diag, HDD		
External monitor	1x VGA, 1x DVI, 1x DSA	1x VGA, 1x DVI	1x VGA, 1x DVI, 1x DSA
Expansion modules			
2.5" hard disk	-	≥ 80 GB (24/7), RAID 1	
Slots*****	max. 2x PCI or 2x PCIexpress		
Power supply	24 V DC (18 V .. 36 V)		
Tested acc. to	CE, UL, CUL, CSA, CC		
Software			
Operating systems***	Windows XP Professional (FES), Windows Embedded Standard 2009		
Visualization	Vis Designer / Java, other visualizations at customer's request		
Ambient conditions			
Operating temperature**	0 °C .. 50 °C fan-free		
Storage temperature	-20 .. +60 °C		
Rel. humidity operation / storage	5 .. 95 % without condensation		
Dimensions and devices			
Dimensions (W x H x D)	256 x 288 x 126 mm (incl. mounting plate, without expansion unit)	256 x 288 x 156 mm (incl. mounting plate and expansion unit)	

*	other processors on request	***	other operating systems on request
**	other temperature ranges on request	****	optional, IPM1400R / IPM1400RA, max. 1x PCI or 1x PCIe slot possible

Headless IPCs and remote displays

IPM1400 series	
Variants	
IPM1400/CM1G1/A	Industrial PC: Headless; CPU: Celeron M ULV 423 (1M Cache, 1.06 GHz, 533 MHz FSB); RAM:1GB-DDR2; CF-Card: 4GB - WXPe; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; 1x DSA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95% without condensation
IPM1400/CD1G6/X	Industrial PC: Headless; CPU: Core Duo Processor L2400 (2M Cache, 2x 1.66 GHz, 667 MHz FSB); RAM:2GB-DDR2; HDD: RAID1-2x160GB WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C.. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95% without condensation
IPM1400/CD1G6/AX	Industrial PC: Headless; CPU: Core Duo Processor L2400 (2M Cache, 2x 1.66 GHz, 667 MHz FSB); RAM:2GB-DDR2; HDD: RAID1-2x160GB WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; 1x DSA operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95% without condensation

Headless IPCs and remote displays

Engineering software

In the automation of plants and machines software has become an essential component. As an innovative provider Bachmann electronic also establishes the state of the technology in this area as well and enables groundbreaking future solutions, such as the Bachmann SolutionCenter. With a series of the latest software engineering and diagnostic tools we support rapid and convenient realization of programs for machine sequence, process control, visualization, and not least, communication with the outside world. »Time-to-market« is no longer just a buzz word, rather it is a principle that is lived.

With engineering software from Bachmann electronic you rely on complete solutions that have been thought-through in the details; solutions that increase the productivity and sovreignty of your applications, that free-up resources for your core business, and that can also be used reliably in the distant future.

Project engineering made easy: SolutionCenter

A milestone in the reduction of engineering costs.

As part of a unique, complete software solution, the Bachmann SolutionCenter covers all aspects of the engineering process – configuration, programming, controlling/regulation, communication, Motion, visualization, as well as test and commissioning. Thanks to the highly modular Eclipse plug-in concept, the tool can be easily expanded, even for integrated user-specific requirements.

Matched in the best manner possible to the devices and systems of the manufacturer, it provides time savings, brings synergies, and increases usability. Users benefit from the cohesive operating concept and avoid redundant entry or unnecessary manual entry. A close linking to the automation systems of Bachmann electronic enables simplifications in virtually all processes.

Configuring

- Controller design offline
- Configuration of the hardware modules
- Management and use of predefined hardware and software modules
- Assignment of signal designations
- Archiving, export and import of subsystems or complete controller systems
- Configuration of the fieldbuses, telecontrol:
  - CANopen, DeviceNet
  - PROFIBUS DP
  - PROFINET IO RT/IRT
  - EtherCAT, SERCOS
  - Modbus TCP, UDP, RTU
  - IEC61850/IEC61400-25 (MMS)
  - IEC60870-5-101, -103, -104
  - OPC UA/DA

Programming

- IEC61131-3 (CoDeSys, PLCopen Safety)
- C/C++
- MATLAB® / Simulink®
- Extensive libraries
- Repository with SVN

Visualizing

- Configurations for M1 webMI pro web visualizations
- VisDesigner project designs
- Communication libraries for developing user-defined visualizations (Java, C, .NET)
- OPC server

Controlling & regulation

- Motion Control:
  - Softmotion (M-SMC)
  - Shaft (M-SHAFT)
  - Three-dimensional motion (M-CNC)
- Temperature controller (M-TEMP)
- M-Target for Simulink®
- Libraries for IEC61131-3 and C

Testing and diagnostics

- Software oscilloscope
- Variable browser / Watch view
- Logbooks
- Task lists with runtime measurement
- Error lists in the Error Handler
- Printout of PLC report
- Direct access to I/O signals
- Remote monitoring
- Internet-enabled communication

Tools/Add-Ons

- Access control
- Time synchronization (SNTP, IEEE1588)
- SVN repository (source code & configuration management)
- Configuration history/ comparison
- Eclipse plugins

Engineering Software

M-Base

The complete product range of the engineering software from Bachmann electronic is delivered in a software package. For different applications, derivatives are made available which are tailored to the needs of individual users.

- Device configuration & system settings
- Fieldbus configuration
- Right of accesses
- Programming in C/C++, IEC61131
- Safe programming
- Visualization project
- Comprehensive system diagnostics
- Many monitoring functions
- Project and diagnostic reports

Items	Item Nr.
M-Base One-time License	00015629-60
M-Base Annual Maintenance	00015629-70
M-Base COM One-time License	00015778-60
M-Base COM Annual Maintenance	00015778-70
M-Base SC One-time License	00018914-60
M-Base SC Annual Maintenance	00018914-70
M-Base SC Light One-time License	00018888-60
M-Base SC Light Annual Maintenance	00018888-70
M-Base Device Viewer One-time License	00015845-60
M-Base Device Viewer Annual Maintenance	00015845-70

Delivery variants	
M-Base	
M-Base One-time License	Complete engineering package for configuration, programming and modeling for the Bachmann M1. The product support and the updates of one year are included in the license.
M-Base Annual Maintenance	extension of the product support and updates for one year longer
M-Base SC One-time License	SolutionCenter for configuration and diagnostic, programming in C/C++, visualization tool and Safety Developer. The product support and updates within one year are included in the license.
M-Base SC Annual Maintenance	extension of the product support and updates for one year longer.
M-Base SC Light One-time License	SolutionCenter with Device Manager for pure configuration and diagnostic for the M1 controller system. The product support and the updates of one year are included in the license.
M-Base SC Light Annual Maintenance	extension of the product support and updates for one year longer
M-Base Device Viewer One-time License	Device Viewer for pure monitoring of the M1 controller system. The product support and the updates of one year are included in the license.
M-Base Device Viewer Annual Maintenance	extension of the product support and updates for one year longer
M-Base COM One-time License	communication library for MVIS visualizations. The product support and the updates of one year are included in the license.
M-Base COM Annual Maintenance	extension of the product support and updates for one year longer

Configuration

Merging hardware, fieldbuses, and software into a unit.

The expenses for design, wiring, and commissioning of a machine represent a considerable share of the engineering costs. Bachmann electronic supports the user on all levels with convenient and innovative tools. From the planning of the control topology and the configuration of fieldbuses to the wiring test and to installation of software modules, one tool can be used that permits flexible adaptation to a wide variety of tasks with its consistent operating concept. The Device Manager as part of the SolutionCenter is the central point for all configuration and diagnostics tasks.

Device Manager

The Device Manager is the integrated tool for configuration and commissioning of all automation devices from Bachmann electronic. The entire M1 controller family, the panel PLCs from the CT series, the terminals of the WT series, but also standard-conformant fieldbus nodes from third-party suppliers are supported by this tool. Through the capability for complete offline engineering work can start before the hardware is available. The flowing alternation between offline and online configuration in both directions is not only possible for the complete controller, it is also possible for the exchange and archiving of individual hardware and software modules, as well as for complex fieldbus configurations.

The work area is consistently organized for all topics in a configurator window and a monitor window. The Configurator shows the saved target status that will be valid after the next system startup, the monitor shows the actual status and allows manual change of values and settings.

The hardware structure is presented in the real topology. The type of networking via proprietary and standardized bus systems is presented through the organization of a tree structure; the I/O modules can be uniquely detected and directly operated through the graphic presentation. Thus the wiring test can be executed immediately after switching on the system.

The software for the controller is also managed in the Device Manager. The system packages from Bachmann electronic are summarized in a catalog. All the software is updated conveniently

via a wizard that guides the user through the procedure. In addition to the provided system packages, the user can also put together and manage his own, machine-specific packages and transfer them to other PCs. Thus unique software states can be assured on all systems and on all service PCs.

The variable set of all participating controllers is presented in a structured manner in a separate view. Searching for values is facilitated through an automatic full-text search; a selection of relevant values can be summarized, saved, and reloaded in an additional window. Through a trend display the temporal progression of values can be graphically presented.

- One interface for all Bachmann devices
- Managing devices
- Backup of existing devices
- Offline configuration of entire control systems or individual HW / SW modules
- Offline and online configuration of fieldbuses (CAN, PROFINET RT and IRT, PROFIBUS DP, EtherCAT)
- The same mode of operation for online and offline devices
- Consistent concept: Monitor (actual status) and configurator (target status)
- Graphic presentation of the I/O modules
- Configuration and diagnostics in one tool
- Software is managed in catalogs, user-specific catalogs
- Flexible compilation of functional window areas (perspectives)
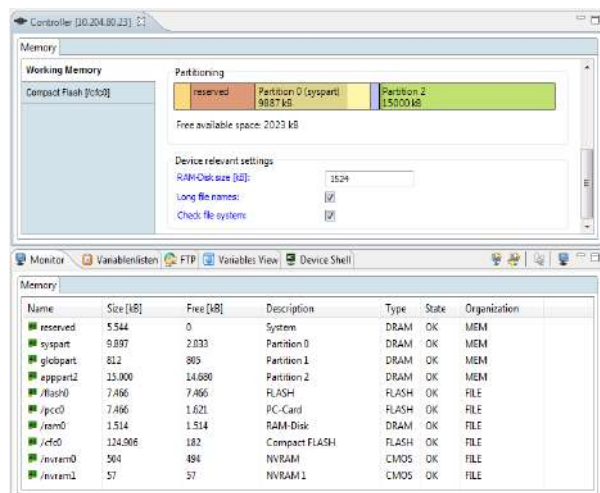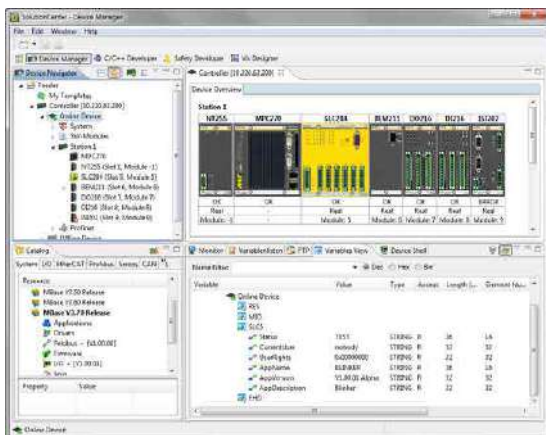
Testing and diagnostics

Monitoring and debugging for every field of application.

Bachmann M1 automation systems are designed for a broad user spectrum. More extensive than is the case with the conventional solutions for industrial automation, the support for experts was considered right from the start. Monitoring and debugging tools for every field of application, from the signal test of the control cabinet builder to section identification of the control system engineer, shorten commissioning times and increase the transparency of the overall system.

Scope 3 – Overview in real-time
Signal analytics and diagnostics directly with the controller

In the initial project design and also for commissioning or troubleshooting, transparent information concerning states and sequences of an automatic system is essential for success. For many dynamic processes seeing a physical variable as only a numeric value is insufficient. The software oscilloscope »Scope 3« makes the temporal progression of processes visible and places this progression in relation to other process variables. »Scope 3« is an indispensable tool for optimization of a controller setting, for troubleshooting in a sequential program, or for ongoing verification of the manufacturing process on the machine. It permits specific and stand-alone recording, archiving of the relevant data in a database and subsequent

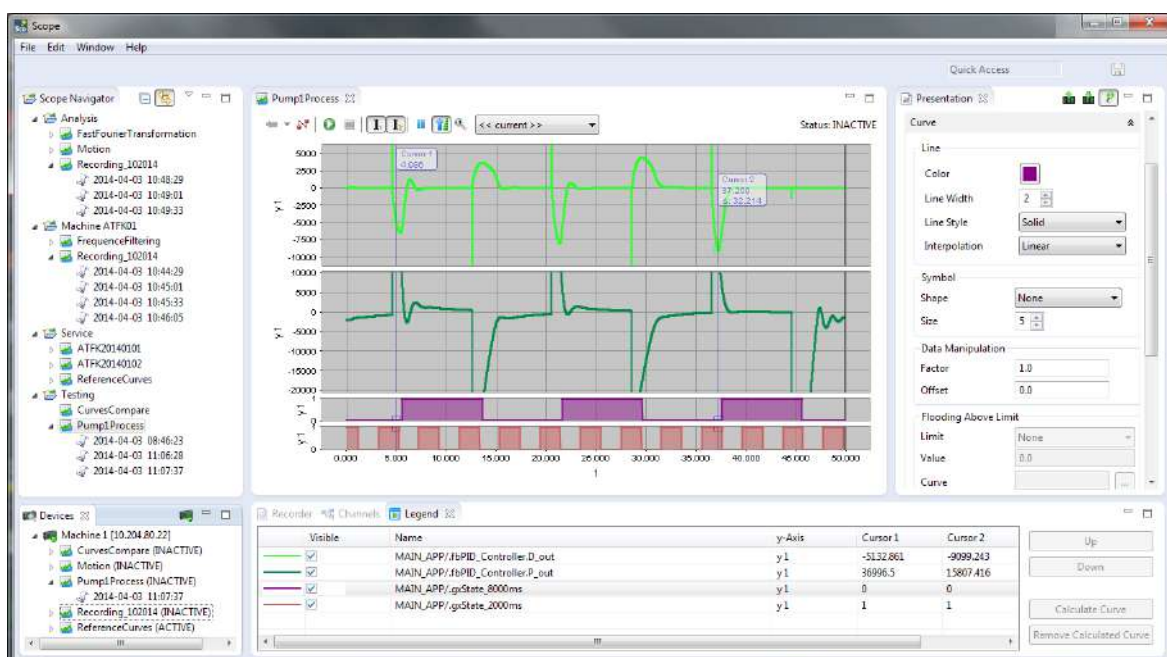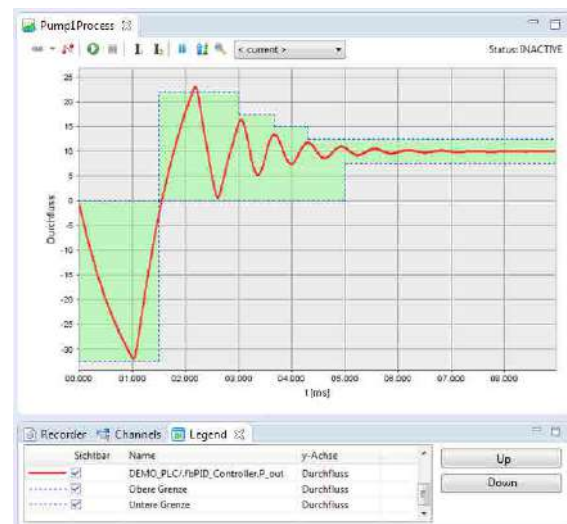| Item		Item no.
SCOPE 3 Pro RT	Software package to install on Windows PCs and M1 controllers for the diagnostics of signal waveforms (IO- and process variables). Stand-alone task for recording and archiving of records on the controller, trigger and pretrigger, multiple recordings. Comprehensive graphical representation (chart) and evaluation functions, data export on the PC, SolutionCenter integration. License bound to target device.	00024212-63
SCOPE 3 DVD	Installation medium for Scope 3 (DVD). Software module for the M1 controller and Scope 3 tool for displaying recordings and data analysis. A Scope software module without a valid runtime license can be used for up to two hours for recordings. After that, the recording is stopped, but it is possible to restart after a period of 10 minutes. Without a runtime license, archiving functions on the M1 controller are disabled.	00024212-00

measurement or evaluation of a great number of values in parallel. Different trigger conditions as well as pre-trigger and post-trigger functionalities enable acquisition of all relevant data, such as in the case of sporadically occurring errors.

Calculation of additional curves from the recording values facilitates retrospective analysis. A special exchange format enables saving and sending of the recording configuration and entered values in one and the same file. Thus, for example, Scope recordings can be forwarded by email and further processed by the recipient to their full extent (zoom, measurement with cursors, calculated curves, etc.). »Scope 3« is also the right tool for the long-term archiving of measured values directly on the controller. The maximum storage space available is configured and the recording started by means of archiving limits.

Thus, millions of data points can also be archived directly on the controller. Backup and export functions then allow further processing of the collected data.

- Recording of analog and digital values
- Real-time acquisition directly on the controller
- Long-term recordings per database
- Large number of signals (multiple acquisition tasks possible)

- High resolution / variable sampling priority
- Versatile trigger possibilities / pre-triggers and post-triggers
- Graphic evaluation / curve display on the PC
- Measurement of curves
- Scaling / shifting of curves and calculated curves
- Overlay of reference curves
- Archiving / export on the PC

Testing and diagnostics

Engineering PC

Scope 3 tool

Configuration | Presentation

• Transforming
• Measuring
• Analysing

CSV
Data exports

Data base

TCP/UDP/QSOAP/SSL

M1 controller

Scope 3 Software module

Management | Data recorder | **Data base**

APP modules

APP1 | APP2

CSV
Data exports

HW modules

Digital I/O | Analog I/O | Technology modules
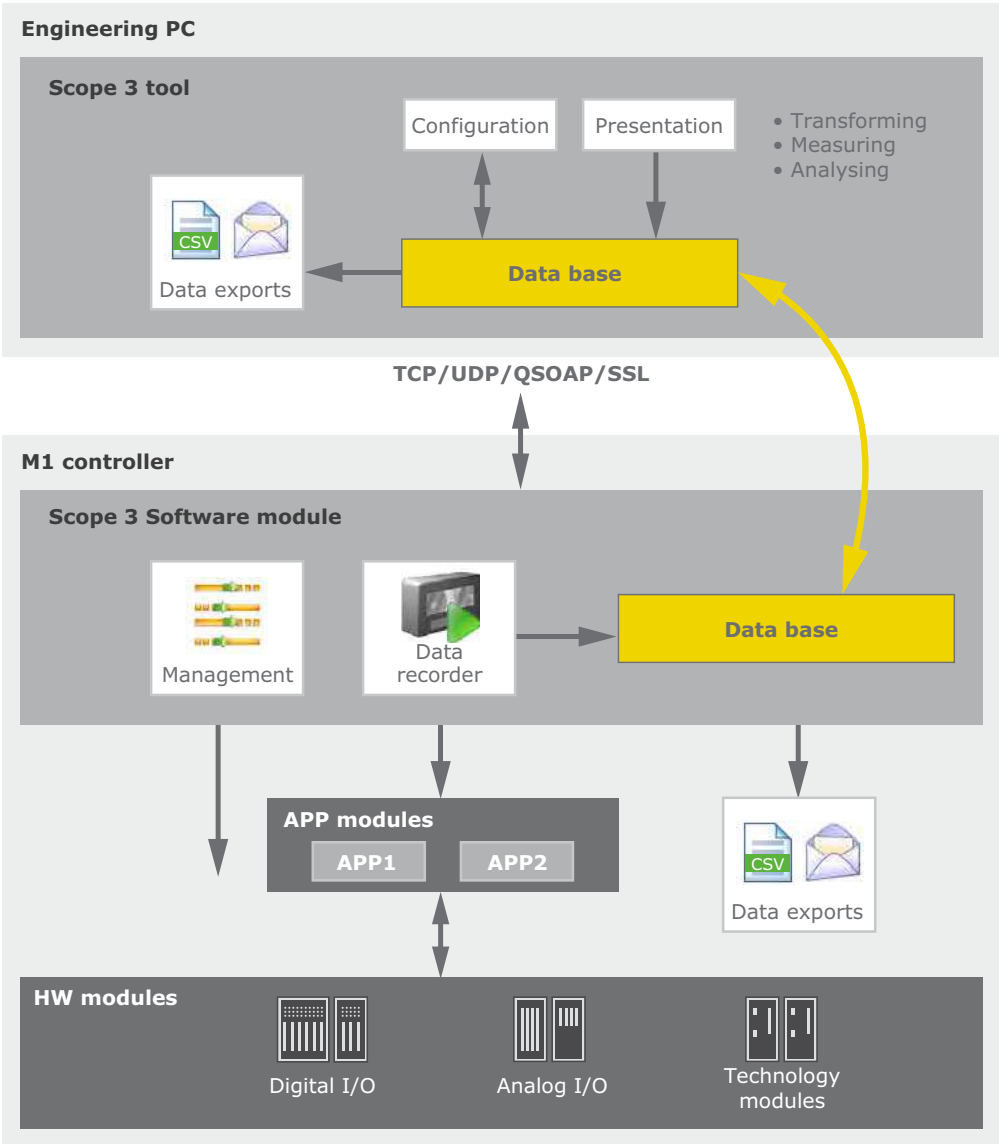
The central aspect of Scope 3 is the portable database on the Engineering PC and M1 controller. This enables very simple data exchange and collaboration – also using copies of a single file, if necessary.

Scope 3	
General	
Recording module	Stand-alone real-time recorder on the controller
Configuration	Graphic configuration interface in the SolutionCenter or standalone-tool
Presentation interface	Diagram display with dynamic legend in the SolutionCenter or standalone tool
Recording module	
Recordable data sources	Channel values direct (MIO), SVI variables
Data Types	All analog and digital formats up to 64-bit
Recordable tasks	SVI variables of any number of software modules simultaneously
Sampling modes	• Continuous • Triggered once • Triggered cyclically
Sampling rate	• Cyclical, min. 100 microseconds, max. 60 minutes • Coupled with hardware interrupts
Time base	• System-tick • Hardware-sync-signal • Auxiliary clock • Real-time clock
Trigger	• Any combination of start- and stop-triggers • Recording conditions as additional limitation of the recorded data • Edge, level and distance triggering • Pre-trigger and post-trigger of any length (max. length of recording)
Data quantities	No technical limitation, dependent on the free resources on the M1 controller
Interface	C-library for using the data recorder in an application: • Executing commands (Start, Stop, etc.) • Changing the recording configuration
Scaling	Several recordings executable in parallel with different sampling rates and different priorities
Auto-run	Yes, automatic start after reboot possible
Write protection	Yes, definable warning text on changes
Data buffer	Configurable ring buffer for loss-free transfer of data from the controller to the PC
Data archiving on controller*	
System	Embedded database, optionally activatable, database file can be copied freely to different controllers or PCs and used
Archiving interval	Freely configurable in seconds, fast recorded data is buffered and stored in the database in the archiving interval
Configurable limits	• Length in seconds • Number of recorded points • Number of recordings
Caching of the data-base	Cache size in the working memory freely configurable
Interface	C-library for using the database in an application: • Addition of reference channels or entire recordings • Export of data or hot backup

* Functions are only available in the Professional Version

Testing and diagnostics

Scope 3	
Management / Configuration	
Project Management	Configurations can be created flexibly in workspace and managed there in projects
Management of recordings	Recordings installed on the M1 can be managed directly via their own view
Configuration of recordings	All configuration methods can be selected via masks. Errors in the configuration are validated immediately.
Delivery of configuration	A recording configuration can be delivered to a controller via a single action.
Backup of data	Data on an M1 can be saved on the PC by drag and drop.
Presentation/analysis system	
Presentation forms	Value-over-time [x(t)], value-over-value [x(y)]
Time formats	Milliseconds [ms] or date/time formats (freely configurable)
Number of value axes	User-defined
Number of curves	User-defined, selective showing/hiding for maintaining clarity
Axis reference	Each curve can be allocated to any axis
Auto-scaling	Yes, linear or logarithmic scaling possible
Fixed scaling	Yes, adjustable
Scale arrangement	Yes, adjustable
Measurement cursors	2 (can be offset separately and together)
Measurement cursor functions	Value display in legend, time display, differential display
Stacked Plot	Yes, a separate diagram per signal, selective full-screen mode per curve
Array of curves	Up to 10 older recordings can additionally be displayed faded into the background for comparison
Grid	Yes, configurable
Presentation options	Curve, axis, grid colors, all line thicknesses, orientation, axis label, axis arrangement (left/right), flooded curves on reference value or other curves
Raw value transformation	Factor and offset per signal
Reference curves	Yes, can be imported from CSV or integrated via application
Highlighting ranges	Curves can be flooded against a configurable reference value or against another curve, configurable via color and transparency value
Curve calculation	• Measured curve values or calculated curve values are the basis • The calculation methods are addition, subtraction, multiplication, division, integration, differentiation, Fast Fourier Transformation (FFT) • Users can add their own calculation methods
Possibilities for making comparisons	Yes, comparison of recordings from different time ranges as well as different recordings
Interfaces	Extendible with regard to specific calculation operations for curves and export functions for individual formats

Scope 3	
Data retention	
Recording configuration	Can be exported/imported as a file
Value storage	On the controller or PC
Exchange formats	A database for configuration and data can be exported/imported
Excel interface	CSV export
System requirements	
PC software (minimum)	Processor 2 GHz, working memory 1024 MB RAM, hard disk drive with 250 MB of free storage space, screen resolution 1024x768 pixels, Microsoft Windows XP or higher
M1 software module	M1 controller system (except for ME2xx) with M-Base 3.75 or higher
Design variants	
SCOPE 3 Pro RT	Software package to install on Windows PCs and M1 controllers for the diagnostics of signal waveforms (IO- and process variables). Stand-alone task for recording and archiving of records on the controller, trigger and pre-trigger, multiple recordings. Comprehensive graphical representation (chart) and evaluation functions, data export on the PC, SolutionCenter integration. License bound to target device.
SCOPE 3 DVD	Installation medium for Scope 3 (DVD). Software module for the M1 controller and Scope 3 tool for displaying recordings and data analysis. A Scope software module without a valid runtime license can be used for up to two hours for recordings. After that, the recording is stopped, but it is possible to restart after a period of 10 minutes. Without a runtime license, archiving functions on the M1 controller are disabled.

Programming

Maximum performance for maximum stability.

Any automation platform is only as good as the software that is available for it. The stability, real-time capability and performance of the runtime system have the highest priorities. The M1 automation system can be programmed in the respective familiar environment of the automation engineer: All five languages of IEC 61131-3 are supported, as are C, C++ or Java.

Also the model-based development via UML-Design / coding or integration in the function block editors of MATLAB® / Simulink® are unique in the industrial environment. Comprehensive, complete provided libraries simplify the use even of complex units from automation, motion control, and information technology / web.

M-PLC programming interface

| Features |
| --- |
| Easy entry into IEC 61131-3 |
| IT, ST, LD, FDB, CFC, QFB |
| Convenient debugging on the target system with single-step, breakpoints, etc. |
| Provided libraries with pre-finished and tested functions |

C / C++ Developer

Features
Languages: ANSI C and C++
Gnu compiler gcc
Automatic adaptation and management of the computer environment
Editor and debugger based on Eclipse CDT
Intellisense: Automatic supplementation of structure elements
Syntax highlighting
Folding code ranges, e.g. for complete while loops

M-PLC
Programming interface
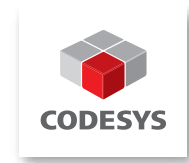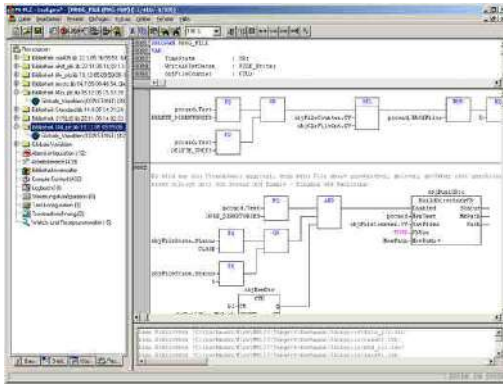
### PLC programming interface according to IEC 61131-3

M-PLC is a complete development environment for programming the M1 controller in accordance with IEC 61131-3. The M-PLC puts a simple approach to the powerful IEC language at the disposal of the PLC programmer. Use of the edit and debugging functions is based on the proven development program environments of advanced programming languages.

- Easy entry into IEC 61131-3
- All languages defined in IEC standard 61131-3 are supported (instruction list, structured text, ladder diagram, function block diagram, continuous function chart, sequential function chart).
- Editor and debugging functions
- Provided libraries with pre-finished and tested functions

Programming
- Editors for programming in all IEC 61131-3 languages

IL	Instruction List
ST	Structured Text
LD	Ladder Diagram
FBD	Function Block Diagram
SFC	Sequential Function Chart
CFC	Continuous Function Chart
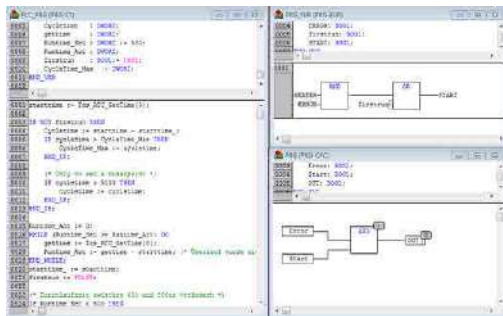
- Syntax highlighting for key words defined in IEC 61131-3
- Graphic project navigation bar (based on Windows Explorer)
- Support of all elementary IEC 61131-3 data types to 64 bit
- Support of fields, structures and pointers
- Graphic controller and task configuration
- CAN objects from *.dcf files in M-PLC can be applied as symbols
- PB objects from *.2bf files in M-PLC can be applied as symbols
- Library management for creation and management of libraries
- Watch manager and recipe manager (freely definable variable monitoring)
- M-PLC can be started several times (multiple projects open and online in parallel)
- Automatic project backup and creation of backup
- Project archiving on the controller
- Password protection for projects
- Offline simulation
- Online help
- Data exchange system-wide via SVI/SMI interface programming
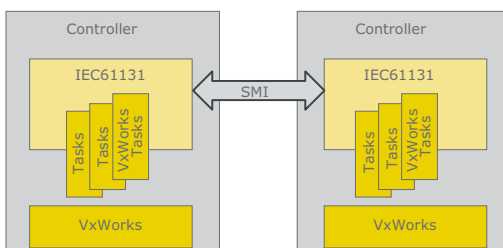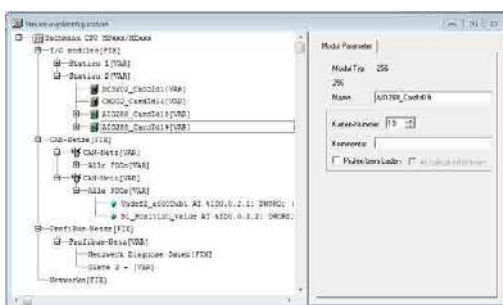
Programming

Runtime system

- Any number of running M-PLC projects on one processor
- Every PLC project supports up to 16 separate tasks
- Each task can be configured independently of the others in terms of (priority, task call-up mode [event, timetrigger, free running, sync], watchdog)
- Actual multitasking via operating system tasks (VxWorks)

Online functions

- Online change (exchange of blocks in running operation) also for multitasking projects
- Monitoring of all project variables
- Writing and forcing of variables
- Single cycle, single step and break points
- Sequence control (program lines that have been run through will be displayed)
- Recording and graphic presentation of project variables – trace
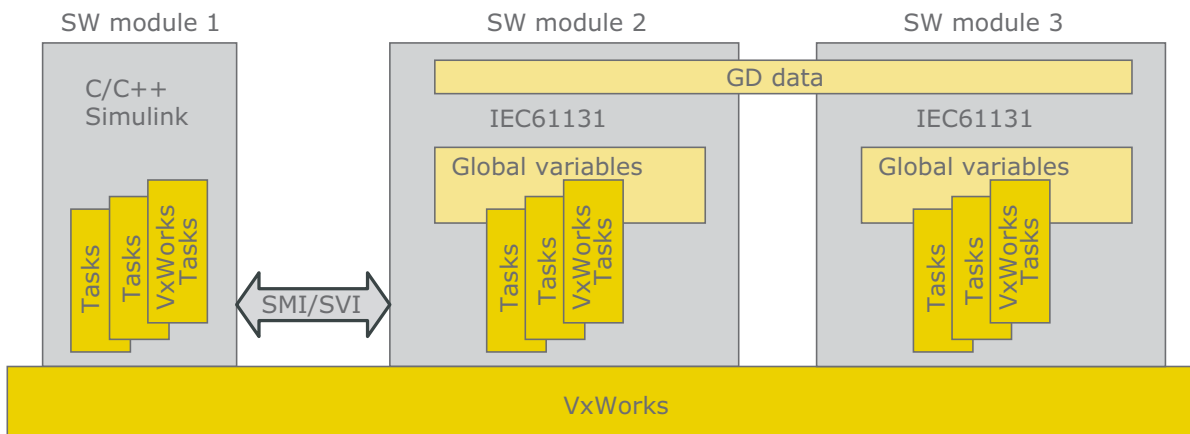
- Communication between software modules (precompiled units)
- Between different tasks of an IEC61131 module: global variables or SMI/SVI
- Between IEC61131 modules: GD flag range or SMI/SVI
- Between IEC61131 modules and other modules (C/C++, Simulink): SMI/SVI
- Between any modules on different controllers: SMI
- Interface to visualization/SCADA/BDE
- Standard protocols: OPC DA, IEC 61850/IEC61400, Modbus, …
- Libraries for integration into separate software (for C/C++, C#.NET, Java)
- Support of battery-buffered data (RETAIN flag)
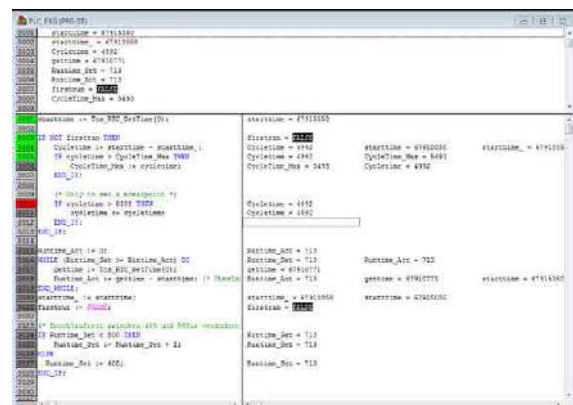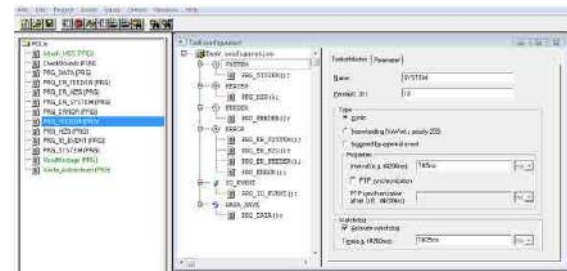
Manufacturer libraries

- **STANDARD** IEC 61131-3 Standard functions and function blocks
- **CONT_PLC** 7 standard PID controllers
- **MIO_PLC** Functions for direct access to hardware I/Os
- **SMI_PLC** Functions for fast communication between modules and controllers (SMI/SVI)
- **EHD_PLC** Functions for inputting and managing errors in the EHD
- **UTIL_PLC** Functions for access to RTC, runtime system info, special conversions
- **FILE_PLC** Functions for access to files, directories and serial interfaces
- **CIA405** Functions for access to CAN
- **DN_PLC** Functions for access to device net
- **PB_PLC** Functions for access to Profibus
- **USS_PLC** Functions for communication with "Micromaster" frequency converters

Extensions relative to CoDeSys

- Grouping possibility for I/O modules in the process image (controller configuration)
- runtime-optimized process image (only channels being used are processed)
- CAN objects with symbolic names in the process image
- Addressing for inputs/outputs: undelayed access that bypasses the process image
- Adjustment of the interval time and watchdog time in the controller configuration
- Multiple, concurrently running PLC projects on one CPU with different priorities/ interval times
- Actual operating system tasks within the PLC projects
- GD flag range for shared data from multiple projects on one CPU
- RD flag range for remnant (battery-buffered) data
- Optionally, the normal flag range (MX .. MR) can also be placed in the battery-buffered memory area.
- Interface in the runtime system for libraries
- Initialization (C), deinitialization, version check, memory management, management of background tasks, provision for online change

- Support for exception handling in the runtime system
- Display of the status "in error handling" (ERROR) in the interface
- Implementation of the I/O modules of the process image in the runtime system
- Optimized for performance, flexibility and combinability, shared use of an I/O module by multiple projects/SW modules possible
- Saving/loading of the entire project including sources to/from the controller
- Transparency of the global variables (flags, symbolic variables, structures) controller- and visualization-wide

Integration in the SolutionCenter (projects are SW modules)

- Generation of an executable *.m file with configuration information
- Task interval time measurement, can be queried in the project itself and in Device Manager
- Watchdog integration
- Execution possible in an application layer (memory protection)
- Install, start, stop, reset and delete of PLC projects in Device Manager
- The state machine of a PLC project in the runtime system always corresponds to the model defined for SW modules.
- Integration via M1 system debug mode and M1 system logbook
- Start of a project when booting through entry in MConfig.ini

Programming

C / C++ Developer

High-level language programming in C and C++ is also gaining increased significance in automation technology. These languages are not only widely used, they also offer the possibility of extremely efficient programming and of encapsulating frequently-used sequences in classes. The ability to structure a software module into any number of tasks, and in the process being able to use all the resources of a powerful operating system, VxWorks®, without restriction is an incredible expansion of the possibilities. C / C++ Developer enables programming in ANSI C, as well as in C++.

Thanks to the mature interface and the restriction to the required setting possibilities, getting started with C and C ++ programming remains easy. For the start of a new project multiple selectable project templates available that already contain all calls for the start of the software module and its interaction with the operating system. Consequently the programmer can immediately devote himself to the logic of his application. Projects can be compiled immediately after they are created. The result is a finished, executable program file for the M1 controller family. The »make« environment and all configuration files are managed and set up by C /C++ Developer automatically. For transfer of existing projects from a different development environment there is also the possibility of continuing to use the existing configuration files for the compile process, without having them managed by the C / C++ Developer (»unmanaged make«). Integration of existing libraries (*.a) in projects is also possible, as is generation of your own libraries.

The generated executable program file can be directly transferred, configured, installed and started from the C / C++ Developer on the control system.
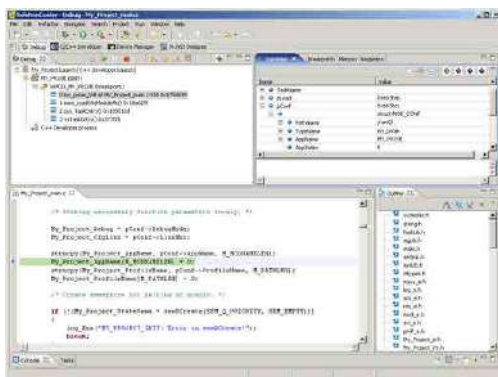
Troubleshooting is supported by a mature debugger that can not only be active after download of the project, but also enables integration of a software module that is already running. Set break points can be deactivated and will be saved automatically in the project, in addition they can also be saved in lists. In addition to the break points, watch points, also referred to as »hardware breakpoints« are also available. These do not stop a task when it executes a defined code, but rather they stop a task when a specific memory address is read and/or written to.

The contents of the stack variables and the global variables are readable and writable, complex data types and structures are resolved appropriately and mapped in the form a tree. In addition, any number of memory contents can be listed in numeric format.

All tasks that belong to the software module are presented. For each function that is in the debugger the call-up hierarchy is displayed (stack trace).

- Languages ANSI C and C++
- Gnu compiler gcc
- Automatic adaptation and management of the compiler environment
- Editor and debugger based on Eclipse CDT
- Intellisense: Automatic supplementation of structure elements
- Syntax highlighting
- Folding code ranges, e.g. for complete while loops
- Jump to the declaration of variables and functions from the code
- Debug agent integrated in the M1 operating system (MSys), no additional settings are necessary
- Installation and start of the created software module from the development environment
- Coupling of the debugger to the running software modules
- Generation and integration of libraries
- All important compiler settings are accessible via dialogs
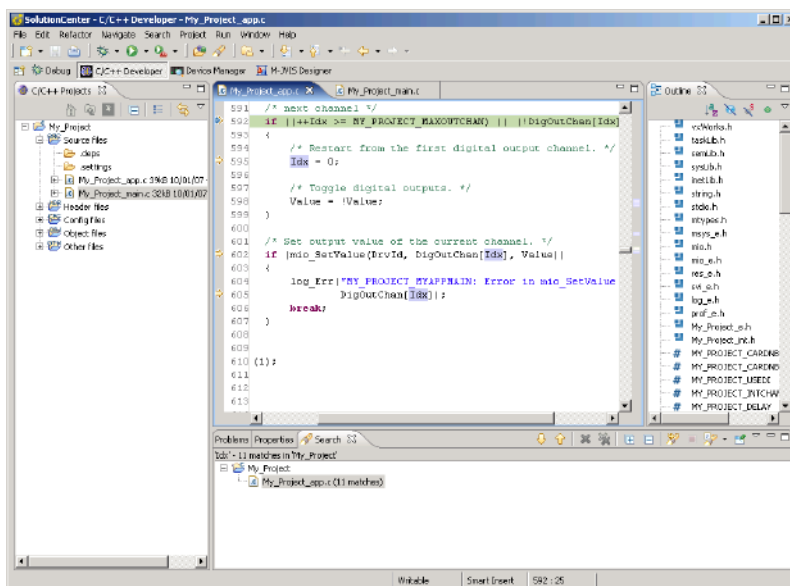
Model-based design/Simulation

Proven security for the future.

M-Target for Simulink® enables rapid implementation of algorithms developed in MATLAB®/Simulink® on the M1 automation system. Processes are presented in the simulation environment of MATLAB® and suitable control and regulation strategies are developed for this. The overall system can be varied as often as desired in the computer simulation, before trials are executed on real prototypes of machines and plants. Automatic code generation enables transfer of the developed algorithms to the controller and automatically establishes the connection to the input/output modules used.

M-Target for Simulink®

Fast development of controllers and sequence controllers

The MATLAB® program package and the associated toolbox, Simulink® from Mathworks Inc. are considered to be the worldwide standard in the area of modeling dynamic systems in technologically demanding processes.

With the complete integration of the M1 controller as target system, a convenient and efficient implementation of the MATLAB® functions is enabled on an M1 control system. The user can concentrate exclusively on working in the familiar, graphic Simulink® programming environment, where he can model the system in its entirety and simulate the effect of changes even before transfer to an M1 control system. The code for the M1 target system is generated automatically in the background and requires no knowledge of a programming language. This complete integration enables efficient programming and commissioning of the M1 control system.

- Faster implementation of controllers through shorter controller design phases
- Shorter commissioning processes through reliable automatic code generation
- Higher level of agreement between machine model and controller model
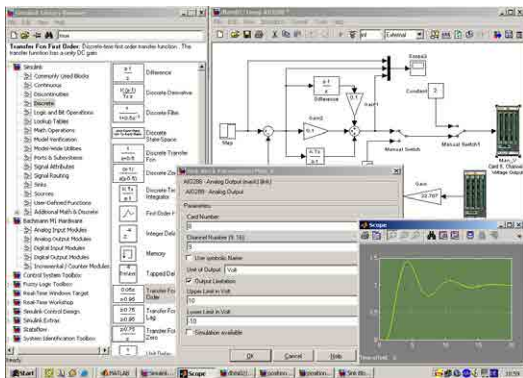
Existing MATLAB®/Simulink® subsystems can be reused in new simulations of the controller programs. The integration of Bachmann »ready-to-use« software modules facilitates development of complex, customer-specific software. The unique and direct interplay between process model, controller model and support a more stable modeling of the overall process. Transfer to the M1 controller is executed automatically from the MATLAB®/ Simulink® environment, parameter variations in the model are implemented online in the M1 target system (target). Sequential programs can be implemented through the optional Stateflow and Coder toolboxes.

Item	Item no.
M-Target for Simulink One-time License	00015577-60
M-Target for Simulink Annual Maintenance	00015577-70

Model-based design/Simulation

Development Process

1. Modeling

Both plant (physical system) and control systems are modeled in Simulink®. Using application specific tools reduces the time spent developing the system. This is achieved by enabling the developer to use modeling languages native to the domain of interest. Domain-specific products for physical modeling, such as SimElectronics, SimHydraulics, SimMechanics, make it easier to create intuitive, reusable models of the multidomain physical system. For mathematical modeling, MATLAB® and Simulink® also offer a range of capabilities. Established service companies offer additional expertise in all domains.

2. Simulation

The resulting complete model is now simulated offline on the computer. Comprehensive test series of all possible operating conditions or error situations are played through. Iterative model adjustments and new simulations follow seamlessly. The high-quality process/solver for numeric calculation of differential equations also prove themselves outside of simple analytical systems. Outstanding graphic depiction possibilities, such as curves and surface plots and even animated 3D-CAD models, optimize the work sequence.
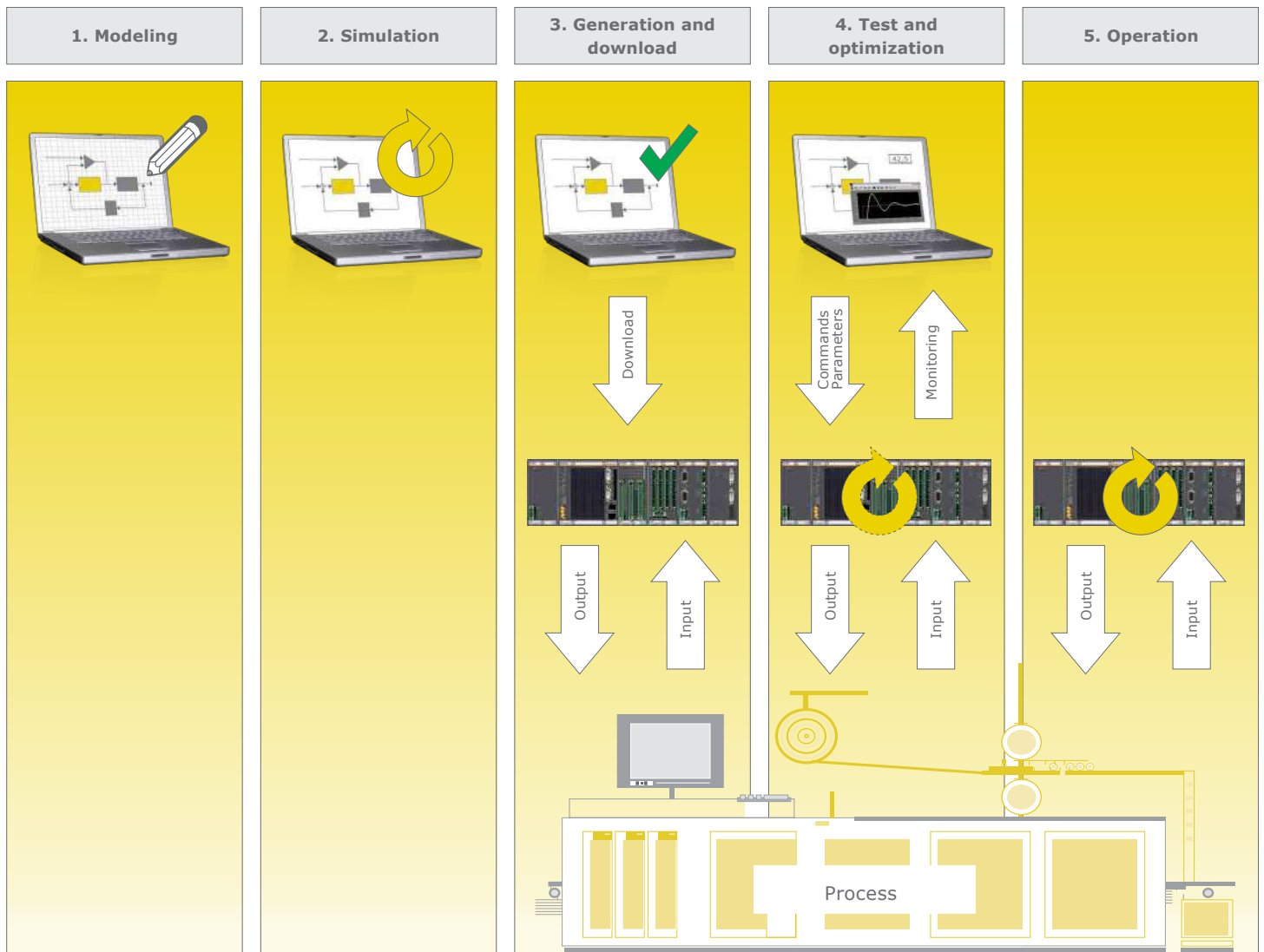
1. Modeling	2. Simulation	3. Generation and download	4. Test and optimization	5. Operation

Download

Commands Parameters

Monitoring

Output

Input

Output

Input

Output

Input

Process

3. Generation and download

In this step, the process model is first separated from the actual control or regulation part. Then a mouse click triggers automatic code generation and preparation of the application for the real-time system. This can be loaded directly from the Simulink® interface into the controller.

4. Test and optimization

The generated real-time program now runs in the controller. But it can exchange data directly with the Simulink® interface on the PC through the communication interfaces integrated during code generation. Then, in the so-called "external mode", the actual process values (variables, channel values) are available directly online in Simulink®. At the same time, variable values or internal parameters of the Simulink® blocks can also be changed from there in the real-time program. In this mode, the Simulink® model created by the developer is only the graphic front end for visualization of process values and stipulation of parameters. Using the real process environment, the discovered solution can be verified and further optimized. If necessary, users can switch to a prior process step and make changes there (iterative improvement).

5. Operation

As soon as a satisfactory result is achieved, the project management PC can be separated from the controller – which continues to run autonomously in real time. All interfaces to parallel-running applications on the same (or other) controllers remain in place. The published process variables can be depicted through the general engineering tool SolutionCenter or in visualizations.

External Mode
Display and change online data directly from real-time systems in Simulink® .
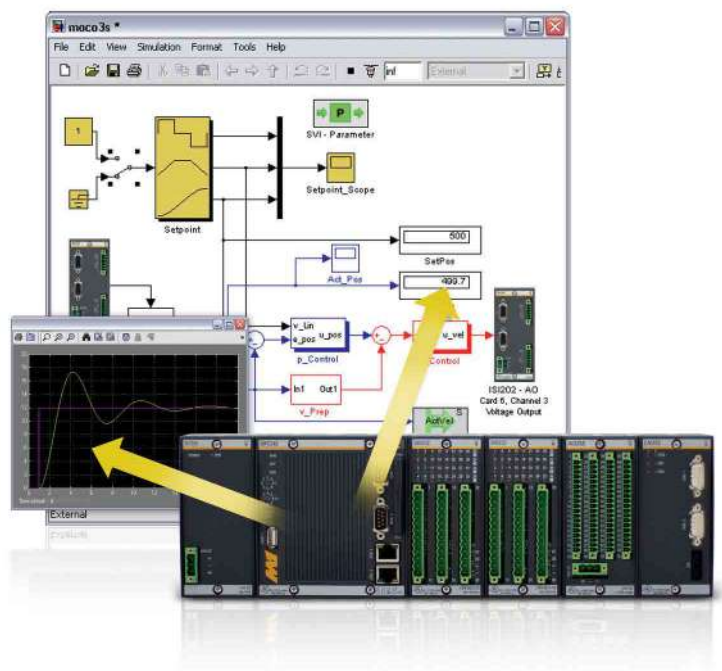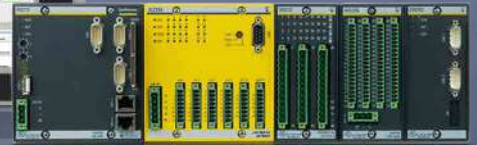
HMI and SCADA Solutions through web technology

Increasing complexity and the constantly escalating level of automation in a wide variety of systems demand future-oriented technologies to monitor and control processes effectively. HMI and SCADA systems contribute significantly in this regard and guarantee a highest possible degree of security. Moreover, future applications have to be able to demonstrate a high degree of flexibility; even connecting to fixed operator control stations in the age of mobile terminals is a thing of the past.

Due to its generic structure, the specially designed HMI and SCADA solutions from Bachmann electronic for professional and control center technology can be used in all areas of application and industries like energy, plant construction and mechanical engineering, maritime applications, building control systems in the infrastructure sector or logistics. The modern and efficient structure makes for scaling from extremely small applications with scarcely a dozen information points up to industrial-scale systems with several hundred thousand process values. Top-quality user interfaces are produced by using web technologies alone, while installations on the HMI equipment fall by the wayside. Visualization is available on all equipment with a standard browser and is not constrained by screen sizes and resolutions.

atvise® scada

The new "Supervisory Control and Data Acquisition" solution puts the Internet in the service of the automation world thanks to pure Web technology. With the continuous use of industrial and communication standards (e.g. OPC UA), the engineering effort is reduced to a minimum.

- Latest-generation SCADA/HMI system
- Client-server architecture (multi-client)
- History database
- User administration & access security
- Java Script server- and client side, open for customer-specific adaptation of the Java Script
- OPC UA Data Access and Alarms & Conditions interface to superior systems

Client   Client   Client   Client

Ethernet/Internet

atvise® scada
Server   Engineering Tool

Ethernet/Internet

PLC   PLC   PLC   PLC
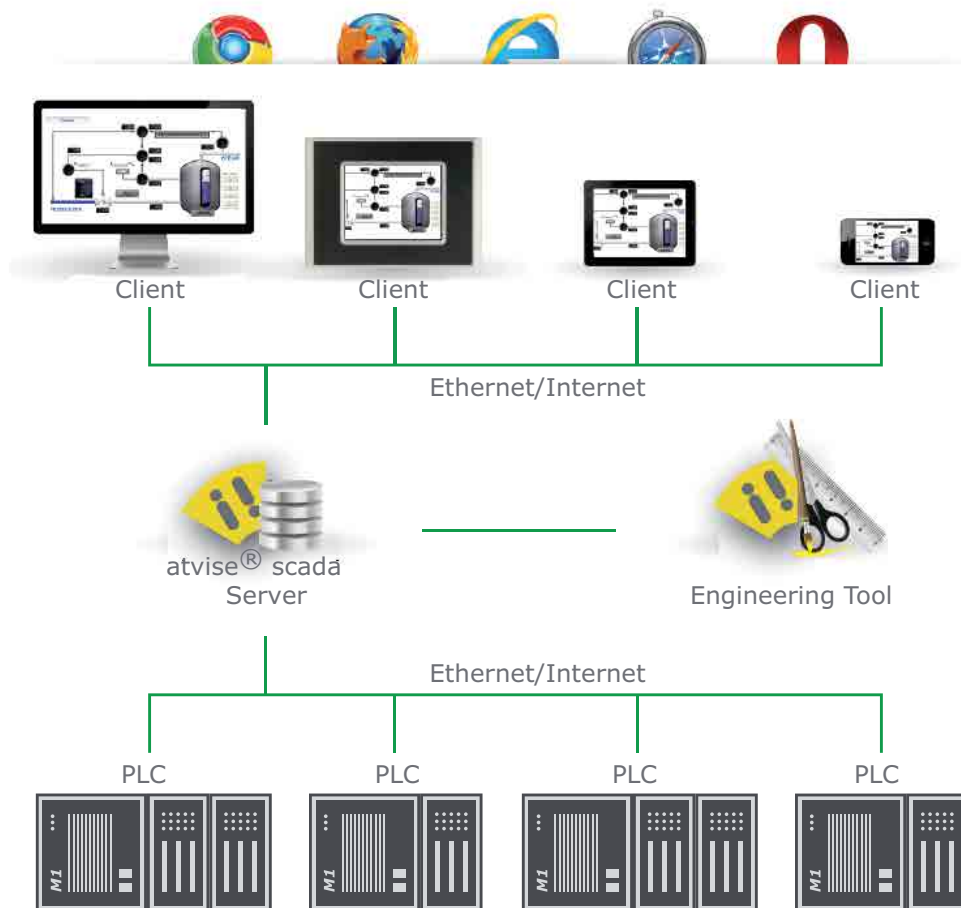
atvise® scada
Pure web Supervisory Control and Data Acquisition Solution

The provision of information independent of location and daytime has become the paradigm of all areas of our life in our Internet age. This requirement expands within the industrial automation in terms of role- and person-selective operation and process manipulation. Conventional control and operating systems emerged along with other requirements and were based on older, restrictive technologies, making their suitability clearly limited for today's challenges.

State-of-the-Art Technology
By using the latest technologies for the development atvise® scada, classical limitations have been overcome: the Internet now serves the automation world - the visualization is based on pure web technology. The implementation of valid industrial and communication standards (e.g. OPC UA) allows for example customers to reduce the efforts in project and maintenance to a minimum.

Open Standards
By focusing on international standards (such as HTML5, SVG - vector graphics, TCP / IP) the generated user interface is displayed and executed on all popular Web browsers without special additives, such as individual plug-ins, ActiveX, Java or Silverlight. This means added value in various ways: Web browsers are everywhere device independently available - whether on the particular facility level or in the case of remote services. Eliminating cumbersome client installations and updates means less effort for operation and maintenance. Maximum possibilities in graphic design along with maximum access security are the values of benefit that the latest

Item		Item No.
atvise scada 50 CCD*	- micro	00021504-00
atvise scada 150 CCD*	- small	00021504-10
atvise scada 1500 CCD*	- standard	00021504-20**
atvise scada 10000 CCD*	- large	00021504-30**
atvise scada Unlimited CCD*	- xxl	00021504-40
atvise Server-sided Scripting Option		00021679-00
atvise Fixed Client Option		00021680-00
atvise Elements Option		00021681-00

* CCD = Concurrent Connected Data points (via http). e.g.: 50CCD = an opened
   Web browser displays 50 data points or two opened Web browsers display 25 data points apiece, etc.
** Starting with the standard, a fixed workstation is included

atvise® scada

stage of expansion of the Internet (web 2.0) and the smartphone era offer. atvise scada is completely based on standards rather than the makeshift „to connect to the outside," therefor securing highest performance, scalability and simplicity.

Powerful Engineering Tool
The project and configuration is done with the engineering tool atvise builder from any PC. Via LAN or Internet the tool accesses the server and allows online, during ongoing operation of the plant, e.g. the creation of data objects, the configuration of alarms or the drawing of process images.
A variety of preconfigured standard objects and panel layouts are available. Their graphics have been created with the onboard-tools of the atvise builders editor and therefore are completely customizable by the user. The user can also create own objects and apply the pre-configured dynamizations to these elements. The designed user interfaces are immediately and without any modification applicable on all target systems - regardless of screen resolution, operating system or Web browser. Refresh rates and response surpass all previous experience with Web applications and even conventional supervisory control systems.

SCADA Functions
atvise scada in general supports all typical SCADA functionalities in regards to alarming, historisation, trending, user management and multi-language.
For specific requirements an additional high performance client-and server-side Java Script option is available within a built-in script editor.
This system has been specifically designed for professional automation and control systems and due

to its generic structure can be utilized in all fields and industries. The modern and efficient design allows scaling from small applications with only a few dozens data-points to world-scale plants with more than 100,000 process variables

- Latest generation SCADA / HMI system
- Client-Server architecture (Multi-client)
- User interfaces in pure web technology
- Device and operating system independent (HTML5, SVG) PC / Mac / Unix, Tablet, Smartphone, iPad ...*
- Process connection OPC UA
- Online Engineering / multi-user
- Built-in alarm system
- History database
- Online-/offline trending
- Online language/font switching
- User management and access security
- Java script, server- and client-sided
- OPC UA Data Access and Alarm Conditions interface to superior level systems

* Current browser compatibility list can be called up at www.atvise.com.

Client   Client   Client   Client

Ethernet/Internet

atvise® scada
Server

Engineering Tool

Ethernet/Internet

PLC   PLC   PLC   PLC

atvise® scada
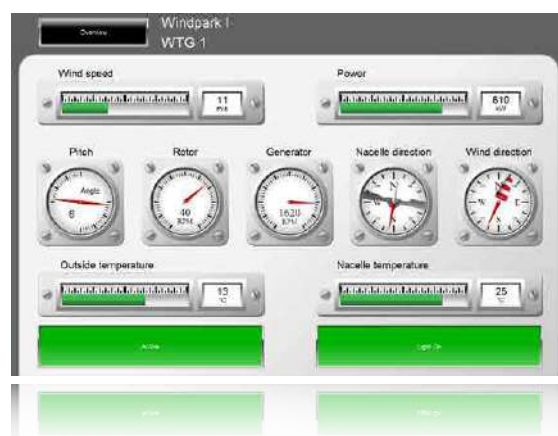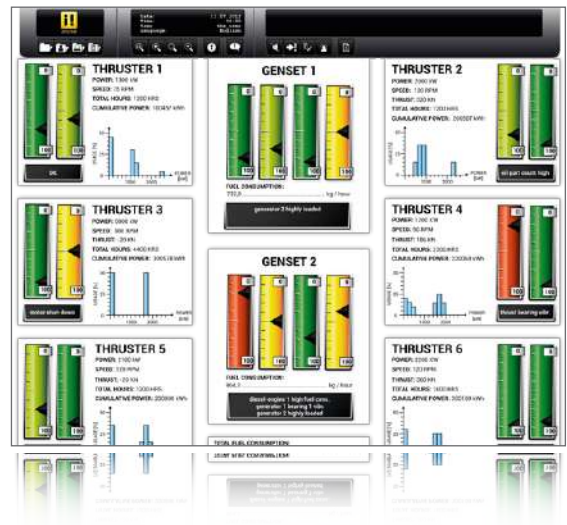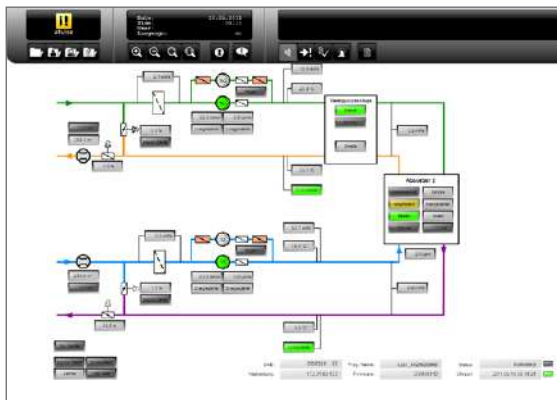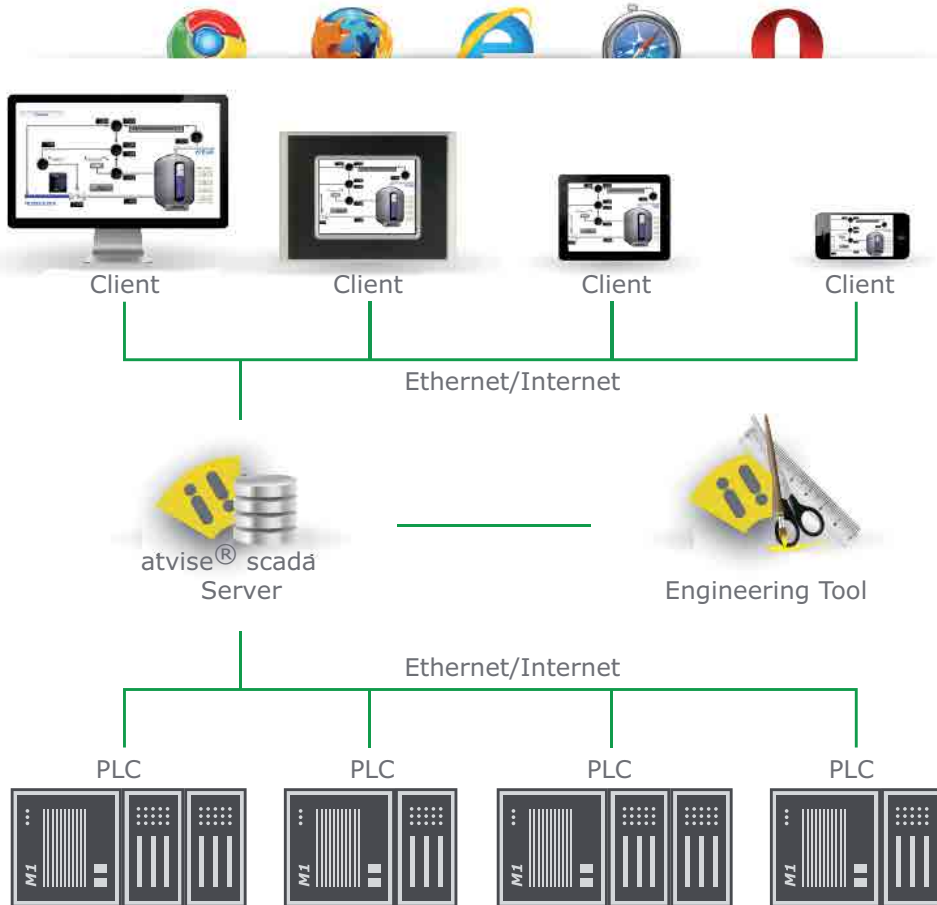
atvise®	
Process interface	
Protocols	OPC Unified Architecture (UA) Data Access OPC Data Access V2.05, V3.0 webMI Data Interface
Physical interface	Ethernet (physical type dependent on target system)
Parallel operation	yes (multiple protocols, multiple data sources)
Data types	all OPC UA compliant elementary types, arrays and structures
Data mapping	integrated (to digital, analog and string as elements of arbitrary structures)
Data model mapping	yes (automatically)
Data naming	arbitrary names (use source name possible)
Source time stamping	yes (from PLC/controller, OPC compliant)
Quality tagging	yes (from PLC/controller, OPC compliant)
Transmission mode	event-driven, cyclically (configurable)
Update rate	dependent on project and configuration (starting from 100 ms)* sampling and publish intervals configurable
Update inhibition	time / threshold dependent
Connection monitoring	yes
Access control / security	yes (OPC UA compliant, including SSL encryption)
Namespace browsing	yes (hierarchical browsing interface at design and runtime)
Simulation mode	yes
Logging	yes (diagnostics user interface per item element)
Server	
Core technology	C++ platform independent
Process data model	fully structured, object oriented (hierarchy, derived types)
Engineering model	type (class) / instantiated objects, inherited properties
Data volume	scalable and dependent on hardware platform (with Windows 7 32-Bit up to approx. 700 000 process items)*
Multi processing	multithreaded computation / benefits from multi-core / multi-CPU systems
Server time stamping	yes (additionally to source time stamp)
Database	embedded, powerfail-safe
Configuration storage	engineering database
Alarm system	OPC UA Alarms & Conditions compliant (arbitrary alarm categories)
Historian	process value database with incremental archiving archive groups with configurable sampling interval and offset alarm database (alarm history)
Longtime archiving	yes (data aggregation, derived long term archives)
Trending	online trending (without archiving) historical trending (offline) combined online/offline trending

* Performance data depends on data volume, computation power, (available) controller performance / device and network topology/-load. Performance depends generally on application.

atvise®	
Server	
Trend configuration	fixed configuration at design time
	user configurable tend displays at runtime (persistable)
User administration	yes (privileges/rights, groups, users)
Functional Extensions	Java Script (server sided)
	full access to all item releated functions and external databases (via ODBC)
	specific extensions via DLL
Module interface	C++ API
Virtualization	possible
Client Interface	HTTP / HTTPS (integrated webserver)
Supervisory Interface (supervisory systems)	OPC UA Data Access (also atvise® <-> atvise® connectivity) OPC UA Alarms & Conditions
Client	
Technology client	up to date, standard-compliant web browser*
Technology process images	HTML, SVG, Java Script
Number of clients	technically almost any number of clients (>>20)
	dependent on license, see also Installation/CCDs
Zooming	yes, continously
Deluttering	yes (zoom level dependent visibility/content)
Scaling	yes (automatic resize/adaption to client device)
Vector graphics	yes (lossless scaling/zooming)
Base objects	see "Configuration/Engineering"
Process objects	see "Configuration/Engineering"
Alarm screen	yes
Trend / multitrend	yes
Operator input protocol	yes
Operation	mouse or other pointer devices
	keyboard (hotkeys configurable)
	touchscreen, multitouch**
Multi language	yes (online language change)
Font type switching	yes (online)
Character sets	any (inclusive asian sign languages, cyrillic etc.)
Maps / GIS	yes
Parallel content	yes (anything running in a web browser: HTML, Video, Audio, VRML/3D, Chat, …)
Functional extensions	Java Script (client sided)

*   Latest browser compatibility list can be accessed at www.atvise.com

** Multitouch support depends on specific device functionality, operating system and web browser

atvise® scada

atvise®	
Configuration/engineering	
Data model editor	yes (integrated in atvise® builder)
Prozess image editor (fully graphical)	yes (integrated in atvise® builder)
Programming editor	yes (integrated Java Script Editor in atvise® builder)
Page editor	yes (integrated HTML Source Editor in atvise® builder, not required for engineering)
Engineering model	type (Class) / instantiated objects, inheritance of properties, graphical objects (face plates) may be a property of a data object
Graphical objects	primitives: line, polygon, shape (any), rectangle, ellipse, etc.
	widgets: label, text field, table, trend etc.
Object library	yes , comprehensive catalogue of predefined standard objects in pure vector graphics (adjustable, extensible), contains beyond others bar graphs, gauges, tanks, engines, etc.
Picture library	yes (optional)
Graphic format support	SVG (and others compliant to W3C)
Animations	text, value, boundary color, background color, text color, visibility, operability, size x/y, position x/y, rotation, flashing, ...
Advanced graphics	arbitrary shapes and clippings, bevel, simple and complex gradient shading, transparency, semi transparency (alpha blending), rotation, shading, transformation/adaption of existing SVG graphics
Server interface	OPC UA (Ethernet/Internet)
Online engineering	yes (project changes during runtime/operation)
Remote engineering	yes (remote access possible)
Multi engineering	yes (several engineering users work on one project)
Variations	Engineering system atvice builder can offer a configured feature set to users (different groups / qualification levels in engineering)
Import/export	XML and CSV
Installation	
Clients	no installation required (pure web technology)
Server	installation by Internet/network (or CD-ROM)
Configured installation	yes (project specific adjustments via XML)
Licensing	CCD (Concurrent Data Points) - simultanously displayed data items on all connected clients
License protection	hardware dependent software key (server sided)

atvise®	
Diagnosis	
Process data monitor	yes
Process data statistics	yes
Systemlog	yes
Online help system	yes
System requirements server	
Device	minimum: PC or server with at least 500 MHz Intel Pentium oder equivalent, 512 MB RAM (project dependent), network (LAN), input devices, 128 MB available disk space. Recommended: PC or server with 1.6 GHz Intel Pentium or equivalent, 2 GB RAM (project dependent), network (LAN), input device, display 1280x1024, 512 MB available disk space**
Operating system	Windows XP SP3, Windows 7 (32), Windows 7 (64)***, Windows Server 2008
Operating elements	not required (headless server operation with remote administration possible)
System requirements engineering	
Device	PC with 1,6 GHz Intel Pentium equivalent or better, 2G B RAM (project dependent), network (LAN), display 1280x1024, 512 MB available disk space
Operating system	Windows XP SP3, Windows 7 (32), Windows 7 (64)***, Windows Server 2008
Operating elements	keyboard, 2-button mouse
System requirements client	
Device	PC, notebook, tablet, smartphone, iPad or similar. Required CPU-performance und memory depends on device type/ technology and project size / parameters
Operating system	any (Web browser is relevant)
Web browser*	any up-to-date Web Browser (Java Script, HTML 5, SVG) e.g. recent versions of Internet Explorer, Firefox, Chrome, Safari or similar
Operating elements	dependent from device technolgy and operating system

*   Latest browser compatibility list can be accessed at www.atvise.com

**   For large scale configurations state-of-the-art server hardware with up to date performance

*** Windows 7 64-Bit currently in 32-Bit compatibility mode, full 64-Bit support in preparation

atvise® scada

atvise®	
Variants	
atvise scada 50 CCD* - micro	atvise scada software package for one SCADA Server for Windows (web licening), limited to a maximum of 50 concurrent visualised datapoints
atvise scada 150 CCD* - small	atvise scada software package for one SCADA Server for Windows (web licening), limited to a maximum of 150 concurrent visualised datapoints
atvise scada 1500 CCD* - standard	atvise scada software package for one SCADA Server for Windows (web licening), limited to a maximum of 1500 concurrent visualised datapoints **
atvise scada 10000 CCD* - large	atvise scada software package for one SCADA Server for Windows (web licening), limited to a maximum of 10000 concurrent visualised datapoints **
atvise scada unlimited CCD* - xxl	atvise scada software package for one SCADA Server for Windows (web licening), more then 10000 concurrent visualised datapoints
atvise serversided scripting option	offers serversided scripting in JavaScript on the atvise scada server (requires atvise scada)
atvise fixed client option	grants access for an additional operating station, independent of the actual status of the CCD count (requires atvise scada "standard" or higher)
atvise elements option	advanced symbol and objects library with more than 4,000 high quality vector graphic elements (per engineering workstation)

* CCD = Concurrent Connected Datapoints (over http). E.g.: 50 CCD = one opened webbrowser displaying 50 datapoints or two opened webbrowser displaying 25 datapoints each, etc.
** Licenses "standard" and higher include 1 fixed client
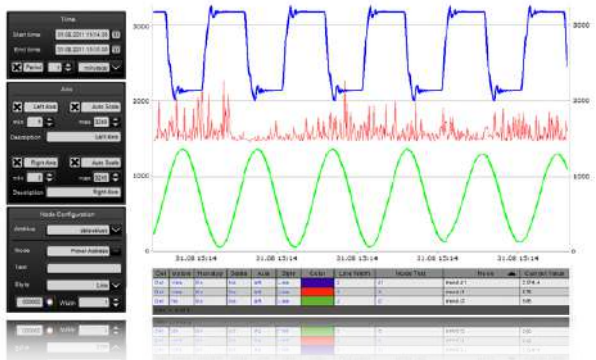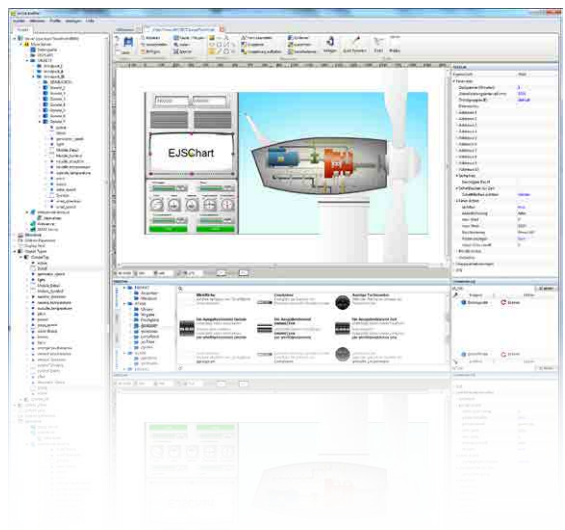
M1 webMI pro

The M1 webMI pro server for Web visualization runs directly on the controller, slim and high-performing software that makes any device with a browser into a user interface for a machine anywhere at any time.

- directly integrated into the M1 controller system
- No dedicated HMI devices necessary
- Free scalability thanks to vector graphics (SVG)
- Device and operating system-independent for, e.g., operator terminals, iPad, ...
- Operate and monitor with standard browser
- Alarming and journaling of variables

Client   Client   Client   Client

Ethernet/Internet

PLC
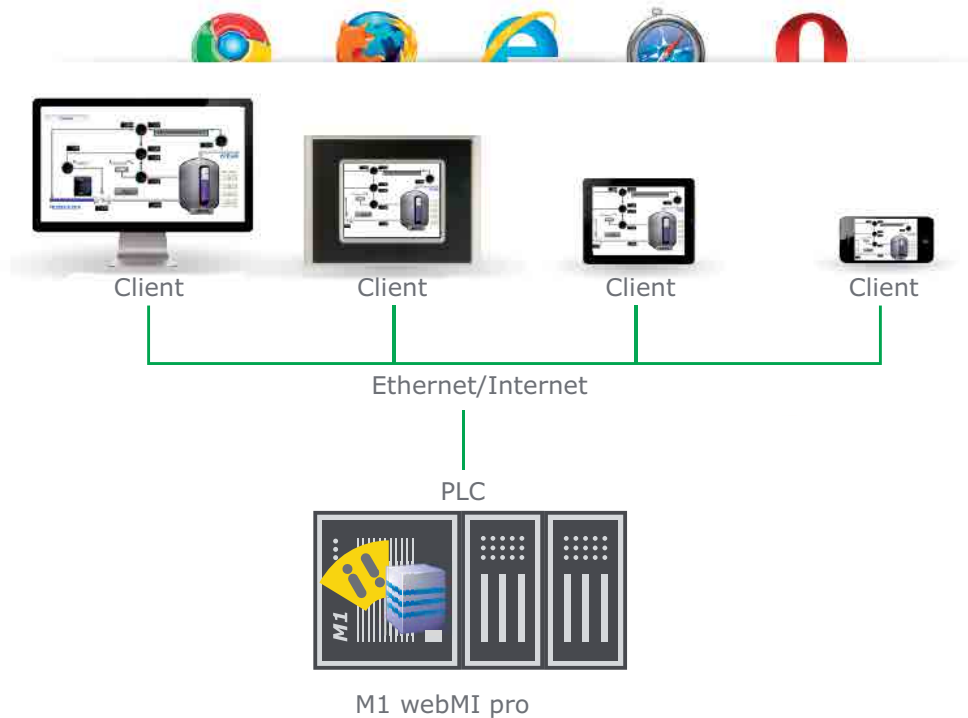
M1 webMI pro

M1 webMI pro
Web visualization directly on the controller

For the operation and monitoring of machines and systems, usually dedicated MMI devices are required and the software for this purpose must be installed and allocated. Thanks to the M1 webMI pro, this is no longer necessary; here, the visualization is integrated directly on the controller. As a result, each authorized device using a current browser becomes the HMI - always and everywhere.

Pure Web standards

With the M1 webMI pro it is possible to exploit the advantages of the Web technologies entirely without limiting add-ons such as browser plug-ins and ActiveX. Any visualization devices from smartphones to a high-performance control panel can be connected directly to the M1 controller via a secure web server - operating and monitoring when- and wherever the process calls for it.

High-quality user interface

The integration into the powerful M1 controller system is evidence of the kind of performance that state-of-the art web technologies provide: A flicker-free display is produced even at data update rates of well under 100 ms and with hundreds of animated graphic elements. The additional resources that are required here are minimal.

When viewing an M1 webMI pro visualization page, the singular advantages of HTML5 and SVG (Scalable Vector Graphics), the basis of all graphic objects, become immediately apparent. Perfect graphic results are achieved with zero loss of quality when scaling and zooming.

Item	Item No.
M1 webMI pro RT	00022839-63
M1 webMI pro YMT	00022839-70
M1 webMI pro Starter	00022846-00
M1 webMI pro DVD	00022839-00

M1 webMI pro
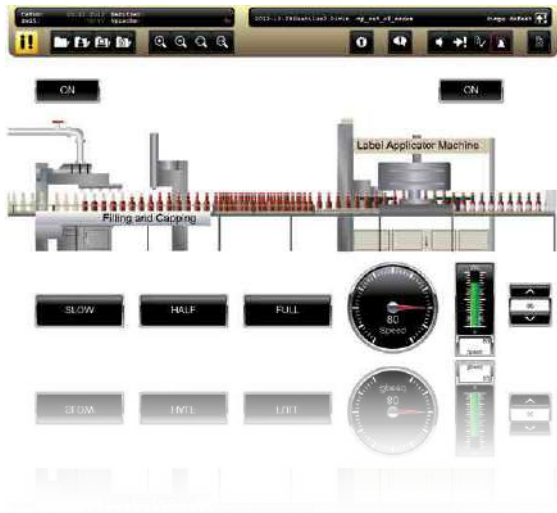
All major HMI functions on board

Thanks to fully-graphic planning incl. dynamization of the objects depicted, the creation of visualizations is easy and possible without programming knowledge. Here all functions of a modern HMI solution such as alarming, journaling, trending, user administration, and multilinguality are supported. Special requirements of the HMI can be implemented via client-slide Java scripts, there are practically no limits to the possibilities.

- Directly integrated in the controller
- Client-server architecture (multi-client)
- User interface in pure Web technology
- Device and operating system-independent (HTML5, SVG) PC/Mac/Unix, tablet, smartphone, iPad, …*
- Alarming and journaling of variables
- Graphic trend display
- Online language/font switchover
- User administration & access security
- Client-side Java Script

* Current browser compatibility list can be called up at www.atvise.com.

Client Client Client Client

Ethernet/Internet

PLC
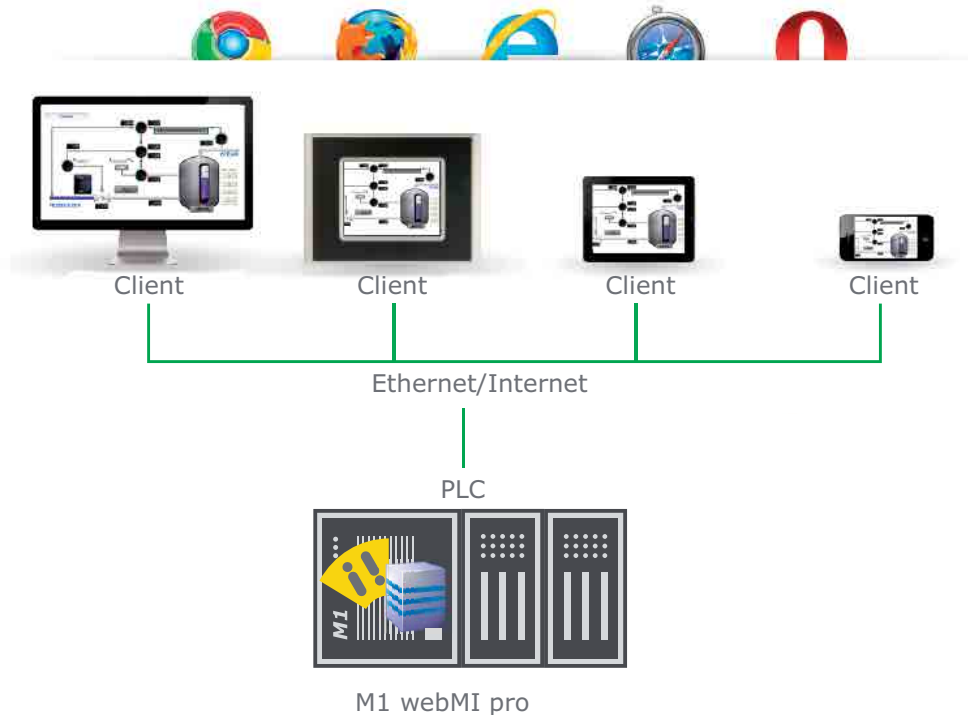
M1 webMI pro

M1 webMI pro	
Server	
Installation	Web server as a software module directly on the M1 controller via SolutionCenter
Parallel Operation	yes, multiple visualizations can be run on several TCP interfaces
Sampling interval	Server monitors the process variables in a cycle of 50 to 5000 ms
Access security/Security	yes (AccessControl of the M1, HTTPS with SSL encryption)
Server time stamp	yes
Alarm system	Alarms on variables incl. persistence of the alarm status
Archiving	Archiving of the process values on the controller, configuration of the sample intervals via archive groups, up to 100.000 data points can be stored in the database
User Administration	yes (rights, groups, users)
Functional expansions	yes, M1 applications can provide data for processing in the HMI
Client	
Installation	No installation necessary
Technology process images	HTML, SVG, Java Script
Number of clients	Up to 16 clients at the same time
Zooming	yes, continuously without quality loss
Scaling	yes (automatic adaptation of the resolution on the target device) without additional engineering effort
Vector graphics	yes (all components of the HMI are SVGs)
Trend	yes (live trending and historical data views are possible)
Operation	Mouse or other pointing device Keyboard (hotkeys can be configured) Touchscreen, Multitouch**
Multilingual	yes (online)
Font switching	yes (online)
Fonts	any (including Asian-language characters, Cyrillic, etc.)
Embedding of external contents	yes (everything that runs in the Web browser: HTML, video, audio, VRML/3D chat, etc.)*
Functional expansions	Total flexibility through Java Script (client-side)

* Current browser compatibility list can be called up at www.atvise.com.
** Multi-touch dependent on device functionality, operating system and browser version

M1 webMI pro

M1 webMI pro	
Configuration/Engineering	
Variable integration	Variables can be read in directly from the M1 controller
Fully-graphic process image editor	yes (integrated into atvise builder)
Program editor	yes (integrated Java Script editor in atvise builder)
Page editor	yes (integrated HTML source editor in atvise builder)
Graphic objects	Primitive: line, polygon, shape (any), rectangle, ellipse, bezier curve, etc. Widgets: label, text field, table, trend, etc.
Object library	yes, extensive catalog of pre-configured standard objects in pure vector graphic (adaptable, expandable) contains among other things bar graphs, tacho/gauges, tanks, engines and much more
Graphic incorporation	SVG (and all other according to W3C) as well as pixel graphics (PNG, JPG, etc.)
Animation types	Text, value, frame color, background color, text color, visibility, operability, size x/y, position x/y, rotation, blinking, distortion, …
Graphic options	Any shapes & sectors, roundings, simple and complex color processes, transparency, semi-transparency (alpha blending), rotation, shading, transformation/change of existing SVG graphics
Interface to the server	HTTP(S), FTP(S)
Import/Export	XML (customer-specific expansions feasible)
System prerequisites	
Clients	commercially available browser only*
Server	All M1 CPUs except ME203 (MH2xx, MC2xx, MPC2xx, MX2xx) with at least M-Base 3.85
Ausführungen	
M1 webMI pro RT	Licenses to operate the M1 webMI pro on one controller CPU. Deployment of dynamized web pages (HTML, SVG) via the integrated web server to display on modern browser-enabled devices. Data coupling to SVI and IO channels locally, simple alarm handling and archiving value directly to the controller system. Engineering with ativse Builder and SolutionCenter.
M1 webMI pro AMT	Product support and updates delivery of webMI pro for one year.
M1 webMI pro Starter	Combination package of 10 Runtime Licenses M1 webMI pro, basic training M1 webMI pro for up to 8 people, advanced training M1 webMI pro for up to 4 people. One Year of product support and updates delivery are included in this package (Annual Maintenance). (Can only be ordered once per company, only one date per training, prices for training location Feldkirch/A or Bochum/D otherwise extra travel expenses are added).
M1 webMI pro DVD	Installation media for webMI (DVD). Graphical development tool atvise Builder and runtime component M1 webMI pro. Without valid Runtime License only limited operation possible. Requires M-Base SC.

* Current browser compatibility list can be called up at www.atvise.com.

Vis Designer

The Bachmann Vis Designer visualization package is a comprehensive software solution for all the requirements of fully-graphic machine and plant visualization.

- Full-graphic visualization software for HMI applications (operating / monitoring)
- Complete configuration tool with graphic user interface (Eclipse)
- Platform-neutral thanks to Java technology
- Online language switchover
- Recipes / dataset management

Vis Designer

Based on the latest Java technology the Vis Designer enables creation and operation of graphic user interfaces, both in the form of conventional applications, as well as for web access (applets). Vis Designer is available as an intuitively operated, graphic editor for generation process images. From the supplied basic elements, such as buttons, input fields, or selection lists, the pages are built up and linked with process variables. Your own graphics and icons can be easily imported. Convenient dialogs guide the user through all important work steps so that no programming skills whatsoever are required for a simple visualization.

Finished created applications can be executed per mouse click, either as a complete application directly on the PC, or they can be installed as software modules on the visualization devices of the WT, CT, OT, or IPC series. Another possibility is that the application can also be stored as an applet on a web server (e.g. on an M1 controller). In this case the visualization application can be loaded and executed from any Java-capable visualization device (PC, IPC, OT, WT, CT). The running application is fully network capable and communicates autonomously with the SVI interfaces of all automation devices from Bachmann electronic.
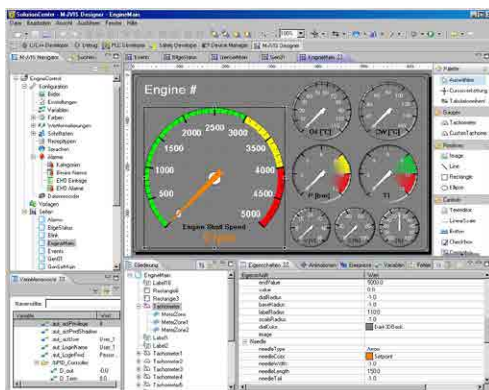
- Full-graphic visualization software for HMI applications (operating/monitoring)
- Complete configuration tool with graphic user interface
- Platform-neutral thanks to Java technology
- Visualization can run on
  - PC/IPC
  - Operator terminals (OT, WT)
  - Control terminals
- Web-capable through applets and Java Webstart
- Extensive presentation possibilities
- Online language switchover
- Recipes/dataset management
- Alarm handling, message screen
- Trend presentation
- Mature window technology (frames, dialogs)
- Input aids: Cursor linking, tab order, soft keyboard, number pad
- Extensive cross-references/search function

The Vis Designer supports the most important control elements and image formats, it is fully-graphic and allows the use of different fonts. The user of the visualization application can switchover between any number of languages online. In addition, to numerous animation types, pre-finished and easy to configure commands can be stored for user inputs.
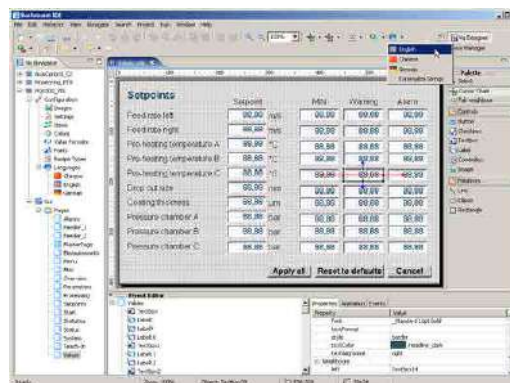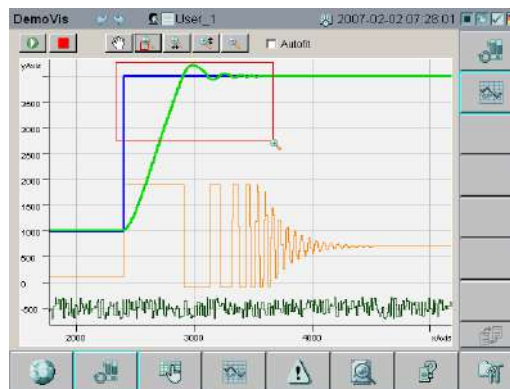
Vis Designer

Vis Designer	
Features – development environment	
Project management	multiple projects / concurrently in access
Project data storage	configuration time: XML runtime: compiled Java code
Image creation	graphic editor and configurators: Vis Designer
Presentation	fully-graphic
Color depth designer	trueColor
Window technology	yes (Elipse dockable views and perspectives)
Page display	multi-document view (multiple pages open in parallel)
Navigation	project tree and tabs in the main view
Zoom in the editor	yes (infinite)
Project planning aids	wizards, content assistance, problems view with quick-fix function, drag & drop
Undo / Redo	yes (user-defined depth)
Cross-reference function	yes (with list output / search tree)
Search function	wild card search and filtering in tables
Graphic objects	line, circle/ellipse, rectangle, button, text (label), input field, text field, combo box, check box, radio box, image/icon, scale, pointer instrument, table, trend
Animations	value presentation (formated), number format, visibility, operability, presentation, image content, image sequence, color change, fill level, position, pointer position, transparency (operating-system dependent)
Reuse / object orientation	templates (groups of animated graphic objects) with the possibility of reuse through referenced variables (placeholders). Changes to the template will be automatically effective in every instance.
User interaction	input, mouse click left (touch), mouse click right, selection, Hover, etc.
Commands	- Value: write constant / toggle value / copy from variable / increment (with step) / decrement (with step) - Recipe (dataset): load / save - Image change (with target area) - Language switchover - Data source: connect / disconnect / change (multiplex) - Start program, data operations, and much more
Number formatting	freely definable for variable configuration
Value ranges	freely definable for variable configuration
Variable definition	manual in the table or import of online controllers
Local variables	yes
Colors visualization	as many as desired (functional color names / referencing)
Fonts	TrueType fonts can be imported; functional font names with referencing
Language switchover editor	yes
Number of languages / project	User defined (memory-dependent)

Vis Designer	
Features – development environment	
Transfer to target device	Can run as: • application on the PC / IPC (local or on the network) • application on Bachmann target device (OT, CT, WT) • Java applet on Bachmann M1 controller and execution in the browser • Webstart application
Preview	yes • Not dynamized in the editor or • local deployment dynamized (process data connection)
Recipe management	integrated (flat dataset handling)
Button navigation runtime	cursor linking can be manually configured or generated automatically. Preview of the jump targets directly in the editor
Tabulator navigation runtime	tab order can be manually configured or generated automatically. Preview of the jump targets directly in the editor
Features – runtime system	
Type	PC, IPC, WT or CT series
Graphic	depending on the target device from QVGA (320x240) to XGA
Presentation	fully-graphic
Colors	depends on the target device (to TrueColor)
Fonts	TrueType fonts can be used in the project planning (at runtime, then either converted embedded fonts, or use of the TrueType fonts installed on the target system)
Operation	2-button mouse, keyboard, touch screen, or membrane keyboard
Navigation in the image	menus, cursor linking, (arrow keys), tab linking, mouse
Menus	configurable
Number of process images (pages)	user defined (memory-dependent)
Number of objects / image	user defined (performance-dependent)
Online language switchover	yes, online
Language management/switchover	yes, online (user-defined number of color schemes, e.g. for day/night or for error indication)
Communication with the controller	Bachmann M1 VHD / SVI with automatic communication groups
Protocols	TCP / IP, UDP / IP, QSOAP
Communication security	SSL (Secure Socket Layer)
Multiplexing of controllers	yes (can be selected from the interface)
Number of data sources	user-defined (data from multiple controllers can be presented in the same process image)

Visualization

Greater transparency and flexibility in process visualization.

The clear and understandable presentation of process and machine information, as well fully intuitive interaction are the center of the visualization software from Bachmann electronic.
In order to provide these characteristics, not only locally on the machine, but also in a distributed manner on the intranet/Internet, the latest generation of the Bachmann software is based on Java and web technologies.
This offers independence from devices and operating systems and saves time, as well as maintenance costs. The provided »ready-to-use« functions, the available libraries and components, and the extraordinary suitability of Java for visualization tasks reduce engineering effort of the applications.

M-JVIS, M-JSYS Tool library

Features
Tool library for Java visualizations
Management of process variables and their values
Language management / switchover
Alarm handling
Quality table
Communication to the controller (RPC, FTP, Vis)
Basis of M1 software modules
Monitoring the communication

M-JVIS, M-JSYS
Tool library

M-JVIS and M-JSYS are libraries for creation of visualizations under Java that can be used platform-independently on Java-capable devices. The components are based on Java version 1.1.8. This version is supported by the VM (virtual machine) from Bachmann electronic.

M-JVIS consists of the following packages:

• M-JVIS / DACC
• M-JVIS / UTIL
• M-JVIS / GUI

The packages are divided into two types of classes:

• Configuration classes that are implemented in the form of beans
• Runtime classes that allow a dynamic configuration and during runtime handle the management or presentation of the data

The configurations of all objects are stored in XML files.
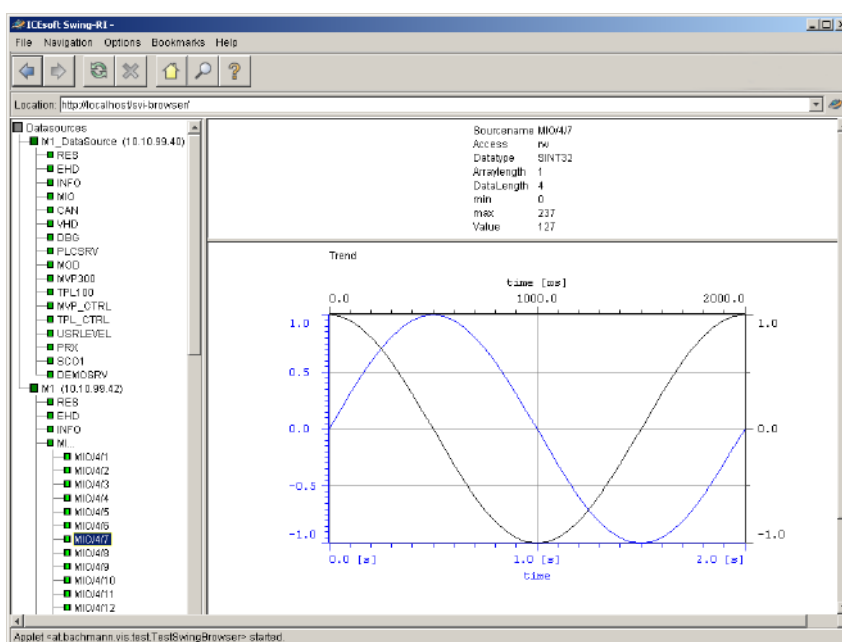
Visualization

M-JVIS / DACC

The M-JVIS / DACC package manages process variables and their values (DACC = Data Access).

M-JVIS/DACC consists of the following components:
• Process variable management
• Recipe management
• Unit switchover
• Communication interface

M-JVIS / UTIL

The M-JVIS / UTIL package consists of the following components:
• Language management / language switchover
• Protocols
• Alarm handling
• Quality table / statistical process control

M-JVIS / GUI

The M-JVIS / GUI contains the graphic components The graphic components are based on AWT.

M-JVIS / GUI consists of the following components:
• XY diagram
• Table
• Tree view
• Screen keyboard
• Input fields
• Button

M-JSYS

The M-JSYS package allows general access to the control system.
• Read-out and change of the controller configuration
• RPCs for control
• Access to system software modules
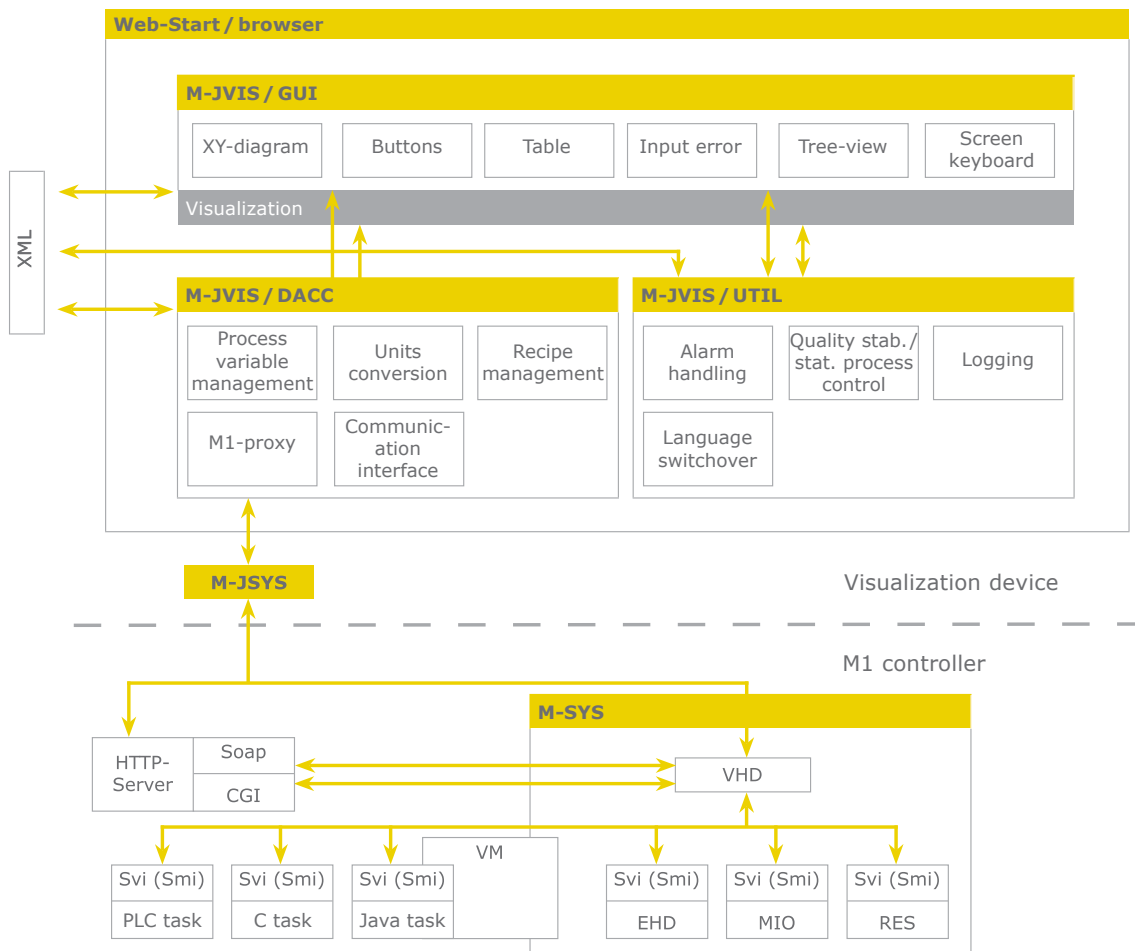
Motion
Control

Motion Control –
standardized drive control

The requirements imposed on modern drive technology are becoming ever more specialized, and not rarely are mechanical engineers confronted with special requests or special regulations from the customer side. Even with the most modern machines, with the most innovative drives, individual drive solutions are still requested. No problem for Bachmann electronic: with the M1 automation system, drive controllers can be selected with complete independence from the drive type.

Building on the IEC 61800-7 standard, an open and universal interface to the drive technology is implemented in the M1 automation system, with the name »Drive Middleware«. Drive Middleware takes over the translation from the logical drive with a manufacturer-independent, standardized drive profile on the respective physical drive.

The Drive Middleware interface permits selection of a drive that is perfectly matched to the respective requirements. In this regard the fieldbus technology (CANopen, EtherCAT, SERCOS, PROFINET, etc.) or the product line of the drive manufacturer are irrelevant. Thanks to fieldbus-independence with concurrent standardization of the fieldbus profiles, the finished Motion Control applications can be implemented in the shortest time possible and the training/maintenance costs of the various drive worlds are significantly reduced. At Bachmann electronic, perfect solutions for every request are just part of the standard.

bachmann

Control

Professional motion guidance for individual requirements.

With expert know-how gained through years of experience in the area of control and system technology, Bachmann electronic is indisputably one of the leading providers of special solutions in the industry. This knowledge and the associated technology does not necessarily have to be worked out by each company itself. Customers and partners of Bachmann electronic can rely on proven and highly-optimized software controllers for a wide variety of applications. Thus years of development work can be embedded as a finished, configurable module in your own application.

Extensive libraries for C or IEC61131-3 encapsulate the functionality and guarantee standardized access from the application program. Naturally all controller modules from Bachmann electronic support SVI communication (Standard Variable Interface), as well as the synchronizing function »Sync« of the M1 system family. Commissioning and diagnostic tools with graphic interface designed by experienced users additionally facilitate use. The palette of freely usable components extends from simple motion control of multiple axes, to CNC and shaft controllers, to special modules for demanding temperature applications.

M-SMC
Software Motion Control

Features
Software module for regulating the speed and/or position of motion axes
Combined actuator / controller operation
Master / slave operation for parallel guided motions
Convenient commissioning via monitor
Library for IEC 61131-3 PLC programs

M-CNC
Three-dimensional motions

Features
Path motion for Cartesian 3-axis system
Profile specification in accordance with DIN 66025 (program structure of numerically-controlled axes)
Interfaces (analog, incremental, fieldbus, etc.)
Configuration and diagnostics via Device Manager
Commissioning interface (CNC monitor)
Library for IEC 61131-3 PLC programs

M-SHAFT
Shaft controller

Features
Software module that simulates a virtual shaft from 0° to 360°
Cyclic and synchronous regulation of 32-axes
Speed of the shaft can be changed in running operation
Independent master operation or can be synchronized as slave
Convenient axis commissioning via monitor

Drive Middleware

Features
Uniform, fieldbus-independent programming of motion applications in accordance with IEC 61800-7
Full integration in the Bachmann SolutionCenter
Easy addition of new, supplemental drives
Position control, speed control, and torque control are integrated
Easy management of the drive parameters

M-TEMP
Temperature controller

Features
Temperature control software for universal implementation
Modes: Actuator or controller (2-3 point)
Automatic parameter assignment (learn function)
Heating power monitoring
Sensor failure detection
For heating sections, cooling sections, and combined sections

Control

M–SMC
Software Motion Control

Software module for regulating the speed and/or position of motion axes Based on a simple configuration a wide variety of options or modes of regulation can be selected.

- Configuration as speed controller, position controller, or underlying speed controller (cascade control)
- Combined actuator / controller operation
- Master / slave operation for parallel guided motions
- Specification of speed, accelerations, delays and the target position to be approached
- Specification of position tolerance window and tolerance monitoring time (settling time)
- Sampling times: min. 200 µs, in 100 µs increments
- Easy application through FUB interface for PLC programs
- Commissioning interface
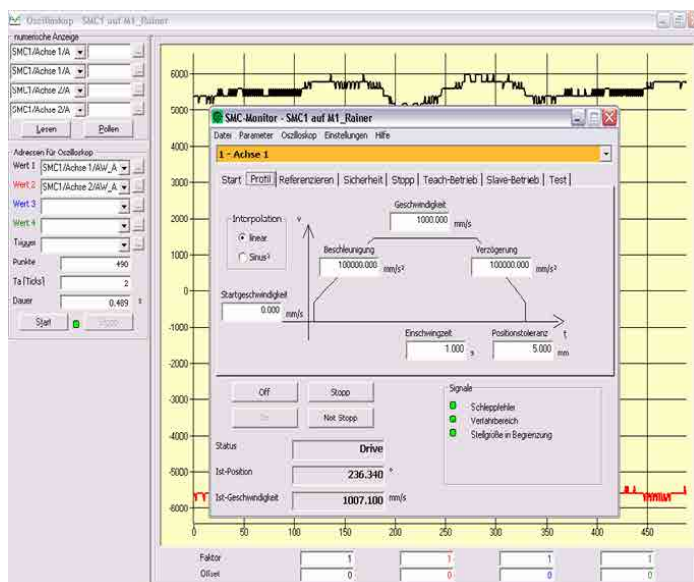
Features

- Up to 16 freely configurable axes per SMC module can be defined
- Software module can be loaded multiple times
- Free configuration of the hardware input and output signals via Device Manager
- »Controller enable« signal (output), »controller ready« signal (input)
- Master slave relationship between axes
- Flying saw
- Online switchover from speed to position specification
- Online change of the controller parameters
- Change of target position or speed during travel
- Selection of different pre-defined referencing methods is possible
- Reversing operation with teach function for controller adjustment
- Integrated drag error monitor with various response methods and status output
- Monitoring of software limit switches
- Monitoring of hardware limit switches
- PLC function library

- Software module available for all M1 processor modules
- Easy integration of visualization systems through disclosure of the parameter interfaces and addressing via symbolic variables
- Different methods of interpolation for position, speed and acceleration
- Configurable PID controller structure with FeedForward
- Different methods for implementing master/slave applications
- Support of fieldbus systems (CAN, SERCOS, EtherCAT)
- Easy commissioning through the Windows interface SMC monitor
- Test function for determination of the section parameters

Visualization	SMC monitor

M1 controller

M-SMC	Application (PLC/C)

Position

Manipulated variable

Speed

Motion unit

| ENC | | M | T |
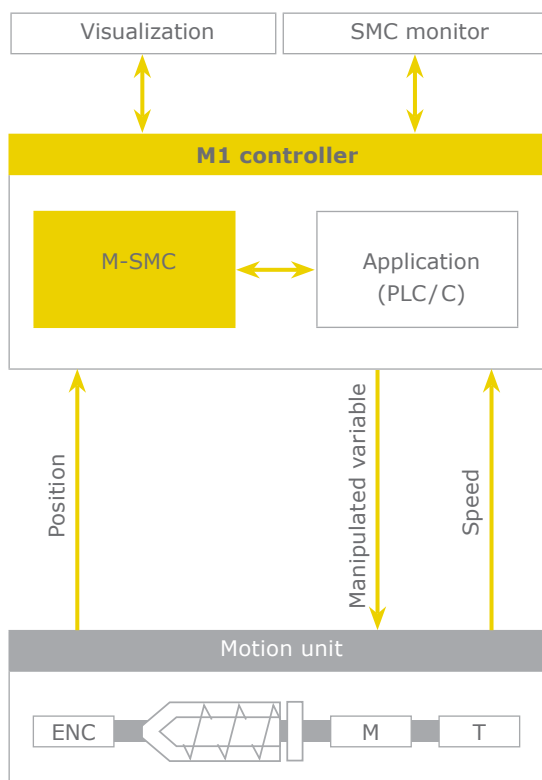
Control

M-SHAFT
Shaft controller

M-SHAFT is a software module that simulates a virtual shaft that turns from 0° to 360°. Different axis types can be synchronized on this shaft. M-SHAFT is ideally suited for machines with a cyclically recurring sequence, such as packaging machines, processing machines, etc.

- Speed (rpm) of the shaft can be changed in running operation
- Independent master operation or can be synchronized as slave
- Up to 32 axes per software module can be synchronized to the shaft
- Step up / step down ratio for each axis can be freely selected
- Axes can be switched on and off in running operation
- End position monitor and dead time compensation for digital axes
- Offline collision monitoring of the axes
- Convenient commissioning tool M-SHAFT monitor
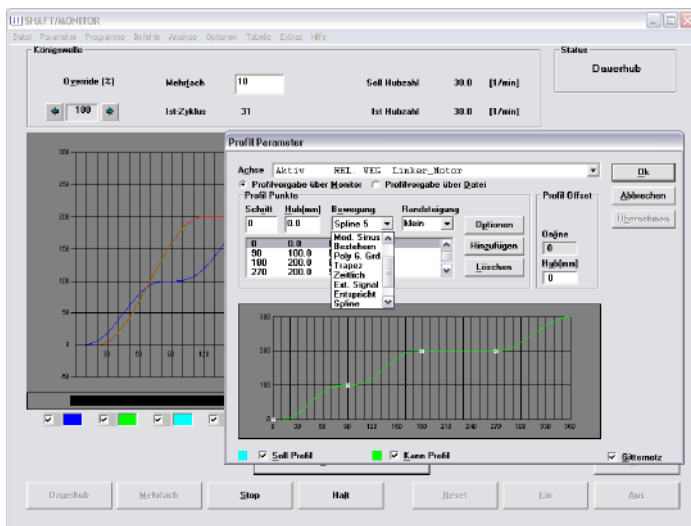
Profile specification

- Offline or online profile specification for each axis is possible
- Profile specification via an external file is possible (up to 360 interpolation points)
- Profile calculation online in the production cycle without stop (online interpolation)
- Free selection of the type of interpolation between the interpolation points
- Interpolation types: Linear, sinoid, $sinus^2$, modified sinus, spline, trapeze, Bestehorn, polygon 6th degree, temporal, ext. signal

Table interpreter

- Profile calculation for minimal cycle times via table interpreter
- Record by record position-oriented consideration of profiles (similar to CNC)
- CNC commands (F, W, X, E, T)
- Loop command for automatic repetitions of specific table columns
- Input of tables via M-SHAFT monitor

Axis types

- Regulated, absolute (absolute coordinates, e. g. lift cylinder)
- Regulated, relative (relative coordinates, e.g. feed)
- Analog (analog manipulated variable, e.g. -10 .. +10 V)
- Digital (e.g. pneumatic ejector, press)
- Multi-cam (16 digital cams per axis)

Summary – features

- Configurable and parameter-assignable software module
- All options can be configured via software (number of axes, axis type, I / Os, etc.)
- Fast commissioning via graphic presentation of all datasets
- High product quality through high repeatability
- Short set-up times through omission of mechanical switch cams
- Simplified mechanics through independent drives
- Software module can be instanced

Control

M-CNC
Three-dimensional motions

M-CNC is a software module for path control of three-dimensional motions with three axes in Cartesian arrangement. Motions are specified in accordance with DIN 66025.

- Path motion for Cartesian 3-axis system
- Profile specification in accordance with DIN 66025 (program structure of numerically-controlled axes)
- Configuration and diagnostics via Device Manager
- Commissioning interface (CNC monitor)
- Library for IEC 61131-3 PLC programs
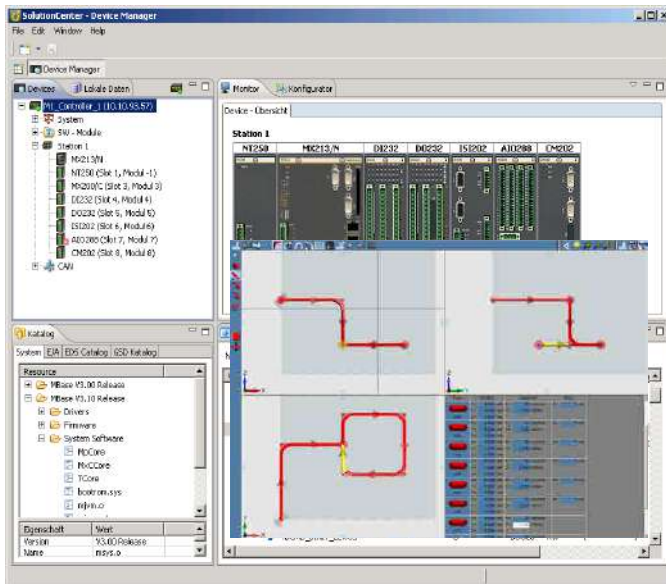
Functions

- Genuine 3-axis CNC controller
- Circle segments and straight lines user-defined in space
- Point control behavior (PTP travel)
- Straight line interpolation (path)
- Circle interpolation (clockwise / counterclockwise)
- Predefined dwell time
- Tool path corrections:
- Tool corrections:
- Reference point travel
- Referencing (various methods)
- Multiple instances of the module are possible
- Different methods for area monitoring at calculation and execution
- Several methods of interpolation for position, speed, acceleration of single axis

Special functions

- Fast and direct setting of outputs from M-CNC
- Single-axle travel
- Teaching of axes / positions
- Cascading with speed controller (M-SMC)
- ActiveX element for Visual Basic, Visual C and Delphi
- Commissioning monitor for efficient graphic user guidance

Visualization	CNC monitor

M1 controller

M-CNC	Application (PLC / C)

Position

Actuating variable

Speed

Motion unit
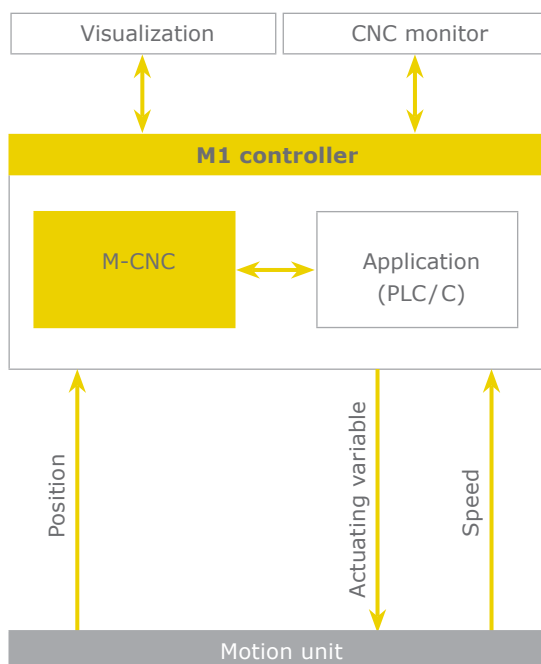
Control
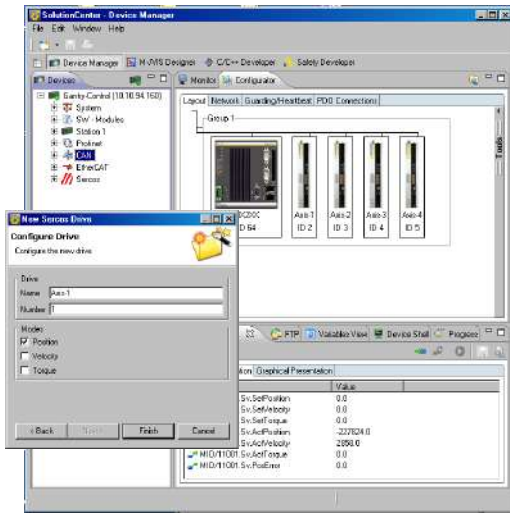
Drive Middleware

Investment security

The investment in a motion application is not lost if there is a change in the drive supplier.

Learning effort is reduced

The different drive profiles, such as SERCOS, ProfiDRIVE, and DS402 have their own state machines, error routines, and parameter designations. Through standardization in accordance, the training effort and the complexity of drive solutions is reduced.

Drive-independence for coordinated axis motions

Multi-axis applications, as they are realized with M-SMC, M-SHAFT, etc. can be implemented independently of the fieldbus profiles of the individual drives.

Features

- Uniform, fieldbus-independent programming of motion applications in accordance
- Full integration in the Bachmann SolutionCenter
- Connection to motion applications for multi-axis applications is already integrated
- Easy addition of new, supplemental drives
- Cyclical and non-cyclical communication is possible
- Referencing methods in accordance with DS402 are integrated
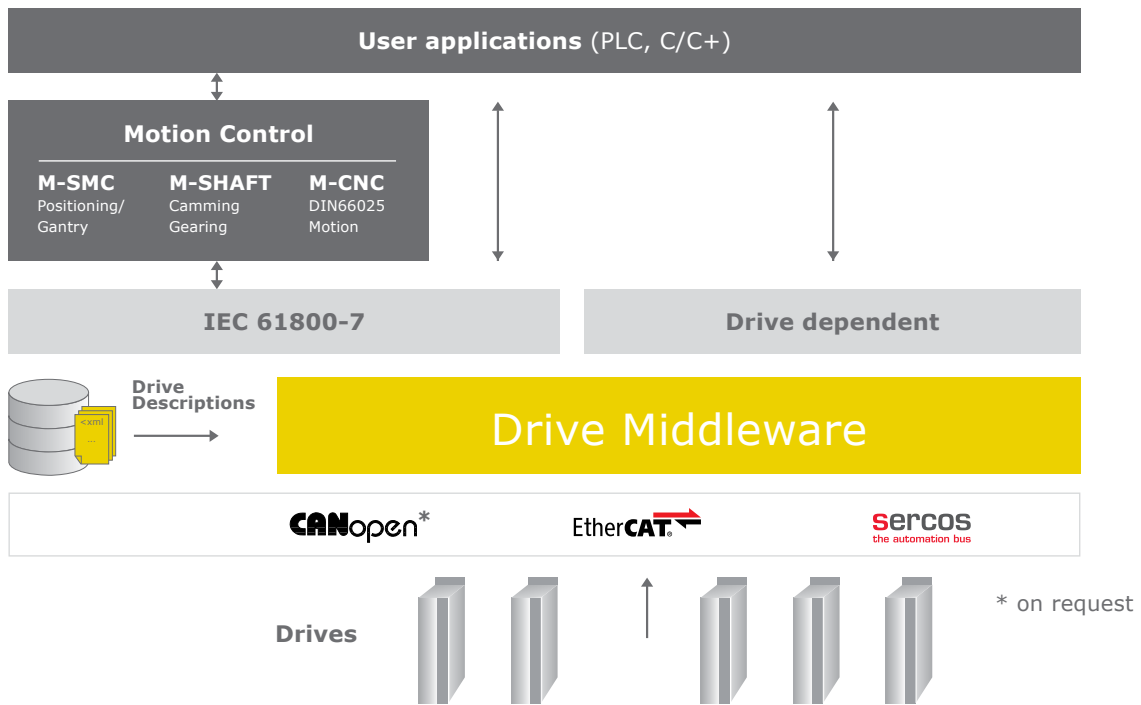
Control

M-TEMP
Temperature controller

M-TEMP is a software module of the M1 controller for monitoring and regulating temperature-dependent processes. To achieve an optimal adaptation to the controlled system, all control parameters can also be changed during operation.

- Temperature control software for universal implementation
- Modes: Actuator or controller
- Automatic parameter assignment (learn function)
- Integrated adaptive setpoint filtering
- Temperature range -200 °C to +1400 °C
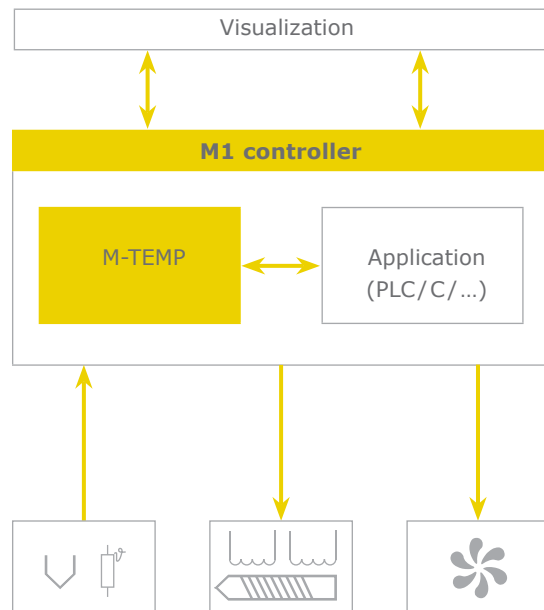
Features

- Fast commissioning via graphic user interface
- User-defined changing between actuator and controller operation
- Heating and cooling path control with one controller is possible
- Setpoint change during operation is possible (setpoint function)
- Suppression of vibrations in the event of major setpoint changes, through adaptive setpoint filtering
- Change of all control parameters is possible during operation
- Possibility of autonomous determination of the control parameters
- Precise determination of the target temperature and process monitoring functions
- Versatile possibilities for data input and output
- Automatic generation of a cleaning pulse for analog cooling controllers
- Conventional and user-defined temperature units are possible
- Detection of sensor break
- Detection of defective power switches
- Current measurement function
- PLC function library
- Maximum of 9 controller systems, each with up to 127 controllers
- Controller sample time 20 ms to 30 min
- Pulse width modulation periods from 20 ms to 30 min
- Temperature resolution 1/100 °C

Possible functions

- Heating controller
- Cooling controller
- Three-state controllers (combined heating and cooling section)

Process monitoring functions

- Tolerance band monitoring
- Increase monitoring
- Heating power monitoring
- Heating current monitoring

Actual value acquisition via

- AIO288 (Pt100 sensor)
- TCO2xx-C (thermal element)
- DA3284-C (Pt100, Pt1000)
- PTAI216 (Pt100 sensor)
- SVI interface (external)

Manipulated variable to

- AIO288, AO204 (analog value 0 .. 10 V)
- TCO2xx-C, DO2xx, DIO2xx, DIO2xx-C, DA3284-C (digital output with pulse width modulation)

SVI interface

- External, e. g. for a different task

CMS
Condition
Monitoring
System
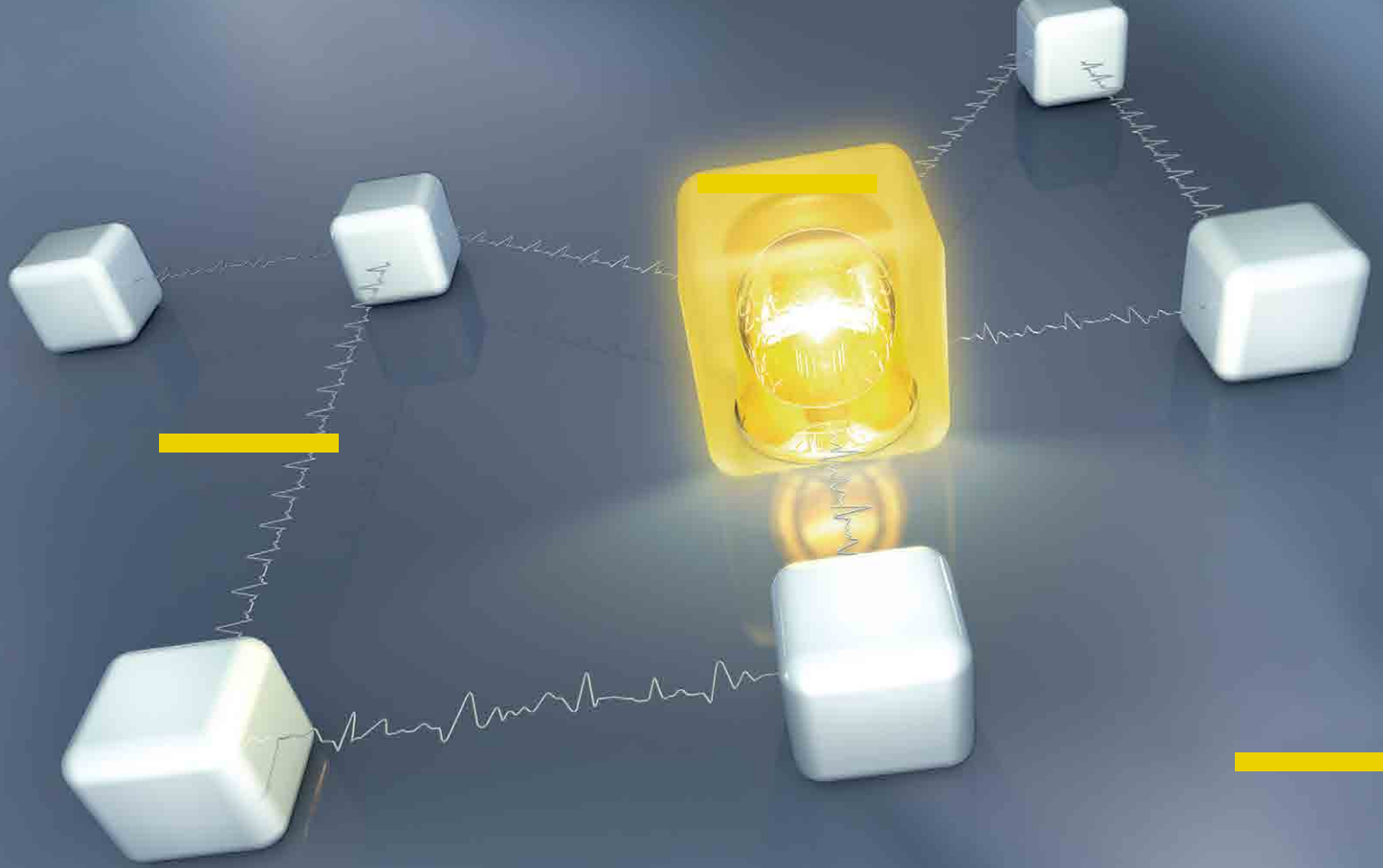
CMS
Condition
Monitoring
System

Condition Monitoring

The annual revenue of a production plant is significantly determined by its reliability. Particularly for difficult to reach plants and plants that can only be reached under specific conditions, such as offshore wind power plans, focused planning of maintenance is necessary. A Condition Monitoring System (CMS) integrated in the automation system can provide all information, in order to detect failure hazards early on and plan maintenance tasks in good time. Thus the costs for spare parts and maintenance can be minimized and downtimes can be significantly reduced.

Condition Monitoring is based on the continuous or regular acquisition of the machine condition by measuring and analyzing meaningful physical variables (e.g. vibration, temperature, condition of lubricant, etc.).

A CMS that is built with the Bachmann M1 system benefits from its versatile communication and service interfaces and also reduces the training period of the operating and maintenance personnel. Secure web technologies also enable defined access to the full system or to individual parts of the plant from the outside. Thus data is accessible at all times for operators and maintenance personnel, so that optimal process control and power generation are ensured.

GL
GL Renewables Certification

CERTIFICATE NO. TC-GL-002A-2014, Rev.1

bachmann

Condition Monitoring

More control, fewer outages.

The operational availability of modern machines and plants requires a comprehensive maintenance and service concept as well as a consistent design. Due to the high costs of failure, heavy mechanical elements for power transmission (power trains, gears, prime movers) and bearings in particular place considerable pressures on manufacturers and operators. A continuous and if possible automatic monitoring of the mechanical systems is the ideal solution.

The condition of the equipment (wear and damage) can be monitored and maintenance and service can be timely scheduled to ensure maximum operability. Within the framework of Condition Monitoring, in addition to numerous well-known indicators, such as temperature, current consumption or load selective operating hour acquisition, vibration analyses in the frequency range, in particular, has proven to be an effective output variable.
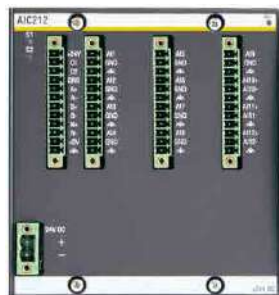
Vibration sensor input module AIC212

Features
Number of inputs: 12 analog inputs (9 inputs with IEPE interface for Piezo vibration sensors and 3 inputs with +/-10 V)
Resolution: > 17 bit
Dynamics: > 95 dB
Sampling rate up to 50 kHz, adjustable
Galvanic isolation from system 500 V

Ω-Guard® Stand-alone solution

Features
12 analog inputs
PLC-independent CMS
Fixing with mounting feet, direct mounting or magnets

Remote service via WebLog Expert

Features
Client-based »WebLog Expert« software for remote diagnostics
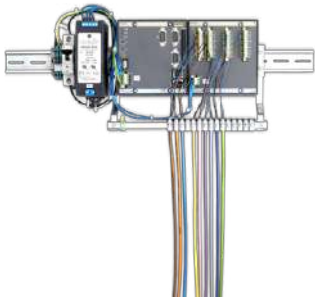
Ω-Guard®
TopBox-integrated solution

Features
12 analog inputs
PLC-independent CMS
Installation in existing control cabinet
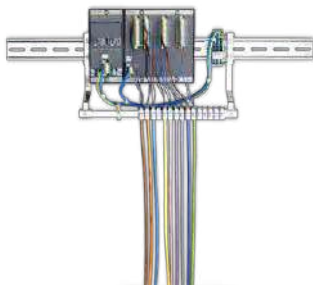
Ω-Guard®
Fully integrated solution

Features
12 analog inputs
PLC-independent CMS
Installation in existing control cabinet

Acceleration sensors
BAM100 / BAM500

Features
Robust design
Connection via ICP inputs of the AIC212
Hermetically sealed
Corrosion resistant
Insulated housing

µ-bridge
Sensor

Features
IEPE standard
Operating current: 4 .. 10 mA
Surge protection: Imax = 16 mA
Output voltage (offset) 11 ± 0.5 V
Max. saturation degree 8V

SVM300 series
Structural Vibration Monitor

Features
Measurement in 2 axes
Measurement range ± 2 g
Resolution: ≥0.305 mg
Internal memory (≤150 days)
Protection class IP67

Condition Monitoring
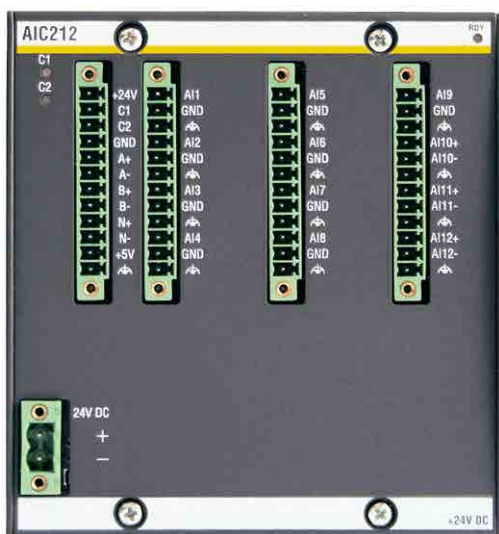
Vibration sensor input module AIC212

The M1 automation system's AIC212 module offers up to nine vibration measuring inputs for high resolution, signal correlated monitoring of different measuring points. Three signal inputs with a standard signal level of ±10 V and a position transducer input provide consistent acquisition of other relevant variables and the angle or position relation of the mechanics. Thanks to the embedding in the M1 system analyses can also directly consider any other signals or variables of the entire controller composite (e. g. current performance, operating condition), doubling the sensor system.

The AIC212 module has its own integrated working memory to record time series of signal profiles for up to 50 kilo samples / second – which is far below the controller cycle time. The evaluation is carried out in the well established M1 CPU modules in the form of CMS application programs that can operate as required with static processes, frequency or location analyses. The measuring data is also provided as channel values in the cycle of controller programs as directly recorded online variables.

Item	Item no.
AIC212	00014151-00
AIC212※	00017444-00

Alarm, service information or external analysis

M1-CPU — AIC212 — AIC212

Results
Analysis
History & reference
Buffer memory
Recording
...

Sensor signals
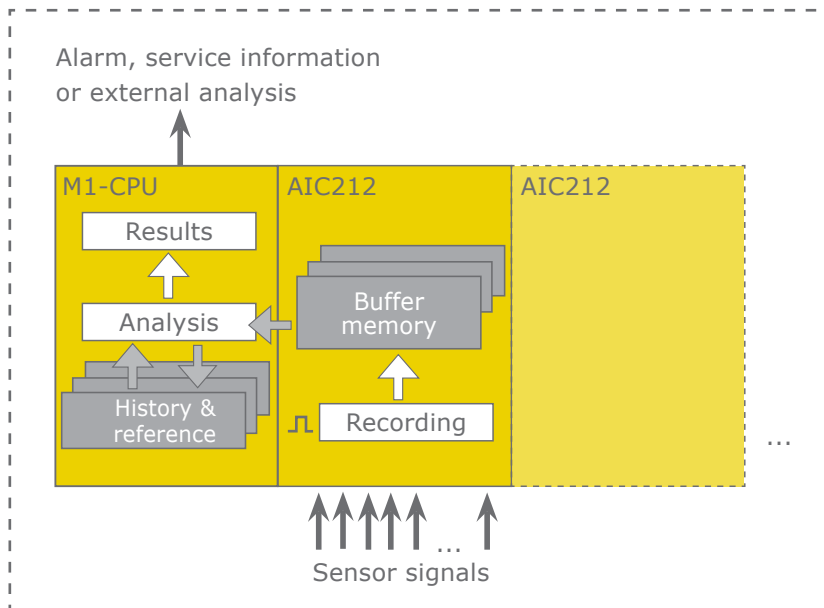
As an M1 standard module, the AIC212 allows implementation of »stand-alone« condition monitoring as well as use in the various remote or distributed configurations of the Bachmann automation system. The use of M1 CPUs for evaluation, logging and alarming allows such a CMS to benefit from the wide range of communication and service interfaces and also reduces the training requirements for start-up and maintenance personnel.

Instead restricting evaluations through a strictly prescribed frame, the AIC212 system concept allows a free design of the Condition Monitoring software for the particular requirements of the respective application. Regardless of the implementation (C/C++, IEC 61131 or MATLAB®/Simulink®) the recording time sequences of the CPU are available in memory and enable consistent access via the location and time specific software. (change to ... consistent location-specific and time-specific access through the software. Existing evaluation packages can be ported to the M1 CPU system (VxWorks®/Intel x86 compatible processor) since no special solutions (DSPs, special operating systems) are required.

- 12 analog inputs (9 inputs with ICP® interface for Piezo vibration sensors and 3 inputs with ±10 V)
- Position detection (incremental encoder input 24 V and A/B/N track or 2 counter inputs with 24 V for initiators)

- All channels, including position measurement (Rotary encoder signal) sampled synchronously
- Analog filter and digital filtering with adjustable cut-off frequency
- Resolution > 17 bits
- Dynamics > 95 dB
- Sampling rate 50 kHz, adjustable
- Different trigger modes for the recording start (position/location, IO bus sync, etc.)
- High-speed buffer memory directly on the module
- Access to channel values also synchronous with application (direct access and process image for PLC programs)
- Embedding in M1 plant management system or as autonmous CMS
- Use of any signals of other modules or calculated variables for evaluation
- Signal base suitable for frequency analysis with/ without location reference
- Several AIC212 modules in one system simultaneously
- Evaluations can be designed to individual requirements
- Broad spectrum of usable implementation technologies (C, C++, MATLAB®/Simulink®) on the real-time operating system VxWorks®
- Synergy by using fieldbus and service communication
- Local memory in evaluation CPU: CF card, PC card

Condition Monitoring

AIC212		
Analog inputs		
Quantity	9	3
Measuring range	AC-coupled ±6 V, ICP® interface	±10 V
Resolution	> 17 bits	
Dynamic	> 95 dB	
Scan rate*	up to 50 kHz per channel adjustable	
Frequency range general	0.1 Hz .. 20 kHz	
Error (full scale) at +25 °C	±0.1 %	
Digital filter	adjustable depending on sampling frequency	
Distortion attenuation/distortion factor THD+N (f_{SIN_In}=1kHz, fSample=50kHz) $Level_{IN\_from\_FullScale}$= 0 dB $Level_{IN\_from\_FullScale}$= -20 dB $Level_{IN\_from\_FullScale}$= -40 dB	 <-78 dB <-68 dB <-48 dB	
Input impedance	200 kOhm	>1 MOhm
Current source for ICP interface	5 mA/channel	
Cross-talk control range	+8 .. +12 V	±2 V
Error detection	wire break	
Interference voltage strength	-15 .. +36 V	
Incremental and counter inputs		
Interface	24 V initiators/proximity switch with 10mA sink	incremental
	either one incremental interface or two counter inputs can be used for proximity switches	
Number of channels	2	1
Display	yes, via green LED	no
Counter frequency	5 kHz	36 kHz
Measured value/resolution	32 bit	32 bit
Input signals	A	A-, A+/B-, B+/N-, N+
Filter frequency	programmable	---
Error detection	error pulse	phase error
Evaluation	-	1, 2, 4 edge signals & pulse direction mode
Supply	for external sensors: 24 V/5 V short circuit proof	
Galvanic isolation from system	500 V	

* Frequency bands/f_{sample}:20 kHz/48 kHz;10 kHz/24 kHz; 5 kHz/12 kHz; 2.5 kHz/6 kHz

AIC212	
Operating conditions	
Power supply	24 V (18 V .. 34 V) with reverse polarity protection
Power consumption module	approx. 9.5 W without encoder supply
Ambient conditions	**Standard** — **ColdClimate (❄)**
Operating temperature	-30 .. +60 °C
Rel. humidity operation	5 .. 95 % without condensation — 5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % with condensation — 5 .. 95 % with condensation
Model variants	
AIC212	Analog measuring module for Condition Monitoring; 9x Input ICP; 3x Input +-10V; 18bit; 0.1%; >95dB dynamic range; 20µs sample time; 1x INC HTL; 36kHz; A,A/B/N; 128MB measured data storage
AIC212❄	like AIC212; ColdClimate (❄)

Condition Monitoring

Stand-alone solution
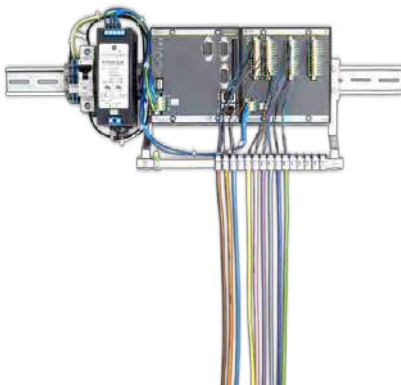
TopBox-integrated solution
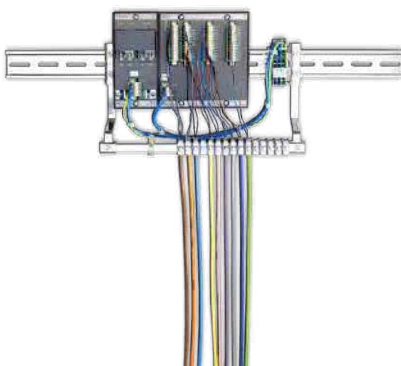
Fully integrated solution

Ω-Guard®
System variants

With the GL-tested and certified machine diagnostic system (Condition Monitoring System: CMS) Ω-Guard® an intelligent monitoring solution without mechanical moving components (hard disks, fans) is available for use under harsh ambient conditions.

The hardware and software architecture has been based on a modular concept. Thus analog and digital inputs and outputs can be flexibly configured. Ω-Guard® in particular has extensive self-test possibilities that enable a detailed function check of the CMS. Script-oriented software enables easy adaptation to different monitoring tasks with due consideration of the special requirements imposed on technical plant management.

The following characteristics of this CMS must be particularly highlighted:
• Modularity
• Future compatibility (inclusion many additional measured values is possible)
• Extensive temperature range
• Robust relative to environmental influences
• Watchdog monitoring
• Client-based »WebLog Expert« software for remote diagnostics

Item	Item no.
Ω-Guard® Stand-alone solution	00022367-00
Ω-Guard® TopBox-integrated solution	00022370-00
Ω-Guard® Fully integrated solution	00022373-10

Ω-Guard®	
Analog measurement channels	
Number of channels	12 analog inputs (9 inputs with IEPE interface for piezo vibration sensors and 3x ±10 V inputs)
Sampling rate	up to 50 kHz, all channels including position detection (encoder signal) scanned synchronously
Measuring range	IEPE standard, current (4-20 mA), voltage (±10 V)
Error detection	Cable break, interference pulse, phase error
Sensor supply	
IEPE	4 mA
External operating voltage	For external sensors: 24 V / 5 V short-circuit-proof
Power supply	
Multi-voltage power supply	100 .. 240 V / 50 .. 60 Hz / 50 W
Interference immunity	
ESD	EN 61000-4-2
Electromagnetic field	EN 61000-4-3
Burst	EN 61000-4-4
Surge	EN 61000-4-5
Conducted HF	EN 61000-4-6
DIPS (line voltage fluctuations)	EN 61000-4-11 Operation with multi-voltage power supply
CPU unit	
Interfaces	Ethernet, FASTBUS
Communication	LAN, GRPS, Modem
Housing/power supply	
Type	Wall mounting, fixing feet mounting, mounting with magnets
Degree of protection	IP65
Dimensions	380 mm x 380 mm x 210 mm (Stand-alone solution)
Operating parameters	
Operating temperature	-25 .. +60 °C
Storage temperature	-40 .. +85 °C

Condition Monitoring

Remote service
via WebLog Expert

Client-based »WebLog Expert« software for remote diagnostics

The success of a condition monitoring system is closely linked to correct installation, parameterization and commissioning, as well as rapid and correct reaction to reported changes of status. Our experts accordingly handle all concerns on-site, even training and orientation of customer personnel. Our modern teleservice for distributed applications includes online monitoring over a secure Internet connection and thus is available worldwide. Currently we monitor far more than 2.000 Condition Monitoring systems via Internet. In this regard the power range of the systems extends from 250 kW to 5 MW. We developed the »WebLog Expert« portal new for this. It serves as an interface to the diagnostic system and enables worldwide access to the status data of the monitored plants. Alarm messages are signaled to the users via a status window.
Simultaneously a trend analysis of the state of the machine can be executed via the integrated database. The »WebLog Expert« software solution that can be implemented universally is the foundation for the worldwide telediagnostics and early error detection for distributed machines and plants.

Communication and analyses are based on progressive web-based and database-based technologies. Through its scalability and modularity »WebLog Expert« permits secure adaptation and fast configuration for solving all tasks, extending to demanding tasks in the condition monitoring area in various industries (particularly wind energy, biogas, shipping industry, etc.) Thus »WebLog Expert« is the basis for use of many Condition Monitoring systems that can be installed immediately in the original equipment with the »M1« controller by the OEM on the same bus system, or that are available for retrofitting of machines and plants.

- Password protected access
- On the start page all current error messages are displayed
- Visualization of the detailed diagnostic results for each measurement point
- Expert tools for fault diagnosis
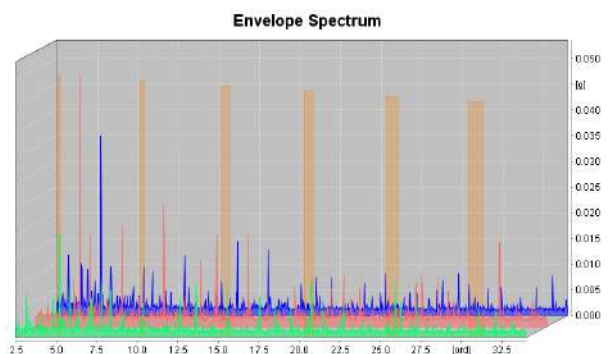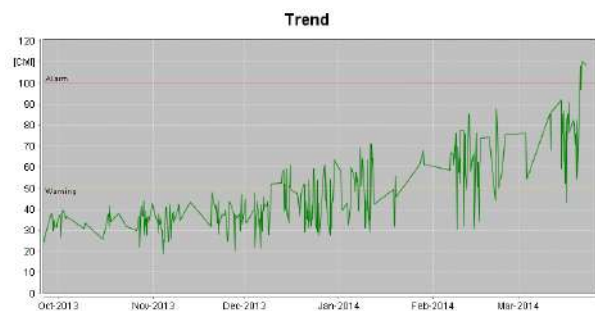
Acceleration sensors
BAM100 / BAM500

The tried and tested acceleration sensors are provided with an extremely robust housing, a hermetic sealing and an insulated housing and are thus proven even for demanding ambient conditions. Their minimally invasive mounting on the object as well compact dimensions make them suitable for difficult to access measuring points.

The piezo vibration sensors offer a sensitive response to the smallest accelerations and are connected via the IPC inputs of the AIC212. The BAM100 sensor is suitable for fast rotating machine areas. The more sensitive BAM500 sensor is used for slow rotating areas.

Item	Item no.
BAM100	00020455-00
BAM500	00020456-00

Acceleration sensor	BAM100	BAM500
Technical data		
Sensitivity	100 mV/g	500 mV/g
Output	ICP®-compatible	
Sensor connection	M12	
Measuring range	0.5/0.2 Hz .. 14 kHz	
Acceleration range	VDC >25 V 80 g maximum	VDC >22 V 10 g maximum
Amplitude nonlinearity	1 %	
Frequency response	± 3 dB 0.5 Hz .. 14 kHz	± 3 dB 0.2 Hz .. 14 kHz
Resonance frequency	30 kHz	
Operating voltage	18 .. 30 VDC	
Operating current	2 .. 10 mA	

Condition Monitoring

µ-bridge sensor

We developed the »µ-bridge« sensor to capture sound waves and flexural vibrations in machines and plants (e.g. on components, solid bodies, etc.). The structure-borne sound waves emitted by machine parts are characteristic for the wear status of a part.

For the µ-bridge sensor the force of the sound wave is converted to a measurement voltage without a detour through a spring mass damper system. This even makes it possible to detect structure-borne sound waves and flexural vibrations at frequencies from 10 kHz to under 1 Hz with high resolution and bandwidth; this means that the sensor is particularly well suited for measurements on slowly rotating or vibrating parts.

Item	Item no.
µ-bridge	00019918-00

µ-bridge	
Technical data	
Operating mode	IEPE standard
Operating current	4 .. 10 mA
Output voltage (offset)	11 ±0.5 V
Max. saturation degree	8 V
Sensitivity	0.7 V/N
Signal-to-noise ratio	-83 dB
Carrier-to-interference ratio	-79 dB
Low limit frequency	high pass 1st order, f_g = 1.6 Hz
High limit frequency	f_g > 10 kHz

Structural Vibration Monitor SVM300 series

The SVM300 structural vibration monitor series is used for analyzing oscillations, shocks and vibrations. It has an internal memory that enables grid-independent autonomous analysis for up to 150 days and is implemented in protection class IP67.

- Measurement in 2 axes
- Measurement range ±2 g
- Resolution: ≥0.305mg
- Internal memory (≤150 days)
- Protection class IP67

Item	Item no.
SVM300/E	00020930-00

SVM300 Series	
Acceleration sensors	
Acceleration axes	x, y
Measuring range	max. ±2 g
Resolution	≥0.305 mg
Signal bandwidth (low-pass)	≤5 Hz
Sample rate	min. 25 samples/s
Memory	
Internal memory	2 GB
Recording period	150 days (at 25 samples/s)
Real-time clock (RTC)	
Deviation/year	≤15 minutes/year (battery buffered)
Diagnostics	
2 status LEDs	Operation/fault and communication
Connections/interfaces	
Ethernet (ETH)	10/100 Mbit/s RJ45 socket, push pull (variant 4)
Power supply (PWR)	+12 V (10 .. 34 V) with reverse polarity protection, push-pull (variant 4)
Housing/power supply	
Degree of protection	IP 67
Dimensions	150 mm x 150 mm x 40 mm
Environmental condition	
Operating temperature	-40 .. +60 °C
Rel. humidity operation	5 .. 95 % with condensation
Storage temperature	-40 .. +85 °C
Rel. humidity storage	5 .. 95 % with condensation
Model	
SVM300/E	Structural vibration monitor with Ethernet connection and two acceleration axes

Sector-specific solutions

Bachmann offers sophisticated automation solutions to its customers worldwide in a wide range of application areas. Setting new standards, thinking ahead, as well as responding quickly and flexibly to new challenges – these are the tasks to which we are committed in securing the critical competitive edge for our customers. All our activities are focused on the benefit to the customer: We deliver tailored solutions and set ourselves the highest standards. The independence we have in development and production enables us to tackle specific market and customer requirements with passion and commitment every day.

Our broad and modular product range meets really every customer requirement. We provide you with a homogeneous and holistic system solution that also ensures a high level of availability and is future proof. We offer you everything from a single source and at the highest quality. Our automation systems stand out on account of their extraordinary robustness, high performance and open interfaces. The latest and most innovative platform for your sector specific requirements.

Sector-specific solutions

Wind Turbine Essentials WTE

The WTE software package is tailored to the requirements of manufacturers and control system developers of wind turbines, and helps to considerably reduce the time required for developing and commissioning the controller software and the visualization. Bachmann's Wind Turbine Essentials cover many standard tasks required for the automation of wind turbines.
The configurator of the WTE toolset is integrated into the Engineering Suite SolutionCenter and enables the structured configuration of the event system, user roles and access rights, data sampling with long-term recording and statistical processing.
A visualization for developers and customers is created in parallel with the data configuration.
The runtime components execute the event system, sample data values, send alarm messages and check passwords of users. The complete logging of all events and user operations is secured by the M1 system features.
A visualization is offered both for a PC with mouse operation and for a panel with touch screen (OT) in optimal resolution. The visualization offers access to process data which can be arranged in arbitrary groups with freely selectable physical units and description texts in any language or character set. The PC visu contains additionally graphical components for snapshots and long-term trends as well as power curve and wind rose diagrams.
The software developer can additionally use the WTE features in his own code because most features are also delivered in program libraries for IEC61131-3 (M-PLC) und C/C++.
For user management and access control, WTE contains also a dedicated login-checker and a tool to generate passwords.

Item	Item no.
WTE SDK (DVD for installation)	00022097-00
WTE Admin Tool (DVD for installation)	00022098-00
WTE Company Licence	00022097-60
WTE Runtime Licence	00022097-63

WTE
Windturbine Essentials

- Configuring instead of programming
- Readable, comparable, extensible project format
- High performance in execution of vast event configurations
- Setting and resetting events automatically from variable value or from user program
- Individual configurable time delay for setting and resetting events and for power-up
- Freely configurable reactions to events
- Complete logging with high-resolution time stamps
- Standardized power curve created with a few mouse clicks

- Numerous statistical functions with automatic data sampling and graphical display in visualization
- Flexible assignment of user access rights depending on login name and password
- Ready-to-use visualization is created by configuration
- Arbitrary grouping of monitor- and parameter values
- Arbitrary language and character sets for description texts
- Extensive program libraries for customer specific extensions

Configure

WTE Configurator Plug-in for SC

M1 settings

Visu settings

Deploy

Project.zip

Execute

WTE.m

Implement

Libs for PLC and C

Monitor

WTE.Visu Standalone
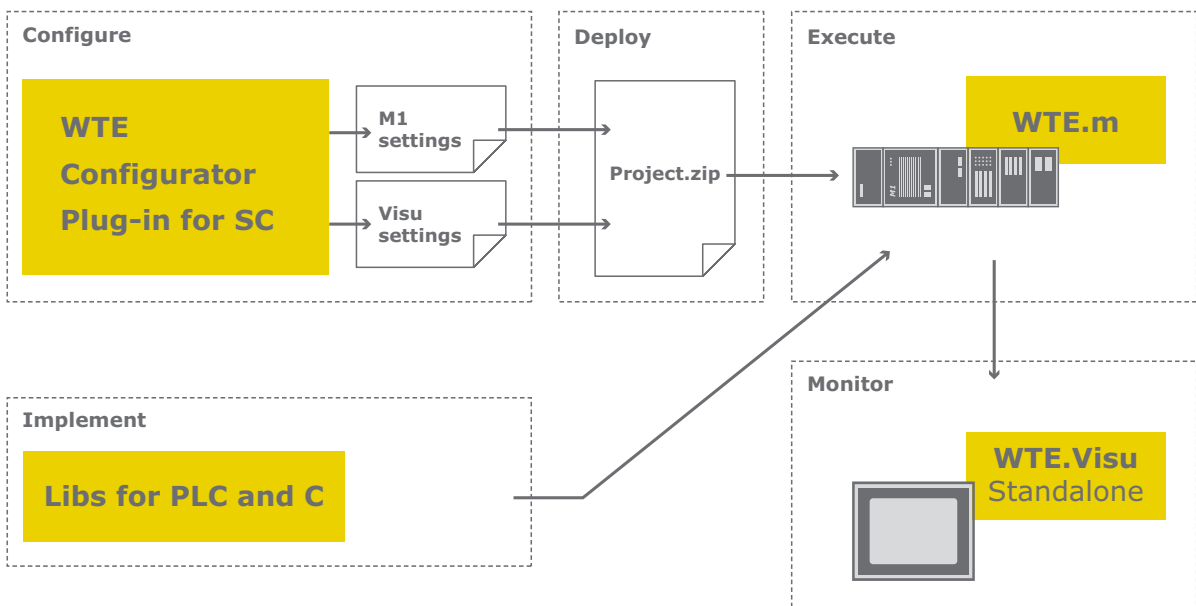
▲ Software package overview: Wind Turbine Essentials (WTE)

Sector-specific solutions

Wind Turbine Essentials WTE	
Configurator	
Environment	The configurator is installed as extension to the Bachmann SolutionCenter.
Project handling	Turbine projects are stored without any external dependencies and thus can be transferred easily from one PC to another.
Workflow	For all parts of the configuration, comfortable table editors with input assistants are available.
Validation	Immediate check for plausible and complete configuration parameters
User management	Configuration of user roles, assignment of required role to each value. Required role for reading and writing can differ
Storage format	Project files in readable format enable comparison between versions and parallel work of different team members
Version control	Tools for version control (SVN, CVS, etc.) can be operated directly from the project navigator. This assures that always complete projects are stored on the server.
Import of external models	Project contents like event configuration can also be imported from different sources as CSV format. Projects of the predecessor product M-WAB can be imported directly into the WTE configurator
Software modules for the controller	
WTE software module	Executable program for the controller, behavior is defined by configuration project. Executes event system, logging, sampling of production data, statistical processing, trend- and snapshot-recordings. Supports fail-safe software update.
WTE alarm handler	Executable program for the controller. Is called in case of an error by the WTE module for automatic dispatch of E-mail and/or SMS messages. Triggering is also possible by other application programs. WTE event logs are included as attachment.
WTE login checker	Executable program for the controller. See *User management and access rights* for details
Visualization	
WTE Visualization	ready-to-use visualization for a Desktop PC with mouse operation, graphical display of trends, power curve, wind rose. Buttons for turbine commands, arbitrary grouping of values in tables for numerical display of monitor values, parameters, event logs and access logs.
Displayed values	Variable values are selected and grouped, then descriptive texts, formats and physical units are assigned. The visualization displays the values according to the selected language and the access right of the current user. Both values of the WTE software module and values of any other process variable on the controller can be selected.
WTE eVis	visualization optimized for HMI panels with touch screen under Windows or Linux
Internationalization	Definition of descriptive texts for events, parameters and monitor values directly in the WTE configurator. Export and import of languages to CSV format for external translation. Filter for missing translations is available.

Wind Turbine Essentials WTE	
Visualization	
Character set	all international character sets are supported, e. g. for Asian, Cyrillic or Arabic languages
Text representation of numerical values	status information is commonly stored as numerical values. For these values it is possible to configure descriptive texts for different languages.
Brand labeling	icons and images can be replaced by manufacturer-specific images
Event system	
Event parameters	Events are operational states which are derived from sensor data, from programmed reactions and from operator input. The complete list of all events that might occur is the central part of the turbine control program. Necessary reactions to events, like stopping the turbine, yawing operations etc. are assigned to events. For each event, a set of the following additional parameters can be configured:
	arbitrary number and type of user-defined event reactions. Typical are brake, yaw and alarm level.
	Creation of follow-up-events on repeated occurrence of another event within a defined period, e. g. frequent exceeding of a temperature limit
	Descriptive name of event in different languages for display in the visualization
	classification in Info, Warning, Error
	Possibility to deactivate an event, e. g. during service procedures. Required user access right for deactivating.
	time delay after power up, e. g. to wait for the completion of an average calculation.
	time delay between setting an event and calling the reaction
	required user right for resetting events (error acknowledgement)
Setting and resetting events	automatically by variable value
	automatically via handler block with hysteresis
	via set- and reset-functions of WTE libraries
	via reset command of the visu (depends on access right)
Max. number of events	only limited by memory and CPU load
Trends and snapshots	
Trends	continuous long-term recording of values for archiving reasons, e. g. for recording of the turbine's production data
Snapshots	continuous short-term recording of some selected variable values until a trigger condition occurs. Then the last few minutes are stored, otherwise the values are discarded. Typically used for error-analysis with a pre-trigger condition.

Sector-specific solutions

Wind Turbine Essentials WTE	
Trends und Snapshots	
Storage	File based on the storage media of the controller. Each recording is stored in one file, the filename contains time and date of the recording. File format is documented and thus can be parsed also by customer specific tools.
Storage	Selection of available recordings by type and by date and time. The trend display offers several Y-axes, show/hide curves and measurement cursors with numerical value display. Trend values can also be shown as table.
Statistical functions	
Average calculation	Average calculation of linear and polar values, selectable sample time and averaging time, with or without calculation of minimum/maximum values and standard deviation.
State counter	Counts rising edges and duration of on-state, separated output as day-, year- and total count/duration. Values are shown as variables and are stored automatically in files. Maximum values for edge count and duration can be configured, then exceeding the limit can raise a maintenance warning. Typically used for counting operating hours of aggregates.
Energy counter	Adds up the current power to energy and keeps produced and consumed energy separated, both are displayed as day-, year- and total values. Results are displayed in variables and are automatically logged to files.
Power curve	Creates a power curve according to IEC61400-12, selectable with or without internal average calculation. One type can directly process raw data, the other expects input data which are already averaged. The WTE Visualization displays the power curve together with an optional reference curve. It is possible to keep several power curves on the controller, e. g. to verify the result of parameter changes
Wind rose	Shows the distribution of wind speed depending on the wind direction. The WTE visualization has a graphical display of the wind rose.
User management and access rights	
Definition of user rights	Creation of a list of user roles in the configurator, then assignment of required role to a variable.
	Required role can be different for Read- and write-access. E. g. reading of operating hours is possible for everybody, resetting the counter is only allowed for certain users.
Password generator	Separated stand-alone tool to create passwords which are valid for a limited period between one day and one year.
Login Checker	Executable program for the controller. Derives user rights from login name, password and date and can limit the access of the user
Access log	Complete logging of all logins and write operations to the controller. Log is stored on the controller

Wind Turbine Essentials WTE	
Programming libraries	
Supported languages	The libraries are available with an identical feature set for IEC61131-3 (M-PLC) as *.lib and for C/C++ as *.a
WTE Interface Library	Comfortable interface for communication between user program and WTE software module, especially for setting/resetting events, retrieving current state of events, resetting counters, triggering snapshots and start/stop wind rose and power curve recordings.
WTE Library	Functions and function blocks for statistical data processing, energy- and state-counters, creation and administration of specific log files
File functions	
General features	Fast and resource-saving access to storage media
	Automatic creation of a series of files with a configurable maximum size for each file
	Filename contains date and time of last entry which makes sorting in chronological order easy
	Each file contains an optional header with selectable information, e. g. turbine name, software version etc.
	The oldest file can optionally be deleted automatically
	Files can optionally be zipped automatically on closing
Supported file formats	CSV with header information and column captions
	Binary with header information
	Ring file for temporary storage of values
System requirements	
Engineering PC	Bachmann SolutionCenter needs to be installed, required version M-Base 3.80 or better
Controller software	M-Base 3.80 or better
Controller hardware	controller CPU of series MX200, MPC200, MC200 and MH200
Delivery variants	
WTE SDK	DVD for installation Software development Kit contains configurator, runtime components, libraries and visualization
WTE Admin Tool	DVD for installation Tool to create manufacturer specific passwords with limited validity period. Matches the login checker included in WTE
WTE Company Licence	License to use the WTE development tools in the whole company
WTE Runtime Licence	License to use the WTE software module on controller

Sector-specific solutions

Wind Power Scada WPS

Based on atvise® scada, Bachmann's Wind Power Scada software (WPS) provides a SCADA system specifically designed for the wind power sector. WPS makes it possible to obtain both a comprehensive and a detailed view of the entire wind farm and any individual turbine at the same time.

State-of-the-art technologies

Just like atvise® scada, WPS uses pure web technology to provide the user with a completely seamless system on all levels. Thanks to this technology, the visualization can be operated on any PC, tablet or smartphone. The use of scalable vector graphics (SVG) enables the creation of a highly ergonomic solution for any device level (control center/wind farm/individual plant).

Communication standards

WPS implements communication standards such as OPC UA (Unified Architecture) and IEC61400-25. The OPC UA interface ergonomically integrates live process data and alarms and can be used for historization. Process variables are standardized thanks to the use of data structures compliant with IEC 61400-25.

Scalability

WPS makes it possible to represent all relevant plant levels: From the global view of the region, to the wind farm, right down to the individual turbine. Specific information providing the user with an overview at any time is displayed for each level. If detailed information is required, the corresponding level can be accessed quickly and conveniently.

SCADA functions

WPS provides the functions familiar to users of atvise® scada, such as alarm handling, historization, trending and multi-lingual functionality. User management is implemented transparently and ergonomically for the user. A login procedure on the WPS is all that is needed to allow access right through to individual turbines. The well-known security standards of the Bachmann M1 controller are used here for transmission (SSL) and user management (groups/level) in order to prevent unauthorized access. Data history, alarms/events and trending are logged by the M1 and seamlessly redirected to the WPS to allow extensive analysis (power curve/wind rose/filter).

Project design

The WPS is designed using the atvise® Builder tool. The IEC61400-25 compliant object structure enables the user to design the required elements simply. As with atvise® scada, the data points are linked in the Builder by browsing an OPC UA data source. The scripting functionality as well as all the other benefits of the atvise® Builder can likewise be used for designing a WPS project. A comprehensive library offers a wide range of ready-to-use components specifically designed for the wind sector. The fully object-oriented implementation of these components allows an efficient operation (reproduction / adaptation).

Connection to external systems

The standard OPC UA interface makes it possible to integrate external controller systems based on the IEC61400-25 data model directly into the WPS system.
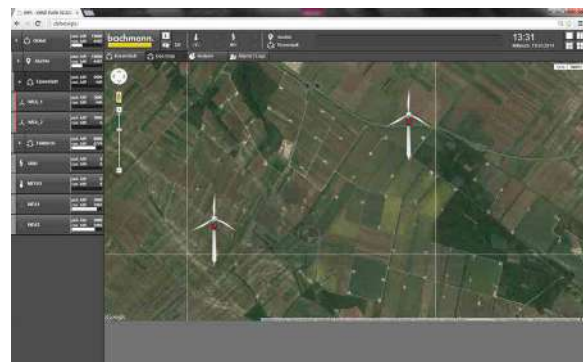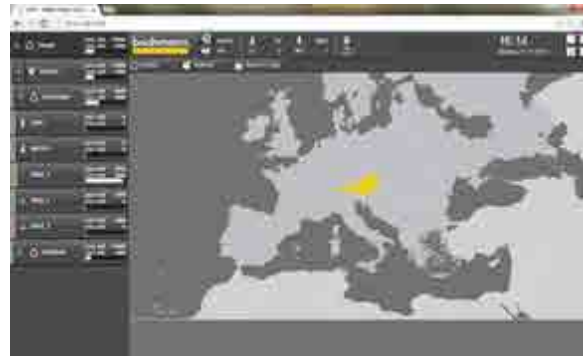
Sector-specific solutions

Third party systems that do not support these standards can be integrated using a (gateway) Bachmann controller that provides the basis for the WPS functions.

The standard communication protocols of the M1 (Profinet/Profibus/CANBus…) are available to provide a basis for taking the process data from the wind turbine. Customized, proprietary solutions can also be implemented on the gateway controller in order to fully utilize WPS.

- Sector-specific SCADA system
- Use of standard OPC UA and IEC61400-25 communication protocols
- High scalability

- Live process data on all visualization levels
- Automatic adaption of the graphic solution for PC, tablet or smartphone
- All visualizations are available on a wide range of state-of-the-art hardware such as smartphone, tablet or PC
- Standard user management for SCADA and turbine
- Online/offline trending
- Online language selection
- Alarm and data history

WPS – Wind Power Scada	
Process connection / Communication	
Protocols	OPC Unified Architecture (UA) Data Access IEC61400-25
Physical interface	Ethernet
Parallel operation	Yes, several clients with different technologies (PC, tablet, cell phone)
Scalability	Cascadable server with WPS instances
Project design	
Development environment	atvise builder
Functionalities	
Language switchover	Yes
Data history	Yes, logged by the M1
Alarm/Event Logging	Yes, logged by the M1
Trending (Event trigger)	Yes, logged by the M1
Wind rose	Yes
User management	Yes
Access security	Yes, with SSL transmission
Visualization	
Browser	HTML5 visualization (Chrome / Firefox / Internet Explorer / Safari) with SVG graphics (Scalable Vector Graphics)

Safe. Qualified. Certified.

Directives and certificates –
for worldwide implementation

Product certifications and approvals are essential prerequisites for global acceptance of industrial products.

Whether national standards, climatic conditions, degrees of protection, set-up, installation, operation or maintenance possibilities – in international implementation the course must be set in the project coordination phase. And it is precisely at this point that our strengths are brought to bear.

Approvals

GL	Germanischer Lloyd
CE	Declaration of Conformity
UL	Underwriters Laboratories
CSA	Canadian Standards Association
HALT	Highly Accelerated Life Test
ISO9001/2000	Quality management
CCC	China Compulsory Certification
DNV	DetNorske Veritas
LR	Lloyds Register
BV	Bureau Veritas
ABS	American Bureau of Shipping

Standards and approvals

M1 controller hardware										
Item no.	Module	CE	CCC	UL	cUL	GL	DNV	LR	ABS	BV	RoHS[*]
00009928-10	ACR222/2	•	•	•	•						•
00012245-10	AI202/SI	•	•	•	•	•	•	•	•	•	•
00010693-20	AI204/1	•	•	•	•	•	•	•	•	•	•
00010693-10	AI204/2	•	•	•	•	•	•	•	•	•	•
00010693-00	AI204/4	•	•	•	•	•	•	•	•	•	•
00017447-00	AI204/4❄	•	•	•	•	•	•	•	•	•	•
00012245-00	AI204/SI	•	•	•	•	•	•	•	•	•	•
00017772-00	AI208/SI	•	•	•	•	•	•	•	•	•	•
00018843-00	AI208/SI❄	•	•	•	•	•	•	•	•	•	•
00014151-00	AIC212	•	•	•	•	•	•	•	•	•	•
00017444-00	AIC212❄	•	•	•	•	•	•	•	•	•	•
00020627-00	AIO208	**	**								**
00020628-00	AIO208❄	**	**								**
00020631-00	AIO216	**	**								**
00020632-00	AIO216❄	**	**								**
00014470-00	AIO288	•	•	•	•	•	•	•	•	•	•
00016157-00	AIO288❄	•	•	•	•	•	•	•	•	•	•
00014470-10	AIO288/1	•	•	•	•	•	•	•	•	•	•
00010692-00	AO202	•	•	•	•	•	•	•	•	•	•
00012246-10	AO202/SI	•	•	•	•	•	•	•	•	•	•
00012246-00	AO204/SI	•	•	•	•	•	•	•	•	•	•
00011244-00	AO208/I	•	•	•	•	•	•	•	•	•	•
00017441-00	AO208/I❄	•	•	•	•	•	•	•	•	•	•
00009540-00	A-PCC200	•	•								•
00009754-00	BEM201	•	•	•	•						•
00012846-00	BEM211	•	•	•	•						•
00009755-10	BES202	•	•	•	•						•
00009755-00	BES202/N	•	•	•	•						•
00012847-00	BES212	•	•	•	•						•
00012848-00	BES212/N	•	•	•	•						•
00013502-00	BES222	•	•	•	•						•
00013503-00	BES222/N	•	•	•	•						•
00010507-00	BS201	•	•	•	•	•	•	•	•	•	•
00009802-00	BS202	•	•	•	•	•	•	•	•	•	•
00009313-00	BS203	•	•	•	•	•	•	•	•	•	•
00015947-00	BS203❄	•	•	•	•	•	•	•	•	•	•
00016785-00	BS203/S	•	•	•	•	•	•	•	•	•	•
00009752-00	BS204	•	•	•	•	•	•	•	•	•	•
00015948-00	BS204❄	•	•	•	•	•	•	•	•	•	•

*   RoHS China (no RoHS Europe)
**   Certification in process

M1 controller hardware											
Item no.	Module	CE	CCC	UL	cUL	GL	DNV	LR	ABS	BV	RoHS[*]
00016786-00	BS204/S	•	•	•	•	•	•	•	•	•	•
00009206-00	BS205	•	•	•	•	•	•	•	•	•	•
00015949-00	BS205❋	•	•	•	•	•	•	•	•	•	•
00016787-00	BS205/S	•	•	•	•	•	•	•	•	•	•
00009792-00	BS206	•	•	•	•	•	•	•	•	•	•
00015950-00	BS206❋	•	•	•	•	•	•	•	•	•	•
00016788-00	BS206/S	•	•	•	•	•	•	•	•	•	•
00009207-00	BS207	•	•	•	•	•	•	•	•	•	•
00015951-00	BS207❋	•	•	•	•	•	•	•	•	•	•
00016789-00	BS207/S	•	•	•	•	•	•	•	•	•	•
00009793-00	BS208	•	•	•	•	•	•	•	•	•	•
00015952-00	BS208❋	•	•	•	•	•	•	•	•	•	•
00016790-00	BS208/S	•	•	•	•	•	•	•	•	•	•
00009634-00	BS209	•	•	•	•	•	•	•	•	•	•
00015953-00	BS209❋	•	•	•	•	•	•	•	•	•	•
00016791-00	BS209/S	•	•	•	•	•	•	•	•	•	•
00009794-00	BS210	•	•	•	•	•	•	•	•	•	•
00015954-00	BS210❋	•	•	•	•	•	•	•	•	•	•
00016792-00	BS210/S	•	•	•	•	•	•	•	•	•	•
00009795-00	BS211	•	•	•	•	•	•	•	•	•	•
00015955-00	BS211❋	•	•	•	•	•	•	•	•	•	•
00016793-00	BS211/S	•	•	•	•	•	•	•	•	•	•
00009796-00	BS212	•	•	•	•	•	•	•	•	•	•
00015956-00	BS212❋	•	•	•	•	•	•	•	•	•	•
00016794-00	BS212/S	•	•	•	•	•	•	•	•	•	•
00009797-00	BS213	•	•	•	•	•	•	•	•	•	•
00015957-00	BS213❋	•	•	•	•	•	•	•	•	•	•
00016795-00	BS213/S	•	•	•	•	•	•	•	•	•	•
00009798-00	BS214	•	•	•	•	•	•	•	•	•	•
00015958-00	BS214❋	•	•	•	•	•	•	•	•	•	•
00016796-00	BS214/S	•	•	•	•	•	•	•	•	•	•
00009799-00	BS215	•	•	•	•	•	•	•	•	•	•
00018623-00	BS215❋	•	•	•	•	•	•	•	•	•	•
00016797-00	BS215/S	•	•	•	•	•	•	•	•	•	•
00009800-00	BS216	•	•	•	•	•	•	•	•	•	•
00018624-00	BS216❋	•	•	•	•	•	•	•	•	•	•
00016798-00	BS216/S	•	•	•	•	•	•	•	•	•	•
00009698-00	CM202	•	•	•	•	•	•	•	•	•	•
00016404-00	CM202❋	•	•	•	•	•	•	•	•	•	•

*   RoHS China (no RoHS Europe)
*** on request

Standards and approvals

M1 controller hardware										
Item no.	Module	CE	CCC	UL	cUL	GL	DNV	LR	ABS	BV	RoHS*
00010709-10	CNT204/H	•	•	•	•	•	•	•	•	•	•
00016407-10	CNT204/H❋	•	•	•	•	•	•	•	•	•	•
00010709-20	CNT204/R	•	•	•	•	•	•	•	•	•	•
00013178-00	CS200	•	•	•	•	•	•	•	•	•	•
00013179-00	CS200/N	•	•	•	•	•	•	•	•	•	•
00013597-00	DA3284-C	•	•	•	•	•	•	•	•	•	•
00017450-00	DA3284-C❋	•	•	•	•	•	•	•	•	•	•
00010281-00	DI212	•	•	•	•	•	•	•	•	•	•
00009002-00	DI216	•	•	•	•	•	•	•	•	•	•
00008997-00	DI232	•	•	•	•	•	•	•	•	•	•
00016411-00	DI232❋	•	•	•	•	•	•	•	•	•	•
00012162-00	DI232/48	•	•	•	•	•	•	•	•	•	•
00011516-00	DI232/np1	•	•	•	•	•	•	•	•	•	•
00010285-00	DIO16-C	•	•	•	•	•	•	•	•	•	•
00017453-00	DIO16-C❋	•	•	•	•	•	•	•	•	•	
00010615-00	DIO216	•	•	•	•	•	•	•	•	•	
00010892-00	DIO216/4	•	•	•	•	•	•	•	•	•	•
00016141-00	DIO216/4❋	•	•	•	•	•	•	•	•	•	•
00013034-00	DIO232	•	•	•	•	•	•	•	•	•	•
00019116-00	DIO248	•	•	•	•	•	•	•	•	•	•
00019115-00	DIO264	•	•	•	•	•	•	•	•	•	•
00009205-00	DIO264-C	•	•	•	•	•	•	•	•	•	•
00019114-00	DIO280	•	•	•	•	•	•	•	•	•	•
00019119-00	DIO280❋	•	•	•	•	•	•	•	•	•	•
00010129-00	DIO32-C	•	•	•	•	•	•	•	•	•	•
00010526-00	DIO48-C	•	•	•	•	•	•	•	•	•	•
00009884-00	DMS202	•	•	•	•						•
00012696-00	DNM201	•	•	•	•	•	•	•	•	•	•
00009004-00	DO216	•	•	•	•	•	•	•	•	•	•
00009003-00	DO232	•	•	•	•	•	•	•	•	•	•
00016414-00	DO232❋	•	•	•	•	•	•	•	•	•	•
00012176-00	DO232/48	•	•	•	•	•	•	•	•	•	•
00014497-10	DOR206/230	•	•	•	•	•	•	•	•	•	•
00010555-00	DPM200	•	•	•	•	•	•	•	•	•	•
00018032-00	DPM200❋	•	•	•	•						•
00012671-00	EM203	•	•	•	•	•	•	•	•	•	•
00017321-00	EM213	•	•	•	•	•	•	•	•	•	•

*   RoHS China (no RoHS Europe)
** Certification in process

M1 controller hardware										
Item no.	Module	CE	CCC	UL	cUL	GL	DNV	LR	ABS	BV	RoHS*
00017470-00	EM213❄	•	•	•	•	•	•	•	•	•	•
00017192-00	FCS214/G	•	•	•	•	•	•	•	•	•	•
00017192-10	FCS214/F	•	•	•	•	•	•	•	•	•	•
00010495-00	FM211	•	•	•	•	•	•	•	•	•	•
00010496-00	FM212	•	•	•	•	•	•	•	•	•	•
00016747-10	FM221	•	•	•	•	•	•	•	•	•	•
00018091-10	FM221❄	•	•	•	•	•	•	•	•	•	•
00016747-00	FM222	•	•	•	•	•	•	•	•	•	•
00018091-00	FM222❄	•	•	•	•	•	•	•	•	•	•
00010497-00	FS211	•	•	•	•	•	•	•	•	•	•
00010498-00	FS211/N	•	•	•	•	•	•	•	•	•	•
00010499-00	FS212	•	•	•	•	•	•	•	•	•	•
00010500-00	FS212/N	•	•	•	•	•	•	•	•	•	•
00016749-10	FS221/N	•	•	•	•	•	•	•	•	•	•
00018092-10	FS221/N❄	•	•	•	•	•	•	•	•	•	•
00016749-00	FS222/N	•	•	•	•	•	•	•	•	•	•
00018092-00	FS222/N❄	•	•	•	•	•	•	•	•	•	•
00020620-00	GIO212	**	**								**
00020623-00	GIO212❄	**	**								**
00022162-00	GM260	**	**			**	**	**	**	**	**
00017829-00	GMP232	•	•	•	•	•	•	•	•	•	•
00019063-00	GMP232❄	•	•	•	•	•	•	•	•	•	•
00019756-00	GSP274	•	•	•	•	**	**	**	**	**	•
00021759-00	GSP274❄	•	•	•	•	**	**	**	**	**	•
00013737-00	ISI222	•	•	•	•	•	•	•	•	•	•
00016421-00	ISI222❄	•	•	•	•	•	•	•	•	•	•
00014127-00	ISI222/8	•	•	•	•	•	•	•	•	•	•
00014477-00	LM20	•	•	•	•	•	•	•	•	•	•
00009494-00	LM201	•	•	•	•	•	•	•	•	•	•
00018805-10	MC205	•	•	•	•	**	**	**	**	**	•
00018805-12	MC205-CFA4GB	•	•	•	•	**	**	**	**	**	•
00020513-1x	MC205❄	•	•	•	•	**	**	**	**	**	•
00018806-1x	MC210	•	•	•	•	**	**	**	**	**	•
00020514-1x	MC210❄	•	•	•	•	**	**	**	**	**	•
00013176-00	ME203/CN	•	•	•	•	•	•	•	•	•	•
00016336-00	ME203/CN❄	•	•	•	•	•	•	•	•	•	•
00013191-00	ME203/CNW	•	•	•	•	•	•	•	•	•	•

*   RoHS China (no RoHS Europe)

Standards and approvals

M1 controller hardware										
Item no.	Module	CE	CCC	UL	cUL	GL	DNV	LR	ABS	BV	RoHS*
00013177-00	ME203/EN	•	•	•	•	•	•	•	•	•	•
00015985-00	ME203/EN❋	•	•	•	•	•	•	•	•	•	•
00016370-0x	MH212/S	•	•	•	•	•	•	•	•	•	•
00018652-0x	MH212/S❋	•	•	•	•	•	•	•	•	•	•
00012711-40	MPC240	•	•	•	•	•	•	•	•	•	•
00018591-x0	MPC240	•	•	•	•	•	•	•	•	•	•
00016338-40	MPC240❋	•	•	•	•	•	•	•	•	•	•
00020547-x0	MPC240❋	•	•	•	•	•	•	•	•	•	•
00013127-40	MPC240/W	•	•	•	•	•	•	•	•	•	•
00021018-00	MPC240/W-CF512MB	•	•	•	•	•	•	•	•	•	•
00018372-00	MPC240/W-CF4GB	•	•	•	•	•	•	•	•	•	•
00012708-40	MPC265	•	•	•	•	•	•	•	•	•	•
00018587-x0	MPC265	•	•	•	•	•	•	•	•	•	•
00012710-40	MPC270	•	•	•	•	•	•	•	•	•	•
00018589-x0	MPC270	•	•	•	•	•	•	•	•	•	•
00016180-40	MPC270❋	•	•	•	•	•	•	•	•	•	•
00020413-x0	MPC270❋	•	•	•	•	•	•	•	•	•	•
00013129-40	MPC270/W	•	•	•	•	•	•	•	•	•	•
00023264-00	MPC270/W-CF512MB	•	•	•	•	•	•	•	•	•	•
00014274-40	MPC293	•	•	•	•	•	•	•	•	•	•
00017629-00	MPC293-CF512MB	•	•	•	•	•	•	•	•	•	•
00017332-40	MPC293/W	•	•	•	•	•	•	•	•	•	•
00020575-00	MPC293/W-CF512MB	•	•	•	•	•	•	•	•	•	•
00014445-00	MX207	•	•	•	•	•	•	•	•	•	•
00018594-x0	MX213	•	•	•	•	•	•	•	•	•	•
00018597-x0	MX213❋	•	•	•	•	•	•	•	•	•	
00018593-x0	MX220	•	•	•	•	•	•	•	•	•	•
00019210-00	MX220❋	•	•	•	•	•	•	•	•	•	•
00017689-x0	MX220❋	•	•	•	•	•	•	•	•	•	•
00012754-00	NT250/48	•	•			•	•	•	•	•	•
00013251-00	NT255	•	•	•	•	•	•	•	•	•	•
00016158-00	NT255❋	•	•	•	•	•	•	•	•	•	•
00012081-10	PCC201/ 8	•	•	•	•	•	•	•	•	•	•

* RoHS China (no RoHS Europe)
** Certification in process

M1 controller hardware										
Item no.	Module	CE	CCC	UL	cUL	GL	DNV	LR	ABS	BV	RoHS*
00012081-20	PCC201/16	•	•	•	•	•	•	•	•	•	•
00012081-30	PCC201/32	•	•	•	•	•	•	•	•	•	•
00012081-40	PCC201/64	•	•	•	•	•	•	•	•	•	•
00010708-00	PTAI216	•	•	•	•	•	•	•	•	•	•
00017456-00	PTAI216❄	•	•	•	•	•	•	•	•	•	•
00011056-00	PWM202	•	•	•	•						•
00021235-00	RS204	•	•	•	•	•	•	•	•	•	•
00021674-00	RS204❄	•	•	•	•	•	•	•	•	•	•
00009542-00	S201	•	•	•	•	•	•	•	•	•	•
00014544-00	SDI208	•	•	•	•						•
00017459-00	SDI208❄	•	•	•	•	**	**	**	**	**	•
00014545-00	SDO204	•	•	•	•						•
00017462-00	SDO204❄	•	•	•	•	**	**	**	**	**	•
00011756-00	SEM201	•	•	•	•						•
00014273-00	SLC284	•	•	•	•						•
00017465-00	SLC284❄	•	•	•	•	**	**	**	**	**	•
00012672-00	SWI205/S	•	•	•	•	•	•	•	•	•	•
00010851-00	TCO204-C	•	•	•	•	•	•	•	•	•	•
00010850-00	TCO208-C	•	•	•	•	•	•	•	•	•	•
00008673-00	TCO216-C	•	•	•	•	•	•	•	•	•	•
00014008-00	TI214	•	•	•	•	•	•	•	•	•	•
00014008-20	TI214/2	•	•	•	•	***	***	***	***	***	•
00009496-00	VP200	•	•	•	•						•
00009498-00	VP200/S	•	•	•	•						•

*   RoHS China (no RoHS Europe)
*** on request

Standards and approvals

HMI devices											
Item no.	Module	CE	CCC	UL	cUL	GL	DNV	LR	ABS	BV	RoHS*
00014221-00	CT205/BE1	•	•	•	•	•	•	•	•	•	•
00014336-00	CT205/V/BE1	•	•	•	•	•	•	•	•	•	•
00016898-00	IPC1410/BE1/CM1G1	•	•	•	•	-	-	-	-	-	•
00016902-00	IPC1410/BE1/CD1G6	•	•	•	•	-	-	-	-	-	•
00016899-00	IPC1412/BE1/CM1G1	•	•	•	•	-	-	-	-	-	•
00016903-00	IPC1412/BE1/CD1G6	•	•	•	•	-	-	-	-	-	•
00016900-00	IPC1415/BE1/CM1G1	•	•	•	•	-	-	-	-	-	•
00016904-00	IPC1415/BE1/CD1G6	•	•	•	•	-	-	-	-	-	•
00016905-00	IPC1419/BE1/CD1G6	•	•	•	•	-	-	-	-	-	•
00017609-00	IPC312/BE1	•	•	•	•	-	-	-	-	-	•
00017227-10	IPC315/BE1	•	•	•	•	-	-	-	-	-	•
00014569-00	OT115/R/BE1	•	•	•	•	•	•	•	•	•	•
00014570-00	OT115/R/BE2	•	•	•	•	•	•	•	•	•	•
00017593-00	OT115/R/BE2/CC	•	•	•	•	•	•	•	•	•	•
00018216-00	OT205/BE1	•	•	•	•	•	•	•	•	•	•
00018217-00	OT205/M/BE1	•	•	•	•	•	•	•	•	•	•
00018218-00	OT205/V/BE1	•	•	•	•	•	•	•	•	•	•
00018219-00	OT205/V/BE1/CC	•	•	•	•	•	•	•	•	•	•
00018221-00	OT205/V/BE2	•	•	•	•	•	•	•	•	•	•
00022298-00	OT1310/BE1/GT1G0	•	•	•	•	-	-	-	-	-	•
00021833-00	OT1312/BE1/GT1G0	•	•	•	•	-	-	-	-	-	•
00022299-00	OT1315/BE1/GT1G0	•	•	•	•	-	-	-	-	-	•
00021831-00	OT1319/BE1/GT1G0	•	•	•	•	-	-	-	-	-	•
00014314-00	WT310/BE1	•	•	•	•	-	-	-	-	-	•
00014329-00	WT312/BE1	•	•	•	•	-	-	-	-	-	•
00014399-00	WT315/BE1	•	•	•	•	-	-	-	-	-	•

M1 controller hardware					
Item no.	Module	BDEW	VDE4105	TR3	TR8
00017829-00	GMP232	•	-	•	•
00019063-00	GMP232❋	•	-	•	•
00019756-00	GSP274	•	•	•	•
00021759-00	GSP274❋	•	•	•	•

*   RoHS China (keine RoHS Europa)
**   Zertifizierung läuft

ColdClimate

ColdCimate modules		
Processor modules	**Item designation**	**Item number**
Processor module	ME203/EN❄	00015985-00
Processor module	ME203/CN❄	00016336-00
Processor module	MX213/❄-CF512MB	00018597-00
Processor module	MX213/❄-CF4GB	00018597-10
Processor module	MX220/❄	00019210-00
Processor module	MX220/❄-CF512MB	00017689-00
Processor module	MX220/❄-CF4GB	00017689-10
Processor module	MPC240❄	00016338-40
Processor module	MPC240❄-CF512MB	00020547-00
Processor module	MPC240❄-CF4GB	00020547-10
Processor module	MPC270❄	00016180-40
Processor module	MPC270❄-CF512MB	00020413-00
Processor module	MPC270❄-CF4GB	00020413-10
Processor module	MC205❄	00020513-10
Processor module	MC205❄-CFA4GB	00020513-12
Processor module	MC210❄	00020514-10
Processor module	MC210❄-CFA4GB	00020514-12
Processor module	MH212/S❄	00018652-00
Processor module	MH212/S❄-CFA4GB	00018652-02
Digital input/output modules	**Item designation**	**Item number**
Digital input module	DI232❄	00016411-00
Digital output module	DO232❄	00016414-00
Digital input/output module	DIO216/4❄	00016141-00
Digital input/output module	DIO232❄	00019502-00
Digital input/output module	DIO280❄	00019119-00
Safety modules	**Item designation**	**Item number**
Safety Logic Controller	SLC284❄	00017465-00
Safety digital input module	SDI208❄	00017459-00
Safety digital output module	SDO204❄	00017462-00
Analog input/output module	**Item designation**	**Item number**
Universal input/output module	GIO212❄	00020623-00
Universal input/output module	AIO208❄	00020628-00
Universal input/output module	AIO216❄	00020632-00
Analog input module	AI208/SI❄	00018843-00
Analog input module	AI204/4❄	00017447-00
Analog output module	AO208/I❄	00017441-00
Analog input/output module	AIO288❄	00016157-00
Temperature recordung module	PTAI216❄	00017456-00
Temperature input module	TI214❄	00018808-00
Measurement module for Condition Mon.	AIC212❄	00017444-00
Functional module	**Item designation**	**Item number**
Counter modulel	CNT204/H❄	00016407-10
Positioning module	ISI222❄	00016421-00
Grid measurement module	**Item designation**	**Item number**
Grid measurement module	GMP232❄	00019063-00
Interface module	**Item designation**	**Item number**
Industrie-Ethernet-Master	EM213❄	00017470-00
Interface module	RS204❄	00021674-00

ColdCimate modules		
System networking	Item designation	Item number
Ethernet Remote Station	ERS202❄	00021244-00
Media converter	FCS214/F❄	00019104-10
Media converter	FCS214/G❄	00019104-00
FASTBUS module	FM221❄	00018091-10
FASTBUS module	FM222❄	00018091-00
FASTBUS module	FM221/N❄	00018092-10
FASTBUS module	FM222/N❄	00018092-00
CANopen Master module	CM202❄	00016404-00
PROFIBUS DP-Master module	DPM200❄	00018302-00
Decentralized CAN modules	Item designation	Item number
Digital input/output module	DIO16-C❄	00017453-00
Analog and digital in/output module	DA3284-C❄	00017450-00
Fieldbusses	Item designation	Item number
EtherCAT slave module	ECS200❄	00019206-00
PROFIBUS-DP-Master module	DPM200❄	00018032-00
Digital input/output module	DIO16-C❄	00017453-00

ColdClimate modules		
System modules	Item designation	Item number
Power supply	NT255❄	00016158-00
Backplane	BS203❄	00015947-00
Backplane	BS204❄	00015948-00
Backplane	BS205❄	00015949-00
Backplane	BS206❄	00015950-00
Backplane	BS207❄	00015951-00
Backplane	BS208❄	00015952-00
Backplane	BS209❄	00015953-00
Backplane	BS210❄	00015954-00
Backplane	BS211❄	00015955-00
Backplane	BS212❄	00015956-00
Backplane	BS213❄	00015957-00
Backplane	BS214❄	00015958-00
Backplane	BS215❄	00018623-00
Backplane	BS216❄	00018624-00

| ColdClimate Terminals		
OT100 series	Item designation	Item number
Operator Terminal	OT115/R/BE2/CC	00017593-00
OT200 series	Item designation	Item number
Operator Terminal	OT205/V/BE1/CC	00018219-00
OT1300 series	Item designation	Item number
Operator Terminal	OT1310/BE1/CC/GT1G0	on request
Operator Terminal	OT1312/BE1/CC/GT1G0	on request

CAE/CAD data –
the convenient solution.

High-quality automation components are good and important, however they no longer suffice for successful machine building and process plant engineering projects. Development and project planning also play a crucial role for automation. Consequently the electrical and mechanical design of control cabinets is increasingly executed with 3D-supported programs that can ensure optimal placement of components and cable routing.

The same applies at Bachmann electronic: With eCAD import functionality in the SolutionCenter the turnaround time of automation projects can be significantly reduced. We satisfy the new market requirements and support our customers with additional components in the integrated engineering process.
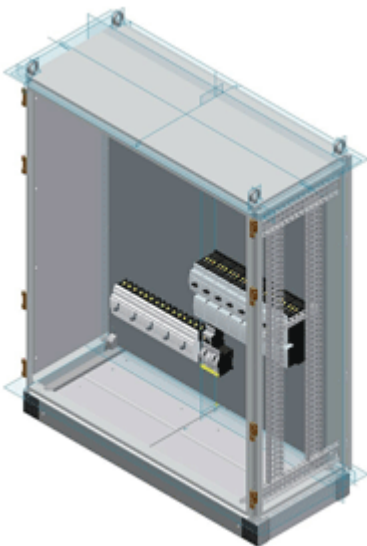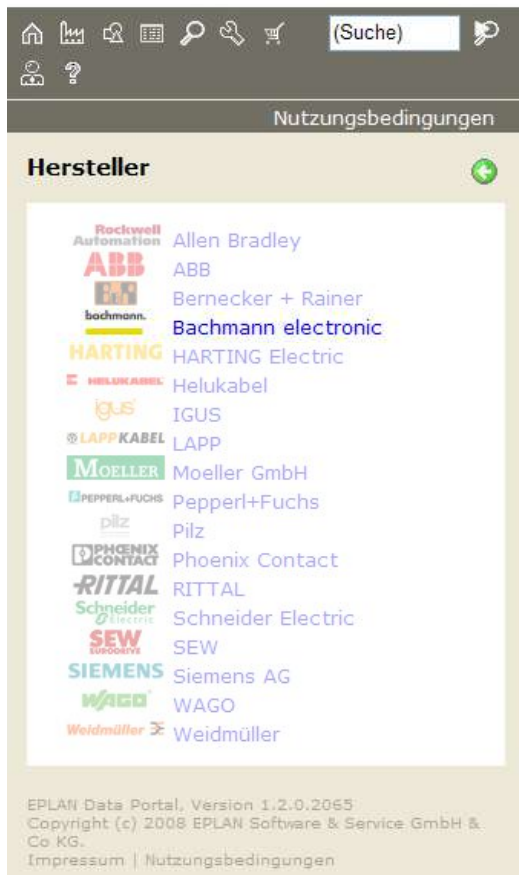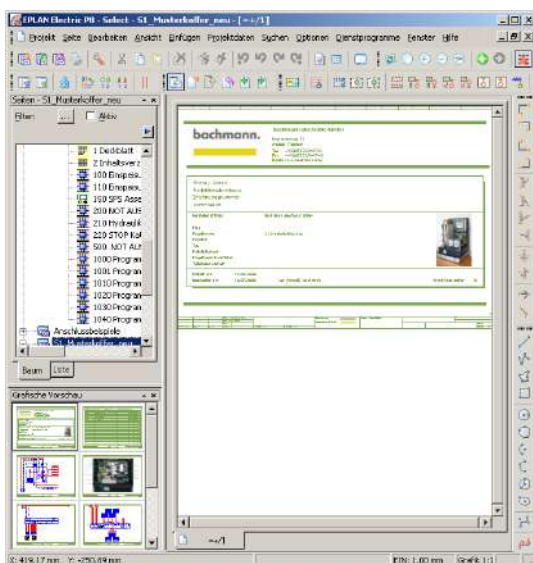
ePLAN library for control cabinet construction

Good automation components no longer suffice for successful machine building and plant engineering projects. Efficient development and project planning is becoming ever more important. Bachmann electronic meets the requirements and supports its customers with two additional components in the integrated engineering process.

The device data necessary for electrical design of the Bachmann automation components is provided as a library in the ePLAN data portal. Macros for circuit diagram and control cabinet layout, function templates for intelligent configuration of controllers, item data for the spare parts catalog; The data that is created and certified with ePLAN can be loaded directly into the ECAD project and immediately used for the design – a significant contribution in time savings, as well as for uniform structuring of the project.

With the new eCAD import functionality in the SolutionCenter the time of automation projects can be significantly reduced. While one team plans parts lists, circuit diagrams and control cabinet layouts, another team can create the required software in parallel. Through the use of symbolic variables in the software, to this point in the project knowledge of the structure of the hardware is not required. Only through automatic import of the ECAD data into the SolutionCenter will a link be established between symbolic variables and the hardware used, and an operable software module be generated.
Variants, extensions or corrections in ECAD project planning are no problem – the software module will simply be re-generated with the changed and newly-imported ECAD data.

CAE/CAD data

ePLAN library

The ePLAN library contains device data, macros and technical documentation of all automation components: M1 hardware, visualization hardware and S1 servo system.

- Direct transfer from the portal into the electrical project planning
- Tested and assured quality through Certification
- Ongoing update and extension
- Support for the entire electrical project planning – circuit diagrams, control cabinet layouts, Overview drawings, PLC configurations and spare part documentation
- Support for implementation of the library
- Use of design software ePLAN P8 and higher

ECAD import in the SolutionCenter

- Software is created with symbolic variables
- Linking of the symbolic variables with the hardware used through import of the ECAD data into the SolutionCenter
- An operable software module is generated
- Variants, extensions, or corrections in the ECAD project planning can be easily integrated at any time through subsequent import

3D-CAD model library for control cabinet design

Control cabinets are increasingly being designed with 3D-assisted programs in order to guarantee an optimal placement of the components and the wiring. Bachmann electronic supports its customers in this engineering process and makes a library available for this purpose.

The 3D-CAD model library contains the versioned 3D models of the controller and terminal products. The 3D models are created on a 1:1 scale. The STEP format was chosen so that it can be further processed by all major 3D drawing programs. The models show the external details of the products at full resolution so that a realistic appearance for the 3D design is facilitated. Internal details are largely masked out, which achieves a considerable reduction of the data size.

Bachmann electronic provides this library without charge to its customers for standard products. Libraries can be created for customer-specific products if needed.
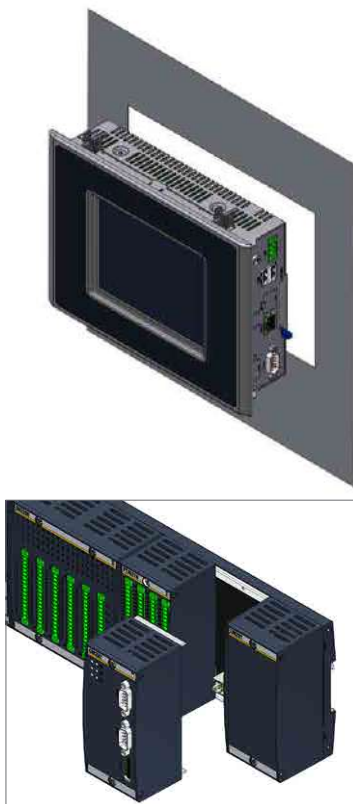
3D-CAD model library
• Detailed display of the products in the STEP 3D exchange format
• Data reduced to the required Data volume
• Labeling of the 3D models with the product version number

Installation in the control cabinet / housing

M1 controller hardware

UL/CSA regulations and those of the EU Directive 73/23 EC (Low-voltage Directive) specify that controllers be mounted in a cabinet, an enclosure or a closed operating area in order to meet the requirements for electrical safety. When determining the spatial requirements of an M1 controller, certain minimum distances between the mounting rack and the adjacent fixtures must be considered
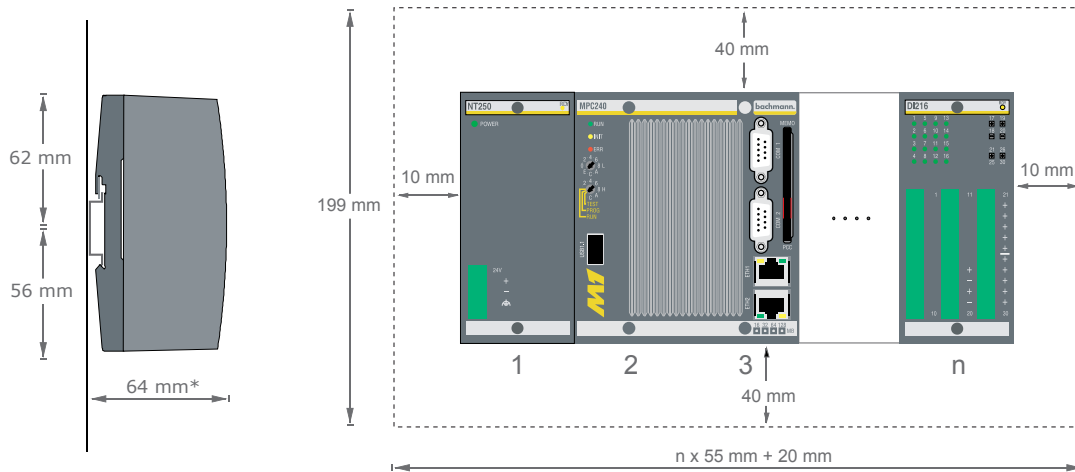
*for cables an additional movement space of at least 30 mm must be provided. When using high covers for the D-SUB connectors more space can also be required.

HMI systems

In order to protect against the potential danger of overheating, the visualization equipment should be mounted in a cabinet or housing, with the minimum distances specified below.
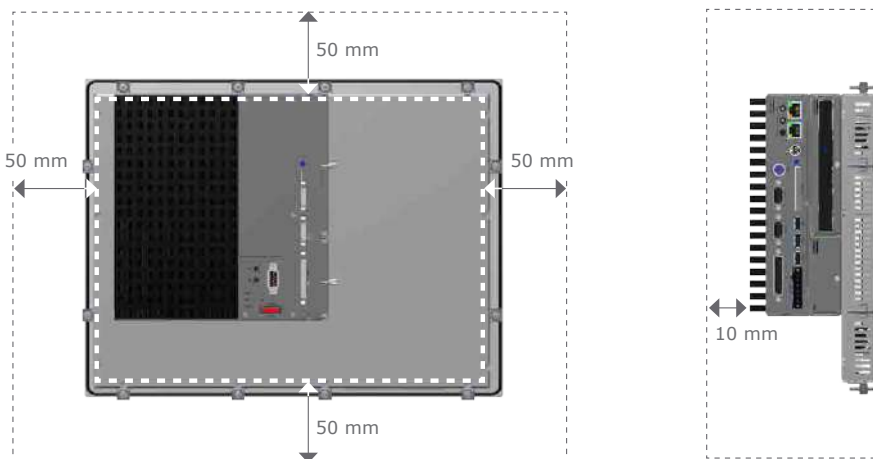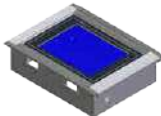

Note: Every device series can have lower minimum distances upon request, depending on the specific conditions.

Installation in the control cabinet*				
	Vertical	Interfaces Bottom/top	45° angle	Horizontal
CT200 series	50 °C	50 °C	50 °C	45 °C
OT100 series	60 °C	60 °C	60 °C	55 °C
OT200 series**	50 °C	50 °C	50 °C	45 °C
OT1300 series	60 °C	60 °C	60 °C	55 °C
WT300 series	50 °C	45 °C	45 °C	45 °C
IPC300 series**	50 °C	45 °C	45 °C	45 °C
IPC1400 series**	50 °C	45 °C	45 °C	45 °C

Installation in the control housing		
	Vertical	Horizontal
CT200 series	45 °C	40 °C
OT100 series	55 °C	50 °C
OT200 series**	45 °C	40 °C
OT1300 series	55 °C	50 °C
WT300 series	45 °C	40 °C
IPC300 series**	45 °C	40 °C
IPC1400 series**	45 °C	40 °C

*   Subject to observation of the defined minimum clearances and surrounding volume in the control cabinet.

** Maximum ambient temperature, individual device variants may vary (see user manual for detailed information).

Dimensions – HMI devices

Dimensions	
Device	W x H x D (mm)
CT series	
CT205	212 x 156 x 49
CT205M	212 x 156 x 49
CT205V	212 x 156 x 49
OT series	
OT115/R/BE1	170 x 128 x 50
OT115/R/BE2	170 x 160 x 50
OT205/BE1	212 x 156 x 49
OT205/V/BE1	270,5 x 175 x 49
OT205/M/BE1	212 x 156 x 49
OT1310/BE1/GT1G0	310 x 234 x 68
OT1310/BE1/CC/GT1G0	310 x 234 x 68
OT1312/BE1/GT1G0	341 x 253 x 68
OT1312/BE1/CC/GT1G0	341 x 253 x 68
OT1315/BE1/GT1G0	406 x 308 x 75
OT1319/BE1/GT1G0	471 x 375 x 76
OT1312/BE1/CE1G1	341 x 253 x 74
WT series	
WT310/BE1	307 x 233 x 94
WT312/BE1	307 x 256 x 97
WT315/BE1	405 x 308 x 97

Dimensions – industrial PCs

Dimensions	
Device	W x H x D (mm)
IPC series	
IPC310/BE1	307 x 233 x 94
IPC312/BE1	337 x 256 x 97
IPC315/BE1	405 x 308 x 97
IPC1410/BE1	314 x 240 x 110
IPC1412/BE1	337 x 256 110[2]/159[3]
IPC1415/BE1	405 x 308 x 124[2]/171[3]
IPC1419/BE1	470 x 374,6 x 121[2]/170[3]

[1] for 19" installation

[2] without attachment/expansion units

[3] with 2 attachments (1 attachment = 25 mm)

Dimensions – control system

Dimensions		
Module	W x H x D (mm)	Weight (g)
Processor modules		
MPC2xx	110 x 119 x 61	650
ME203/x	55 x 119 x 61	230
ME203/xN	55 x 119 x 61	310
MX213	110 x 119 x 61	670
MH212/x	220 x 119 x 96	1870
Safety modules		
SLC284	110 x 119 x 61	360
SDI208	55 x 119 x 61	210
SDO204	55 x 119 x 61	230
Digital input/output module		
DI2xx/xx	55 x 119 x 61	200
DO2xx/xx	55 x 119 x 61	240
DOR206/xx	55 x 119 x 61	220
DIO216/xx	55 x 119 x 61	210
DIO232	55 x 119 x 61	210
DIO248	110 x 119 x 61	370
DIO264	110 x 119 x 61	390
DIO280/x	110 x 119 x 61	385
Analog input/output module		
GIO212	55 x 119 x 61	200
AIO208	55 x 119 x 61	200
AIO216	55 x 119 x 61	200
AI204/x	55 x 119 x 61	210
AI20x/SI	55 x 119 x 61	210
AO202	55 x 119 x 61	200
AO208/Ix	55 x 119 x 61	230
AO202/SI	55 x 119 x 61	200
AO204/SI	55 x 119 x 61	210
AIO288/x	55 x 119 x 61	240
PTAI216x	55 x 119 x 61	220
TI214/x	55 x 119 x 61	210
DMS202	55 x 119 x 61	235
AIC212x	110 x 119 x 61	360
Technology module		
CNT204/Hx	55 x 119 x 61	200
CNT204/R	55 x 119 x 61	225
ISI222/x	55 x 119 x 61	235
ACR222/2	55 x 119 x 61	265
PWM202	55 x 119 x 61	220
Interface module		
RS204/x	55 x 119 x 61	200
EM213x	55 x 119 x 61	340
SWI205/S	55 x 119 x 61	240
Bus module		
BEM211	55 x 119 x 61	195
BES212	55 x 119 x 61	205
BES222	55 x 119 x 61	205
BES202/N	55 x 119 x 61	290
BES2x2/N	55 x 119 x 61	290
FCS214/x	55 x 119 x 61	290
Grid measurement module		
GSP274	165 x 119 x 75	640
GMP232	110 x 119 x 61	600
GM260	55 x 119 x 61	190

Dimensions – control system

Dimensions		
Module	W x H x D (mm)	Weight (g)
Bus modules		
FM211	55 x 119 x 70	320
FM222	55 x 119 x 70	400
FS221/N	55 x 119 x 70	350
FS222/N	55 x 119 x 70	425
CM202x	55 x 119 x 61	200
CS200/x	55 x 119 x 61	300
DPM200	55 x 119 x 61	200
DNM201	55 x 119 x 61	205
SEM201	55 x 119 x 72	200
Dezentralized CAN modules		
DIO16-Cx	110 x 119 x 61	485
DIO32-C	164 x 119 x 61	695
DIO48-C	228 x 119 x 61	750
DIO264-C	137 x 119 x 61	250
DA3284-Cx	228 x 119 x 61	850
TCO2xx-C	137 x 119 x 61	250
Power supply modules / bus rails / accessories		
NT250/48	55 x 119 x 61	300
NT255x	55 x 119 x 61	300
VP200/x	55 x 119 x 61	260
LM201	55 x 119 x 61	115
BS201	55 x 119 x 14	260
BS202	110 x 119 x 22	150
BS203x	165 x 119 x 22	260
BS204x	220 x 119 x 22	365
BS205x	275 x 119 x 22	440
BS206x	330 x 119 x 22	515
BS207x	385 x 119 x 22	620
BS208x	440 x 119 x 22	690
BS209x	495 x 119 x 22	740
BS210x	550 x 119 x 22	880
BS211x	605 x 119 x 22	960
BS212x	660 x 119 x 22	1000
BS213x	715 x 119 x 22	1100
BS214x	770 x 119 x 14	1200
BS215x	825 x 119 x 22	1310
BS216x	880 x 119 x 22	1420
BS203/S	165 x 137 x 22	280
BS204/S	220 x 137 x 22	385
BS205/S	275 x 137 x 22	460
BS206/S	330 x 137 x 22	535
BS207/S	385 x 137 x 22	640
BS208/S	440 x 137 x 22	710
BS209/S	495 x 119 x 22	760
BS210/S	550 x 137 x 22	900
BS211/S	605 x 137 x 22	980
BS212/S	660 x 137 x 22	1020
BS213/S	715 x 137 x 22	1120
BS214/S	770 x 137 x 14	1220
BS215/S	825 x 137 x 22	1330
BS216/S	880 x 137 x 22	1440

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[i]   Note: Additional information on this topic
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Imprint

KA-SYSTEM / 06EN, 03/2014

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