IEC 60870-5 Client and Server (Master and Slave)

For communication in accordance with IEC 60870-5-101, -103 and -10

Item	Item-No.
IEC 60870-5-Server RT	00022127-63
IEC 60870-5-Download	00022127-xx
IEC 60870-5-Client RT	00024214-63
IEC 60870-5 Server/Client RT	00024327-63
IEC 60870-5 Redu-Server RT	00027197-63
IEC 60870-5 Client/ Redu-Server RT	00027198-63

Application areas

The remote control protocol, according to standards IEC 60870-5-101 and IEC 60870-5-104, 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 IEC 60870-5-103 standard was defined especially for communication with protective devices.

Product features

The IEC 60870-5 service 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; the function as master or slave can be selected per instance. It is possible to connect multiple external masters by creating multiple slave instances. Multiple redundant masters are also possible for each instance.

Control station

Plant / field level
Process

SolutionCenter

I/O, Fieldbus

IEC 60870-5-101, -103: Serial RS232, 422, 485

IEC 60870-5-104: Ethernet

M1-CPU
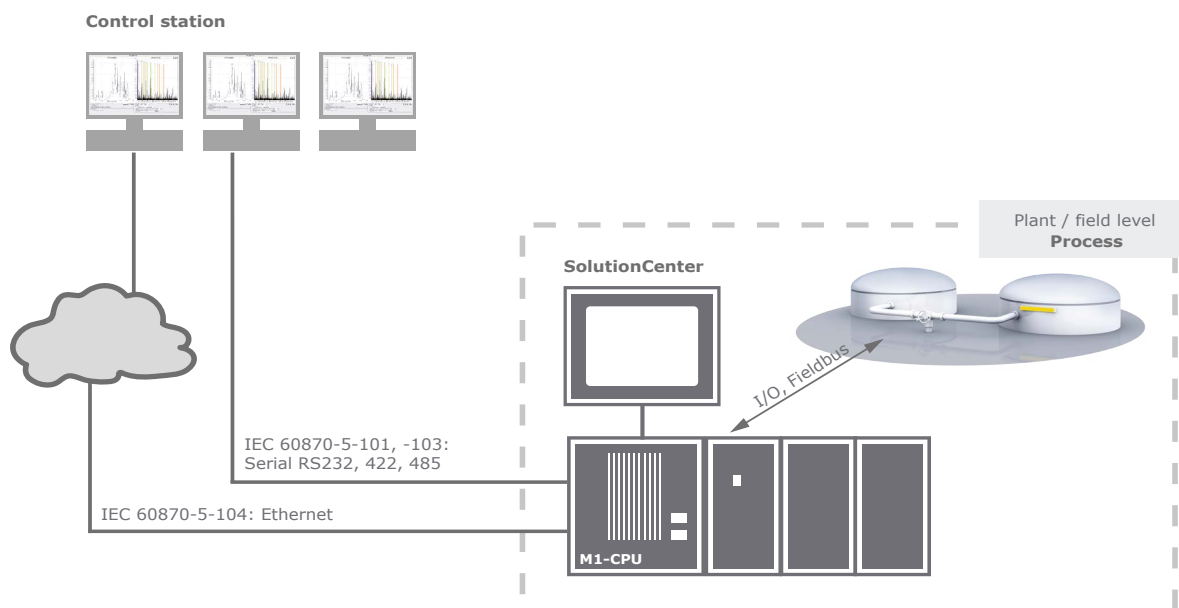
Client (Master)

Each instance of the master connects automatically to the assigned external slave device, sends a general interrogation and receives the interrogated values as well as the values transmitted spontaneously from the slave. These values are represented as channel values and are available to the user immediately without any additional programming effort. Values can be sent in the direction of the command by simply writing to an output channel. As a result, the slave can be operated as easily as a local I/O module.

Event-driven reception of the slave data is possible for more complex applications. Additional library functions are available for special functions such as setting the time of the slave, meter readout etc.
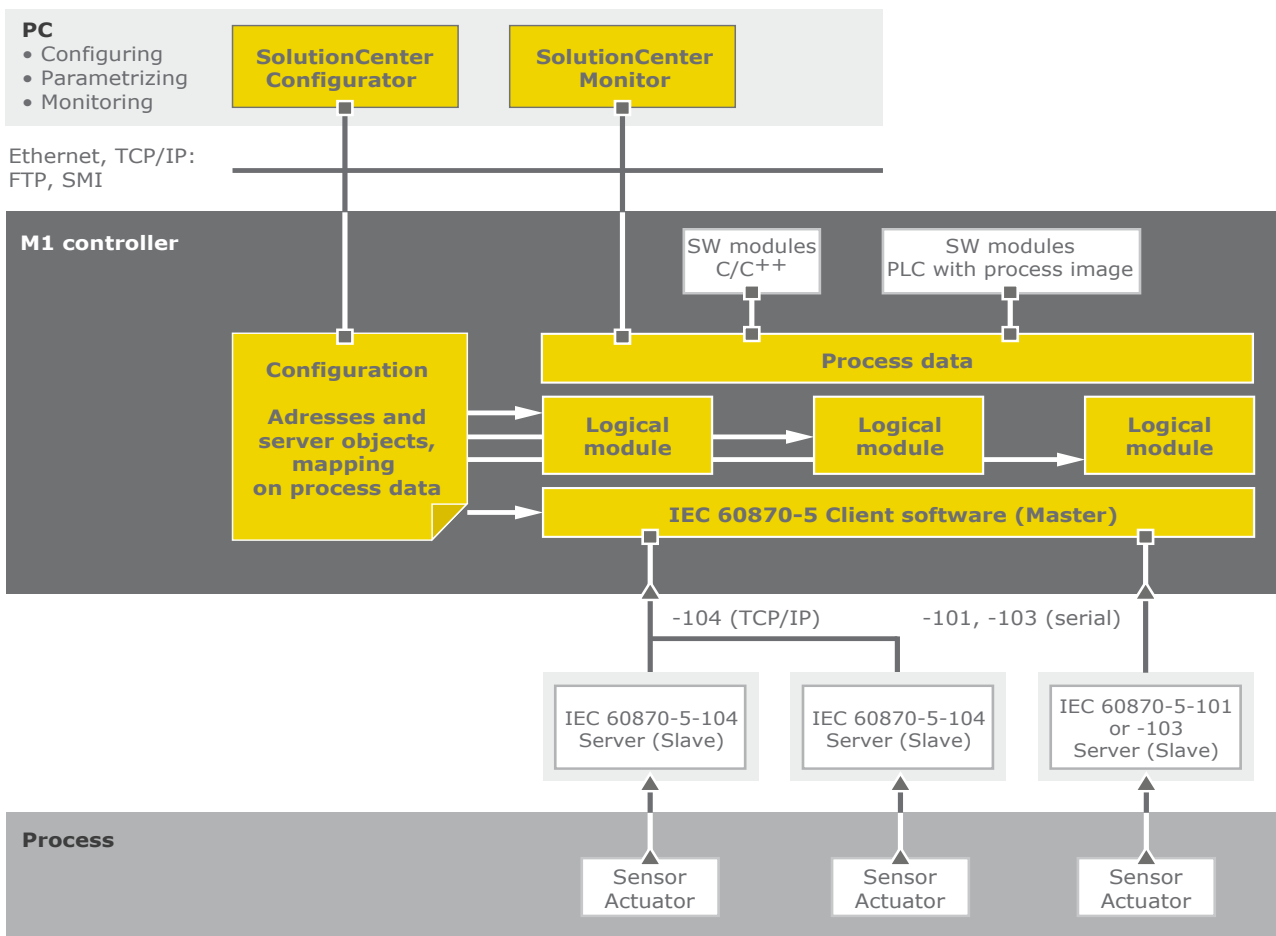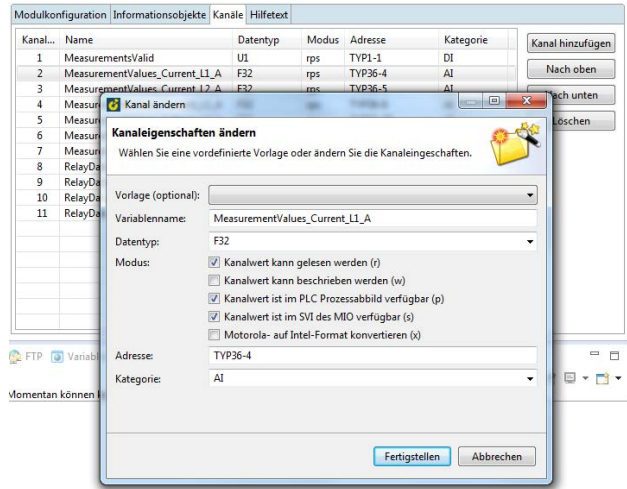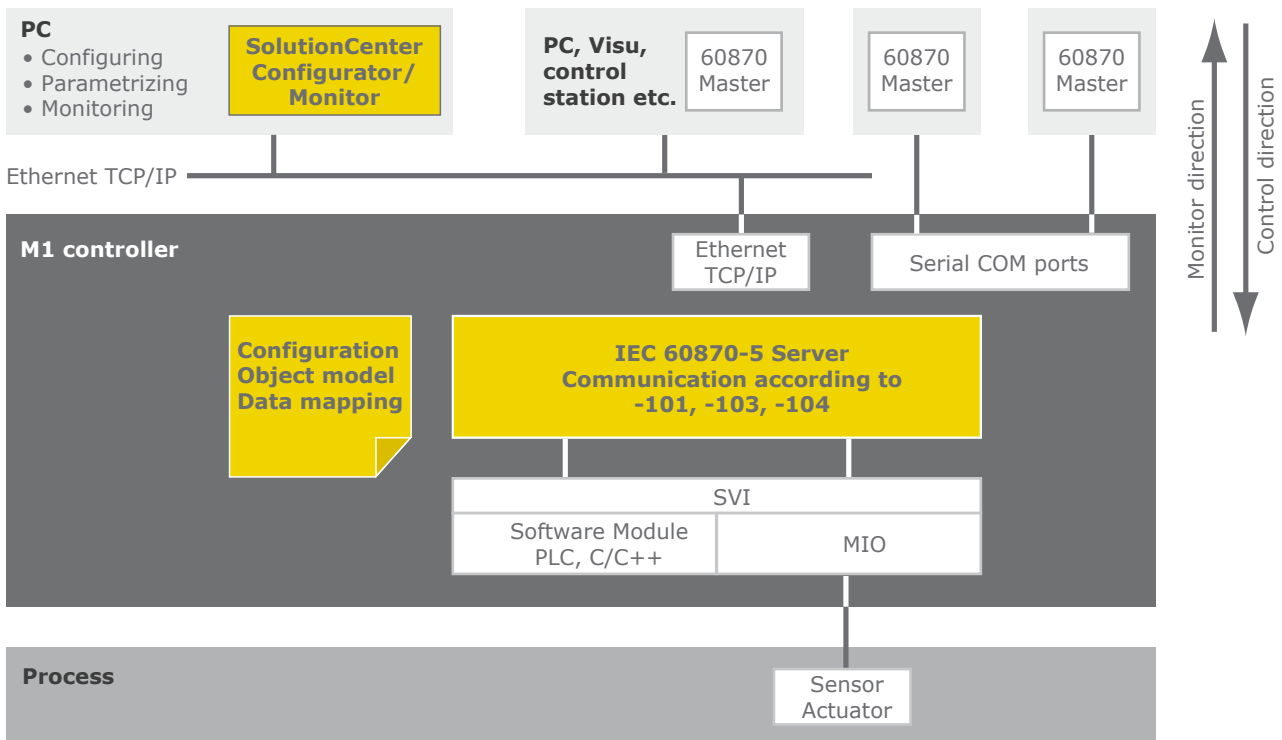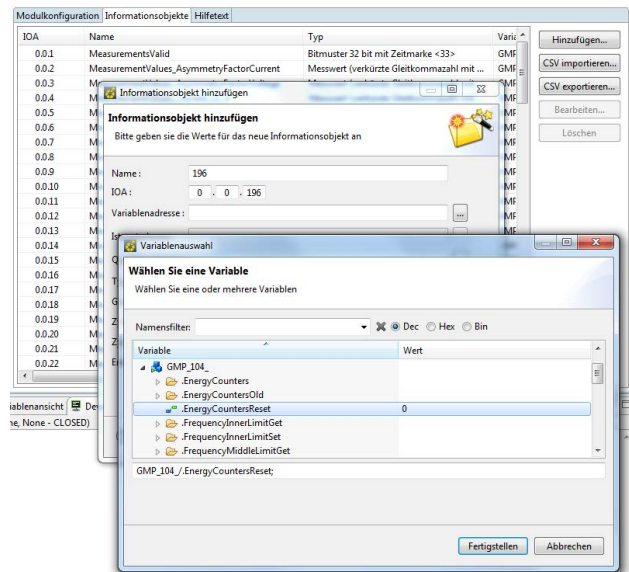

Block diagram IEC 60870-5 Client

Server (Slave)

The information objects that the server offers in the command and monitoring direction, are linked to the controller with existing process variables, via the configuration. No change to the programming code is necessary for this. A different data model can also be created for different clients.

To reduce the communication load, 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. 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. The log-in of clients can be restricted by specifying a permitted IP address, and the number of simultaneous client connections can also be limited. Write accesses can be captured in the security log of the controller; the user-dependent management of access rights is also effective for IEC 60870.

Block diagram IEC 60870-5 Server

Engineering

Easy to use tools for configuration of the client and server are available in the SolutionCenter. The master is configured like a local I/O module on whose channels the information objects of the internal devices are represented in monitoring and command direction.

There is a table editor for the slave for generating the outwardly visible information objects. The link to the process data takes place by selecting the corresponding SVI variables from a variable browser. To exchange the configuration using other tools, import and export functions of a generic CSV format are available.

Advantage

Existing software for sequence control and regulation does not need to be changed and will not be affected in its runtime. Thus it can be flexibly responsive to final customer requirements without changing the existing tested software for control and regulation 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. Engineering and testing time can thus be reduced, and the integrated diagnostics shorten the troubleshooting in the event of malfunctions during 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 make the M1 system in conjunction with the remote control protocol of the series IEC 60870-5-10x ideally suitable for use as a control device, central control, data concentrator, datalogger and gateway.

Technical data

- Standard compliant implementation of IEC 60870-5-101, -103, -104 client and server
- Subsequently installable service/software solution
- 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 of the slave configuration 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
- Easy and fast start-up including diagnosis without any programming effort
- The remote control protocol can be operated like a simple I/O module

Control room #1: 2 Master
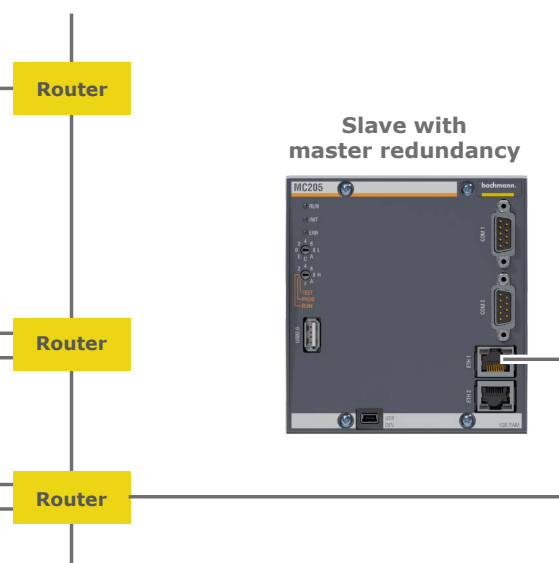
1 computer with
1 network card with
2 IP addresses

Router

Slave with master redundancy

Control room #2: 4 Master
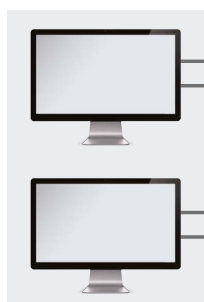
2 computer with
2 network cards each

Router

Router

Application example of redundancy per IEC 60870-5-104

IEC 60870-5-10x services

General product features

Supported protocols	IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104 as client (master) or server (slave)
Type	Licensable service for Bachmann M1 controls (software-only solution, subsequently installable) with configuration interface. Requires a valid license file for operation.
Parallel operation	Simultaneous operation of client and server as well as various protocols on one controller possible
Message types (ASDU types)	Comprehensive implementation of the essential application data 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 (See interoperability documents for details)
File transfer	Supported by -104 server in both directions, file pathes are configured as information objects
Delivery form	Separately installable product (service); delivery 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 Software Key, can be ordered separately for server or combination
Device	All M1 CPU families (MH200, MC200, MPC200, MX200) except ME203
System version	Msys from version 3.85, Mcore from version 3.80

General features of Client (Master)

Receipt of data in monitoring direction	- Automatic mapping of the values on input process variables without any programming - Display in process image for IEC 61131-3 programs - Event-driven reception in C/C++ possible - Access to the receiving buffers also possible via function interface
Transmission of data in controller direction	- Automatic transmission by writing output process variables - Display in process image for IEC 61131-3 programs - Function interface for special procedures such as time synchronization, multistage command execution or meter readout

General features Server (Slave)

Configuration of the information objects	Configurator im SolutionCenter for generating the information objects and for connecting to process variables. Checking for plausibility of the parameters and suitability of the selected variable type depending on the ASDU type, storage of the configuration as a CSV file on the controller.
Data type conversion	Automatic conversion of SVI data types to IEC data types
Query groups	Yes, information can be assigned to query groups 1 to 16 per configuration
Source time stamping	This is created automatically by the server or read from a configured process variable.
Quality labeling	This is created automatically by the server or read from a configured process variable.
Designation of the (COT) cause of transmission	Created automatically by the server.
Cyclic transmission	Can be configured with individual cycle time per information object
Background interrogation	Can be configured with individual cycle time per server instance

IEC 60870-5-10x services

General features Server (Slave)

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 filter	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
Multi-master capability	A connection to multiple masters is possible by multiple instancing. Different object directories are possible per instance.

Configuration

Configuration interface	Integrated in Bachmann SolutionCenter
Data configuration/mapping	Storage of configuration as CSV file via configuration interface with variable browser and consistency check

Diagnostics

Monitor for information objects	Bachmann SolutionCenter shows all information objects with the last transmitted value and time stamp
Connection statistics	Connection status, connection error, number of correct/incorrect telegrams etc. are mapped on process variables and are available for the user software, tools and visualizations.
Error messages in plain text	Shiftable levels of logbook entries during runtime
Logging	Write accesses can be logged automatically in the security log of the M1 controller.

IEC 60870-5-101

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

IEC 60870-5-103

Physical interface	Same as for -101
Addressing	Device: Common station address Information object: Via FUN, INF or via GIN

IEC 60870-5-104

Physical interface	Ethernet IEEE 802.3 (interfaces of the M1 CPUs and EM213[1]) 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
Redundancy	Supports master redundancy per IEC 60870-5-104 and the Norwegian Convention. The redundant operation of the slave requires an appropriate RT license.

1) EM213 Performance values limited compared to the onboard interfaces of the CPUs

Order codes		
Item	**Item no.**	**Description**
IEC 60870-5-Server RT	00022127-63	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 IEC 60875-5-104 protocol in accordance with the compatibility documentation.
IEC 60870-5-Download	00022127-xx	Software and documentation for the IEC 60870-5 server (slave) and client (master). Enables communication according to the standards IEC 60870-5-101, -103 and -104. Without a valid Runtime License the IEC 60870-5 server runs only temporarily for 2h in demo mode.
IEC 60870-5-Client RT	00024214-63	License to operate the IEC 60870-5 client on one controller CPU. Provides communication over the ethernet or serial interface with standards-compliant servers using IEC 60875-5-101, -103 and -104 protocols in accordance with the compatibility documentation.
IEC 60870-5 Server/ Client RT	00024327-63	License for the combined operation of the IEC 60870-5 client and server on one controller CPU without regard of number of connections or data points. Provides communication over the ethernet or serial interfaces with standards-compliant partners using the IEC 60875-5-101, -103, -104 protocol in accordance with the compatibility documentation.
IEC 60870-5 Redu-Server RT	00027197-63	License for the operation of the IEC60870-5 server with redundant network connection on a controller CPU. Enables communication via the Ethernet or serial interface with standard compliant clients via IEC60870-5-101, -103 and -104 protocol in accordance with interoperability documents.
IEC 60870-5 Client/Redu-Server RT	00027198-63	License for the combined operation of the IEC60870-5 server with redundant network connection and of the client on a controller CPU. Enables communication via the Ethernet or serial interface with standard compliant communication partners via IEC60870-5-101, -103 and -104 protocol in accordance with interoperability documents.