Technical Description

FBP FieldBusPlug
MTQ22-FBP
Modbus TCP Interface

Description

The MTQ22-FBP Ethernet adapter module allows the connection of FBP devices to Ethernet

Up to four FBP devices can be connected to one MTQ22-FBP.

Power and productivity
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MTQ22-FBP Modbus TCP Interface

Technical Description

Please note the following

Target group

This description is intended for the use of trained specialists in electrical installation and control and automation engineering, who are familiar with the applicable national standards.

Safety requirements

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Using this Handbook

Symbols

This technical document contains sentinels to point the reader to important information, potential risks and precaution information. The following symbols are used:

	Sign to indicate a potential dangerous situation that can cause damage of the connected devices or the environment.
	Sign to indicate important information and conditions.
	Sign that indicates a potential dangerous situation that can cause human injuries.

Terms and Abbreviations

MRP	Media redundancy protocol
MRC	Media redundancy client
MRM	Media redundancy manager
TCP/IP	Transmission Control Protocol / Internet Protocol
UDP	User Datagram Protocol
Client / Server	The Modbus TCP messaging service provides a Client/Server communication between devices connected on an Ethernet TCP/IP network. The device initiating the communication (e.g. a PLC) is called the client. The device answering the request is called the server (the MTQ22-FBP in this case).
Master / Slave	Master/slave is a model of communication where one device e.g. a PLC has control over one or more other devices (here MTQ22-FBP and UMC). In the Modbus TCP context the master is the client and the slave is the server.
MAC	Medium Access Control
MAC Address	Unique address of every Ethernet device. The MAC address of the MTQ22-FBP is printed on the nameplate.
PLC	Programmable Logic Controller

Related Documents

Technical Documentation	Document No.

MTQ22-FBP Modbus TCP Interface

Technical Description

Content

Document History		

MTQ22-FBP Modbus TCP Interface

Technical Description

Overview

The MTQ22-FBP Ethernet adapter module supports the Modbus TCP network protocol.
This chapter contains a short description of Modbus TCP and the MTQ22-FBP Ethernet adapter module.

Highlighted Features

- The MTQ22-FBP Ethernet adapter module provides Ethernet connectivity for FieldbusPlug (FBP) devices such as UMC100 or PST.
- Up to four FBP devices can be connected to one MTQ22-FBP. This allows a very cost efficient connection of FBP devices to Ethernet.
- Through the MTQ22-FBP Ethernet Adapter module it is possible to:
  - give control commands to the device (Start, Stop, Auto, etc.). The meaning of the commands depends on the connected device
  - read status information and actual values from the device
  - change parameter values
  - read maintenance counters
  - reset a trip
- A built in two-port switch allows the flexible usage in bus, star or ring network topologies.
- Up to four masters can concurrently access the connected devices. The master connections can be supervised.
- Access via Modbus TCP can be restricted to a limited set of IP addresses.
- The Media Redundancy Protocol (MRP) is implemented (client). MRP is standardized in IEC/EN 62439-2 and offers cable redundancy in case of a single failure.
- The Modbus address map offers flexible data access to best suit the needs of MobbusTCP client (e.g. PLC).
- Location supervision for detecting of interchanged drawers in withdrawable systems.

Ethernet

Ethernet standards support a variety of physical media (coaxial cable, twisted pair, fiber optics) and topologies (bus, ring and star). The MTQ22-FBP Ethernet Adapter supports twisted pair as the physical media in a bus, ring and star topology. Possible topologies are shown in Figure 1.
The MTQ22-FBP is compatible with Ethernet standards IEEE 802.3 and IEEE 802.3u.

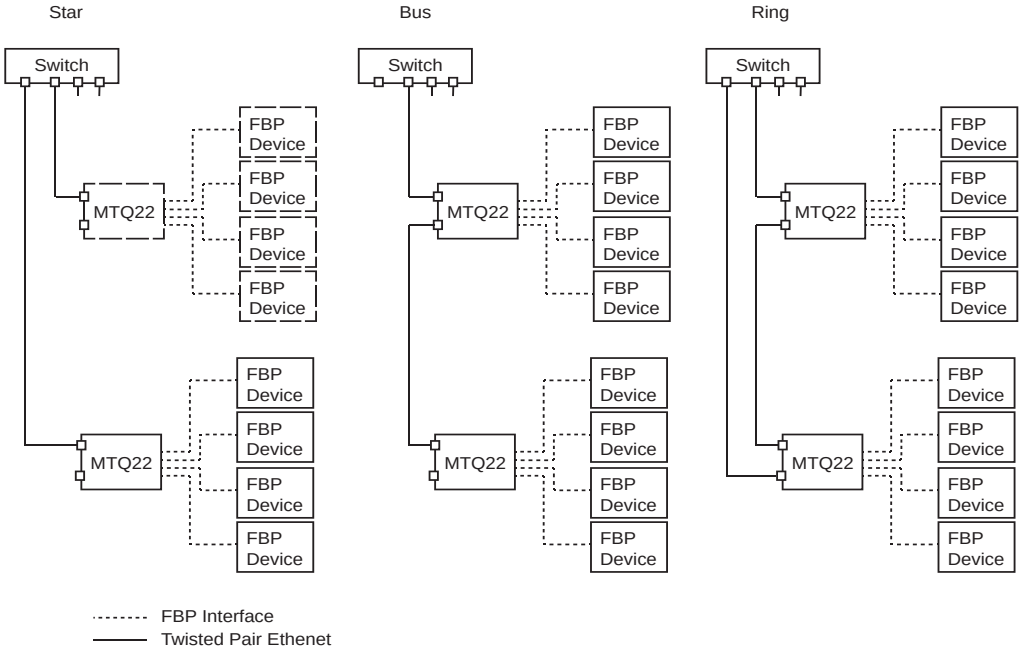


Figure 1:
Different topologies that can be realized with the MTQ22-FBP Ethernet Adapeter.
For the ring structure a special switch must be used.
See chapter Communication for more information.

Modbus TCP

Modbus TCP is a variant of the Modbus family of simple, vendor neutral communication protocols intended for supervision and control of automation equipment. Specifically, it covers the use of Modbus messaging over TCP connection on an IP network.

The implementation of the Modbus TCP server in the MTQ22-FBP module is done according to

- Modbus Application Protocol Specification v1.1b
- Modbus Messaging on TCP/IP Implementation Guide v1.0b

The supported Modbus commands are listed in chapter Communication. Four simultaneous Modbus TCP connections are supported.

Further information on the Modbus TCP protocol is available on the world wide web from www.modbus.org.

MTQ22-FBP

Connectors X1 ... X4 are used to connect up to four FBP devices to the MTQ22-FBP. Ready made cables are available for the connection in withdrawable systems or non-withdrawable systems. The order codes are available in chapter Ordering Data. On the left side of the port connectors LEDs show the current communication status. See chapter Diagnosis / Behavior in Case of an Error for details. The Micro USB connector X5 allows device configuration using a PC. A standard USB cable can be used. Two RJ45 sockets E1 and E2 offer Ethernet connectivity. The communication status of each interface is shown by two LEDs. The MTQ22-FBP must be supplied with 24VDC via X6.

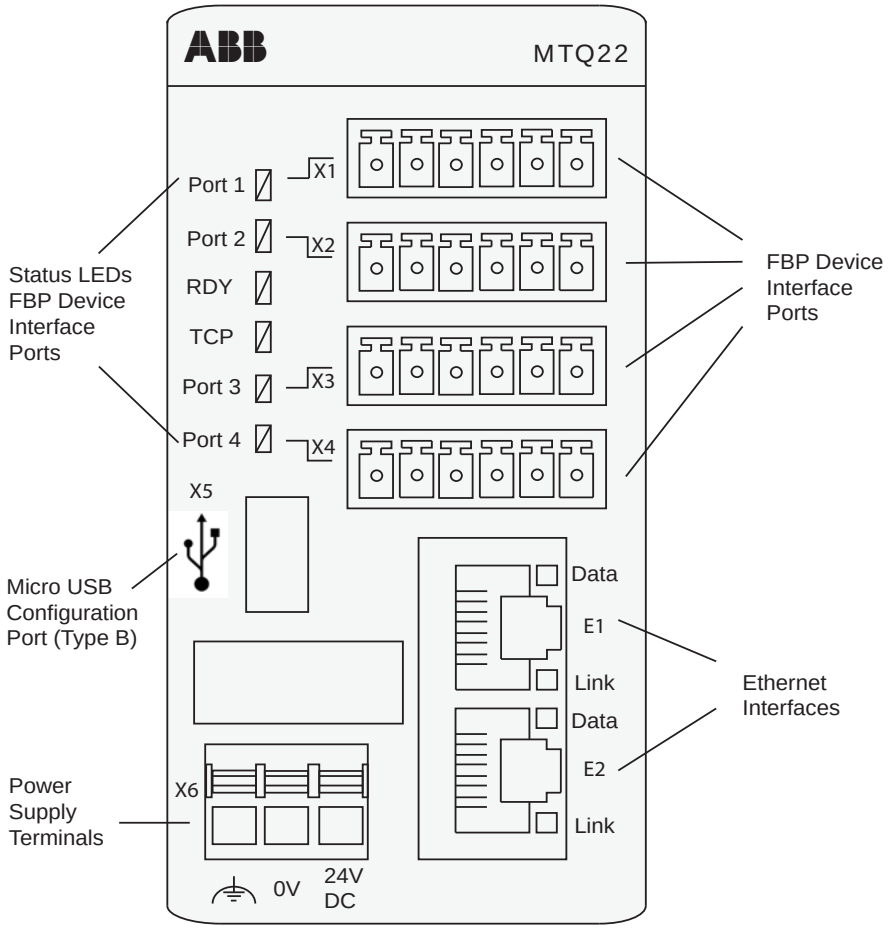


Figure 2:
Top view of the MTQ22-FBP. Four FBP devices can be connected to the MTQ22 via the ports X1 to X4.
The standard Micro USB connector X5 allows to configure the device.
The two Ethernet interfaces E1, E2 allows the flexible integration into different network structures.

Supported FBP devices

The following FBP devices can be connected to the MTQ22-FBP.

- UMC22 (all revisions)
- UMC100 (all revisions)
- Other FBP devices as listed in the configuration tool

Installation

Mounting and Dismounting

You can mount and unmount the MTQ22-FBP onto a 35 mm standard mounting rail, without tools.

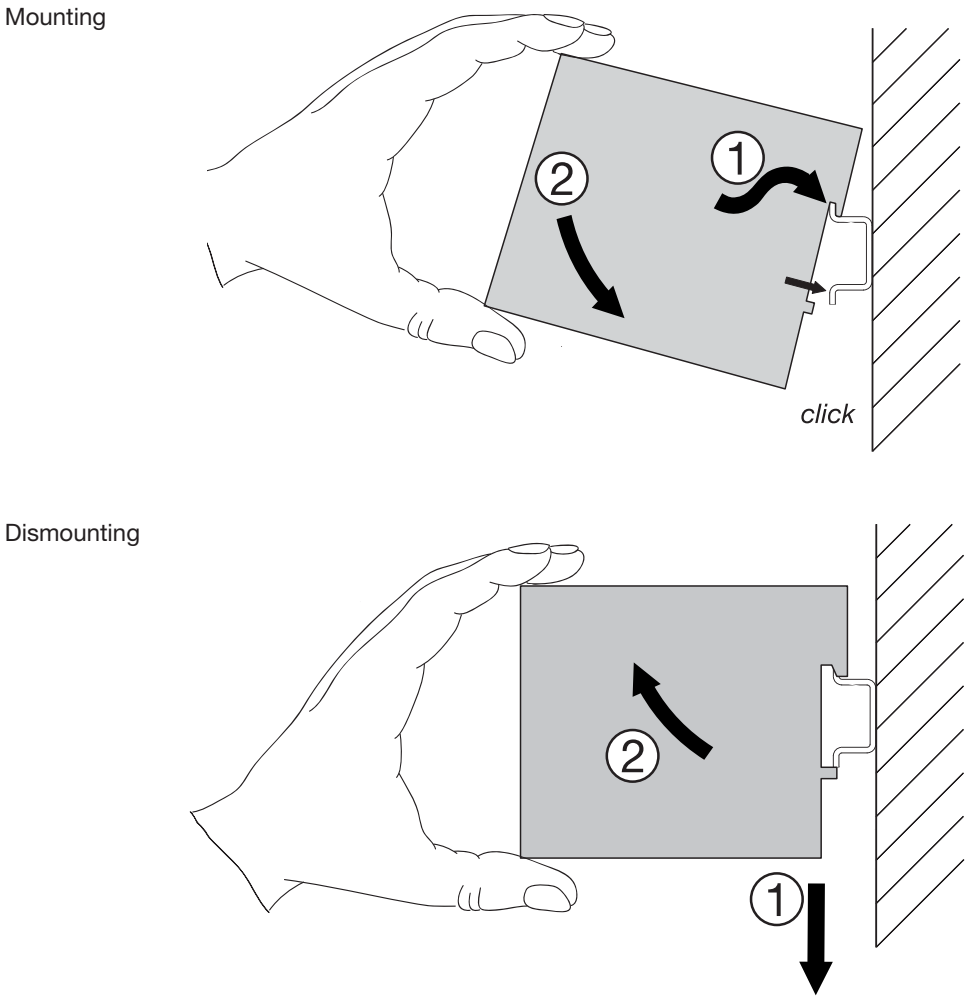


Figure: 3
Mounting and dismounting the MTQ22-FBP on a 35 mm standard mounting rail.

Electrical Installation

General

Arrange the communication cables as far away from the motor cables as possible. Avoid parallel runs. Use bushings at cable entries.

Ethernet Connection

The network cable is connected to the RJ45 connectors on the MTQ22-FBP module. Standard CAT5 UTP, FTP or STP cables can be used. The shield of the RJ45 cable is connected to the shield of connector X6.

Power Supply Connection

The MTQ22-FBP has to be supplied with 24 VDC on the terminals X6. Using the shield connection is optional.

FBP Device Connection

FBP devices (e. g. UMC100) can be connected point to point using the ready made cable CDP17.
This option is recommended in non withdrawable installations (e.g. using a mounting plate for the installation).

In case the FBP device is mounted within a withdrawable unit (drawer) all the needed cables and auxiliaries are available as well as shown in detail in the figure below.

	The distance between the MTQ22-FBP and the FBP device shall not exceed 3 meter. The communication cables between MTQ22-FBP and UMC100 shall not run in parallel to the motor cables.

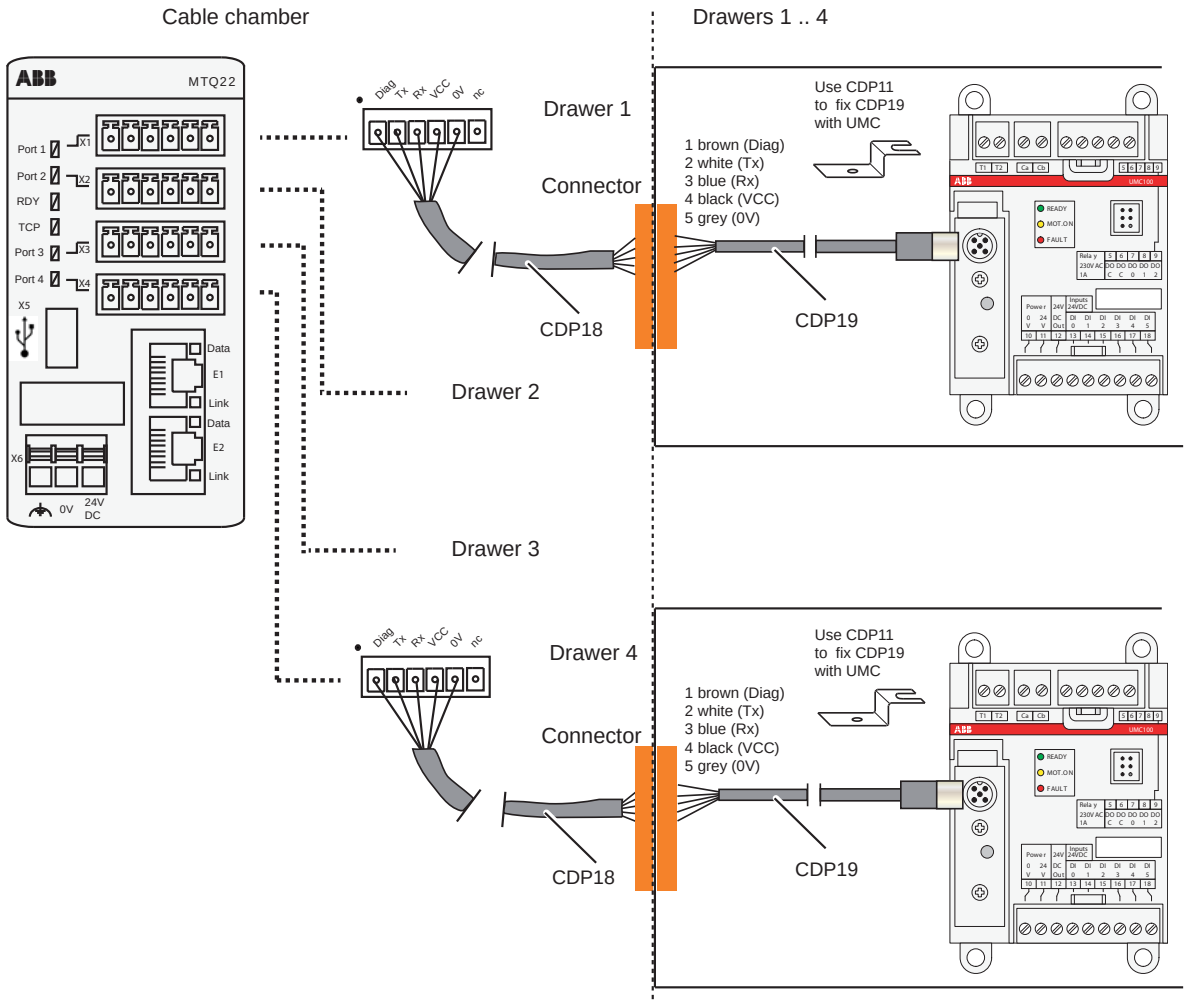


Figure 4:
Solution for motor Control Centers in drawout technology.
Connecting the MTQ22-FBP ports 1 to 4 - connectors X1 to X4 - to the UMC mounted inside a drawer.

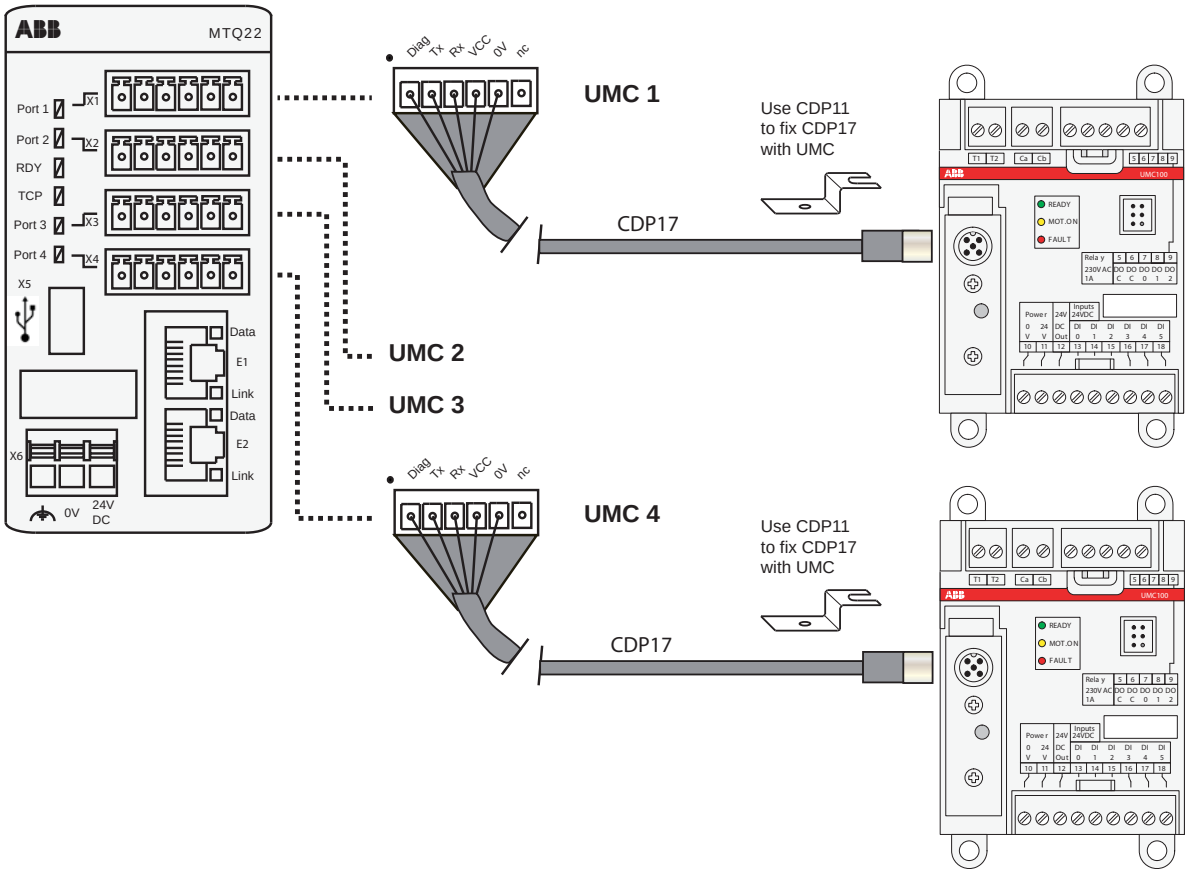


Figure 5:
Connecting the MTQ22-FBP ports 1 to 4 - connectors X1 to X4 - to the UMC.

Ethernet Commuication

Star topology

In star topology only one RJ45 cable must be connected between the MTQ22-FBP and a switch. An unmanaged standard switch can be used in this operation mode.

Bus topology

In bus topology the internal two-port-switch of the MTQ22-FBP is used to connect MTQ22-FBP to MTQ22-FBP. Only the first MTQ22-FBP in the chain needs to be connected to a switch. The second Ethernet port of the last MTQ22-FBP can be left unconnected. An unmanaged standard switch can be used in this operation mode.

Ring topology with network redundancy

The ring topology offers cable redundancy on Ethernet side. The topology is similar to the bus topology but the last MTQ22-FBP in the chain must be connected to the switch again to close the ring. A managed switch supporting MRP and acting as MRP manager must be used in this case. The redundancy protocol implemented in the MTQ22-FBP is according to EN/IEC 62439-2.

The MRP standard defines two principal device roles in a MRP network. The MRP manager which is typically a managed network switch, and MRP clients which are typically automation devices like the MTQ22-FBP.
The MRP master sends out test telegrams cyclically to check the health status of the network. If everything is ok it blocks telegrams on one side of its internal switch to avoid loops (left side of the next figure). If somewhere in the network a fault is detected the MRP master reorganizes the network and closes its internal switch. So all network nodes are still accessible (right side of next figure).

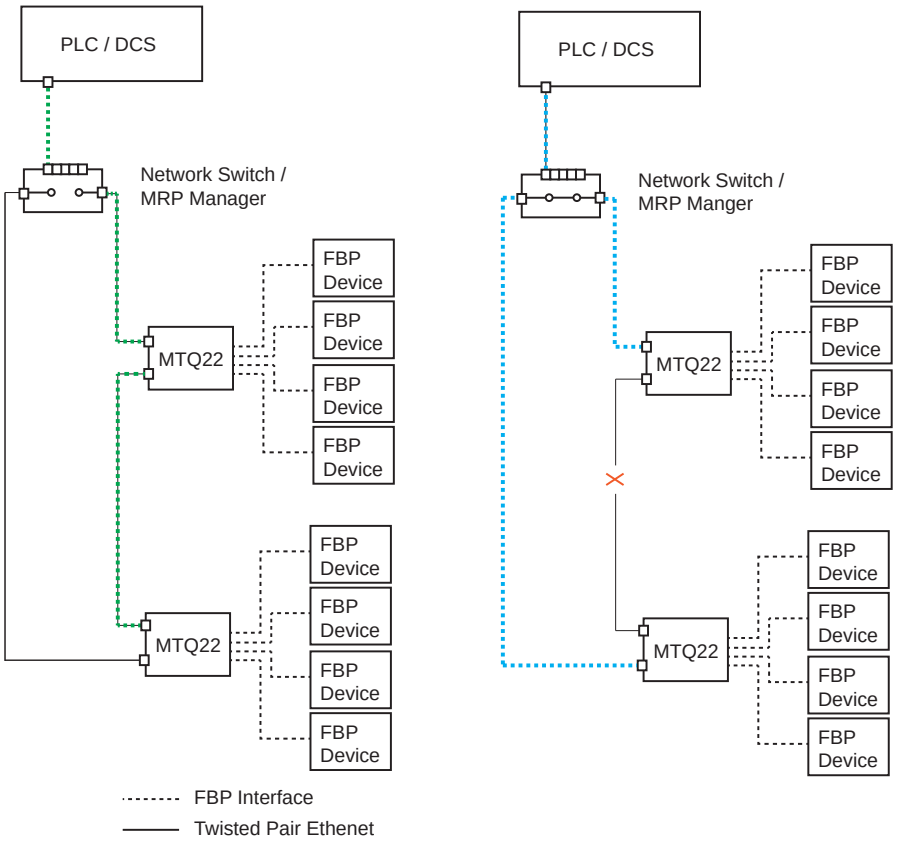


Figure 6:
This figure shows how a single network failure is corrected in a MRP network. The left side shows the intact network. The MRP manager has opened its internal switch, so all nodes can be reached using the green dotted route.
On the right side the MRP master has detected a network problem and has closed its internal switch to ensure connectivity to all network nodes. The blue dotted path shows how all network nodes are reached now.

Ring topology with network redundancy in drawout systems

Drawout systems are used where highest availability and shortest downtimes should be achieved. In such systems all the devices required for a single motor feeder are installed into a drawer to ensure fast and easy exchange in the event of a failure. Here the MTQ22-FBP offers the following benefits:

- No need to bring high speed Ethernet into the withdrawable unit
- Stable communication even if two or more drawers are withdrawn.

The right figure below shows the situation where devices have integrated Ethernet and two drawers are withdrawn. Devices between these two drawers cannot be reached anymore. Also the MRP redundancy function cannot solve this situation.

On the left side the solution with MTQ22-FBP is shown. The MTQ22-FBP is not mounted inside the drawer but is installed in the cable compartment where the switch and other central equipment are installed. The Ethernet cable is not connected to the UMC mounted inside the drawer. But the robust and well known FBP interface goes to the UMC in the drawer. Therefore no special measures are required in the case that one or more drawers are withdrawn.

A removed drawer cannot disturb the Ethernet communication in any way.

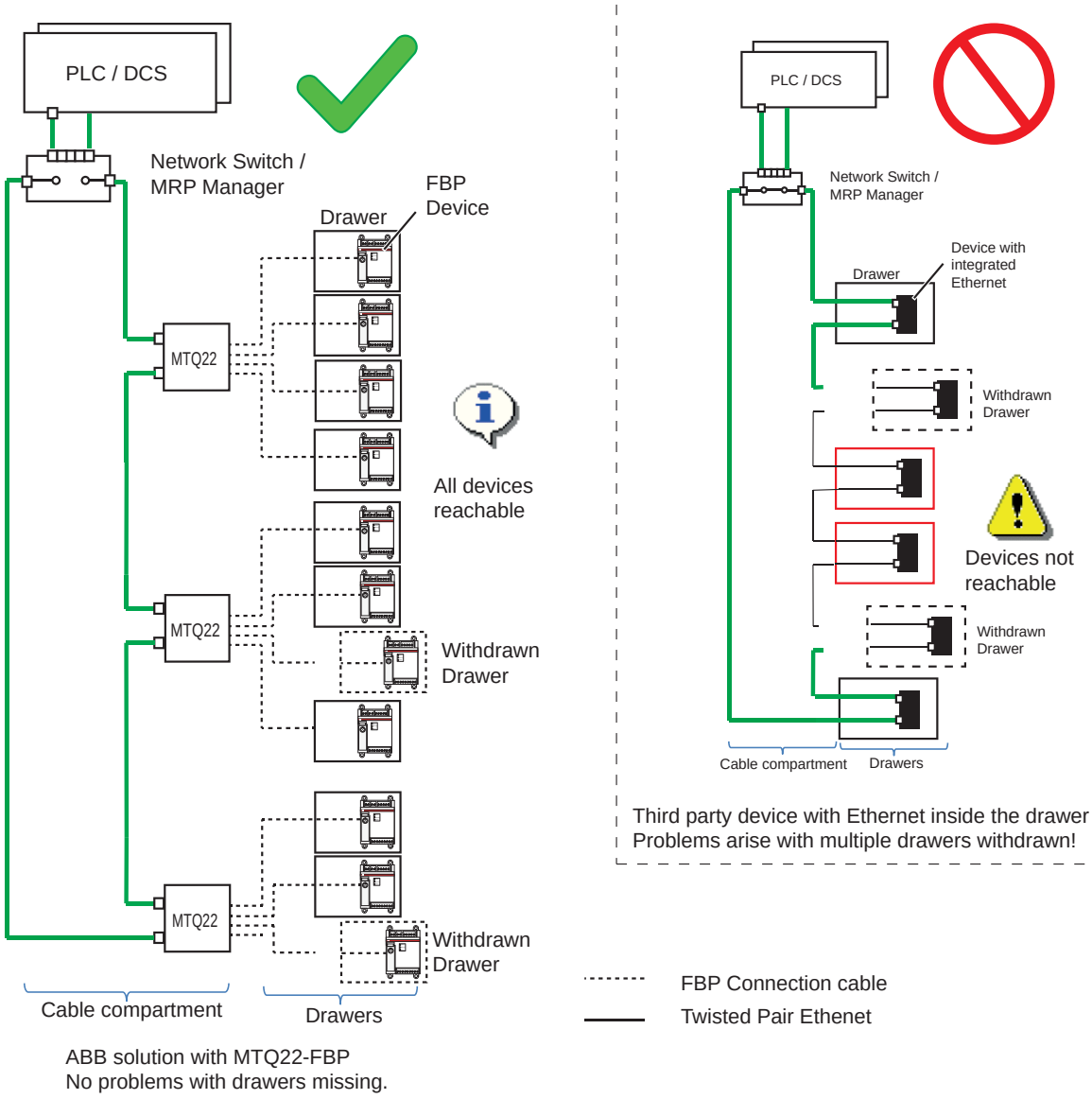


Figure 7:
The left side shows the benefits not having Ethernet connected inside a drawer.

Switch Configuration for Ring Topology

Managed switches of various vendors offer the possibility to configure ring topologies with MRP redundancy.
In the following exampe a network switch from Belden/Hirschmann is used as example.
The screenshots are taken from the RS20 configuration tool.

- Follow the setup instructions of the switch manual
- Open the "Redundancy" page and select the marked options shown in the figure below.
  To get help press the Help button.

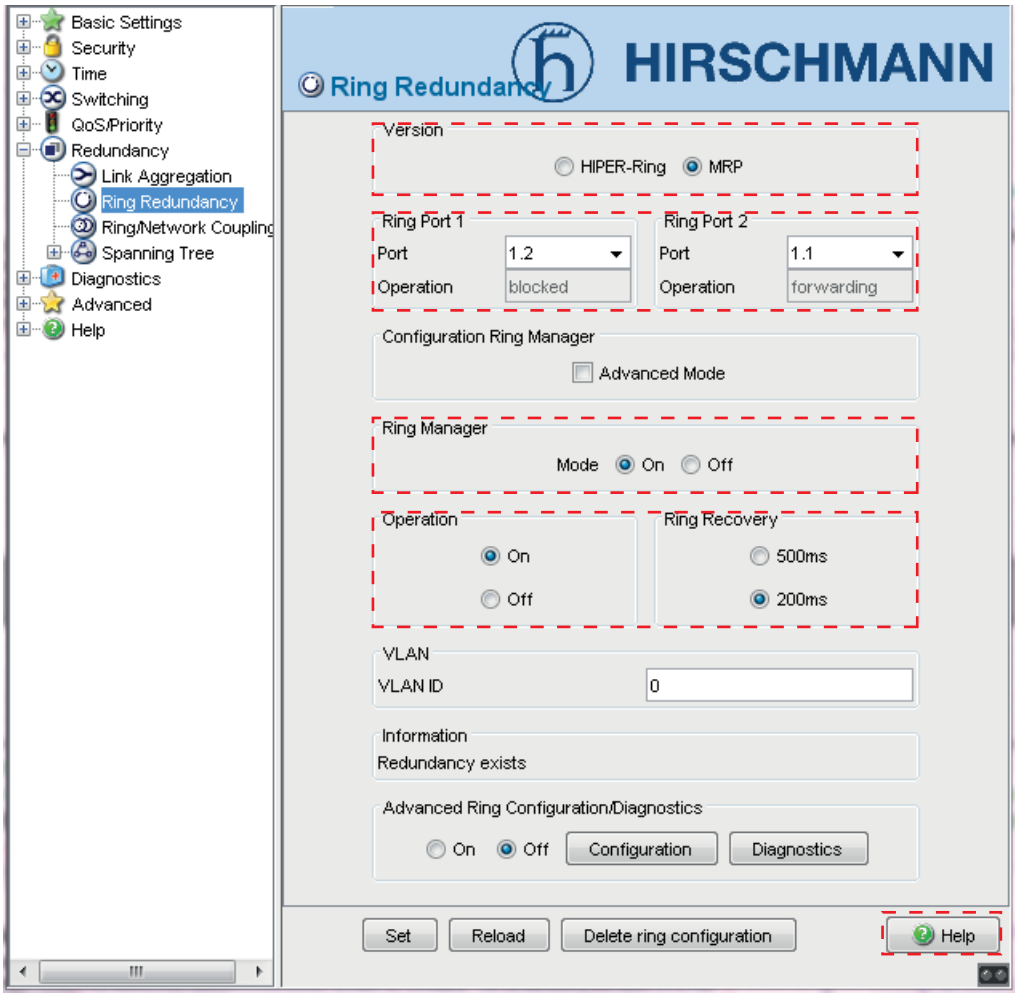


Figure 8:
The page 'Ring Redundancy' allows to enable the MRP redundancy protocol and to define the ports that are the start and end of the ring.

Usage with multiple Modbus TCP Clients

The MTQ22-FBP allows the concurrent communication with up to four Modbus TCP clients (e.g. PLCs). The MTQ22-FBP optionally can supervise the clients and signal a bus fault to the connected FBP devices in case of a fault. Note the following points:

- specify the number of clients that should be supervised and the number of clients that have to be present at least. See section Configuration for more info.
- Only one of the concurrent PCLs should send command data to a FBP device (e.g. UMC100). Otherwise there might arise conflicts (e.g. if two different command words are sent at the same time).
- Different Modbus TCP clients can control FBP devices connected to the same MTQ22-FBP.
  E. g. Modbus TCP client 'A' controls the UMC100 connected to port 1 and client 'B' controls the FBP devices connected to port 2 - 4
- Monitoring of all FBP devices from the clients is always possible

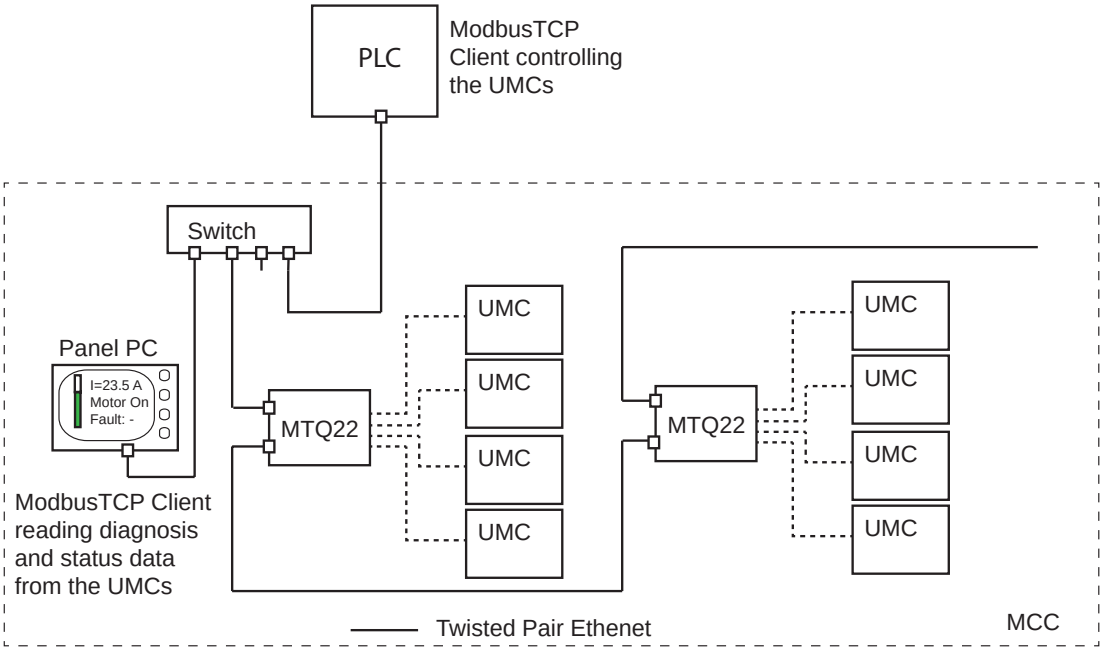


Figure 9:
The MTQ22-FBP allows up to four concurrent Modbus TCP clients.
This can be used to monitor the FBP devices (e. g. UMCs as shown here) in the MCC with the help of a panel PC for example. At the same time the PLC controls the UMCs.

Usage in Remote Access Applications

In some applications it is essential to do monitoring or even control remotely, e. g. in case of regional distributed pump stations. In these case the use of standard Ethernet is of great benefits because standard routers, gateways etc. can be used.

	Take measures where only authorized users have access to the remote installation and can read or write data.

The following figure shows a system with a central SCADA (supervision control and data acquisition) station and several remote locations.
The SCADA system is connected to the remote locations via a model or other wireless or wired network.

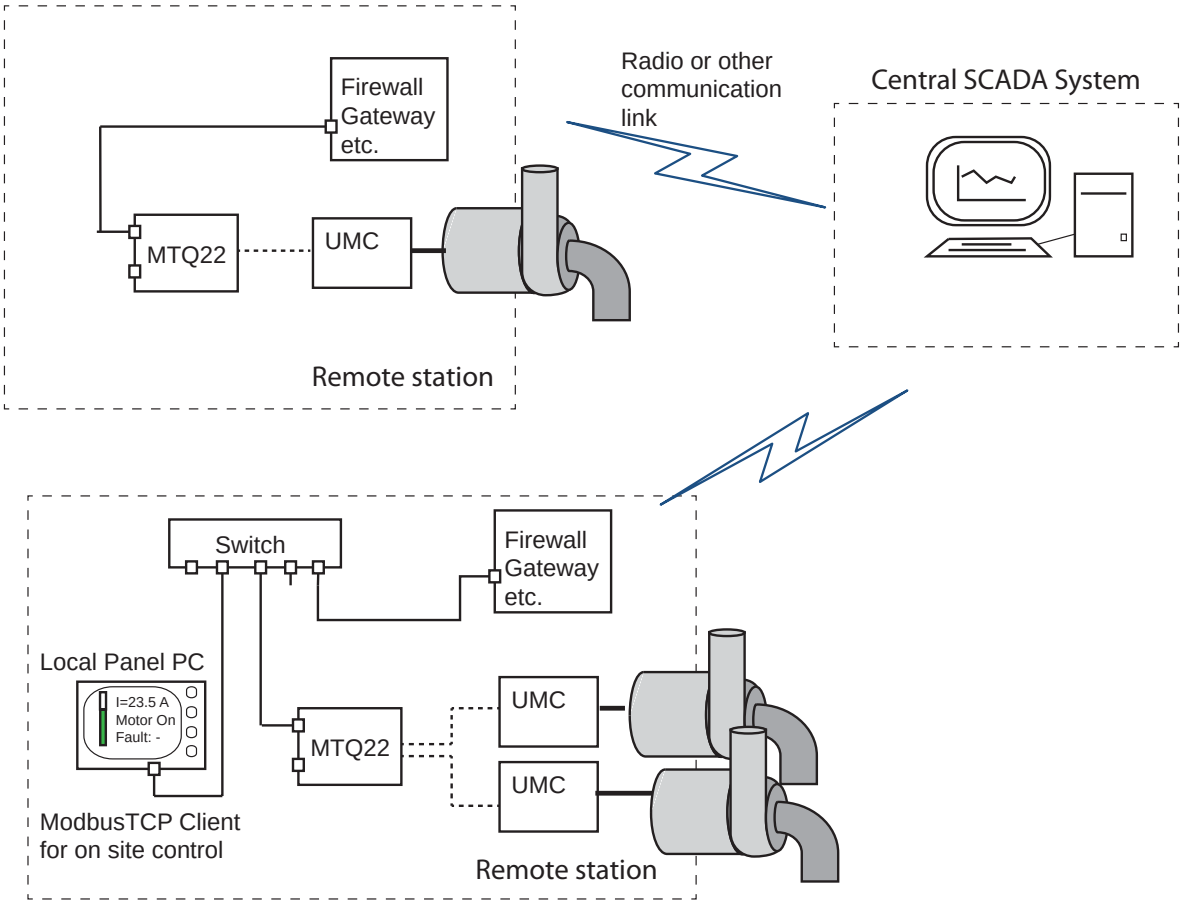


Figure 10:
TCP-IP based communication makes the integration of distributed stations much simpler.

Configuration

An easy to use PC configuration tool is provided to adjust the parameters of the MTQ22-FBP. The PC can be connected to the MTQ22-FBP with a standard Micro USB-cable. Together with the software the file "readme.txt file is provided which contains the latest installation and setup instructions.

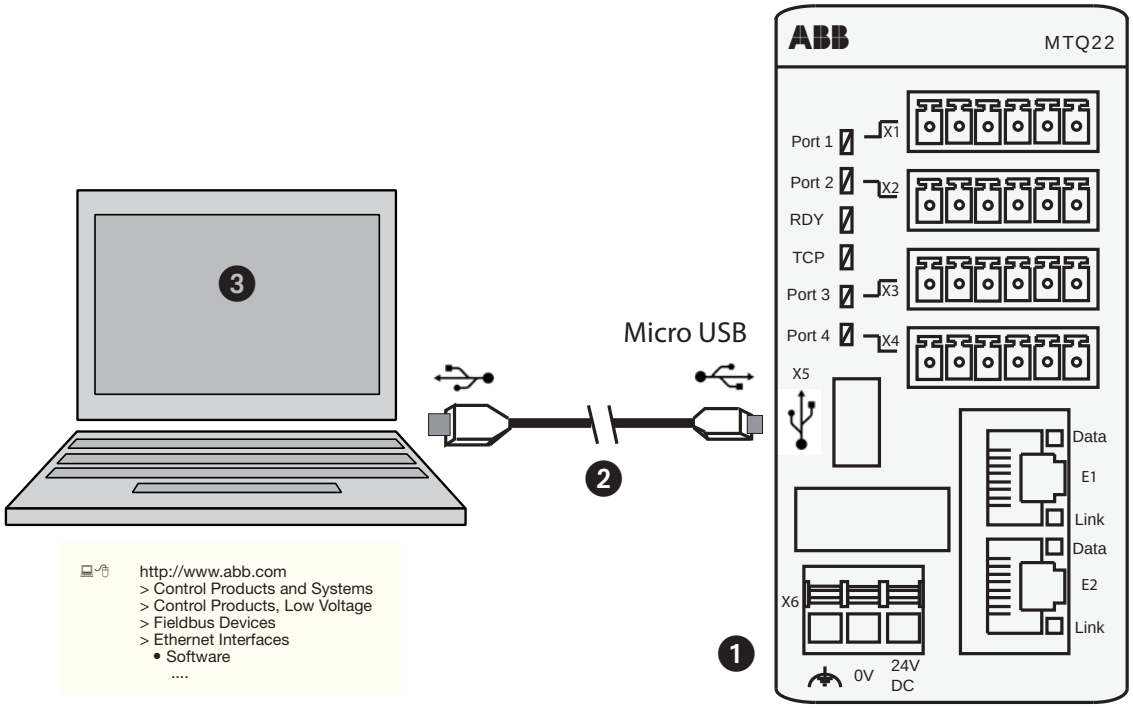


Figure 11:
Connecting the MTQ22-FBP to a service Laptop.
The MTQ22-FBP must be supplied with 24V DC before the configuration can take place ①.
For the connection a Micro USB cable ②) is used.
On the PC the MTQ22 configuration software must be installed ③.

First Steps

If the MTQ22-FBP is connected for the first time the required USB driver has to be installed. The Microsoft USB driver is not part of the software package because of license reasons. It is pre-installed on Windows 7, for XP it must be downloaded separately from Microsoft. Follow the setup instructions of Windows to install the new hardware. The required driver inf-file is part of the software package.

After startup of the application the screen is split into three areas - left, middle and right.
In the left area you can add as many MTQs as you have in your project. In the middle area the configuration parameters per MTQ22-FBP are displayed. You can change them offline or online. The right area shows a short help text.
See figure 12.

Online Mode

In online mode it is possible to read the configuration data stored in a MTQ22-FBP back into the configuration tool or to write the data from the configuration tool down into the MTQ22. The online connection is realized via USB.
On USB side the serial profile is used. Therefore Windows detects the MTQ22-FBP interface as a serial link and creates a COM port for it. Before going online, lookup the COM port assigned by Windows and set it in the configuration tool. Now press the connect button on the toolbar. A closed connector indicates online mode.

	To up- or download parameters to the MTQ22-FBP the device must be supplied with 24 V DC. The USB port is galvanically isolated to protect the PC in case potential differences exist between the MTQ22 ground and the PC ground.

Figure 12:
The configuration tool allows to set the parameters in an easy way.
Several MTQ22-FBP devices can be created in the device tree (left).
The final configuration can be saved to disk and downloaded into the devices using a standard USB cable.

Parameters

Master Configuration and Supervision

The MTQ22-FBP supports up to four parallel connections to Modbus TCP clients (i.e. PLCs). It is possible to monitor these clients for activity and signal a communication fault to the connected FBP devices after an adjustable timeout time.

For security reasons the access to the MTQ22-FBP can be limited to clients having IP addresses within a user defined range. Single addresses or address ranges can be defined.

Network Settings

Before any Ethernet communication takes place the MTQ22-FBP must have an IP address. It is possible to provide a static address or obtain the address via DHCP or the BootP protocol.
In case of a static IP address also the netmask and the gateway address must be set manually.

FBP Device Settings

Up to four FBP devices can be connected to the MTQ22-FBP. For each port the connected device type (or NONE) must be specified. The MTQ22-FBP then monitors the presence of the configured FBP device.

Position Supervision

The MTQ22-FBP detects accidental permutation of devices connected to it. Therefore a specific address (1...254) has to be set per port which must match the address (1...254) set in the connected device. The MTQ22-FBP offers status registers to read the actual FBP device supervision status via Modbus TCP.
See chapter Address Map for details.

Parameter Overview

Before using the MTQ22-FBP device the following parameters must be set

Parameter name	Default settings
DHCP / BOOTP	Manual
IP Address	192.168.171.254
Subnet Mask	255.255.255.0
Standard Gateway	192.168.171.1
Number of Modbus TCP masters under supervision	1
Allowed number of supervised connections missing	0
Allowed Modbus TCP IP Address for master 1 ... 4	0.0.0.0 ... 255.255.255.255 for master 1 0.0.0.0 ... 0.0.0.0 for master 2-4
Timeout for master 1 ... 4	10s
Device port 1 ... 4 used	UMC100
Device address for device 1 ... 4	1,2,3,4

Modbus TCP Register Map

Supported Function Codes

The following Modbus Function Codes are supported:

Function Code	Explanation
FC1	Read coils
FC2	Read input discretes
FC3	Read multiple registers
FC4	Read input registers
FC5	Write single coil
FC6	Write single register
FC7	Read exception status
FC15	Force multiple coils
FC16	Write multiple registers
FC23	Read/Write multiple registers

Modbus Address Table

The I/O-data as well as parameter, diagnosis and configuration data of the connected FBP devices can be accessed applying the supported function codes on the addresses described in the following table 2.

Modbus TCP counts registers beginning with one. But on the bus registers start counting from zero. The addresses in this manual describe the addresses that are transmitted on the network. Depending on your client application it might be necessary to increment all addresses by one.

Device I/O data and diagnosis can be accessed by three different ways:

- separate access to each data type (boolean values or analog values) of each module.
  This requires sending several Modbus telegrams to the dedicated addresses
- access to the data of all connected devices with one MODBUS telegram ordered by module connected to port 1..4
- access to the data of all connected devices with one MODBUS telegram ordered by data type DI, AI, Diagnosis or DO, AO.

MTQ22 Status Data

Adress	Data	Size	Access
0x0000 - 0x007F (HEX) 0 - 127 (DEC)	General Parameter for MTQ22-FBP (reserved for further use)	128 Words	Read, Write
0x0080 - 0x0083 (HEX) 128 - 131 (DEC)	Diagnostics (one block)	4 Words	Read
0x0080 - 0x0083 (HEX) 128 - 131 (DEC)	FBP Port 1 ... Port 4 communication status	1 Word	Read
0x0090 - 0x0093 (HEX) 144 - 147 (DEC)	Number of connection losses between FBP device (e.g. UMC100) and MTQ22-FBP	1 Word	Read / Write

See section Diagnosis / Behaviour in Case of an Error for an explanation of the communication status codes.

Reading and Writing FBP Device Data

The following tables show how to generally access data of the FBP-devices connected to port one to port four of the MTQ22-FBP. The manuals of the connected FBP devices are needed in addition to understand what data is provided and thereof derive the length of the input and output data telegrams.

Individual data access by device

This method allows to individually access data of a connected device via single registers or groups of registers organized in words.

Adress for data access to device connected to port				Data	Length	Access
1	2	3	4			
0x0C00 dec 3072	0x0C20 dec 3104	0x0C40 dec 3136	0x0C60 dec 3168	Diagnosis data of connected device	0 ... 16 registers*	Read
0x1000 dec 4096	0x1010 dec 4112	0x1020 dec 4128	0x1030 4144	Digital Inputs (DI)	0 ... 16 registers* (0 - 32 bytes)	Read
0x1800 dec 6144	0x1810 dec 6160	0x1820 dec 6176	0x1830 dec 6192	Digital Outputs (DO)	0 ... 16 registers* (0 - 32 bytes)	Write, Read
0x2000 dec 8192	0x2100 dec 8448	0x2200 dec 8704	0x2300 dec 8960	Analog Inputs (AI)	0 ... 256 registers	Read
0x2800 dec 10240	0x2900 dec 10496	0x2A00 dec 10752	0x2B00 dec 11008	Analog Outputs (AO)	0..256 registers	Write, Read

*) Concrete number of registers (length) depends on the connected device.

The following table shows the data which can be accessed using bit access requests.

Adress for data access to device connected to port				Data	Length	Access
1	2	3	4			
0x1000 dec 4096	0x1100 dec 4352	0x1200 dec 4608	0x1300 dec 4864	Digital Inputs (DI) bitwise access	0 ... 256 Bit*	Read Coils, Read Multiple Coils
0x1800 dec 6144	0x1900 dec 6400	0x1A00 dec 6656	0x1B00 dec 6912	Digital Outputs (DO) bitwise access	0 ... 256 Bit*	Write Coils, Write Multiple Coils Read Coils, Read Multiple Coils

*) Concrete number of bits depends on the connected device.

Access to all data ordered by device

For performance reasons some applications might require access to the entire I/O data with one Modbus TCP telegram. This access method allows to read or write data of all the connected devices with one request.

Adress	Data	Length	Access
0x3000 dec 12288	Input Data Block DI1 | AI1 | Diag1 | DI2 | AI2 | Diag2 | ... | DI4 | AI4 | Diag4	0...1216 registers	Read
0x4000 dec 16384	Output Data Block DO1 | AO1 | DO2 | AO2 | DO3 | AO3 | DO4 | AO4	0...1216 registers	Write, Read

The total input data block length depends of the length of the AI, DI, Diagnosis data of each configured device.

The total output data length depends of the length of the AO, DO data of each configured device.

In case only three ports are used (e.g. port four used as spare) the data length for device four must be set to zero in the input and output data block.

If a device does not provide a certain data type (e. g. AO) the length of this field has to be set to zero.

Only word access is supported in this address range.

Access to all data ordered by data type

For performance reasons some applications might require access to the entire I/O data with one Modbus TCP telegram. This access method allows to read or write data of all devices ordered by data type

Adress	Data	Length	Access
0x5000 dec 20480	Input Data Block DI1 | DI2 | DI3 | DI4 | AI1 | ... | AI4 | Diag1 | ... | Diag4	0...1216 registers	Read
0x6000 dec 24576	Output Data Block DO1 | ... | DO4 | AO1 | ... | AO4	0...1216 registers	Write, Read

The total input data block length depends of the length of the AI, DI, Diagnosis data of each configured device.

The total output data length depends of the length of the AO, DO data of each configured device.

In case only three ports are used (e. g. port four used as spare) the data length for device four must be set to zero in the input and output data block.

If a device does not provide a certain data type (e. g. AO) the length of this field has to be set to zero.

Only word access is supported in this address range

Example Addressmap with UMC100

The previous section described the Modbus address map in a device independant manner.

In this section the address map is presented for the case that four UMC100 devices are connected.

Note that the UMC100 allows to remap the content of the IO data bytes.
In case you changed the IO data content in an own function block application the content of the data bytes might be different compared to the data shown in the following tables.

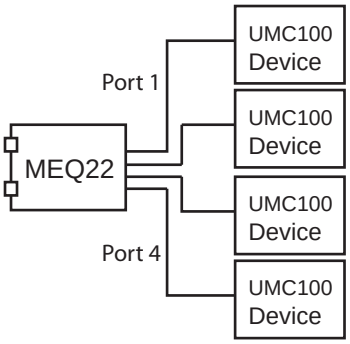
UMC100-I/O data referrred to in section A1 Parameters and Data Structures on a Fieldbus: in the UMC100 manual

Diag: 8 Bytes (4 Words)
DI: 2 Bytes (1 Word)
DO: 4 Bytes (2 Words)
AI: 14 Bytes (7 Words)
AO: 8 Bytes (4 Words)

→

Monitoring Data:
DI + AI + Diag = 24 Bytes = 12 Words

Command Data:
DO + AO = 12 Bytes = 6 Words



Individual data access by device

This method allows to individually access data of a connected device via single registers or groups of registers.

Adress for data access to device connected to port				Data	Length	Access
1	2	3	4			
0x0C00	0x0C20	0x0C40	0x0C60	Diagnosis	4 Words (= 8 Bytes) each UMC	Read
0x1000	0x1010	0x1020	0x1030	Digital Inputs (DI)	1 Word (= 2 Bytes) each UMC	Read
0x1000	0x1100	0x1200	0x1300	DI bitwise	0 ... 16 Bit each UMC	Read Coils, Read Multiple Coils
0x1800	0x1900	0x1A00	0x1B00	Digital Outputs (DO)	2 Word (= 4 Byte) each UMC	Write, Read
0x1800	0x1810	0x1820	0x1830	DO bitwise	0..32 Bit each UMC	Write Coils, Write Multiple Coils Read Coils, Read Multiple Coils
0x2000	0x2100	0x2200	0x2300	Analog Inputs (AI)	7 Words each UMC	Read
0x2800	0x2900	0x2A00	0x2B00	Analog Outputs (AO)	4 Words each UMC	Write, Read

Word oriented access to the monitoring data of UMC100 acc. to the UMC100 manual section
A1 Parameters and Data Structures on a Fieldbus

UMC at port 1	UMC at port 2	UMC at port 3	UMC at port 4	Bit 7 Bit 15	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit1	Bit 0 Bit 8	
Address												
0x1000 dec 4096	0x1010 dec 4112	0x1020 dec 4128	0x1030 dec 4144	Summary Warning	Summary Fault	Local Control	Reverse Lockout Time[3]	Overload warning	Run Forward / Opening	Off	Run Reverse / Closing	Low-Byte
				UMC100 DI5	UMC100 DI4	UMC100 DI3	UMC100 DI2	UMC100 DI1	UMC100 DI0	Run Fast Forward	-	High-Byte

Bit oriented access to the monitoring data of UMC100 acc. to the UMC100 manual section
A1 Parameters and Data Structures on a Fieldbus

UMC at port 1	UMC at port 2	UMC at port 3	UMC at port 4	Bit Information	
Address					
0x1000 dec 4096	0x1100 dec 4352	0x1200 dec 4608	0x1300 dec 4864	Run Reverse / Closing	Bit 0
0x1001 dec 4097	0x1101 dec 4353	0x1201 dec 4609	0x1301 dec 4865	Off	
...	...	...	...	...	
0x100F dec 4111	0x130F dec 4867	0x130F dec 4823	0x130F dec 4879	UMC100 DI5	Bit 15

Word oriented access to the command data of UMC100 acc. to the UMC100 manual section
A1 Parameters and Data Structures on a Fieldbus

UMC at port 1	UMC at port 2	UMC at port 3	UMC at port 4	Bit 7 Bit 15 Bit 23 Bit 31	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit1	Bit 0 Bit 8 Bit 16 Bit 24	
Address												Low Byte
0x1800 dec 6144	0x1810 dec 6160	0x1820 dec 6176	0x1830 dec 6192	-	Fault Reset	Auto Mode	Prepare Emergency Start	-	Run Forward / Opening	Off	Run Reverse / Closing	High Byte
				UMC100 DO2	UMC100 DO1	UMC100 DO0	UMC100 24VDC Out	-	-	Run Fast Forward	-	Low Byte
0x1801 dec 6145	0x1811 dec 6161	0x1821 dec 6177	0x1831 dec 6193	VI15x DO0	-	-	-	DX1xx DO3	DX1xx DO2	DX1xx DO1	DX1xx DO0	High Byte
				-	-	-	-	-	-	-	-	

Bit oriented access to the command data of UMC100 acc. to the UMC100 manual section
A1 Parameters and Data Structures on a Fieldbus

UMC at port 1	UMC at port 2	UMC at port 3	UMC at port 4	Bit Information	
Address					Bit 0
0x1800 dec 6144	0x1900 dec 6400	0x1A00 dec 6656	0x1B00 dec 6912	Run Reverse / Closing	
0x1801 dec 6145	0x1901 dec 6401	0x1A01 dec 6657	0x1B01 dec 6913	Off	
...	...	...	...	...	Bit 31
0x1820 dec 6175	0x 191F dec 6431	0x1A1F dec 6687	0x1B1F dec 6943	-	

Analog Inputs of UMC100 acc. to the UMC100 manual section
A1 Parameters and Data Structures on a Fieldbus

UMC at port 1	UMC at port 1	UMC at port 1	UMC at port 1	Data								
Address												
0x2000 dec 8192	0x2100 dec 8448	0x2200 dec 8704	0x2300 dec 8960	Motor Current in % of I_e (0% - 800%								
0x2001 dec 8193	0x2101 dec 8448	0x2201 dec 8704	0x2301 dec 8961	Analogue Word (Thermal Load: 0% - 100%)								
0x2002 dec 8194	0x2102 dec 8450	0x2202 dec 8704	0x2302 dec 8962	Analogue Word (Time to trip in seconds)								
0x2003 dec 8195	0x2103 dec 8451	0x2203 dec 8704	0x2303 dec 8963	Analogue Word (Time to restart in seconds)								
0x2004 dec 8196	0x2104 dec 8452	0x2204 dec 8704	0x2304 dec 8964	Analogue Word (Active power in selected scale)								
0x2005 dec 8197	0x2105 dec 8453	0x2205 dec 8704	0x2305 dec 8965	DX1xx DI7	DX1xx DI6	DX1xx DI5	DX1xx DI4	DX1xx DI3	DX1xx DI2	DX1xx DI1	DX1xx DI0	Low Byte
				-	-	Run Time Excee-ded[1]	Out of Positi-on[1]	Torque Open[1]	Torque Closed[1]	End Pos Open[1]	End Pos Closed[1]	High Byte
0x2006 dec 8198	0x2106 dec 8454	0x2206 dec 8704	0x2306 dec 8966	U Imbal. warn	U Imbal. trip	Under-voltage warn	Under-voltage trip	Under-power warn	Under-power trip	Over-power warn	Overpo-wer trip	Low Byte
				Earth fault warning	Earth fault trip	Cooling time running	-	THD war-ning	No start possi-ble[5)]	1 start left [5)]	More than 1 start left[5)]	High Byte

Analog Outputs of UMC100 acc. to the UMC100 manual section
A1 Parameters and Data Structures on a Fieldbus

UMC at port 1	UMC at port 1	UMC at port 1	UMC at port 1	Data
Address				
0x2800	0x2900	0x2A00	0x2B00	Analogue Word
0x2801	0x2901	0x2A01	0x2B01	Analogue Word
0x2802	0x2902	0x2A02	0x2B02	Analogue Word
0x2803	0x2903	0x2A03	0x2B03	Analogue Word

Diagnosis Data of UMC100 according to the UMC100 manual section
A1 Parameters and Data Structures on a Fieldbus

UMC at port 1	UMC at port 2	UMC at port 3	UMC at port 4	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit1	Bit 0
Adress											
0x0C00 dec 3072	0x0C20 dec 3104	0x0C40 dec 3136	0x0C60 dec 3168	Check-back missing	PTC wiring failure	PTC hot	Pre-waring thermal model	Locked rotor during start-up (stall)	Phase imbalance[1]	Phase loss[1]	Thermal overload trip
				Actuator problem[1]	UMC self-test error	Earth fault pre-warning	Eart fault trip (internal or externally triggered)	I above high current warning threshold	I above high current trip threshold	I below low current warning threshold	I below low current trip threshold
0x0C01 dec 3073	0xC021 dec 3105	0x0C41 dec 3137	0x0C61 dec 3167	Trip/Warning from AuxFault function block input 5[2)]	Trip/Warning from AuxFault function block input 4[2)]	Trip/ Warning from AuxFault function block input 3[2)]	Trip/Warning from AuxFault function block input 2[2)]	Trip/Warning from AuxFault function block input 1[2)]	HW fault on IO module	Custom application error	IO module missing
				-	-	-	-	Trip triggered from Multifunction input DI2	Trip triggered from Multifunction input DI1	Trip triggered from Multi-function input DI0	Trip / Warning from AuxFault function block input 6[2)]
0x0C02 dec 3074	0x0C22 dec 3106	0x0C42 dec 3138	0x0C62 dec 3168	-	-	THD Warning	Voltage out of spec[1]	Overload power	Underload power[1]	-	-
				-	-	Cooling Time Running	Just one start left	Num Starts Overrun	-	-	-
0x0C03 dec 3075	0x0C23 dec 3107	0x0C43 dec 3139	0x0C63 dec 3169	Extended diagnosis is available[1)].	Parameter out of range	-	-	-	-	-	-
				Fault code. See section "Error Handling, Maintenance and Service-> Fault Messages" for a description of the code.							

Data Access in one block ordered by device

This section explains how to access the data of the connected devices in one block.
Only one Modbus TCP read request is required to read all monitoring data and only one request is necessary to write all command data.

Monitoring Data

This address map shows how the complete monitoring data from up to four UMCs can be read in one block.
The data is ordered without any gaps after each other in the followng way.

DI UMC1	AI UMC1	Diag UMC1	DI UMC2	AI UMC2	Diag UMC2	...	DI UMC4	AI UMC4	Diag UMC4

The following table shows in detail how the data is organized

UMC at port 1	UMC at port 2	UMC at port 3	UMC at port 4	Data
0x3000 dec 12288	0x300C dec 12300	0x3018 dec 12312	0x3024 dec 12324	Summary Warning / UMC100 DI5 | Summary Fault / UMC100 DI4 | Local Control / UMC100 DI3 | Rev Lockout Time / UMC100 DI2 | Overload warning / UMC100 DI1 | Run Fwd / Opening / UMC100 DI0 | Off / Run Fast Fwd | Run Rev/ Closing / -
0x3001 dec 12289	0x300D dec 12301	0x3019 dec 12313	0x3025 dec 12325	Motor Current in % of I_e (0% - 800%
0x3002 dec 12290	0x300E dec 12302	0x300A dec 12314	0x3026 dec 12326	Analogue Word (Thermal Load: 0% - 100%)
0x3003 dec 12291	0x300F dec 12303	0x301B dec 12315	0x3027 dec 12327	Analogue Word (Time to trip in seconds)
0x3004 dec 12292	0x3010 dec 12304	0x301C dec 12316	0x3028 dec 12328	Analogue Word (Time to restart in seconds)
0x3005 dec 12293	0x3011 dec 12305	0x301D dec 12317	0x3029 dec 12329	Analogue Word (Active power in selected scale)
0x3006 dec 12294	0x3012 dec 12306	0x301E dec 12318	0x302A dec 12330	DX1xx DI7 / - | DX1xx DI6 / - | DX1xx DI5 / Run Time Exceeded[1] | DX1xx DI4 / Out of Position | DX1xx DI3 / Torque Open | DX1xx DI2 / Torque Closed | DX1xx DI1 / End Pos Open | DX1xx DI0 / End Pos Closed
0x3007 dec 12295	0x3013 dec 12307	0x301F dec 12319	0x302B dec 12331	U Imbal. warn / Earth fault warning | U Imbal. trip / Earth fault trip | Undervoltage warn / Cooling time running | Undervol-tage trip / - | Underpo-wer warn / THD warning | Underpo-wer trip / No start possible | Overpo-wer warn / One start left | Overpower trip / More than one start left
0x3008 dec 12296	0x3014 dec 12308	0x3020 dec 12320	0x302C dec 12332	CB miss-ing / Actuator problem | PTC wiring failure / UMC self-test error | PTC hot / Earth fault pre-warning | Pre-warn therm. model / Eart fault trip | Locked rotor / I > warning threshold | Phase imbalance / I > trip threshold | Phase loss / I < warning threshold | Thermal OL trip / I < trip threshold
0x3009 dec 12297	0x3015 dec 12308	0x3021 dec 12321	0x302D dec 12333	Trip/Warn-ing from AuxFault fb input 5 / - | Trip/Warn-ing from AuxFault fb input 4 / - | Trip/ Warn-ing from AuxFault fb input 3 / - | Trip/Warn-ing from AuxFault fb input 2 / - | Trip/Warn-ing from AuxFault fb input 1 / Trip trig-gered from Multifunc. input DI2 | HW fault on IO module / Trip trig-gered from Multifunc. input DI1 | Custom application error / Trip trig-gered from Multifunc. input DI0 | IO module missing / Trip / Warn-ing from AuxFault fb input 6
0x300A dec 12298	0x3016 dec 12310	0x3022 dec 12322	0x302E dec 12334	- / - | - / - | THD Warning / Cooling Time Running | Voltage out of spec[1] / Just one start left | Overload power / Num Starts Overrun | Underload power[1] / - | - / - | - / -
0x300B dec 12299	0x3017 dec 12311	0x3023 dec 12323	0x302F dec 12335	Ext. diagnosis is available | Parameter out of range | - | - | - | - | - | - / Fault code.

Command Data

This address map shows how the complete command data from up to four UMCs can be written in one block.
The data is ordered without any gaps after each other in the followng way.

DO UMC1	AO UMC1	DO UMC2	AO UMC2	DO UMC3	AO UMC3	DO UMC4	AO UMC4

The next table shows in detail how the data is organized

UMC at port 1	UMC at port 2	UMC at port 3	UMC at port 4	Data
0x4000 dec 16384	0x4006 dec 16390	0x400C dec 16396	0x4012 dec 16402	- / Fault Reset / Auto Mode / Prepare Emergency Start / - / Run Forward / Opening / Off / Run Reverse / Closing UMC100 DO2 / UMC100 DO1 / UMC100 DO0 / UMC100 24VDC Out / - / - / Run Fast Forward / -
0x4001 dec 16385	0x4007 dec 16391	0x400D dec 16397	0x4013 dec 16403	VI15x DO0 / - / - / - / DX1xx DO3 / DX1xx DO2 / DX1xx DO1 / DX1xx DO0 - / - / - / - / - / - / - / -
0x4002 dec 16386	0x4008 dec 16392	0x400E dec 16398	0x4014 dec 16404	Analogue Word
0x4003 dec 16387	0x4009 dec 16393	0x400F dec 16399	0x4015 dec 16405	Analogue Word
0x4004 dec 16388	0x400A dec 16394	0x4010 dec 16400	0x4016 dec 16406	Analogue Word
0x4005 dec 16389	0x400B dec 16395	0x4011 dec 16401	0x4017 dec 16407	Analogue Word

Data access in one block ordered by data type

This section explains how to access the data of the connected devices ordered by data type. Only one Modbus TCP read request is required to read all monitoring data and only one request is necessary to write all command data.

Monitoring Data

This address map shows how the complete monitoring data from up to four UMCs can be read in one block.
The data is ordered without any gaps after each other in the followng way.

DI UMC1	DI UMC2	DI3 UMC3	DI4 UMC4	AI1 UMC1	...	AI UMC4	Diag UMC1	...	Diag UMC4

The following table shows in detail how the data is organized

UMC at port 1	UMC at port 2	UMC at port 3	UMC at port 4	Data
0x5000 dec 20480	0x5001 dec 20481	0x5002 dec 20482	0x5003 dec 20483	Summary Warning / Summary Fault / Local Control / Rev Lockout Time / Overload warning / Run Fwd / Opening / Off / Run Rev/ Closing UMC100 DI5 / UMC100 DI4 / UMC100 DI3 / UMC100 DI2 / UMC100 DI1 / UMC100 DI0 / Run Fast Fwd / -
0x5004 dec 20484	0x500B dec 20491	0x5012 dec 20498	0x5019 dec 20505	Motor Current in % of I_e (0% - 800%
0x5005 dec 20485	0x500C dec 20492	0x5013 dec 20499	0x501A dec 20506	Analogue Word (Thermal Load: 0% - 100%)
0x5006 dec 20486	0x500D dec 20493	0x5014 dec 20500	0x501B dec 20507	Analogue Word (Time to trip in seconds)
0x5007 dec 20487	0x500E dec 20494	0x5015 dec 20501	0x501C dec 20508	Analogue Word (Time to restart in seconds)
0x5008 dec 20488	0x500F dec 20495	0x5016 dec 20502	0x501D dec 20509	Analogue Word (Active power in selected scale)
0x5009 dec 20489	0x5010 dec 20496	0x5017 dec 20503	0x501E dec 20510	DX1xx DI7 / DX1xx DI6 / DX1xx DI5 / DX1xx DI4 / DX1xx DI3 / DX1xx DI2 / DX1xx DI1 / DX1xx DI0 - / - / Run Time Exceeded[1] / Out of Position / Torque Open / Torque Closed / End Pos Open / End Pos Closed
0x500A dec 20490	0x5011 dec 20497	0x5018 dec 20504	0x501F dec 20511	U Imbal. warn / U Imbal. trip / Undervoltage warn / Undervol-tage trip / Underpo-wer warn / Underpo-wer trip / Overpo-wer warn / Overpower trip Earth fault warning / Earth fault trip / Cooling time running / - / THD warning / No start possible / One start left / More than one start left
0x5020 dec 20512	0x5024 dec 20516	0x5028 dec 20520	0x502C dec 20524	CB miss-ing / PTC wiring failure / PTC hot / Pre-warn therm. model / Locked rotor / Phase imbalance / Phase loss / Thermal OL trip Actuator problem / UMC self-test error / Earth fault pre-warning / Eart fault trip / I > warning threshold / I > trip threshold / I < warning threshold / I < trip threshold
0x5021 dec 20513	0x5025 dec 20517	0x5029 dec 20521	0x502D dec 20525	Trip/Warn-ing from AuxFault fb input 5 / Trip/Warn-ing from AuxFault fb input 4 / Trip/Warn-ing from AuxFault fb input 3 / Trip/Warn-ing from AuxFault fb input 2 / Trip/Warn-ing from AuxFault fb input 1 / HW fault on IO module / Custom application error / IO module missing - / - / - / - / Trip trig-gered from Multif. input DI2 / Trip triggered from Mul-tif.input DI1 / Trip trig-gered from Multif. input DI0 / Trip / Warn-ing from AuxFault fb input 6
0x5022 dec 20514	0x5026 dec 20518	0x502A dec 20522	0x502E dec 20526	- / - / THD Warning / Voltage out of spec[1] / Overload power / Underload power[1] / - / - - / - / Cooling Time Running / Just one start left / Num Starts Overrun / - / - / -
0x5023 dec 20515	0x5027 dec 20519	0x502B dec 20523	0x502F dec 20527	Ext. diagnosis is available. / Parameter out of range / - / - / - / - / - / - Fault code.

Command Data

This address map shows how the complete command data from up to four UMCs can be written in one block.
The data is ordered without any gaps after each other.

The following table shows in detail how the data is organized

UMC at port 1	UMC at port 2	UMC at port 3	UMC at port 4	Data
0x6000				- | Fault Reset | Auto Mode | Prepare Emergency Start | - | Run For-ward / Opening | Off | Run Reverse / Closing UMC100 DO2 | UMC100 DO1 | UMC100 DO0 | UMC100 24VDC Out | - | - | Run Fast Forward | -
				VI15x DO0 | - | - | - | DX1xx DO3 | DX1xx DO2 | DX1xx DO1 | DX1xx DO0 - | - | - | - | - | - | - | -
				Analogue Word
				Analogue Word
				Analogue Word
				Analogue Word

Diagnosis / Behaviour in Case of an Error

The MTQ22-FBP provides detailed diagnosis information about the status of the connected devices, its own status and the status of the Modbus TCP connection.

Diagnosis information is accessible

- with the locally available lamps and
- via the Modbus TCP services.

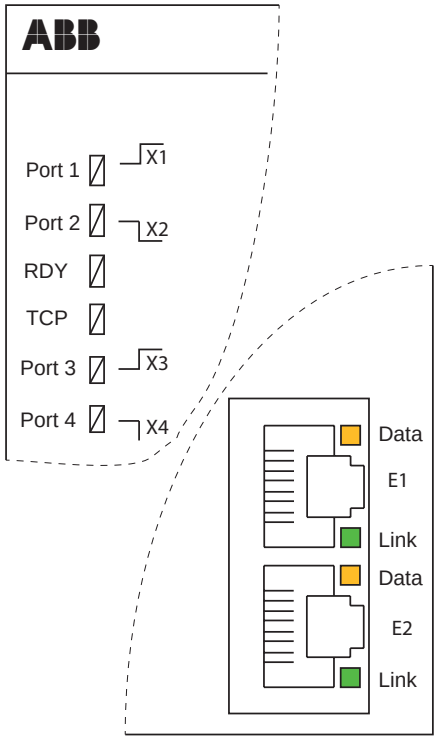
The possibilities of locally available diagnostics are described in the next section.

LED status indications

Diagnosis information is locally displayed using two Light Emitting Diodes (LEDs) per interface to an FBP device. The meaning of the LEDs is as follows:

LED Port 1,2,3,4	Explanation
Off	Disabled (no device configured)
Green blinking	Startup (waiting for device)
Green on	Configured device identified and data exchange running
Red blinking	Communication fault
Green / Red alternating	• Address mismatch between expected device address and connected device address. E. g. caused by swapping two devices. • Wrong device type connected.

*) Only for intelligent devices like UMC or PST. Not for passive sensors.



MTQ22-FBP Status

LED RDY General Status	Explanation
Green on	Normal
Red blinking	Minor error, e. g. wrong configuration or IP address already available in the network.
Red on	Major internal fault. If the error is permanent after reboot replace the device.

LED TCP Communication Status	Explanation
Green blinking	Waiting for Modbus TCP connection
Green on	At least one Modbus TCP connection established
Red blinking	One or more (as parameterized) connections timed out
Red on	Fatal error
Green / Red alternating	Error in the TCP/IP configuration

Ethernet Status

The Ethernet status is shown at the two LEDs integrated in the RJ45 connectors.

	Off	On	Flashing
Data LED Yellow	No network traffic	-	Communication with network active (traffic).
Link LED Green	No connection to network. E.g. cable not plugged in or broken wire.	Connection to network established (e.g. connection with network switch)	-

Reading the FBP device communication status

The status of the connected FBP devices can be read via Modbus TCP on the addresses 0x80 ... 0x83 for the devices connected to port 1 ... port 4. See chapter Modbus TCP Address Map for a detailed Modbus TCP address map.

The communication status is zero (0) in case of no error. A value different from zero indicates an error.
The value itself describes the error reason.

Error Code	Description	Possible Reasons, Corrective Measures
0	OK	-
1	Wait For FBP Device. Communication not yet established	• Check that the FBP device is powered. • Check the wiring between the FBP device and the MTQ22-FBP. • Check that the drawer is inserted (in a withdrawable system).
2	Unsupported FBP Device. An unsupported device was connected to the MTQ22-FBP	• See section "Overview -> Supported FBP Devices" for a list
3	Communication Fault on Module Port. Communication to a FBP device was established but was lost again	• Check the FBP device • Check that the FBP device is powered. • Check that the drawer is inserted (in a withdrawable system).
4	Address Mismatch. The configured device address and the real FBP device address do not match.	• Fix parameterization • Check that the connected FBP device was not interchanged (e.g. wrong drawer inserted). See section Configuration -> Position supervision
5 - 10	General configuration error	• Double-check the configuration • Check that no unsupoorted device was connected. See section "Overview -> Supported FBP Devices" for a list. • Check configuration data sent to the MTQ22-FBP (if own config was sent).
other values	reserved	-

Technical Data

General

Supply voltage	24 V DC (+30 % ... -20 %) (19.2 ... 31.2 V DC) including ripple
Current consumption	Max. 180 mA (at 19.2 ... 31.2 V DC)
Short-circuit protection at port 1 ... 4	PTC resistor.
Reverse polarity protection of supply inputs	Yes
Pollution degree terminals	3
Mounting	Snap-on mounting onto 35 mm standard mounting rails
Mounting Position	Any
Degree of protection	IP20
Temperature range: Storage / Operation	-25 ... +70 °C / 0 ... +60 °C
Dimensions (W x H x D)	45 mm x 90 mm x 96 mm
Total power dissipation	max. 3,5 W
Net weight	0.172 kg
Configuration	Via PC Tool
Diagnosis with LEDs	See section Diagnosis
Cable length between MTQ22-FBP and devices	It is strongly recommanded to limit the cable length to 3 m
Marks, Approvals	CE, cUL Further in preparation. Ask your Local Sales Unit representative for other marks/approvals.
Operation altitude above sea level	max. 2000 m For higher altitudes please contact your Local Sales Unit.

EMC

Measurement of radiated and conducted interference according to EN61131-2 CISPR16-2-3	Class A
Electrostatic discharge accoring to IEC 61000-6-2	8 kV air discharge 6 kV contact discharge
Radiofrequency electromagnetic field according to IEC 61000-4-3	10 V/m
Fast transient bursts according to EN61000-4-4	2 kV power supply 0.5 kV communication lines
High energy surges according to EN61000-4-5	1/0.5 kV CM/DM power supply
Conducted radio frequency interference according to EN61000-4-6	10 V
Immunity low frequency harmonics according to EN61000-4-11	Power supply: 50 ... 12 kHz, 3 V

Ethernet and Modbus TCP Performance Data

Network Redundancy Protocol	MRP client acc. to EN/IEC 62439-2
Recovery time in a network with 15 MTQ22-FBP nodes in ring topology and interruption of the communication at one place (single fault)	< 200 ms typically (depends on the settings in the MRP master)
Response time of a ModebusTCP request to IO data	< 1 ms (typically)
Response time of a ModebusTCP request to parameter data and maintenance counters	< 3 ms (typically)
Max. concurrent Modbus TCP connections	4
Ethernet interfaces	2 (internal two-port switch)
Supported Ethernet topologies	Star, ring, bus (daisy chain)

Ordering Data

Type	Description	Order No.
MTQ22-FBP.0	Modbus TCP Interface for 4 FBP-Devices	1SAJ260000R0100
ETHTB-FBP.4	Terminalset X1…X4 for EthernetFBP 4 pcs	1SAJ929200R0001
ETHTB-FBP.50	Terminalset X1…X4 for EthernetFBP 50 pcs	1SAJ929200R0002
CDP17-FBP.150	Cable ETH-X1/X4-M12 female	1SAJ929170R0015
CDP18-FBP.150	Cable ETH-X1/X4-open wire	1SAJ929180R0015
CDP19-FBP.100	Passive cable drawer inside	1SAJ929190R0010
CDP11-FBP.0	Drawer passive cable, fixing bracket 50 pcs	1SAJ929100R0001
CDP11-FBP.4	Drawer passive cable, fixing bracket 4pcs	1SAJ929100R0004

Dimensions

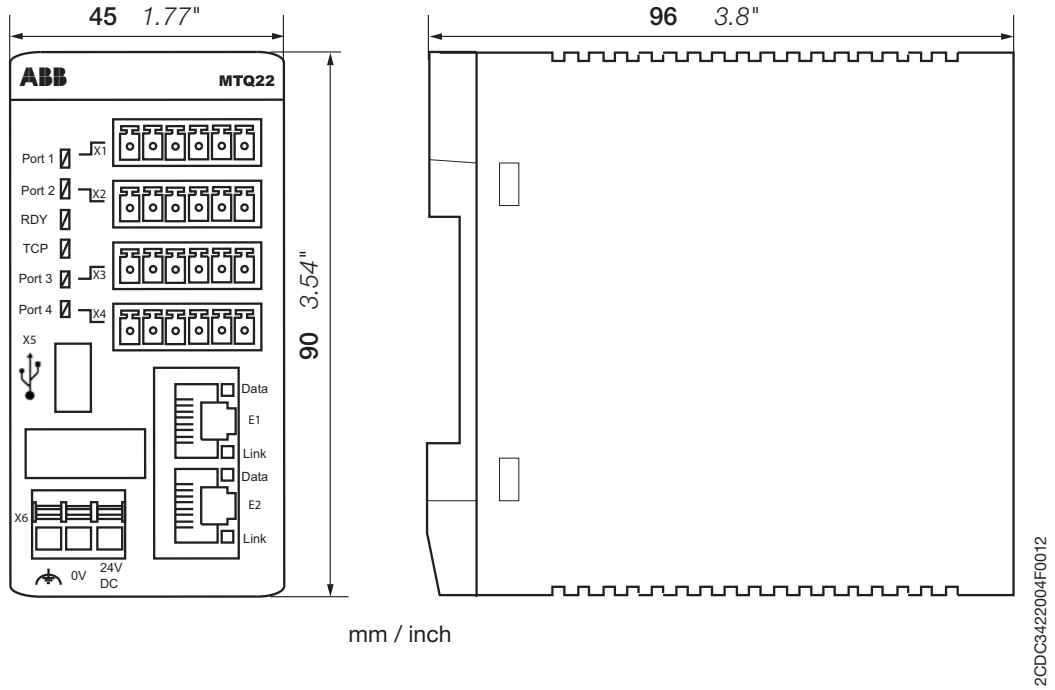


Figure 13: Dimensions MTQ22-FBP.0

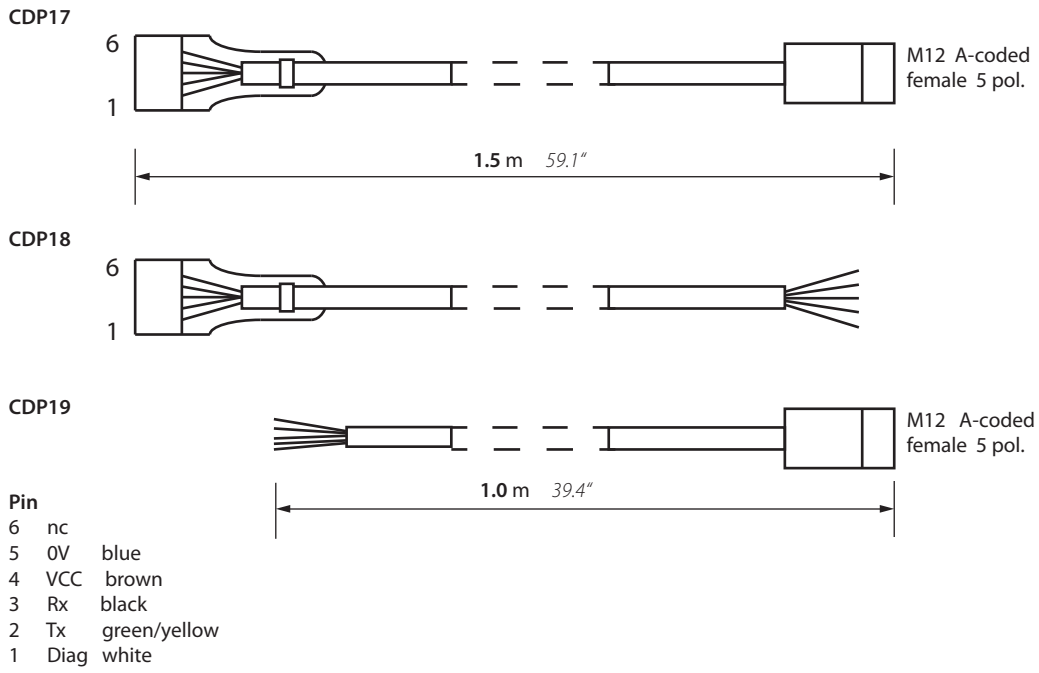


Figure 14: Dimensions auxiliary cables

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Detected an Error?

Your feedback helps us to constantly improve our products. We are grateful for your comments and suggestions. Please provide us with the following information if you have noticed an issue:

Name

Company / Department

Telephone / Email

Problem Description

- Steps to reproduce the problem
- Version of UMC (Ident number on nameplate and firmware version which is displayed on the UMC100-PAN)
- Version of MTQ (Ident number on nameplate)
- Version of config tool / Windows version (Control->System)

MEMO

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