
Energy Management System

Operating Instructions



Setting up an EM System

Safety and Warning Instructions

!!! Important: read before commissioning !!!

- The user must ensure that all system operators are familiarized with the operating manuals for the instruments and follow them at all times
- The operating manuals for the instruments must be carefully read through before the instruments are mounted, installed and commissioned
- Always act in accordance with these Operating Instructions
- Only appropriately skilled personnel may install and commission the system, observing the relevant rules and regulations currently in force
- If an instrument is visibly damaged, it must not be installed, connected up or commissioned
- If an instrument does not function after commissioning, it must be immediately disconnected from the power supply
- Any other currently valid laws, standards or directives that apply to these products must also be complied with

Contents	Page
1. Quick start	4
2. The EM System	5
2.1 System architecture (hardware)	5
2.2 System architecture (software)	6
2.3 Typical system architectures	9
3. System requirements (network)	12
3.1 Analysis of the system	12
3.2 Limits to the scope of the system	12
3.3 Requirements for the PC and server	13
3.4 Database.....	14
3.5 Performance.....	15
3.6 E-mail und timeserver	15
3.7 Network connections.....	16
3.8 Other important requirements	17
4. System limits (hardware)	18
4.1 EMIS [®] 1500 system points.....	18
4.2 Network and buses	18

1. Quick start

- **Before installation:**



Important:

If it is necessary to connect the installation to a network, the system design should be carried out jointly with the network administrator.

- ⇒ Draw up a plan of the installation with information on the locations and addresses
- ⇒ Read all operating manuals for the instruments to be installed and follow their instructions

- **Installation:**



Important:

During installation or servicing work the instruments must be disconnected from the power supply.

- ⇒ Mount or install the instruments at a suitable location
- ⇒ Prepare the power supply for the instruments
- ⇒ Wire up a continuous bus or network connection appropriate to the instrument
- ⇒ Carry out any other necessary instrument-specific installation work and make the appropriate connections

- **Commissioning:**

- ⇒ Switch on the instruments and verify their correct functioning. If an instrument is not working correctly or does not function at all, switch it off and examine it
- ⇒ Program the bus or network address, if necessary making any other settings on the instruments
- ⇒ Install the software in the PCs
- ⇒ Check out the network and bus connections step by step and commission them
- ⇒ Using the PC software, configure the instruments and the EM System (register instruments, set up counter channels, define alarms)

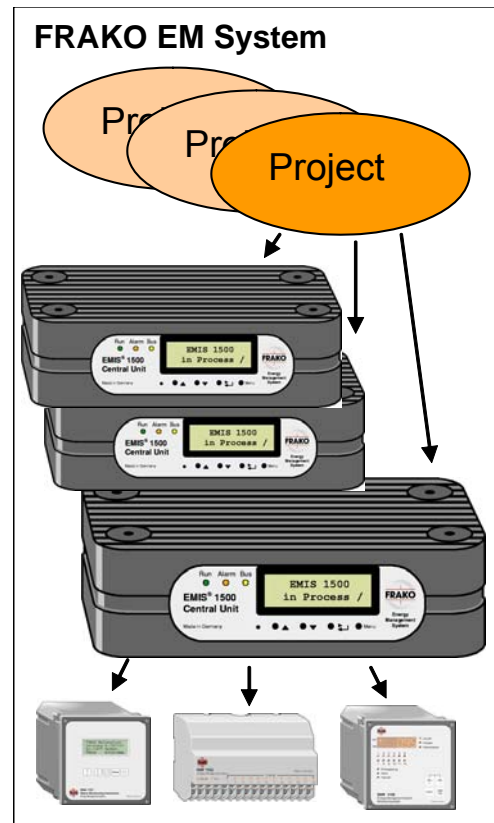
2. The EM System

2.1 System architecture (hardware)

A FRAKO Energy Management (EM) System is divided into individual projects, it being possible to create up to eight of these. A separate database with separate data management is assigned to each project. This means that the data from different projects cannot be compared directly with each other.

Up to 16 data collectors can be assigned to each project. A data collector is either an EMIS[®] 1500 instrument or a virtual data collector, the latter being used when the historic log is created directly in the measuring instrument or the historic data are entered manually. A virtual data collector is also required for reading in CSV (comma-separated value) files.

The data collector is connected with the various sources of data, it being possible, for example, for the EMIS 1500 to be linked to the individual instruments via Ethernet, RS232, FRAKO Starkstrombus or M-Bus connections.



2.1.1 The projekt

The connected data collectors are divided into virtual groups by assigning them to projects. This limits the quantity of data that accumulates per project. The division into projects takes place within the computer and has no bearing on the installation of the system.

A folder is assigned to each project in the *system directory\HDB* (historic database) where the data of a project are saved, normally *FRAKO-NET\System\HDB*. In addition, a database for the project is created at the location *system directory\DATABASE*.

Nearly all the settings of the EM System are made using the software SYSTEM-SW. This means that the projects are also created with this program. Up to 16 data collectors can be grouped in one project.

2.1.2 The data collector

In the EM System there are two types of data collector:

1. EMIS[®]1500 instruments
2. Virtual data collectors

The EMIS[®]1500 has the function of collecting and providing intermediate storage for the data from the instruments connected to it. In addition, alarms and limits are monitored and alarm signals are given via various routes when necessary. The EMIS[®]1500 is configured using *SYSTEM-SW* software.

A virtual data collector is said to exist if the data are read directly from an instrument (e.g. EMF 1102) and saved in the PC. It is also possible to enter data manually or import CSV files. These data are therefore not collected in an EMIS[®]1500 but are transferred directly to a PC for data management.

2.1.3 The bus coupler

A bus coupler is always connected between a data collector and the measuring instrument. In the physical architecture of an EM System, this has the function of making a connection between the Ethernet and the instrument's bus system. Even when instruments are directly connected to the EMIS[®]1500 (e.g. by an internal bus connection), an appropriate bus coupler must be selected before commissioning the system.

2.1.4 The instruments

The instruments are normally connected with the EM System via a bus system or a serial interface. At the present time the following systems are supported:

- FRAKO Starkstrombus[®]
- PL-Master from the Jean Müller company
- M-Bus
- Modbus
- Modbus-TCP
- EIB

All the instruments connected carry out their functions independently of the bus connection. The operating parameters are polled regularly via the bus connection and are saved in the data collector.

In addition, the instruments that are connected via the FRAKO Starkstrombus[®] can also be parameterized (i.e. set).

2.2 System architecture (software)

Just as important as the design and installation of the hardware architecture is the configuration of the software architecture. A FRAKO EM System offers various options for organizing the user programs and data storage. To a certain extent some of the following examples can also be combined.

2.2.1 Client/server architecture

With this arrangement the user program (visualization, SYSTEM-SW) and the data storage are located on different computers.

Only the *FRAKO-NET* software is installed on a central computer (the server), the database and the file storage facility also being established on this computer. A utility program, which must be activated, continually polls for the data from the configured data collectors automatically and writes these to the database and the file storage facility. It must, of course, be ensured that an Ethernet connection to the data collectors can be established.

Both software components (*FRAKO-NET* and *EMVIS-NET*) are installed on the user's computer (the client). Via the Ethernet, the client can access the data storage facility and the database in the central computer. The data are then displayed by means of the *EMVIS-NET* software.

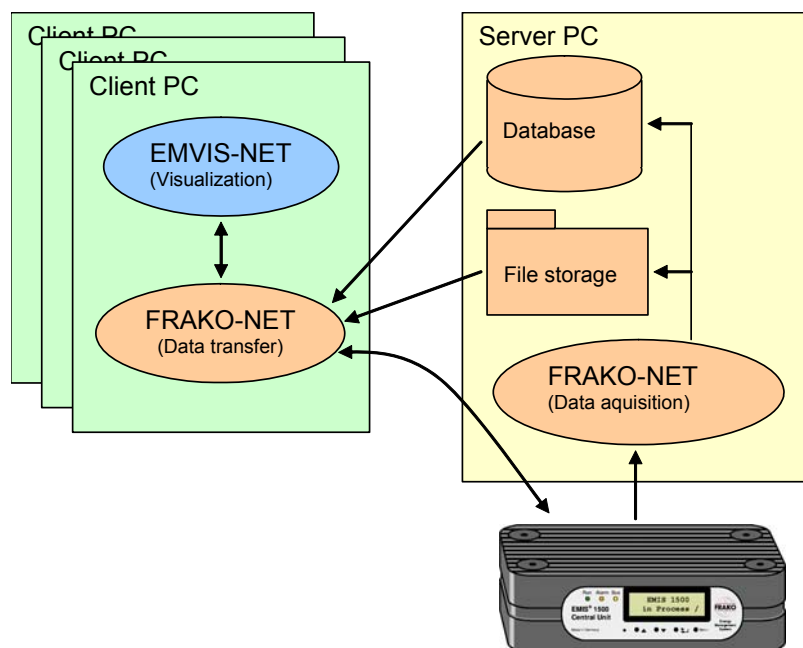


Figure 1: Client/server data architecture

With this model up to eight users can access the data storage. By making appropriate settings during installation as many users as desired can be denied configuration rights.

2.2.2 Local installation with utility program

With this option everything is installed on one local computer. It must be ensured that the Ethernet connections to the data collectors are made. The utility program is started as in the client/server installation.

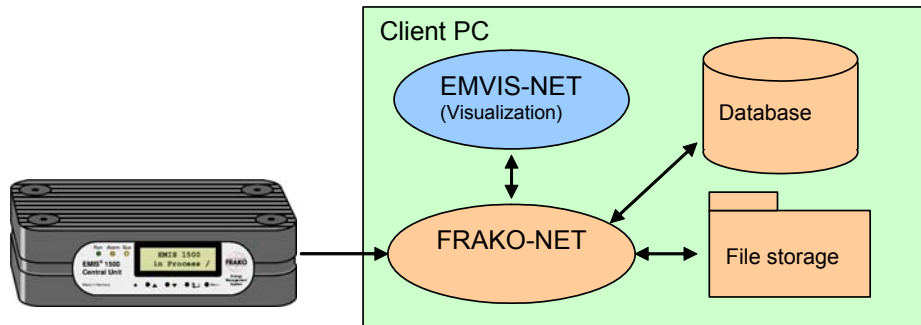


Figure 2: Data architecture for local installation

As soon as the computer is started up, the data acquisition function runs in the background and polls all data collectors in a regular cycle. When *EMVIS-NET* is started, the data are visualized.

2.2.3 Local installation (standard)

In a similar way to *local installation with utility program* (previous section), all the programs are installed on one computer, but a utility program is not started.

The automatic data acquisition program (*FRANKO-NET*) is only active when *EMVIS-NET* is also working. This is practical when dial-up connections (via a modem) to the data collector are used.

2.3 Typical system architectures

The following graphic illustrates some, but not all, of the configuration options for the EM System.

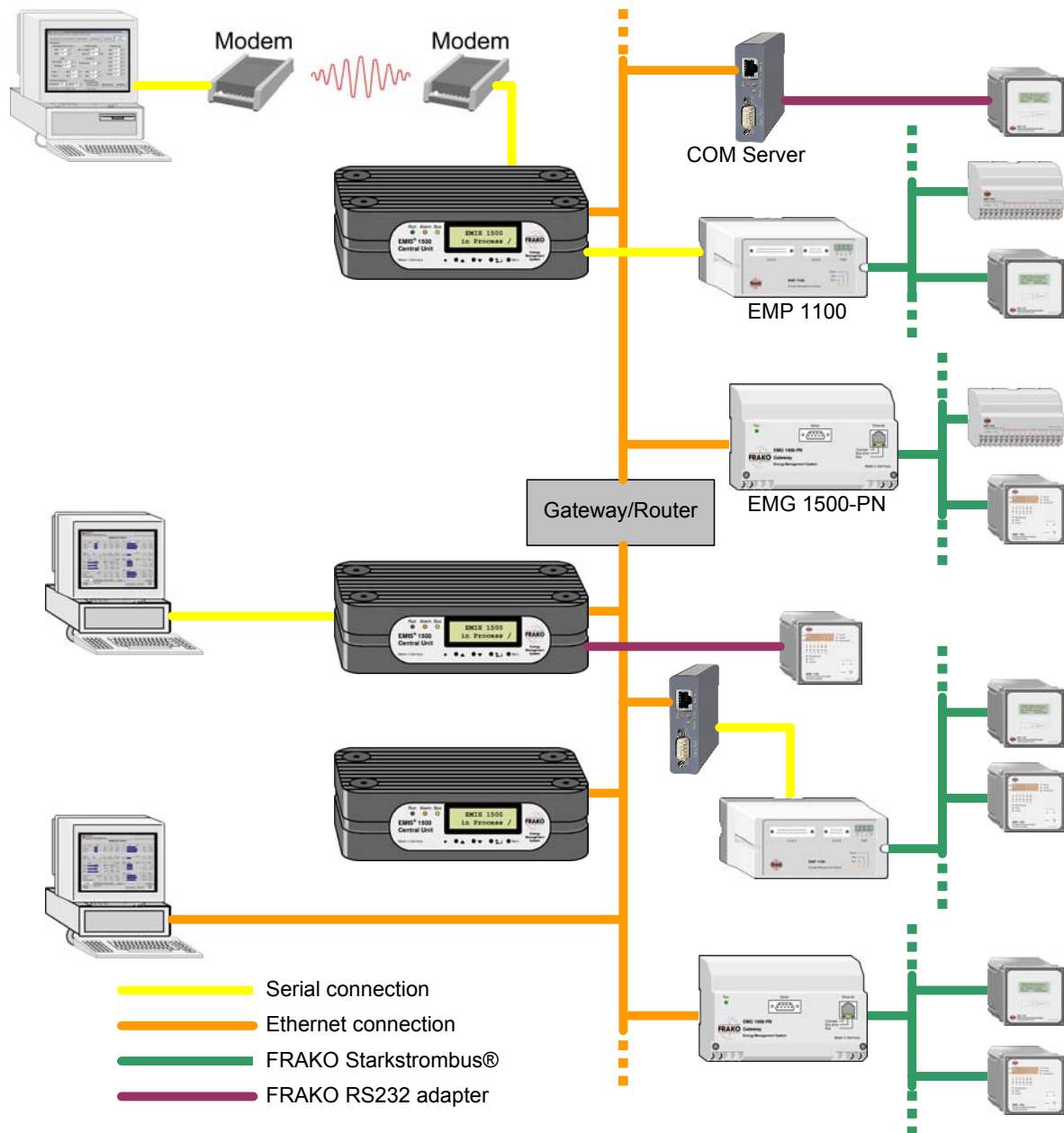


Figure 3: Typical architectures

2.3.1 Connecting the data collector

The following methods of connecting a data collector (EMIS[®]1500) with the computer assigned to data storage are possible:

- Via the Ethernet
- As a direct serial dial-up connection
- As a dial-up connection via modem

The last option can only be applied, however, if the data collector is dialled manually (see Section 2.2.3).

An Ethernet connection to the data collector is of course preferable to the other methods.

2.3.2 Connecting the instruments

The data collector itself again offers three options for accessing the connected instruments:

- Serial interface
- Interface to the FRAKO Starkstrombus[®]
- Ethernet

The following instruments can be accessed via the **serial interface**:

- M- Bus instruments via M-Bus level shifter (M-Bus master)
- FRAKO Starkstrombus[®] via EMP 1100 or EMT 1101
- Individual FRAKO instruments via RS232 adapters

A bus system with FRAKO instruments can be connected directly at the **interface to the FRAKO Starkstrombus[®]**. The limitations and technical details are described in Sections 4.2.2 and **Fehler! Verweisquelle konnte nicht gefunden werden..**

The **Ethernet** offers the greatest number of options for connecting instruments to the data collector:

- Via COM Server to a serial interface (see above for the relevant options)
- Direct connection from PLMaster (instruments from the Jean Müller company)
- Via an EMG 1500 instrument to the FRAKO Starkstrombus[®] (see above for the relevant options)
- Via a Modbus coupler to Modbus instruments
- Direct connection from Modbus TCP instruments
- Via Nk1 network coupler to an EIB system

2.3.3 Virtual data collectors

The EM System also offers the possibility of acquiring counter data that are not collected in an EMIS[®]1500 instrument. Possible sources are:

- EMF 1102 instruments
- CSV files (text files with the counter readings)
- Manual input of counter readings

The computer to which the data storage is assigned can be automated to the extent that it polls EMF 1102 instruments in a regular cycle (e.g. via a modem connection) or searches for CSV files. Counter readings can also be input manually at every user (client) computer.

3. System requirements (network)

3.1 Analysis of the system

The table below can be used to estimate the volume of data in the Energy Management-System (EM System).

Data volume in the file system for each fully registered instrument:

	<i>Per Day</i>	<i>Per annum</i>
EMA 1101	approx. 155 kB	approx. 56,6 MB
EML 1101	approx. 50 kB	approx. 18,3 MB
EMR 1100	approx. 60 kB	approx. 21,9 MB
EMPQ 1500	approx. 200 kB	approx. 73,0 MB

Data volume in the database and the file system per registered channel:

	<i>FRAKO-NET database per annum</i>	<i>File system per annum*</i>
Zählkanal	approx. 2,4 MB	approx. 400 kB
Analogkanal	approx. 7,1 MB	approx. 1,2 MB
Zustands-/Alarmkanal	approx. 14,1 MB	approx. 2,4 MB

* *Does not apply if the channel is from a fully registered instrument.*

The necessary storage capacity must be made available to cope with the data volume in the system.

Small systems: Up to 200 system points and a maximum database volume of 200 MB per annum

Medium systems: Up to 550 system points and a maximum database volume of 500 MB per annum

Large systems: Over 550 system points (in total in the EM System) or a database volume exceeding 500 MB per annum

3.2 Limits to the scope of the system

The following limits to the extent of the EM System must be taken into account at the planning stage:

- A maximum of 16 data collectors (e.g. EMIS[®] 1500) per project
- Per server one project (see also Section 3.5)
- max. 8 Anwenderrechner, die gleichzeitig mit einem Zentralrechner verbunden sind.
- Maximum of 8 users connected simultaneously with an EMIS[®] 1500 instrument
- A maximum of 6 bus couplers (e.g. EMG 1500, M-Bus coupler, Modbus coupler, EMIS[®] 1500 interface) per data collector
- A maximum of 1500 historic data points per project
(One counter or analogue channel is equivalent to 1 historic data point
One status or alarm channel is equivalent to 2 historic data points)

**Note:**

The **SYSTEM-SW** setup software does not check or constrain all the limits. It is therefore necessary to carry out a manual check.

If the limits are exceeded, this can result in long computing times or system malfunctioning.

3.3 Requirements for the PC and server

The following requirements for the PC and software apply to small and medium-sized systems:

User computer (client) without data management:

- Windows 2000 Professional or Windows XP Professional without x64 Edition
- Internet Explorer 5.5 or later (including Ethernet tools)
- No BORLAND Interbase[®] database installed
- At least 2 GHz
- At least 1 GByte RAM, of which 512 MB is free memory
- At least 300 MB free hard disk space
- Operation via a terminal server is not possible

Computer with data management or central computer (server):

- Windows 2000 Professional or Windows XP Professional without x64 Edition
- For a pure central computers also Windows Server 2003
- Internet Explorer 5.5 or later (including Ethernet tools)
- NTFS file system
- Hyper-Threading deactivated
- No BORLAND Interbase[®] database installed
- At least 2 GHz, preferably 3 GHz
- At least 1.5 GB RAM free memory
- Free hard disk space in this computer appropriate to the system as analysed (see Section **Fehler! Verweisquelle konnte nicht gefunden werden.**)
- Possibly a separate hard disk for backup purposes

**Note:**

These requirements only apply to small and medium-sized systems. The performance can be improved by modifying the database and the server structures (see Section 3.5).

In larger systems the database and the server must be adapted to suit the volume of data and the utilization structure, the notes on performance given in Section 3.5 5 being taken into account. It is strongly recommended that the project execution and commissioning of larger systems be carried out by FRAKO. For this please contact FRAKO

**Kondensatoren- und Anlagenbau GmbH in Teningen, Germany, directly.
The address is given on page 20)**



Note:

The following points must always be taken into account in order to prevent loss of data:

- **The database file (normally located at C:\FRAKO-NET\System\DATABASE) must be hidden from virus scanners and backup programs. These files must also not be copied manually while the data loader program is running.**
- **The data files in the file system path SYSTEMPFAD\HDB (normally located at C:\FRAKO-NET\System\HDB) must also be hidden from virus scanners and backup programs.**

3.4 Database

The FRAKO Energy Management System installs and uses two databases.

- a) EMVIS-NET (client software) installs the *Microsoft[®] SQL Server Desktop Engine (SVRCA)*. This is used only temporarily during the operation of EMVIS-NET and no permanent data storage takes place. The amount of data (alarm report) is small.
- b) FRAKO-NET installs and uses the SQL Database *Firebird[®] 2.0*. Here the counter, analogue, status and alarm channel data are permanently stored in the server computer. The client computers only use the *Firebird[®] Client* software from this installation.



Note:

Before installation it must be clarified whether Interbase[®] or Firebird[®] is installed on the computers (client and server), and which version is concerned. If Interbase[®] is installed, it must be uninstalled, as it is not possible to operate both databases in the same computer. If Firebird[®] is installed in another version, FRAKO must be consulted before proceeding with the installation.

The standard method is to install the *Firebird[®] Classic Server* version, with 32 MB RAM cache assigned to each connection. Each EMVIS-NET program that is running opens up to 6 connections.

3.5 Performance

The following points have a negative impact on the speed of the system:

- If the database (Firebird[®]) has to use the computer's virtual memory.
- The use of a virtual server (VMware) in particular will reduce the performance of the database (Firebird[®]).
- If a slow hard disk (e.g. a laptop) is used for the server.
- If other applications are running on the client computer or the server.

In addition to the minimum requirements set out in Section ., improved performance can also be achieved by optimizing the system. For larger systems this must be done specifically.

- Increase the database cache (if sufficient RAM is available) *(This can only be done by service personnel)*
- Provide the computer with more RAM to suit the increased database requirements.
- Switch the database to *Superserver* operation (if this is possible with the utilization structure of the EM System) *(This can only be done by service personnel)*
- Use of fast hard disks.
- Use of a RAID0 or RAID10 system for the database.
- Use of a separate hard disk for backup purposes (backup by FRAKO-NET)

Only one project per server is recommended, otherwise there may be loss of performance. If the computing capacity and the database settings are appropriately selected, more than one project may be installed on a server.

Note: In order to optimize the performance of data retrieval, the hardware of the central computer should also comply with the current recommendations for SQL servers (see the literature on SQL servers). These always represent the current state of the art.

3.6 E-mail und timeserver

If appropriately configured (e.g. Systemcheck), the possibility exists that the central computer can transmit e-mails. The EMIS[®] 1500 should also always be set up so that it can send e-mails.

An enabled SMTP server (where appropriate with POP3) with an e-mail account set up is necessary for both systems. Under certain circumstances the address of a DNS server is also required. These data must be available when configuring the central computer and the EMIS[®] 1500 instrument.

The EMIS[®] 1500 receives its time signal via an NTP timeserver. It must be ensured that the EMIS[®] 1500 can access this timeserver, the IP address of which must be available when the system is configured.

3.7 Network connections

The individual components of the EM System are linked to each other as follows:

Client computer: This uses the Firebird[®] database on the server. In addition, it requires access to the file system of the server computer (normally the FRAKO-NET directory), and it also communicates directly with the EMIS[®] 1500 instruments.

Server computer: This computer is also in contact with the EMIS[®] 1500 instruments via the data loader service program. Under certain conditions, the server computer also uses modem connections in order to read external data collectors sporadically.

EMIS[®] 1500: These instruments, on the other hand, are in continuous contact with their data sources. These are the EMG 1500, PLMaster, COM server or instruments with a Modbus TCP connection.

The individual instruments have the following port addresses:

- EMIS[®] 1500 Port 20 and 21 (FTP); Port 8000
- COM-Server..... Port 8100; Port 9194
- EMG 1500..... Port 8000
- PL-Master Port 11278
- Firebird database server Port 3050
- Modbus-TCP..... Port 502 (usually)
- EIB coupler (NK1)..... Port 5000 (Port 80 for HTML visualization)



Note:

All the EM instruments listed above require a fixed IP address. DHCP or boot servers are not supported. IP address, subnet mask and, where appropriate, gateway address must be available for commissioning purposes.

The speeds of the individual FRAKO components are at present as follows:

EMIS [®] 1500 ...	100 Mbit/s	COM-Server.....	10 Mbit/s
EMG 1500	100 Mbit/s	PL-Master	10 Mbit/s
COM-Server for Modbus-TCP	100 Mbit/s		
Modbus-TCP instruments	10 or 100 Mbit/s		
EIB Nk1	10 / 100 Mbit/s		

3.8 Other important requirements

- Only the backup program integrated in *FRAKO-NET* must be used.
- If the system backup is carried out on a network drive, the UNC path must be given (taking into account shared resources and write authorizations). The backup service running under Windows must be started with the appropriate user.
- It is not recommended to run other SQL servers on the server.
- When installing Firebird[®], performing the HDB check and working on the database, it is essential to terminate the *data loader service*.
- Administrator authorization is necessary to install *FRAKO-NET* and *EMVIS-NET* (please also take into account the domain rights)
- A *FRAKO-NET* update must be carried out on all PCs in the system.
- In order to use *EMIS Report*, Version 2000 (or later) of Excel is necessary. It is recommended to install Microsoft Office
- If a PC is suitable for remote maintenance, access to the Internet must be made available.
- Client computers must have full access authorization to the *FRAKO-NET* directory of the server.

4. System limits (hardware)

4.1 EMIS[®] 1500 system points

The EMIS[®] 1500 data collector is provided with a points system, the number of system points depending on the capacity of the instrument:

EMIS [®] 1500 S	50 system points	EMIS [®] 1500 XL	350 system points
EMIS [®] 1500 M	100 system points	EMIS [®] 1500 XXL	550 system points
EMIS [®] 1500 L	200 system points		

The smaller instrument capacities can be upgraded as far as the EMIS[®] 1500 XXL size by purchasing appropriate enabling codes.

System points are also assigned to individual instruments or channels:

EML 1101	30 system points	PL-Master pro Sensor	3 system points
EMA 1101	15 system points	Pro Kanal	1 system points
EMPQ 1500	7 system points		
EMR 1100	5 system points		

These system points are subtracted from the EMIS[®] 1500 point account in accordance with the configuration. For some instruments it is possible to register not the complete instrument but only individual measuring points as channels. In this case the system points listed above do not apply, but only those for the registered channels. Further information can be obtained from the online help of the SYSTEM-SW software.

4.2 Network and buses

4.2.1 Ethernet

Size and extent: According to the possibilities of the Ethernet

Speed: All Ethernet components of the EM System must be connected with a speed of at least 10 Mbit/s. The connections from the user computer to the central computer should have a speed of at least 100 Mbit/s.

Standard: 10BaseT or 100BaseT connection compatible with IEEE 802.3 (RJ45 jack on the instruments)

The transmission speeds of the EM instruments are as follows:

EMIS [®] 1500 ...	100 Mbit/s	COM-Server	10 Mbit/s
EMG 1500	100 Mbit/s	PL-Master	10 Mbit/s
COM-Server for Modbus-TCP	100 Mbit/s		
Modbus-TCP instruments	10 or 100 Mbit/s		
EIB Nk1	10 / 100 Mbit/s		

4.2.2 FRAKO Starkstrombus®

- Bus length:** Max. 1000 m; with repeaters the distance between master and slave must not exceed 15 km; the distance between masters must be a maximum of 1.5 km.
- Bus devices:** 32 instruments may be operated per bus cable. If repeaters are used, 120 instruments can be operated in a bus system.
- Bus cable:** Characteristic impedance is 120 Ω ; shielded twisted pair
- Additional information:** If two repeaters are used, a long-distance bus of 4 km can be installed. The bus can also be extended by means of optical fibre couplers.

4.2.3 Other bus systems

The EM System can be used with other bus systems that it supports. The specifications of these bus systems can be obtained from the literature or the Internet. They comprise:

- RS232:** V24 standard. The maximum distance is 15 m. The possibility of potential differences must be taken into account (provide galvanic isolation?).
- M-Bus:** The maximum transmission speed is 9600 Baud. The FRAKO EM System only works with primary addresses. It is not possible to commission this bus system with the FRAKO-NET software. External tools are necessary, such as *MBCONF* from the company Relay GmbH.
- Modbus:** The design and limitations of this bus system are described in the literature.
- EIB:** The design and limitations of this bus system are described in the literature. It is not possible to commission this bus system with the FRAKO-NET software. (External tools are necessary, such as *ETS-3*).

Energie-Management-System

Sales Programme



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