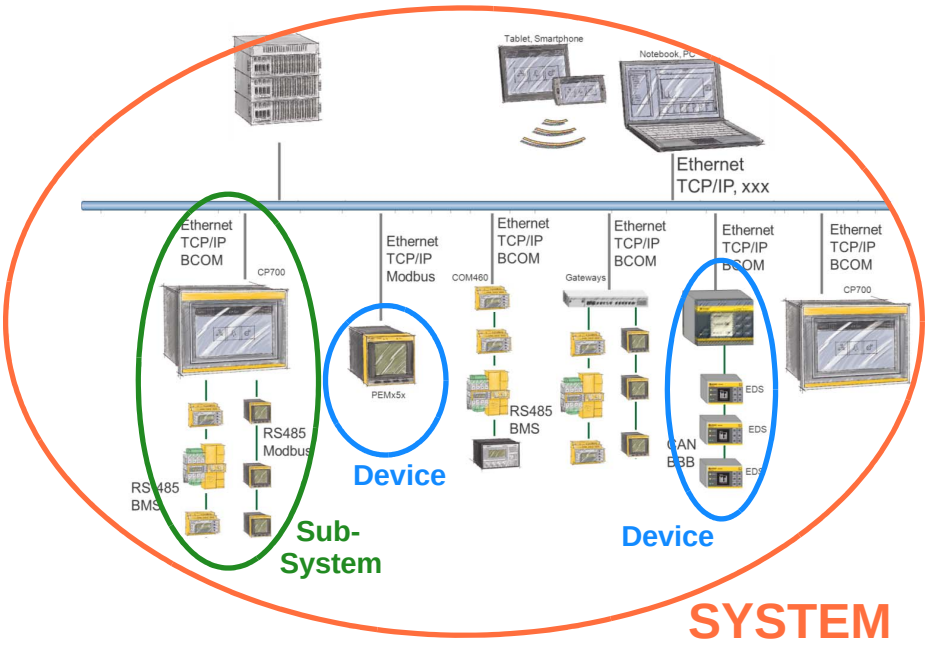
EN Manual

BENDER
The Power in Electrical Safety©

BCOM



Protocol for communication between Bender devices via an IP-based network

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Photos: Bender archives and bendersystembau archives.

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1. Making effective use of this documentation

1.1 How to use this manual

This manual describes BCOM, a protocol for the communication between Bender devices via an IP-based network. **The manual is aimed at qualified experts in electrical engineering and communications technology!**

Before using the devices please read:

- This manual. It describes the basic functions of the BCOM interface.
- The manual for the gateway used.
- The manual "COMTRAXX". It describes the functions of the web user interface for Bender gateways.
- The manuals for the system components.
- The sheet "Important safety instructions for Bender products"

As well as, if the related interface is used:

- The instruction leaflet "BMS bus".

This document must be kept in an easily accessible location near to the equipment.

If you have any questions, please do not hesitate to contact us. For this purpose contact our Technical Sales Department. We are also happy to provide on-site service. Please contact our Service Department for more information.

Although great care has been taken in drafting this manual, it may nevertheless contain errors and mistakes. The Bender Group cannot accept any liability for injury to persons or damage to property resulting from errors or mistakes in this manual.

Gateways of the COMTRAXX® series are also referred to as gateways for short in this manual. COMTRAXX® is a registered trademark of Bender GmbH & Co. KG.

This manual explains Bender-specific terms and functions in detail. Familiarisation with general specialist IT and network terminology is considered a prerequisite. These terms are therefore only explained briefly in this manual (see also "Terms used" on page 20). You will find more detailed explanations in the related specialist literature and on the Internet.

1.2 Explanations of symbols and notes

The following terms and symbols are used to denote hazards and instructions in Bender documentation:

*This signal word indicates that there is a **high** risk of danger, which **will** result in **death** or **serious injury** if not avoided.*

WARNING

*This signal word indicates a **medium** risk of danger that **can** lead to **death** or **serious** injury if not avoided.*

CAUTION

*This signal word indicates a **low** level risk, which **can** result in minor or **moderate injury** or d**amage to property** if not avoided.*

This symbol denotes information intended to assist the user in making optimum use of the product.

1.3 Safety instructions

1.3.1 Work on electrical installations

DANGER

Risk of fatal injury from electric shock
Any work on electrical installations that is not carried out properly can lead to death and injury!
► *Only skilled persons are permitted to carry out the work necessary to install, commission and run a device or system.*

- Compliance with applicable regulations governing work on electrical installations, and with the regulations derived from and associated with them, is mandatory. EN 50110 is of particular importance in this regard.
- If the device is used in a location outside the Federal Republic of Germany, the applicable local standards and regulations must be observed. European standard EN 50110 can be used as a guide.

1.3.2 Setting addresses

For correct function of the communication via BCOM, the correct assignment of addresses to the connected devices is of utmost importance.

CAUTION

The duplicate assignment of addresses can cause serious malfunctions in the bus systems affected.
► *Ensure the devices are correctly addressed.*

2. Description of function

2.1 General

BCOM is a protocol for the communication between Bender devices via an IP-based network. The communication is based on standard Ethernet hardware, TCP/IP or UDP/IP protocol and other standardised network services. The communication between Bender devices can take place in parallel with office communication and use the same infrastructure.

BCOM

- Is based on IP (Internet Protocol)
- Uses standard protocols: IP, UDP, TCP, DHCP, mDNS, NTP, JSON, …
- Is convenient for the user – beyond the standards – due to Bender's additions
- Is “plug and play”
- Is scaled and is independent of the communication topology
  - From no communication to full networking
  - Number of devices: 1…64 000
  - No server or master required
- Possibility for future integration of non-BCOM devices via proxies (not available yet)

2.2 Characteristics of BCOM

2.2.1 Measured values and alarm messages

BCOM permits two processes for distributing measured values and alarms in the system.

- In the simplest process the related device is polled directly. Of course, the requesting station can request data regularly.
- The second possibility is to subscribe to measured values and alarms on the device polled. The required data are sent to the requesting station.

2.2.2 Control

Control commands are used to instruct the addressed device to undertake specific actions, e.g. to run a test.

2.2.3 Setting parameters

Along with the possibility of making settings directly on the device, settings can also be made via BCOM. This feature is particularly important for devices on which the controls are difficult to access or that do not have any controls.

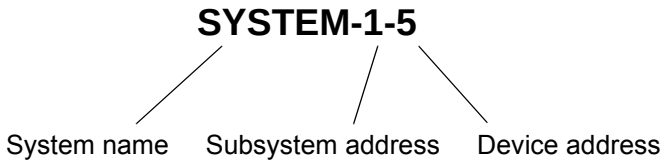
2.2.4 Proxies (function not available yet)

Proxies are surrogates for "non"-BCOM devices. They translate from BCOM to the respective third-party system and back. In the BCOM direction they behave like subsystems and the other way they behave like the third-party system.

2.3 Address assignment

2.3.1 Structure of the BCOM address

To make commissioning and system maintenance easier for the user of a Bender system, all devices are identified via names. The name can be set on the device (display) or using software. A 3-layer addressing scheme is used:



The **system** is the overall installation that is visible to the customer and that is defined by the customer. The BCOM communication takes place within this system. Of course, different systems can exist independently of each other in a network.
The **subsystem** structures parts of the system as customer-defined units, e.g. all PQ devices. Devices "without BCOM support" hidden behind a proxy are also a typical subsystem.
The **device** is the smallest unit that can be addressed via BCOM, e.g. an Isometer.
A device can also comprise several parts (example: Isometer iso685-S with display FP200 for front panel cut-out).

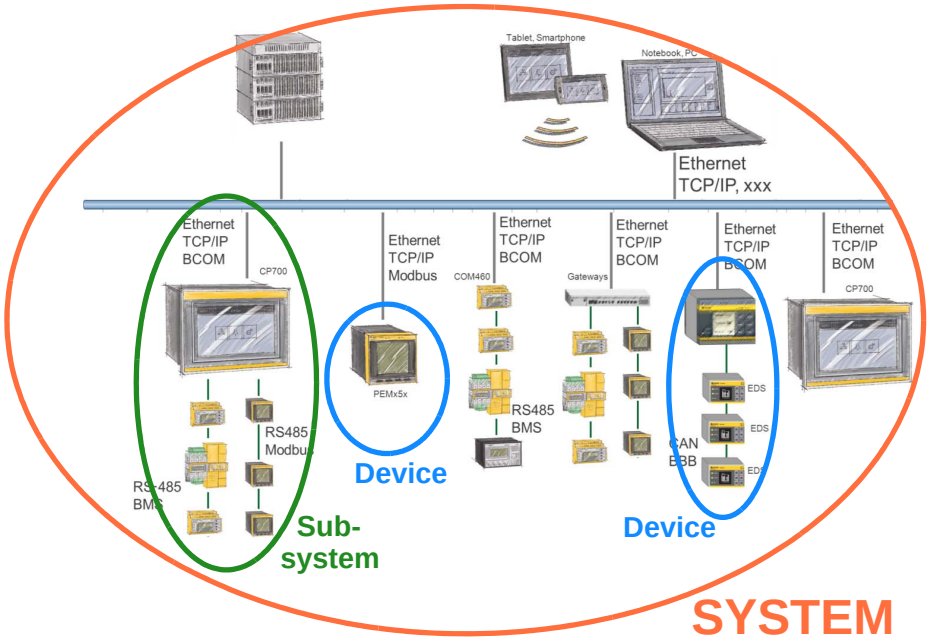


Abb. 2.1: System, subsystem, device

2.3.2 Several systems in a network

Different systems can exist independently of each other in a network. Only BCOM devices that have the same system name can communicate with each other.

Example
A device with the name "Areal-3-19" can communicate with the device "Areal-4-3". Both belong to the system with the name "Areal". Despite being located in the same network, neither of them can communicate with a device "Campus-3-11", as "Campus" represents a different system.

2.3.3 Address space BMS, Modbus, BCOM

The table shows the different address spaces for the BMS, Modbus and BCOM interfaces.

BMSi Column 1 (green) represents the addresses 1…150 on the internal BMS bus (address 1 = master).

BMSe The external BMS bus is represented by the range column 1…99 (ext. BMS bus address) and row 1…150 (int. BMS bus address).

Modbus RTU and **Modbus TCP**. The devices can be assigned addresses from 1…247 (column 1). If communication with the devices is via BCOM, the range covers (light yellow) column 1…255 (subsystem address) and row 1…247 (device address).

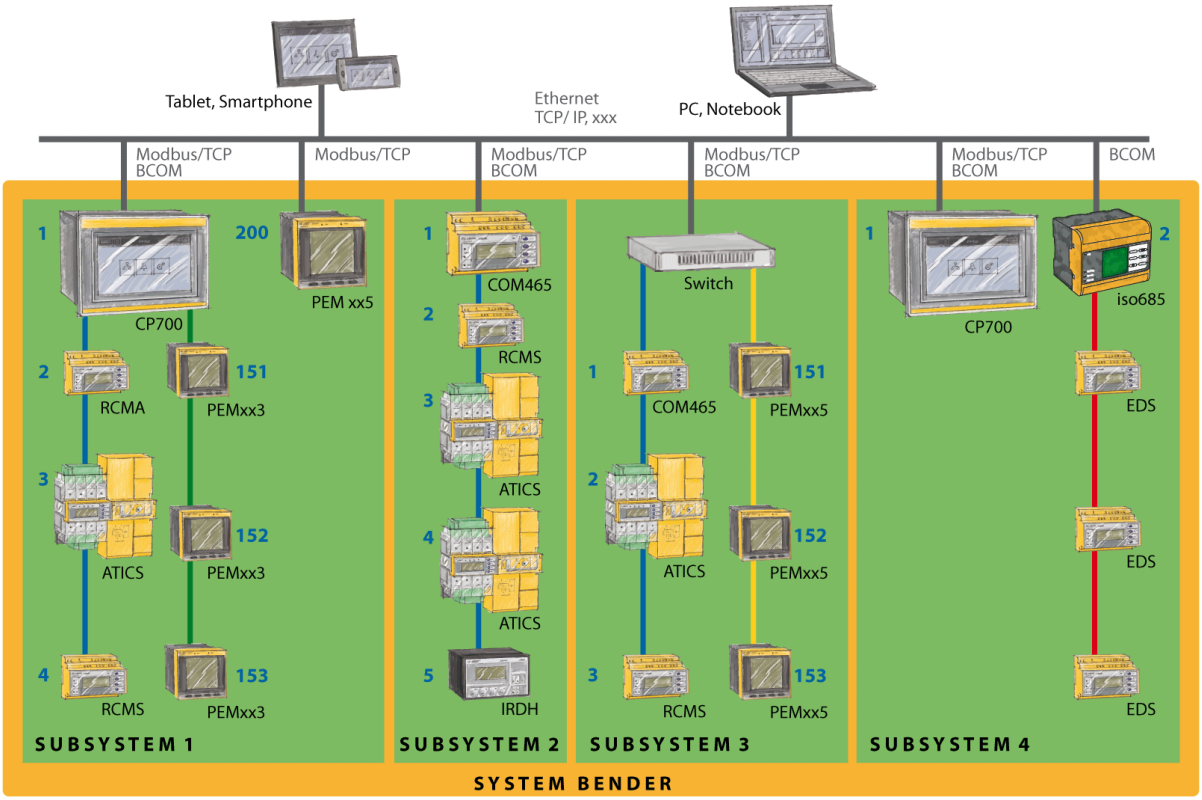
BCOM The largest address space is provided by the BCOM interface (orange).

BCOM device address row 1…255

BCOM subsystem address column 1…255. The column is defined by the subsystem address of the connected gateway.

BCOM system name		← Subsystem address →										
		BMS i										
		BMS e										
		BCOM Subsystem address										
Subsystem addr. →		1	2	3	…	98	99	100	…	120	…	255
← Device address →	BMS i Master	1	1		…	1	1					
	BMS i Slave	2										
		3				3						
		…										
		30										
		31										
		…										
		60										
		61										
		…				66						
		90										
		…										
		99										
		100										
		…										
		110										
		…										
		120										
		121										
		…										
		150			…		150					
	Modbus Slave	…				183						
		247										
	BCOM Device address	…								253		
		255									…	255

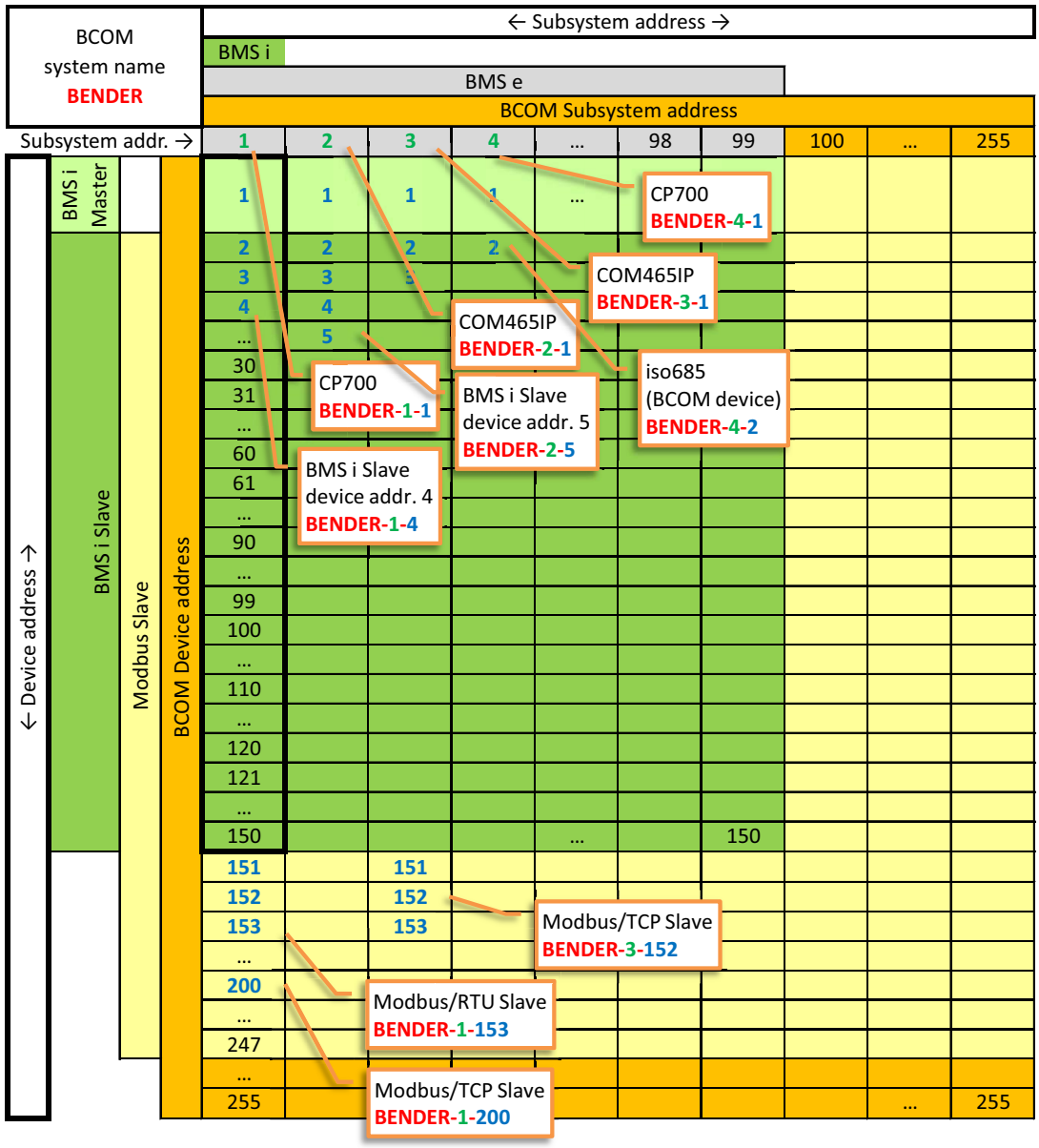
Example
Addresses are assigned to several Bender devices with different interfaces.



Addresses and interfaces for some of the devices shown in the example:

Device/type	System	Subsystem	Device address	Interface used
CP700	BENDER	1	1	BMS internal/ BCOM
RCMS	BENDER	1	4	BMS internal
PEMxx3	BENDER	1	153	Modbus RTU
PEMxx5	BENDER	1	200	Modbus TCP
COM465IP	BENDER	2	1	BMS internal/ BCOM
IRDH	BENDER	2	5	BMS internal
COM465IP	BENDER	3	1	BMS internal/ BCOM
PEMxx5	BENDER	3	152	Modbus TCP
CP700	BENDER	4	1	BCOM
iso685 + 4*EDS	BENDER	4	2	BCOM

Address space for the example



2.4 Automatic login to the system (Auto-discovery)

In order to avoid manual configuration of the devices during the commissioning of a system, the devices introduce themselves to each other. For this purpose all devices notify the entire system of their name. Each device can store the names of the system devices and communicate with them if necessary. There is no central address list.

Example

The device Bender-1-7 is present in the system. Bender-1-11 is added to the system and introduces itself. Bender-1-7 then stores the new device and introduces itself on request. Both devices now know each other's name and can communicate with each other (see figure).

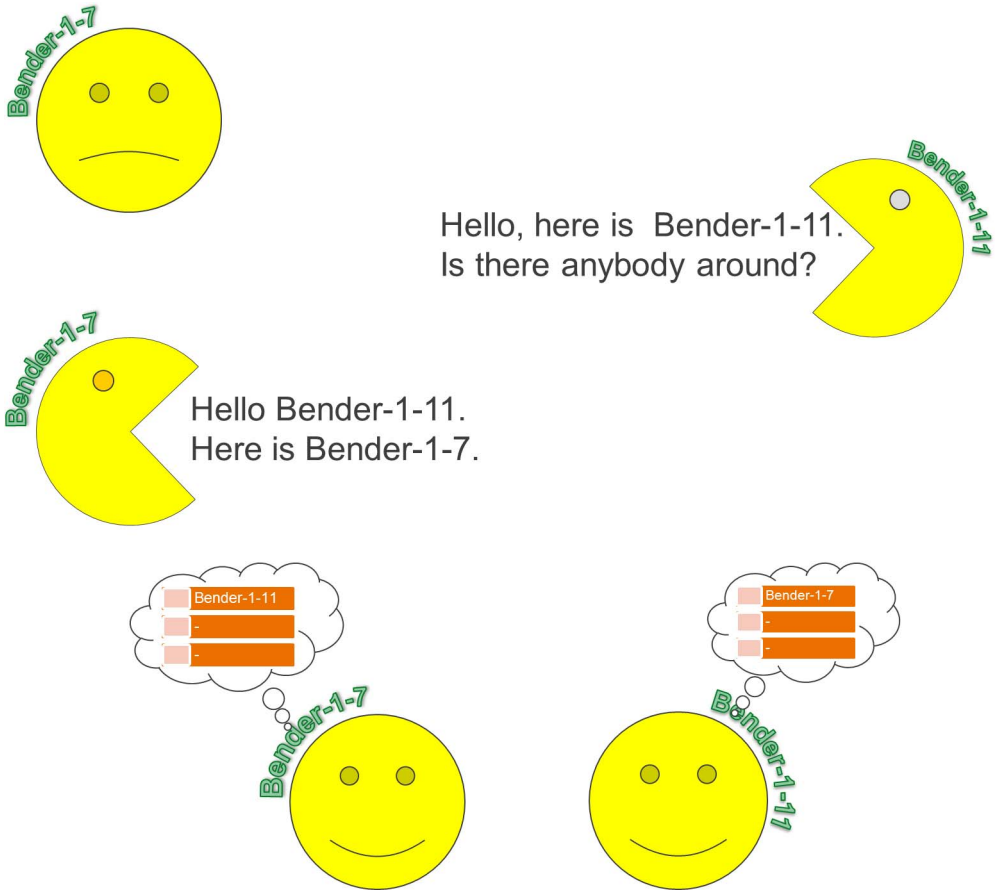


Abb. 2.2: Auto-discovery

3. Installation and commissioning

3.1 Preliminary considerations

1. Have all the questions regarding the installation been answered by the technician responsible for the installation?
2. Does the computer network comprise a DHCP server? - The IP address is obtained automatically. Otherwise, the network data such as the IP address and subnet allocated by the person responsible for the electrical installation have to be set manually.
3. Ask for the IP address of the NTP server, which is required for automatic time setting.
4. Are suitable PC hardware and software available for commissioning? - Some devices have a web user interface. You will find the system requirements in the manual for the respective device.

3.2 System requirements

- Ethernet cabling and a switch.
- The devices must be connected via standard Ethernet components.
- All of the ports stated in chapter "3.3" must be opened for the communication on the internal network.
- Some BCOM functions (operation without DNS server, ISOnet) are only possible within a subnet.
- Only the required ports must be unlocked for external access via the Internet (HTTP) or Modbus TCP.

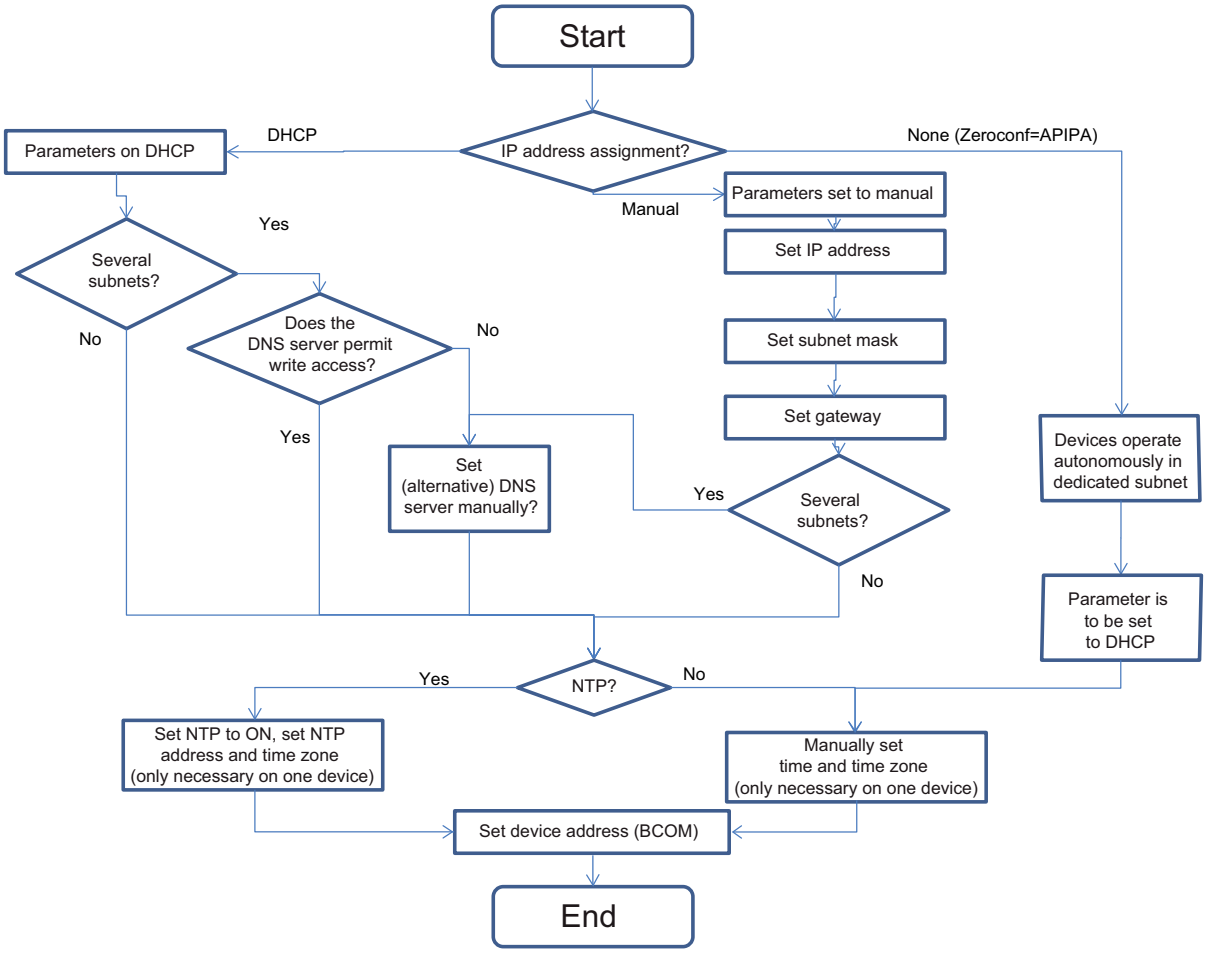
3.3 Protocols and ports used

- DNS (53)
- DHCP (67, 68)
- HTTP (80), web access to the configuration interface
- NTP (123), only if NTP is used
- Modbus TCP: (502).
  Example: to set parameters via building management system or for visualisation.
- mDNS (multicast on port 5353)
- BCOM (48862)

3.4 Address assignment

3.4.1 Ethernet address assignment

BCOM uses the existing IT infrastructure. For this reason the following settings are necessary for the IP address and time synchronisation:



3.4.2 BCOM address assignment

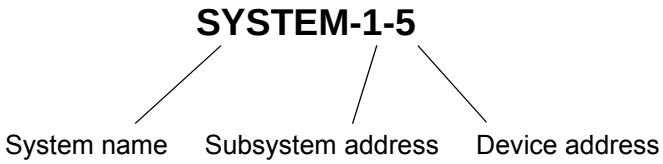
CAUTION

Malfunction due to incorrect address data

*Incorrect address data settings can cause serious malfunctions in the affected BCOM networks. Observe the following **basic rules**:*

- *Each BCOM device must have a unique BCOM address, comprising system name, subsystem address and device address*
- *Each BCOM device must have an IP address (DHCP or manual configuration)*
- *If the IP address is configured manually, the default gateway and subnet mask must also be set.*
- *Each device requires a network connection.*
- *A DNS server is required for communication across multiple IP subnets.*

Each Bender device is assigned one BCOM address. The BCOM address comprises:



System name
Set the system name. Only devices with the same system name can communicate with each other. In this way several systems can be established separately on the same network. The system name is allowed to be a maximum of 16 characters long. Only the following characters are allowed: a…z, A…Z, 0…9 and the character "_". The character "-" is not allowed.

Risk of duplicate addresses if system name is not changed.
The factory setting for the system name on all Bender devices is "SYSTEM". If several systems are established in the same network, there is a risk that addresses will be assigned more than once.
► *Therefore always assign a new system name.*

Subsystem address
The subsystem address is used to structure large systems in a clearer manner. It is also required on the usage of gateways.
Set the name of the network subsystem in which devices are located. The devices can communicate with the same or different subsystem addresses.
EXCEPTION: To be able to use the ISOnet function, all devices must have the same subsystem address.

Device address
Assign a device address. Each device must have a different address so that it
can be distinguished from other devices in the system and can communicate correctly.

Timeout (does not apply to CP700 and COM465…)
Set a timeout for messages.
This time defines how long a device is allowed to take to respond.
Example ISO685: in the case of an ISOnet timeout the error message "Address failure" is output.

TTL for subscription (does not apply to CP700 and COM465…)
Set a time (TTL = Time To Live).
This time defines the intervals at which a BCOM subscriber sends messages, e.g. to a gateway. If it is not possible to make this setting, this time is set to a pre-defined value in the device.

Important messages (e.g. insulation alarm or large value change) are always sent immediately.

3.4.3 BCOM settings menu

To set the BCOM parameters, BCOM devices have a standard menu. Example for the menu structure in the CP700:

Menu text	Sub-item	Parameter
Interface		
- BCOM		
	System name	16 characters
	Subsystem	1 … 255
	Device address	1 … 255
- Ethernet		
	IP address	IP address
	SN (subnet mask)	IP address
	Standard gateway	IP address
	DNS server	IP address
	DHCP	on/off
	t(off) for DHCP	5 s…60 s
- BMS (not available in all devices)		
	BMS address	1 … 90
	Interval	1 s… 3 s
	Protocol	BMSi/BMSe
- Modbus TCP		
	Modbus TCP	on, off
- Modbus RTU (not available in all devices)		
	Modbus	on/off
	Baud rate	e.g.: 9600, 19200, 38400, 57600
	Parity	none/even/odd

3.4.4 Setting parameters

The following ways of configuring BCOM devices exist:

- Make settings directly on the device. This action is only possible on devices that have buttons and a display.
- Make settings via web user interface.
  - Connect device to network or directly to PC using a LAN cable.
  - Start a web browser.
  - Open configuration page: type http://<IP address> in the address bar in the web browser (or in systems with DNS server: http://<device name>).
- Make settings in a different device that can display the menu on the device to be configured as an "external device" and transfer the settings made to the device.

3.4.5 BCOM DiscoveryTool/address assignment (in preparation)

All devices that are connected to the same subnet (LAN segment) can be found using the "DiscoveryTool". Devices are not found if they have been set, on the menu or via the web interface, to an unknown IP address with an unknown subnet.

If the device has a display, the unknown address can be changed to a known value. Devices of the COMTRAXX family also have an additional static IP address that makes it possible to set the parameters using a PC.

3.4.6 Time synchronisation

BCOM devices synchronise their clocks automatically. For this purpose the time must be set on any one device (see diagram "Ethernet address assignment" on page 14). If an NTP server is available, it should be used to obtain better accuracy.

3.5 Coupling different sites

The protocols used are stated in chapters "General" and "Protocols and ports used". The corresponding rules are to be observed.

3.6 Troubleshooting

1. Determine which network configuration is used (static, DHCP, zeroconf)
2. Write down the parameters and check logically
3. Check address settings (system name, subsystem address, device address)
4. Check parameter settings in the devices
5. Connect devices together directly and test (switch could be faulty)
6. Connect laptop directly and test using ping and web interface

4. Appendix

4.1 Frequently Asked Questions

Which cable lengths are allowed?
The same requirements as for Ethernet apply.

Which media (e.g. optical fibre, WLAN, …) can be used?
The same requirements as for Ethernet apply.

Is the protocol routable, also with slow connections?
The protocol is routable to a limited extent. Internally there are currently timeouts in the range of >100 ms.

The isonet part is not routable. The time synchronisation is not routable. Time synchronisation beyond the subnet is not possible.

4.2 Terms used

BMS	Bender measuring device interface (RS-485 interface with BMS protocol)
DHCP	Dynamic Host Configuration Protocol. It is used to assign the network configuration to clients using a server.
Domain	Domain name for the network
Gateway	Connects devices and networks that operate with different interfaces and protocols.
HTTP	Hypertext Transfer Protocol. File transfer protocol: is used in particular for loading web pages in a browser
IP	Internet Protocol. A unique IP address must be assigned to each device.
ISOnet	Function of Bender insulation monitoring devices (e.g. ISOMETER® iso685-D). Only one ISOMETER® may exist in an isolated system. If several systems monitored by ISOMETERs® are coupled together, this function ensures that only ISOMETER® actively measures.
LAN	Local Area Network. Local network, e.g. in businesses.
LAN segment	Section of a LAN
mDNS	Multicast DNS. Is an element of zeroconf.
Modbus	A communication protocol
Multicast	Data transfer to a closed device group.
NTP	Network Time Protocol. Synchronisation standard for watches in PC networks.
Ping	Sends a data packet to determine whether the connection is working
Proxy	Surrogate for one or more other devices.
UTC	Coordinated Universal Time.
Web interface	Configuration interface for a device.
Zeroconf	Zero Configuration Networking. Zeroconf is a process for the configuration of PC networks (e.g. automatic assignment of an IP address).

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