

imc BUSDAQflex

Manual

Edition 9 - 2024-04-24



Disclaimer of liability

The contents of this documentation have been carefully checked for consistency with the hardware and software systems described. Nevertheless, it is impossible to completely rule out inconsistencies, so that we decline to offer any guarantee of total conformity.

We reserve the right to make technical modifications of the systems.

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The software described in this document may only be used in accordance with the provisions of the "imc Software License Agreement".

Open Source Software Licenses

Some components of imc products use software which is licensed under the GNU General Public License (GPL). Details are available in the About dialog.

A list of the open source software licenses for the imc measurement devices is located on the imc STUDIO/imc WAVE/imc STUDIO Monitor installation medium in the folder "*Products\imc DEVICES\OSS*" or "*Products\imc DEVICEcore\OSS*" or "*Products\imc STUDIO\OSS*". If you wish to receive a copy of the GPL sources used, please contact our tech support.

Notes regarding this document

This document provides important notes on using the device / the module. Safe working is conditional on compliance with all safety measures and instructions provided. The manual is to be used as a kind of reference book. You can skip the description of the modules you do not have.

Additionally, all accident prevention and general safety regulations pertinent to the location at which the device is used must be adhered to.

These instructions exclusively describe the device, **not how to operate** it by means of **the software!**

If you have any questions as to whether you can set up the device / module in the intended environment, please contact our tech support. The measurement system has been designed, manufactured and unit-tested with all due care and in accordance with the safety regulations before delivery and has left the factory in perfect condition. In order to maintain this condition and to ensure safe operation, the user must observe the notes and warnings contained in this chapter and in the specific sections applicable to the concrete device. Never use the device outside the specification.

This will protect you and prevent damage to the device.

Special notes

Warning

Warnings contain information that must be observed to protect the user from harm or to prevent damage to property.

Note

Notes denote useful additional information on a particular topic.

Reference

A reference in this document is a reference in the text to another text passage.

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1 General introduction

1.1 Tech support

If you have problems or questions, please contact our tech support:

Phone: (Germany): **+49 30 467090-26**
E-Mail: hotline@imc-tm.de
Internet: <https://www.imc-tm.com/service-training/>

Tip for ensuring quick processing of your questions:

If you contact us **you would help us**, if you know the **serial number of your devices** and the **version info of the software**. This documentation should also be on hand.

- The device's serial number appears on the nameplate.
- The program version designation is available in the About-Dialog.

Product Improvement and change requests

Please help us to improve our documentation and products:

- Have you found any errors in the software, or would you suggest any changes?
- Would any change to the mechanical structure improve the operation of the device?
- Are there any terms or explanations in the manual or the technical data which are confusing?
- What amendments or enhancements would you suggest?

Our [tech support](#) will be happy to receive your feedback.

1.2 Service and maintenance

Our service team is at your disposal for service and maintenance inquiries:

E-Mail: service@imc-tm.de
Internet: <https://www.imc-tm.com/service>

Service and maintenance activities include, for example calibration and adjustment, service check, repairs.

1.3 Legal notices

Quality Management



imc Test & Measurement GmbH holds DIN EN ISO 9001 certification since May 1995 and DIN EN ISO 14001 certification since November 2023. You can download the CE Certification, current certificates and information about the imc quality system on our website:

<https://www.imc-tm.com/quality-assurance/>.

imc Warranty

Subject to the general terms and conditions of imc Test & Measurement GmbH.

Liability restrictions

All specifications and notes in this document are subject to applicable standards and regulations, and reflect the state of the art well as accumulated years of knowledge and experience. The contents of this document have been carefully checked for consistency with the hardware and the software systems described. Nevertheless, it is impossible to completely rule out inconsistencies, so that we decline to offer any guarantee of total conformity. We reserve the right to make technical modifications of the systems.

The manufacturer declines any liability for damage arising from:

- failure to comply with the provided documentation,
- inappropriate use of the equipment.

Please note that all properties described refer to a closed measurement system and not to its individual slices.

Guarantee

Each device is subjected to a 24-hour "burn-in" before leaving imc. This procedure is capable of detecting almost all cases of early failure. This does not, however, guarantee that a component will not fail after longer operation. Therefore, all imc devices are granted liability for a period of two years. The condition for this guarantee is that no alterations or modifications have been made to the device by the customer.

Unauthorized intervention in the device renders the guarantee null and void.

Notes on radio interference suppression

imc BUSDAQflex devices satisfy the EMC requirements for an use in industrial settings.

Any additional products connected to the product must satisfy the EMC requirements as specified by the responsible authority (within Europe¹) in Germany the BNetzA - "Bundesnetzagentur" (formerly BMPT-Vfg. No. 1046/84 or No. 243/91) or EC Guidelines 2014/30/EU. All products which satisfy these requirements must be appropriately marked by the manufacturer or display the CE certification marking.

Products not satisfying these requirements may only be used with special approval of the regulating body in the country where operated.

All lines connected to the imc BUSDAQflex devices should not be longer than 30 m and they should be shielded and the shielding must be grounded.

Note

The EMC tests were carried out using shielded and grounded input and output cables with the exception of the power cord. Observe this condition when designing your setup to ensure high interference immunity and low jamming.

¹ If you are located outside Europe, please refer the appropriate EMC standards used in the country of operation.

Cables and leads

In order to comply with the value limits applicable to Class B devices according to part 15 of the FCC regulations, all signal leads connected to the imc BUSDAQflex devices must be shielded.

Unless otherwise indicated, no connection leads may be long leads (< 30 m) as defined by the standard IEC 61326-1. LAN-cables (RJ 45) and CAN-Bus cables (DSUB-9) are excepted from this rule.

Only cables with suitable properties for the task (e.g. isolation for protection against electric shock) may be used.

ElektroG, RoHS, WEEE, CE

The imc Test & Measurement GmbH is registered with the authority as follows:

WEEE Reg. No. DE 43368136

valid from 24.11.2005



Reference

<https://www.imc-tm.com/elekrog-rohs-weee/> and <https://www.imc-tm.com/ce-conformity/>

FCC-Notice

This product has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult our tech support or an experienced technician for help.

Modifications

The FCC requires the user to be notified that any changes or modifications made to this product that are not expressly approved by imc may void the user's authority to operate this equipment.

1.4 Explanation of symbols



CE Conformity

see CE [chapter 1.2](#)



No household waste

Please do not dispose of the electrical/electronic device with household waste, but at the appropriate collection points for electrical waste, see also [chapter 1.2](#).



Potential compensation

Connection for potential compensation



Grounding

Connection for grounding (general, without protective function)



Protective connection

Connection for the protective conductor or grounding with protective function



Attention! General danger zone!

This symbol indicates a dangerous situation; Since there is insufficient space for indicating the rated quantity at the measuring inputs, refer to this manual for the rated quantities of the measuring inputs before operation.



Attention! Injuries from hot surfaces!

Surfaces whose temperatures can exceed the limits under certain circumstances are denoted by the symbol shown at left.



ESD-sensitive components (device/connector)

When handling unprotected circuit boards, take suitable measures to protect against ESD (e.g. insert/remove ACC/CANFT-RESET).



Possibility of electric shock

The warning generally refers to high measurement voltages or signals at high potentials and is located on devices suitable for such measurements. The device itself does not generate dangerous voltages.



DC, Direct Current

Supply of the device via a DC voltage source (in the specified voltage range)



RoHS of the PR China

The limits for hazardous substances in electrical/electronic equipment applicable in the PRC are identical to those in the EU. The restrictions are complied with (see [chapter 1.2](#)). A corresponding "China-RoHS" label is omitted for formal/economic reasons. Instead, the number in the symbol indicates the number of years in which no hazardous substances are released. (This is guaranteed by the absence of named substances).



Labeling integrated energy sources

UxxRxx are integrated in the symbolism. "U" stands for the installed UPS energy sources, if 0 = not installed. "R" stands for the installed RTC energy sources, if 0 = not installed. You can download the corresponding data sheets from the imc website:

<https://www.imc-tm.com/about-imc/quality-assurance/transport-instructions/>



Observe the documentation

Read the documentation before starting work and/or operating.



On/Off

On/Off button (no complete disconnection from the power supply)

1.5 Last changes in content

Amendments and bug-fix in Edition 9

Section	Amendments
Storage media	updated description of recommended handling

Amendments and bug-fix in Edition 8

Section	Amendments
Batteries	new battery labeling on the name plate

Amendments and bug-fix in Edition 7

Section	Amendments
GPS connection	maximum current = 220 mA, i.e. the 5 V can be loaded with max. 220 mA

2 Safety

This section provides an overview of all important aspects of protection of the users for reliable and trouble-free operation. Failure to comply with the instructions and protection notes provided here can result in serious danger.

Responsibility of the operator

imc BUSDAQflex is for use in commercial applications. The user is therefore obligated to comply with legal regulations for work safety.

Along with the work safety procedures described in this document, the user must also conform to regulations for safety, accident prevention and environmental protection which apply to the work site. If the product is not used in a manner specified by the manufacturer, the protection supported by the product may be impaired.

The user must also ensure that any personnel assisting in the use of the imc BUSDAQflex have also read and understood the content of this document.

Operating personnel

This document identifies the following qualifications for various fields of activity:

- *Users of measurement engineering*: Fundamentals of measurement engineering. Basic knowledge of electrical engineering is recommended. Familiarity with computers and the Microsoft Windows operating system. Users must not open or structurally modify the measurement device.
- *Qualified personnel* are able, due to training in the field and to possession of skills, experience and familiarity with the relevant regulations, to perform work assigned while independently recognizing any hazards.

Warning

- **Danger of injury due to inadequate qualifications!**
- Improper handling may lead to serious damage to personnel and property. When in doubt, consult qualified personnel.
- Work which may only be performed by trained imc personnel may not be performed by the user. Any exceptions are subject to prior consultation with the manufacturer and are conditional on having obtained corresponding training.

Special hazards

This segment states what residual dangers have been identified by the hazard analysis. Observe the safety notes listed here and the warnings appearing in subsequent chapters of this manual in order to reduce health risks and to avoid dangerous situations. Existing ventilation slits on the sides of the device must be kept free to prevent heat accumulation inside the device. Please operate the device only in the intended position of use if so specified.

Danger



Lethal danger from electric current!

- Contact with conducting parts is associated with immediate lethal danger.
- Damage to the insulation or to individual components can be lethally dangerous.

Therefore:

- In case of damage to the insulation, immediately cut off the power supply and have repair performed.
- Work on the electrical equipment must be performed exclusively by expert electricians.
- During all work performed on the electrical equipment, it must be deactivated and tested for static potential.

Injuries from hot surfaces!



- Devices from imc are designed so that their surface temperatures do not exceed limits stipulated in EN 61010-1 under normal conditions.

Therefore:

- Surfaces whose temperature can exceed the limits under circumstances are denoted by the symbol shown at left.

Industrial safety

We certify that imc BUSDAQflex in all product configuration options corresponding to this documentation conforms to the directives in the accident prevention regulations in "Electric Installations and Industrial Equipment" (DGUV Regulation 3)*. This confirmation applies exclusively to devices of the imc BUSDAQflex series, but not to all other components included in the scope of delivery.

This certification has the sole purpose of releasing imc from the obligation to have the electrical equipment tested prior to first use (§ 5 Sec. 1, 4 of DGUV Regulation 3). This does not affect guarantee and liability regulations of the civil code.

For repeat tests, a test voltage that is 1.5 times the specified working voltage should be used to test the isolation for the highly isolated inputs (e.g. measurement inputs for high-voltage applications).

* previously BGV A3.

Observe notes and warnings

Devices from imc have been carefully designed, assembled and routinely tested in accordance with the safety regulations specified in the included certificate of conformity and has left imc in perfect operating condition. To maintain this condition and to ensure continued danger-free operation, the user should pay particular attention to the remarks and warnings made in this chapter. In this way, you protect yourself and prevent the device from being damaged.

Read this document before turning on the device for the first time carefully.

Warning

Before touching the device sockets and the lines connected to them, make sure static electricity is diverted to ground. Damage arising from electrostatic discharge is not covered by the warranty.

3 Assembly and connection

3.1 After unpacking...

Check the delivered system immediately upon receiving it for completeness and for possible transport damage. In case of damage visible from outside, proceed as follows:

- Do not accept the delivery or only accept it with reservations
- Note the extent of the damage on the packing documents or on the delivery service's packing list.
- Begin the claims process.

Please check the device for mechanical damage and/ or loose parts after unpacking it. The supplier must be notified immediately of any transportation damage! Do not operate a damaged device!

Check that the list of accessories is complete (product package):

- AC/DC-power adaptor with appropriate LEMO plug
- Grounding set consisting of: a spring washer S3 (stainless steel), a flat washer (A3.2 DIN 433 A2) and a pan-head screw M3x8 (mounted on the rear panel).
- 1x Ethernet network cable with latch protection (uncrossed, 2 m)
- 1x protective cover for the remote control socket type 0B
- Getting started with imc BUSDAQflex (one copy per delivery)

Note

File a claim about every fault as soon as it is detected. Claims for damages can only be honored within the stated claims period.

3.2 Before commissioning

Condensation may form on the circuit boards when the device is moved from a cold environment to a warm one. In these situations, always wait until the device warms up to room temperature and is completely dry before turning it on. The acclimatization period should take about 2 hours. This is especially recommended for devices without ET (extended environmental temperature range).

We recommend a warm-up phase of at least 30 min prior to measure.

Ambient temperature

The limits of the ambient temperature cannot be strictly specified because they depend on many factors of the specific application and environment, such as air flow/convection, heat radiation balance in the environment, contamination of the housing / contact with media, mounting structure, system configuration, connected cables, operating mode, etc. This is taken into account by specifying the operating temperature instead. Furthermore, it is not possible to predict any sharp limits for electronic components. Basically, reliability decreases when operating under extreme conditions (forced ageing). The operating temperature data represent the extreme limits at which the function of all components can still be guaranteed.

3.3 Notes on connecting

3.3.1 Precautions for operation

Certain basic rules for operating the system, aside from reasonable safety measures, must be observed to prevent danger to the user, third parties, the device itself and the measurement object. These are the use of the system in conformity to its design, and the refraining from altering the system, since possible later users may not be properly informed and may ill-advisedly rely on the precision and safety promised by the manufacturer.

Note

If you determine that the device cannot be operated in a non-dangerous manner, then the device is to be immediately taken out of operation and protected from unintentional use. Taking this action is justified under any of the following conditions:

- I. the device is visibly damaged,
- II. loose parts can be heard within the device,
- III. the device does not work
- IV. the device has been stored for a long period of time under unfavorable conditions (e.g. outdoors or in high-humidity environments).

1. Observe the data in the chapter "Technical Specs", to prevent damage to the unit through inappropriate signal connection.
2. If you are using a internal device drive, observe the notes in the imc software manual. Particular care should be taken to comply with the storage device's max. ambient temperature limitation.
3. Change the removable flash storage with care.

3.3.2 Supply

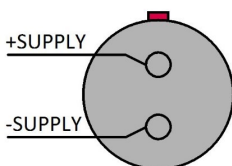
The range of permitted supply voltages is 10 .. 50 V DC. The table-top power supply unit which is included standard delivers 24 V_{DC} at a max. power consumption of 60 W. The AC input voltage can be 110 .. 240V 50/60Hz.

Note

Please note, that the operation temperature of the desktop supply is prepared for 0°C to 40°C, even if your measurement devices is designed for extended temperature range!

Connecting a DC supply source such as a car battery is also fundamentally possible. Note when making such a connection:

- **Grounding** of the device must be provided. If the supply voltage source has a ground reference (ground connected to the (–) terminal), then the device is automatically grounded via the (–) terminal. The table-top power supply unit is configured in this manner.
- The **supply line** must take the form of a low-resistance cable of sufficient cross-section. Any extra (suppression) filters connected in the middle of the supply circuit should not contain any serial inductance coils of more than 1 mH. Otherwise an extra parallel capacitor is needed.



3.3.2.1 Supply of directly connected imc CANSASflex modules

imc BUSDAQflex (BUSFX) is compatible with the imc CANSASflex series (CANFX), CAN-Bus based measurement technique. All modules of the *flex* series (CANFX and BUSFX) can be joined together mechanically and electrically by means of a latching ("click") [mechanism](#)^[39], without the use of any tools nor the need for any extra cables.

Note

The data sheet list the **available power consumption** for the supply of directly connected modules (click-connection) and the max. **current-limit** of the module connector.

3.3.2.2 DC power supply at CAN-Nodes 1 and 2

If desired, the DC power supply can be made accessible at the CAN-nodes 1 and 2 ([DSUB pin 1 and 5](#))^[88]. This connection is directly wired through, bidirectional and with its PTC protected against overload with max. 1 A current limit.

This option provides the possibility to use the DSUB-9 as an output and to power connected imc CANSAS modules. If it is used as an input it is possible to supply the BUSDAQ via CAN-cable (e.g. OBD). In this case there are no current reserves available to supply further connected CANSAS modules!

Note

In each case, using the CAN cable for supply purposes a cable with sufficient cross-section is required.

3.3.2.3 Notes on operation with power supply lead through the device

- With this setup, the maximum current of 1 A must not be exceeded. The CANSAS modules' low power consumption should not be underestimated, since low supply voltages can cause high power values via high current. E.g. two CAN/UNI8 modules with a power consumption of approx. 30 W (with connected sensors) already exceed the limit by having a current of 2 A at 15 V. Additional factors are the voltage drop along long wires, and small wire cross-sections. In any case, it is necessary to first calculate the power consumption and the current strengths to be expected.
- By dint of its engineering, the CAN-bus is ideally suited to re-structuring systems. However, this can easily lead to situations where the current demands and wire cross sections were correctly chosen originally, but the specifications were later violated when the system was gradually supplemented with new modules.
- It is always possible to use only one supply source. If an external supply is applied to the CAN-bus and the BUSDAQ's power supply unit is additionally connected, the BUSDAQ can be damaged irreparably. Under no circumstances may the BUSDAQ's power supply unit be used as an uninterrupted power supply for the connected CAN-Bus system.
- The current limiter attempts to ensure that the measurement is correctly closed and that data loss is thus avoided. Nevertheless, incorrect configuration may lead to data loss or damage of the BUSDAQ unit. When in doubt, please contact our Customer Service department.
- Using -SUPPLY does not replace the CAN_GND connection! CAN_GND should always be connected, independent from this power supply. CAN_GND is necessary to keep a defined level for CAN_H and CAN_L.

3.3.2.4 UPS and power fail function

Automatic conclusion of measurement and data saving upon power outage

imc BUSDAQflex comes with **UPS-functionality** to ensure the integrity of data in case of power outages. When power outage occurs, this functionality prevents loss of data and is referred to as Power Fail. If the power fails, the measurement stops automatically and the data are saved to the internal bulk memory ("μ-Disk": flash media or HDD) in sufficient time.

The parameter "**Buffer-time constant**" specifies the delay time which the device waits to actually initiate automatic conclusion of measurement ("Auto-Shutdown") after a power outage has been detected. This prevents a measurement from being stopped after only very short power outages. For all imc BUSDAQflex device varieties, the buffer time constant is **1 second** and can not be changed by means of the device configuration (unlike in other imc device series).

After elapse of the buffer time constant, the running measurement is stopped and all open measurement files are closed and saved to the device's Flash removable memory (CF-Card, "μ-Disk"). This can typically take **up to 10 more seconds**.

The buffer capacity of the internal **UPS Super-Caps** is sufficient to securely buffer the device's power supply (aggregate buffer time: 11 sec.). The condition for this is that the Super-Caps are fully charged. Super-Caps have higher self-discharge rates than conventional rechargeable batteries and do not keep their charge for long periods even when deactivated. For this reason, it is necessary for the device to have been activated/running for a certain minimum duration (see table) in order to ensure the full function of the "Auto-Data Saving in Power Outage". Accordingly, a sufficiently long time of uninterrupted operation between successive Power-Fail events must be ensured, in order to recharge the Super-Caps and to achieve the full buffer capacity.

Note

- It must be ensured that the device is always deactivated in a controlled way by means of the switch. Simply unplugging the power supply cable causes the buffering Power Fail function to become active, which unnecessarily discharges the Super-Caps.
- If the device is always only powered very briefly for the duration of very short measurements, correct working of the Power Fail function can not be assured.

3.3.2.5 Main switch

Switch ON

The device's *main switch* is a power-on button with a built-in "POWER"-LED which must be pressed down for approx. 1 sec. to achieve activation, indicated by the "POWER"-LED flashing. If the device boots correctly, three short beep-tones are emitted.

Switch OFF

To switch the device off, press the power-on button again down for approx. 1 sec, what will cause a constant blinking of the "POWER"-LED. This causes the device to not be deactivated abruptly during a running measurement. Instead, any files on the internal hard drive involved are closed before the device switches off by itself. This process takes up to 10 sec. Holding the power-on button down is not necessary!

If no measurement is currently running, it takes only approx. 1 sec. for the device to be deactivated.

3.3.2.6 Remote On/Off

The imc BUSDAQflex can be activated and deactivated via the Control switch. When the pin Remote On/Off is connected with -Supply via a push-button switch, the device can be activated/ deactivated as with the blue LED-button. I.e., one short push of the button switches the device on or off after a brief delay.

If these pins are **connected via a closed two-way switch, the device remains on throughout**. In such a case, the device's blue push-button switch has no effect! In order to turn the device off, the switch must be opened and then closed again, mimicking the behavior of a push-button switch. Please note: Depending on the [BUSFX variant](#)⁵⁵, the behavior is different.



Reference

Please find here the [pin configuration of the CTRL-socket](#)⁸⁷.

3.3.3 Grounding, shielding

In order to comply with Part 15 of the FCC-regulations applicable to devices of Class B, the system must be grounded. The same applies to the specified technical data.

3.3.3.1 Grounding

The grounding set supplied with the device can be used to ground your device. This grounding set consists of: a spring washer S3 (stainless steel), a flat washer (A3.2 DIN 433 A2) and a pan-head screw M3x8 (mounted on the rear panel).

When using the included table-top power adapter, this is ensured by the protection ground terminal: at the **LEMO terminal of the included table-top power adapter**, both the power supply's negative contact, and the shielding and connector pod are connected with the network cable's protection ground.

The DC power voltage applied to the device itself (**LEMO-socket**) is **not isolated**, i.e. it has contact with the electrical system ground ("GND") or the frame ("CHASSIS")!

When drawing power from an isolated DC power supply (e.g. battery), be sure to provide grounding by making a connection to the frame.

3.3.3.2 Shielding

As a matter of principle, the use of shielded and grounded cabling is required in order to comply with the relevant EMC and interference suppression limits.

In many cases, the use of an affordable multi-wire single-layer shielded cable (even for multiple channels) is adequate.

Note

- Protect the CAN-H-L against common mode voltage using shielded cables.
- Connect chassis with earth ground.
- Use CAN-Ground.
- Use shielded cables, connect shield to chassis.
- To avoid compensation currents, always connect the shielding to one side (potential) only.




3.3.4 Fuses (polarity-inversion protection)

The device supply input is equipped with maintenance-free polarity-inversion protection. No fuses or surge protection is provided here. Particularly upon activation of the device, high current peaks are to be expected. When using the device with a DC-voltage supply and custom-designed supply cable, be sure to take this into account by providing adequate cable cross-section.







3.3.5 Batteries

For an uninterruptable power supply (UPS) Super-Caps are used to supply the imc BUSDAQflex device. imc BUSDAQflex devices delivered by imc after November 2022 will have a ["battery label"](#) on the nameplate for integrated energy sources.

3.3.6 Power LED: meaning and codes

	Code	Function
	Permanent blue	Normal operation
	Blue blinking	Power fail recognized or device is switching off

3.3.7 LED Codes

	Code	Function
	Blue blinking upon activation	Normal booting process. After successful booting, the LED extinguishes.
	Blue blinking at 1 s rhythm	Device is in sleep mode.
	Permanent blue	Error after Auto- or Diskstart (e.g. data overflow at the internal drive)
	Permanent orange	Sleep signal recognized - device is within delay time.
	Permanent red	Error

After booting or a successful started measurement after sleep mode the LED is switched off.

3.3.8 Storage media in the device

This section describes how to handle the storage media of the imc measurement devices and how to use them with imc STUDIO.

The storage media are exclusively for data acquisition with imc STUDIO.

Storage media with verified performance can be purchased as accessories from imc. Hard drives are ordered with the device and can only be installed subsequently by imc.



Note

Manufacturer and Age of the storage medium

- imc has no way to affect the quality of the removable storage media provided by the various manufacturers.
- Storage media which come with newly purchased devices have been inspected in the framework of quality assurance and have passed the relevant tests.
- We expressly declare that the use of removable storage media is at the user's own risk.
- imc and its resellers are only liable within the framework of the guarantee and only to the extent of providing a substitute.
- imc expressly declines any liability for any damages resulting from loss of data.

3.3.8.1 For devices of the firmware group A (imc DEVICES)

Swapping the storage medium

Pressing the button signals to the system that you intend to remove the storage medium. Once this is done, the device stops access to the storage medium. If you were to remove the drive without prior announcement, it could produce defective clusters. If the storage medium is removed while a measurement is in progress, the data records are not completed. Therefore, always proceed as follows when swapping the storage medium:

1. **Important!** Before removing the storage medium from the measurement device, first announce the procedure to the system by pushing the button, in order to **avoid damage** to the storage medium.
2. Once the LED blinks, remove the storage medium.
3. Insert the new storage medium. Devices indicate by a short flash that the new drive has been successfully recognized.

Hot-Plug (exchanging the storage medium during a measurement)

It's possible to exchange the storage medium during a running measurement. This makes it possible to carry out a measurement without a PC practically without any limitations. It is only necessary to check the amount of memory available using imc Online FAMOS. To do this, use the function `DiskFreeSpace` belonging to the group "System". You can set an LED, for instance, or a digital output or a beeper to be activated when less than the minimum amount remains. One convenient solution would be to have a readout of the remaining space outputted by a display variable, which would indicate by a display on the device how the remaining memory decreases.

While swapping the storage medium during a running measurement, the data are stored in the measurement device's internal memory. If you complete the process within the specified RAM buffer duration, this is certain to work without any loss of data (see in the imc STUDIO manual "Setup pages - Configuring device" > "Storage options and directory structure" > "RAM buffer time"). Note that not only the time for the swap must be buffered, but that the buffered data must also be transferred to the new disk once the swap has been completed.

Swapping the storage medium

1. **Important!** Before removing the storage medium from the measurement device, first announce the procedure to the system by pushing the button, in order to **avoid data loss and damage** to the storage medium. The LED will **shine continuously** in green.
2. Once the device is ready for removal of the storage medium, the LED **blinks**.
3. Remove the already full storage medium.
4. No announcement is necessary for inserting a storage medium.

3.3.8.1.1 Storage media

Storage media	Description
CF Cards (Compact Flash)	For devices of group A4 and A5 ³⁷ : The device group exclusively uses CF cards for storage medium.

3.3.8.1.2 Data transfer

The internal storage medium can be accessed **directly via Windows Explorer**. Alternatively, the storage medium can be inserted into a **card reader** on the PC (suitable for large amounts of data due to faster transfer).

Warning



- Do **not use force** to insert or remove the device storage medium.
- During a **running measurement** having a high sampling rate, you should **never** try to **access the storage medium in the device** using the Windows Explorer shell. Otherwise, this additional burden could cause a data overflow.

Note

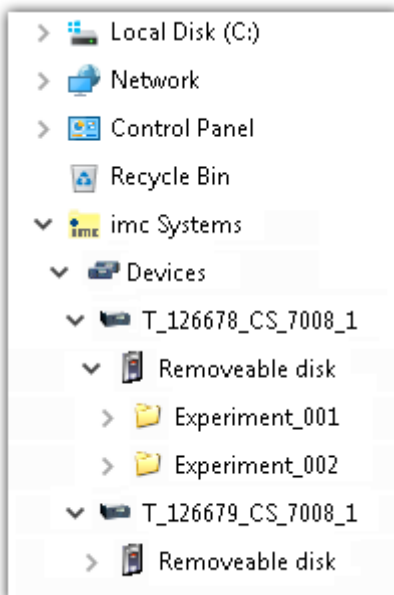
A tip on **interval saving**: Supposing the system's power supply suffers an outage during a measurement, it would not be possible to guarantee that the data file on the storage medium is terminated properly. This may lead to a failure to record the last measurement taken. Saving at intervals is a way to reduce this risk.

Access via Windows Explorer

The menu item "*Data (Device)*" () causes the Windows-Explorer to start while indicating the device selected.

Ribbon	View
Extra > Data (Device) ()	Complete
Home > Data (Device) ()	Standard

Access via "*imc Systems*" - an Explorer shell extension



While installing the operating software, if the option "*Extension for Windows-Explorer*" is activated, you are able to copy, display or delete the files of measured data saved within the device (e.g. on the removable storage medium). The method of doing this is the familiar one under Windows.

This function is independent of the device software. As well, selection of the devices in the tree diagram is independent of the device list in the operating software.

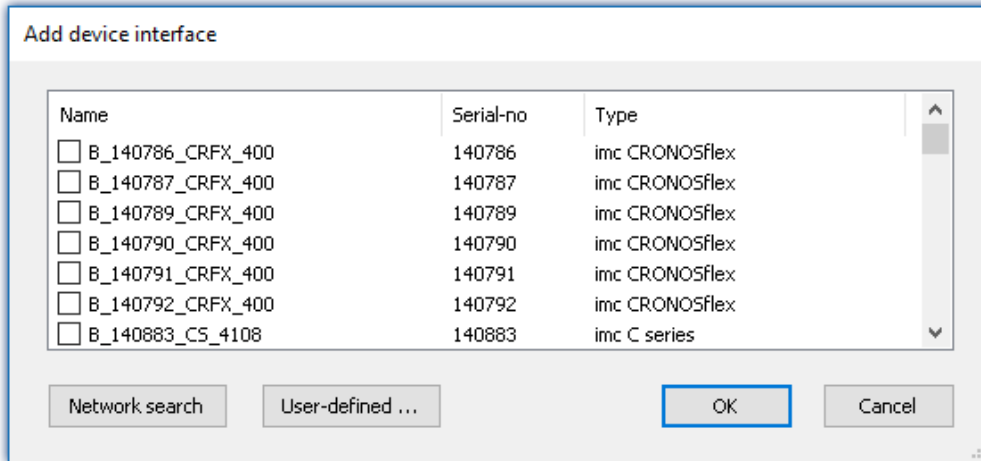
In order to get access to your device's storage medium, you must first add it to the tree diagram (see "[imc Systems - Adding a device](#)"²³). Subsequently, you are able to navigate to the desired data in the storage medium and thus to work with them.

3.3.8.1.2.1 imc Systems - Adding a device (Add)

Even if you have already been connected with the device by means of the imc STUDIO software, it is still not listed in the Explorer. It's possible to measure with one device while copying data from another.

- Click on "Devices" under "imc Systems" to highlight that entry.
- Open the context menu over the "Devices"-area and select "Add".

The "Add device interface" dialog appears:



Add Device interface

Search for devices	Description
Network search	<p>"Network search" causes the system to search the network for any suitable devices. How long this will take depends on how many devices are connected and on the network type. Ultimately, the devices found are listed.</p> <p>Select your measurement device and confirm your selection with "OK". The measurement device is then available.</p>
User-defined	<p>In a structured network (network with routers, Internet, ...), imc devices could not be integrated by means of a network search. With the knowledge of the IP address or of the domain name (DNS name), it is now possible to integrate a device into the list.</p>

Reference

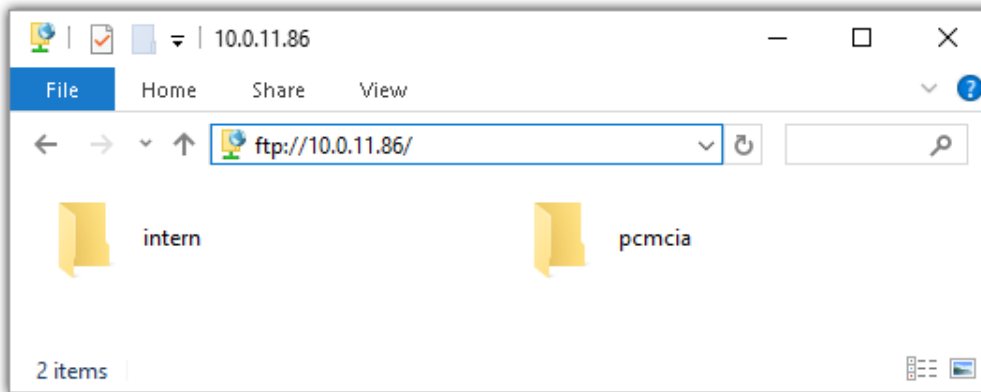
More information is presented in the imc STUDIO manual in the section: "Setting Up - Connect the device"

- General: "Device connection via LAN"
- "Connection via a direct address"

3.3.8.1.2.2 FTP access

It is also possible to access the device's internal data via FTP, as well as to transfer data. Other goals are to change the configuration of devices via FTP and to restart the device for measurement with the altered configuration. Application areas include test drives, where there is no way to connect the devices directly with the device software. The Diskstart/Autostart capabilities are applied and enhanced. For this purpose, the device is usually configured for autostart. Upon activation, the configuration is loaded and the measurement, as well as data transmission, starts automatically.

Start the explorer and enter "ftp://" and the IP address of the device:



Note

- In general it is a read only operation. If you intend to delete files via FTP, you have to add "imc@" between "ftp://" and the IP address:
Example: <ftp://imc@10.0.10.219>
- Furthermore, a password can be assigned to protect access via FTP. This password is entered into the device properties.

Warning

The following limitations apply when accessing the storage media in a device via an FTP-client:

- The device can't delete folders, accessed by a FTP-client.
- It is not possible to replace the storage medium during measurement (Hot-Plug).

3.3.8.1.3 File system and formatting

Storage media with the file systems FAT32 and FAT16 (maximum 2 GB) are supported. It is recommended that a memory card be [formatted](#)^[25] and possibly partitioned before use.



Note

Routine formatting protects the memory card

Routine formatting is recommended

Take every opportunity to format the storage medium. **Recommendation:** at least every **six months**.

In this way, any **damaged storage medium** can be detected and repaired if possible. A damaged file system may cause **data loss**. Or the **measurement system may fail to start** correctly.

In order to avoid data loss, any data still needed should first be saved!

Using a data storage medium in different devices

There are no known limitations. But it is recommended to always format the medium whenever transferring it in order to avoid data loss.

Additional notes

- To select the appropriate file system for the respective application, observe the notes on the data rate and on "[Avoidance of Data Overflow](#)"^[25].
- No limitations regarding the currently available storage medium volumes are known.
- The maximum filesize is 2 GB. In case a signal would exceed that limit, use interval saving.



Notes

General restrictions applicable to file systems

Please observe the general restrictions regarding the respective file systems.

3.3.8.1.3.1 Formatting

The formatting can be performed directly in the PC's hard drive by the Windows operating system, or in the device using the Explorer shell.



Note

Recommendation

- **imc recommends formatting in the device:** In comparison to formatting by Windows, this provides higher data writing rates for high-speed channels.
- Only **one(!)** partition may be created. Multiple partitions may cause the measuring device not to recognize the storage medium.



Warning

Please back up the data first

Formatting causes all data on the storage medium to be deleted. Before performing the formatting, ensure that all data have been saved on a different storage medium.

Note

Cluster size - Avoidance of Data Overflow

The size and number of assignment units (clusters) and thus also the [file system](#)^[25] used have a substantial effect on the storage medium's speed! Small clusters can dramatically reduce the speed! If high data rates are required, it is normally recommended to have a size of 8 kB/cluster.

The optimum size of the clusters must be determined for each storage medium separately. For all of them, the following applies:

- **Few channels having a high data rate**

If a few channels having a high data rate are being recorded, then **large clusters** on the data carrier provide better advantage. Formatting with FAT32 on the PC and drive sizes < 8 GB creates disadvantageously small clusters, which in conjunction with the full aggregate sampling rate can lead to a data overflow.

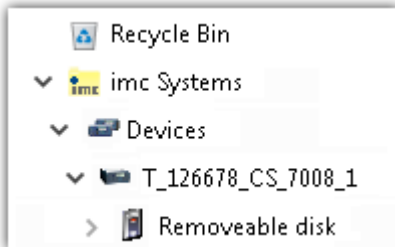
Whenever using cards of up to 8 GB, always use the formatting by the device.

In the device, cards larger than 512 MB are formatted with 8 kByte clusters and cards larger than 4 GB are formatted with 16 kByte clusters. Cards of up to 1 GB can alternatively be formatted by the PC with FAT16. With cards of 16 GB onward, there is no difference whether the formatting is done in the PC or in the device.

- **Very many channels with a low data rate**

If hundreds of channels having a low data rate (e.g. CAN channels) are saved, the exact opposite is true. Here, **small clusters** are an advantage. This means that drives with up to 8 GB should in such cases be formatted in the PC with FAT32.

Formatting in the device (Recommended)



For **formatting in the device**, navigate via the Explorer shell "[imc Systems](#)"^[22] to the desired device.

There, open the properties of the drive: context menu > "*Properties*" (not via the Navigation pane in the Explorer).

Go to the Property dialog under the tab: "*Tools*".

Start the formatting by clicking on "*Format now!*".

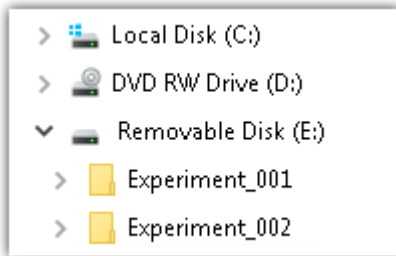
The device performs the formatting according to the following rule:

Drive size	Cluster size	File system
<= 512 MB	2 kB	FAT16
<= 4 GB	8 kB	FAT32
> 4 GB	16 kB	FAT32

Note

Formatting the storage medium is not allowed if an experiment whose data are to be saved internally has just been prepared.

Formatting using the Windows-Explorer



To perform **formatting of a storage medium via the [Windows-Explorer](#)**²⁴, navigate to the desired storage medium. Run the formatting by means of the context menu, for example.

Select one of the following two file systems: "FAT32" or "FAT" ("FAT16").

The file system "FAT32" is designed for media **larger** than 32 MB. Under no circumstances can smaller media can be formatted to "FAT32". With "FAT32", Windows generates 4 kByte clusters when the drive size is up to 8 GB, which is inconvenient for high-speed writing rates.

SSD hard drives are inherently formatted with Ext2 and for that reason **can not be formatted directly in the PC**, but only in the [device](#)²⁵.

However the Ext2 format offers these advantages:

- Mistaken duplicate occupation of individual clusters is not possible.
- Integration into the operating system is accomplished much more quickly than with FAT32.
- Higher writing output than with FAT32.

3.3.8.1.4 Known issues and limitations

Known issues and limitations	Description
If the memory card can not be read under Windows	The memory cards must first be partitioned (formatted) under Windows. Windows automatically generates the correct partitioning information. Subsequently, the memory card should be formatted again in the device. When in doubt, please contact our tech support ^[6] .
The system won't recognize the data storage drive	<ul style="list-style-type: none"> • Answer 1: Check the file system: The device supports FAT32/FAT16 ^[25]. • Answer 2: If there are two storage media simultaneously plugged into your device, only one media will be detected (e.g. USB and CFast). Only the first plugged media will be detected.
File system becoming gradually slower	As the count of folders increases, so does the time required by the system to access the data. In consequence, the data saving procedure becomes slower and data loss becomes possible. For this reason, creating more than 1000 folders is to be avoided.
Errors in accessing the storage medium	<p>Errors can have the following causes, among others:</p> <ul style="list-style-type: none"> • The data rate is too high, the storage medium can't keep up and data overflow results. • The storage medium is full. <p>The device signals any error by flashing this LED. Its further responses depend on whether or not the device is connected to the PC.</p> <ul style="list-style-type: none"> • If no PC is connected, for instance in cases involving automatic self-start capability, the button lights continuously. At the end of an experiment, always check for this if measurements are taken without PC aid. • If the PC is connected to the measuring device, imc STUDIO documents the error with an message in the Logbook and switches the LED off. Any one-time data overflow only shows up in the Logbook, since the LED is reset afterwards. If data overflow occurs repeatedly, The LED is activated again, the PC records the message again, and as a result the LED blinks intermittently.
Data overflow due to improper cluster size	<ul style="list-style-type: none"> • With a storage medium formatted by Windows to FAT32 ^[25], data overflow can occur if a high aggregate sampling rate is generated by a few high-speed channels. • With a storage medium formatted in the device ^[25], data overflow can occur if a high aggregate sampling rate is generated by very many low-speed channels.

4 Maintenance and servicing

4.1 Maintenance and servicing

imc recommends performing a service check every 12 months. An imc service check includes system maintenance in accordance with the service interval plan as specified by the manufacturer and a complete function test (maintenance, inspection and revision).

Maintenance (*repair*) work may only be carried out by qualified personnel from imc Test & Measurement GmbH.

For service and maintenance work, please use the [service form](#) that you download from our website and fill out: <https://www.imc-tm.com/service>



Reference

Device certificates and calibration protocols

Detailed information on certificates, the specific contents, underlying standards (e.g. ISO 9001 / ISO 17025) and available media (pdf etc.) can be found on [our website](#), or you can contact us directly.

4.2 Cleaning

Always unplug the power supply before cleaning the imc BUSDAQflex device. Only [qualified personnel](#)¹¹ are permitted to clean the housing interior.

Do not use abrasive materials or solutions which are harmful to plastics. Use a dry cloth to clean the housing. If the housing is particularly dirty, use a cloth which has been slightly moistened in a cleaning solution and then carefully wrung out. To clean the slits use a small soft dry brush.

Do not allow liquids to enter the housing interior.

4.3 Storage

As a rule, the imc BUSDAQflex devices must be stored in a temperature range of -40°C to +85°C.

4.4 Transport

When transporting, always use the original packaging or a appropriate packaging which protects the device against knocks and impacts. If transport damages occur, please be sure to contact our tech support. Damage arising from transporting is not covered in the manufacturer's guarantee. Possible damage due to condensation can be limited by wrapping the device in plastic sheeting.



Warning

A protective cover in the CTRL socket is intended to protect the device from accidental insertion of the power supply plug. This cover is [included in delivery](#)¹⁴.

5 Start of operation Software / Firmware

5.1 Installation - Software

The associated measurement engineering software imc STUDIO, the configuration and operating interface for all imc instruments, provides the devices with exceedingly versatile functionality. It achieves comprehensive total solutions for everything from laboratory tests through mobile data logger application all the way to complete industrial test stations.

Use of the software requires a license, subject to the purchase order and configuration (see e.g. imc STUDIO manual product configuration / license).

In order to be able to install or uninstall imc STUDIO products, you must be registered with a user account possessing administrator rights to the PC. This applies to the overwhelming majority of all installations of Windows. However, if you are only logged on to your PC without administrator rights, log off and log back on with an administrator user account. If you do not possess an administrator user account, you will need the support of your system administrator or IT department.

You will find a detailed description to the installation of the software in the adequate manual or getting started.

5.1.1 System requirements

The minimum requirements of the PC, the recommended configuration for the PC, the supported operating system are mentioned in the data sheets and the imc STUDIO manual.

5.2 Connect the device

There are multiple ways to **connect the imc measurement devices with the PC**. In most cases, the **connection via LAN** (local area network, Ethernet) is implemented. See section "[Connecting via LAN in three steps](#)"³¹ for the **quickest way to connect** PC and measurement device.

But there are also other connection types:

- WLAN
- LTE, 4G, etc. (via appropriate routers)

These are described in a separate chapter in the software manual: "*Special options for connecting to the device*".

The devices use the **TCP/IP protocol** exclusively. With this protocol, some settings and adaptations for your local network may be necessary. For this purpose, the support of your network administrator may be necessary.

Recommended network configuration

The latest and high-performance network technologies should be used to achieve the maximum transfer bandwidth. This means especially 1000BASE-T (GBit Ethernet). GBit Ethernet network devices (switches) are downward compatible, so that imc devices that only support 100 MBit Fast Ethernet can also be operated on them.

The cable length between the switch and a PC or a device should be less 100 m. Use a shielded cable. If the length of 100 m is exceeded, then you have to insert another switch.

If the system is being integrated into an existing network, you must ensure that the minimum data rate can be guaranteed. Under some circumstances, this may require using switches to subdivide the network into separate segments in order to govern the data traffic in a targeted way and thus optimize the data rate.

In very demanding applications, you might consider grouping multiple GBit Ethernet devices via even higher-performance sections lines of the network (e.g. via 5 GBit Ethernet) and to connect these groups to NAS-components, for instance, via these lines.

When such imc devices are included which use network-based PTP-synchronization (e.g. CRXT or CRFX-2000GP), then it is necessary to use network switches which fully support this protocol on the hardware side. Appropriate network components are also available as imc accessories (e.g. CRFX/NET-SWITCH-5) and are then electrically and mechanically fully compatible with the imc systems.

5.3 Connecting via LAN in three steps

The most common case is described below: the PC and the device are connected via cable or network switch. The device's IP address must be set in the PC's address range. Subsequently, the device can be connected with the PC. If a connection has ever been established previously, the software recognizes the device's hardware configuration. In that case, experiment configurations can be prepared without any connection to the device.


Step 1: Connecting the measurement device


To connect via LAN there are two options:

1. The measurement device is connected to an **existing network**, e.g. via network switch. Only with a switch is it possible to run multiple devices.
2. The measurement device is connected directly to a network adapter on the PC (**point-to-point**).

In a LAN, the first case is typically implemented. Modern PCs and network switches are usually equipped with Auto-MDI(X) automatic crossover recognition, so that it is not necessary to distinguish between crossed and uncrossed connection cables. Thus both cable types can be used.

Step 2: IP-configuration

Start imc STUDIO. Click the "Device interfaces" button () to open the dialog for configuring the IP address of the device.

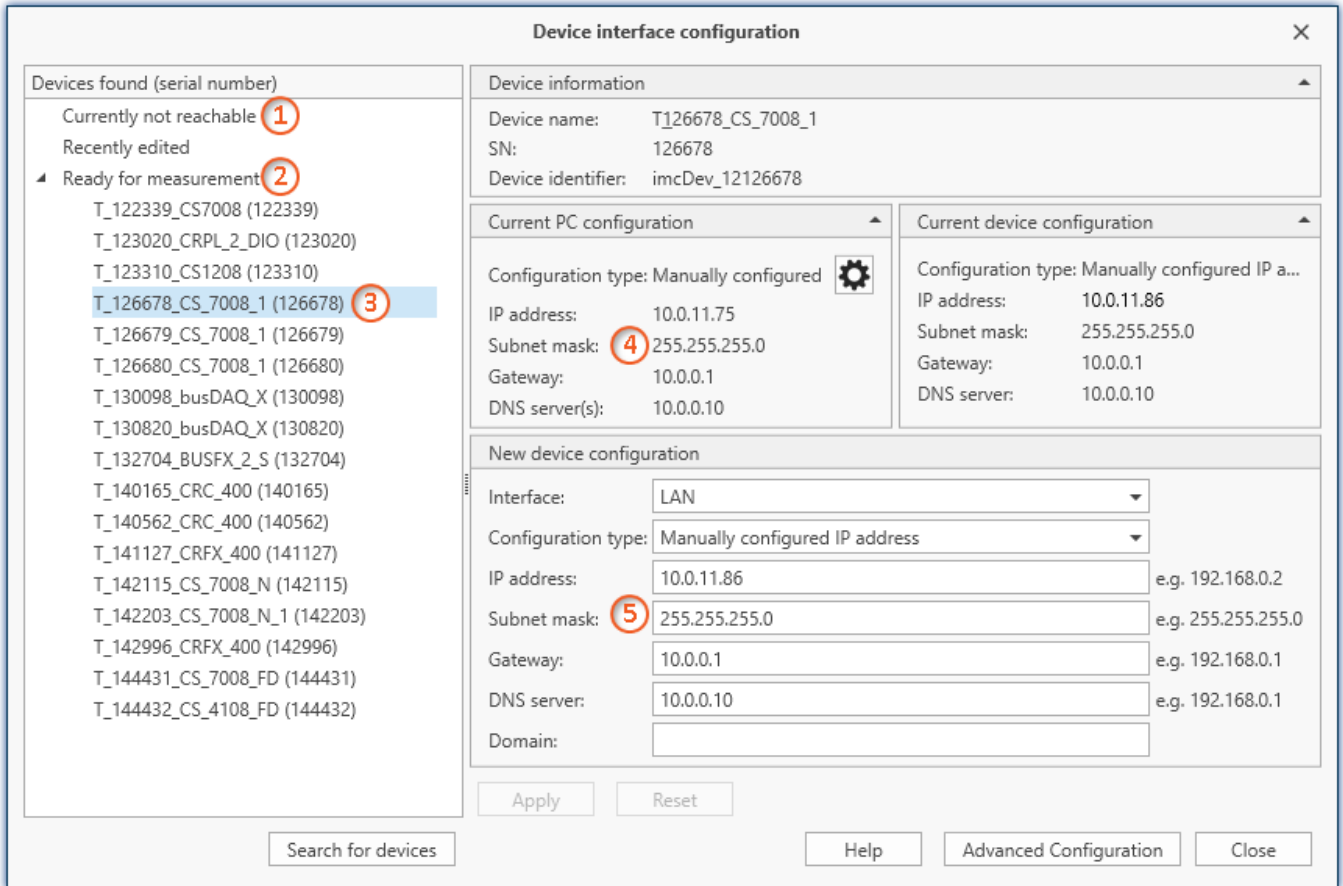
Ribbon	View
Setup-Configuration > Device interfaces ()	Complete

If this **button** is **not present** in the view, it is also possible to open the dialog after a device search if it failed to find any new devices. Subsequently, a prompt appears asking whether to search for devices with an inappropriately configured network interface. Close this message box by clicking "Yes".

Once the dialog starts, the system automatically searches for all devices in the network. In the tree diagram, all available devices are indicated. If the device appears among the group "Currently not reachable" ①, it is necessary to modify the device's LAN-settings. If the device appears among the group "Ready for measurement" ②, you can leave the settings as they are or review them.

Select the device for making modifications ③.

If there is any IP-conflict, devices affected will not be listed.



Display of measurement devices found and of the IP address

Set the **IP address manually** if you are not using DHCP. The device's IP address ⑤ must match with the PC's address ④. To conform to the network mask, only the device portion may be different (see example).

Example

In the example shown, the fixed IP 10.0.11.75 with subnet mask 255.255.255.0 is selected for the PC. For measurement devices, any numbers would be suitable which begin with 10.0.11. and then do not contain 0, 75, or 255. The 0 and the 255 should not be used, if possible, due to their special significance. The 75 is the computer's number.

Example for IP settings	PC	Device
IP address	10 . 0 . 11 . 75	10 . 0 . 11 . 86
Network mask	255 . 255 . 255 . 0	255 . 255 . 255 . 0

If the configuration type: "DHCP" is used, **the IP address is obtained automatically** from the DHCP-server. If it is **impossible to obtain any setting values** via DHCP, the **alternative values are used**. These could lead to errors in the connection (different networks, same IP addresses, etc.).

If there is a **direct connection** between the device and the PC by a cable, then **DHCP should not be used**.

In order to apply the changes, click on the button "Apply". Wait for the device to restart and then close the dialog.



Note

Connection via modem or WLAN

If the connection to the device is established via a modem or WLAN, start the program "imc DEVICES Interface Configuration" by clicking on the button: "Advanced Configuration" (see previous figure). An exact description is found in the software manual chapter: "Setting Up - Connect the device" > "Special options for connecting to the device".

Step 3: Integrating a device into an experiment

Now you are ready to add the device to the imc STUDIO experiment. If your device is unknown to the system, first perform the "device search".

Ribbon	View
Home > Search for devices ()	all
Setup-Control > Search for devices ()	Complete

Select the desired device: Once you click in the checkbox "Selected" for the desired device, it is ready to use in the experiment.

Selected	Device name	SN	Device specification
<input checked="" type="checkbox"/>	T_124835_C1_1_LEMO_ET	124835	imc C1-1 LEMO
<input type="checkbox"/>	T_130039_busDAQ_X	130039	busDAQ-X
<input type="checkbox"/>	T_130311_SPARTAN_U32_CAN	130311	imc SPARTAN

You can also select multiple devices for your experiment.

Now the device is "known". After the next program start it is available for selection. For further information, see the documentation on the component "Setup".

Reference

Time zone

Now check whether the correct time zone is set for the device. For more info, see the description of the software manual under the keyword "Device properties".

5.4 Firmware update

Every software version comes with matching firmware for the hardware. The software only works with devices having the right firmware.

Once the program connects up with the unit, the device's firmware is checked. If the software version doesn't match the device's firmware version, you are asked if you want to perform a firmware-update.

Note

The firmware update is only required if the software was obtained as an update. If you obtained your hardware equipment together with the software, no firmware update is necessary.

Warning

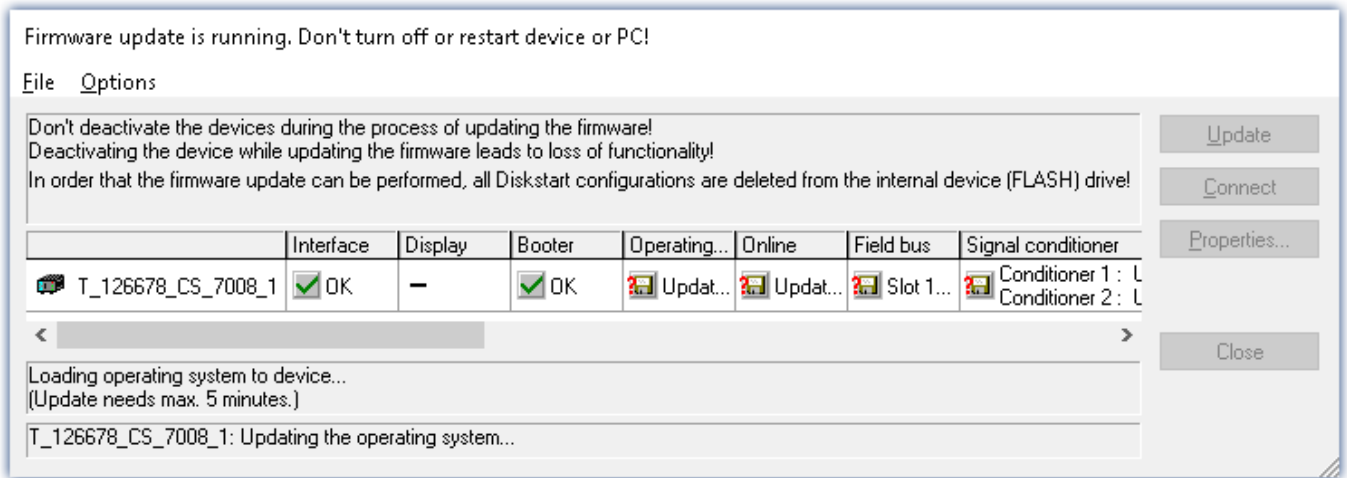
Do not interrupt the firmware update!

Be absolutely certain to observe the following:

1. Under no circumstances should the device or its power supply be deactivated during the firmware update!
2. The network connection may not be interrupted. Use a cable connection, not WLAN!

Depending on the device type, the following components are loaded automatically: Interface-firmware (Ethernet, modem, ...), booting program, amplifier firmware, firmware for the signal processors.





The dialog for the firmware-update looks like this:



*Start of the firmware update (example of a single device)
The state of the components of the firmware is displayed in the list.*

Component	Description
Interface	Interface-Firmware (Ethernet)
Booter	Start-up program for the device upon switching-on
Operating system	Device operating system
Online	Online-functions and hard drive controller
Display	Operating system of the connected displays
Fieldbus	Fieldbus interfaces (e.g. CAN etc.)
Signal conditioners	Amplifiers

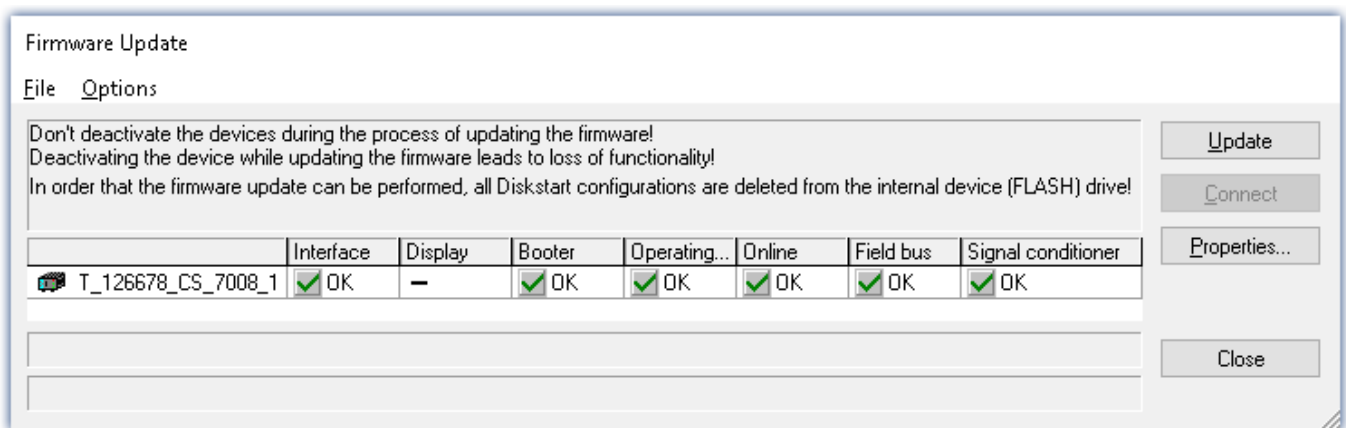
The following symbols for the individual firmware components appear in the list:

Symbols	
	not current
	firmware conforms to current standards
	error occurred during update procedure
	this option is not available on the device

If no status indicators are displayed, no connection could be made to the corresponding device.

The duration of the update depends on the number of amplifiers (can last up to several minutes). You will be informed on the progress.

You are notified when the firmware setup concludes successfully, as shown below:



Conclusion of the firmware update (example of a single device)

Choose "Close". The device can now be used with the product software.

**Warning****Be sure to observe in case of error**

- For a variety of reasons, the firmware update sometimes does not conclude properly, for example due to interruption of the power supply. For instance, the "handshake signal" at the end of the procedure may be missing. In this case, no measurement channels would be displayed initially. However, restarting the device and its software and performing the firmware update again usually restores everything to normal. It may be necessary to call the menu function "Update all components" in the Firmware update dialog's Options menu. This scenario only results in permanent damage in the most rare cases, and it is very worthwhile to repeat the procedure before sending a device in for repair.
- Behaviour under error condition, Windows cuts off the network connection without the user's knowledge; but this can be prevented using the PC's Control Panel.
Background: During the firmware updates there is no data transfer for a few minutes and thus no network activity; Windows detects inactivity of the connection and the following mechanisms are set in motion:
 - a) Windows' energy saving mode switches the LAN adapter off, consequently interrupting the network connection!
 - b) Windows switches to the next LAN adapter if there is one (some PCs have multiple adapters in order to, for instance, to access services in parallel that are accessible via separate networks.)
 - c) Other scenarios are feasible, e.g. if switches are activated, which can also respond to missing data traffic.

If an error message is posted during the firmware update, leave the device on and contact our [tech support](#). The firmware update may be continued with guidance from the tech support.

**Note****Firmware logbook**

The "*File*" menu offers a function for working with the firmware log file. Every action taken during a firmware update plus any errors which may occur are recorded in a log file. This log file can be displayed with menu "*File*" > "*Show log file*".

Update all components

The "*Options*" menu offers the option to "*Update all components*". This makes it possible to earmark all the components of the selected device for an update. The function is only to be used in compliance with instructions from the tech support.

6 Properties

6.1 Device overview

Some of the capabilities discussed in this document only pertain to certain device models. The associated device groups are indicated at the respective locations. The groups are shown in the following table.

— not available ● standard ○ optional
 CRXT imc CRONOS-XT CRFX imc CRONOSflex CRC imc CRONOScompact

imc device	SPARTAN	BUSDAQ	BUSLOGflex	BUSDAQflex	SPARTAN-R	SPARTAN-N	CRSL-N	CRC-400	C1-N	C-SERIE-N	C1-FD	C-SERIE-FD	CRFX-400	CRFX-2000	CRC-2000G	CRC-400GP	CRFX-2000G	CRFX-2000GP	CRXT	EOS	ARGUSfit
Driver package	imc DEVICES																		imc DEVICEcore		
Firmware group	A																		B		
Device group	A4				A5					A6	A7				B10	B11					
SN ¹	13				14					16	19				4120	416					
TCP/IP Interface [MBit/s]	100				100					100	1000				1000	1000					
Sampl.Rate ² [kHz]	400				400					2000 / 400 ³	2000 / 400 ³	2000 / 400 ³	2000	2000	2000	4000	5000				
STUDIO Monitor supported	●				●					●	●				—	—					
Connections ⁴	4				4					4	4				—	—					
Signal processing in the device																					
Online FAMOS	○	○	—	○	○	●	●	●	●	●	●				—	●					
Preprocessing original channel	●	—	—	—	●	●	●	●	—	●	●	●	—	—	—	—	—				
Preprocessing monitor channel	●	—	—	—	●	●	●	●	—	●	●	●	—	—	—	—	●				
Data Storage																					
CF	●				●					—	—				—	—					
Express Card	—				—					●	—				—	—					
CFast	—				—					—	●				—	—					
USB	—				—					●	●	●	●	●	—	—	—				
microSD	—				—					—	—				—	●					
Storage on network drive	●				●					●	●				—	—					
Internal hard disk	○	(○) ⁵	—	—	○	○	—	—	○	○	○				●	—					
Synchronization																					
DCF	●				●					●	●				—	—					
IRIG-B	—	—	●	●	●					●	●				●	●					
GPS	●	●	—	(●) ⁶	●					●	●				—	●					
NTP	—	—	●	●	●					●	●				●	●					
PTP	—				—					—	—	●	—	●	●	—	—				
Phase offset correction	—	—	●	●	●					●	●				●	●					

1 Extend serial number range by four digits (three for imc EOS)
 2 Max. aggregate sampling rate (see data sheet)
 3 2000 via EtherCAT else 400
 4 Number of imc STUDIO Monitor-connections or imc REMOTE (as of 14xxxx) connections
 5 not available for imc BUSDAQ-2
 6 not available for imc BUSDAQflex-2-S

6.2 imc BUSDAQflex device series

imc BUSDAQflex is a series of data loggers for CAN, CAN FD, LIN, ARINC, FlexRay, XCPoE, MVB and EtherCAT. The basic configuration with default configuration with 2 CAN-nodes can be expanded to up to 12 nodes in the larger device models for various fieldbuses and vehicle buses. Along with recording of streaming raw data and log channels, live decoding of individual channels and of complex protocols such as CCP, KWP2000, XCP, OBD2, UDS, DiagOnCan, TP2.0, GMLAN is also supported.

The BUSDAQflex devices works autarkic autonomously (without PC) and they are specified are rated for the extended temperature range (-40 to +85°C), making them ideal for mobile applications. The BUSDAQflex series has very low power consumption and thanks to built-in UPS (uninterruptible power supply) the BUSDAQflex they ensure complete data integrity even in case of power failure/ breakdown outages. As a CAN or LIN-bus logger, imc BUSDAQflex supports a signal-governed Sleep-mode (Wake-on-CAN) with a start-up time of only 200 ms and is thus highly suitable for the car fleet testing experiment.

Recorded data are stored in the device on a removable storage media (in particular Flash) and can also be pre-processed or analyzed on the device by online analyzes (imc Online FAMOS). This allows e.g. threshold monitoring, min./max. values, digital filters, spectral analysis, order analysis, classification, and more. With imc BUSDAQ, measurement data and status information of any bus subscribers can be recorded, such as control devices, sensors and CAN-based measuring amplifier (e.g. imc CANSAS). In particular, modules of the imc CANSASflex series (CANFX) can be directly docked and thereby build up a very compact measuring system. The tool-free click mechanism connects a data logger and measuring modules both mechanically and electrically and requires no additional connecting cables.

imc BUSDAQ, like all imc measurement systems, is operated with the imc STUDIO software. The software provides a complete manual and automatic setting of the measurement parameters, real-time functions, triggering machines and storage modes. The measurement curve display in the curve window and the documentation in the report generator are an integral part.

Characteristics and abilities

Logger-operation:

- Autonomous operation without PC possible, self-start (timer, absolute time)
- Integrated real-time signal analysis, control and regulation with imc Online FAMOS
- Optional recording with time stamp (on receipt, 100 µs resolution) or fixed sampling rates (equidistant sampled)
- Also supports sending via CAN bus (via imc Online FAMOS)

Storage and Trigger:

- Storage possibilities onboard removable media (CF card) and/or on PC
- Circular buffer storage operation
- Complex trigger functionality, PC-independent, incl. Multi-Trigger machines and different sampling rates

Power supply:

- Intelligent power supply (10 to 50 V DC) with UPS-function and data saving when power failure
- CAN/LIN-Logger: Sleep-Mode with Wake-on-CAN (200 ms) or wake up when control signal
- Remote control and Suspend/Resume function

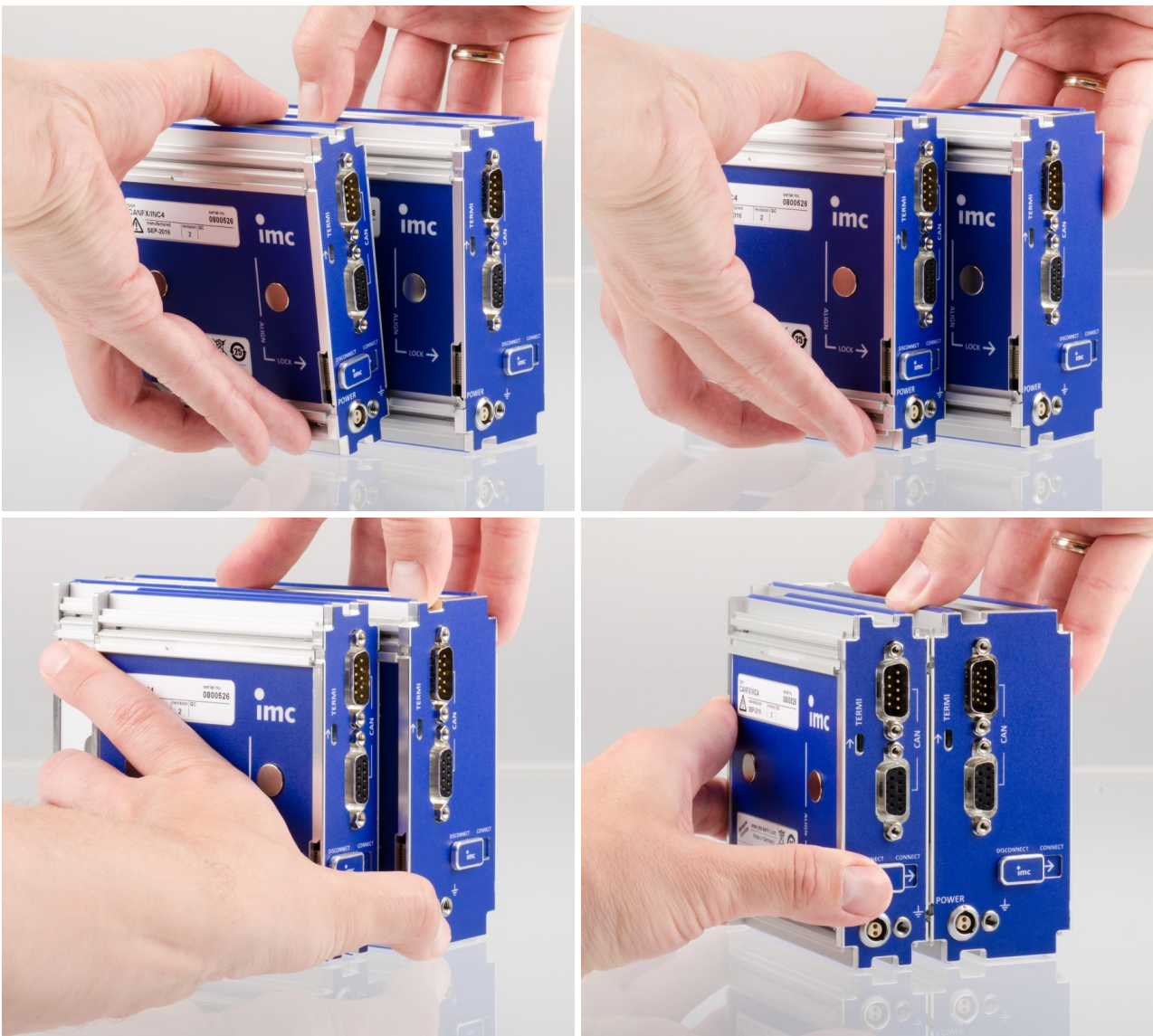
6.3 Topology and Mounting

Click-connection:

- Modules joinable to module-blocks: mechanical and electrical connection (CAN and supply)
- No tools or additional cabling required
- With guide grooves, magnetic catches and locking slider
- Both short and long housing versions joinable:
with electrical connection: align on rear side; mechanically only: align on front side

1. Please insert the guiding noses of the first module in the guiding notches of the second module.

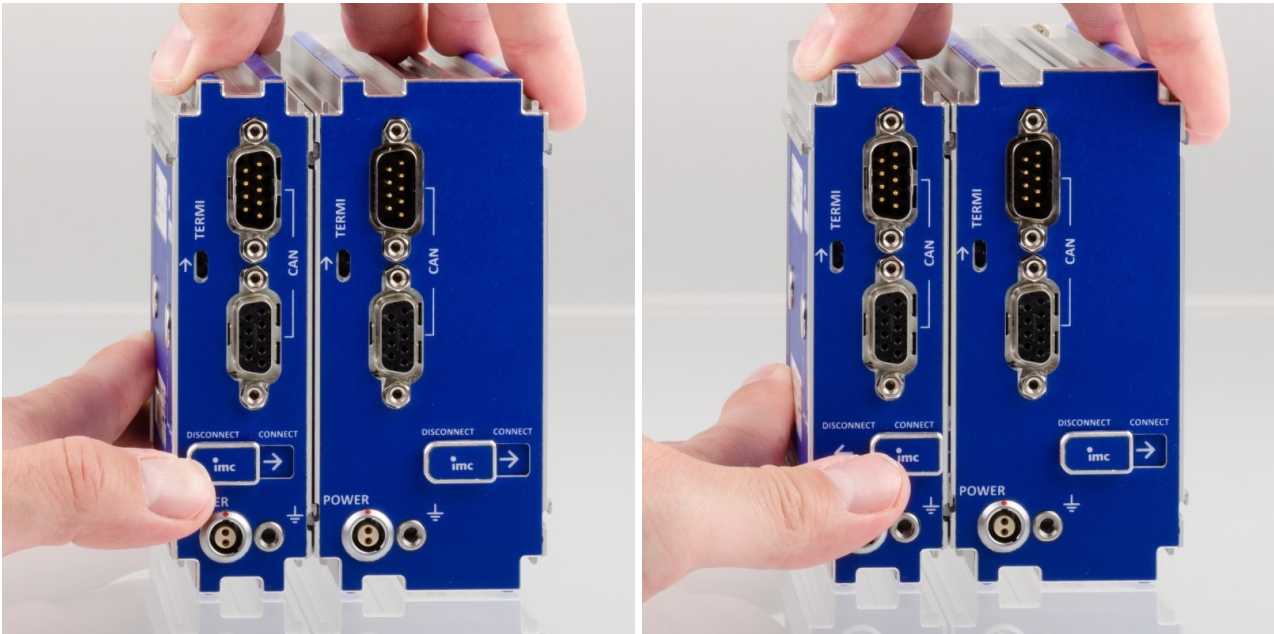
The white arrow on the side module side indicates, where the module has to be aligned. The magnets will help to find the correct position (**LOCK**).



2. In order to connect the modules correctly, the modules has to be positioned as shown in the picture above.

 Reference

The different available housing variants are specified in each data sheet.



3. Switch the locking slider in "**CONNECT**"-position. The modules are now electrically connected and mechanically saved. In order to separate the module, switch the locking slider back into the "**DISCONNECT**"-position.

 Warning

In order to secure the mechanical handling and avoid displacement, the locking slider of each module in a block of modules should be closed (locking slider in "CONNECT" position).

 Warning

According to current scientific knowledge, **magnetic fields** of permanent magnets do not affect human health. For this reason, health **hazards due to the magnetic field are unlikely**. However, the functioning of heart pacemakers and implanted defibrillators can be affected (e.g. a heart pacemaker may be switched into test mode). Persons wearing such devices should maintain adequate distance.

The magnetic fields are so strong in the immediate vicinity that sensitive electronic equipment such as data carriers, credit and debit cards, hearing aids, loudspeakers or sensitive ferromagnetic mechanical equipment such as pocketwatch mechanisms can also be affected or damaged.

Contact with the magnets by food should be avoided. The magnets are protected with a coating (Ni, Au, Zn) to which some persons can have an allergic reaction (Nickel allergy).

6.4 CAN Termination

 Reference

Please find here a [detailed description concerning CAN Termination](#) 

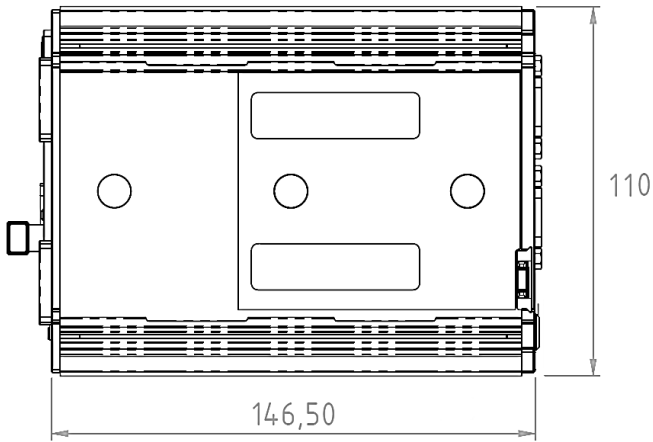
6.5 Device variants and options

Key: ● standard, ○ optional, (●) restricted

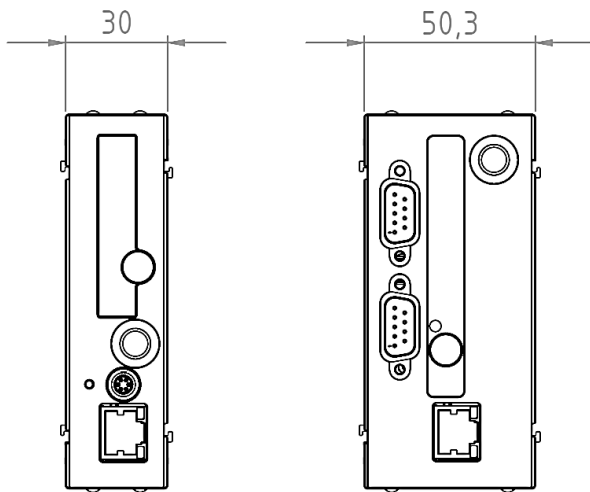
imc BUSDAQflex device models and functions

	BUSLOGflex	BUSDAQflex-2S	BUSDAQflex-2	BUSDAQflex-4 / 6 / 8 / 12	BUSDAQflex-4 / 6 / 8 / 12
General				CAN only	+ others
CAN nodes	2	2	2	4 / 6 / 8 / 12	>= 2
Extension modules					1 / 2 / 3 / 5
CAN, CAN FD, Lin, FlexRay, J1587, ARINC					○
XCPoE, MVB, RoaDyn, APPMOD					○
Housing type (size)	L0	L0	L1	L2/L3/L4/L6	L2/L3/L4/L6
Autonomous device capabilities					
Sleep/Standby, Wake-on-CAN	●	●	●	●	
Real-time data analysis (imc Online FAMOS)		○	○	○	○
Network storage (NAS)	●	●	●	●	●
Synchronization and clock					
DCF 77, NTP, IRIG-B	●	●	●	●	●
GPS (via ext. GPS Mouse)			●	●	●
Connectivity					
WLAN (WiFi) internal				○	○
Wireless UMTS, 3G/4G (external)	○	○	○	○	○
GPS, Display connection ports (2 x DSUB-9)			●	●	●
Process control (digital I/O): 4+4 Bit (2 x DSUB-15)				●	●
Remote controlled main switch	LEMO.0B	LEMO.0B	LEMO.0B	LEMO.0B	LEMO.0B
Synchronization signal	SMB	SMB	BNC	BNC	BNC
Programmable status feedback (LEDs)			●	●	●
Software					
Vector data base (*.dbc import)	●	○	○	○	○
ECU protocols		○	○	○	○
Web-Server (imc REMOTE)	○	○	○	○	○

Mechanical drawings with dimensions:

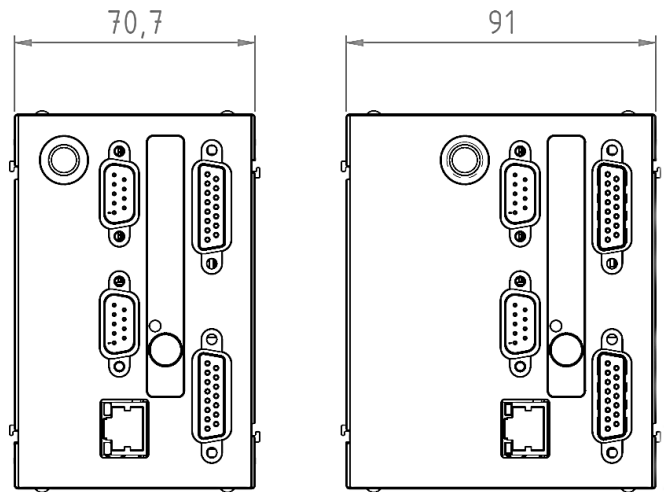


Front



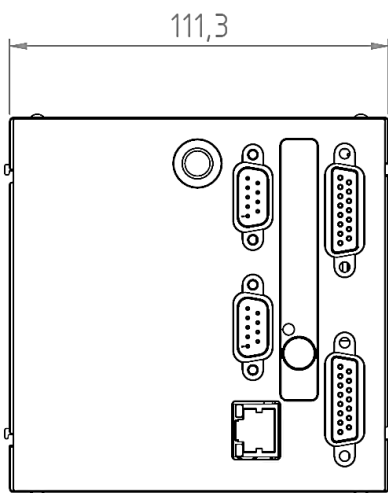
L0

L1

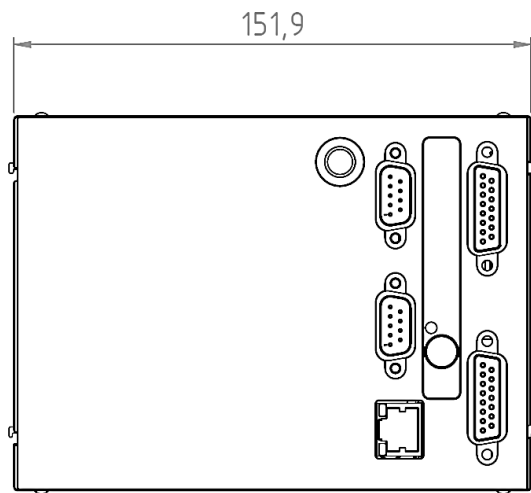


L2

L3



L4



L6

6.6 Operating software

- imc BUSDAQ*flex*, imc BUSDAQ, imc SPARTAN, imc C-SERIES and measurement devices from the imc CRONOS-series is operated using the operating software **imc STUDIO**. The operating software enables complete manual and automatic setting of the measurement parameters, real-time functions, trigger machines and data saving modes. Display of measurement plots in the curve window and, as well as experiment documentation in the Report Generator, are integral elements of the software. There are extensive triggering options and data storage options adapted to particular applications. Together with the supplementary software imc Online FAMOS, the raw data can be processed in real time to yield the result data in the desired format, and can be displayed.
- imc CANSAS modules can be configured directly from the operating software if the imc CANSAS software is on the same computer. A separate connection from the imc CANSAS module to the PC, e.g. via a USB-CAN adapter, is not necessary.
- For special tasks such as system integration in test rigs, there are comfortable interfaces for all common programming languages like Visual Basic™, Delphi™ or LabVIEW.



Note

Software requirement

The following minimum operating software version out of the following group is necessary:
imc STUDIO 5.0 R5 in connection with the firmware and drivers of the imc DEVICES 2.9.

6.7 Sampling interval

The sampling rates of **Fieldbus channels** are not subject to any particular rule and may be as diverse as desired. The **aggregate sampling** rate of the system is the **sum of the sampling rates** of all active channels.

7 Device description

7.1 Device options

7.1.1 Vector Database connection

In many cases, parameter settings are already available as a Vector database which can be imported by any imc BUSDAQ modules. This makes it possible to set large amounts of parameters quickly and easily.

The data storage media used are either Compact Flash data carriers or IDE hard drives, having various data storage capacities depending on requirements. The standard equipped Ethernet TCP/IP interface enables easy connection to the PC or integration into decentralized measurement networks.

7.1.2 imc Online FAMOS

imc Online FAMOS is a program package offering online data processing on the built-in signal processor. Using imc Online FAMOS it is possible to subject data from different channels jointly to computational operations and thus form computed (virtual) channels which return the specified results in real time. In particular, imc Online FAMOS enables monitoring of measurements, where the crossing of a signal limit can be indicated on the display or by the closing of a relay contact. Entering commands is accomplished in a simple manner resembling the operation of a pocket calculator. The computational power provided is sufficient for reacting in real time even given the aggregate sampling rate. This makes it possible to implement two and three-step controllers. Not least of this online processing's abilities is data reduction, where complex triggering conditions are formulated and measurement data are only stored when necessary.

imc Online FAMOS is not available for imc BUSLOG.

Reference

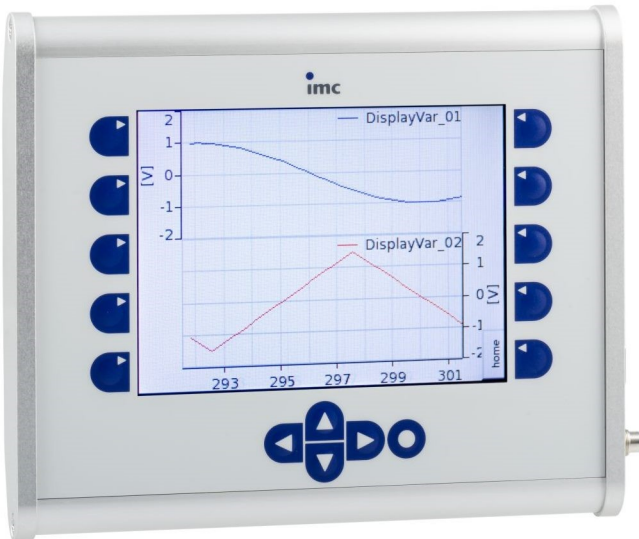
Please find detailed information concerning imc Online FAMOS in the Software manual.

7.1.3 Operation without PC

To operate your imc measurement device, you don't necessarily need a PC. Your device will start the measurement independently, if an autostart has been prepared. Using the display, you can use its keyboard to control the measurement. The display serves as a comfortable status indicator device and can replace or complement the imc operating software when it comes to controlling the measurement. It can even be used where no PC can go.

The Display can be connected or disconnected at any time without affecting a running measurement. This makes it possible, to check the status of multiple devices running simultaneously one at a time. Detailed descriptions of the functions are presented in the chapter *Display* of the imc software manual.

7.1.3.1 Graphical display



The imc graphical display allows the user to interact with a running measurement process by displaying system status and allowing parameter adjustments via the membrane touch panel.

If the measurement device is prepared for opening a particular configuration upon being activated, it's possible to carry out the measurement without any PC. The Display serves as a convenient status indicator.

The **description of the control elements** and their function can be found in the imc STUDIO manual chapter "*imc Display Editor*".

Properties:

- 320 x 240 pixels in 65536 colors
- Housing dimensions approx. 306 x 170 x 25 mm; Readout screen size: approx. 11.5 cm x 8.6 cm
- Bore diameter for Display fixing: diameter core hole 5.11 mm, diameter exterior 6.35 mm (1/4" - 20 UNC),
- Weight: approx. 1 kg, more properties see chapter "[Technical Specs](#)".

- The Display is controlled by a serial RS232 connection. The update frequency can't be changed. It depends on the load of the device, which is at best 15 Hz.
- The Display must be powered via the 3-pole Binder socket.

7.1.4 Synchronization

Synchronization with other devices

In order to synchronize the device to an absolute time reference and/or synchronize multiple imc devices (even of different types) use the SYNC terminal. That connector has to be connected with other imc devices or a DCF77/IRIG B signal generator.

Synchronization with GPS

The measuring device can be synchronized to absolute time using a [GPS receiver](#) connected to the GPS socket.

Note

- To use the SYNC input, IRIG B must be supported. SYNC use with BUSDAQflex (serial number circle 13...) is therefore additionally possible.
- The yellow ring on the SYNC socket indicates that the socket is shielded from voltage differences.
- See also chapter *Synchronization* in the imc software manual.
- In sleep mode, synchronized measurement is not possible because the wake up is too short to synchronize the internal clock.

7.1.4.1 Optical SYNC Adapter: ACC/SYNC-FIBRE

One fundamental feature of all imc measurement devices, is their ability to synchronize multiple devices, even of differing models, and to operate them all in concert. The synchronization is typically accomplished by means of a Master/Slave process via the electrical SYNC-signal, which terminates on the devices at a BNC socket.

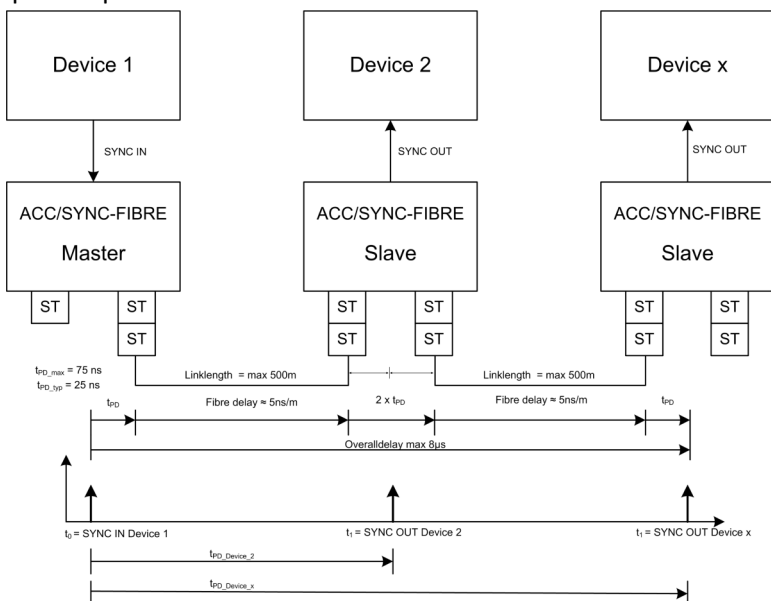
In areas of high electrical interference, or where long-distance signal transmission is needed, the signal can be conducted via fiber optic cabling with total isolation and no interference. For this purpose, the externally connectable optical SYNC adapter ACC/SYNC-FIBRE is available.

When this adapter is used, the BNC socket is not, but rather one of the DSUB-9 sockets for the GPS, DISPLAY or MODEM, which then conducts both the isolated electrical SYNC signal and additionally a supply voltage which is required by the adapter, as well as supplying directional indication (Master to Slave).

For this reason, any imc measurement devices used must be remodeled in accommodation to one of the DSUB-9 sockets. Once either the MODEM or the GPS socket has been remodeled, it is no longer usable for its original purpose. For the GPS socket, this does not apply. Even parallel operation is possible (via Y-cable), if the GPS-data are only used for the position data and the adapter is used for the SYNC signal.

For whichever signal (adapter or BNC) is currently connected, both the electrical and the optical mode can be used, however not both at the same time.

The plug is designed for the extended environmental range. The imc measurement devices used with this adapter require some modification.



[Find here technical details: ACC/SYNC-FIBRE](#) 

7.1.5 GPS

At the GPS socket it is possible to connect a GPS-receiver. This makes it possible to achieve absolute **synchronization to GPS time**. If the GPS-mouse has reception, the measurement system synchronizes itself automatically. **Synchronization with a NMEA source** is possible. The precondition for this is that the clock must return the GPRMC-string along with the one-second-interval clock signal.

All **GPS information** can be **evaluated** and subjected to **subsequent processing** by imc Online FAMOS.

GPS signals are **available as**: process vector variables and fieldbus channels.

GPS information	Description
pv.GPS.course	Course in °
pv.GPS.course_variation	Magnetic declination in °
pv.GPS.hdop	Dilution of precision for horizontal
pv.GPS.height	Height over sea level (over geoid) in meter
pv.GPS.height_geoidal	Height geoid minus height ellipsoid (WGS84) in meter
pv.GPS.latitude pv.GPS.longitude	Latitude and longitude in degree (Scaled with 1E-7)
pv.GPS.pdop	Dilution of precision for position
pv.GPS.quality	GPS quality indicator 0 Invalid position or position not available 1 GPS standard mode, fix valid 2 differential GPS, fix valid ...
pv.GPS.satellites	Number of used satellites.
pv.GPS.speed	Speed in km/h
pv.GPS.time.sec	The number of seconds since 01.01.1970 00:00 hours UTC. For this reason, it is no longer possible to assign the value to a Float-format channel without loss of data. This count of seconds can be transformed to absolute time under Windows and Linux. To do this, use the function below. <pre>MySeconds = CreateVChannelInt(Channel_001, pv.GPS.time.sec)</pre>
pv.GPS.vdop	Dilution of precision for vertical see e.g. www.iota-es.de/federspiel/gps_artikel.html (German)

 Note

Scaling of the latitude and longitude

pv.GPS.latitude and pv.GPS.longitude are **INT32 values, scaled with 1E-7**. They must be **treated as Integer channels**, otherwise the **precision is diminished**.

By means of imc Online FAMOS, you are able to generate virtual channels from them. However, due to the reversal of the scaling, precision is lost:

```
latitude = Channel_001*0+pv.GPS.latitude *1E-7
```

Recommendation: Use the corresponding fieldbus channel: "*GPS.latitude*" or "*GPS.longitude*". Here, no scaling is required, so that the precision is preserved.

Sampling rate

Due to system limitations, GPS channels for determining the fastest sampling rate in the system are not taken into account. For an working configuration, at least **one other channel** (fieldbus, digital or analog) must be sampled at either the **same** sampling rate as the GPS-channel, or a **faster** one.

Internal variables; do not use

- pv.GPS.counter
- pv.GPS.test
- pv.GPS.time.rel
- pv.GPS.time.usec

GPS-Receiver

The **GARMIN GPS receivers** supplied by imc are set ready for operation and provide a 1 Hz or 5 Hz pulse, depending on the model.

The following conditions must be met in order to use other GPS receivers from imc devices:

- **RS232 port settings**
 - **Baud rate:** Possible values are 4800, 9600, 19200, 38400, 57600 or 115200
 - 8 bit, 1 stop bit, no flow control
- The following **NMEA strings** must be sent: **GPRMC, GPGGA, GPGSA**. The order of the strings must be adhered to.
Additional strings should be deactivated. If this is not possible, all other strings must be **before** the GPGSA string!
- The receiver must deliver a **1 Hz clock**.
- The rising edge of the clock must mark the second specified in the next GPRMC string.
- All three strings should be sent as soon as possible after the 1 Hz clock, so that there is sufficient time for processing between the last string and the next 1 Hz clock.

NMEA-Talker IDs

Supported NMEA-Talker IDs:

- GA: Galileo Positioning System
- GB: BeiDou (BDS) (China)
- GI: NavIC (IRNSS) (India)
- GL: GLONASS, according to IEIC 61162-1
- GN: Combination of multiple satellite systems (GNSS) (NMEA 1083)
- GP: Global Positioning System (GPS)
- GQ: QZSS regional GPS augmentation system (Japan)

[DSUB-9 pin configuration](#) 

7.1.6 NET-SWITCH

The NET-SWITCH is a Network-Switch compatible with imc BUSDAQflex (BUSFX) housing (Click-mechanism and power supply).

Highlights:

- 5 Ethernet-Ports up to 1 GBit (1000BaseT)
- Supports PTP (Precision Time Protocol, IEEE 1588v2, end-to-end transparent clock)
- Synchronization of imc CRONOSflex (CRFX-2000GP) and imc CRONOScompact (CRC-400GP)
- Housing compatible with imc BUSDAQflex: Click-mechanism / supply. Can be operated as:
 - Stand-Alone Switch
 - Directly connected with imc BUSDAQflex devices (Note: imc BUSDAQflex does not support PTP)
- 2-way redundant options for the power supply (10 to 50 V DC):
 - Module connector/locking slider
 - LEMO.0B
- Extended operating temperature range for industrial applications: -40 to +85°C

Click-mechanism (imc CANSASflex / imc BUSDAQflex):

- Modules joinable to module-blocks: mechanically and electrically connected (power supply)
- No tools or additional cabling required
- With guide grooves, magnetic catches and locking slider
- Both short and long housing versions joinable:
 - with electrical connection: align on rear side; mechanically only: align on front side
- Direct connection of compatible CAN-logger: imc BUSDAQflex



Reference

[Technical specs](#) 

7.1.7 Sleep/Resume Modus

The imc BUSDAQflex with CAN- or LIN-Interface is able to start a measurement out of a sleep mode within an extremely short time. It is optimized for very low power consumption. Therefore it is especially suitable for recording CAN or LIN data of vehicles, as soon as they have been started.

A new operation mode has been developed in which the device isn't switched off, but put into a sleep or **sleep mode**. The transition from sleep to normal operation takes less than 200 ms.

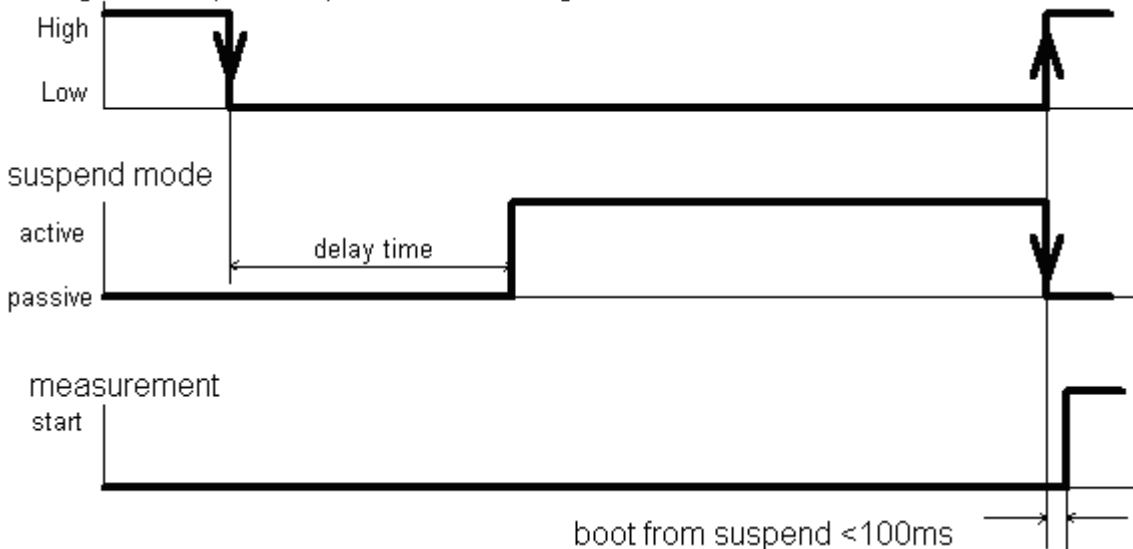
! Notes

- The **Sleep/Resume Mode** is only supported for imc BUSDAQflex devices with CAN/LIN interface. Other fieldbusses such as FlexRay, CAN FD, etc. won't be supported.
- In case imc CANSAS modules are synchronized by imc BUSDAQ / imc BUSDAQflex with **CAN-1** protocol, synchronization after resume is not assured.
- If the **termination at the CAN nodes is activated by software**, it is also retained in sleep mode.

7.1.7.1 Description

In the **sleep** operation mode, imc BUSDAQflex consumes less than 200 mW with a full charged battery. If an experiment has been written to the device drive or internal flash, the experiment will be run after less than 200 ms upon leaving the sleep mode (resume).

voltage CTRL-pin: Suspend/Resume High



7.1.7.2 Preparing the imc BUSDAQ: diskstart / autostart

The device will be prepared as soon as **one experiment** has been written to the devices as a **diskstart or autostart configuration**. But it is important that there is only one experiment inside the device.

! Notes

- If more than one diskstart configuration is present in the device, sleep mode is not available, because a selected has to be made when starting.
- No more than 300 folders may be on the internal data carrier! Otherwise, a startup time within 200 ms is not ensured.

7.1.7.3 Activate Sleep Mode

To enable the sleep/resume mode, it is necessary to jumper the pins **Sleep/Resume Mode** enable/disable and – **Supply**. After the desired configuration is saved as a Diskstart, the device is put into sleep mode by **a voltage transition from High to Low at the CTRL-socket's contact "Sleep/Resume High"**; see circuit on [CTRL socket pinout](#)⁵⁵. This happens after a **delay time**. That delay time can be changed with a special program by imc at any time.

Delay time

The delay time allows the following features:

- Default is 5 seconds
- Prevent voltage peaks on "Sleep/Resume High" contact of the CTRL socket from activating the sleep mode.
- The user must apply a clear voltage of some duration to the contact "Sleep/Resume High" into sleep mode. If the device is to be switched automatically upon ignition of a vehicle, the car can be restarted without interrupting the measurement.
- When stopping the measurement, the switching-off process (e.g. of a vehicle to be measured) will be recorded completely.



Note

In very rare cases involving particular system setups, the activation process may cancel. In this case, the LED first shines continuously orange, after which the device reboots automatically.

7.1.7.4 Step by Step: summarization

1. Connect the device to the PC and create the desired configuration. Make sure that the channels are recorded to the internal disk.
2. Open diskstart dialog by imc STUDIO: Ribbon (Setup): "*Configuration*" > "*Diskstart*"
 - a. Write diskstart configuration to the device
 - b. The configuration's location doesn't matter
 - c. Only one diskstart configuration
3. Activate sleep mode by applying voltage to the CTRL-socket's contacts. The LED is orange for the delay time and indicates successful activation of the sleep mode by blinking green.
4. Start measurement by applying voltage to the pins of the CTRL-socket.
5. For checking purposes, connect to the device. A message appears "Measurement running – connect; stop, cancel". Connect and check the running measurement.

7.1.7.5 Error handling

Error handling with Autostart:

If an error occurred during an automatic Autostart, the LED on the device's removable drive shines. No measurement took place.

1. If an error occurs during an automatic Autostart, the device reboots and tries again to prepare for Autostart.
2. If this fails again, the device reboots and now tries to prepare the Autostart in such a way the **no** data are written to the internal data carrier. In case the drive is full or not present, the Autostart is prepared anyway. In particular for imc BUSDAQ devices, this ensures that the transition to Sleep Mode and the Resume function in response to WakeOnCAN continue to work. This error is indicated by the LED on the removable data carrier and if possible by an entry in the logfile,

e.g. 2013-09-11 13:12:46.046892 M#:Autostart failed! Ignoring device's data storage settings at next try! E#:-4009 R#:2

3. If this attempt also fails, the system reboots again and an empty Standard-experiment is set up. The status-LED continues to shine. If possible, the following entry is then written in the logfile:

e.g. 2013-09-11 14:12:46.012345 M#:Autostart failed! Using empty configuration for next try! E#:-5001 R#:3

General handling of internal errors:

In consequence of fatal internal errors (unexpected hardware problems, e.g. due to electrical disturbances, bus errors, etc.), the device had previously no longer been operable. In order to continue use, the device needed to be switched off and then on again.

Error handling during Resume:

1. In case of fatal internal errors, the device automatically reboots. If there is an internal data carrier, an entry is made in the logfile DeviceXXXXXX.syslog (XXXXXX = the device's serial number) in the root directory.

e.g.: 2013-09-11 09:55:31.135739 M#:SIGSEGV occurred, forcing reset!

2. Following the reboot, the system tries again to prepare for Autostart.

Error handling with Sleep/Resume

If an error occurred during the transition to Sleep mode, this was indicated by the red status-LED. In that case, the device remained activated at normal power consumption.

Error handling with Sleep

1. If an error occurs during the transition to Sleep mode, the device reboots. Subsequently, a new attempt is made to go into Sleep mode.
2. if necessary, this is repeated twice.
3. If even the third attempt fails, another reboot is performed and the empty Standard-experiment is prepared.

If possible, the following entry is then made in the logfile:

e.g. 2013-09-11 14:12:46.012345 M#:Suspend failed! Using empty configuration for next try!
E#:-5001 R#:3

If this attempt is successful, the Suspend mode is indicated by a red blinking LED (instead of the customary green blinking LED). If it does not succeed, Step 3 is repeated as often as necessary.

Error handling with Sleep/Resume

Steps 1 and 2 match those of the predecessor version

3. If this fails again, the device reboots and tries to prepare the Autostart experiment in such a way that **no** data are written to the internal data carrier. For cases where the drive is full or not present, the Sleep/Resume is prepared anyway. In consequence, devices having WakeOnCAN can be started from Sleep. This error is indicated during the Suspend by red blinking LED on the removable data carrier. If possible, this is also noted by an entry in the logfile.

E.g. 2013-09-11 13:12:46.046892 M#:Autostart failed! Ignoring device's data storage settings at next try! E#:-4009 R#:2

4. If even this attempt fails, the system reboots and the empty Standard-experiment is prepared. If possible, the following entry is now written in the logfile:

e.g. 2013-09-11 14:12:46.012345 M#:Autostart failed! Using empty configuration for next try! E#:-5001 R#:3

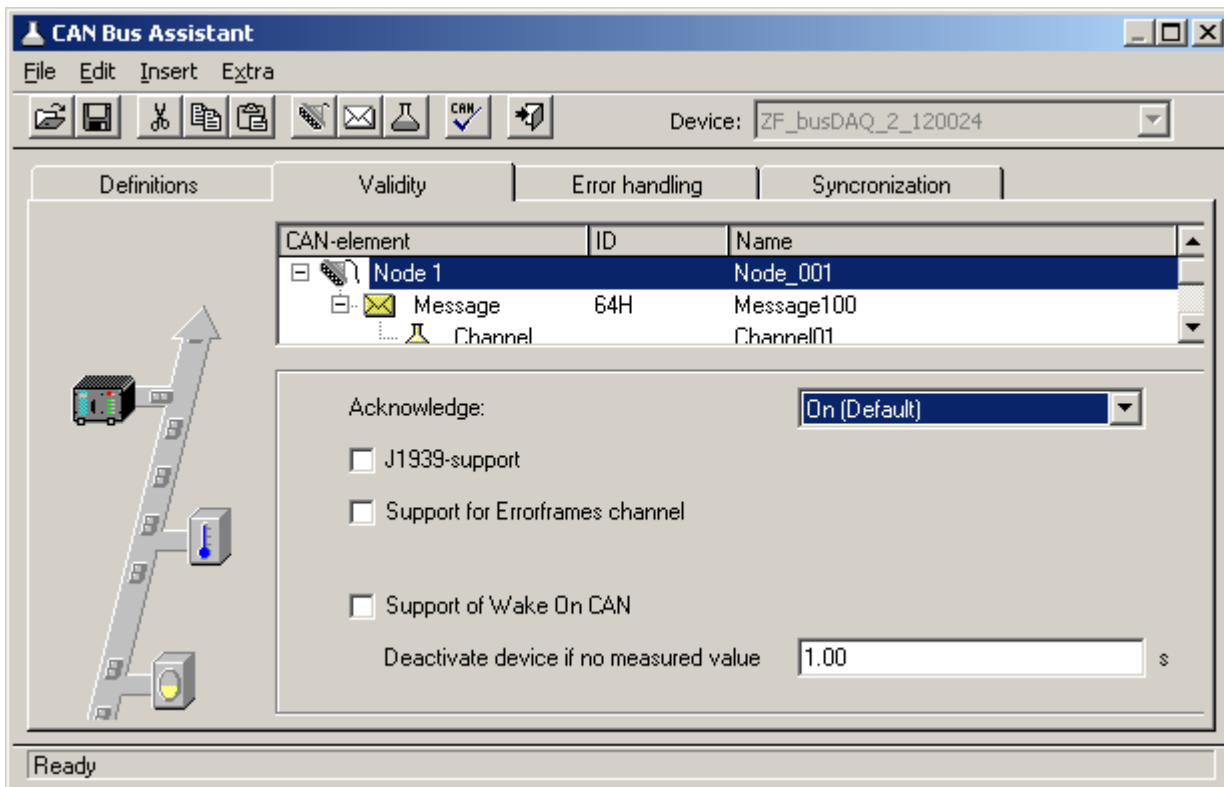
If this attempt succeeds, the Suspend mode is indicated by a red blinking LED (instead of the customary green blinking LED). If it does not succeed, step 4 is repeated as often as necessary.

7.1.8 Wake On CAN

Wake On CAN enables the functionality of Sleep mode in dependence on the CAN-Bus activity. As soon as data arrive at the CAN-node, the device starts measurement. After a specifiable time without bus activity, the device returns to the Sleep mode.

Systems supply or activate the measurement device separately from the connected CAN-Bus thus avoid premature startup of data capture and the resulting unnecessary power consumption.

The prerequisite is the appropriate configuration of the Remote connection, described previously, which enables the hardware-driven Sleep mode. Previously, the Sleep mode was available without any additional preparation of the experiment in the device software. The *Wake On CAN* function is a supplemental AND condition and must be activated in the CAN-Assistant.



The option Support of *Wake On CAN* appears on the page Validity if a node is selected in the CAN-element tree diagram. If it isn't shown, this indicates that your device's hardware isn't set up for this function.

Under Deactivate device if no measured value x s, enter the time interval whose elapse without the arrival of data is to be interpreted as deactivation of the CAN-sensors.

Each node can be adjusted individually.

7.2 Pin configuration and wiring of the CTRL-plug

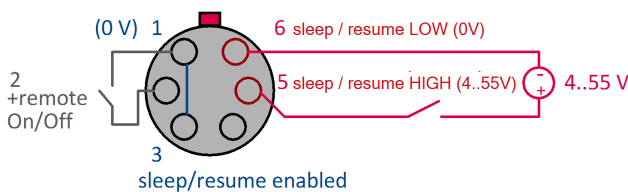
7.2.1 LEMO Typ 0B

The sleep mode is controlled by a voltage applied at the CTRL-socket's contact +Sleep/Resume High. The sleep mode is activated when this voltage is switched off (<1 V). The devices will wake up and start the measurement as soon as the voltage (4 to 55 V) is applied.

To enable the Sleep/Resume Mode, there must be a connection between *Sleep/Resume Mode enable/disable* and *-Supply*, see pin configuration of the [LEMO socket](#) ⁸⁷.

Possible Sleep / Resume configuration

1. Configuration with external voltage source

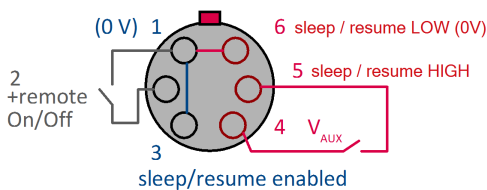


Pins 1 and 3 are connected to activate the Sleep/Resume mode.

An external voltage source at Pin 5 wakes the device from the sleep mode.

The reference of the external voltage source must be connected to Pin 6.

2. Configuration with supply voltage at Pin 4



Here too, Pins 1 and 3 are connected in order to activate the Sleep/Resume mode.

The module's auxiliary voltage is led through Pin 4, and is used for applying voltage to Pin 5.

The reference of the Sleep/Resume circuit at Pin 6 is implemented by a jumper to Pin 1.

Remote On/Off

The device can be powered on or off by the control-socket's **Remote On/Off pin**. Therefore, Remote On/Off (**Pin 2**) has to be connected with **-Supply (Pin 1)** using a pushbutton.

Be aware that BUSDAQflex-2 behaves differently in this situation than the larger model variants:

- **BUSFX-2(S), BUSLOG:** Switch On/Off by briefly jumpering using a **pushbutton**.
- **BUSFX-4/6/8/12:** Switch On/Off by means of a **switch**.

Note

BUSFX-4/6/8/12: On/Off via the power supply

If there is a **permanent connection** between Remote On/Off and Pin1 (**-Supply**), the device can be switched On/Off automatically **via the power supply** circuit. So for instance, if an autostart configuration is saved in the device, this can be used to automatically start a measurement on board a vehicle once the vehicle's battery power is switched on.

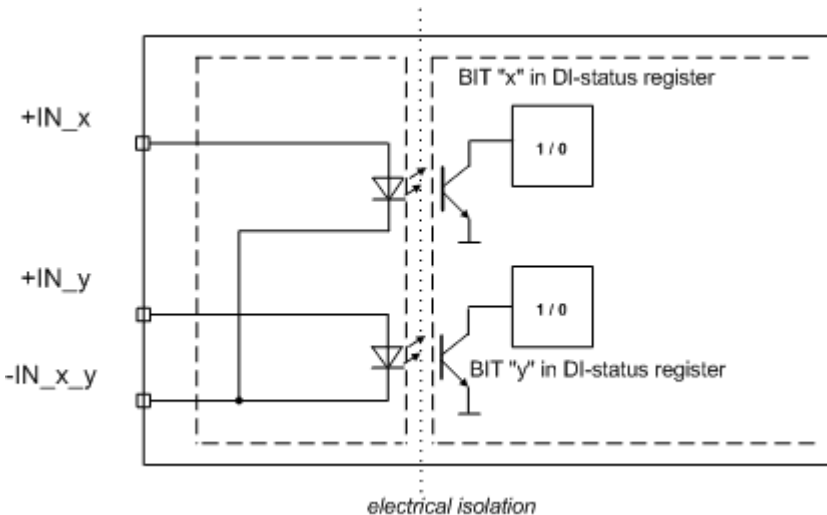
Note that in the case of such a switching configuration, the device **can no longer be switched off by means of the Power-On button!**

7.3 Digital inputs and outputs DIO for BUSFX-4/-6/-8/-12

7.3.1 Digital Inputs

Parameter	Value	Remarks
Channels	4	Each pair of channels has a common ground reference and is isolated from the other inputs, the power supply and CAN-Bus, but not mutually.

The digital input portion possesses 4 inputs which can take samples at rates of up to 10 kHz. Every pair of inputs has a common ground reference and are not mutually isolated. However, this input pair is isolated from all other pairs.



[Pin configuration of the DSUB-15 plugs for digital inputs](#) 

7.3.1.1 Input voltage

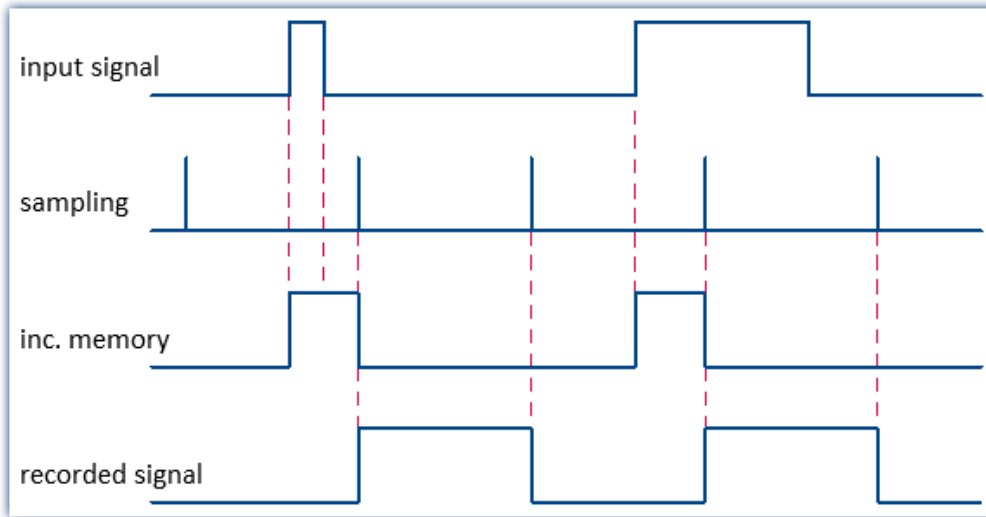
The input voltage range for two digital inputs can be set for either 5 V (TTL-range) or 24 V. The switching is accomplished by means of a jumper between pin LEVEL x/y and reference voltage -IN x/y:

- If LEVEL x/y and reference voltage -IN x/y are jumpered, both bits work with 5V and a threshold of 1.7..1.8 V.
- If LEVEL x/y is open, 24 V and a threshold of 6.95 ...7.05 V are valid.

Thus, an unconnected plug is set by default for 24 V. This prevents 24 V from being applied to the voltage input range of 5 V.

7.3.1.2 Sampling interval and brief signal levels

The digital inputs can be recorded in the manner of an analog channel. It isn't possible to select individual bits for acquisition; all 4 bits (digital port) are always recorded. The hardware ensures that the brief HIGH level within one sampling interval can be recognized.

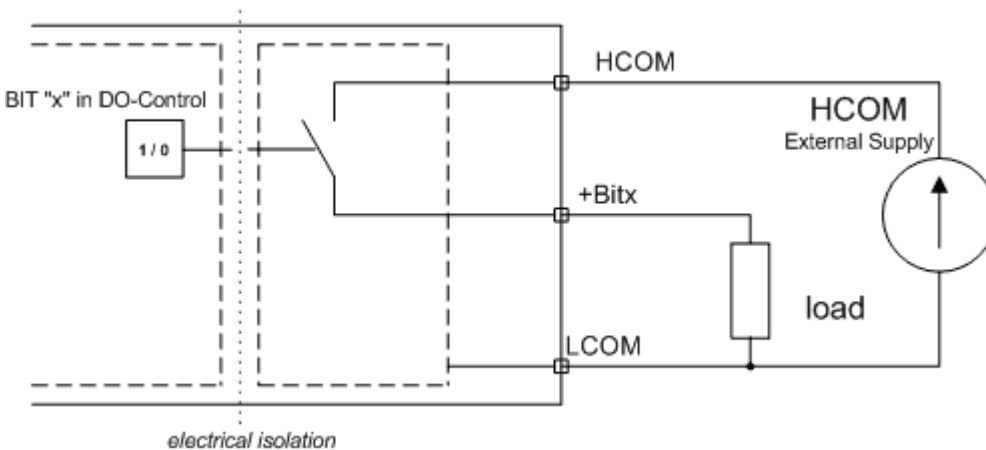


7.3.2 Digital Outputs

Parameter	Value	Remarks
Channels	4	All outputs and the external voltage supply have a common ground reference and are isolated from the other inputs, the power supply and CAN-Bus, but not mutually.

The output voltage must be provided by an external voltage supply connected to pin HCOM. That voltage has to be in the range of 7 to 30 V. The load will be connected to Bit_x. All outputs and the external supply have a common reference at pin LCOM, but are isolated from all other components of the device.

The outputs are switched by transistors. The maximum current is limited to 0.7 A.



Reference

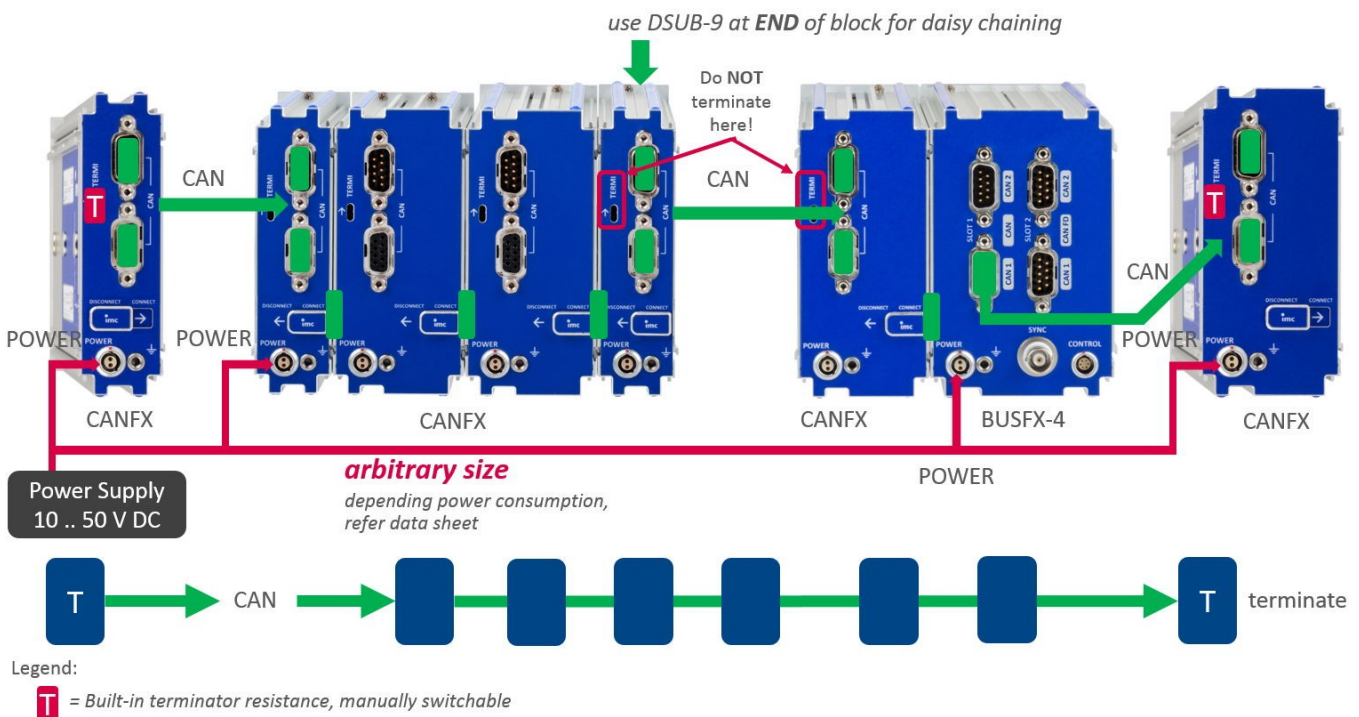
[Pin configuration of the DSUB-plugs for the digital outputs](#) 85

7.4 Fieldbus interfaces

7.4.1 CAN, CAN FD

Each imc BUSDAQflex (BUSFX) offers 2 CAN nodes as basic equipment. The imc CANSASflex modules (CANFX), which are connected to the BUSFX device via the [click connection](#)³⁹, are located at the **CAN 1 node of slot 1** (see labeling on the device, CAN 1).

Terminators must be provided at the end of the CAN bus. The BUSFX device has internal terminators that can be activated by software. These can be activated individually for each node. If the BUSFX device is connected to one end, the termination can be activated in the CAN Assistant. As soon as CAN modules are connected to the CAN 1 node and additional clicked modules are [connected](#)³⁹ to the BUSFX device, no additional termination is allowed in the CAN Assistant.



Note

- A **Y-type stub** cannot be terminated. Only the **bus end** has to be terminated: last module or **end** (not beginning) of the last block!
- A **Y-type stub** must not exceed a maximum length of 30 cm.
- **Connection of the terminators:**
 - CANFX modules are equipped with built-in terminator resistances which are manually switchable. Alternatively, terminator resistances can be connected between pin 2 and 7, using resistances of 120 Ω according to the CiA® standard.
 - Terminate end of entire CAN bus only. Otherwise, no further terminators may be connected.

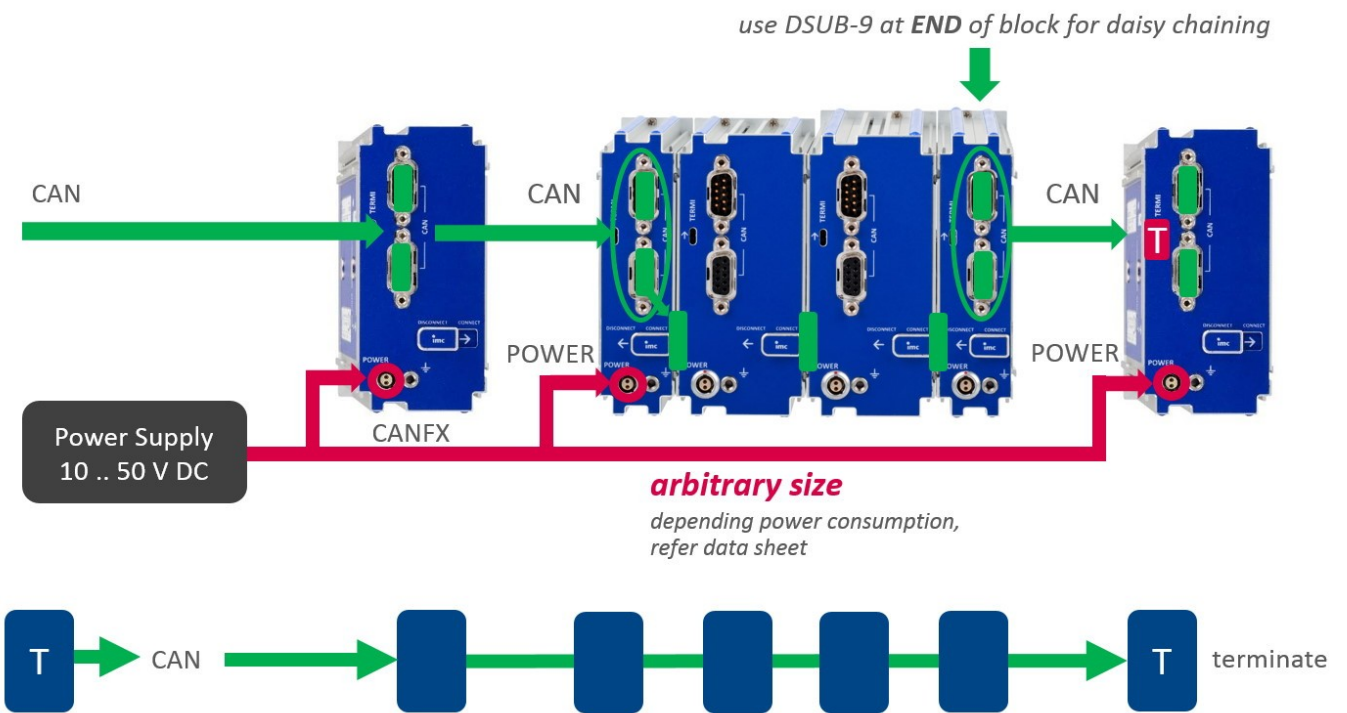
Reference

- Please find here [technical specs](#)^[72] of the CAN-Bus interface.
- Please find here [technical specs](#)^[73] of the **CAN FD** interface and
- in the following chapter the [DSUB-9 pin configuration](#)^[88].

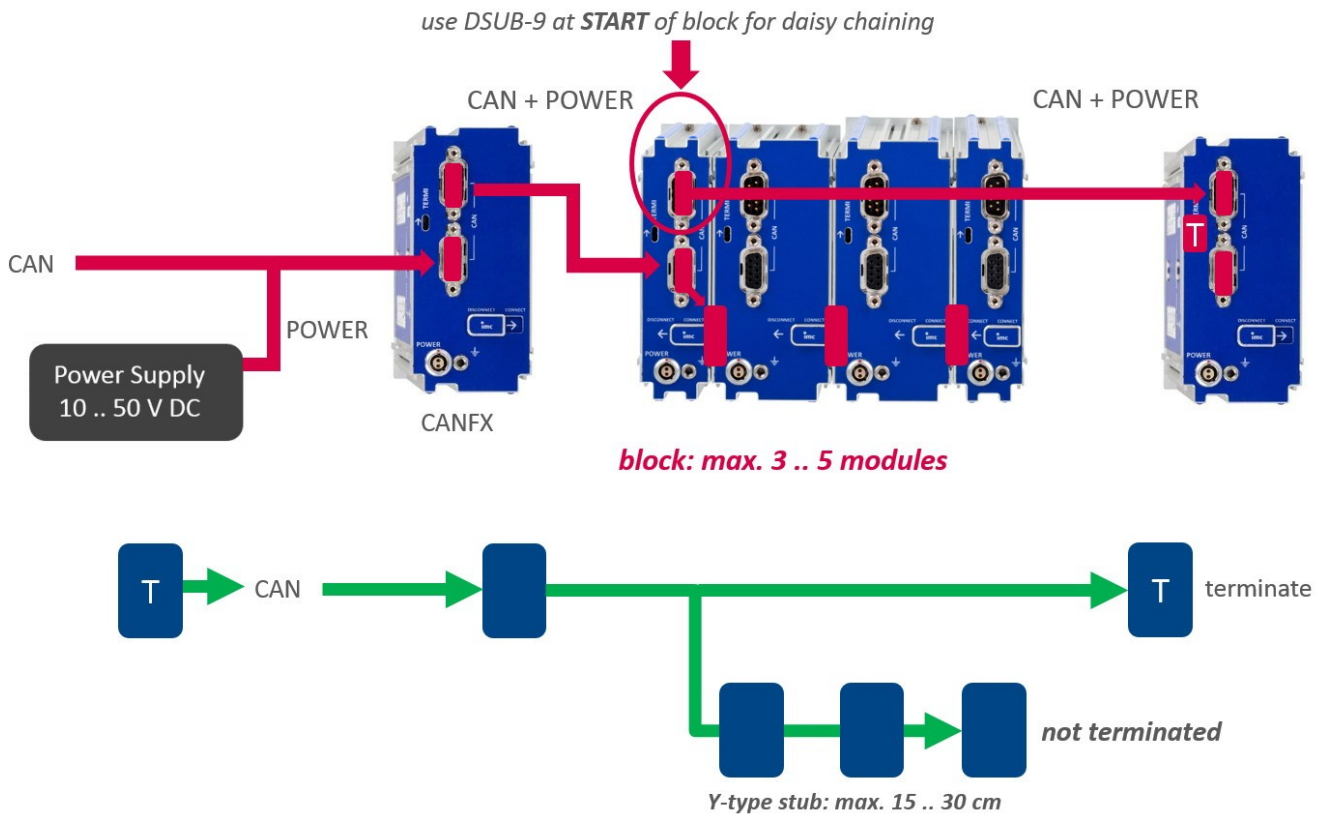
Power via CAN

The following figures: A) and B) show connection possibilities, depending on the use of power via CAN. If your device has the **Power via CAN** functionality, the **DSUB connection** on your device is labeled "**Power via CAN**".

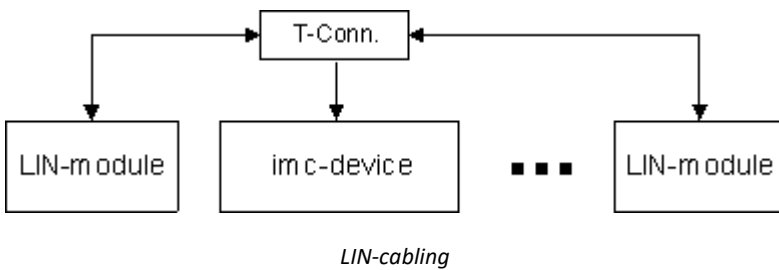
A) Power via CAN not used: no stubs, unlimited block size



B) Use of Power via CAN: max. size of stub blocks (Y-type stub), according CiA®



7.4.2 LIN



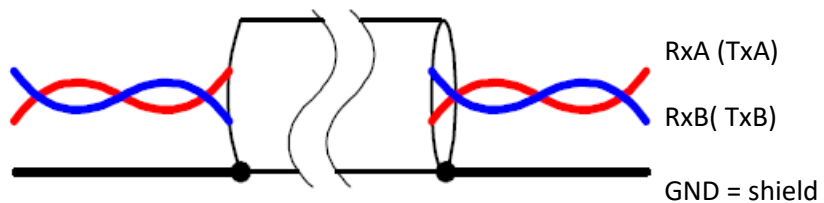
To the [technical data](#)^[74] and the [pin configuration](#)^[88] of the LIN-BUS interface.

7.4.3 ARINC

imc standard: DSUB-15

This pin configuration corresponds the suggested imc standard. Transmitting channels and any differing pin configuration can be considered as special order.

We recommend for the connection twisted and shielded wiring:



To the [technical data](#)^[78] and the [pin configuration](#)^[90] of the ARINC-Bus interface.

7.4.4 FlexRay

Standard 1x DSUB-9



To the [technical data](#)^[74] and the [pin configuration \(optional 2x DSUB-9\)](#)^[89] of the FlexRay interface.

7.4.5 XCPoE

Standard 1x RJ45



To the [technical data](#)^[76] and the [pin configuration](#)^[89] of the XCPoE interface.

7.4.6 PROFINET



To the [technical data](#)^[75] and the [pin configuration](#)^[91] of the PROFINET interface.

7.4.6.1 LED

PROFINET			
Parameter	Value		Remarks
Explanation NET LED	off		no supply no connection to the IO-Controller
	green		connection with IO-Controller established IO-Controller in RUN state
	green, 1 x blinking		connection with IO-Controller established IO-Controller in STOP state or erroneous IO data RT synchronization not completed
	green, blinking		network identification
	red		internal error in combination with red module status LED
	red, blinking once		station name not set
	red, blinking twice		IP address not set
	red, blinking three times		expected IO-Device identification deviates from real identification
Explanation MOD LED	off		no supply device not in initialization phase
	green		normal operation
	green, blinking once		diagnosis-event(s) available
	red		internal error in combination with red NET-LED
	alternating green, red		Firmware-Update. The device must not be switched off during the update. Otherwise it can lead to total failure of the device.
Explanation LEDs of the network socket	green (left)	yellow (right)	
	off	off	no connection
	on	off	100 Mbit/s connection
	blinking	off	100 Mbit/s connection, active
	off	on	10 Mbit/s connection
	off	blinking	10 Mbit/s connection, active

7.4.7 PROFIBUS



To the [technical data](#)^[75] and the [pin configuration](#)^[91] of the PROFIBUS interface.

7.4.8 MVB

EMD (Electrical Medium Distance) with duplicate interconnection providing redundant transmission for the bus via two differential lead pairs. Up to 32 devices can be connected across a distance of max. 200 m. The cables used are standard 120 Ω lines. The signals are connected by means of two DSUB-9 plugs. The shielding is connected directly to the device housing. The housing should be grounded if possible. Internally, the bus is electrically insulated from the device connected.

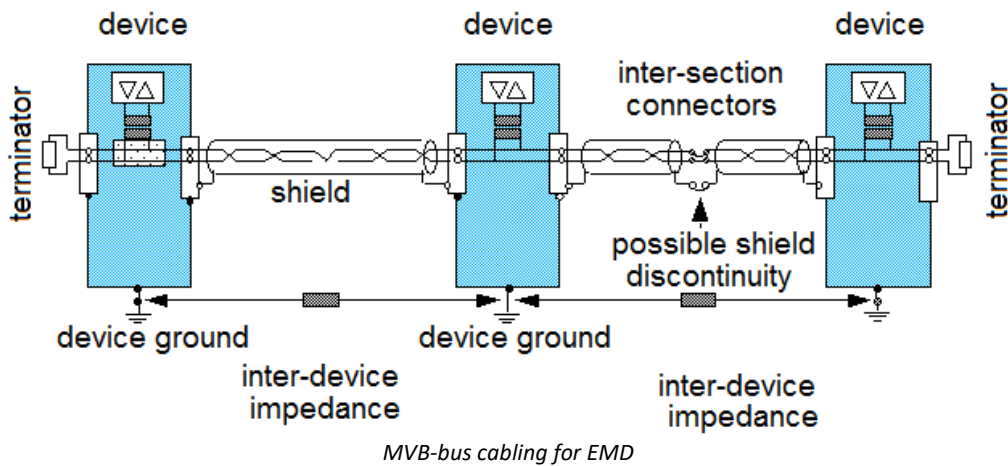
 **Reference**

To the [technical data](#)^[77] and the [pin configuration](#)^[92] of the MVB-Bus interface.

7.4.8.1 EMD

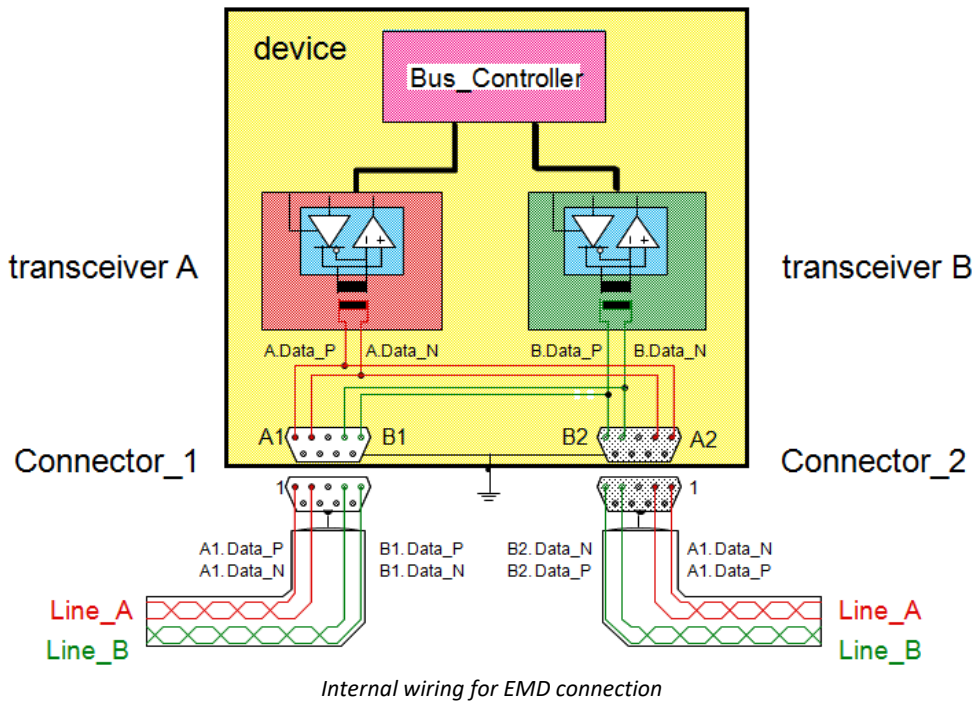
EMD (Electrical Medium Distance) with duplicate interconnection providing redundant transmission for the bus via two differential lead pairs.

- Up to 32 devices can be connected across a distance of max. 200 m.
- The cables used are standard 120 Ω lines.
- The signals are connected by means of two DSUB-9 terminals.



The shielding is connected directly to the device housing. The housing should be grounded if possible.

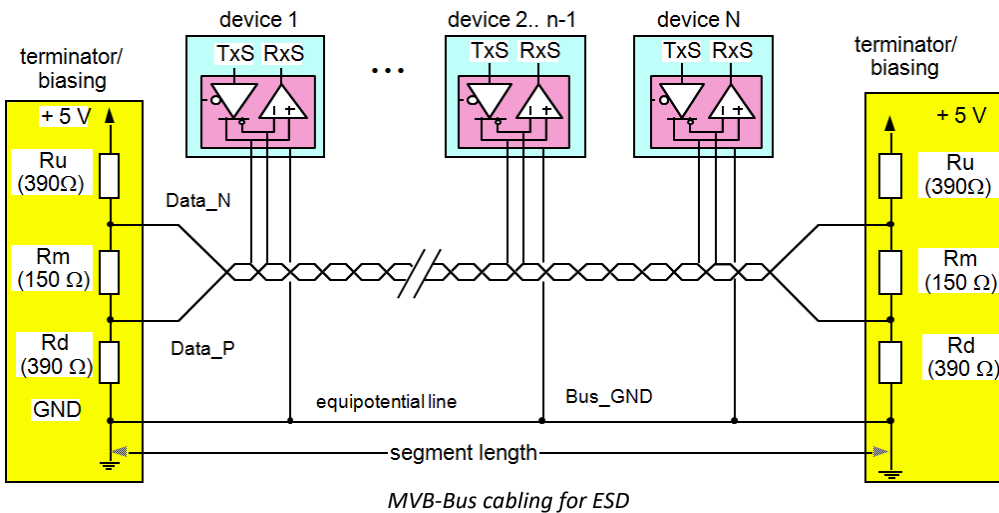
Internally, the bus is electrically insulated from the device connected.



7.4.8.2 ESD

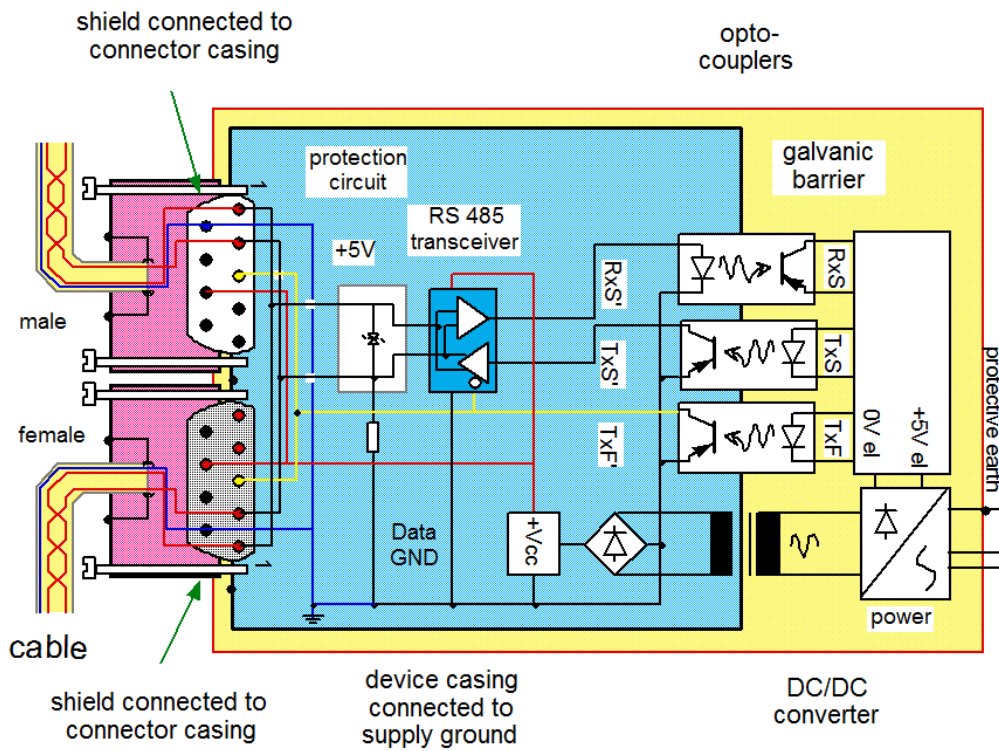
ESD (Electrical Short Distance) RS485 sets up the connection without galvanic isolation. The variant ESD+ comes with galvanic isolation and is available from imc.

- Up to 32 devices can be connected across a max. distance of 20 m.
- Standard 120 Ω cable leads are used.
- Lines are connected via DSUB9 terminals.



The shielding is connected directly to the device chassis, which should be grounded if possible.

Internally, the bus is galvanically isolated from the connected device.



ESD+ device with galvanic isolation

8 Technical Specs

All devices described in this manual are intended at least for normal ambient conditions according to IEC 61010-1. In addition, the extended ambient conditions apply according to the explicitly stated technical data.

The data sheets in this chapter "Technical Specs" correspond to the separately managed data sheets. In addition to the tables, the separate data sheet contains module and device photos, drawings with dimensions, accessories and imc part numbers. This additional information would go beyond the scope of this manual. In individual cases it may happen that we publish a new data sheet before there is a new manual edition. The valid data sheets are always available on the imc website:

www.imc-tm.com/download-center/product-downloads

The specified technical data refer to the reference conditions, such as the specified preferred position of use (see respective technical data sheet) and an ambient temperature of 25 °C as well as compliance with the specifications for use (see chapter "Precautions for operation") and for grounding and shielding.

For device variants with BNC connection technology in particular (established for certain measurement tasks), gapless shielding is not initially guaranteed due to the design, as the negative pole of the measurement input is directly connected out as a coaxial outer conductor. Any interference coupled to the measuring lines thus has an asymmetrical effect on the measuring input. As a result, the accuracy specifications specified in the tables may be exceeded during the fault. Appropriate measures are taken to meet the EMC requirements for these devices as well. For the acceptance criterion A, a measuring accuracy of 2 % is assumed in the unshielded case for the reasons mentioned. If significant RF interference is to be expected in the measurement environment and if the limited accuracy is insufficient, the shielding measures shall be implemented in accordance with the above sections, i.e. the coaxial test lead shall be shielded.

8.1 imc BUSDAQflex

Terminal connections		
Parameter	Value	Remarks
CAN	2 x DSUB-9	2 nodes, standard equipment for all device variants 1 node / DSUB-9 (male at device side) in/out
PC / network	RJ45	Ethernet 100 MBit
Power supply	type LEMO.0B (2-pin)	compatible with LEMO.EGE.0B.302 multi coded 2 notches compatible with plugs: FGG.0B.302 (standard) or FGE.0B.302 (E-coded, 48 V)
Remote	type LEMO.0B (6-pin)	LEMO FGG.0B.306 plug
Sync	SMB BNC	synchronization BUSFX-2-S and BUSFX-LOG all others
Flash removable storage	CF-Card slot	can also be read out via network
External Display	DSUB-9	except BUSFX-2-S, BUSFX-LOG
External GPS module	DSUB-9	except BUSFX-2-S, BUSFX-LOG
Internal WLAN-adaptor	optional IEEE 802.11g (1 antenna) max. 54 MBit/s	only with BUSFX-4/6/8/12
Digital Input/Output	2 x DSUB-15	only with BUSFX-4/6/8/12
	4 x DI (TTL / 24 V, isolated) 4 x DO (0.7 A high-side switch)	ACC/DSUBM-DI2-4, ACC/DSUBM-DO4
Module connector	via locking slider	for power supply and networking (CAN) of directly connected modules (Click- mechanism) without further cables

Power supply		
Parameter	Value	Remarks
Input supply voltage	10 V to 50 V DC	not galvanically isolated of housing (CHASSIS)
Power consumption	5 W 8 W 10 W 12 W 15 W	depending on model, typ. value: at 12 V Super-Caps charged imc BUSDAQflex-2(-S) imc BUSDAQflex-4 imc BUSDAQflex-6 imc BUSDAQflex-8 imc BUSDAQflex-12 when the Super-Caps are discharged, then the power consumption will increase by a max. of 6 W for a short period of time, depending on the model
Forwarded (passing through) power supply	onto module connector on CAN connections	standard; for CANFX optional (upon request)
Pass through power limits for supply of directly connected modules (click-connection)		
Max. current	8 A	current rating of the module connector
Max. power	96 W at 12 V DC 192 W at 24 V DC 384 W at 48 V DC	equivalent pass through power typ. DC vehicle voltage AC/DC line adaptor or facilities optional AC/DC adaptor
Available power with optional supply via CAN (DSUB-9)		
Max. current	1 A	passed through on 2 x DSUB-9; secured with PTC; bidirectional: in/ out
UPS and data integrity		
Parameter	Value	Remarks
Self start (Automatic data acquisition operation)	configurable	automatic start when power supply is available
Auto data-saving upon power outage	✓	buffering (UPS) with auto-stop, data storage and shutdown
UPS	integrated	Super-Caps
Charging time of the UPS Super-Caps	3 min. 4 min. 8 min.	minimum active operation for full UPS functionality BUSFX-LOG, BUSFX-2(S) BUSFX-4/-6 BUSFX-8/-12
Shutdown delay with power outage	1 s	"buffer-time constant": required duration of a continuous outage that will trigger auto shutdown procedure

Sleep-Mode		
Parameter	Value	Remarks
Sleep mode	available with devices equipped exclusively with CAN/LIN	
Sleep / Wakeup Trigger	CAN-activity or control signal	mode "Wake-on-CAN" enter sleep mode upon inactivity (after configurable time)
Power consumption in sleep mode	200 mW	average power consumption, including occasional refresh-cycles of the UPS Super-Caps
Boot delay	200 ms 30 s	wake up from sleep mode upon Power-On
Sleep / Wake up via control signal	external signal (5..55 V) or switch contact	at REMOTE terminal ("Suspend/Resume")
Data acquisition, storage, signal processing		
Parameter	Value	Remarks
Channels	max. 512	each device
Channel individual sampling rates	selectable in 1–2–5 steps	
Number of sampling rates	arbitrary	to be used in one system configuration
Monitor channel	✓	to be enabled for each individual node: doubled channels with independent sampling and trigger settings
Intelligent trigger functions	✓	e.g. logical combination of multiple channel events (threshold, edge) to create triggers that start and stop acquisition of assigned channels
Multi-triggered data acquisition	✓	Multitrigger and multi-shot
Independent trigger machines	48	start/stop, arbitrary channel assignment
Extensive real-time analysis and control functions	optional (imc Online FAMOS)	device-option, licensed via activation code
CAN message send	via imc Online FAMOS	
Synchronization	DCF 77, GPS, NTP	Master / Slave
Removable flash storage	Compact Flash (CF)	recommended media available at imc; the specified operating temperature range of the media is relevant
Storage on NAS (network storage)	✓	alternatively to flash storage
Arbitrary memory depth with pre- and post trigger	✓	maximum pretrigger limited by size of Circular Buffer RAM; posttrigger only limited by available mass storage (Flash)
Circular buffer mode	✓	cyclic overwrite of circular buffer memory on mass storage media

Operating conditions		
Parameter	Value	Remarks
Ingress Protection	IP40	only with optional protective cover on top of the locking slider, otherwise IP20
Pollution degree	2	
Operating temperature	-40°C to 85°C	internal condensation temporarily allowed (pollution degree 2)
Weight	0.5 kg	BUSFX-2-S

8.1.1 Synchronization and time base

Time base of individual device without external synchronization			
Parameter	Value typ.	min. / max.	Remarks
Accuracy		±50 ppm 1 µs (1 ppm)	internal time base RTC (at 25°C) not calibrated (standard devices) calibrated devices (upon request)
Drift	±20 ppm	±50 ppm	-40°C to +85°C operating temperature
Ageing		±10 ppm	at 25°C; 10 years

Time base of individual device with external synchronization signal				
Parameter	GPS ⁽⁴⁾	DCF77	IRIG-B	NTP
Supported formats	NMEA / PPS ⁽¹⁾		B000, B001, B002, B003 ⁽²⁾	Version ≤4
Precision		±1 µs		<5 ms after ca. 12 h ⁽³⁾
Jitter (max.)		<100 ns ⁽⁵⁾		---
Voltage level	TTL (PPS ⁽¹⁾) RS232 (NMEA)	5 V TTL level		---
Input impedance	1 kΩ (pull up)	20 kΩ (pull up)		---
Input connection	DSUB-9 "GPS"	BNC respectively SMB "SYNC" (not isolated)		RJ45 "LAN"
Cable shield connection		signal-GND = CHASSIS single-ended signal (with possible ground loops: external option "ISOSYNC" recommended)		---

Synchronization of multiple devices via DCF77 (Master/Slave)			
Parameter	Value typ.	min. / max.	Remarks
max. cable length		200 m	BNC cable type RG58 (propagation delay of cable needs to be considered) with possible ground loops: external option "ISOSYNC" recommended
max. number of devices		20	Slaves, plus 1 Master

(1) PPS (Pulse per second): signal with an impulse >5 ms is required; max. current = 220 mA

(2) Using BCD information only

(3) Max. value concerning the following condition: first-synchronization

(4) not imc BUSDAQflex 2-s

(5) Without the system-related jitter for fieldbus channels

8.1.2 Digital Inputs and Outputs (BUSFX-4/6/8/12)

Digitale Inputs		
Parameter	Value	Remarks
Channels / Bits	4	each 2 Bit with common ground reference are isolated against the other inputs, the supply, CAN-Bus and housing
Configuration options	TTL or 24 V input voltage level	configurable at DSUB globally for 2 Bit-groups: LEVEL = LCOM: TTL-mode LEVEL offen: 24 V-mode
Sampling rate	≤ 10 kHz	
Isolation strength	60 V	tested: 200 V against housing (CHASSIS)
Input current	< 500 μA	
Switching threshold	1.5 V (±200 mV) 8 V (±300 mV)	TTL / 5 V level 24 V level
Switching delay	200 μs	
Digital Outputs		
Parameter	Value	Remarks
Channels / Bits	4	group of 4 Bit with common ground reference LCOM. isolated against supply, CAN-Bus and housing
Configuration	electronic High-Side switch	connection of an external power supply required: 7 V .. 30 V at HCOM / LCOM
Max. load current	0.7 A	protected against short circuit and over load
Output impedance	≤ 0,4 Ω	
Isolation strength	60 V	against housing (CHASSIS)
Switching delay	100 μs	

8.2 Further technical specs

8.2.1 Fieldbus: Technical Details

8.2.1.1 CAN-Bus Interface

Parameter	Value	Remarks
Number of CAN-nodes	2	one galvanically isolated node per connector (each with CAN IN and CAN OUT)
Terminal connection	2x DSUB-9	
Topology	bus	
Transfer protocol	configurable per software: CAN High Speed (max. 1 MBaud) CAN Low Speed (max. 125 KBaud)	individually for each node according to ISO 11898 according to ISO 11519
Operating mode	Multi Master principle	
Direction of data flow	sending and receiving	
Baud rate	5 kbit/s to 1 Mbit/s	configurable via software; maximum is depending on selected protocol (High/Low Speed)
Max. cable length at data transfer rate	25 m at 1000 kBit/s 90 m at 500 kBit/s	CAN High Speed cable delay 5.7 ns/m
Termination	120 Ω	switchable by software for each node
Isolation strength	60 V	to system ground (case, CHASSIS)
Direct access for configuration of imc CANSAS modules	yes	via the CAN node of the device, with imc STUDIO

To the [pin configuration](#)^[88] and the [cabling](#)^[58] of the CAN-Bus interface.



Note

Remote Frame

imc devices actually does not support Remote Frames (RTR) according to CAN specification.

8.2.1.2 CAN FD Bus Interface

Parameter	Value	Remarks
Number of CAN-nodes	2	one galvanically isolated node per connector
Terminal connection	2x DSUB-9	
Topology	bus	
Transfer protocol	configurable per software: CAN FD (ISO Standard) (max. 8 MBaud) non-ISO CAN FD (Draft) (max. 8 MBaud) CAN High Speed (max. 1 MBaud) CAN Low Speed (max. 125 KBaud)	individually for each node current standard according ISO 11898-1:2015 former draft (Bosch) according ISO 11898 according ISO 11519
Operating principle	Multi Master principle	
Direction of data flow	sending and receiving	
Baud rate	5 kbit/s to 8 Mbit/s	configurable via software; maximum is depending on selected protocol (FD/High/Low Speed)
Termination	120 Ω	switchable by software for each node
Isolation strength	± 60 V	to system ground and case
Direct access for configuration of imc CANSAS modules	yes	via the CAN node of the device with imc STUDIO (CAN High Speed Mode only)



Note

Remote Frame

imc devices actually does not support Remote Frames (RTR) according to CAN specification.

8.2.1.3 LIN-Bus Interface

Parameter	Value	Remarks
Nodes	2	for each node LIN_IN / LIN_OUT
Terminal connection	2x DSUB-9	one DSUB for each node
Topology	Bus	
Transfer protocol	LIN 2.1, LIN 2.0, LIN 1.3	LIN 1.3 and LIN 2.x specifications can run on a bus simultaneously
Operating mode	Master and/or Slave	Master: with fixed schedule table in the LDF file
Direction of data flow sending receiving	Display variables, virtual bits LIN data in measurement channels	
Baud rate	1 to 20 kbit	
Data rate	30 kS/s	
Termination	Pull up resistor	selectable via software Master/Slave
Isolation strength	60 V	to system ground (case, CHASSIS)

To the [pin configuration](#) ^[88] and the [cabling](#) ^[60] of the LIN interface.

8.2.1.4 FlexRay Interface

Parameter	Value	Remarks
Number of FlexRay nodes	1 additional 1 cold start node	1x channel A+B
Terminal connection Standard	1x DSUB-9 per module	optionally 2x DSUB-9 (channel A+B separately)
Topology	Bus	
Transfer protocol	FlexRay protocol specification v3.0 XCP- specification Universal Measurement and Calibration Version 1.2.0; Date: 2013-06-20"	<ul style="list-style-type: none"> ASAM_AE_MCD-1_XCP_BS_Protocol-Layer_V1-2-0.pdf "ASAM MCD-1 (XCP); Protocol; Protocol Layer Specification; ASAM_AE_MCD-1_XCP_AS_Flexray-Transport-Layer_V1-2-0.pdf "ASAM MCD-1 (XCP on FlexRay); Protocol; FlexRay Transport Layer;
Operating mode	Sync nodes, cold start nodes or normal nodes	
Direction of data flow sending	Display variables, Virtual bits, Process vector variables and Ethernet bits	Cyclic and Single Shot Frames with imc Online FAMOS
Baud rate	2.5 / 5.0 or 10.0 Mbit/s	
Max. cable length at data transfer rate	see FlexRay protocol	
Data rate	max 60 kSample/s	per module
Isolation strength	60 V	to system ground (case, CHASSIS)

To the [pin configuration](#) ^[89] and the [cabling](#) ^[61] of the FlexRay interface.

8.2.1.5 PROFIBUS Interface

Parameter	Value	Remarks
Nodes	1	
Terminal connection	1x DSUB-9 per module	RS 485
Transfer protocol	DPV0, DPV1	
Operating mode	Sniffer (logging of existing bus communication)	no master, no slave
Baud rate	max. 12 Mbit/s	
Max. cable length at data transfer rate	PROFIBUS specification	
Isolation strength	60 V	to system ground (case, CHASSIS)

To the [pin configuration](#)^[91] and the [cabling](#)^[62] of the PROFIBUS interface.

8.2.1.6 PROFINET Interface

Profinet-Class	Value	Remarks
Node	1	
Device class	IO-DEVICE	
Functionality	CC-C	Conformance Class C
Profinet-Certification	Netload Class III certified according to PNIO-version V2.34	
Cyclic data exchange	RT, IRT	
Minimum supported bus cycle time	250 µs	Isochronous Real Time (IRT)

Network connection	Value	Remarks
Terminal connection	2x RJ45	internal network switch labeling: Port 1 and Port 2
Network	100 Mbit/s	full duplex with autonegotiation
Isolation	standard Ethernet specification	
Supported topologies	star/tree/line/circular	

Configuration options	Value	Remarks
Supported variable assignments	channels, pv-variables	assignment to Profinet variables
Max. number of pv-variables	800	general system limit for imc CRONOS devices
Endianess support	Big-Endian / Little-Endian	Byte order (Motorola/Intel), via wizard
internal data type converter	yes	
Save / Load configurations	yes	via wizard
Validation of configurations	yes	via wizard
Number of pluggable slots	40	Profinet: logical module structure "plugging" of slots = parameterization of logical units
max. pluggable output modules	20	
Size per output modules	64 Byte	
max. pluggable input modules	20	
Size per input module	64 Byte	
Maximum I/O process space	1280 Byte each	20 · 64 Byte

To the [pin configuration](#)^[91] and the [cabling](#)^[61] of the PROFINET interface.

8.2.1.7 XCPoE Master-Slave Interface

Parameter	Value	Remarks
Nodes	1	
Terminal connection	1x RJ45	
Transfer protocol	XCP -Part 1- Overview XCP -Part 2- Protocol Layer Specification	Ver. 1.0; ASAM e.V. Ver. 1.0; ASAM e.V.
	XCP -Part 3- Transport Layer Specification XCP on Ethernet (TCP_IP and UDP_IP)	Ver. 1.0; ASAM e.V.
	XCP -Part 4- Interface Specification XCPplus	Ver. 1.0; ASAM e.V.
Operating mode	Master or Slave	A2L file can be imported (XCPplus support included) A2L-file will be generated
Transmittable channel type when operating as slave	All meas. channels (analog, digital, fieldbus-, as well as virtual channels (OFA))	
Data rate per channel	max. 50 kHz max. 10 kHz	depending on system configuration Slave Master
Max. cable length	100 m	
Hardware interface (Physical Layer)	Ethernet 100 Mbit/s	
Isolation strength	standard Ethernet specification	

To the [pin configuration](#)^[89] and the [cabling](#)^[61] of the XCPoE interface.

8.2.1.8 IPTCom Interface

Parameter	Value	Remarks
Node	1	
Terminal connection	1x RJ45	
Operating mode	Slave	
Data transfer direction receive	SINT16/FLOAT-channels	
Data rate	max. 100 kS/s	total
Ethernet	100 Mbit/s	
Isolation strength	60 V	to system ground (case, CHASSIS)

8.2.1.9 MVB-Bus Interface

Property	Characteristics
Node	1
Transmission medium	Copper: twisted pair, RS485
Terminal connection	2x DSUB-9
Topology	Bus
Protocol standards	IEC 61375-3-1 Electronic Railway Equipment - Train Communication Network - Part 3-1: MVB - Multipurpose Vehicle Bus IEC 61375-3-2 Electronic railway equipment - Train communication Network - Part 3-2: MVB - Multipurpose Vehicle Bus Conformance Testing
Physical Layer	EMD Electrical Middle distance medium non-reactive tapping of data or as an option (alternatively): ESD+ Electrical short distance
Operation mode	logging of periodical process data
Max. cable length	200 m with up to 32 subscribers
Redundancy	duplication: messages sent on both lines
Gross data rate	1.5 Mbit/s
Address room	4095 physical devices, 4095 logical ports, 8-bit station addresses for messages
Frame size	16, 32, 64, 128 and 256 bit
Isolation strength	500 V _{RMS} (1 min.)

To the [pin configuration](#)⁹² and the [cabling](#)⁶³ of the MVB-Bus interface.

8.2.1.10 ARINC-Bus Interface

Parameter	Value typ.	min. / max.	Remarks
Number of Rx-channels	8		
Number of Tx-channels	4		
Terminal connection	2x DSUB-15		
Transfer protocol	ARINC 429		
Baud rate	Low (12.5 kbit/s) High (100 kbit/s)		
Max. voltage for each Rx connection		±29 V	to System ground (protection ground)
Max. voltage for each Tx connection	5 V	4.5 V / 5.5 V	to GND "ZERO": min -0.25 V .. max 0.25 V
	10 V	9 V / 11 V	differential "ZERO": min -0.5 V .. max 0.5 V
Isolation strength	no galvanically isolation		

To the [pin configuration](#)^[90] and the [cabling](#)^[60] of the ARINC interface.

8.2.1.11 RoaDyn Interface

The RoaDyn® Interface provides the interface between the wheel force transducer system RoaDyn® 2000 by Kistler and an imc CRONOS measurement device. The compatible Kistler unit version is 4.01a, 4.01b and c with DSP-Type_ VC33.

Along with the RoaDyn® system's (3x force, 3x torque, angle, angular velocity, temperature, supply voltage) main channels, all additional service channels (single force components, errors etc.) are available.

Physical structure: The RoaDyn® Interface is a configuration option ("configuration module"), devices can only be equipped ex-factory with this Interface. An exchange or plug-in by the user is not allowed.

Parameter	Value	Remarks
Nodes	Interface for a Kistler 2000 system max. 4 wheels	
Terminal connection	2x BNC RJ45	Clock and Trigger for the data exchange
Channels	all channels of the RoaDyn® system available: 10 main channels (3x force, 3x torque, angle, angular velocity, temperature, supply voltage additionally all service and additional-channels (single force, error cases etc.)	
Transmission medium	Ethernet 100 Mbit/s	10/100 Mbit/s, approvable cable length for 100 Mbit/s Ethernet max. 100 m according IEEE 802.3
Delay of tested Kistler unit - Version: 4.01a - DSP-Type: SBC31	2 ms plus 16 Samples	complete delay is compensated in the data processing imc Online FAMOS calculates with measurement data
Sampling rate	max. 1 kHz synchronized to imc system	

8.2.2 Color Display

Parameter	Color Display	
Display	5.7" TFT	
Colors	65536	
Resolution	320 x 240	
Backlight	LED	
Contrast (typ.)	600:1	
Brightness (typ.)	450 cd/m ²	
Connection cable	RS232, max. 2 m	
Dimensions (W x H x D)	192 x 160 x 30 mm (w/o connectors)	
Display area	approx. 11.5 x 8.6 cm	
Weight	approx. 1 kg	
Supply voltage	9 V to 32 V _{DC} 6 V to 50 V _{DC} upon request	
Power consumption	approx. 3 W with 100% back light	
Temperature range	-20°C to +60°C ≤+85°C	operating temperature module interior temperature
Rel. humidity	80% up to 31°C, above 31°C: linear declining to 50%, according DIN EN61010-1	
Terminal connections	DSUB-9 (female) for connection to measurement device 3-pin Binder (metal) ESTO RD03 series 712, 3-pin for external current supply	
Miscellaneous	membrane touch panel with 15 buttons robust metal frame anti-reflection coated glass pane to protect display	

[Description the display](#)^[45] and the [DSUB-9 pin configuration](#)^[87].

Included accessories

- Modem cable in the extended temperature range
- ACC/POWER-SUPPLY AC/DC power supply unit
- ACC/POWER-PLUG4 power plug

article no.

1350043

1350052

8.2.3 ACC/SYNC-FIBRE

Parameter	Value typ.	min./ max.	Remarks
Compatible with	GPS-connection imc measurement device		Modification of the GPS-connection is necessary (device preparation for SYNC-FIBRE). The simultaneous use of both SYNC-FIBRE and the device's SYNC plug (BNC) is not allowed. Only the SYNC-FIBRE or the SYNC plug (BNC) can be used.
Terminal connection	2x ST plug 1x DSUB-9		FOC connection with measurement device
Supply	5 V	±10%	out of device internal sensor supply
Power consumption	0.5 W	±10%	
Propagation Delay tPD	25 ns	75 ns	SYNC-In to Opto-Out or Opto-In to Sync-Out
Link length		500 m	Length of the fiber optic distance between two ACC/SYNC-FIBRE
Total delay		8 µs	SYNC-In first device to SYNC-Out last device
Fiber Optics plug type	ST		
Fiber Optics	50 / 125 µm 62.5 / 125 µm		
Wave length	820 nm		
General			
Extended environmental range	-40°C to + 85°C		condensation temporarily allowed

Find here [the description of the ACC/SYNC-FIBRE](#) .

8.2.4 Technical Specs imc NET-SWITCH-5

Ports and operating modes		
Parameter	Value	Remarks
Number of ports	5	identical properties
Transfer rate	10 / 100 / 1000 Mbit/s	automatically
Modes	10BASE-Te 100BASE-TX 1000BASE-T	IEEE 802.3 Clause 14, requires Cat5 cabling IEEE 802.3 Clause 25 (ex 802.3u) IEEE 802.3 Clause 40 (ex 802.3ab)
Auto-Negotiation	active	priority 1: 1000BASE-T, full-duplex priority 2: 1000BASE-T, half-duplex priority 3: 100BASE-TX, full-duplex priority 4: 100BASE-TX, half-duplex priority 5: 10BASE-Te, full-duplex priority 6: 10BASE-Te, half-duplex
Auto MDI/MDI-X	active	
Address table	4 k entries	
Operating mode	store and forward	
MTU	1500 Byte	
Accepted frame size	64..1518(1522) Byte	smaller or larger packets are rejected
IEEE 1588v2 PTP clock configuration	E2E, TC, one-step	end-to-end transparent clock compatible with two-step no P2P (peer-to-peer) and no BC (boundary clock)
PTP Transport 1	UDP IPv4 and IPv6, Ethernet	
PTP Transport 2	multicast and unicast, Ports 319 and 320	multicast: messages are forwarded to all ports unicast: messages are only forwarded to the port to which the recipient is connected
PTP domain	is not checked	

General			
Parameter	Value		Remarks
Status LED	blue = on		
Port LED	yellow (left)	green (right)	
	off	off	no connection
	on	off	1000 Mbit/s connection, inactive
	flashing	off	1000 Mbit/s connection, active
	off	on	100 Mbit/s connection, inactive
	off	flashing	100 Mbit/s connection, active
	on	on	10 Mbit/s connection, inactive
	flashing	flashing	10 Mbit/s connection, active

Power supply			
Parameter	Value typ.	min. / max.	Remarks
Input supply voltage	10 V to 50 V DC		
Power consumption		4 W	
Module power supply options	power socket (LEMO) or adjacent module		imc CRONOSflex or imc BUSDAQflex imc CANSASflex

Terminal connection (front)	Value	Remarks
LAN interface	8P8C modular socket	RJ45
Interfaces for power supply	<ul style="list-style-type: none"> LEMO.0B or LEMO.1B with CRFX module connector/slider 	suitable for setting up a redundant supply from 2 possible sources

Variant imc CRONOSflex (CRFX)

Terminal connections (rear side of the CRFX module)		
Parameter	Value	Remarks
Input supply plug (female)	LEMO.EGE.1B.302	multicoded, 2-notch connector for optional individual power supply
Module connector	2x 20 pin	system bus for distributed imc CRONOSflex components: EtherCAT not used by switch but fed through via module connector. Switch can be docked and inserted at arbitrary positions within the CRFX system (right hand side of base unit)

Pass through power limits	
Directly connected (clicked) imc CRONOSflex Modules	3.1 A (maximum current) Equivalent power with chosen DC power input: <ul style="list-style-type: none"> 149 W @ 48 V DC (e.g. AC/DC line adaptor) 74 W @ 24 V DC (e.g. AC/DC line adaptor) 37 W @ 12 V DC (typical vehicle supplied DC input)

Operating conditions	Value	Remarks
Ingress protection rating	IP20	
Pollution degree	2	
Operating temperature	-40°C to +85°C	condensation temporarily allowed
Weight	550 g	

Variant imc BUSDAQflex (BUSFX, CANFX)

Terminal connections (rear side of the module)		
Parameter	Value	Remarks
Supply input	type: LEMO.0B (2-pin)	compatible with LEMO.EGE.0B.302 multicoded 2 notches for optional individually power supply compatible with connectors FGG.0B.302 (Standard) or FGE.0B.302 (E-coded, 48 V) pin configuration: (1)+SUPPLY, (2)-SUPPLY
Module connector/locking slider	via locking slider compatible with imc BUSDAQflex and/or imc CANSASflex	Power supply of directly connected modules (BUSFX/CANFX Click-mechanism) without further cables. CAN-Bus "Backbone" für imc CANSASflex Systems: CAN not used by Switch but fed through via module connector. Switch can be docked and inserted at arbitrary positions within BUSFX/CANFX system

Pass through power limits for directly connected modules (Click-mechanism)		
Parameter	Value	Remarks
Max. current	8 A	at 25°C current rating of the click connector
	$-50 \text{ mA/K} \cdot \Delta T_a$	Derating with higher operating temperatures T_a , $\Delta T_a = T_a - 25^\circ\text{C}$
Max. power	96 W at 12 V DC 192 W at 24V DC	Equivalent pass through power at 25°C typ. DC vehicle voltage AC/DC power adaptor and installations
	60 W at 12 V DC 120 W at 24V DC	at +85°C

Operating conditions		
Parameter	Value	Remarks
Ingress protection class	IP40	only with optional protective cover (CANFX/COVER-IP40) on top of the locking slider, otherwise IP20
Pollution degree	2	
Operating temperature range	-40°C to 85°C	internal condensation temporarily allowed
Weight	410 g	



9 Pin configuration

9.1 DSUB-15

The Standard imc plug is a 1:1 DSUB-15 to screw terminal adaptor. It is offered in a number of variants.

Pin configuration

Metal connector

ACC/DSUBM-	DI2-4	DO4	
DSUB Pin	Terminal	DIGITAL IN	DIGITAL OUT
9	1	+IN1	BIT1
2	2	+IN2	BIT2
10	3	-IN1/2	BIT3
3	4	+IN3	BIT4
11	5	+IN4	
4	6	-IN3/4	
12	7		
5	8		
13	9	LEVEL 1/2 **	
6	10		
14	11		HCOM
7	12	LEVEL 3/4 **	LCOM
15	15		LCOM
8	18		
	13		
	14		
	16	CHASSIS	CHASSIS
	17	CHASSIS	CHASSIS

** : open = 24 V

LEVEL 1/2 and IN 1/2 jumpered respectively

LEVEL 3/4 and IN 3/4 jumpered = TTL

Note

1.5 mm² cross section

To connect the measurement leads with the screw terminals, suitable leads should have a maximum cross section of 1.5 mm² incl. cable end-sleeve. The terminals' screw heads only have secure electrical contact once they are tightened to a connection wire. For this reason, a control measurement (for instance with multimeter probe tips) at "open" terminals can falsely mimic a missing contact!

Cable shielding must be connected at CHASSIS (DSUB frame) as a rule. At some connectors, V_{CC} (5 V) is available, with a maximum load current of typically 135 mA per plug.

9.2 Metal connector - Handling

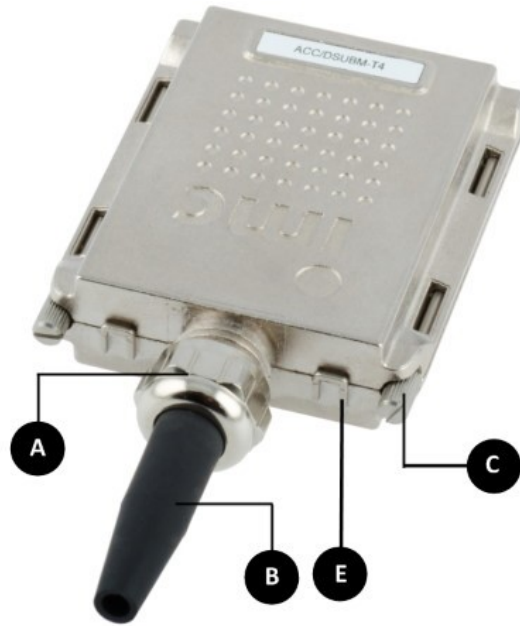
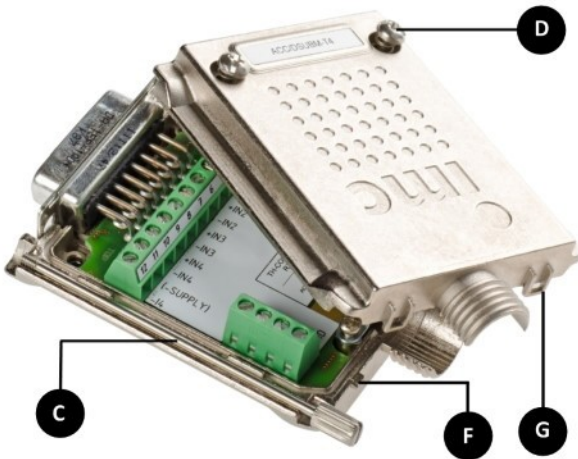
For devices with DSUB-15 connection technology, the convenient imc terminal plugs for solderless screw terminal connection are available as optional accessories.



ACC/DSUBM-xxx: snap the nose into the slot

Open the Metal plug:

1. Unscrew the cable fitting (cable gland) [A]
2. Remove the bend protection [B]
3. Unscrew the lid screws [D]
4. Lift the lid in the DSUB connection area and unfasten the nose of the slot



- A: Cable fitting (cable gland)
- B: Bend protection
- C: Fastening screw for the devices' front panel
- D: Lid screws
- E: Locking key (Nose / Slot)
- G: Slot
- F: Nose

Close the Metal connector:

1. Assemble the lid by snapping the nose into the slot (see the picture above)
2. Audible click when the lid snaps in the front of the DSUB pod
3. Insert the bend protection
4. The pressure nut must be screwed back on
5. The lid screws can be tightened

9.3 LEMO.0B (6-pin) CTRL socket

Pin contact	Signal	Description
1	-Supply	0 V
2	Remote On/Off	On/Off via a short-period connection to pin1 (-Supply)
3	Sleep/Resume Mode enable/disable	Activate the Sleep/Resume mode with jumper top pin1 (-Supply)
4	+V _{AUX}	5 V or 10 V to 55 V (Voltage of the power supply (via R = 1 kΩ)) Only for control functions. No load!
5	+Sleep / Resume High	Sleep mode: 0..1 V ; Resume mode: 4..55 V
6	-Sleep / Resume Low	0 V

To the description of the [LEMO plug](#)^[55]. Please note: Depending on the [BUSFX variant](#)^[55], the behavior is different.



Note

Sleep Mode

The Sleep Mode is available with devices equipped exclusively with CAN/LIN. The Sleep Mode is **not available** with devices equipped with other fieldbus such as FlexRay, CAN FD, etc.



Warning

A protective cover in the CTRL socket is intended to protect the device from accidental insertion of the power supply plug.

9.4 DSUB-9 pin configuration

9.4.1 Display

DSUB-PIN	Signal	Description	Use in device
1	DCD	Vcc 5V	connected
2	RXD	Receive Data	connected
3	TXD	Transmit Data	connected
4	DTR	5V	connected
5	GND	ground	connected
6	DSR	Data Set Ready	connected
7	RTS	Ready To Send	connected
8	CTS	Clear To Send	connected
9	R1	Pulldown to GND	connected

Supply for the graphical display

Connector	+9 V to 32 V	- (0V)	nc
Binder	1	2	3
Souriau	B	C	A

To the [description](#)^[45] and the [technical data of the displays](#)^[80].

9.4.2 GPS

DSUB-9		GPS 18 LVC	GPS 18 - 5Hz
Pin	Signal	Color	Color
1	Vin	Red	Red
2	RxD1*	White	White
3	TxD1	Green	Green
4	-	-	-
5	GND, PowerOff	2x Black	2x Black
6	-	-	-
7	PPS (1 Hz clock)	Yellow	Yellow
8	-	-	-
9	-	-	-

* Pin configuration at measurement device. At the GPS-mouse Rx and Tx are interchanged.

9.5 Pin configuration of the fieldbusses

9.5.1 CAN-Bus, CAN FD (DSUB-9)

DSUB-PIN	Signal	Description	Use in device
1	+CAN_SUPPLY	optional supply	unused as per standard* (supply I < 1 A)
2	CAN_L	dominant low bus line	connected
3	CAN_GND	CAN Ground	connected
4	nc	reserved	do not connect
5	-CAN_SUPPLY	optional supply	unused as per standard* (supply I < 1 A)
6	CAN_GND	optional CAN Ground	connected
7	CAN_H	dominant high bus line	connected
8	nc	reserved (error line)	do not connect
9	nc	reserved	do not connect

Find here the * Optional and only at CAN node 1 and 2, see DC power supply on CAN-Nodes 1 or 2.

9.5.2 LIN-Bus (DSUB-9)

DSUB-PIN	Signal	Description
3	LIN_GND	LIN Ground
6	LIN_GND	Optional LIN Ground
7	LIN_INPUT/OUTPUT	LIN bus line
1, 2, 4, 5, 8 and 9	n.c.	

Find here the [technical data](#)⁷⁴ and the [cabling](#)⁶⁰ of the LIN-Bus interface.

9.5.3 FlexRay-Bus (DSUB-9)

imc standard: One DSUB-9 socket with two channels

DSUB-Pin	Signal	Description
1	nc	
2	BM channel A	negative bus line channel A
3	GND	FlexRay ground
4	BM channel B	negative bus line channel B
5	GND	FlexRay ground
6	nc	
7	BP channel A	positive bus line channel A
8	BP channel B	positive bus line channel B
9	nc	

Option: Two DSUB-9 sockets (CON1 and CON2) with one channel each

DSUB-Pin	CON1	CON2
1	nc	nc
2	BM channel A (negative bus line channel A)	BM channel B (negative bus line channel B)
3	GND	GND
4	nc	nc
5	GND	GND
6	nc	nc
7	BP channel A (positive bus line channel A)	BP channel B (positive bus line channel B)
8	nc	nc
9	nc	nc

Find here the [technical data](#)^[74] and the [cabling](#)^[61] of the FlexRay-Bus interface.

9.5.4 XCPoE (RJ45)

Standard Ethernet 1x RJ45. Find here the [technical data](#)^[76] and the [cabling](#)^[61] of the XCPoE interface.

9.5.5 ARINC-Bus (DSUB-15)

CON 1					
ARINC-Interface with 8 Rx channels			ARINC-Interface with 8 Rx and 4 Tx channels		
DSUB Pin	Signal	Description	DSUB Pin	Signal	Description
Standard 4x Rx			Standard 4x Rx; 2x Tx		
1	Rx1A	receiving channel 1A	1	Rx1A	receiving channel 1A
9	GND	GND	9	Tx1A	sending channel 1A
2	Rx1B	receiving channel 1B	2	Rx1B	receiving channel 1B
10	GND	GND	10	Tx1B	sending channel 1B
3	Rx2A	receiving channel 2A	3	Rx2A	receiving channel 2A
11	GND	GND	11	GND	GND
4	Rx2B	receiving channel 2B	4	Rx2B	receiving channel 2B
12	GND	GND	12	GND	GND
5	Rx3A	receiving channel 3A	5	Rx3A	receiving channel 3A
13	GND	GND	13	Tx2A	sending channel 2A
6	Rx3B	receiving channel 3B	6	Rx3B	receiving channel 3B
14	GND	GND	14	Tx2B	sending channel 2B
7	Rx4A	receiving channel 4A	7	Rx4A	receiving channel 4A
15	GND	GND	15	GND	GND
8	Rx4B	receiving channel 4B	8	Rx4B	receiving channel 4B

CON 2					
ARINC-Interface with 8 Rx channels			ARINC-Interface with 8 Rx and 4 Tx channels		
DSUB Pin	Signal	Description	DSUB Pin	Signal	Description
Standard 4x Rx			Standard 4x Rx; 2x Tx		
1	Rx5A	receiving channel 5A	1	Rx5A	receiving channel 5A
9	GND	GND	9	Tx3A	sending channel 3A
2	Rx5B	receiving channel 5B	2	Rx5B	receiving channel 5B
10	GND	GND	10	Tx3B	sending channel 3B
3	Rx6A	receiving channel 6A	3	Rx6A	receiving channel 6A
11	GND	GND	11	GND	GND
4	Rx6B	receiving channel 6B	4	Rx6B	receiving channel 6B
12	GND	GND	12	GND	GND
5	Rx7A	receiving channel 7A	5	Rx7A	receiving channel 7A
13	GND	GND	13	Tx4A	sending channel 4A
6	Rx7B	receiving channel 7B	6	Rx7B	receiving channel 7B
14	GND	GND	14	Tx4B	sending channel 4B
7	Rx8A	receiving channel 8A	7	Rx8A	receiving channel 8A
15	GND	GND	15	GND	GND
8	Rx8B	receiving channel 8B	8	Rx8B	receiving channel 8B


Find here the [technical data](#) ⁷⁸ and [the cabling](#) ⁶⁰ of the ARINC-Bus interface.

9.5.6 PROFIBUS (DSUB-9)

DSUB-PIN	Signal	Description
3	DATA+	B-Line
5	GND	PROFIBUS Ground
8	DATA-	A-Line
1, 2, 4, 6, 7 and 9	n.c.	

Find here the [technical data](#)⁷⁵ and the [cabling](#)⁶² of the PROFIBUS interface.

9.5.7 PROFINET (RJ45)

Pin configuration of the network socket type modular 8P8C	Pin	Signal	
	1	TX+	
	2	TX-	
	3	RX+	
	6	RX-	
4, 5, 7, 8	via RC to ground		

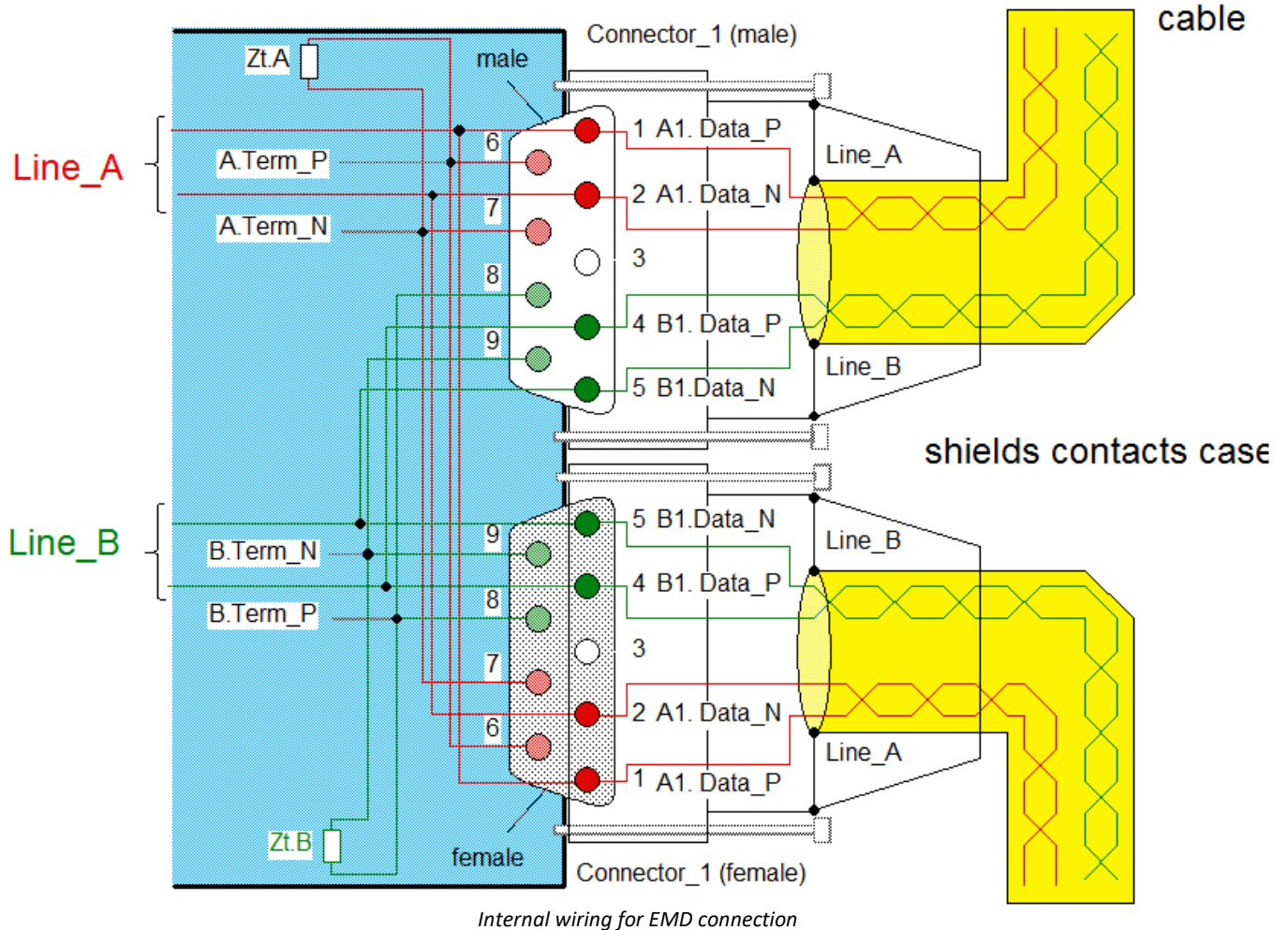
Find here the [technical data](#)⁷⁵ and the [cabling](#)⁶¹ of the PROFINET interface.

9.5.8 MVB-Bus (DSUB-9)

9.5.8.1 EMD Pin configuration - DSUB-9

EMD connection with double-occupancy. Standard DSUB-9 terminals are used.

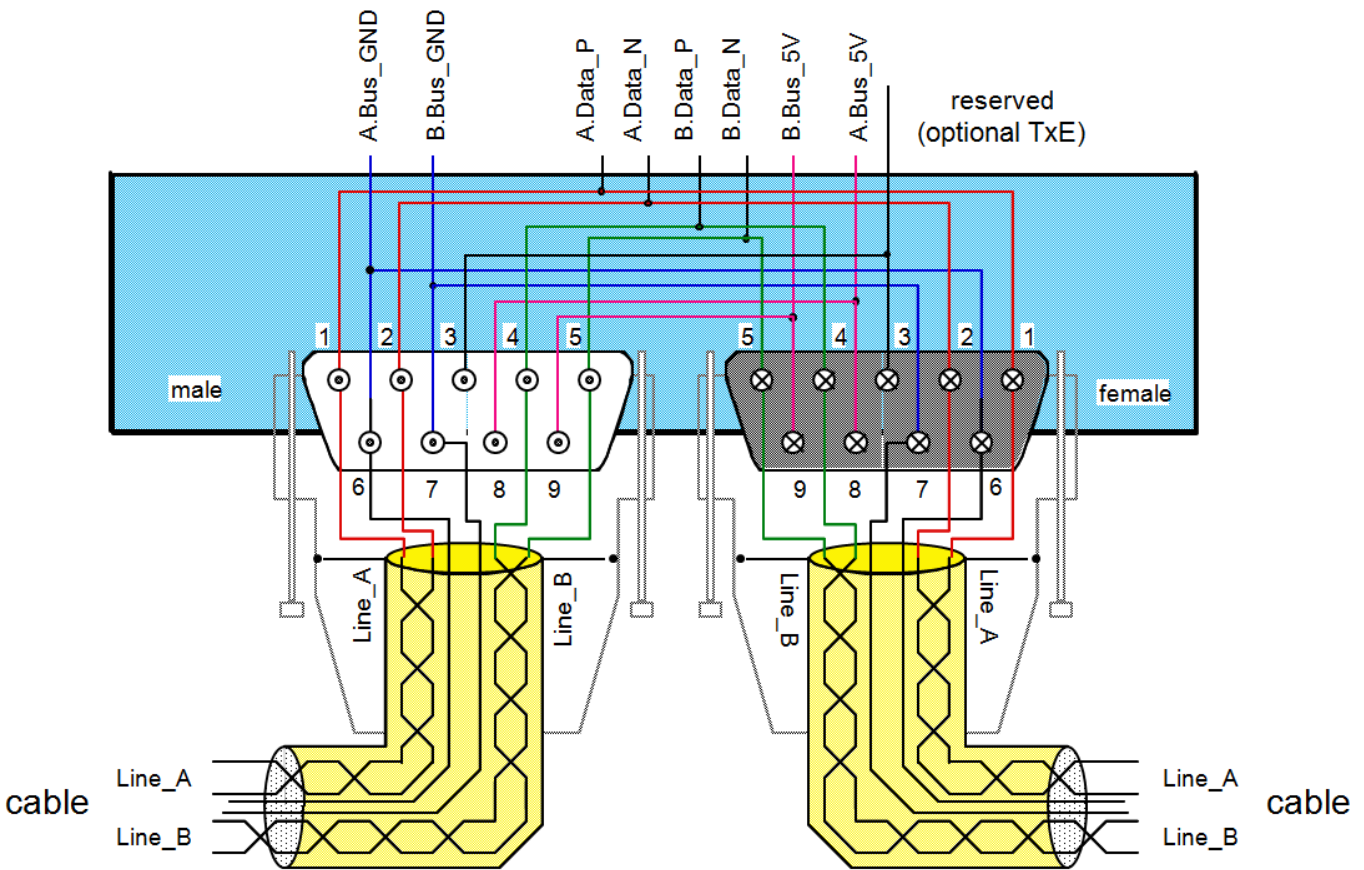
DSUB-PIN	Signal	Description	as termination terminal
1	A1. Data_P	data line A	jumper to 6
2	A1. Data_N	data line A	jumper to 7
3	NC	not connected	
4	B1. Data_P	data line B	jumper to 8
5	B1. Data_N	data line B	jumper to 9
6	Terminator A	internal	jumper to 1
7	Terminator A	interna	jumper to 2
8	Terminator B	interna	jumper to 4
9	Terminator B	interna	jumper to 5



9.5.8.2 ESD Pin configuration - DSUB-9

ESD Connection. Standard DSUB-9 terminals are used.

DSUB-PIN	Signal	Description	Termination
1	A. Data_P	Data lead A	
2	A. Data_N	Data lead A	
3	NC	not connected	
4	B. Data_P	Data lead B	
5	B. Data_N	Data lead B	
6	A.Bus_GND	Ground A	
7	B.Bus_GND	Ground B	
8	A.Bus_5V	5V Supply A	
9	B.Bus_5V	5V Supply B	



Find here [the technical data](#)⁷⁷ and [the cabling](#)⁶³ of the MVB-Bus interface

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