imc **CRONOS**-SL/*compact*

Getting Started

Edition 8 - 2022-07-08

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.

Copyright

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 installation medium in the folder "*Products\imc DEVICES\OSS*" or "*Products\imc DEVICEcore\OSS*". If you wish to receive a copy of the GPL sources used, please contact our Hotline.

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1 General

1.1 imc Customer Support / Hotline

If you have problems or questions, please contact our Customer Support/Hotline:

imc Test & Measurement GmbH

Hotline   (Germany):   **+49 30 467090-26**

E-Mail: hotline@imc-tm.de
Internet: https://www.imc-tm.com

International partners

For our international partners see https://www.imc-tm.com/distributors/.

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.

1.2 Notes / Quality Management

Quality Management

imc Test & Measurement GmbH holds DIN-EN-ISO-9001 certification since May 1995. 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.

ElektroG, RoHS 2, 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/

Remarks Concerning EMC

imc CRONOS-SL/compact satisfies the EMC requirements for the use in industrial environments.

Any additional devices connected to imc CRONOS-SL/compact must satisfy the EMC requirements as specified by the responsible authority (within Europe[1]) 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 signal lines connected to imc CRONOS-SL/compact must 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 experiment 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.

FCC-Note

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules [2]. 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 [imc hotline] [5] or an experienced radio or television technician for help.

Modifications

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

[2] FCC - United States Federal Communications Commission

Cables

Connections to this device must be made with shielded cables with metallic RFI/EMI connector hoods to maintain compliance with FCC Rules and Regulations.

Unless otherwise marked, all connecting cables are not to be designed as long cables in the sense of IEC 61326-1 (< 30 m). LAN cables (RJ 45) and CAN bus cables (DSUB-9) are excluded.

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

Industrial Safety

We certify that imc CRONOS-SL/compact 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)[3]. This confirmation applies exclusively to the imc CRONOS-SL/compact, but not to all other components of the scope of delivery.

This certification has the sole purpose to indemnify imc from the obligation to have the electrical equipment tested prior to first use (§ 5 Sec. 1, 4 of DGUV Regulation 3). The responsibility of the company within the meaning of DGUV regulation 3 remains unaffected by this. This does not affect guarantee and liability regulations of the civil code.

[3] Formerly BGV-A3

Observe Notes and Warnings

The measurement system has 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 manual **before turning the device** on for the first time.

> ⚠️ **Warning**
>
> Before touching the device sockets and the lines connected to them, make sure static electricity is drained. Damage arising from electrostatic discharge is not covered by the warrantee.

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/single or block (click), 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.

1.3 Liability limitations

All specifications and notes in the operating instruction manual are subject to applicable standards and regulations, and reflect the state of the art well as accumulated years of knowledge and experience.

The manufacturer declines any liability for damage arising from:

- failure to comply with the manual and the "Getting Started" documents provided,
- inappropriate use of the equipment,
- additionally, the general terms and conditions of the company imc Test & Measurement GmbH apply.

Please note that all properties described refer to a closed measurement system and not to its individual slices. A liability claim requires particularly careful handling of the unprotected individual slices (e.g. CRXT slices).

1.4 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.

1.5 Before starting

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.

1.6 Notes on maintenance and servicing

No particular maintenance is necessary.

> **❗ Note**
>
> The specified maximum errors are valid for 1 year following delivery of the device under normal operating conditions (observe operating temperature).

There are a number of important device characteristics which should be subjected to precise checking at regular intervals. We recommend annual calibration. Our calibration procedure includes calibration of inputs (checking of actual values of parameters; deviations beyond tolerance levels will be reported), a complete system-checkup, newly performed adjustments and subsequent calibration (the complete protocol set with measurement values is available at an extra charge). Consult our Hotline for the price for system calibration according to DIN EN ISO 9001.

For devices with UPS functions, we recommend maintenance every 2-3 years. Please read the notes in the chapter . When returning the device in connection with complaints, please include a written, outlining description of the problem, including the name and telephone number of the sender. This will help expedite the process of problem elimination.

For questions by telephone please be prepared to provide your device's serial number and have your imc installation software, as well as this manual at hand, thanks! The serial number, necessary power supply, interface type and software version included can be determined from the plaque on the side of the device.

1.7 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.

1.7.1 Responsibility of the user

The device 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 instruction manual, the user must also conform to regulations for safety, accident prevention and environmental protection which apply to the work site. If the device is not used in a manner specified by the manufacturer, the protection supported by the device may be impaired.

The user must also ensure that any personnel assisting in the use of the device have also read and understood the instruction manual.

1.7.2 Operating personnel

⚠ **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.

The manual distinguishes the following degrees of qualification for performing various actions:

- Users of the measurement equipment. Fundamentals of measurement engineering. Recommended: knowledge of foundations of electrical engineering. Familiarity with the Microsoft Windows operating system. Users may not open or modify the device.
- Qualified personnel is 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.

1.7.3 Special dangers

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.

⚠ **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.

1.8 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 (not for racks) with cable and pre-assembled
- LEMO plug for DC-powering
- Getting started with your imc measurement device (printed)

> **!** **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.

1.9 Transport

CRC or CRXT slices should be transported as a closed device. 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 the imc Customer 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. The represented handling label for lithium ion batteries can be attached also independently printed on the package (e.g. by gluing on the package or in a transparent unlabeled document bag). Note however that the form and the format are accurately given by IATA and the expression has to take place in color. Format: 120 x 110 mm.

Lithium Battery Handling Label:
UN 3480 / UN3481

1.10 Storage

As a rule, the measurement device can be stored at temperatures ranging from -40°C to +85°C.

1.11 Cleaning

- Always unplug the power supply before cleaning the device. Only qualified service technicians 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.
- Be certain that the ventilation slits remain unobstructed.

2 Start of operation CRC, CRSL

2.1 Precautions for operation

Certain ground 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.

> **❶ 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:
> - the device is visibly damaged,
> - loosed parts can be heard within the device,
> - the device does not work,
> - 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 specs in the manual chapter "Technical Specs" and the application hints about the individual system in order to prevent damage to the unit through inappropriate signal connection.
2. Note when designing your experiments that all input and output leads must be provided with shielding which is connected to the ground ("CHASSIS") at one end in order to ensure high resistance to interference and noisy transmission.
3. Unused, open channels (having no defined signal) should not be configured with sensitive input ranges since otherwise the measurement data could be affected. Configure unused channels with a broad input range or short them out. The same applies to channels not configured as active.
4. To measure voltages >60 V use adequate plug.
5. In case you are using a removable storage medium,
   please be aware that before you remove it
   (if the device is switched on), the button (1) ⌐22⌐ must be pressed to ensure that storage medium can be safely removed. Please read the instructions in the chapter "removable storage ⌐22⌐".
6. Be aware that during a running measurement, modules should not be disconnected from the system (hot plug functionality is not supported during a running measurement).
7. Avoid prolonged exposure of the device to sunlight.
8. Make sure that there is sufficient space at the ventilation slits.
9. Note that parts that are not explicitly intended to be carried may be warmer than the handles.

2.2 Modularity

CRC systems

The devices belonging to the imc CRONOS*compact* (CRC) are modular systems. A variety of signal conditioners and digital I/O modules can be combined to a system.

> ⚠ **Warning**   **Changing modules**
>
> Changing modules is only permitted for users trained by imc or imc service and in agreement with imc! Devices having HV modules (HV-2U2I etc.) do not support exchanging of modules (device safety!).

The following constraints, however, apply:

- Within the device, the necessary supply voltage is made available by a central power supply unit. A maximum supply current is specified for each supply voltage. The allowable current load on the voltage supply line is different for each module type. In addition, the power for the supply of an external sensor (e.g. supply of a strain gauge measurement bridge) must be taken into consideration. The supply power required by the power supply unit is tested at the factory. In the process, the power consumption of the modules ordered is taken into account. Power reserves can be requested from imc, if desired. If modules are subsequently added to a system which has already been shipped, it is absolutely necessary to check whether enough reserve power is available! As a matter of principle, only trained service personnel should install new system modules!

- Individual modules are distinguished by "module addresses". These module addresses must be configured prior to installing the module (e.g. DIP-switch, rotary switch, soldered jumpers). Previously existing addresses of other modules must be taken into account. If the same module address appears multiple times, conflicts will arise and the modules affected will either not be recognized by the device software at all or only incorrectly. This generally leads to errors which are hard to identify!

- The addresses of the module DI16-DO8-ENC4 can't be changed and are set to: DI4-16 (Addr. 1), DO8 (Addr. 0). That has to be considered, when addressing other digital modules (DI-16, DO-8, ENC-4). The variant of this multiboard with an additional DAC-4 will need an additional address. A further multiboard DI16(8)-DO8-ENC4(-DAC4) can be added without gap.

- For safety reasons high voltage modules (HV4U, HV2U2I etc.) are **not to be changed** by a customer!

CRSL systems

The devices of the imc CRONOS-SL (CRSL) series are factory configured devices. You can freely combine signal conditioning and digital I/O modules into one system. However, you **cannot** add new modules after delivery of an imc CRONOS-SL system, as for example with imc CRONOS*compact*.

2.3 Power supply

Measurement devices of the imc CRONOS system family are powered by a DC supply voltage which is supplied via a 2-pin LEMO-plug.

Device	LEMO plug type designation	Size
imc CRONOS-SL2/-SL4	FGG.**1B**.302.CLAD.62ZN	(middle)
imc CRONOS*compact*	FGG.**2B**.302.CLAD.82ZN	(big)

The permissible supply voltage range with is 10 V to 32 V DC. The standard product package includes a desktop supply unit with 15 V DC (<60 W) or 24 V DC (<150 W). On the input side the AC-voltage of the desktop supply is 100 V to 240 V 50/60 Hz. The DC-supply inputs of our imc measurement devices are not designed for a connection to a DC-grid with reference to EN 61326-1.

> **Note** **Desktop supply unit**
>
> 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!

The package also includes a cable with a ready-made LEMO-plug which can be connected to a DC-voltage source such as a car battery. When using this, note the following:

- Grounding of the device must be ensured. If the power supply unit comes with a grounding line, it would be possible to ground the system "by force", by making a connection from this line to the plug enclosure (and thus to the device ground). The table-top power supply unit is made to allow this.
  This manner of proceeding may not be desirable because it may be desirable to avoid transient currents along this line (e.g. in vehicles). In this case the ground-connection must be made to the device directly. For this purpose a (black) banana jack ("CHASSIS") is provided.
- The feed line must have low resistance, the cable must have an adequate cross-section. Any interference-suppressing filters which may be inserted into the line must not have any series inductor greater than 1 mH. Otherwise an additional parallel-capacitor is needed.

Pin configuration:
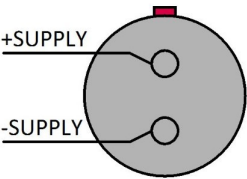
The +pin is marked with a red dot.

2.4 Grounding, shielding of the devices

In order to comply with Part 15 of the FCC-regulations applicable to devices of Class B, the system must be grounded. Grounding is also the condition for the validity of the technical specifications stated.

2.4.1 Grounding with the use of the included power adaptor

The DC-supply input on the device itself (LEMO socket, female) **is galvanically isolated** from the housing (CHASSIS): -SUPPLY input is not connected to CHASSIS internally. That means the decive's internal power supply circuitry comprises isolating DC/DC converter.
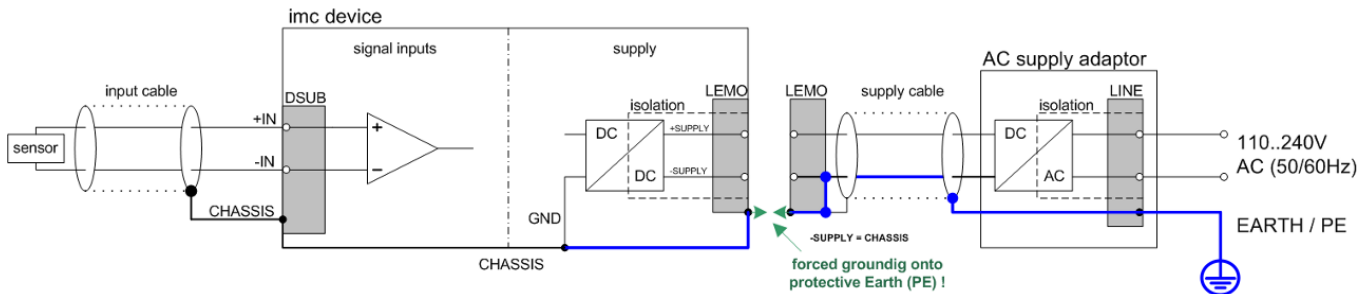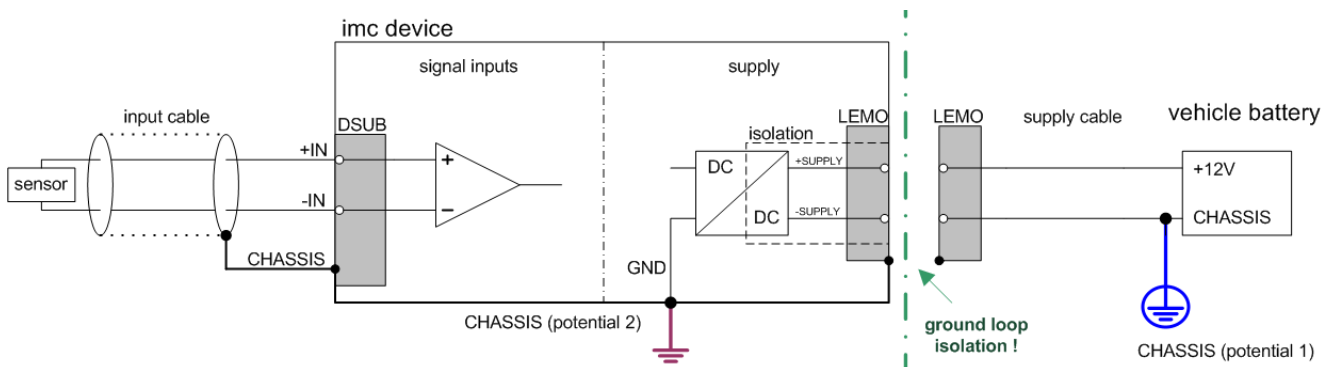
imc CRONOS-SL and imc CRONOScompact with desktop power supply unit

Use of the desktop power supply unit, included in the package, ensures proper grounding via the plug's protective earth terminal: the supply voltage's (-) pole as well as the shield and plug enclosure are connected to the cable's ground.

2.4.2 Grounding with power supplied by a car battery

If the power supply (e.g. car battery) and the measurement device are at different voltage levels, then if they were connected by the supply line, it would cause a ground loop. For such cases, the isolated internal device power supply ensures separation of the two voltage levels. The ground reference for the measurement device must then be established in a separate step.

imc CRONOS-SL and imc CRONOScompact powered by an isolated DC-voltage source (e.g. battery)

For running on an isolated DC power supply source (e.g. battery), either the grounding socket terminal, a grounding contact on the device ("CHASSIS"), or the CHASSIS contact on the imc signal plugs must be used.

Isolated power inputs avoids ground loops in distributed topologies

With stationary installations and the use of (already isolated) AC/DC adapters, any system ground differentials between the device and the central or local power supplies may not be relevant. The big issue in such a case, in contrast to mobile, in-vehicle applications, is from where to obtain a reliable ground voltage. Since it is convenient to use the AC power supply's protection ground line as the ground voltage, the LEMO-terminated AC/DC adapters for imc measurement devices are designed so that the protection ground line is connected all the way through to the LEMO plug's housing, thus securing the device's voltage level to protection ground. Additionally, in the AC/DC-adapter's LEMO-terminal (not the device's LEMO-socket!), the reference ground of the power adapter is connected with the housing's (CHASSIS) protection ground: Since the AC/DC power adapter is already isolating, as is the power input, this supply voltage's reference would not initially be defined and can be set arbitrarily. In particular for reasons of suppressing HF (high-frequency) interference signals stemming from the AC/DC switching power adapter, direct grounding is normally advisable.

2.4.3 Shielding

Also, all signal leads to the device must be shielded and the shielding grounded (electric contact between the shielding and the plug housing "CHASSIS").

To avoid compensation currents, always connect the shielding to one side (potential) only.If the imc DSUB block screw terminal plug is used, the shielding should be connected to the pull-relief clamp on the cable bushing. This part of the conductor-coated plastic plug housing has electrical contact to the device's housing, just as Terminals 15 and 16 (labeled: "CHASSIS", to the left and right of the imc-plug cable bushing) do; but is preferable to the "CHASSIS" terminals for optimum shielding.

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. 1second for the device to be deactivated. |

Some older imc measurement instruments may be equipped with a rocker-switch as main switch. It must be pressed down to the "ON"-side (upper portion) for approx. 1 sec to achieve activation, indicated by the "POWER"-LED flashing (e.g. CRONOS-PL devices). To switch the device off, press the rocker switch down on the OFF-side (lower portion) for approx. 1 sec.

2.6 Remote control

As an alternative to the manual main switch, imc devices can be switched on or off remotely with a wiring of the corresponding signals of the remote plug. There are several functions and operating modes available. The most common operating mode, available for all types, is the basic ON/OFF push button action performed with one single temporarily closing contact: connecting the signals "ON/OFF" and "SWITCH" for at least a short time, activates the device. The following table lists imc devices and the corresponding socket type.

imc device	Remote socket
CRONOS*compact* (CRC), CRONOS-SL (CRSL), SPARTAN (SPAR)	DSUB-15
CRONOS*flex* Base and the Power Handle (CRFX)	LEMO.EGG.1B.306 (6-pin, middle big)
C-SERIES (CL)	LEMO.EGG.0B.306 (6-pin, small)

Pin configuration

view on device front
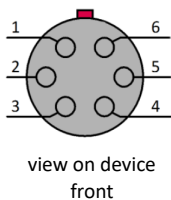
LEMO Pin	Signal name	Remarks
1	ON/OFF	LEMO Pin 1 and Pin 3 are internally bridged, two operating modes are supported: SWITCH and SWITCH1
2	SWITCH1	automatic activation when external power supply is connected, → permanently jumpered to ON/OFF, e.g. in vehicle
3	ON/OFF	
4	SWITCH	activation, deactivation like a push button, → briefly jumpered to ON/OFF, like the main switch
5	MUTE_GND	
6	MUTE	muting the UPS buzzer, only with the CRFX Power Handle

view on device front
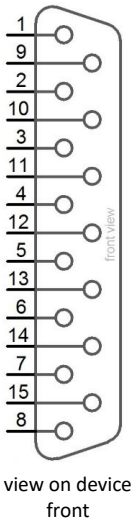
DSUB-15 Pin	Signal name	Remarks
1	RESET	immediate deactivation without saving, will cause lost of data
9	OFF	
2	SWITCH	activation, deactivation like a push button, → briefly jumpered to ON/OFF, like the main switch
10	ON	
3	SWITCH1	automatic activation when external power supply is connected, → permanently jumpered to ON/OFF, e.g. in vehicle
11, 4 und 12	n.c.	
5	MUTE	muting the UPS buzzer, e.g. for acoustic applications
13	ON/OFF	
6, 14, 7, 15, 8	n.c.	

> **❶ Note**
>
> When the SWITCH and ON/OFF signals are bridged with a switch, the device remains permanently on. In this case, the main switch has no effect.

2.7 Potential difference with synchronized devices

When using multiple devices connected via the **SYNC socket** for synchronization purposes, ensure that all devices are at the same voltage level.

> 🛈 **Note**
>
> The yellow ring on the SYNC socket indicates that the socket is shielded from voltage differences.

2.8 Fuses (polarity-inversion protection)

The supply input of all devices listed in this manual is provided with a maintenance-free reverse polarity protection.

> 🔷 **Reference**
>
> In the chapter "Technical Specs" you will find information on the fuse or the overcurrent limitation of the individual devices, if applicable.

The supply voltage for external sensors wired out from the voltage channels is equipped with maintenance-free electronic fuses (current-limiters).

The incremental counter channels provide a supply voltage for external sensors, which is not protected and should be provided with an external fuse in order to be used!

2.9 UPS

Devices with DC supply input are equipped with an uninterruptible power supply (UPS). This allows for a continuous operation unaffected by temporary short-term outage of the main power supply. This type of operation is particularly useful for operation in a vehicle, permanently attached to starter lock and main power switch and thus not requiring manual control. Activation of UPS buffering is indicated by the power control LED (PWR) changing from green to yellow. With many imc measurement devices, active UPS buffering is additionally indicated by an acoustic buzzer signal.

The UPS provides backup in case of power outage and monitors its duration. If the power outage is continuous and if it exceeds the specific device's "buffer time constant", the device initiates an automatic shutdown sequence, which equals manual shutdown procedure: Any current active measurement is automatically stopped, data storage on flash card or internal harddisk is completed by securely closing all data files, and finally the device is actually switched off. This entire process may take a couple of seconds.

Thus, a typical application of this configuration is in vehicles, where the power supply is coupled to the ignition. A buffer is thus provided against short-term interruptions. And on the other hand, deep discharge of the buffer battery is avoided in cases where the measurement system is not deactivated when the vehicle is turned off.

If the power failure is not continuous but only temporary, the timer that monitors blackout duration is reset every time the main supply has returned to valid levels. The buffer time constant is a variable device parameter that can be configured according to system size and battery capacity. It can usually be written into the device under software control and is preconfigured to reasonable default values upon delivery (see description in the software manual).

> ⬦ **Reference**
>
> Please find the technical specs (buffer duration) in the manual or in the data sheet.

2.9.1 Rechargeable accumulators and batteries

2.9.1.1 Li-ion batteries

The Li-ion batteries (Smart Batteries) are accessible for exchange, with a keyed insertion mechanism, secured against reversed polarity. They are installed at the bottom of an imc CRONOS*compact* (CRC) device.

imc CRONOScompact with two Li-ion battery packs
The batteries are equipped on the bottom.

imc CRONOScompact with two Li-ion battery packs
The batteries can be inserted easily, the connections are protected against polarity reversal.

> ⓘ **Note**
>
> • Due to the inevitable leakage and self-discharge of the Smart Batteries we recommend a regular recharging cycle at least every 3 months that a device has not been in use (device must be switched on for charging).

Do not deposit Li-ion batteries in domestic recycling containers!

> ◆ **Reference**   **Li-ion battery**
>
> Please find the technical specs of the Li-Ion battery in the manual.

Notes on Li-ion Smart Batteries:

- Failing to adhere to the recommended temperature ranges for storing, charging and discharging will not render the battery pack unsafe but will reduce its life expectancy and capacity.
- If Smart Batteries are stored in low charge state (<10%) they will age faster.
- When storing discharged Smart Batteries, internal deep discharge protection circuitry may get activated. This will cause the following charge cycle to run through a reactivation procedure, starting with a very low charging current. This may prolong the required charging time.
- Prolonged storage of discharged batteries is not recommended and may cause irreversible damage to the battery!
- The battery may temporarily deactivate itself in response to:
  -excessive temperature
  -excessive discharge current (e.g. due to short circuit)
  -insufficient cell voltage (to prevent discharge)
  Otherwise the UPS is operable as long as the battery does not prevent discharge.
- Once the passive temperature fuse has been triggered, it cannot be reset and thus renders the battery pack unusable. The rated temperature may not be exceeded!
- For safety reasons, the Li-ion batteries may not be exposed to temperatures exceeding 100°C!

> ❶ **Note**
>
> In order to preserve maximum life expectancy of the Smart Batteries they should be recharged at least every 3 months. The device must be switched on for charging!

State of charge indicator of the Li-ion batteries

The state of charge of the Li-ion batteries is indicated by different signal patterns of the LEDs. The position of the LEDs on your measurement device can differ from the pictures below. The following signal patterns can be interpreted as follows:

state of charge: 75% to 100%	50% to 74%	25% to 49%	10% to 24%	Flashing at 2 Hz <10%

During active charging the last active one of the four green status LEDs flashes at a rate of approx one second. In contrast to this, the warning signal at very low state of charge (<10%) consists in the lowermost ("25") flashing at an even faster rate.

The UPS Status LED is bicolor. In case of an error it flashes red.

Error Conditions

If the UPS Status LED flashes alternating red and green, a long term continuous battery operation is inhibited due to high battery temperature of 60°C ≤ ϑ <75 ±5°C (1) . In this case, the buffer time constant of the UPS is reduced to 15 seconds, regardless of the configured setting. Thus, in case of an outage of the external power supply automatic shutdown procedure will already be initiated after 15 seconds, stopping the current measurement, storing all data and turning off the device.

The following error conditions are indicated by LED signal patterns:

Battery is not present or cannot be detected	Internal Error (UPS may not be operable)	Battery operation is inhibited and the UPS is not operable $\vartheta \geq 75 \pm 5°C$ (2)
● UPS Status ○ 100 ○ 75 ○ 50 ○ 25	● UPS Status ● 100 ○ 75 ○ 50 ○ 25	● UPS Status ○ 100 ● 75 ○ 50 ○ 25

(1)   ±5°C due to tolerances of internal temperature measurement of the battery

(2)   Internal protection circuitry prevents discharge at temperatures above $\vartheta \geq 75 \pm 5°C$. The UPS may only be operable again once the batteries have cooled down to 65°C.

The following picture display the front of devices with integrated Li-ion batteries. The exact position of status LED can differ between each system.

CRC Rack   CRC portable housing   CRFX Power Handle (Li Ion)

2.10 Removable storage

For saving measured data, all imc devices support a removable storage medium.

In case you are using a removable storage medium, please be aware that before you remove it (if the device is switched on), the button (1) must be pressed to ensure that storage medium can be safely removed.

Pressing the button signalizes to the system that you intend to remove storage medium. Once this is done, the device stops access to the storage medium. During this time the Status LED shines.

If you were to remove the drive without prior announcement, it could produce defective clusters. And if you were to remove the storage medium while a measurement is running, the waveforms would be incomplete! Therefore, always proceed as follows when removing the storage medium:

1. Press the button (1) (device is switched on)
2. Status LED shines, the device stops access to the storage medium
3. When the Status LED starts blinking, the removable storage can be removed.

Reference

Please find a detailed description of internal removable storage media in the software manual: chapter "internal storage media".

Inserting and ejecting the CFast data storage card

Follow these instructions to insert and eject a data storage card:

- Insert the card straight into the slot correctly aligned, until is snaps in with a clicking sound.
- To eject, gently press on the card once.

Note

- Proper operation can not be guaranteed for any arbitrary kind of data storage card.
- Before removing the data carrier (from an activated device), it is necessary to first notify the system of the removal by pressing on the pushbutton next to the Status LED. On this topic, please read the notes in the section "Removable storage device" in the included documentation First Steps.

---

3 Signal connection

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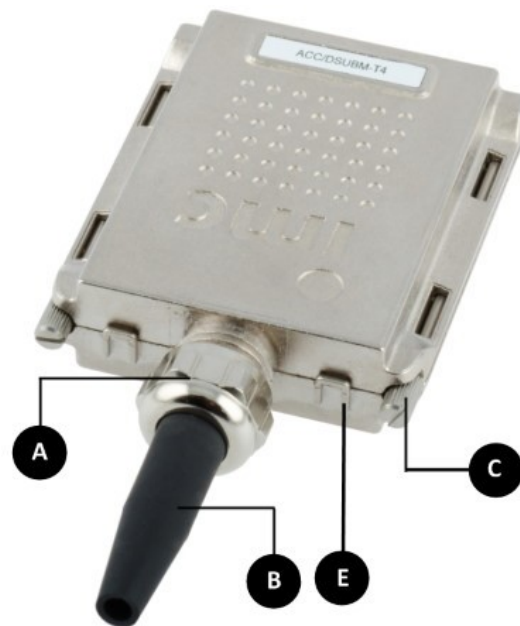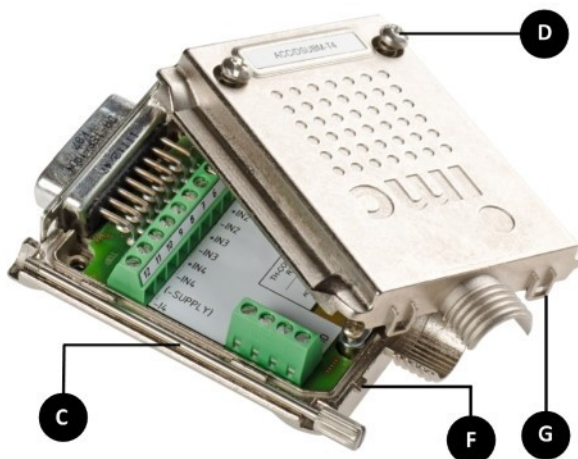
A: Cable fitting (cable gland)
B: Bend protection
C: Fastening screw for the devices' front panel
D: Lid screws
E: Locking key (Nose / Slot)
G: Slot
F: Nose

Close the Metal plug:

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

Reference   Pin configuration

Please find the pin configuration of each available plug in the .

---

4 Start of operation Software / Firmware

4.1 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 or 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.

4.1.1 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.

4.2 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 chapter "*Connecting via LAN in three steps* [25]" 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

Please use up-to-date, high-performance network equipment in order to achieve the maximum transfer bandwidth. This particularly means 100BASE-T (Fast Ethernet 100 MBit/s) or 1000BASE-T (GBit Ethernet). GBit Ethernet network equipment (switch) is backwards compatible, so that it can even be used to operate such imc devices which only support 100 MBit Fast Ethernet, but not also GBit Ethernet (such as CRXT or CRFX-2000GP).

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.

4.3 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. Open the dialog for configuring the device IP address by clicking on the button "*Device interfaces*" (⊞).

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.

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

Select the device for making modifications ③.

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
▸	☑	T_124835_C1_1_LEMO_ET	124835	imc C1-1 LEMO
	☐	T_130039_busDAQ_X	130039	busDAQ-X
	☐	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*".

4.4 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:
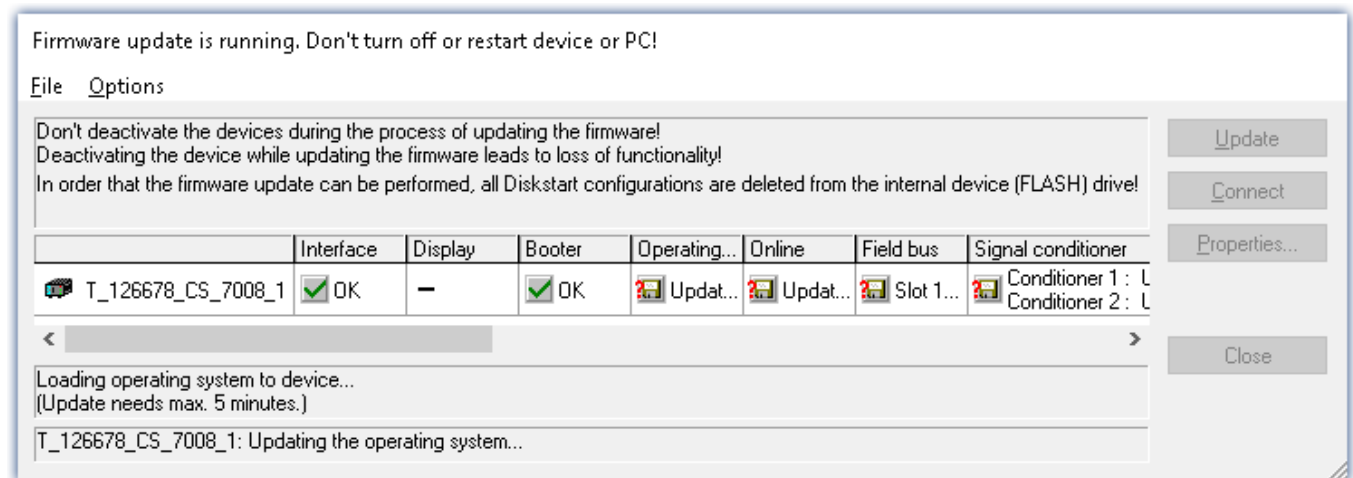
Start of the firmware update (example of a single device)
The state of the components of the firmware is diaplayed in the list.

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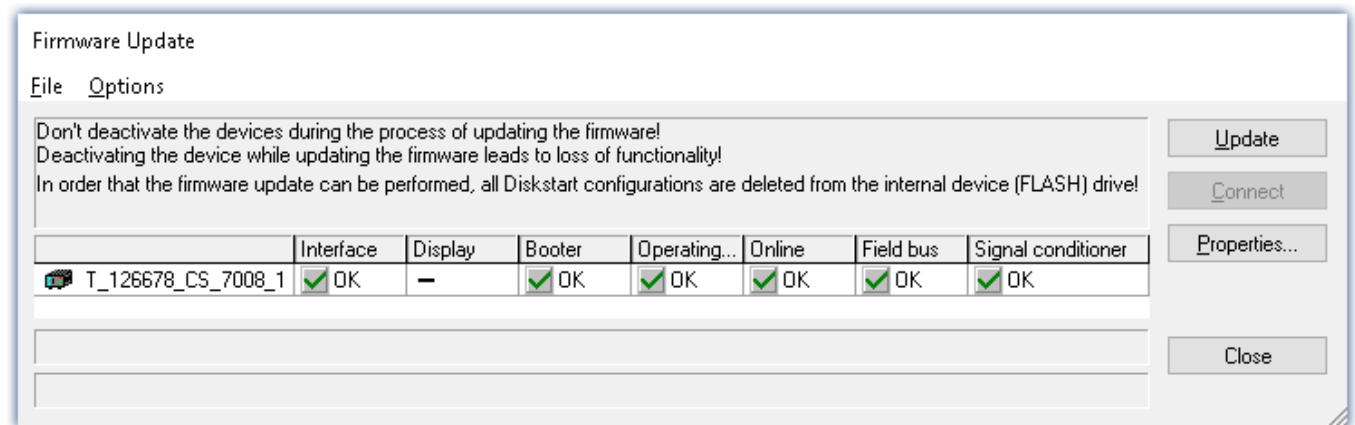
Conclusion of the firmware update (example of a single device)

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 the imc Hotline. The firmware update may be continued with guidance from the Hotline.

❗ **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 imc-Hotline.

Calling an update manually

The following function is possible **only in conjunction with the "imc STUDIO Developer" edition**. You need to possess **"imc Developer" user privileges** (with user administration activated)
You can call the Firmware-Update dialog manually.

Ribbon	View
Setup-Configuration > Updating Firmware	Complete

The function is only to be used in compliance with instructions from the imc-Hotline.

5 Pin configuration

5.1 Connecting DSUB-15 adaptor plug

The **Standard plug** is a 1:1 DSUB-15 to screw terminal adapter. It can be used for all modules which come with the corresponding pin configuration.

The **Special plugs** do not offer direct adaption from the DSUB pins to the screw terminals, but instead come with extra functions:

- For current measurement (up to 50 mA) with voltage channels the **Shunt plug** (ACC/DSUBM-I2 and I4) have a built-in 50 Ω shunt. The scaling factor 0.02 A/V must be set in order to display the current value.
- For temperature measurements, a special, patented **Thermo plug** (ACC/DSUBM-T4) is available. This DSUB-15 plug is suited for measurement of voltages as well as temperatures with PT100 and thermocouples with integrated cold junction compensation (CJC). Any types of thermocouples can be connected at the differential inputs (+IN and -IN). It also has additional "auxiliary contacts" for connecting PT100 in 4-wire configurations, where the reference current loop is already pre-wired internally.The Thermo plug can also be used for normal voltage measurement.
- The **IEPE/ICP plug** (ACC/DSUB-ICP2 and ICP4) provide a current supply source as well as a capacitive coupling.
- The **TEDS plugs** store sensor information according to IEEE1451.4 for use with imc Plug & Measure (integrated TEDS chips DS 2433).

> ⓘ Note   The screw terminals of the plug
>
> - 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 plugs, V_{CC} (5 V) is available, with a maximum load current of typically 135 mA per plug.

5.1.1 Device models overview

Analog amplifier	Voltage	Current	Bridge	Thermocouple	PT100	Current feed sensors IEPE (ICP)	Universal
UNI2-8	UNI2 B2	UNI2 I2	UNI2 B2	UNI2	UNI2	ICP2	UNI2
UNI-4	UNI2	UNI2 I2	UNI2 B2	UNI2	UNI2	ICP2	UNI2
DCB2-8	B2 UNI2	I2	B2 UNI2			ICP2	
BR2-4	B2	I2	B2			ICP2	
LV-16	U4	I4					
LV3-8	U4	I4				ICP4	
SC2-32	U4	I4				ICP4	
OSC-16	U4 T4	I4		T4	T4		
C-8	U4 T4	I4		T4	T4		
ISO2-8	U4 T4	I4		T4	T4	ICP4	
ISOF-8	U4 T4	I4		T4	T4	ICP4	

Digital modules	INC.-ENCODER	FREQUENCY	DIGITAL IN	DIGITAL OUT	DIGITAL OUT HIGH CURRENT	RELAIS	ANALOG OUT
ENC-4, HRENC-4	ENC4, ENC4-IU						
FRQ2-4		FRQ2					
DI-16			DI8				
DIOINC	ENC4		DI2-8			REL4	
DIO-PL2			DI8			REL4	
DI2-16			DI4-8				
DO-16				DO-8			
DO-16-HC					DO8-HC		
DAC-8							DAC4
DI16-DO8-ENC4	ENC4		DI4-8	DO-8			
DI8-DO8-ENC4-DAC4	ENC4		DI4-8	DO-8			DAC4

5.2 DSUB-15 pin configuration

In general: DSUB pin 1 is internally reserved.

5.2.1 Universal plug

Metal plug

ACC/DSUBM-		UNI2
DSUB Pin	Terminal	UNIVERSAL
9	1	+VB1
3	2	-VB1
2	3	+IN1
10	4	-IN1
11	5	I1_1/4B1 [1]
4	6	-SENSE1
5	7	+IN2
13	8	-IN2
14	9	I2_1/4B2 [1]
7	10	-SENSE2
12	11	+VB2
6	12	-VB2
15	15	(GND)
8	18	(+5V)
	13	
	14	
⏚	16	CHASSIS
⏚	17	CHASSIS

The abbreviation VB stands for the bridge sensor supply and can be equated with the sensor supply, abbreviation: SUPPLY.

(1) if the special version of the amplifier is equipped with the ±15 V option, then this pin = -15 V

5.2.2 Standard plug

ACC/DSUBM-		B2	U4
DSUB Pin	Terminal	BRIDGE	VOLTAGE
9	1	+VB1	(RES.)
2	2	+IN1	+IN1
10	3	-IN1	-IN1
3	4	-VB1	(+SUPPLY)
11	5	[+SENSE1_1/4B1]	+IN2
4	6	-SENSE1	-IN2
12	7	+VB2	(-SUPPLY)
5	8	+IN2	+IN3
13	9	-IN2	-IN3
6	10	-VB2	(GND) *
14	11	[+SENSE2_1/4B2]	+IN4
7	12	-SENSE2	-IN4
15	15	GND	(GND)
8	18	+5V	(+5V)
	13		
	14		
⏚	16	CHASSIS	CHASSIS
⏚	17	CHASSIS	CHASSIS

[ ] : 1/4 Bridge with UNI2-8 and DCB2-8   * if special version with ±15 V option, then this pin 6 is the reference
+SENSE with BR2-4 and UNI-4

ACC/DSUBM-		ENC4, ENC4-IU	FRQ2	DO-8	REL4	DAC4
DSUB Pin	Terminal	INC.-ENCODER	FREQUENCY	DIGITAL OUT	RELAIS	ANALOG OUT
9	1	+INA	+IN1	BIT1	IN1	
2	2	-INA	-IN1	BIT2	IN2	DAC1
10	3	+INB		BIT3	IN3	AGND
3	4	-INB		BIT4	IN4	
11	5	+INC	+IN2	BIT5	OFF1	DAC2
4	6	-INC	-IN2	BIT6	OFF2	AGND
12	7	+IND		BIT7	OFF3	
5	8	-IND		BIT8	OFF4	DAC3
13	9	+INDEX			ON1	AGND
6	10	-INDEX			ON2	
14	11	+5V	+5V	HCOM	ON3	DAC4
7	12	GND *	GND	LCOM	ON4	AGND
15	15	(-SUPPLY)		LCOM	(GND)	
8	18	(+SUPPLY)		OPDRN	(+5V)	
	13					
	14					
⏚	16	CHASSIS	CHASSIS	CHASSIS	CHASSIS	CHASSIS
⏚	17	CHASSIS	CHASSIS	CHASSIS	CHASSIS	CHASSIS

[ ] : 1/4 Bridge with UNI2-8 and DCB2-8   * if special version with ±15 V option, then this pin 6 is the reference
   +SENSE with BR2-4 and UNI-4

ACC/DSUBM-		DI8	DI2-8	DI4-8	PWM
DSUB Pin	Terminal	DIGITAL IN	DIGITAL IN	DIGITAL IN	TTL PULSE
9	1	BIT1	+IN1	+IN1	PWM1_OPDRN
2	2	BIT2	+IN2	+IN2	PWM2_OPDRN
10	3	BIT3	-IN1/2	+IN3	PWM1_TTL
3	4	BIT4	+IN3	+IN4	PWM2_TTL
11	5	BIT5	+IN4	-IN1/2/3/4	PWM3_OPDRN
4	6	BIT6	-IN3/4	+IN5	PWM4_OPDRN
12	7	BIT7	+IN5	+IN6	PWM3_TTL
5	8	BIT8	+IN6	+IN7	PWM4_TTL
13	9	CLK	-IN5/6	+IN8	
6	10		+IN7	-IN5/6/7/8	
14	11	HCOM	+IN8	+HCOM	+5V
7	12	LCOM	-IN7/8	LCOM	GND
15	15	LCOM	LEVEL	LCOM	GND
8	18	LEVEL	LCOM	LEVEL	
	13				
	14				
	16	CHASSIS	CHASSIS	CHASSIS	CHASSIS
	17	CHASSIS	CHASSIS	CHASSIS	CHASSIS

[1] The DI4-8 plug is used by the latest digital input modules such as DI2-16 and the DI8-DO8-ENC4 multi-boards. In these cases, each 4-bit group has its own ground reference .

[2] The DI2-8 plug is used by the predecessor version DI-16. All of the plug's 8 bits share a common ground reference.

5.2.3 Special plug

Metal plug   Metal plug

ACC/DSUBM-		T4
DSUB Pin	Terminal	TH-COUPLE/RTD
9	1	+I1
3	2	(+SUPPLY)
2	3	+IN1
10	4	-IN1
11	5	+IN2
4	6	-IN2
5	7	+IN3
13	8	-IN3
14	9	+IN4
7	10	-IN4
12	11	(-SUPPLY)
6	12	-I4 (GND) *
	15	-I3
	18	+I2
15	13	GND
	14	+I3
	16	+I4
	17	-I1
	19	-I2
	20	CHASSIS

ACC/DSUBM-		I4	I2
DSUB Pin	Terminal	CURRENT	CURRENT
9	1	(RES.)	+SUPPLY1
2	2	+IN1	+IN1
10	3	-IN1	-IN1
3	4	(+SUPPLY)	-SUPPLY1
11	5	+IN2	
4	6	-IN2	
12	7	(-SUPPLY)	+SUPPLY2
5	8	+IN3	+IN2
13	9	-IN3	-IN2
6	10	(GND)	-SUPPLY2
14	11	+IN4	
7	12	-IN4	
15	15	(GND)	(GND)
8	18	(+5V)	(+5V)
	13		
	14		
⏚	16	CHASSIS	CHASSIS
⏚	17	CHASSIS	CHASSIS

DSUB-	ICP4	ICP2
Terminal	ICP	ICP
1	+ICP1	+ICP1
2	-ICP1	-ICP1
3	+ICP2	
4	-ICP2	
5	+ICP3	+ICP2
6	-ICP3	-ICP2
7	+ICP4	
8	-ICP4	
9		
10		
11		
12		
13		
14	CHASSIS	CHASSIS
15	CHASSIS	CHASSIS
16	CHASSIS	CHASSIS
17	+5V	+5V
18	AGND	AGND

* if the special version of the amplifier is equipped with the ±15 V option, then this pin 6 is the reference

Metal plug

ACC/DSUBM-		DO-HC-8
DSUB Pin	Terminal	DIGITAL OUT HIGH CURRENT
9	1	BIT1
2	2	BIT2
10	3	BIT3
3	4	BIT4
11	5	BIT5
4	6	BIT6
12	7	BIT7
5	8	BIT8
13	9	HCOM_1-4
6	10	LCOM_1-4
14	11	HCOM_5-8
7	12	LCOM_5-8
15	15	LCOM
8	18	OPDRN
	13	
	14	
⏚	16	CHASSIS
⏚	17	CHASSIS

Metal plug

ACC/DSUBM-		SYNTH4
DSUB Pin	Terminal	SYNTHESIZER
9	1	DOUT1
2	2	AOUT1
10	3	AGND
3	4	DOUT2
11	5	AOUT2
4	6	+5V
12	7	HCOM
5	8	AOUT3
13	9	AGND
6	10	DIN1
14	11	AOUT4
7	12	LCOM
15	15	LEVEL
8	18	OPDRN
	13	
	14	
⏚	16	CHASSIS
⏚	17	CHASSIS

5.2.4 TEDS plug

ACC/DSUBM-TEDS-		UNI2
DSUB Pin	Terminal	UNIVERSAL
9	1	+VB1
3	2	-VB1
2	3	+IN1
10	4	-IN1
11	5	I1_1/4B1 [1]
4	6	-SENSE1
5	7	+IN2
13	8	-IN2
14	9	I2_1/4B2 [1]
7	10	-SENSE2
12	11	+VB2
6	12	-VB2
15	15	TEDS_GND
8	18	(+5V)
	13	TEDS2
	14	TEDS1
⏚	16	CHASSIS
⏚	17	CHASSIS

ACC/DSUBM-TEDS-		B2	U4
DSUB Pin	Terminal	BRIDGE	VOLTAGE
9	1	+VB1	(RES.)
2	2	+IN1	+IN1
10	3	-IN1	-IN1
3	4	-VB1	(+SUPPLY)
11	5	[+SENSE1_1/4B1]	+IN2
4	6	-SENSE1	-IN2
12	7	+VB2	(-SUPPLY)
5	8	+IN2	+IN3
13	9	-IN2	-IN3
6	10	-VB2	GND
14	11	[+SENSE2_1/4B2]	+IN4
7	12	-SENSE2	-IN4
15	15	(GND), TEDS_GND	TEDS_GND
8	18	(+5V)	(+5V)
	13	TEDS1	TEDS1
	14	TEDS2	TEDS2
⏚	16	CHASSIS	CHASSIS
⏚	17	CHASSIS	CHASSIS
	19		TEDS3
	20		TEDS4

(1) if the special version of the amplifier is equipped with the ±15 V option, then this pin = -15 V

(2) if special version with ±15 V option, then this pin 6 is the reference   [ ] : 1/4 Bridge with UNI2-8 and DCB2-8

ACC/DSUBM-TEDS-		T4
DSUB	Terminal	TH-COUPLE/RTD
9	1	+I1
3	2	(+SUPPLY)
2	3	+IN1
10	4	-IN1
11	5	+IN2
4	6	-IN2
5	7	+IN3
13	8	-IN3
14	9	+IN4
7	10	-IN4
12	11	(-SUPPLY)
6	12	-I4
	15	-I3
	18	TEDS4
15	13	TEDS_GND
	14	+I3
	16	+I4
	17	TEDS3
	19	TEDS2
	20	TEDS1
	21	-I1
	22	+I2
	23	-I2
	24	CHASSIS

ACC/DSUBM-TEDS-		I4	I2
DSUB Pin	Terminal	CURRENT	CURRENT
9	1	(RES.)	+SUPPLY1
2	2	+IN1	+IN1
10	3	-IN1	-IN1
3	4	(+SUPPLY)	-SUPPLY1
11	5	+IN2	
4	6	-IN2	
12	7	(-SUPPLY)	+SUPPLY2
5	8	+IN3	+IN2
13	9	-IN3	-IN2
6	10	GND	-SUPPLY2
14	11	+IN4	
7	12	-IN4	
15	15	TEDS_GND	TEDS_GND
8	18	(+5V)	(+5V)
	13	TEDS1	TEDS1
	14	TEDS2	TEDS2
	16	CHASSIS	CHASSIS
	17	CHASSIS	CHASSIS
	19	TEDS3	
	20	TEDS4	

5.3 DSUB-26 pin configuration (high density)

ACC/DSUBM-		HD-I4	HD-B4
DSUB	Klemme	CURRENT	BRIDGE
13	1	+IN2	+IN2
4	2	-IN2	-IN2
14	3		[+SENSE2_1/4B2]
5	4		-SENSE2
15	5	+IN3	+IN3
6	6	-IN3	-IN3
16	7		[+SENSE3_1/4B3]
7	8		-SENSE3
23	9	+SUPPLY3	+VB3
24	10	-SUPPLY3	-VB3
25	11	+SUPPLY4	+VB4
26	12	-SUPPLY4	-VB4
17	13	+IN4	+IN4
8	14	-IN4	-IN4
18	15		[+SENSE4_1/4B4]
9	16		-SENSE4
21	17	+SUPPLY2	+VB2
22	18	-SUPPLY2	-VB2
19	19	+SUPPLY1	+VB1
20	20	-SUPPLY1	-VB1
11	21	+IN1	+IN1
2	22	-IN1	-IN1
12	23		[+SENSE1_1/4B1]
3	24		-SENSE1
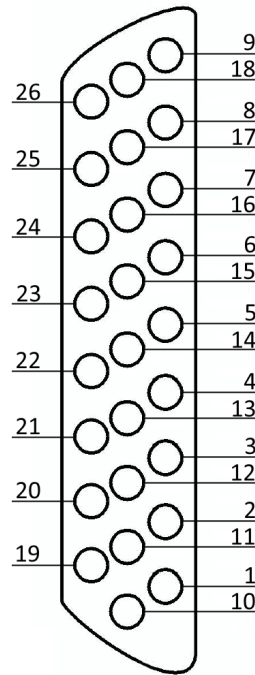
Please use the screw for a contact with Chassis.

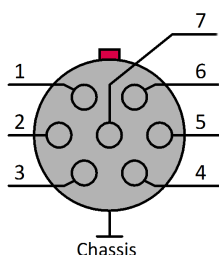## 5.4 DSUB configuration of scanner SC2-32

5.4.1 Variety 8 x DSUB 15
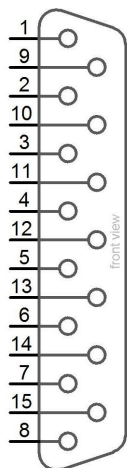
Pin	Signal	Plug 1	Plug 2	Plug 3	Plug 4	Plug 5	Plug 6	Plug 7	Plug 8
1	reserved								
9	reserved								
2	+IN A	+IN 17	+IN 21	+IN 25	+IN 29	+IN 1	+IN 5	+IN 9	+IN 13
10	-IN A	-IN 17	-IN 21	-IN 25	-IN 29	-IN 1	-IN 5	-IN 9	-IN 13
3	+V ext								
11	+IN B	+IN 18	+IN 22	+IN 26	+IN 30	+IN 2	+IN 6	+IN 10	+IN 14
4	-IN B	-IN 18	-IN 22	-IN 26	-IN 30	-IN 2	-IN 6	-IN 10	-IN 14
12	-V ext								
5	+IN C	+IN 19	+IN 23	+IN 27	+IN 31	+IN 3	+IN 7	+IN 11	+IN 15
13	-IN C	-IN 19	-IN 23	-IN 27	-IN 31	-IN 3	-IN 7	-IN 11	-IN 15
6	reserved								
14	+IN D	+IN 20	+IN 24	+IN 28	+IN 32	+IN 4	+IN 8	+IN 12	+IN 16
7	-IN D	-IN 20	-IN 24	-IN 28	-IN 32	-IN 4	-IN 8	-IN 12	-IN 16
15	GND								
8	Vcc ICP								

5.4.2 Variety 2 x DSUB 37

1	+IN1
20	-IN1
2	+IN2
21	-IN2
3	+IN3
22	-IN3
4	+IN4
23	-IN4
5	+IN5
24	-IN5
6	+IN6
25	-IN6
7	+IN7
26	-IN7
8	+IN8
27	-IN8
9	+IN9
28	-IN9
10	+IN10
29	-IN10
11	+IN11
30	-IN11
12	+IN12
31	-IN12
13	+IN13
32	-IN13
14	+IN14
33	-IN14
15	+IN15
34	-IN15
16	+IN16
35	-IN16
17	
36	
18	GND
37	Vcc ICP
19	

DSUB-37

1	+IN17
20	-IN17
2	+IN18
21	-IN18
3	+IN19
22	-IN19
4	+IN20
23	-IN20
5	+IN21
24	-IN21
6	+IN22
25	-IN22
7	+IN23
26	-IN23
8	+IN24
27	-IN24
9	+IN25
28	-IN25
10	+IN26
29	-IN26
11	+IN27
30	-IN27
12	+IN28
31	-IN28
13	+IN29
32	-IN29
14	+IN30
33	-IN30
15	+IN31
34	-IN31
16	+IN32
35	-IN32
17	
36	
18	GND
37	Vcc ICP
19	

DSUB-37

5.5 LEMO pin configuration

5.5.1 LEMO.1B (7-pin)

Chassis

LEMO PIN	ISO2-8	ISOF-8(-SUPPLY, bipolar ±15 V)	C-8, OSC-16	LV3-8, LV-16, SC2-32	LV3-8-L-SUPPLY
1	+IN	+IN	+IN	+IN	+IN
2	-IN	-IN	-IN	-IN	-IN
3	+SUPPLY	+SUPPLY	+SUPPLY	+SUPPLY	+SUPPLY
4	GND (-SUPPLY*)	GND (-SUPPLY, -15 V)	GND (-SUPPLY*)	-SUPPLY (GND)	GND
5	TEDS OneWire	TEDS OneWire (SUPPLY GND) TEDS is omitted with ±15 V option	TEDS OneWire	TEDS OneWire	TEDS OneWire
6	PT100 current source	PT100 current source	PT100 current source	n.c.	-SUPPLY (-15 V)
7	+I (pos. signal input for current measurement)	+I (pos. signal input for current measurement)	n.c.	n.c.	n.c.

LEMO PIN	DCB2-8, B-8	UNI-8, UNI2-8	UNI-4	BR-4, BR2-4 **
1	+IN	+IN	+IN	+IN
2	-IN	-IN	-IN	-IN
3	+SUPPLY	+SUPPLY	+SUPPLY	+SUPPLY
4	-SUPPLY (GND)	-SUPPLY (GND)	-SUPPLY (GND)	-SUPPLY
5	TEDS (OneWire)	TEDS (OneWire)	TEDS (OneWire)	
6	-SENSE	-SENSE/PT100 current source	-SENSE	-SENSE
7	quarter bridge completion	quarter bridge completion / sense for PT100 3-wire configuration	+SENSE_1/4B	+SENSE

LEMO PIN	ENC-4, HRENC-4 ***
1	+IN X
2	-IN X
3	+SUPPLY
4	-SUPPLY (GND)
5	+INDEX
6	+IN Y
7	-IN Y

*   sensor supply voltages available via the optional sensor supply module, see data sheet
     Default ranges: +5 V to +24 V

**   Upon request BR2-4 with TEDS - then with 8-pin LEMO (because -SUPPLY is not GND and is also not TEDS-GND)

*** Reference of +INDEX is -SUPPLY (GND)
     sensor supply voltage 5 VDC/ 100 mA (optional 300 mA)
     other sensor supply voltages available via the optional sensor supply module

5.6 DSUB-9 pin configuration

5.6.1 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

5.6.2 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.

5.7 APPMOD

RS 232

Signal	PIN
n.c.	1
RX	2
TX	3
n.c.	4
DG	5
n.c.	6
RTS	7
CTS	8
n.c.	9

RS 422 / RS 485 Full-Duplex

Signal	PIN
Rx+	2
Rx-	8
TX+	3
Tx-	7

RS 485 Half-Duplex

Signal	PIN
+D	3
-D	7

5.8 Pin configuration of the fieldbusses

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

DSUB-PIN	Signal	Description	Use in device
1	nc	reserved	do not connect
2	**CAN_L**	**dominant low bus line**	connected
3	**CAN_GND**	**CAN Ground**	connected
4	nc	reserved	do not connect
5	nc	reserved	do not connect
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

5.8.2 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.	

5.8.3 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

5.8.4 XCPoE (RJ45)

Standard Ethernet 1x RJ45.

5.8.5 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

5.8.6 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.	

5.8.7 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
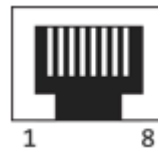
5.8.8 MVB-Bus (DSUB-9)

5.8.8.1 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

Internal wiring for EMD connection
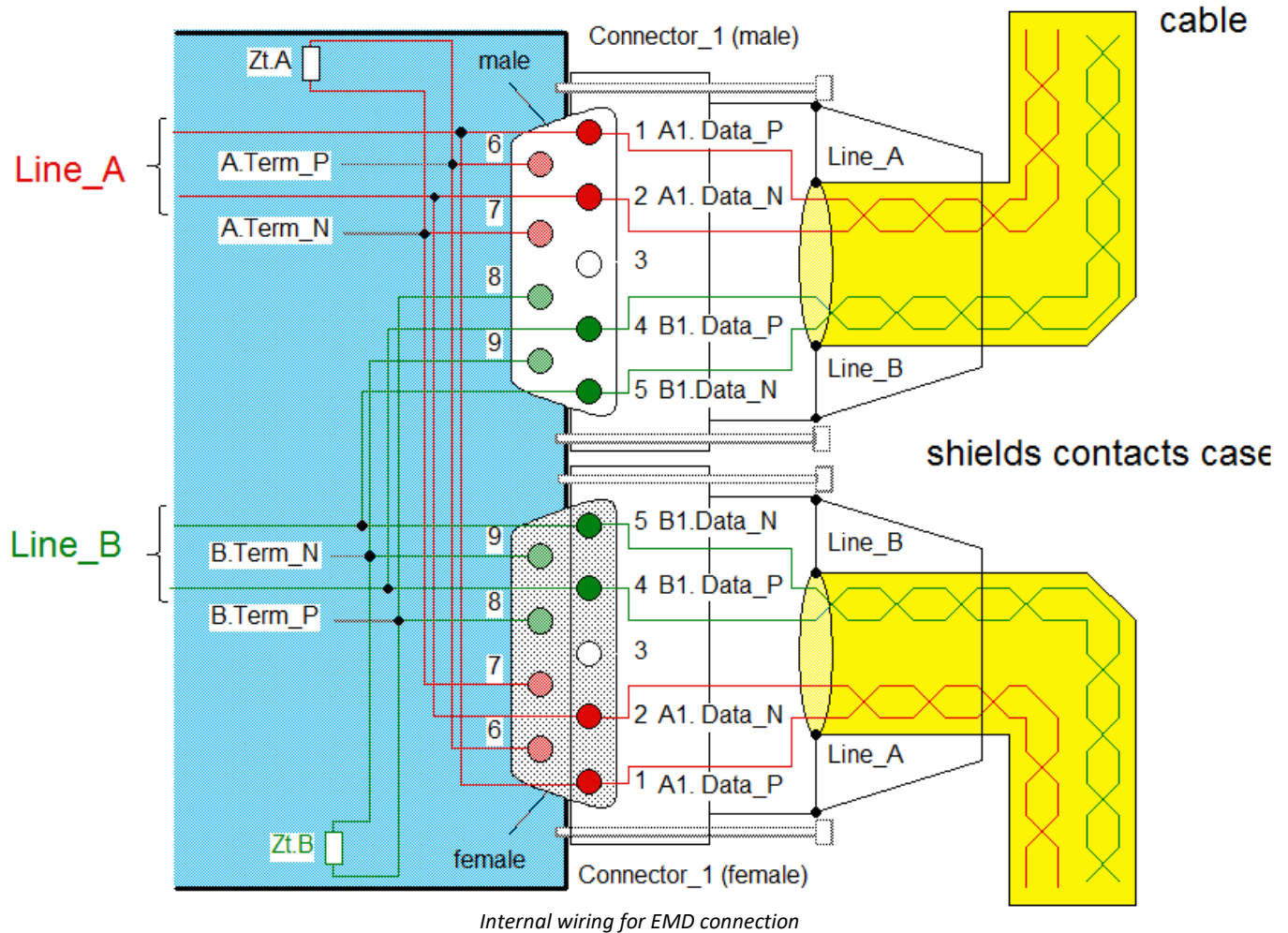
5.8.8.2 ESD Pin configuration - DSUB-9

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	$Rm = 143\ \Omega;\ Ru = Rd = 383\ \Omega$

DSUB connection for ESD
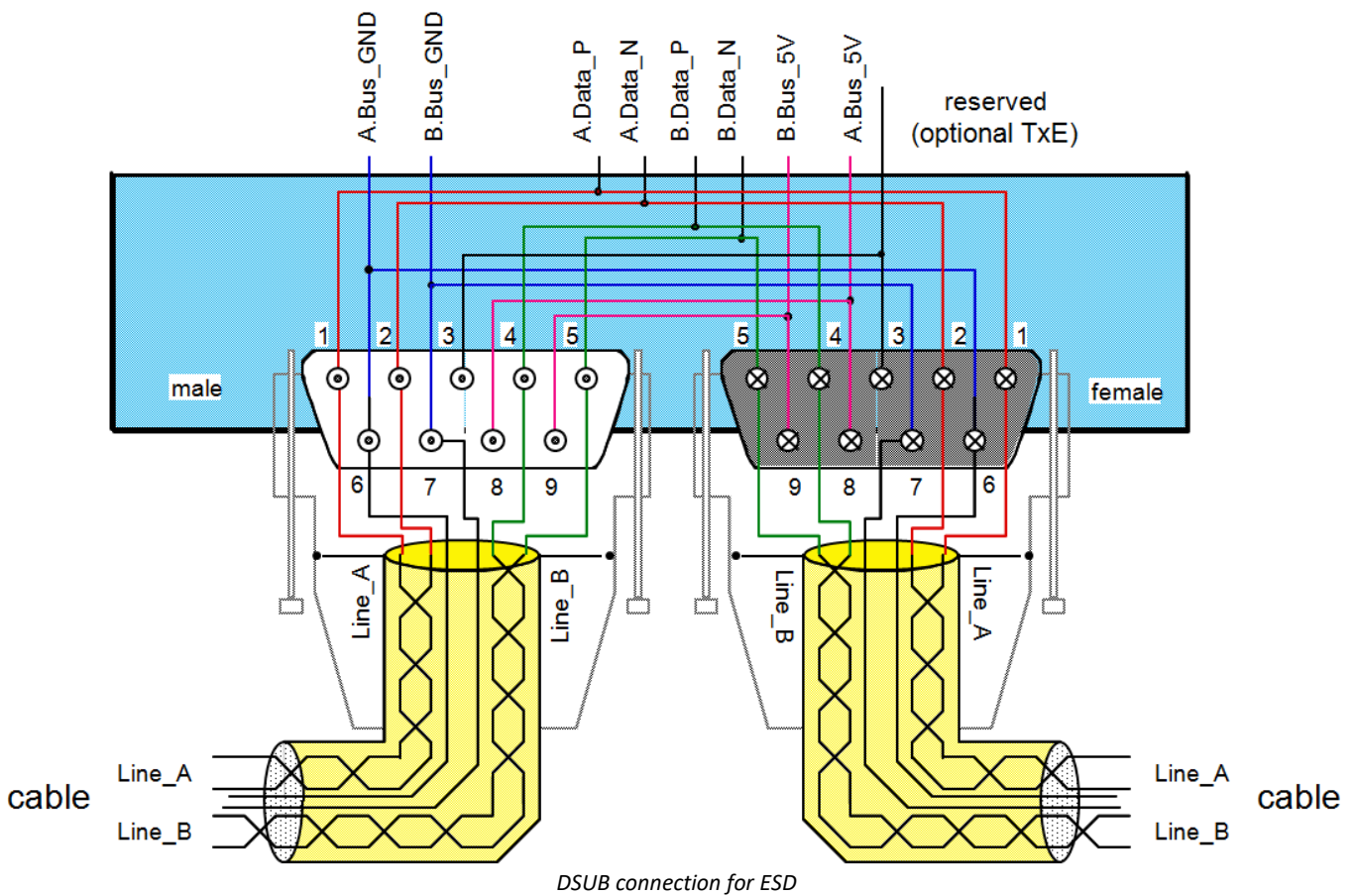
5.9 Pin configuration of the REMOTE socket

Reference   **Remote control**

The assignment and the description of the modes can be found in the chapter "Start of operation 17".

6 Symbols and legend

Tips and recommendations

Note!
... highlights useful tips, recommendations and information for efficient and trouble-free operation.

Reference
...indicates where to find more detailed or otherwise related information.

Drawings of the pin alignment

The number in each connection drawing is meant to be the correspondent LEMO pin.

Notes of caution

Warning notes are denoted in this manual by symbols. The notes begin with a signal phrase characterizing the extent of the danger. Be certain to observe these notes carefully to avoid accidents and harm to persons and equipment.

Caution!
...indicated a potentially hazardous situation which could cause slight injury if not avoided.

Danger of electric shock!
... warns of danger from electrical voltages at the measurement object which are conducted into the measurement inputs. The device itself does not produce dangerous voltages.

Caution!
...refers to potentially hazardous situations which can cause equipment damage if not avoided.

Symbols on your measurement device

Caution! Danger area!
Due to the insufficient space at the measurement inputs the calculation parameters can not be stated nearby. Before starting consider the calculation parameters of the measurement inputs in this manual.

Danger of electrical shock!
... points on both, the danger outgoing from the measurement source and on the danger at the measurement inputs (e.g. HV modules) and dangerous voltage coming from the measurement device (e.g. MIC-SUPPLY).

Recycling!

... points out, concerning WEEE guideline, that the product may not be thrown in the domestic refuse. The product was brought into the market after 2005 August 13th.

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