imc SENSORS 1.3R22

Manual

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imc Test & Measurement GmbH • Voltastraße 5 • 13355 Berlin • Germany

Foreword

Thank you for deciding to purchase our product. We wish you total success in accomplishing your measurement assignments with the help of your hardware and software. If you have any open questions about our products, please contact our Hotline (hotline@imc-tm.de).

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 gratefully accept any suggestions for improvements, please contact our Hotline (hotline@imc-tm.de).

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

Copyright

imc Software and Microsoft® Windows

imc software runs on the Microsoft® Windows operating system.

GPL Sources

Some components of our hardware use software, that is licensed under GNU General Public License (GPL). If you would like a copy of the GPL source code contained in this product please contact our Hotline.

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1 General Notes

Welcome to imc SENSORS

In this manual, you will find a detailed description of how to operate the software.

Customer Support / Hotline

If you have any open questions about our products, please contact our Hotline.

Questions or problems? Contact our Customer Support / Hotline 6.

Copyright

1.1 Before you Start

Dear user.

1. The software you have obtained, as well as the associated manual are directed toward competent and instructed users. If you notice any discrepancies, we request that you contact our Hotline 6.
2. Updates during software development can cause portions of the manual to become outdated. If you notice any discrepancies, we request that you contact our Hotline.
3. Please contact our Hotline if you find descriptions in the manual which you believe could be misunderstood and thereby lead to personal injury.
4. Read the enclosed license agreement 7. By using the software, you agree to the terms and conditions of the license agreement.

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: www.imc-tm.com/quality-assurance/.

imc Warranty

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

Product Improvement and change requests

Please help us to improve our documentation:

- What terms or descriptions are incomprehensible?
- What additions and enhancements you suggest?
- Where have material mistakes slipped in?
- Which spelling or typing errors have you found?

Responses and other feedback should be directed to the Hotline 6 (phone / e-mail)
or by writing to: imc Test & Measurement GmbH, Voltastrasse 5 in 13355 Berlin, Germany

1.3 imc Customer Support / Hotline

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

imc Test & Measurement GmbH

Hotline Berlin	(Germany):	**+49 (0)30 / 467090-26**
Hotline Frankfurt	(Germany):	**+49 (0)6172 / 59672-40**

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

International partners

For our international partners see 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. Thank you!

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

1.4 imc Software License Agreement

imc Test & Measurement GmbH
Voltastrasse 5
13355 Berlin
Commercial register: Berlin-Charlottenburg HRB 28778
Managing director: Dr. Dietmar Sprenger, Kai Gilbert, Ralf Winkelmann

imc Test & Measurement GmbH
Terms and Conditions
Governing the Use of imc Test & Measurement GmbH Software
As of: September 12, 2018

§ 1 Objects of the Agreement

(1) In addition to the "General Terms and Conditions Governing imc Test & Measurement GmbH Deliveries and Services to Customers", these terms and conditions apply to all contracts concluded with imc Test & Measurement GmbH (hereinafter referred to as "imc") which involve the transfer of rights of use to any software developed by imc (standard software, software created or adjusted specifically for the Customer, which is recorded on the machine-decodable data carriers such as data files, databases and database material, updates, upgrades, releases, etc., including corresponding documentation, information and materials, hereinafter referred to as "Software").

(2) The Software is provided to the Customer as an executable object program on machine-decodable data carriers specified in the "Objects of the Agreement". The Software's product documentation is also supplied to the Customer either in print or on a machine-decodable data carrier. Unless otherwise expressly agreed in writing, the Customer is not issued the source code of the Software.

§ 2 Rights of Use, Scope

With regard to any transfer of rights of use to Software created by imc, the following provisions apply:

(1) Basic provisions

a) The Customer is granted a non-exclusive and – subject to the terms and conditions governing the use of Software by third parties, resale and leasing – non-transferrable right of use to the Software for its own purposes. "Use" signifies running the programs and editing the data records.

b) Until each due fee is paid in full, the Customer is entitled to use the Software solely on a revocable basis. If the Customer is in default with regard to the payment of fees, imc is entitled to revoke the use of the respective services for the duration of the default. The Customer is granted the permanent right to use copyright protected services, in particular the Software, only upon full payment of the agreed fee.

c) The Customer agrees to undertake appropriate precautionary measures to prevent unauthorized access by third parties to the Software. The original data carriers and the data carries used to make copies as per the agreement, as well as the documentation, are to be stored in a secure location. Employees are to be notified that the production of copies beyond the scope of the agreement is not permitted.

d) If the right of use is revoked or expires due to another reason, the Customer is obligated to return to imc the Software, the copies made by the Customer and the documentation. Provided that a physical return of the Software and the copies is not possible due to technical reasons, the Customer is obligated to delete such and confirm deletion to imc in writing.

(2) Reproduction

a) The Customer is entitled to make copies of the Software only if copies are necessary to use the Software in accordance with the contract. The following are considered cases in which reproduction is necessary: installation of the Software from the original data carrier onto the hard disk drive of the hardware used, as well as loading the Software into the computer memory.

b) The Customer is entitled to create a backup copy if such is necessary to safeguard future use. Copies may only be made for other purposes after prior written consent has been issued by imc.

c) The Customer is not allowed to make any reproductions other than those expressly permitted under the provisions of this agreement.

(3) Use of the Software by Third Parties, Resale and Leasing

a) The Software may be used for the purposes stipulated in this contract, in particular for the Customer's business operations. Access to the Software may also be provided to parties which rely on using the Software as instructed by the Customer. In particular, the Customer is entitled to operate the Software or allow the Software to be operated on data processing devices, which are located on the premises of and are directly owned by a third party company (outsourcing). The prohibition against multiple use remains unaffected.

b) The Customer may permanently sell or give the Software to third parties provided that the Customer is granted permanent use of the Software. In the context of its period of use, the Customer may temporarily transfer the Software to third parties for a fee or free of charge. The prohibition against multiple use remains unaffected. The Customer is expressly notified that transfer to third parties is not permitted and use by third parties is technically not possible if an individual license must be acquired or an individual activation is required for third party usage, such as in the case of runtime licenses.

c) With regard to the valid use of Software by a third party, the Customer is obliged to ensure that the third party acknowledges the provisions of this agreement governing the rights of use as binding for such third party. The Customer may not transfer Software and documentation to third parties if there are grounds to suspect that the third party may infringe upon the provisions of this agreement governing the rights of use, in particular with regard to the unauthorized production of copies.

d) Subject to the provisions stipulated in § 4 Paragraphs 1 and 2 or a deviating express agreement in writing, the Customer may not use the Software while the Software is being used by a third party (prohibition against multiple use); in the event that the Software is transferred to the third party, the customer is obliged to surrender to imc all Software copies including, if applicable, all existing backup copies, or to destroy copies not surrendered.

(4) Decompilation

The reverse translation of the provided program code into other code forms (decompilation), disassembling and other forms of reverse engineering of the various production phases of the Software is not permitted. If interface information is required to achieve the interoperability of a separately created computer program, such may be requested from imc, or a third party to be named by imc, for a minor fee. Section 69 e of the German Copyright Act ("UrhG") remains unaffected by this provision.

(5) Changes by imc

If imc conducts adjustments, changes or enhances the Software on behalf and on account of the Customer, the Customer thus acquires the corresponding rights of use to the changes or enhancements of the Software to which he is entitled according to the stipulations of this agreement.

(6) Exceptional Usage Requests by the Customer

If the Customer requests to use the Software according to terms which deviate from the requirements stipulated in Paragraphs 2 through 5, this exceptional use of the Software must be agreed in writing by imc. In such an instance, the Customer agrees to provide imc with information about the desired scope of use, the pertinent field of application, etc. If imc subsequently grants a license covering the Customer's special intended use, the parties agree that a new license fee is owed by the Customer, which is independent of payments made by the Customer for the previously existing license.

§ 3 Copyright, Protection of the Software

(1) The intellectual property, in particular the copyright as well as all industrial property rights and trade secrets, are retained by imc and are not transferred to the Customer. The Customer's ownership of the machine-decodable data carries and data processing units remains unaffected.

(2) Copyright notices, serial numbers as well as designations and reservations of rights which serve as program identification or a protective right may not be removed or changed. The Customer is obliged to transfer the existing protective right notices to all copies. In particular, backup copies of the Software must be expressly designated as such.

§ 4 License Types, Multiple Use

(1) In the case of a Single-User License, the Software may be activated and run on only one data processing unit. "Activation" refers to the process of transferring the license to the data processing unit.

If the technical specifications for the Software permit a second activation, then the Customer may additionally activate the Software on a second data processing unit. However, the Software may only run on one data processing unit at any one time, not on both simultaneously.

(2) With a Network License, the Software may be run on as many data processing units as the amount of licenses obtained. In this case a central data processing unit acts as the license server for which the activation process is performed.

If the technical specifications for the Software permit a second activation, then the Customer may additionally activate and run the Software on as many data processing units as the amount of licenses obtained. However, these additional data processing units must be used by the same users who operate the Software via the license server.

(3) Subject to the provisions in Paragraphs 1 and 2 or a deviating express agreement in writing regarding network use, multiple use of the Software is not permitted.

(4) If the data processing unit is changed, the Customer is obliged to delete the Software from the hard disk drive of the previously used hardware.

§ 5 Trial Version

If the Software used is a free trial version, then the following additional limitations apply:

(1) The trial version only entitles the user to test the Software. In particular, commercially productive utilization is not permitted.

(2) The rights of use granted expire after the elapse of a period stated in the product description.

§ 6 License Key

(1) Upon delivery of the Software the Customer receives a License Key. Using this License Key, the Customer is able to activate the Software purchased. By means of this License Key the Customer can also view his license status and order updates and upgrades.

(2) The License Key is to be protected against access by third parties in order to prevent misuse. If, however, a third party gains unlawful access to the Key, the Customer is obliged to notify imc immediately via telephone, as well as in writing, so that the previous License Key may be suspended and a new one issued.

§ 7 Conclusion

(1) The law of the Federal Republic of Germany shall apply under exclusion of private international law. The provisions of the UN Convention on Contracts for the International Sale of Goods (CISG) do not apply.

(2) The place of performance for all obligations arising from this agreement is imc's registered seat. Insofar as the Customer is a merchant as defined by the German Commercial Code (HGB), a legal entity under public law, or a special asset under public law, the exclusive place of jurisdiction for all disputes directly or indirectly arising from the contractual relationship is agreed as imc's registered seat. The same applies to persons who have no general place of jurisdiction in Germany, as well as to persons who have moved their place of residence or usual whereabouts abroad since conclusion of the contract, or whose place of residence or usual whereabouts is unknown at the time the action is filed. In addition, imc is entitled to file suit at the statutory venue.

(3) Oral side-agreements are not valid. Deviating or supplementary conditions as well as modifications of this contract, including this written requirement clause, are only valid if agreed in writing and expressly marked as a modification or supplement.

(4) If certain provisions of this contract are inoperative or unfeasible, this does not prejudice other provisions of the contract. The contracting parties agree to contractually substitute an operable provision which approximates the commercial intention of the contract as closely as possible for any inoperable one.

1.5 Documentation

Other imc manuals	Description
imc STUDIO and imc DEVICES	Description and operation of the device software, description of the XMLRpc commands, UDP etc.
imc FAMOS	Analysis, display and subsequent processing of the recorded measured data.
imc Software Common Components	Explicit description of the imc curve window
imc LICENSE Manager	

2 Installation

2.1 System requirements

Supported operating systems
Windows 10
Windows 8 / 8.1
Windows 7
Windows Vista (32 bit) as of SP1
Windows XP (32 bit) as of SP3

Minimum requirements for the PC
IBM - (100%-compatible) PC
Minimum of 256 MByte free memory on hard drive
CD-ROM drive (for installation)
Min. 512MByte RAM
Mouse (or other pointing device)
Keyboard

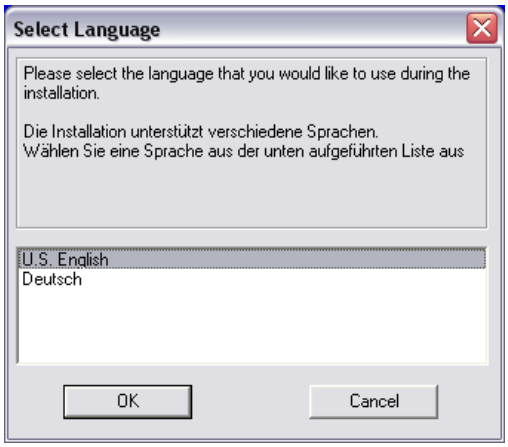
2.2 Performing installation

Before installing the software, please read the license agreement also contained in this chapter.

To install, run the file setup.exe which is on the CD.

To perform installation, administrator rights are needed.

In the course of installation, you will be asked to choose a language. This refers to the language in which you are guided through the installation. There may also be examples which are installed, which would also take the language you choose at this point.



Later, it is possible to set the language of the software via the file imcLanguageSelector.exe, which is also installed.

If the database components of your PC's operating system aren't at the most up-to-date level, they will also be installed. In this case, the PC will reboot. After booting, the software is still not completely installed. You need to start setup.exe again.

During the installation you will be asked for a password. This is noted on an adhesive label on the CD jewel box.

In the course of installation you will also be asked for the directory in which you wish to install the software. The default is "c:\imc\imc SENSORS". Of course, you can edit the default entry. But please don't select a folder in which other imc products are already installed.

2.3 CD Contents

./Drivers/*.*	This contains the drivers necessary for using 1-wire USB adapters to read/write to TEDS chips; these drivers are normally not required. If you have Internet connection while you attach the USB devices to your computer, Microsoft Windows will automatically download the appropriate files.
./OSUpdate/*.*	This folder contains installers from Microsoft for installing database support of Microsoft Windows. Please install imc SENSORS first. Only if your operating system is missing database support can these installers be used. Alternatively you can download them from Micrsoft's homepage.
./Tools/*.*	If you want to use the setup in a silent mode, the necessary instructions and examples are located here.
./autorun.inf	Starts the CD setup, which is also started automatically upon inserting the CD if the corresponding PC option is active.
Historie.txt	File in German. States what is new in the version on this CD.
History.txt	File in English. States what is new in the version on this CD.
./imcSharedSetup70.exe	Automatically executed while Setup_imcSensors.exe is running. You do not need not execute imcSharedSetup70.exe manually.
./Setup_imcSensors.exe	The actual setup file for installing imc SENSORS.

2.4 Installed files

.\imsensor.exe	The main program. Selecting this file starts imc SENSORS
./sensordatabase.mdb	The sensor database. It is set up under this name at the first installation. An MS Access file. The sensor data are permanently stored in this database. However, imc SENSORS can be used to save sensor data to other databases as well.
./imcsensor.pdf	This documentation in PDF format. If needed, you can also install the PDF Reader by Adobe from the CD.
./*.dll	Run-time libraries
./*.dll.*	International language support for run-time libraries
./CurveWindow.chm	Help on the curve window. Double-clicking on the file starts the help.
Init/SensorFilters.xml	All currently used filters. This is an .INI-file in xml format.
Init/SensorFilters.xml.bak*	Backups of SensorFilters.xml; saved when the software is exited. Not installed, but instead is created in the course of working with the software.
init/SensorUserProps.xml	Saved the definition of all user-specific properties.
Init/SensorUserProps.xml.bak*	Backups of SensorUserProps.xml; saved upon exiting the dialog for making settings for the user-specific properties. Not installed, but instead is created in the course of working with the software.
ieee1451/manufacturelist.xdl	The manufacturer's list as per IEEE 1451.4. The file is to be downloaded later as a constantly updated version from the IEEE 1451 homepage (a service provided by IEEE).
Uninstall/unwise.exe	Manual de-installation of the software. You can also use the Windows Control Panel to uninstall.
WORK	Working directory for temporary Transport-files, e.g. for CSV files for the purpose of exchange with MS Excel; or also for xml Import / Export Transport-files.
ActiveX	Aids and examples for developers using the COM Library of the ActiveX Control. These files are replaced upon each installation. Therefore, don't changes these files, but only copy or read from this directory. Refer also to the chapter "Notes for developers".
ActiveX/Original	Example databases, filters etc. belonging to the current updates are in this directory. If you don't wish to use the filter you edited yourself, but that of the newest update, you can copy it from this directory and replace your current filter with it.
<Program Files>\imc\Shared	Shared directory for imc binary files. <Program Files> is e.g. „C:\Program Files“.
ImcLanguageSelector.exe	Help program for switching languages in which imc Software appears. Located in imc\Shared.

2.5 New installation, update

Simply install a new version to the same directory as the previously installed version.

The following files are not updated upon a new installation:

- ./sensordatabase.mdb
- Init/SensorFilters.xml
- init/SensorUserProps.xml
- ieee1451/manufacturelist.xdl

This is because these files may have been altered during operation and contain settings made by the user in the course of working with the software.

If you wish to restore these file as part of a new installation, then simply delete these files before a new installation of the software.

The System-Registry contains references to installed files. These references aren't included in any update.

2.6 Use of the System Registry

The software uses the System Registry for recording current settings.

Note

In general, no notice is taken of the System Registry. Please also note that some changes to the entries can lead to the software no longer working or even to permanent damage.

`HKEY_LOCAL_MACHINE / SOFTWARE / imc Measurement And Control / imc Sensors`	Settings mainly made upon the first installation of the software. These entries are valid for all users equally.
`HKEY_CURRENT_USER / SOFTWARE / imc Measurement And Control / Default / imc Sensors`	Settings which can apply separately for each user.

2.7 List of software changes

See the file *History.txt* on the CD.

2.8 De-Installation

- Run *uinstall**imc SENSORS**unwise.exe*. Alternatively, remove the software via Control Panel / Software.
- Certain files remain which the user himself has modified. These are never removed upon automatic de-installation. You can delete them manually using the Windows Explorer. These file are founding the imc SENSORS folder (.*.*) and in the associated subfolders.

3 Operation

3.1 Overview

imc SENSORS is a tool for managing and editing information about sensors. In particular, it handles their technical data and calibration values.

The software package has a database-oriented operating style. Thus it stored all data reliably in a database.

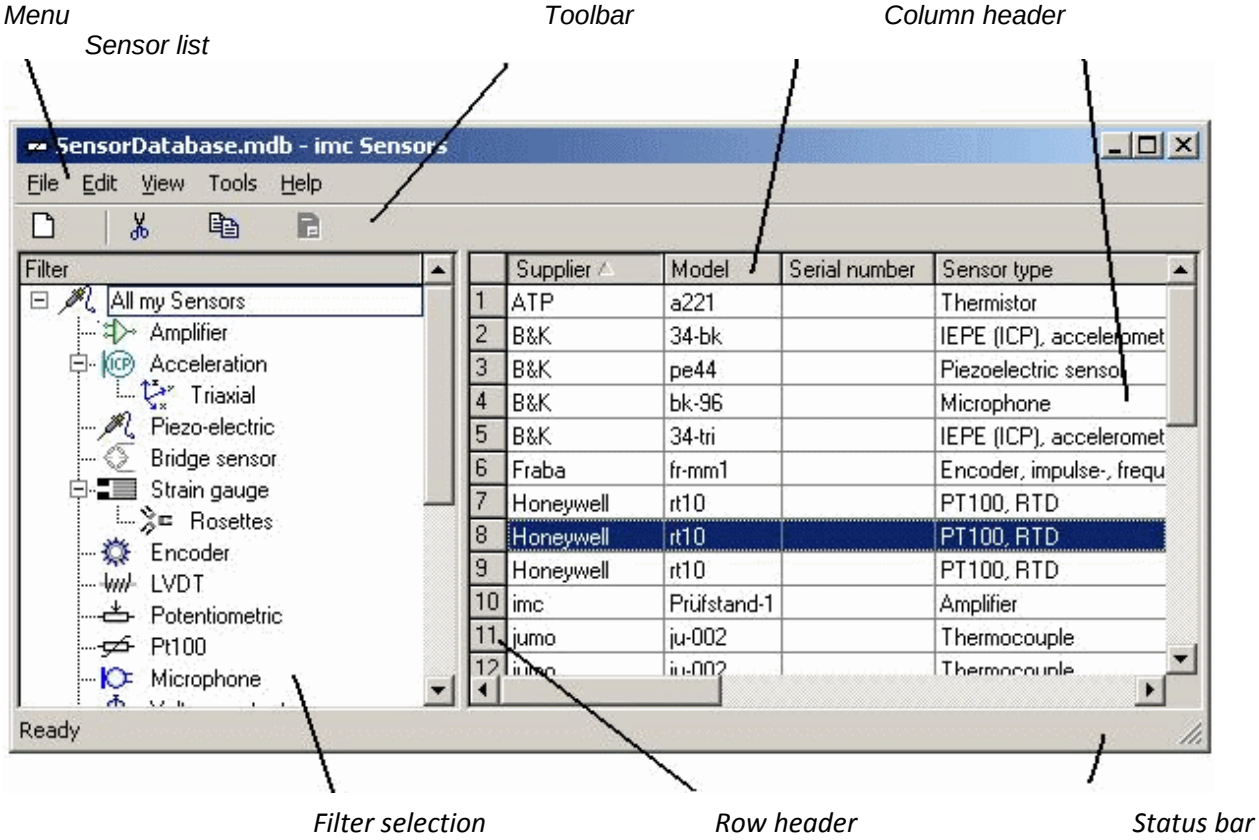
The world of sensors is full of variety; sensors come in a large array of different types. They are distinguished not only by their shapes and sizes, by the physical principles according to which they operate and the way their signals are converted, but also by their properties, specs and how they are connected to measurement instruments.

The purpose of imc SENSORS is to access sensor information quickly and completely. Such information can be used to

- parameterize an input channel (e.g. for imc CANSAS or imc CRONOS PL),
- find out the relevant calibration history,
- inspect the spec sheet.

3.2 Main window

The main window's elements:



3.3 Editing sensors

The sensor list presents the selected properties of the selected sensor in tabular form.

3.3.1 Editing cells

Each cell in the table can be edited directly.

Operation:

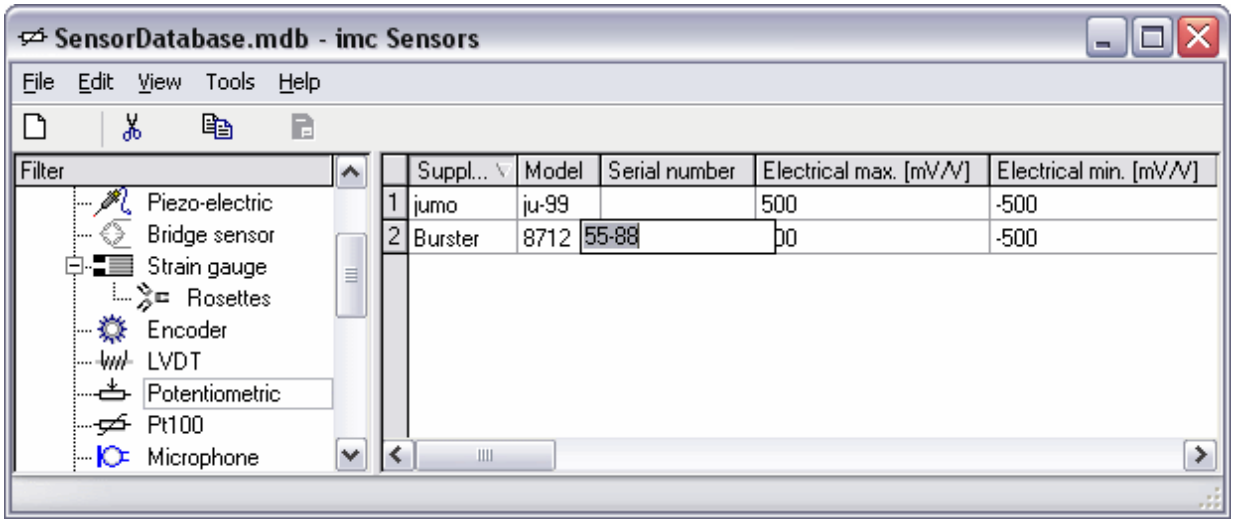
- First select the row.
- Next, click on the cell to be edited.
- A single click is sufficient to edit another cell in the same row, if desired.

Operation with multi-selection

- First select multiple rows. To do this, use either the Ctrl or Shift keys as customary with Windows.
- Hold the Ctrl or Shift key down while clicking on the cells to be edited.
- Subsequently, the cell can be edited. The change is adopted in all selected rows in which this property exists.

The editing technique is the same as for renaming a file in the Windows Explorer: first click to select, and then click again.

In this context, note that clicking too quickly in succession will cause Windows to respond as for a double-click (also in the Windows Explorer). Therefore, for reliable operation, wait for the amount of time set in the Windows Control Panel for the double-click interval.



Depending on the type of data in the cell, the control element is:

Cell data type	Editing tool
Text	Text input box
Integer	Text input box, only allowing digits
Real number	Text input box, only allowing characters belonging to real numbers

Cell data type	Editing tool
Color	see below, "Changing color"
Date	see below, "Changing date"
Characteristic curve	see below, "Specialized dialog"
Sequence of real numbers	Text input box, only allowing characters belonging to real numbers. The separator is <Space>. Decimal point is valid.
Selection 1 among N	Pop-down list

3.3.1.1 Concluding the editing

The ENTER key is used to confirm and conclude the input. The input box is closed. The table shows the value entered. With entries made from a pop-down, the first click closes the pop-down, and the second closes the input control itself.

Clicking anywhere else on the screen also causes the entered contents to be adopted, if they are valid.

To cancel entries made, press the ESC (Escape) key.

3.3.2 Text input

This is a standard Windows input box for texts (Editor). Note that the Windows input box comes with a context menu, which depends on the operating system.

3.3.3 Following a link

A property of the type "*Link*" is edited in exactly the same way as a text; see above. The link itself is a text. The data type "*Link*", however, also allows opening the document referenced by means of the filename. Hold down the Shift key while clicking on the cell. This opens the file. The same thing happens as when double-clicking on such a file's entry in the Explorer. For instance, if a pdf-document is specified, the pdf Reader starts and displays the document.

Attention: Please only use the function if you are sure which program is used for the respective file type, and that you desire to run that program.

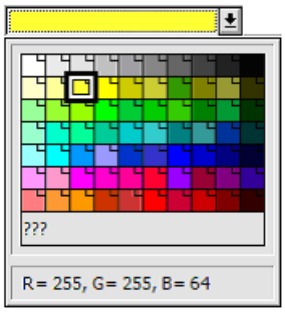
3.3.4 Edit Link

It is also possible to edit a property of the type "*Link*" by means of a file selection dialog, if the link is a filename. This is usually easier than specifying the filename by keyboard entry. To do this, first select the line in which the cell is located. Then, click on the cell while holding down the ALT key. A dialog for selecting the file appears. This functionality is only truly helpful in cases where the file is accessible from the computer used.

3.3.5 Changing date

It's possible to perform editing with or without the pop-down list. Without the pop-down, the date's individual parts can be selected. The values can be changed directly via the keyboard or adjusted up or down with the arrow keys.

3.3.6 Changing color



It's possible to edit either using the pop-down list or without it. With the pop-down, the desired color's box is selected by mouse. It is also possible to scroll through the available options using the arrow keys.

The box "???" is used if the color is to be set as "not defined" or "unknown".

3.3.7 1 among N selection

The usual Windows pop-down list is used.

The selection <Empty!> sets the cell's contents to "*not defined*" or "not known". This is expressed in the table by " <???>".

3.4 Editing characteristic curves

3.4.1 The purpose of characteristic curves

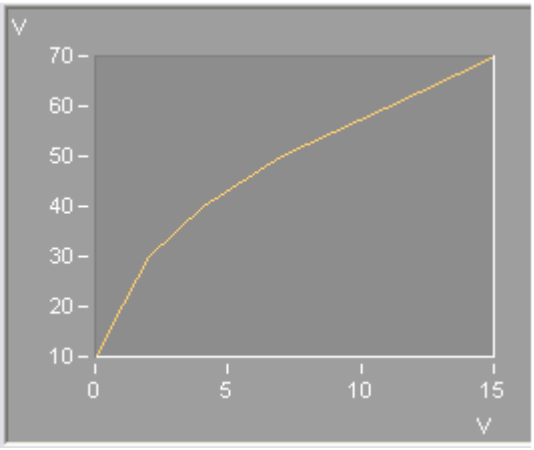
The characteristic curve (here: a sensor's characteristic curve) describes the quantitative connection between the physical quantity applied to the sensor and the electrical signal generated at the sensor's output. Here, the characteristic curve takes the form of a sequence of value pairs correlating electrical to physical signal values.

Note: Many non-linear characteristic curves such as those of thermocouples and PT100's are specified by official standards. For such sensors, a simple statement of the type is sufficient (e.g. with thermocouples, the type, such as Type K). With thermistors (NTCs), coefficients of a complex function are specified. For all other sensors, a series of measurement points is generally supplied.

Basically, then, the characteristic curve is an ordered collection of measurement points.

Example of a non-linear characteristic curve:

	Physical value [V]	Electr. value [V]
1	10	0
2	20	1
3	30	2
4	40	4
5	50	7
6	60	11
7	70	15
8		



Note that depending on the context, the characteristic curve can be expressed as shown here or also the other way around, namely as electrical values plotted over physical values.

The characteristic curve must be a one-to-one function. This is necessary for two reasons:

- Firstly, for physical reasons, the sensor omits a unique electrical signal from its output depending on the physical signal.
- A connected measurement device receives the electrical signal and displays the corresponding, re-converted physical values for the user. For this purpose, the measurement device must be able to unambiguously determine a physical value from the electrical value (e.g. via a table).

3.4.2 Using characteristic curves in CANSAS and imc Devices

imc CANSAS and imc DEVICES/STUDIO both proceed according to the same algorithm to take the characteristic curve points into account. imc DEVICES/STUDIO does not support non-linear characteristics in version 2.6. Please refer to the imc DEVICES/STUDIO documentation for information on the version required.

Characteristic curve points are considered as points actually measured by the sensor and thus take precedence over other spec sheet properties (e.g. sensitivity or the correlation of physical min/max to electrical min/max).

If all the points lie along a straight line (or at least within the measurement device's accuracy), then the firmware doesn't need to make calculations according to a non-linear characteristic curve. It simply performs linear transformation.

In the case of a non-linear characteristic curve, the firmware does carry out the necessary correction.

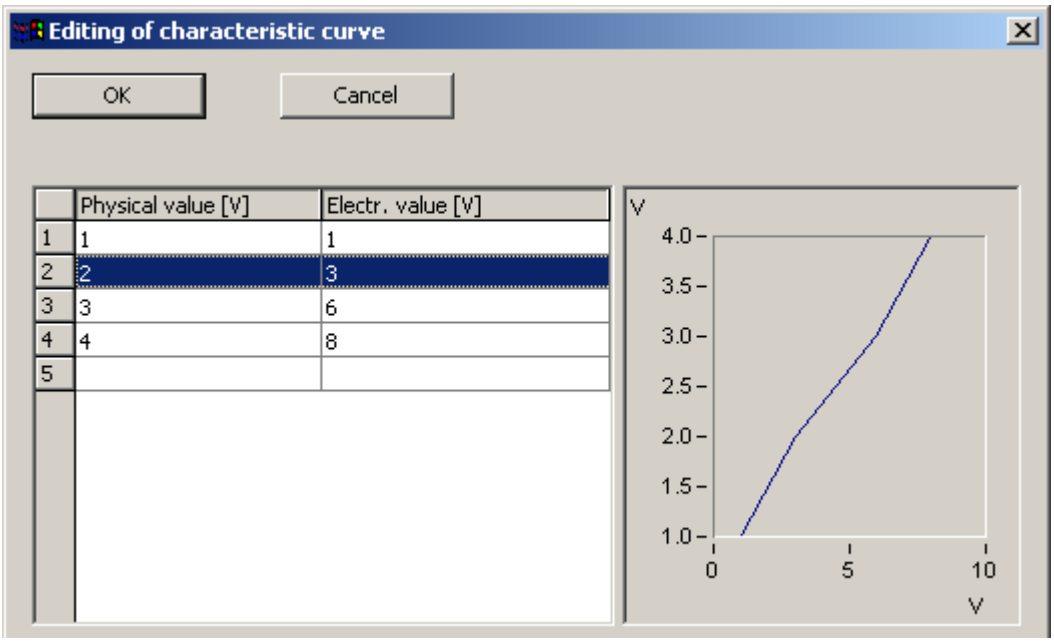
If the points belonging to the characteristic curve don't cover the entire input range, then the system extrapolates for the range beyond the curve. Within the range of the available points, there is interpolation using polynomials defined for specific segments. Beyond the edges, these are extended at the edge slope.

Note

With imc DEVICES/STUDIO, the informations will be transferred for the following amplifiers only: UNI(2)-8, DCB(2)-8, LV2(2)-8, ICPU(2)-8, UNI-4, SC2- 32, ISO2-8LV-16, ICPU-16 (as at June 2016)

3.4.3 The dialog

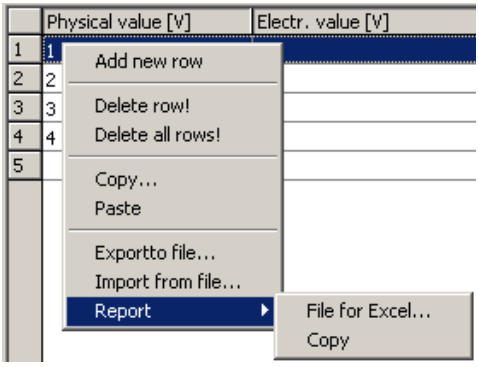
If a cell which contains characteristic curve value is to be edited, then instead of a simple input box for numerical values, a specialized dialog appears:



At the bottom of the table there is a new row in which values can be appended.

All values must be entered in correct order. Both the electrical and physical values must be either only monotonously increasing or decreasing.

The table has a context menu:

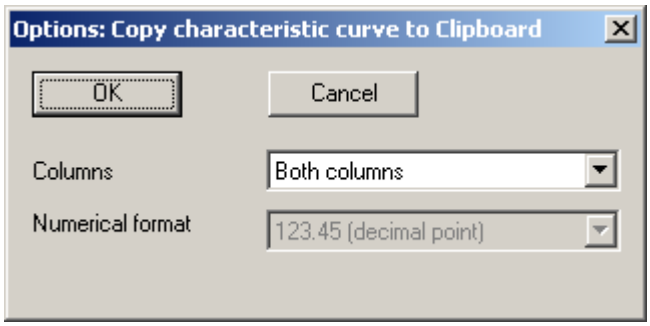


Right-clicking on the row header (far left, shaded grey) calls the context menu. The context menu appears over the table's cells unless an input box is already open (in which case the Windows input box's context menu appears!).

3.4.4 Context menu functions

- Add new row: An empty row is added in the place of the selected row.
- Delete row!: The selected row is deleted.
- Delete all rows! Only an empty row remains in which to start over.

- Copy... : Copies the (entire) table to the Windows Clipboard. A prompt appears asking whether both columns or only the left or only the right column should go to the Clipboard. It is also possible to set the decimal character.

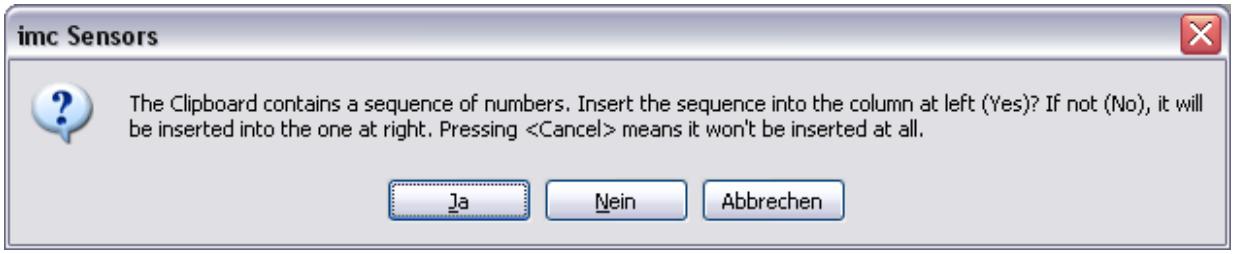


  Copying to the Clipboard proceeds row-by-row; with the tabulator, there are separate columns.

  Note that MS Excel expects the decimal character which corresponds to the country setting which is in effect.

- Paste: The Windows Clipboard is read out. In the process, one or both of the columns are completely replaced by the newly read-in values. If the Clipboard contains text which clearly contains two columns, the entire table is replaced.

  If there is only one column in the Clipboard, the following prompt appears.



In this way you can specify whether the left or the right column is replaced by the Clipboard contents.

- Export to file: Here, you can set a filename in order to write the table to a FAMOS file.
- Import from file: Here, a file in FAMOS format can be selected. This file contains a single data set. This data set is read in and replaces the entire table contents. The data types supported are XY and equidistant data (normal data).
- Report: See the segment "Reports".

The curve window on the dialog's right side is the FAMOS or imc DEVICES/STUDIO curve window. Detailed help is available in the file curvewindow.chm. Double-clicking on this file's entry opens the help.

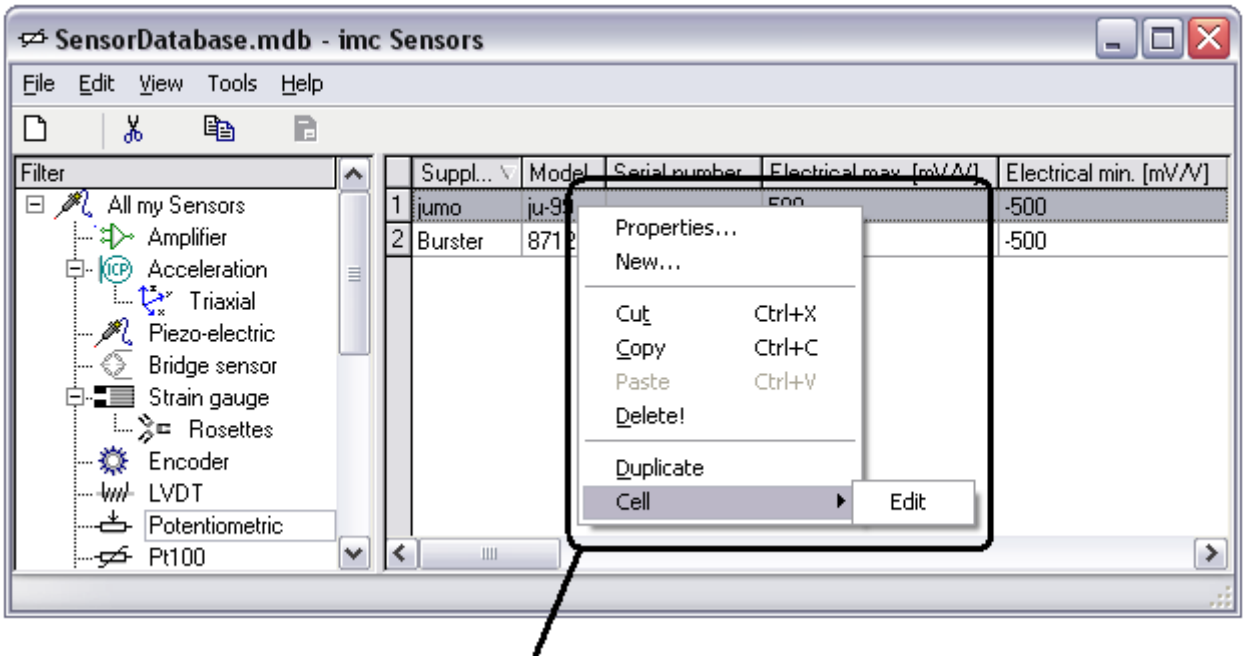
After exiting the dialog, a simple readout of the number series remains:

Calibration	
Measurement points (electr.) [V]	0 1 2 4 7 11 15
Measurement points (physical) [V]	10 20 30 40 50 60 70

3.5 Editing a complete sensor

3.5.1 Context menu

The context menu for editing the selected sensors is called by right-clicking over the area of the table. However, it won't work by clicking over the column headers.



The context menu contains the following functions:

- Properties: Edits the sensor spec sheet. For this, only one sensor may be selected. See below for a description.
- New: Sets up a new sensor. See below for a description.
- Cut: The selected sensors are removed to the Windows Clipboard. See below.
- Copy: The selected sensors are copied to Windows Clipboard. See below.
- Paste: Sensors are inserted from the Windows Clipboard. See below.
- Delete: The selected sensors are deleted from the database. Caution: These sensors are then really gone (like in the MS Windows recycling). The only way to retrieve them then is via "Deleted sensors".
- Duplicate: The selected sensor is duplicated. A dialog appears for editing the newly created duplicate's spec sheet.
- Cell / Edit: A table cell can also be edited via the context menu. See above on editing a cell directly via the mouse. The cell editing takes effect on the cell over which the mouse pointer was positioned when the context menu was opened. If multiple rows are selected, then at the end of the editing procedure the changes are adopted in all selected rows where the property concerned exists.
- Cell / Set to empty: The cell above which the mouse pointer was located when the context menu was opened is set to an empty text or “undefined” or <???>. The changes only take effect in the rows in which the property concerned exists.

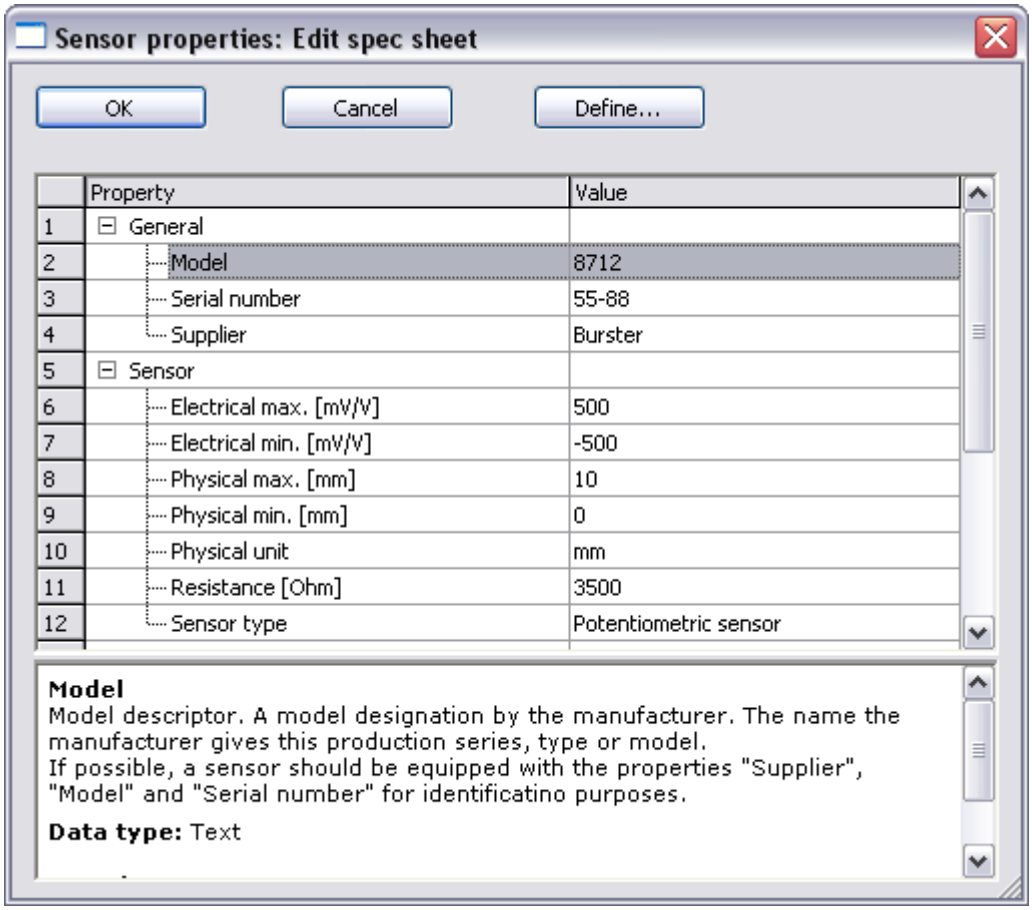
- Compare: If multiple sensors are selected at the same time, they can be compared with each other. To do this, the selected sensors are displayed in the view “Compare”. Even within this view comparison is possible, in order to be able to compare even smaller selections with each other. In the “Comparison” view, the columns where the sensors being compared are different are color-highlighted.
- “Edit Link...”: If a link exists, this menu item is available. By means of this item, the link can be edited using a file selection dialog, if it refers to a filename.

3.5.2 "Edit" menu

The main window's "*Edit*" menu contains the same entries as the sensor list context men, if the main window's right side (the sensor list) was last active. If the filter list was last active, the "Edit" menu pertains to editing the filters.

3.5.3 Properties: Editing the spec sheet

Double-clicking on a row in the or over the sensor list context menu item "*Properties*..." calls the following dialog for editing the selected sensor's spec sheet:



The spec sheet presents a list of the sensor's properties. The properties are arranged in groups. Most of the properties can be edited in the column "*Value*" (see above on the technique for editing sensors), e.g. by simply clicking on a row. By the way, it is sufficient here to click once on a row which hasn't yet been selected.

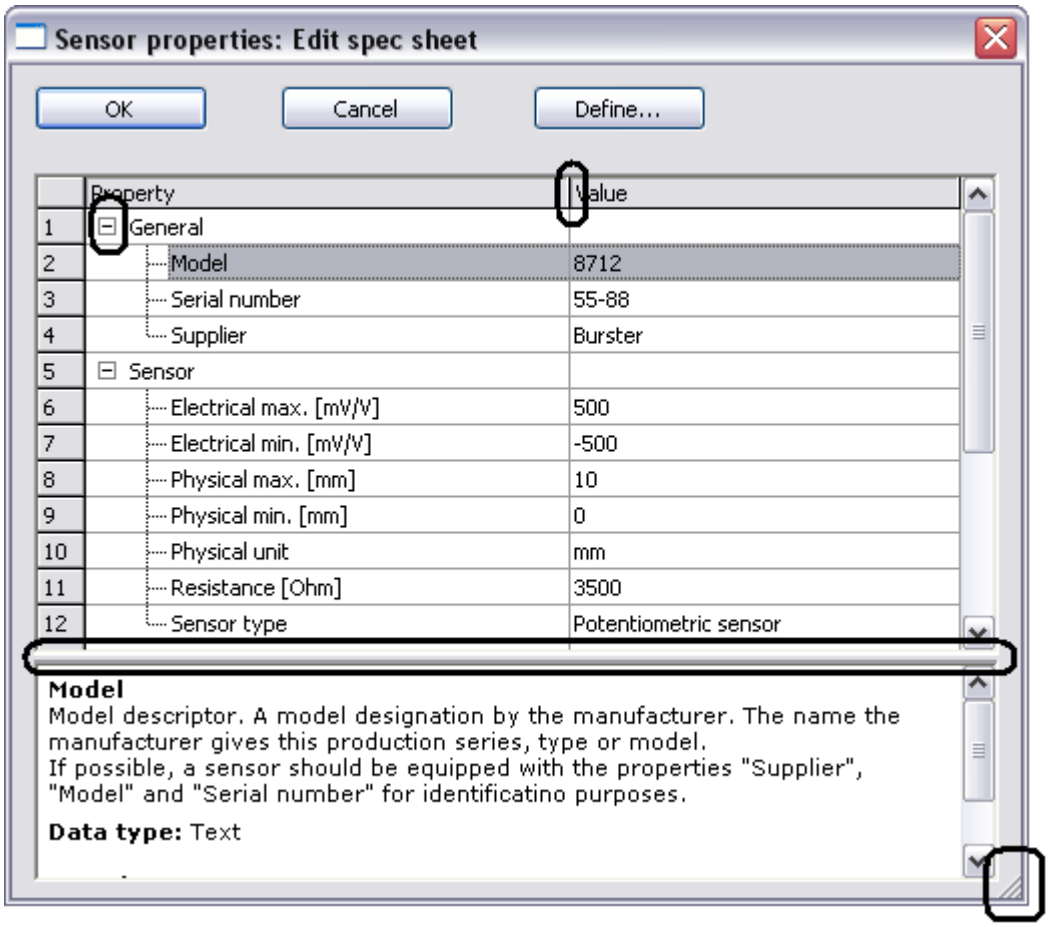
When a row is selected (e.g. in the column "*Properties*"), then a help text about the corresponding property appears at the bottom. There you can read what this property means and what kinds of values are permitted.

Most properties can be edited. The exceptions are groups (which aren't actual properties), the sensor type (refer to "*Define…*") and the internal properties (see below).

"*Define…*" button:

Here the form of the spec sheet can be edited. The selection of the properties can be changed. See the segment "*Defining the sensors*" below.

The dialog can be adapted to your wishes in the following areas:



- Expansion and collapse of property groups
- Changing the column width
- Changing the dialog size and position
- Changing the height of the help window on the bottom

All these settings are saved and restored upon the next call of the dialog.

3.5.3.1 Internal properties

The list of properties also contains a group of internal properties. These cannot be edited. But they indicate how the sensor is administered internally.

Internal administration	
Identification	{6638112D-8FF2-49A5-AA48-5643E...
Last modified	12.11.2004 15:12:47
Size [Bytes]	304

The entries are defined as follows:

- ***Size***: This is the memory requirement for administering the sensor. This number is usually not so important for saving to a database. There are database systems which only permit a maximum of 64kByte. But when transferring the data to a chip, for instance sensor TEDS or Eprom, the size can play an important role due to limited space.
- ***Identification***: This is a GUID (global unique identifier), a world-wide unique ID assigned by Windows for this sensor. No two separate sensors have the same identification. But it is possible for the same sensor to have spec sheets of different ages, for instance, due to sensor recalibration every two years. In that case, the same ID has a history of spec sheets having multiple time stamps (calibration history).
- ***Last modified***: The time stamp of the last change (however minor) to the spec sheet. When copying and pasting or exporting and importing sensor information, this time stamp is used to determine whether an update can be attached to an existing sensor or whether a newer version is already present in the administration.

3.5.4 Setting up a new sensor

Using the context menu item "*New*…", a new sensor can be set up in the administration. A new ID is created for the sensor. The sensor has no other properties otherwise, not even a sensor type.

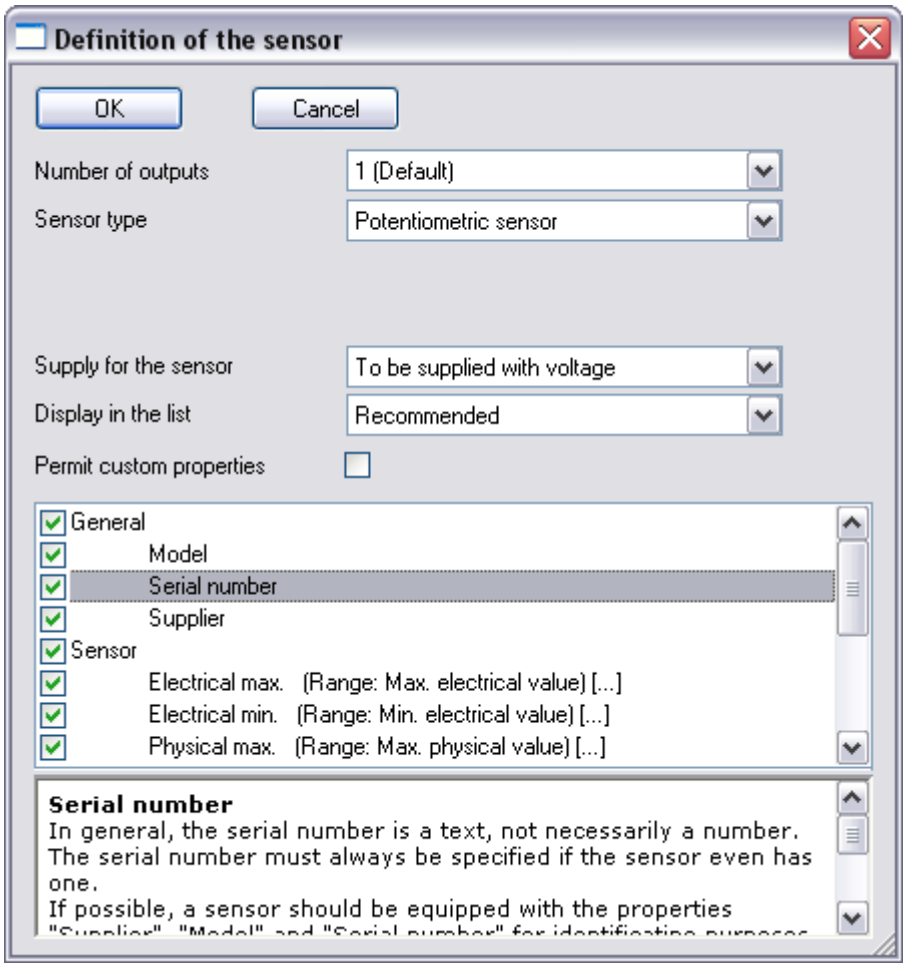
A dialog for defining the sensor appears (shown below). The form of the spec sheet can also be set.

Subsequently, the spec sheet is filled in; see the dialog above, "*Properties*...", on editing the spec sheet.

If you press Cancel, the newly set up sensor is canceled.

3.5.5 Defining the sensor: Determining the spec sheet's form

This dialog can be called from within a sensor's "*Properties*" dialog or it appears when a new sensor is set up. Here, you can specify how the spec sheet's layout: What properties does the sensor concerned possess? Not only is the sensor's serial number "88443-323" specified here, but also that the sensor's description even includes a serial number.



In particular, you select:

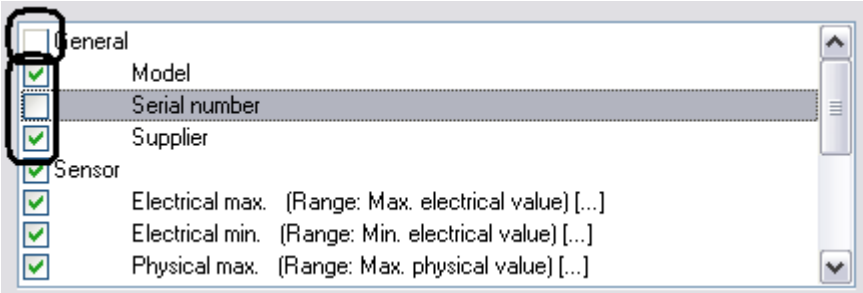
- *The sensor type*: The sensor type is selected from a pop-down. This control lists as choices both sensors and actuators, as well as the entry "No sensor". The latter is used if the device is something different.
- *Sensor supply*: Is the sensor supplied with current (in other words from a current source) or with voltage (in other words by a voltage source), or not at all?
- Display in the list: Which properties are to be indicated in the long list of properties below, and offered for selection.
  - Necessary: Only the really absolutely necessary properties are displayed. These properties must be checkmarked.
  - *Recommended*: The properties recommended based on the sensor type selected are offered for selection. These are relatively few in number. You can checkmark all of them if desired. For example, the serial number is recommended. But if your sensor has none (because, for instance, its only a simple thermo-wire), you don't need to checkmark this property.
  - *Also optional*: The list of properties available for selection becomes longer. Even not-so-important properties are listed.

- *All*: Even the rarest and least important properties are listed for selection.
- *Currently used*: Only the currently checkmarked properties are listed. This is useful mostly for getting a quick overview: you can see right away which properties are in use. It is especially easy to de-select currently selected properties.

- *Properties list:* Here you checkmark all properties which you wish to appear in the spec sheet. Only the properties really visibly checkmarked in the list are adopted when you press "OK".

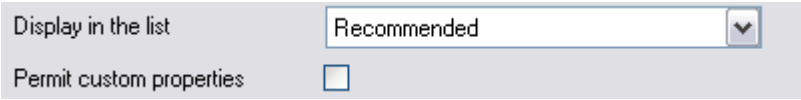
  You can checkmark a group as a shortcut to checkmarking all of the properties belonging to it. The box in front of the group header indicates whether none of the group's properties (empty box), some of them (grey box), or all of them (clear checkmark) are checkmarked.

  Note that checkmarking (as well as removing a checkmark) is done by clicking in the box. A click on the row, by contrast, selects that row's entry and causes detailed information on the property concerned to be displayed at the bottom of the dialog.



Display of custom properties:

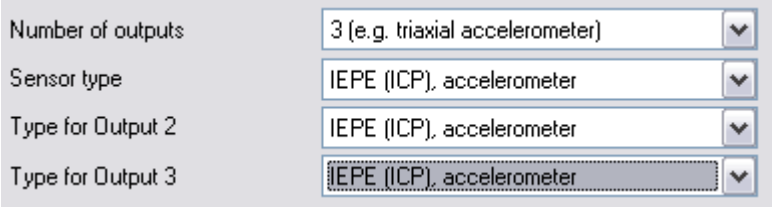
There are also custom sensor properties (for setting these, go to the main menu item Tools/ User-specific properties..."). If all or almost all of the properties are displayed in the list, you can select whether the user-specific ones should be displayed as well.



3.5.5.1 Sensors with multiple outputs:

There are also sensors which actually consist of a complex of multiple individual sensors.

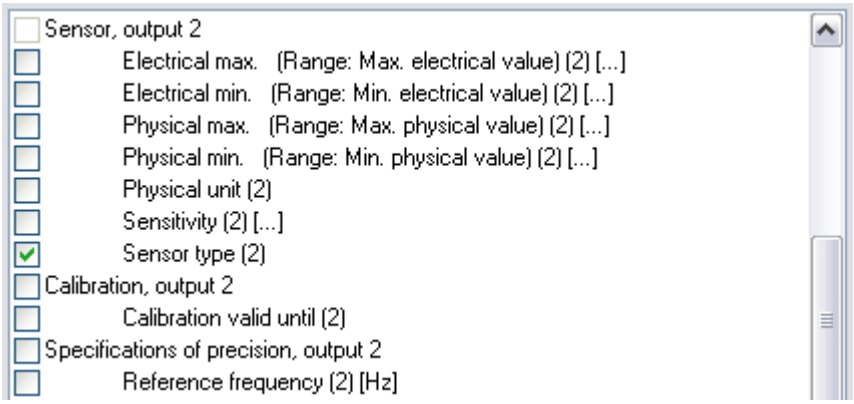
A typical example would be a triaxial accelerometer: This is actually made up of three sensors combined in a place- and expense-saving manner. This sensor operates as three separate ones sharing a housing. The sensor naturally has only one plaque and one serial number, not three. Therefore it makes sense to administer this sensor here as a single one. Nevertheless, it is a complex one, since it has three electrical outputs.



A maximum of 3 outputs can be administered.

Another example is a strain gauge rosette. With these, there are three actually independent strain gauges on a common carrier. The user has the choice of either administering each one separately or all three jointly. Each strain gauge then counts as one sensor output.

There are additional properties for every output:



With groups, an "*Output 2*" and "*Output 3*", if appropriate, is appended, and the indices (2) or (3) to properties, in order to indicate that a property pertains to the 2nd or 3rd output.

The sensor type must be stated for each output. The same applies to all other obligatory properties.

For all other properties, the following rules apply:

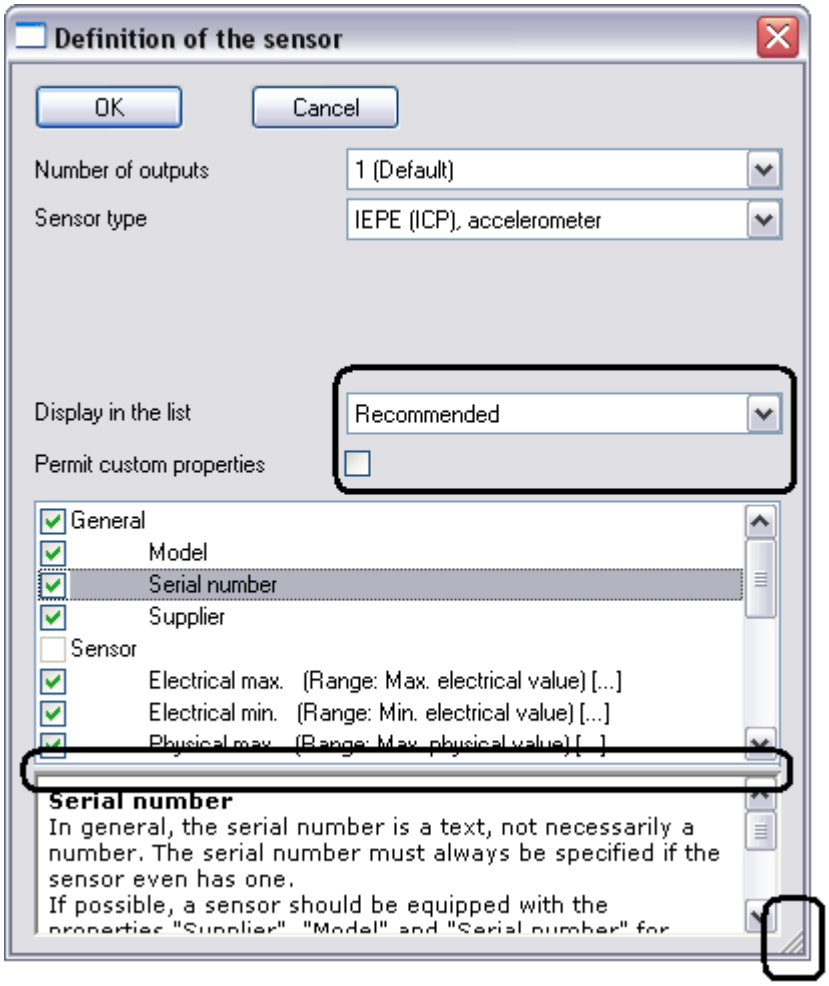
- If a property isn't specified for an extra output, the 1st output's property is used. The condition for this is that the 1st output has this property.
- If the property is specified for an extra output, it is valid even if a different value is specified for the same property differently for the 1st output.

  This makes it conveniently possible to state the sensitivity of only one input of a triaxial accelerometer, for example. Then the other outputs share the same sensitivity.

  This behavior of "*inheriting the 1st output's properties*" is noticeable when a sensor's properties are used to parameterize channels in imc CANSAS or imc DEVICES/STUDIO.

There are groups of properties which only appear once: this pertains especially to general administration properties, the internal properties and custom properties.

In the following areas, the dialog can be adapted to your wishes:



- Changing the dialog's size and position
- The option "*Display in the list*"
- Changing the height of the help window at the bottom of the dialog.

All these properties are saved and restored upon the next call of the dialog.

Note

When transferring a sensor having multiple outputs into configuration software by means of Drag&Drop, it is also necessary to configure multiple channels. Whether this can work depends on the measurement system's operation software. To do this, refer the associated operating instructions (imc CANSAS, imc DEVICES, imc STUDIO.

3.5.5.2 What properties should a sensor possess?

The following rules can provide some perspective:

- Use just a few properties in order to distinguish the sensor. To do this, assume that you will someday have many similar sensors in the database and that they will be displayed in the sensor list. It will be necessary to recognize a particular sensor. For this, the internal identification (GUID) is theoretically suitable, but not easy to remember and also not self-explanatory. Instead, select specifications which can be read from the sensor's plaque: manufacturer, model, serial number.

- Try to use the same properties for similar sensors as far as possible. Since the sensor list presents similar sensors in tabular form, it is sensible to have an economical and informative arrangement of columns. If in an exceptional case a certain sensor doesn't possess a particular property, the corresponding cell simply remains empty.
- If you set up new sensor which are similar to ones already present, it is worthwhile to use the sensor list context menu item "*Duplicate*…". The newly set up sensor then gets the same properties as the original. You only need to adapt the values, especially the ones serving to distinguish the sensor. Only internal properties such as the Eprom-ROM-ID are not applied.
- For sensors which cannot be distinguished from each other, it may not be worthwhile to set up separate new sensors. For example, if you have dispensable thermocouples and the thermo-wire is simply cut from a roll, then it's usually not necessary to set up a new sensor in the administration for every such thermocouple. Thermocouples used in this way neither have serial numbers nor will they every have a calibration history. If anything there might be an entry for thermocouples of a certain type (e.g. Type K). However, for an expensive mantled thermocouple intended for long use it may be justified to make an entry.
- In order for a sensor's spec sheet to be used properly for setting a measurement channel in, for example, the imc DEVICES/STUDIO or imc CANSAS software, the sensor specifications should enable the correct channel setting to be derived. This means such properties as the sensor type, the sensitivity along with its physical units (or else explicit electrical and physical min/max values). Which properties these are depends on the sensor type. Most of these properties appear under "*Recommended properties*".
- Fill in the properties concerning the sensor's supply with current or voltage. This is especially important when using measurement amplifiers which supply the sensor at the same time.
- If the sensor is non-linear but its behavior is a standard non-linearity, then the non-linear characteristic curve should be specified as a sequence of measurement points ("*Calibration*" group, "*Measurement points*…" properties). This isn't necessary with thermocouples, PT100s and thermistors (NTC).
- Make note of until when the sensor's calibration is valid.
- In the group "Data acquisition", you may want to make entries for the channel name (if the measurement location, at which the sensor is positioned, is known) and the sampling rate (if the sensor or its installation lend themselves to a particular sampling rate). That could make it easier to parametrize the measurement channel later on.
- Add any other properties as desired. But note that it's usually not necessary to administer a sensor's entire spec sheet. This amount of trouble is only worthwhile if you're not using imc SENSORS as just an aid in setting up measurement channels, but as a complete sensor management system.

3.5.6 Data exchange

Complete collections of sensor data can be exchanged via the Clipboard and vie files. By these means it's possible to exchange information on either one or multiple sensors.

Sensors data include:

- the sensor's identification (GUID),
- the date when the sensor information was last modified,
- the complete sensor data withal groups, properties and other values.

Sensor data does **NOT** include:

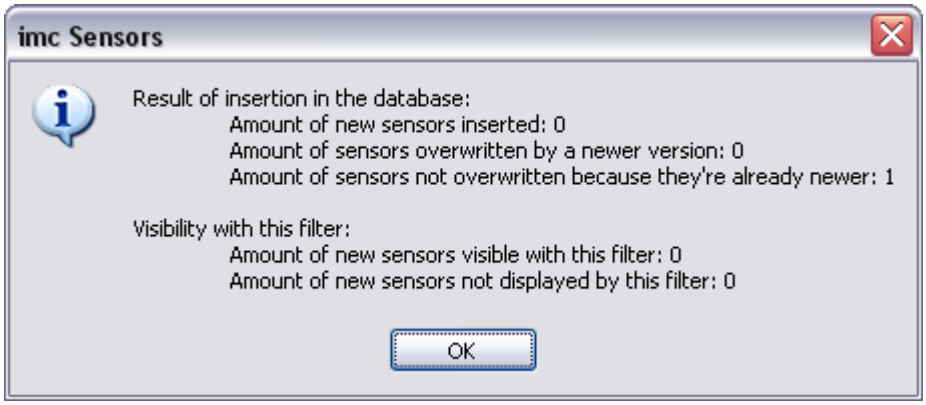
- the filter settings,

- the settings for which columns are displayed, or how they're ordered or their layout,
- strings representing names and list of user-specific value lists,
- the sensor's history, if available.

The exchange of sensor information pertains to the sensors used. Adding and updating of data proceeds according to the principle "the last one there wins". This means that data for any previously unknown sensors will always be added to the system, otherwise information on existing sensors is only added if it's newer.

Since a sensor along with its ID and modification date is exchanged, the following scenarios are possible:

- When a sensor in the sensor list is selected, copied (to the Clipboard) and subsequently pasted (inserted) from the Clipboard to a new target, it won't actually be inserted; the sensor to be inserted is still in the database. The problem is, the same sensor (having the same ID) is supposed to be inserted with the same modification date. As a result, the insertion fails. the following message is posted:

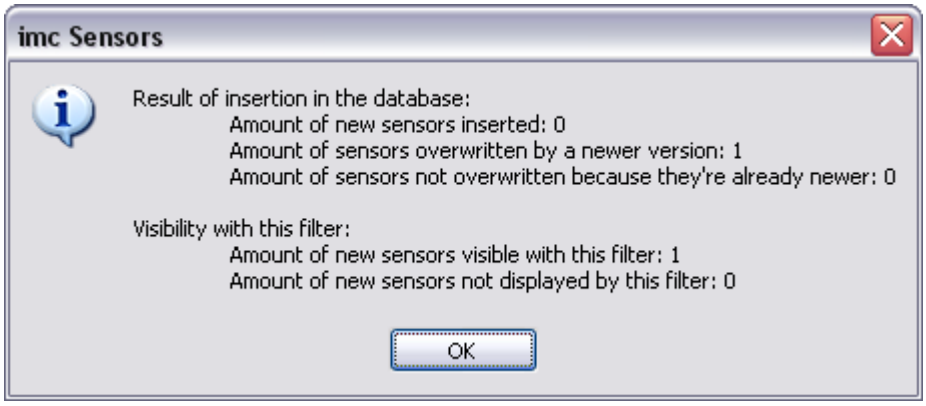


Note

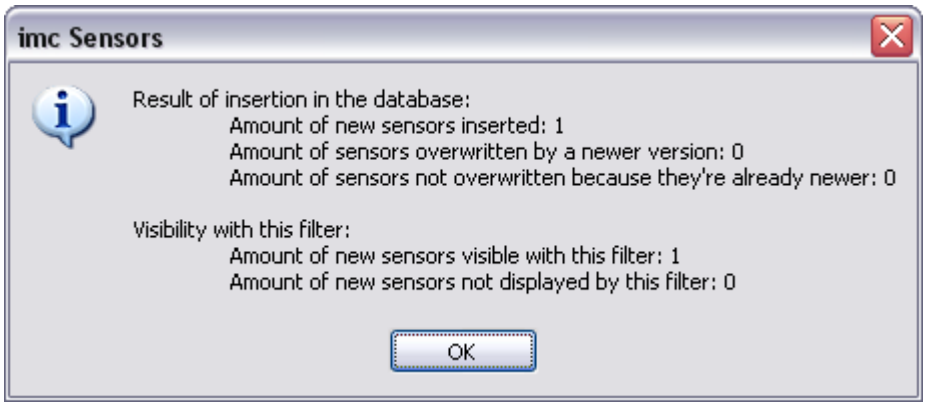
If you want to duplicate a sensor, use the sensor list's context menu's item "Duplicate...".

The same tip also appears if the Clipboard contains older information on a sensor than the database has. Thus, if the database already contains newer information, it will not be overwritten with older data.

- Suppose the calibration laboratory re-calibrates a sensor in the database (a sensor with which you have also worked in your own database). You open the calibration database, select the sensor and copy it to the Clipboard. Then you open your own database and paste the sensor in from the Clipboard. Since the ID is the same in both places, the system notices that the sensor information in your own database needs updating. The pertinent sensor is already present, but its information is obsolete. The Clipboard contains newer contents for the exact same sensor. The following message is posted:



- Suppose a colleague enters newly purchased sensors into the database. He exports them as an xml-file and then provides you with this file, which you then import. Since these are totally new sensors not yet present in your database, they will actually be added. The following message is posted:



- How pasting and importing are accomplished doesn't depend on the filter currently in use. Therefore it can happen that either all, some of, or none of the sensors inserted appear in the list. Since it may seem strange that something which was just added doesn't show up, the message is posted after the insertion to indicate that so-and-so many sensors were added, though not currently visible. Then, you can select the appropriate filter or even the filter "*All sensors*". But if that filter had already been in effect, you would see any sensors which were just added.

Data exchange with sensors having user-specific properties:

See the section "Exchanging sensors with user-specific properties 66".

3.5.7 Clipboard: Copy

Sensor list context menu item "*Copy*". The sensors selected are copied to the Clipboard.

3.5.8 Clipboard: Paste

Sensor list context menu item "*Paste*". All contents of the Windows Clipboard are pasted in if they are either new sensors or new data on existing sensors.

3.5.9 Clipboard: Cut

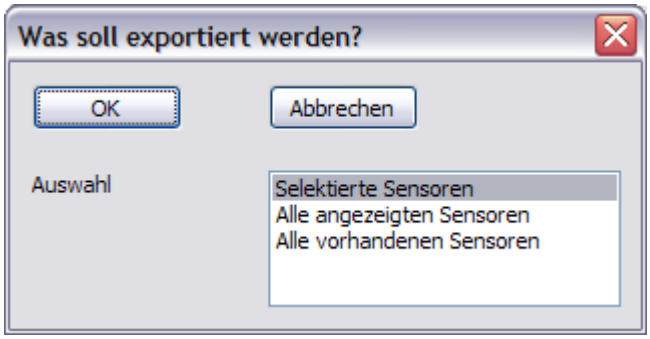
Sensor list context menu item "*Cut*". The sensors selected are removed to the Clipboard while being removed from the database. Caution: These sensors are really gone then (like in the MS Windows recycling bin). They can then only be retrieved via "*Deleted sensors*".

3.6 Importing, exporting sensor information

Parts of the sensor database can be written to a Transport file by means of the menu item Exporting. This procedure will be referred to here as exporting. The Transport-file is written in XML format It can easily be copied and sent. The receiver is then able to import the file. This means that the sensors which the Transport-file contains are adopted into the database.

Export to an xml-file is like copying to the Clipboard and then saving the text in the Clipboard to a file with the extension ".xml". Importing from an xml-file is like saving this file to the Clipboard and then pasting it to imc SENSORS.

Exporting is accomplished using the menu item "*File / Export:..*" .

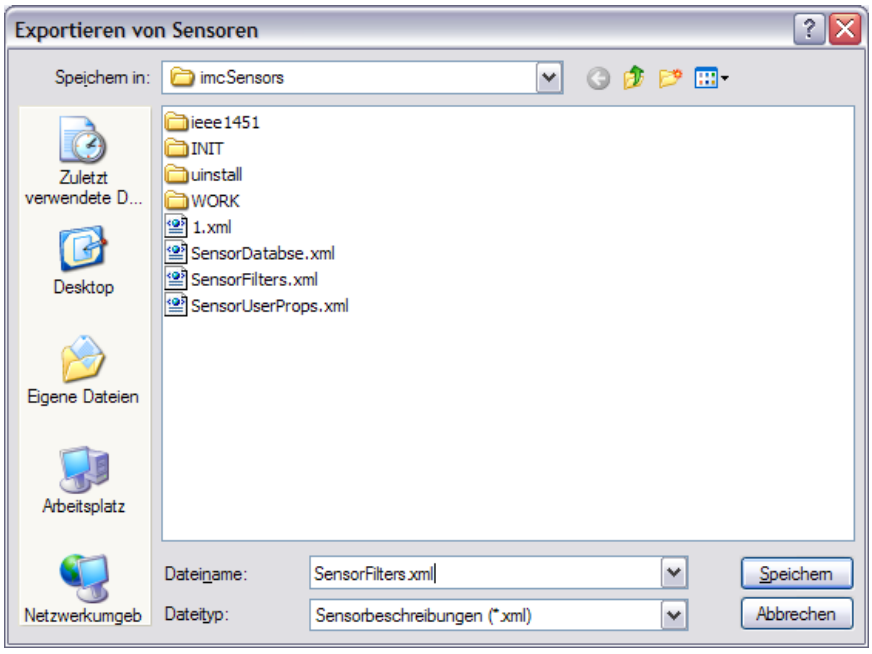


Next appears a prompt to select what to write to the Transport-file. You have the choice of either the sensors visible in the right section of the main window, or all selected sensors, or all sensors currently saved in the database.

Note

The history for sensors and deleted sensors is never exported.

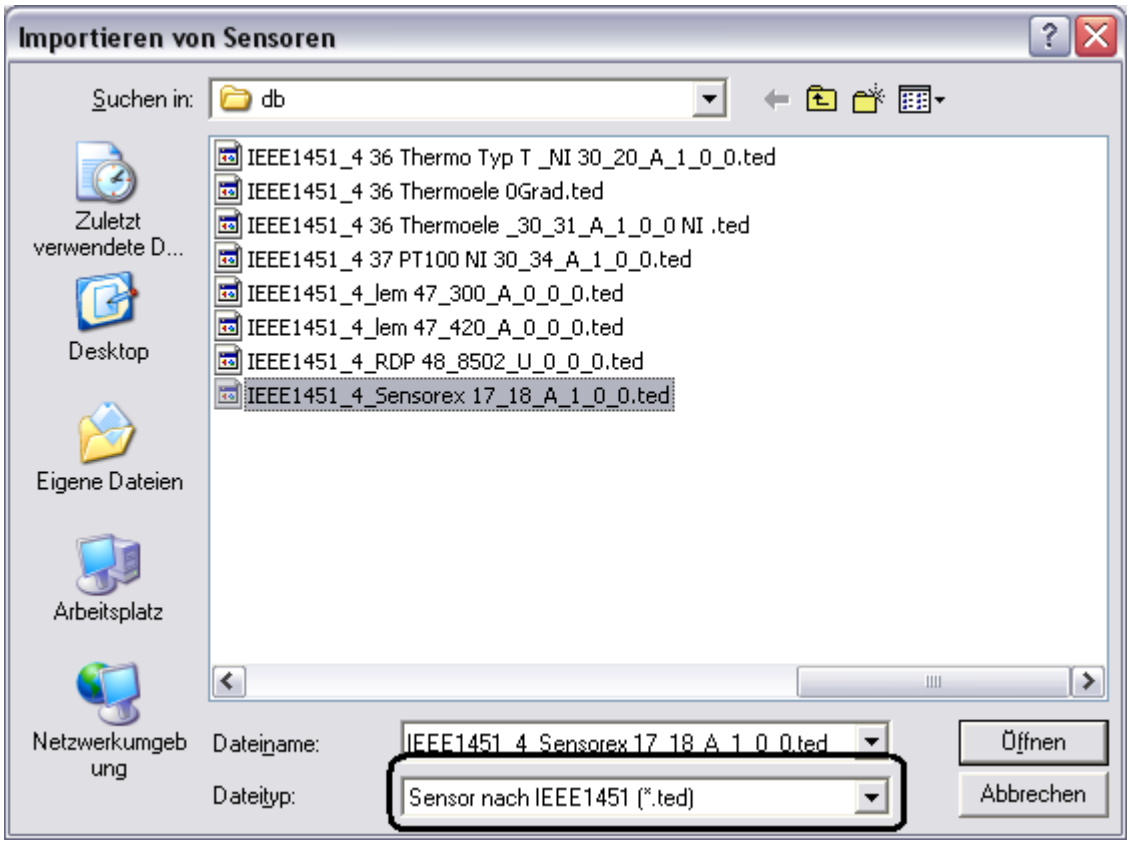
Next, the file is selected.



It can later be imported to a different location using the menu item "*File/ Import ...*". Note that the selected format here is "*Sensor descriptions (*.xml)*". For further info, see the chapter "*Operation*", Sections "*Copy* 32" and "*Paste* 32".

3.6.1 Import of virtual TEDS

Along with xml files, it's also possible to load virtual TEDS (*.TED) files. To do this, reset the file type accordingly :



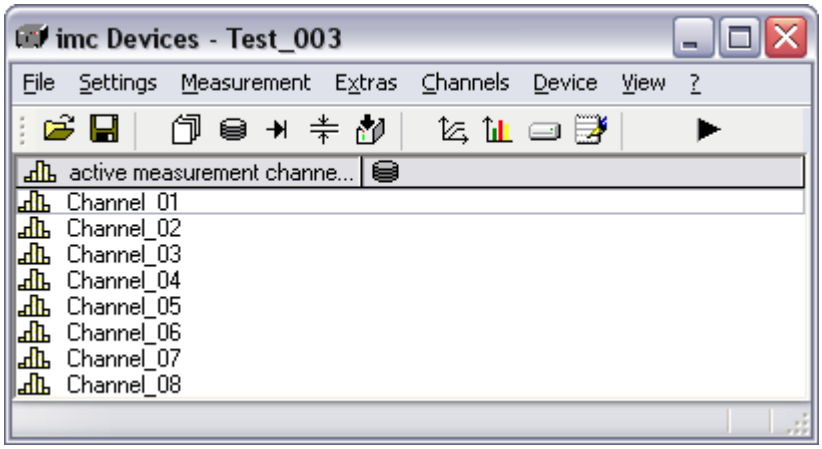
These *.TED files contain the description of a sensor according to IEEE 1451.4. Some sensor manufacturers offer downloads of these files for their sensors (as of 2004). The format is binary. A new sensor is added to the sensor database each time such a file is imported.

3.7 Connecting with imc Devices

Compatibilities:

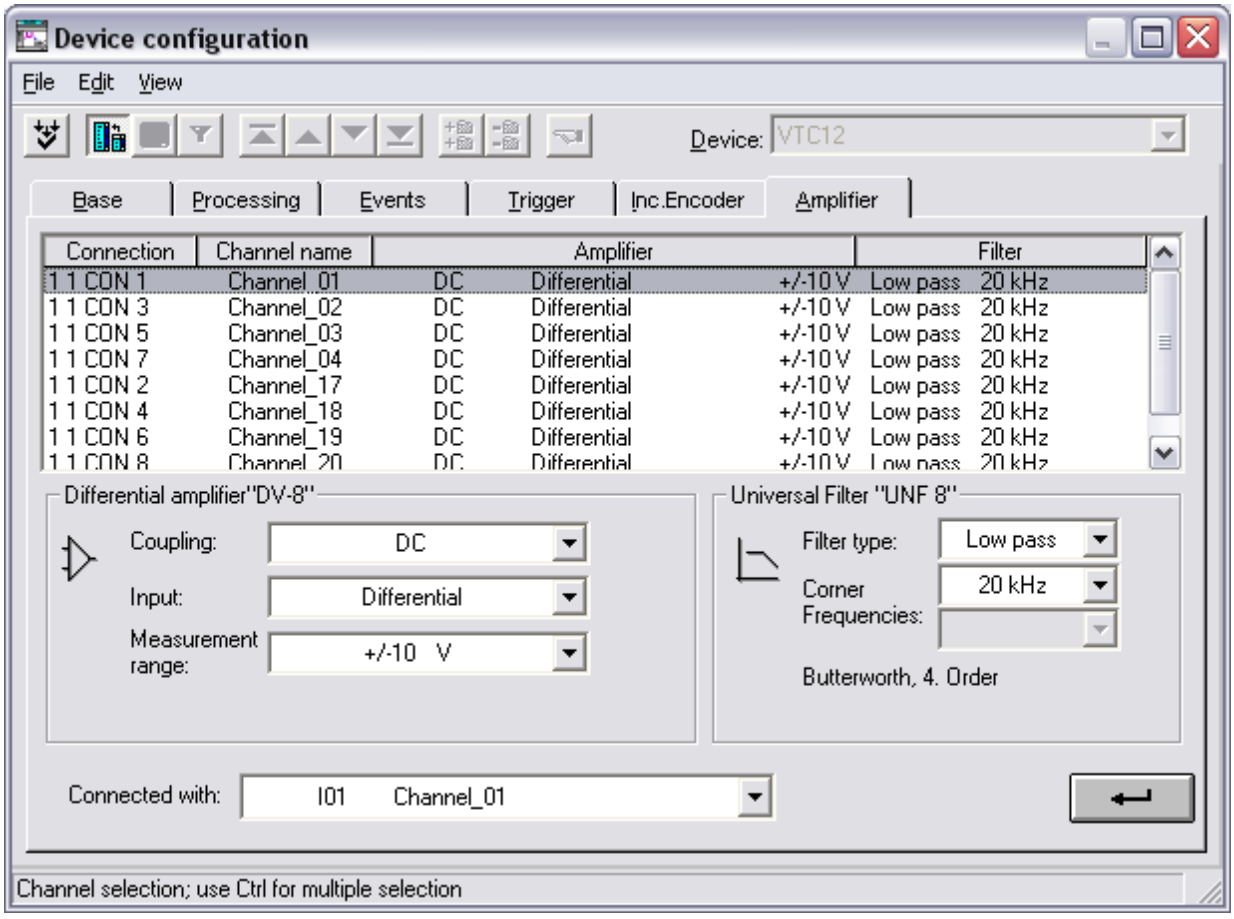
imc DEVICES	imc SENSORS
V 2.5	V 1.2 rev 11

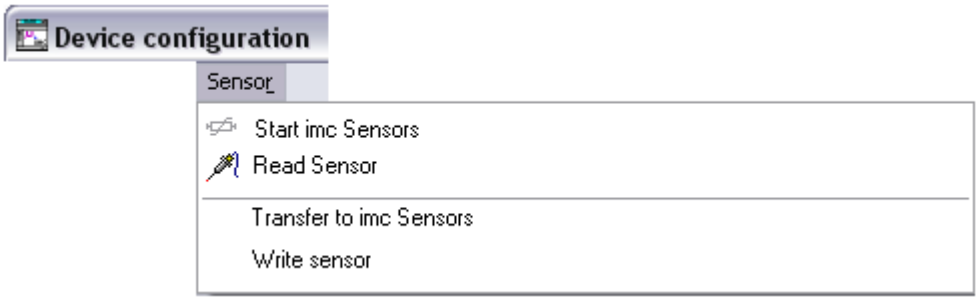
Please refer also to the detailed material in the imc DEVICES manual.



Interactions:

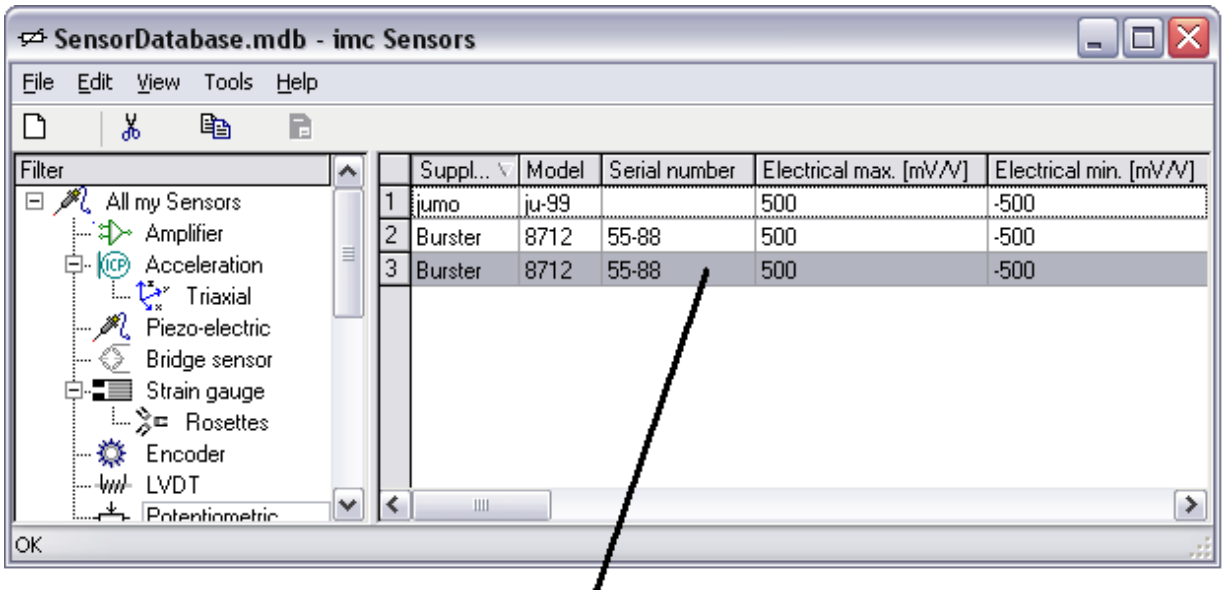
- Starting imc SENSORS from imc DEVICES: Menu "*Edit / Open imc SENSORS*..." in imc DEVICES.



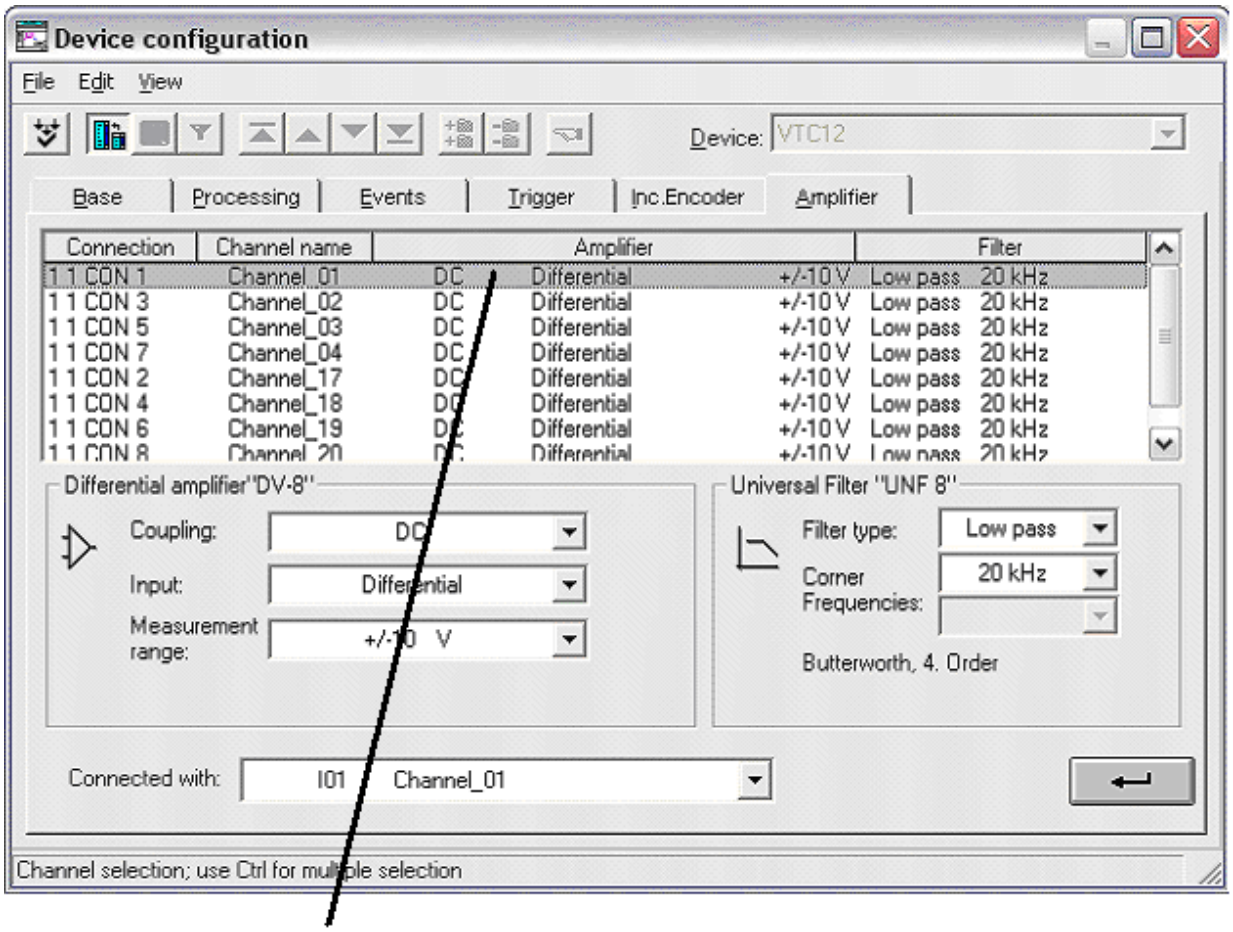


- Transferring sensor information from imc SENSORS to a channel in imc DEVICES, in order to adjust this channel. To do this, a sensor in imc SENSORS sensor list must be selected, and in imc DEVICES one or more channels are selected in the dialog *"Device configuration*". Then the item "*Sensor / Paste sensor from imc SENSORS*" in the imc DEVICES dialog "Device configuration" is selected.

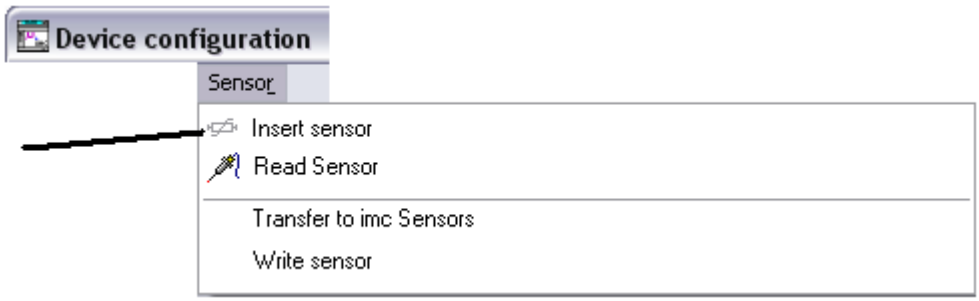
Selecting the sensors in imc SENSORS:



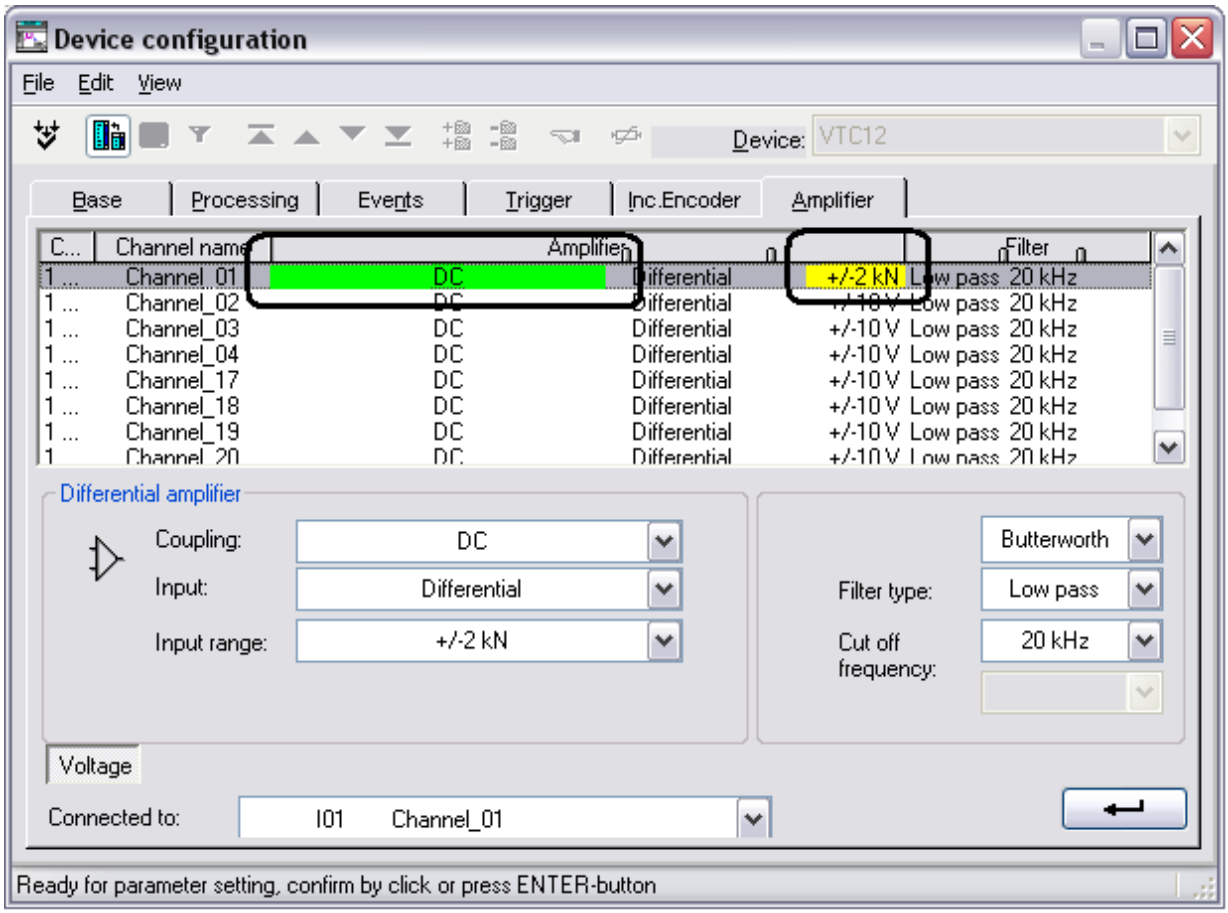
Selecting the channels in imc DEVICES:



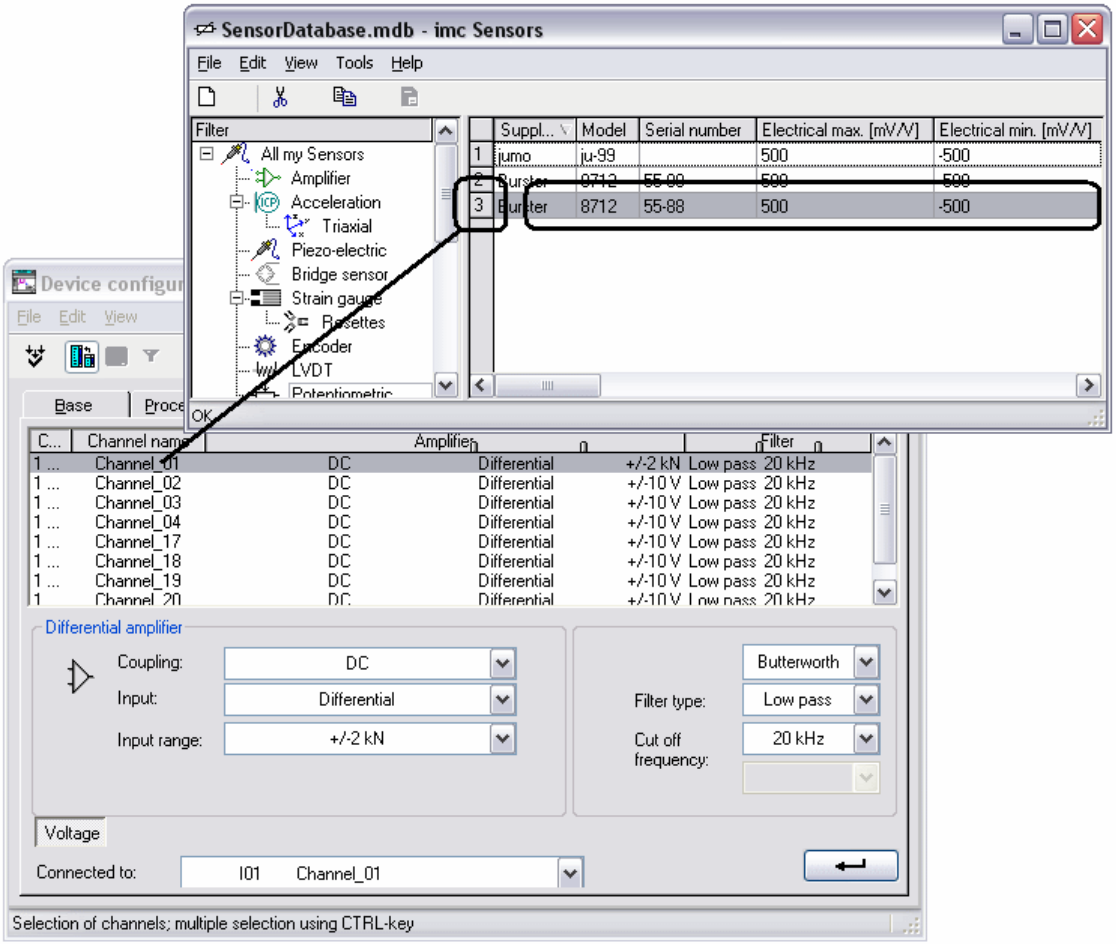
Menu item and execution:



The channel is parameterized in imc DEVICES:



- Transferring sensor information by means of Drag&Drop from imc SENSORS to a channel in the imc DEVICES Software dialog "*Device configuration*". To do this, first select the channel in imc SENSORS.



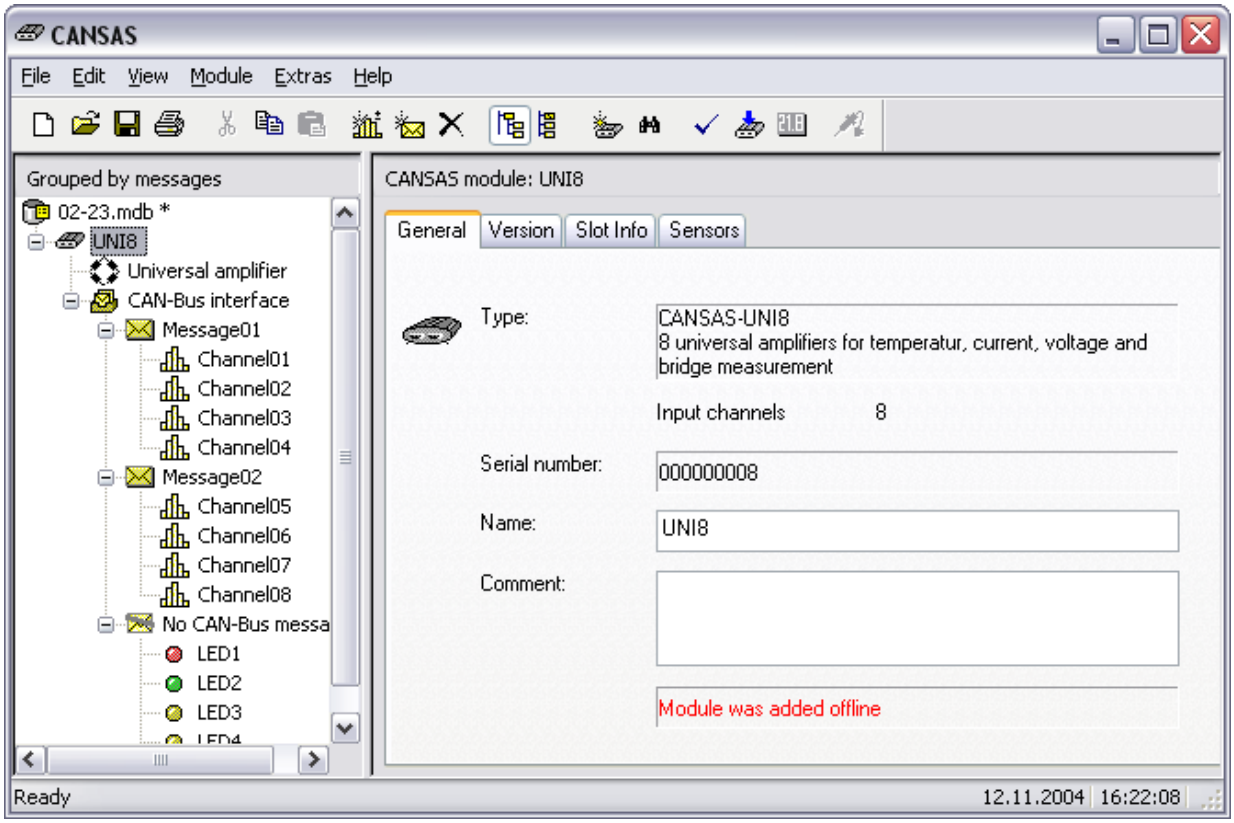
- Within imc SENSORS, the sensor information can be saved as an xml file. In the imc DEVICES software, this file can be opened and written to a sensor's Eprom. For more on this topic, see the imc DEVICES manual.

3.8 Connecting with CANSAS

Compatibilities:

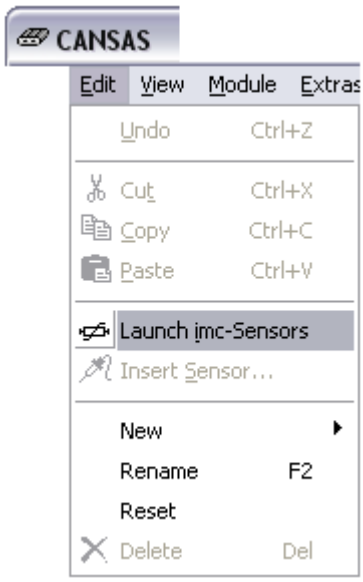
imc CANSAS	Imc sensors
V 1.3 rev 23	V 1.2 rev 11

Please refer also to the detailed material in the imc CANSAS manual.



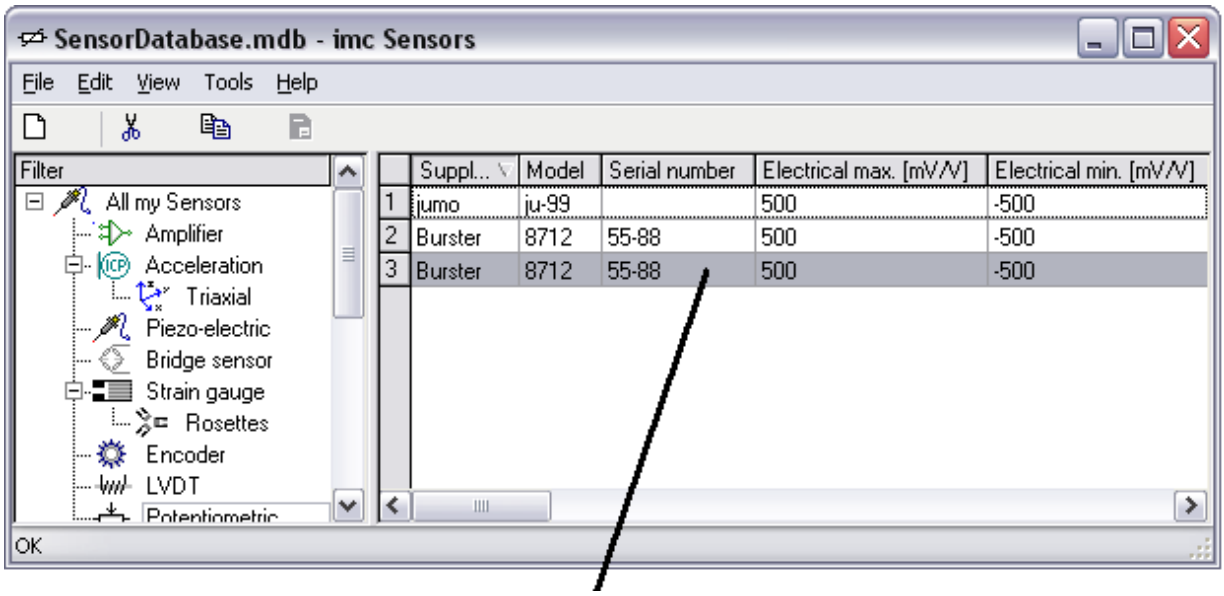
Interactions:

- Starting imc SENSORS from imc CANSAS: imc CANSAS menu item "*Edit / Start imc SENSORS*...".

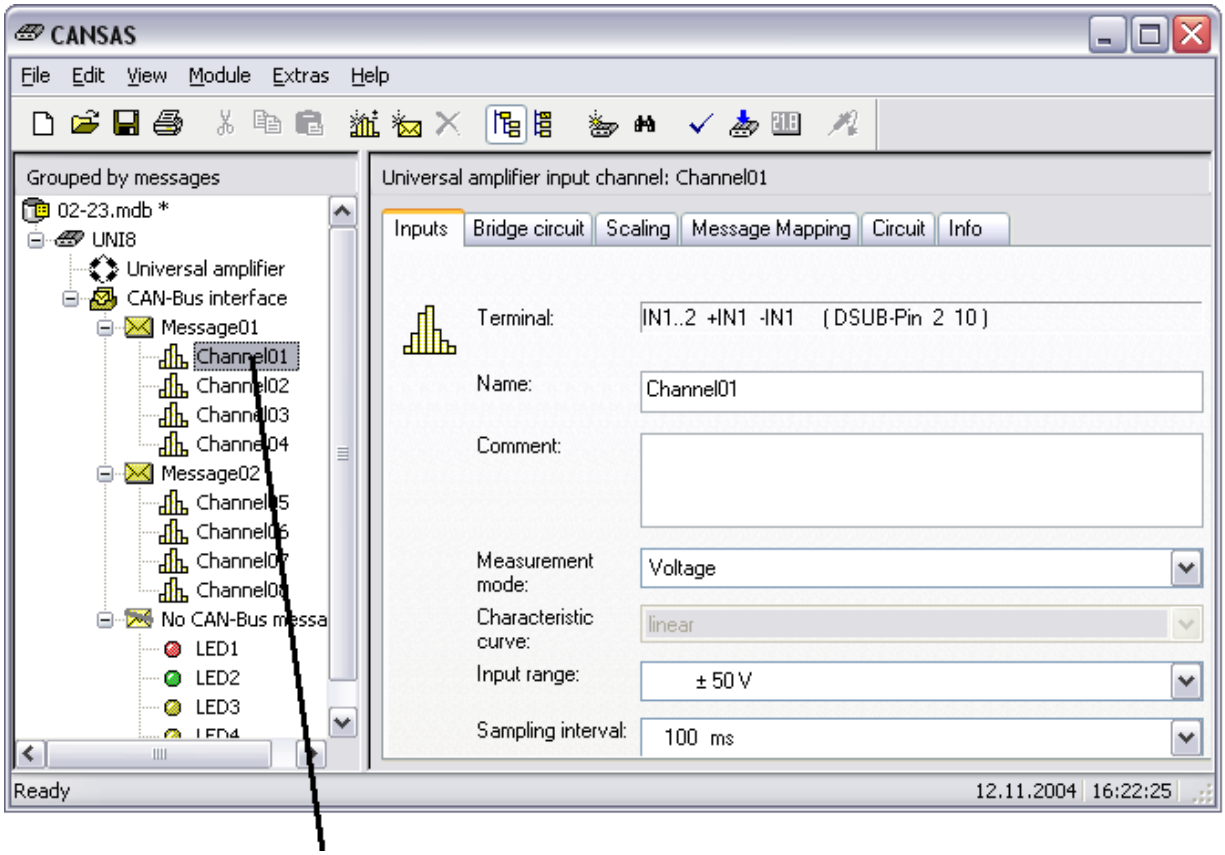


- Transferring sensor information from imc SENSORS to a channel in imc CANSAS, in order to set up the channel. To do this, a sensor must be selected in imc SENSORS' sensor list, and one or more channels selected in imc CANSAS. Then the imc CANSAS menu item "*Edit / Add sensor*" is selected.

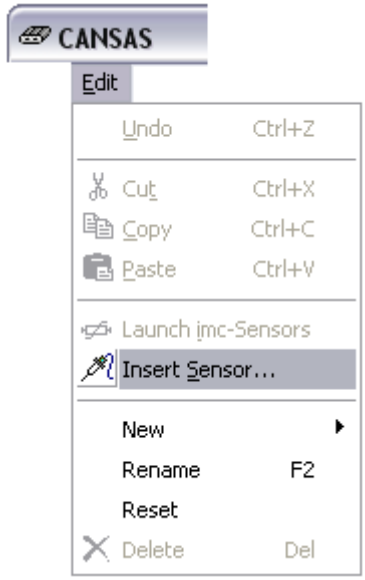
Selecting the sensor in imc SENSORS:



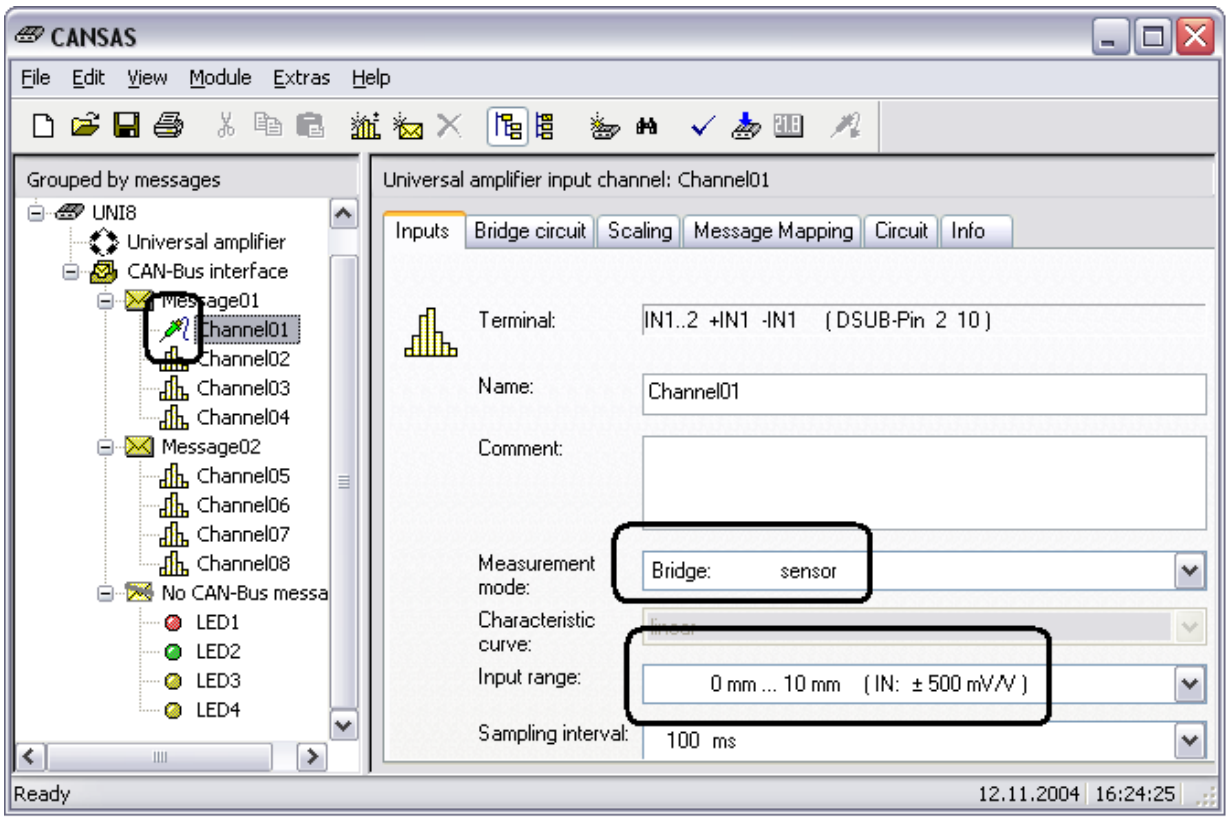
Selecting the channel in imc CANSAS:



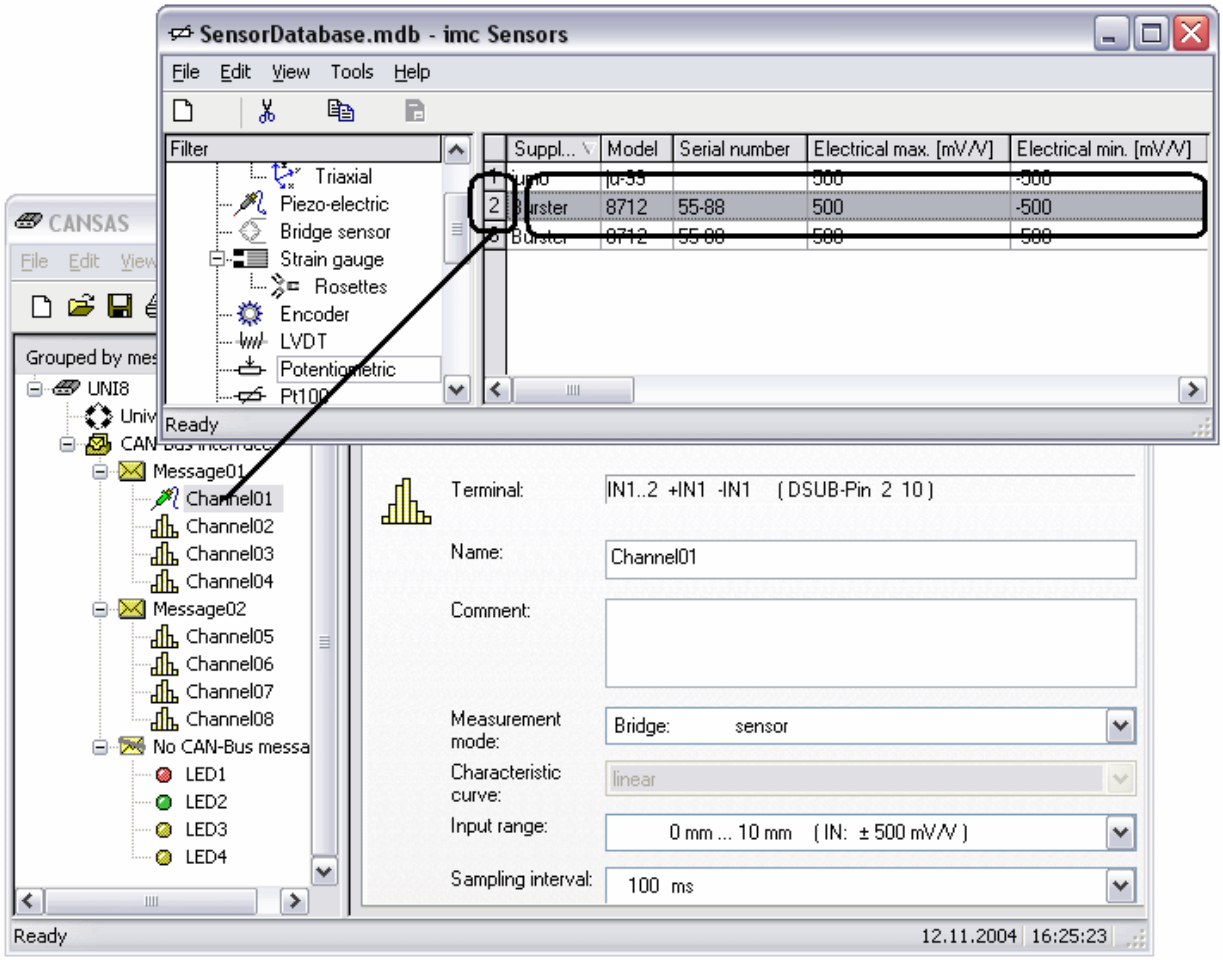
Menu item and execution:



The channel is parametrized in imc CANSAS:



- Transferring the imc SENSORS sensor information using Drag&Drop from a imc CANSAS channel. To do this, the channel is first selected in imc SENSORS.



- Within imc SENSORS, the sensor information can be saved as an xml file. In the imc CANSAS software, this file can be opened and written to a sensor's Eprom. For more on this topic, see the imc CANSAS manual.

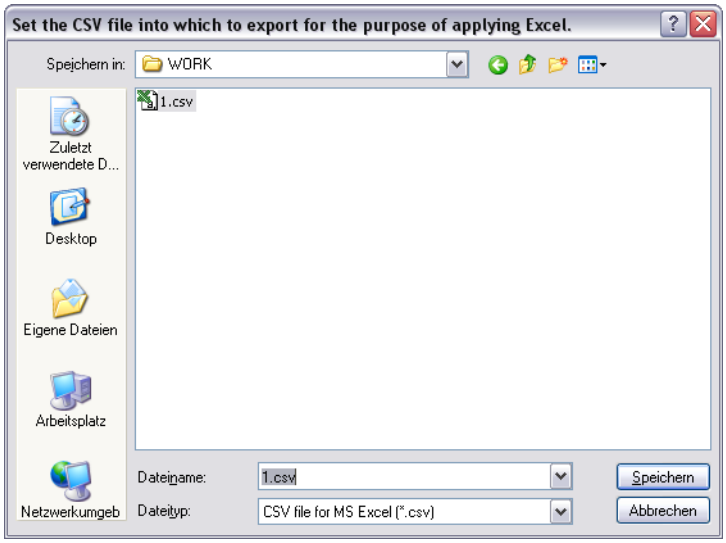
3.9 Reports

Reports are composed using MS Excel or other software able to read .CSV-files.

Reports always pertain to the table currently visible. Most table screens have a context menu containing a submenu "*Reports*". In the case of the main window with the sensor list, the item "*Reports*" is under the "*File*" menu.

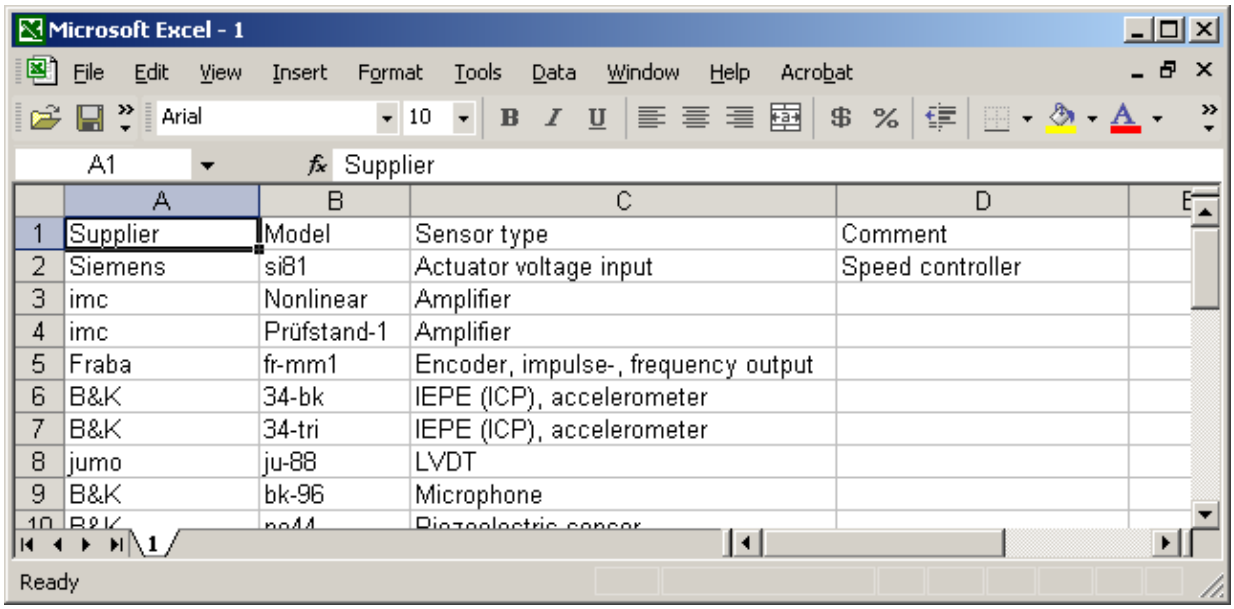
The "Reports" menu contains the following items:

- Copy: The contents of the table displayed are copied to the Windows Clipboard. For this purpose, an ASCII format is selected which contains the Tabulator character (ASCII 9) for separating the columns, and the combination Carriage Return + LineFeed (ASCII 13, ASCII 10) for denoting the end of a row. You can then use other tools, for instance MS Excel, to paste the table from the Clipboard.
- File for Excel: A CSV-file is created. You can specify the filename. Select a file which isn't itself already open in Excel. The separator character used in the CSV-file as the column separator is set according to your computer's country or regional settings.



Next, MS Excel is started and loaded into this file. But this only works if Excel is installed and Registered for opening CSV-files. Otherwise, the software which you have installed and registered is used.

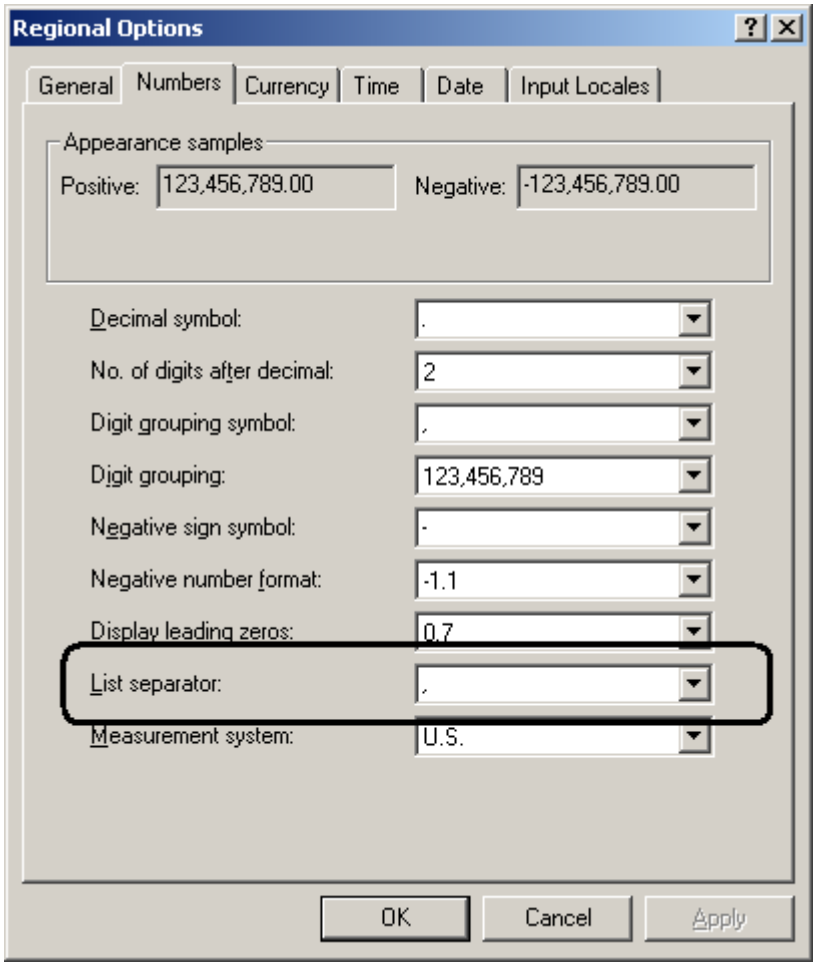
The data should then be well displayed in Excel:



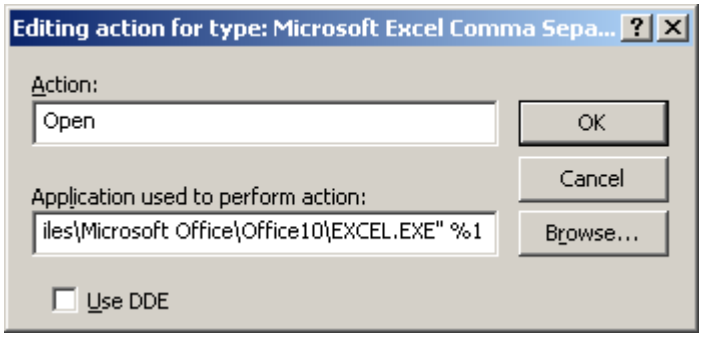
	A	B	C	D
1	Supplier	Model	Sensor type	Comment
2	Siemens	si81	Actuator voltage input	Speed controller
3	imc	Nonlinear	Amplifier	
4	imc	Prüfstand-1	Amplifier	
5	Fraba	fr-mm1	Encoder, impulse-, frequency output	
6	B&K	34-bk	IEPE (ICP), accelerometer	
7	B&K	34-tri	IEPE (ICP), accelerometer	
8	jumo	ju-88	LVDT	
9	B&K	bk-96	Microphone	

Older Excel versions (mainly from before 2003) sometimes have a problem displaying CSV-files correctly upon an automatic start:

It can be helpful to adapt the Windows list separator character (Windows Control Panel/ Regional options/ Numbers) (e.g. to a comma for German Excel 2000). Upon being started, imc SENSORS reads the Windows list separator in and later uses it to write CSV files. The list separator is typically a comma or semicolon. If direct transfer to Excel causes problems, it often helps to copy to the Clipboard (see above).



Alternatively, it can be helpful to make the following selection for the folder options for file types with the CSV ending (de-select DDE):



3.10 Starting and ending the program

Start

Upon starting, the database last open is re-opened. You are prompted to enter the password unless you selected the option to skip this step.

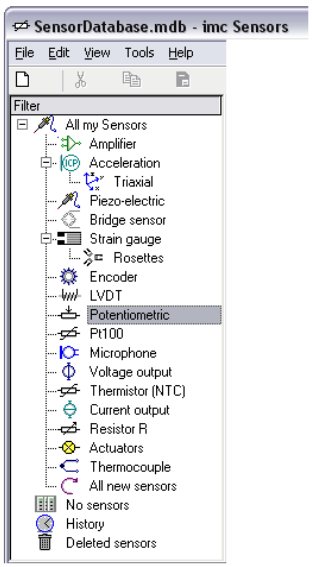
End

When the application is exited, the file SensorFilters.XML is updated and your backup SensorFilters.XML.bak1 or its backup file SensorFilters.XML.bak2 is updated.

These files contain the filter's settings.

3.11 Setting up filters and views

The currently valid filter selection is shown on the left side of the main window. The right side of the sensor list displays the sensors which the respective filter allows.

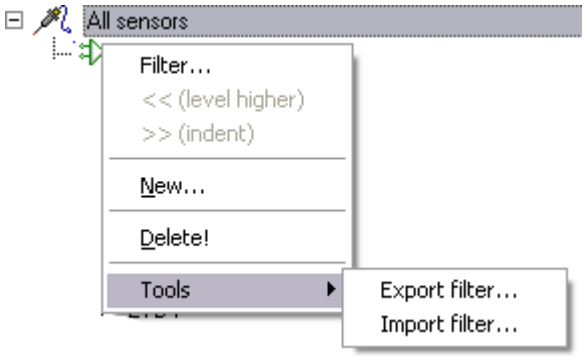


The database always encompasses all sensors. A filter can be considered like a special view mode: only a narrowed-down selection of sensors is displayed: E.g. "*All potentiometric sensors*".

Settings for the filters can be made, and the filters ordered in groups.

There are a few special filters such as "*History*", "*Deleted sensors*" and "*Search results*". See the corresponding chapter further below.

3.11.1 Filter context menu



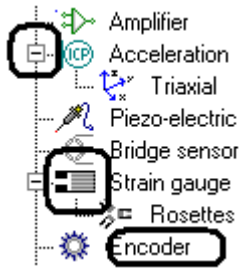
The context menu is called by right-clicking the mouse above the selected filter. It contains the following functions:

- "*Filter*...": See section "Editing filters" below.
- *<< (Level higher):* In the tree view, the filter is shifted left by one position to the left. It thus rises in the hierarchy by one level.
- *>> (Indent):* The filter is shifted left by one position to the right. It thus becomes a subordinate filter to the one above it, for example.
- *New*...: A new filter is created at the location selected.
- *"Delete!":* The selected filter is deleted. Note: Only the filter is deleted, not the sensors displayed. In normal cases, only the selected filter is deleted. However, if the filter selected includes subordinate filters, the user is prompted to decide whether these subordinate filters are also to be deleted. Subordinate filter are any filters appearing below the selected filter and which are indented at least one position further right than the selected filter.

- *Export Filter…:* The filter settings are written to a file. The filter settings include operation of the filter, its name, but also the arrangement and selection of columns displayed on the right side. The filename is queried by means of a dialog. In normal cases, only the selected filter's settings are written to the file. However, if the selected filter contains subordinate filters, the user is prompted to decide whether these subordinate filters are also to be saved to the same file. Subordinate filters are any filters appearing below the selected filter and which are indented at least one position further right than the selected filter. In this way, an entire "branch" of the filter tree diagram can easily be saved at one go.
- *Import Filter…:* A file previously written by means of Export Filter Settings is loaded. All filters in the file are added. If system-filters such as History, Search and "Deleted sensors" were loaded, the system ensures that they occur no more than once. The new filters are inserted before the filter currently selected. The hierarchy is adjusted so that the first filter inserted appears with the same indenting to the right as the one currently selected.

The main window's "*Edit*" menu contains the context menu's items, if the left side of the main window (Filters) was last active.

3.11.2 Editing the filter list with the mouse:



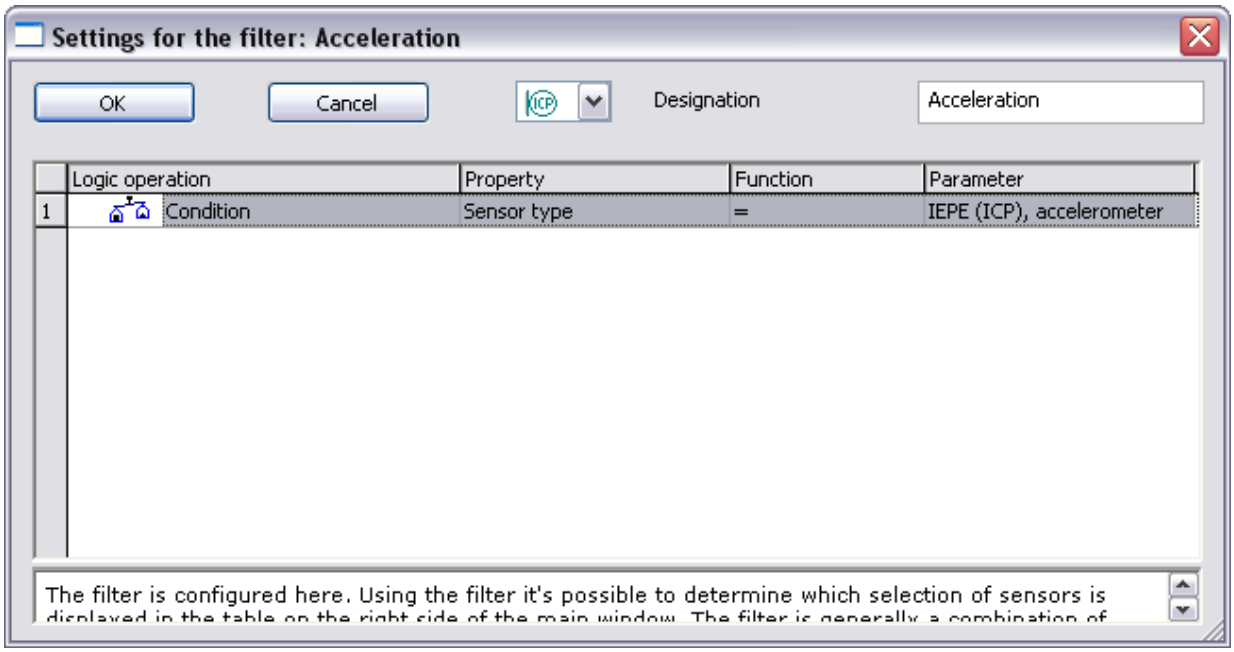
The following actions are possible with the mouse:

- **Clicking on a name already selected:** The name can be edited as a text. During the text editing, the Windows context menu for editing text boxes is in operation.
- **Double-clicking on a filter**: The dialog for setting the filter appears.
- **Clicking on '-' and '+'**: Collapsing and expanding of the subordinate filters.
- **Drag and Drop**: A selected filter can be shifted to another position.

Please not that editing filters is not the same thing as editing sensors. It only means editing various views of the many sensors in the database.

3.11.3 Editing filters:

Via the context menu "*Filters*...", the filter selected can be adjusted. Double-clicking on the selected filters leads to the same result. The following dialog appears:

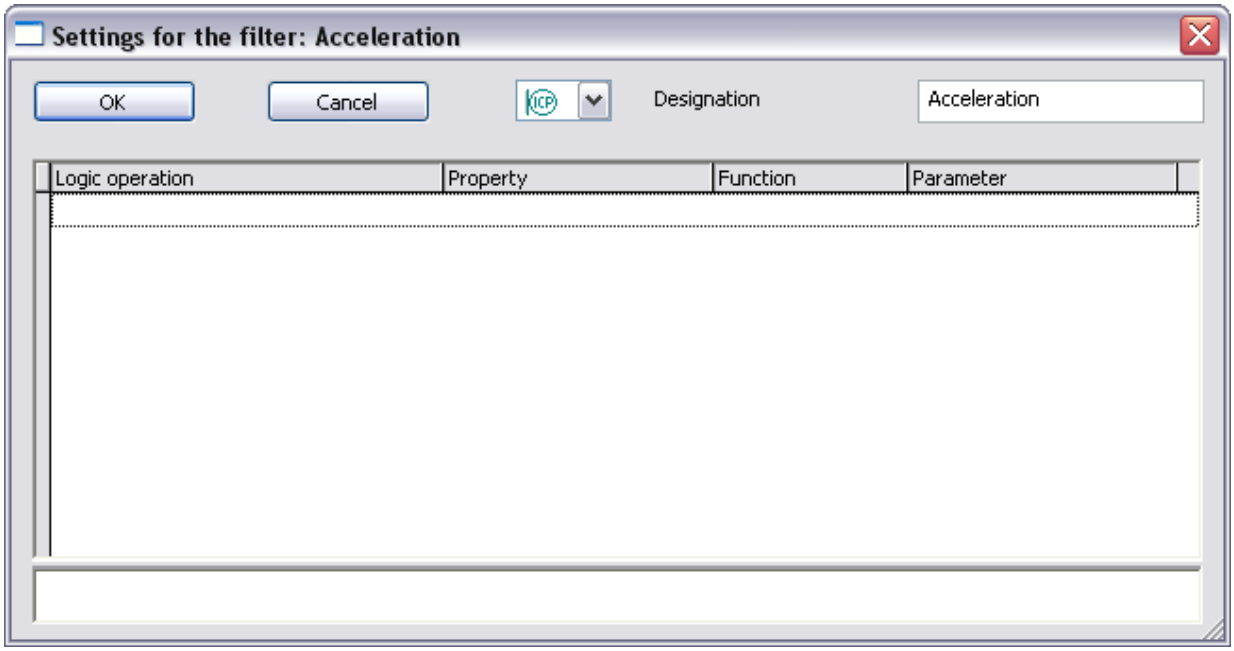


At the top of the dialog, the icon and a text for the filter can be set.

The large table contains the filter condition or a combination of filter conditions.

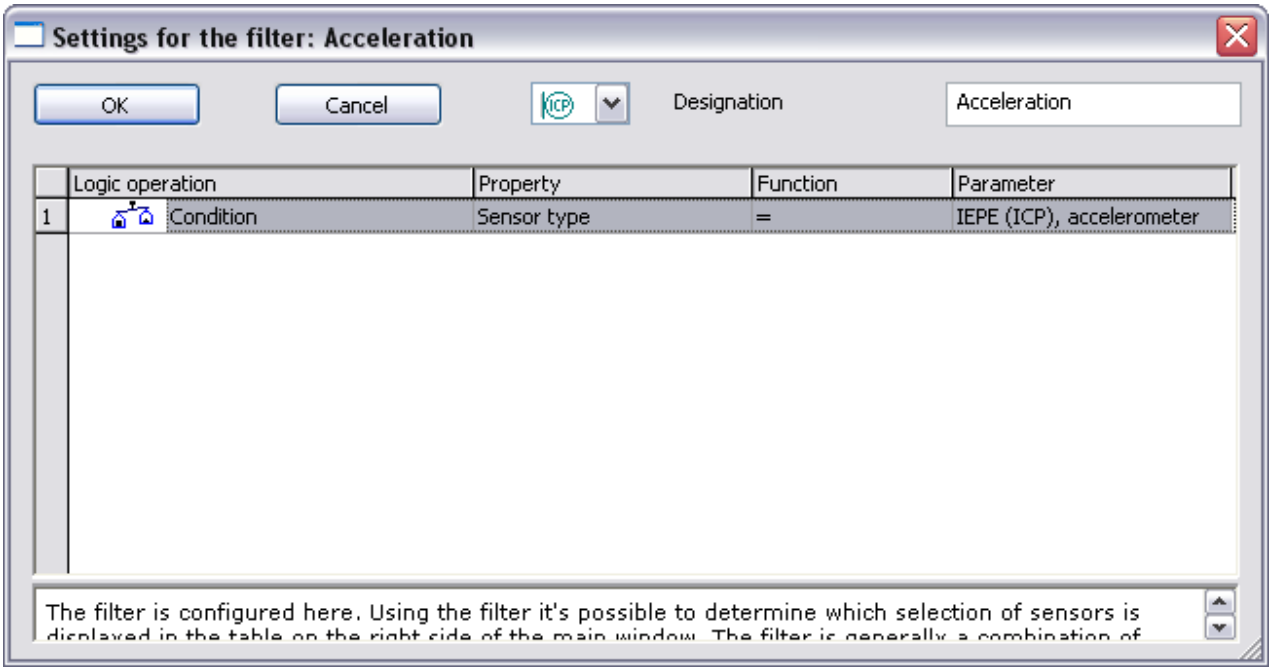
The simplest filter:

- Empty filter. All rows in the list of filter conditions are deleted. This filter displays all sensors in the database.



Typical filters:

- Filters which display a particular sensor type:

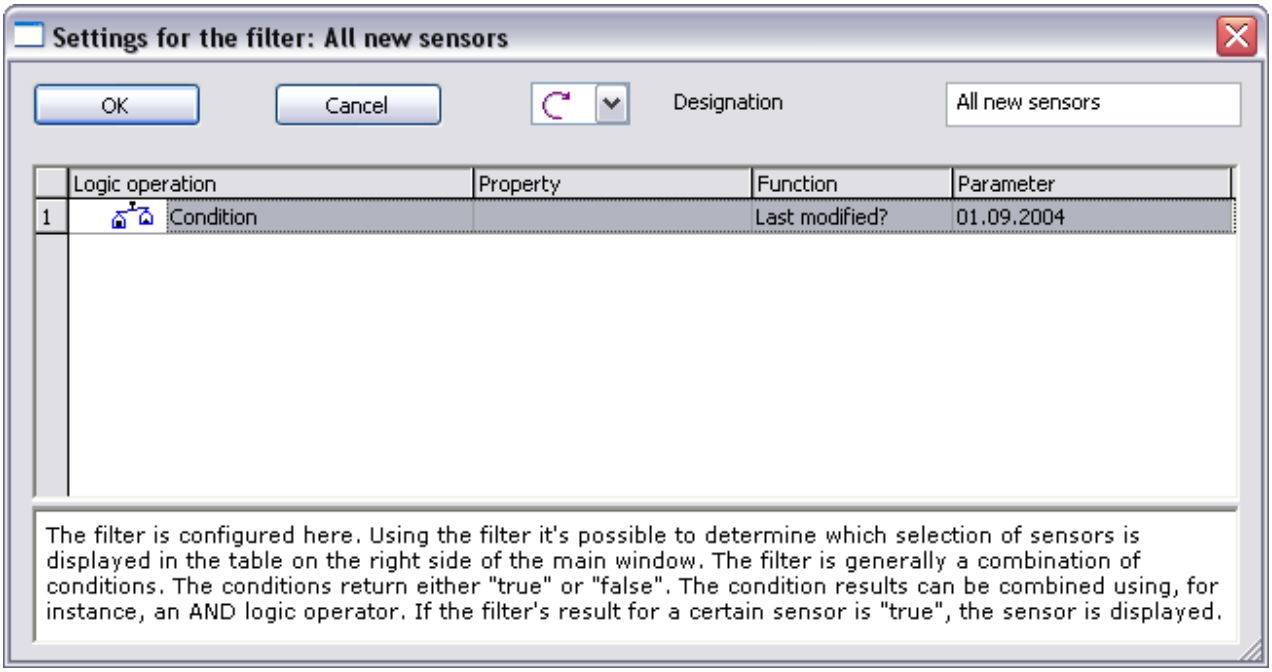


This is a filter with only a single condition:

"*Sensor type" equals "ICP, accelerometers*".

Each sensor has a property entitled "Sensor type". The filter is supposed to provide a list of all ICP-sensors. In other words, it is to list all sensors for which the property "Sensor type" takes a particular value, namely "ICP, accelerometers".

Filter for newly added sensors:

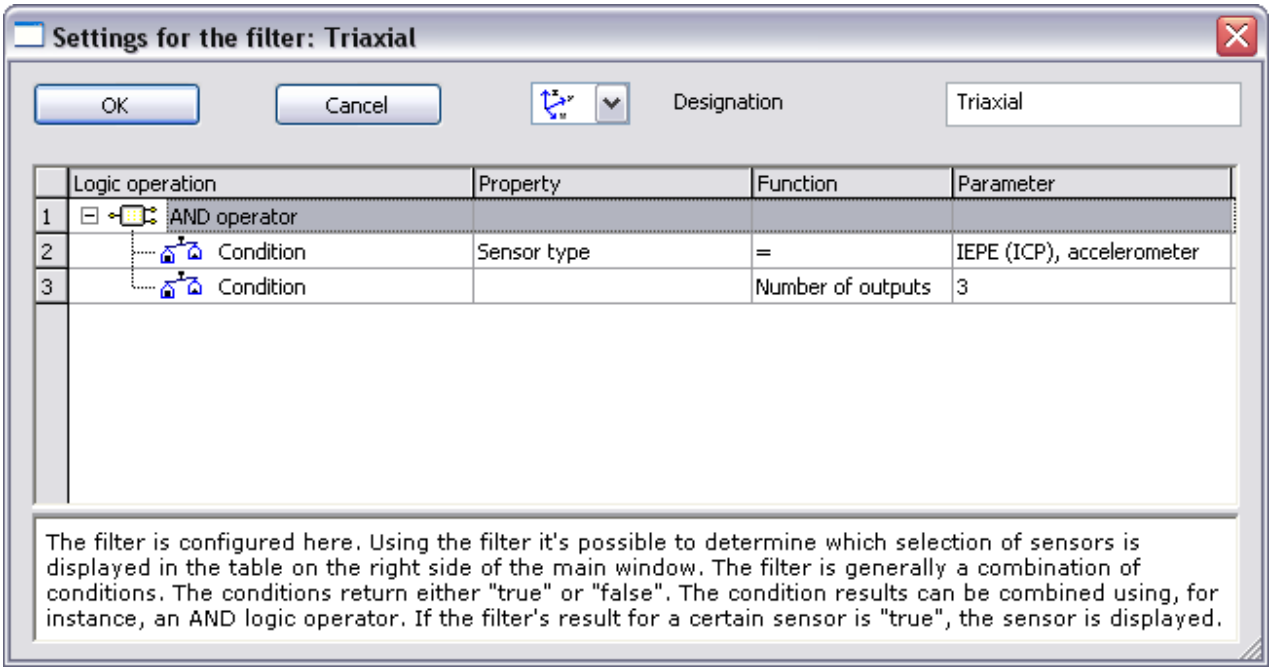


The filter has only a single condition:

Was the sensor "*last modified" on "01.09.2004*" ?

So here, each sensor is checked for its last modification date. If the date is more recent, the sensor appears in the corresponding view; otherwise not.

Example of a compound filter:



The filter is the logical conjunction of two conditions. The filter displays the sensor only if both conditions are fulfilled.

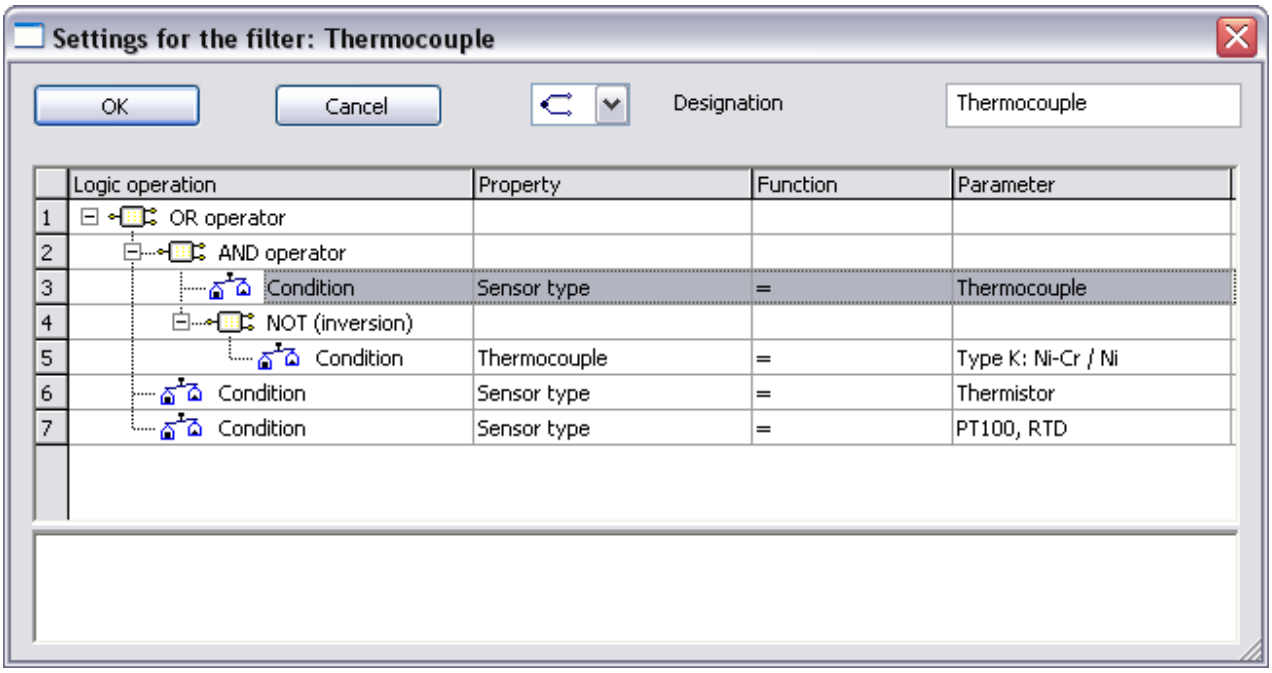
The filter serves to select triaxial accelerometers based on the ICP principle, and is structured as follows:

AND-conjunction

1. Condition: "Sensor type" equals "ICP, accelerometer"
2. Condition: "Number of sensor outputs" equals 3

3.11.4 Compound logical expressions (AND, OR)

Example of a multi-stage conjunction:



In this filter, temperature sensors are to be listed, but no thermocouples of "*Type K*".

The OR-disjunction links three conditions: the thermistors, the PT100 sensors and the AND-conjunction.

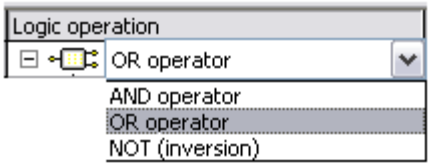
The indentation of the diagram entry indicates which conditions are combined in the con-/disjunction: the elements directly beneath in the hierarchy are joined in the logical expression.

The AND operator links the thermocouples to the condition "*NOT Type K*".

The following compound logical expressions are available:

- AND: All constituent conditions must be met for the AND-conjunction to be fulfilled. Two or more conditions are allowed.
- OR: At least one of the constituent conditions must be met for the OR-disjunction to be fulfilled. Two or more conditions are allowed.
- NOT: Exactly on condition is specified. The truth value of the condition statement must be negative.

Editing compound conditions: A click on the previously selected row at the location of the compound logical expression:



3.11.5 Conditions

The filter can consist of a single condition. Or it can be a combination of conditions. All conditions linked together are on the same hierarchy level, so that they are listed with the same amount of indentation.

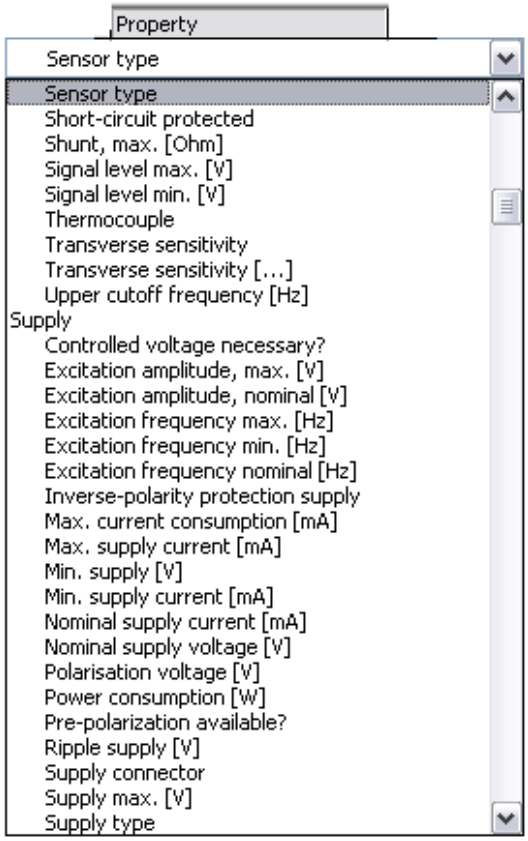
A condition can take two forms:

- Property / Function / Value: E.g. "Sensor type" = Thermocouple.

- Function / Value: E.g. "Last modified" date.

A property can be involved with a condition or not, depending on the function. From this it follows that what functions are available depends on the property selected.

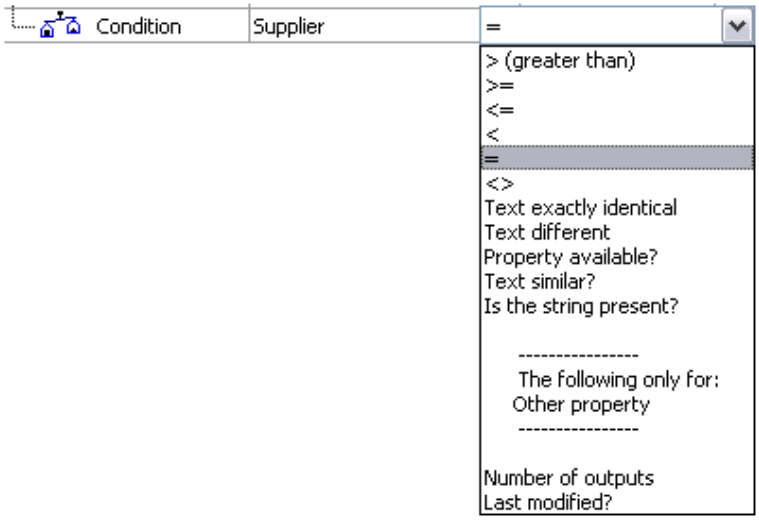
List of properties:



This list contains all possible sensor properties, ordered by groups.

You can first select a property which you intend to use for constructing a condition. If a function not suitable for the newly selected property was already selected, then simply proceed next to select a better function.

List of the functions:



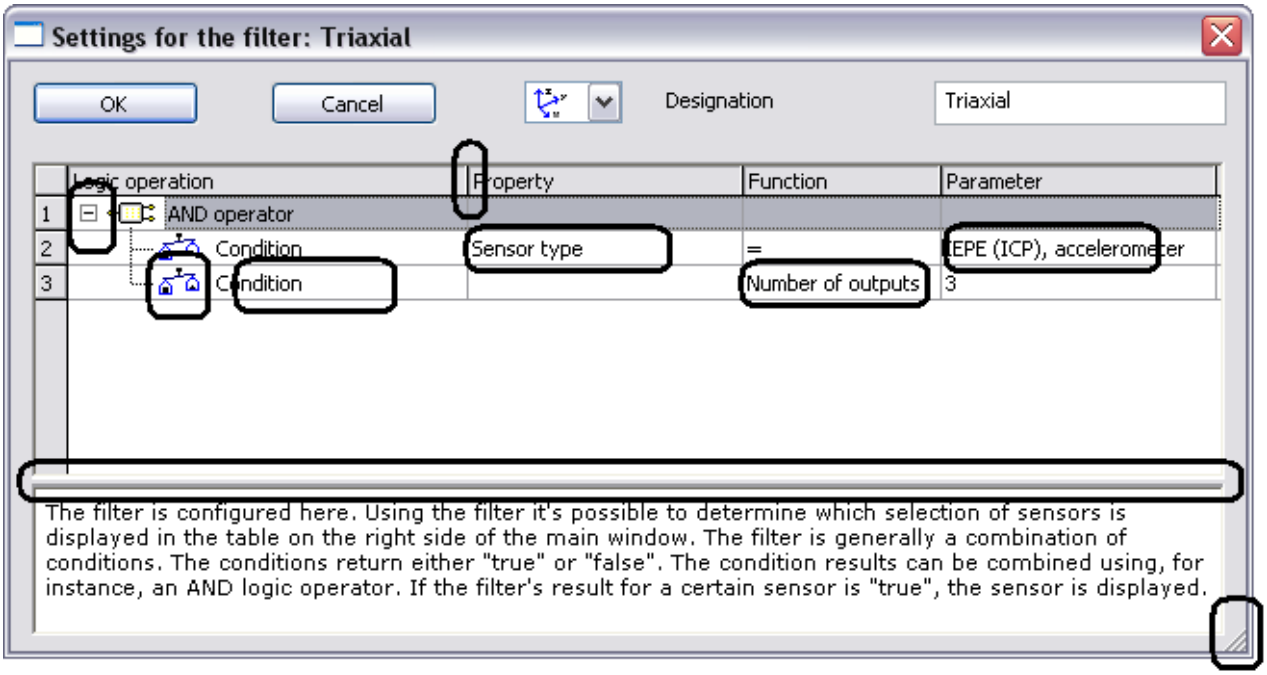
In the upper list portion, the functions which are available for use with the selected property are listed. However it is possible to select even such functions which are at the bottom of the list; but as a result, the previously selected property may disappear.

The following functions are possible:

- *>: Greater than:* Example: "k-factor" > "2.0". sensors whose k-factor is greater than 2.0. With texts, "Greater than" refers to further down in the alphabetic order. Upper-/ lower case spelling makes no difference. Thus, the conditions "Manufacturer > IMC" and "Manufacturer > imc" are both fulfilled by sensors whose manufacturer is "Kistler". With the data type date, "greater than" means "later" or "newer". To the right of the function, the comparison value must be stated in the corresponding format.
- *>= (Greater than or equal to):* See example above.
- *<= (Less than or equal to):* See example above.
- *< (Less than):* See example above.
- *= (Equal):* See example above.
- *<> (Unequal):* See example above.
- *Text exactly identical:* Only for text. Does the specified text match the text in the selected sensor property exactly? Each character in both texts must be identical. The comparison text must be specified to the right of the function.
- *Text different:* See the example above.
- *Property available?* Is the selected property available to the sensor? There is no check of what value the property takes. For instance, if a sensor has the property "Coupling", then it doesn't matter whether the coupling is set to "DC", "AC" or even is empty or undefined (<???>). But that property is administered for this sensor. With this function, no value is entered on the right side.
- *Text similar:* Only for text. Is the comparison text specified at right similar to the text searched for? E.g. "Endevco" and the misspelling "Enedvco" are similar. Differences in the position of spaces, separators, switched letters and missing characters are all allowed. However, in all cases there must be more characters which match than ones that differ.
- *Is the string present:* Only for text. Checks whether the specified comparison text is present. For instance, the search text "dit" for a sensor's manufacturer's name is contained in "Manufacturer = Add**dit**ive".

- *Number of outputs:* The system checks whether the sensor has exactly the specified number of outputs. A number from 1 to 3 is allowed. Thus, a normal sensor has only one output. A triaxial accelerometer has 3 outputs. This function operates without having any property specified.
- *Last modified:* The date on which the sensor was last modified is checked. If a sensor has the same or a newer date for its last modification, the condition is met. This function operates without having any property specified.

3.11.6 Editing by mouse in the dialog



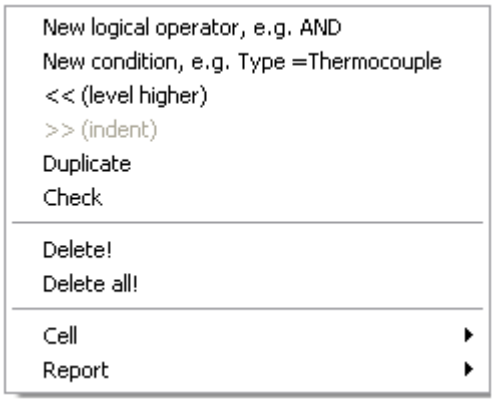
The following operational techniques are possible:

- Changing the column width
- Changing the dialog size
- Changing the help window's height
- "Drag And Drop" of conditions and compound logical expressions for re-ordering the individual rows
- Clicking on elements of already selected rows in order to edit a cell (Caution: don't double-click. Like renaming a file in the Windows Explorer).
- Right mouse-click over the table: context men, see below.

The settings for the columns and the dialog dimensions are saved.

3.11.7 Context menu for the list of conditions:

The following context menu appears after right-clicking in the list of conditions:

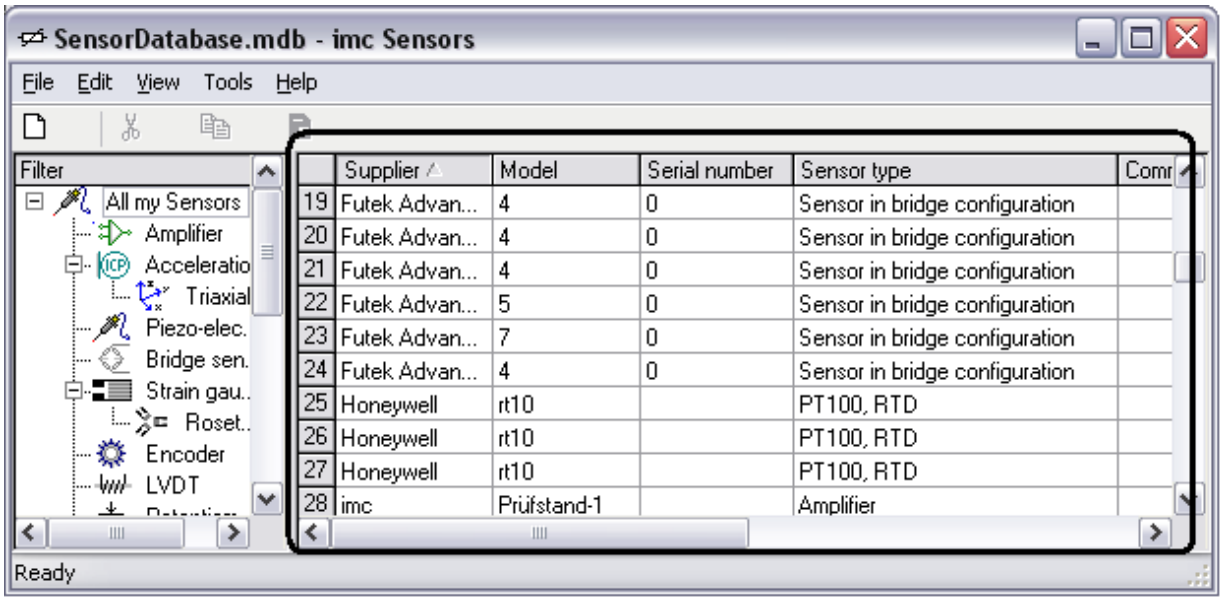


The specific functions are the following:

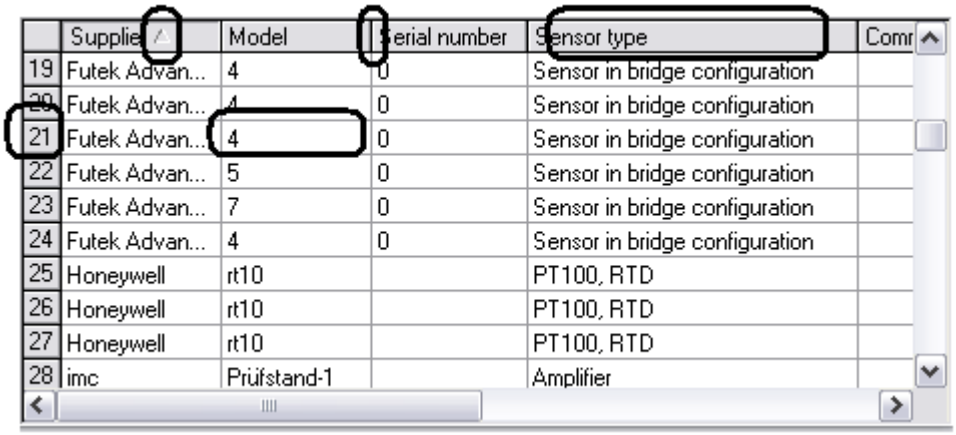
- *New logical operator*: A new line with an operator, e.g. AND or OR is added.
- *New condition*: A new line is inserted with a condition, e.g. "*Sensor type = Thermocouple"*
- *<< (level higher):* The line is shifted one space further left in the hierarchy.
- *>> (indent):* The line is shifted one space further right in the hierarchy.
- *Duplicate:* The selected line is duplicated.
- *Check*: All conditions and logic operations are checked, as well as the hierarchy.
- *Delete!*: Deletes the selected line.
- *Delete all!*: All visible operators and conditions in the list are deleted.
- *Cell/* edit: Affects the cell in the selected row which was below the mouse pointer when the context menu was called. See also the section on mouse operation.
- *Report*: Refer to the section "Reports 43".

3.12 View: Sensor list

In accordance with the operating filter, the software administers the settings in the sensor list. This means the administration of the columns displayed. Each filter is associated with a suitable selection of columns. The columns can be arranged and their widths adapted.

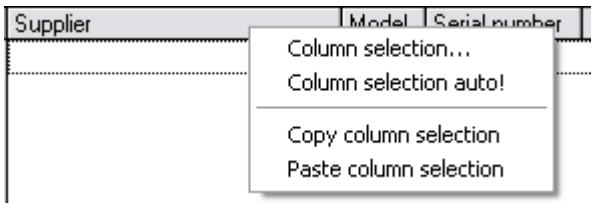


In the sensor list, the following mouse operations are possible:



- Clicking on a row not yet selected: The row becomes selected.
- Multi-selection: With the Shift-key held down, it's possible to select multiple sensors appearing in direct succession in the list. With the Ctrl-key held down, it's possible to select multiple sensors appearing in arbitrary locations throughout the list.
- Drag&Drop: A selected row can be transferred to a channel in imc CANSAS or imc DEVICES/STUDIO by means of the Drag&Drop technique. See the sections "Connecting with imc CANSAS 39" and "Connecting to imc DEVICES 34".
- Drag&Drop can also be used from the row header.
- Clicking on a cell in an already selected row enables the cell to be edited. See the section "Editing sensors" and "Editing cells 16".
- Dragging the edges between column headers in order to change the column width.
- Dragging a column header in order for re-ordering purposes: Drag&Drop to reposition the column head left or right, in front of or behind another column head.

- Clicking on a column header in order to sort the column data. Clicking again changes the sorting order.
- Right-clicking in the table calls a context menu for editing sensors, see the section "Editing complete sensor 22".
- Right-clicking on any column header calls a context menu for selecting columns:

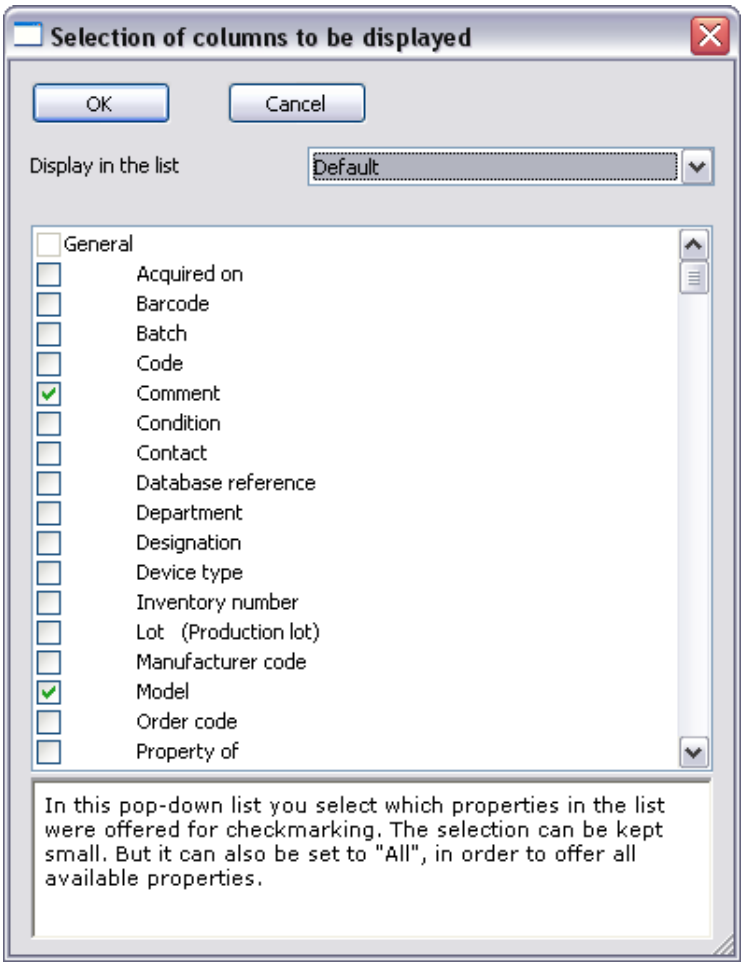


This context menu contains the following functions:

- *Column selection*...: A dialog for selecting columns appears, see below.
- *Column selection auto!*: Column selection is automatic. Here, the properties of all sensors displayed in the sensor list are checked. All properties present are displayed. If there are too many for you, you can later use the menu item "Column selection..." to get rid of all checkmarked columns.
- *Copy column selection*: The selection and arrangement of the table columns is copied to the Windows Clipboard. Later, the Clipboard content can be used with a different filter.
- *Paste column selection*: A selection and arrangement of table columns previously copied to the Clipboard is imported and applied to this table. By this means, the table for this filter is set in the same way as reflected in the Clipboard contents. The current filter then has the same table arrangement as the filter whose arrangement was previously moved to the Clipboard.

3.12.1 Column selection dialog

The item "*Column selection*" in the context menu of the sensor list's column headers calls a dialog for selecting the columns which are displayed.



Simply checkmark the desired properties. To select or de-select an entire group, the group's checkbox can be used.

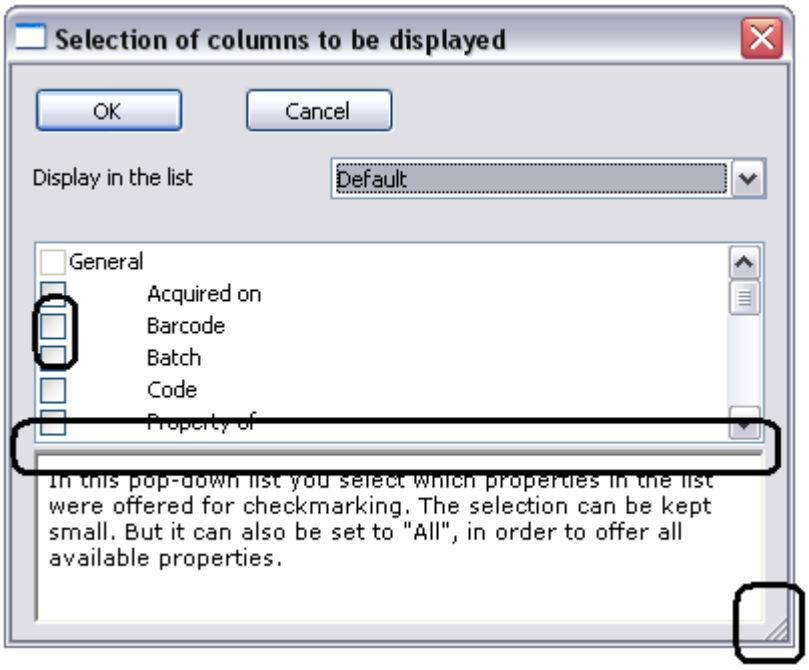
Note that clicking anywhere above a line only selects that line. You can then see at the window bottom the help text for the corresponding property. You must click on the checkbox to put a mark in it.

The pop-down list "*Display in the list*" offers the following options:

- *Automatic*: Recommended. Generally for use with custom properties, properties of extra (second and third) outputs; only if needed.
- *Default*: Displays the properties only of the first output, not user-specific properties.
- *Also user-specific*: Display of the first output's properties, but also of user-specific ones.
- *Also multiple outputs*: Displays properties of all three outputs, not user-specific properties.
- *All*: All available properties.

Here, "*Automatic*" is the recommended setting. Use the other settings to make either more or less of the long list visible.

Mouse operation in the window:



- The height of the help text box can be adjusted.
- The dialog can be adjusted in terms of its position and size.

These properties are saved.

3.13 History

A history on each sensor is administered in the database. Whenever a sensor is edited and thus modified, it receives a new time stamp which signifies "*Last modified*".

Upon each change, a backup for the sensor data is also created. These backups are created according to a special rule:

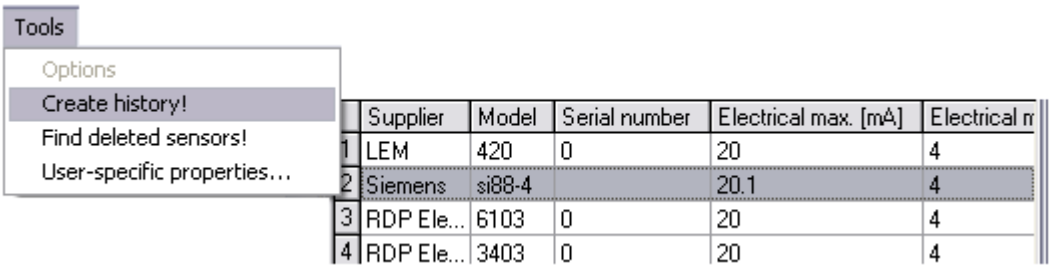
- There is a backup for each change made.
- All backup which are created in the course of one day are deleted.

This means that there are only day-by-day backups. This prevents a flood of backups from developing. If multiple properties of a single sensor are changed, there won't be that many backups.

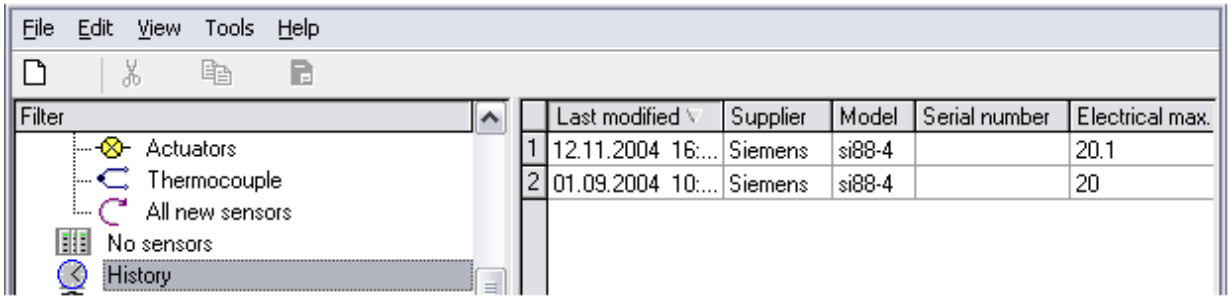
Instead, what develops is a record of all important changes over the course of the sensor's life history: At the beginning, the sensor is newly set up. Later, errors in the setup are corrected. In subsequent years, the sensors is regularly inspected and calibrated. In the process, its characteristic values may be (slightly) modified.

This history can be inquired for each sensor.

To do this, the sensor is selected in the sensor list, and then the menu item "Tools / Create history!" is carried out.

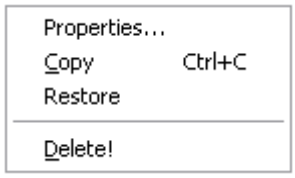


The "*History*" view is updated:



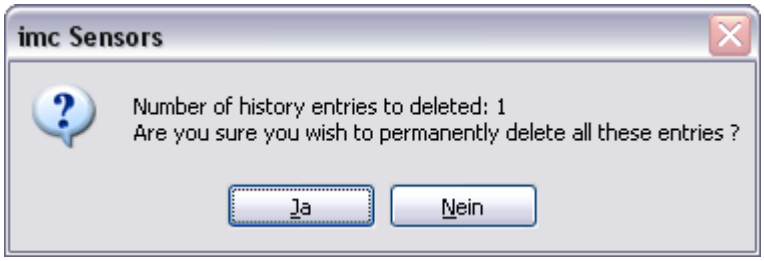
In this view, all of the sensor's most recent version states are displayed, sorted by date, with a maximum of one per day. The table provides a clear indication of whether there are any irregularities, alterations or trends.

The sensor list's context menu has the following abbreviated form:



It contains the following functions:

- *Properties...*: The properties for the selected version state can be viewed in a dialog, but not changed.
- *Copy*: Copy to the Clipboard. Only sensible for use on a single version state, since upon later pasting, only the newest one will be accepted, if any.
- *Restore*: The selected version state is restored. By that action, that version is designated as the most current and newest. The previously newest one, in turn, is filed in the history or deleted, if appropriate.
- *Delete!*: After the confirmation prompt below, the selected version state is permanently deleted from the history.

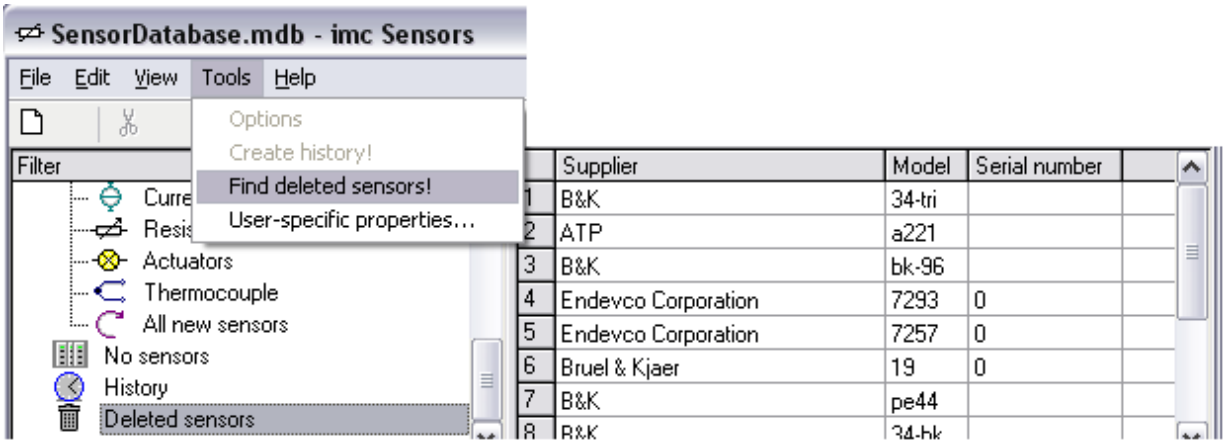


The "*History*" view is only updated, if the corresponding menu item is tapped again. You can also completely delete the "*History*" filter, but the sensor information will remain intact (just like whenever you delete a filter).

3.14 Deleted sensors

The database has a mechanism similar to the MS Windows recycling bin. When a sensor is deleted, it's not really gone from the database right away, but initially only marked as deleted. Just as in Windows the bin can be viewed, it is possible to view the deleted sensors. It is then also possible, of course, to delete them permanently.

The display is called via the menu item "*Tools / Find deleted sensors*":



The filter "Deleted sensors" presents a list of all deleted sensors. For each deleted sensor, only its last (most recent) state prior to deletion is shown. These sensors, too, can have histories.

In this view, there is an abbreviated context menu accessed via the sensor list:

It contains the following functions:

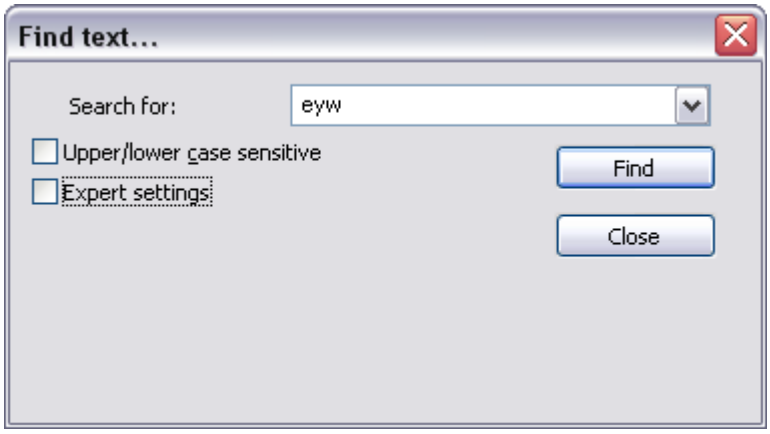
- *Properties...*: The properties for the selected version state can be viewed in a dialog, but not changed.
- *Copy*: Copy to the Clipboard. Later pasting-in leads to "restoration", which see below.
- *Restore*: The selected version state is restored. It is thus no longer deleted.
- *Delete!*: After the confirmation prompt below, the selected version state is permanently deleted from the history. Its whole history is deleted.

The "*Deleted sensors*" view is only updated if the corresponding menu item is tapped again. You can also completely delete the "*History*" filter, but the sensor information will remain intact (just like whenever you delete a filter).

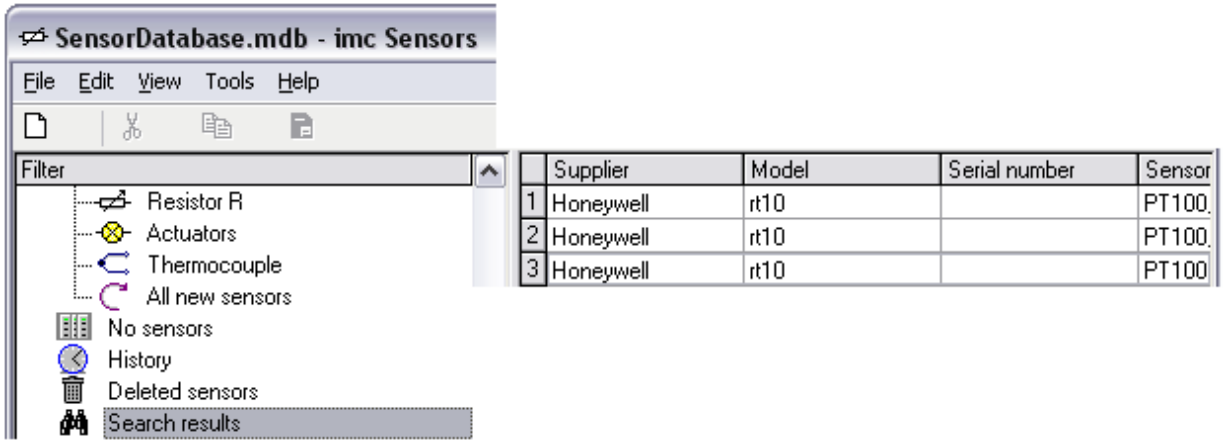
3.15 Searches

The entire sensor database can be searched for a particular text.

This functionality is called via the menu item "*Edit / Find text*...". The following dialog appears:



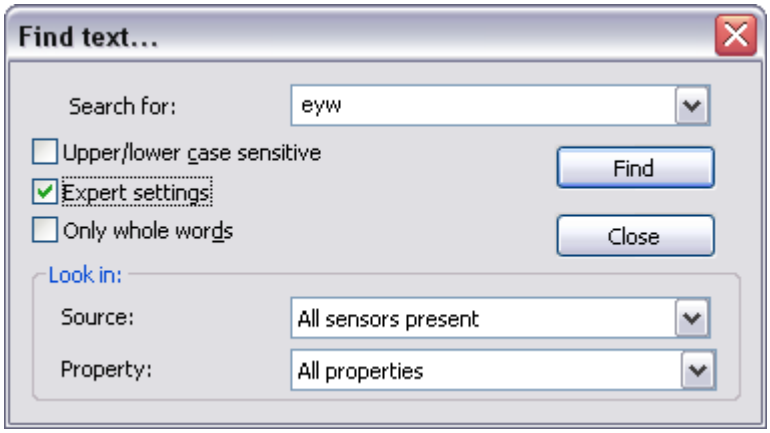
You enter the search text and press the key <Enter> or the button "*Find*". All properties of all sensors are searched for this text. If the text appears anywhere, the pertinent sensor is listed in the view "*Search results*". This view is then displayed right away.



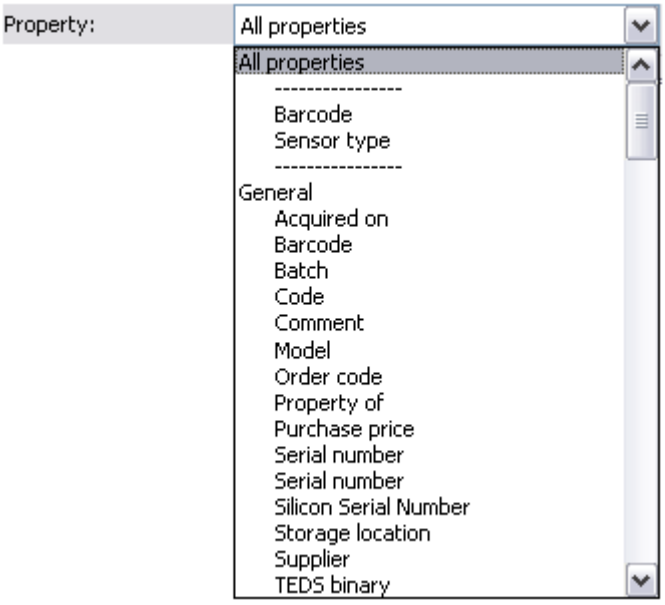
Note

In the view "*Search results*", the originals of the sensors found are displayed. This view, too, is a filter which can be applied to the database. If a sensor is deleted in this view, then it is really deleted from the database, not just from the view (as is usual with deleting). Conversely, if the view is deleted, then only the filter disappears, but the database remains intact.

The search dialog contains the following options:



- *Upper-/ lower-case sensitive*: If this options is activated, the search take account of the exact spelling in terms of upper and lower case letters. Thus, if the text "supply" is associated with a sensor, it isn't found if the search text is "Supply".
- *Expert settings*: If this option is active, the additional options mentioned below are enabled. Otherwise, the default settings for these extra options are: for "Whole words only" = NO, "Source" = "All sensors present", and "Properties" = "All properties".
- *Only whole words*: The search text as entered is a whole word. Thus, the system only looks for the search text between spaces which separate words from each other. Within the range between these spaces, there must be an exact match.
- *Source*: Where to search? The following options are available:
  - o *All sensors present*: The entire database is searched (but not the history or deleted sensors).
  - o "*View: <Name of current view>*": Searches only the current view. If, for instance, the current view (the view before opening the dialog) is of thermocouples, then the search is only among thermocouples. This means only among the sensors in the sensor list at right.
- *Properties*: This is usually set to "All properties". This means that the system searches for the search text among all sensor properties. But it's also possible to select a particular property. In the list of properties, the last properties searched have an extra entry at the top.



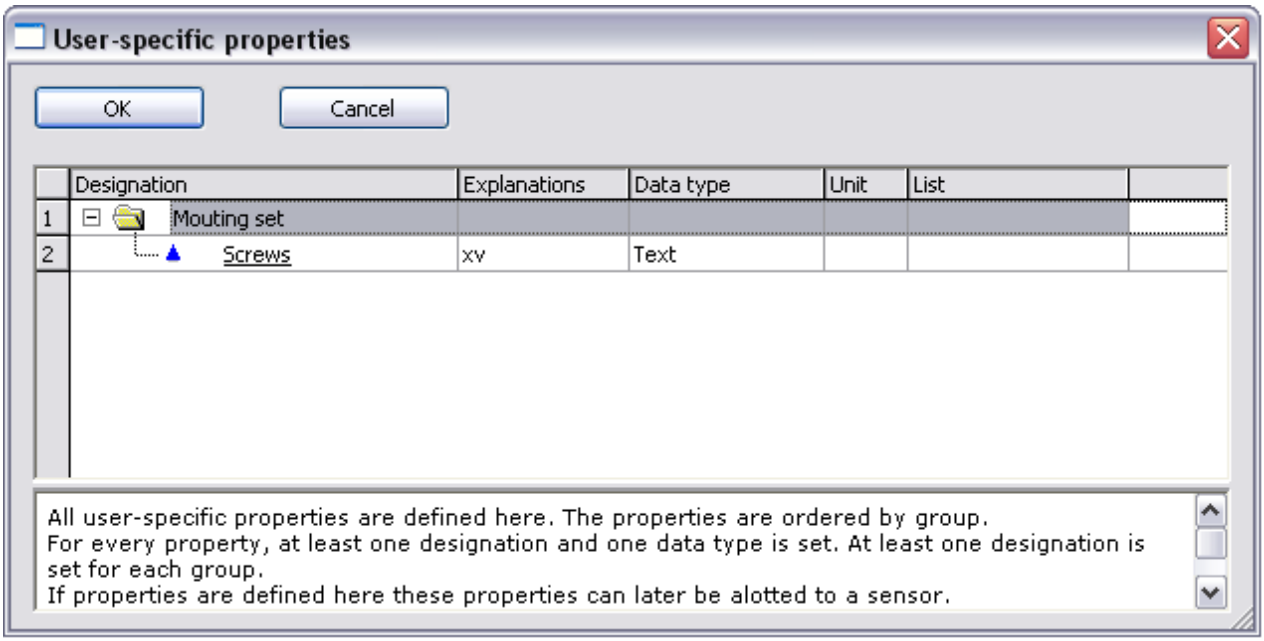
When selecting a special property, the search goes much faster. This is advantageous particularly when the property is known. It may also reduce the number of search results.

3.16 User-specific properties

Along with the sensors' permanently defined properties (such as "*Sensor type", "Manufacturer*", …), the user can also define his own properties. These new properties can in turn be joined together into groups.

User-specific properties are helpful particularly where the default properties are insufficient.

The dialog for setting the user-specified properties is called via the menu item "*Tools/ User-specific properties…*":



Here, all user-specific groups and their constituent properties are listed.

To edit a cell, simply click on a cell in a previously selected row. Editing is accomplished in the same way as renaming a file in Windows Explorer.

For groups, only the columns "*Designation*" and "*Explanations*" are used.

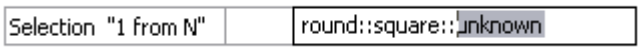
For properties, the other columns are also used. These are defined as follows:

- *Designation*: This refers to the name for the group or property. Choose a unique designation. This designation is later used or working or recognizing this property. Try to make the designation short, so that it fits well into table column headers.
- *Explanations*: A freely defined optional comment. This comment is displayed for the user later whenever he works with the group or property. The comment is supposed to be an aid in understanding what the property's meaning is, how to use it and what values it supports.
- *Data type*: For every property, the data type is takes must be specified. When in doubt, the type is text. The data type determines how the user must later fill in the spec sheet for a sensor which has the particular property.
  - *Text*: Any text can be entered (later).
  - *Integer*: A whole number (0, 1, 2, …)
  - *Real number*: Any real number (e.g. 0, 1, -2.4e-6, 2323.99)
  - *Date*: E.g. 31.12.2003
  - *Selection 1 from N*: Here, the column "*List*" is used to specify the available values. These values are texts, such as "*big", "small", "medium*". In this example, the user will later be able to choose among those three texts from a pop-down list, in other words, he has the choice of 1 from N available.

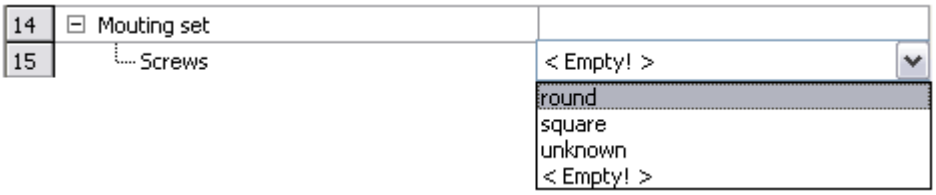
- Sequence of real numbers: E.g. the sequence -10.0 0.0 10.0

  And for special applications, such as a sequence of measurement points, measured frequency points, …
- *Color*: E.g. Red, Green
- *Link*: File name including path. E.g. \\server\dastasheet\0045.pdf

- *Unit*: The physical unit is only entered if a property takes the data type "*Real number*". The unit is displayed for the used late, in order to clarify how the real number to be entered must be scaled.
- *List*: This list can only be edited with the data type "*Selection 1 from N*". The individual texts to be selected are separated from each other by the string"::" (two colons).



Later, when filling in the spec sheet, this can lead to the following settings options:



The context menu called from the table of user-specific properties takes the following form :

The functions this menu contains are:

- *New group*: A new group is appended.
- *New property*: A new property is appended to the current group.
- *Check*: The contents of the current list of groups and properties are checked for consistency and completeness, e.g., unique designations.
- *Delete*: The selected property is selected. Attention: If applied to a group, the entire group including all the properties it contains is deleted.
- *Delete all*: Deletes the entire list.
- *Cell/* Edit: <in the currently selected row, it's possible to edit the cell which is below the mouse pointer at the moment the context menu is opened. Note: This can also be accomplished by clicking on the pertinent cell in the already selected row.
- *Report*: Refer to the section "Reports 43".

Drag&Drop:

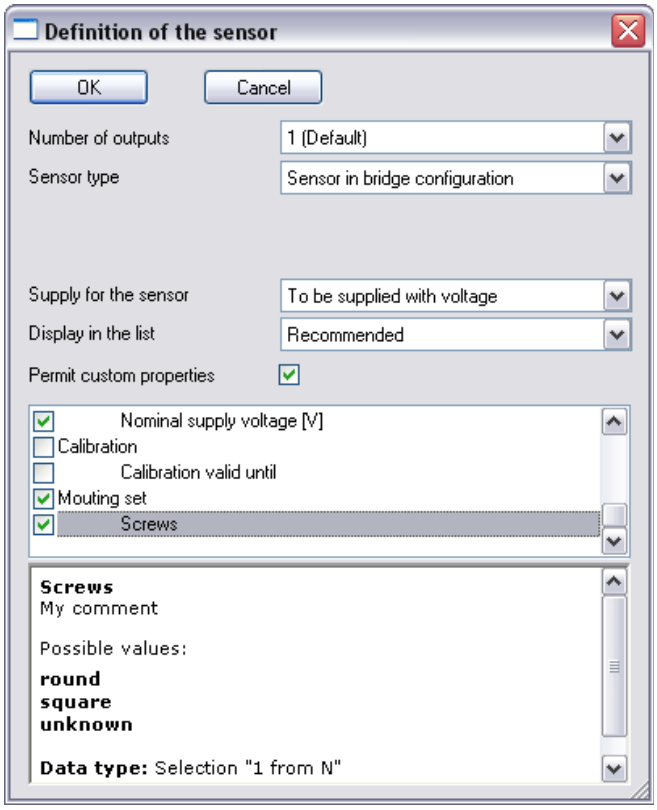
- Properties can be re-arranged by means of Drag&Drop. As well, they can be moved from one group to another. Please note that the drop is on the row at which you release the button.

If you exit the dialog via OK, then the file UserSensorProps.XML is updated and your backup UserSensorProps.XML.bak1 or its Backup-file UserSensorProps.XML.bak2 is updated.

If the dialog is closed following a change and the changes are to be applied, there are various possible outcomes:

- Only new properties or groups were added. This proceeds without difficulties. Filters and sensors in the database are not affected. The new properties can later be used to make sensor definitions.
- Properties were deleted. Please note that sensors having these properties can subsequently no longer be viewed or edited completely. Some information on these sensors will be lost. All other properties of these sensors can naturally be edited as before. Therefore, only delete properties which are truly no longer needed. If any filters are using properties which are deleted, those filters will subsequently no longer work. In that case, re-adjust the filters. A warning message will of course be posted beforehand.
- If properties : were only re-arranged or moved from one group to another by means of Drag&Drop, then the database sensors and the filters will be adapted accordingly. However, the filters are only adapted on the computer used. For example, if you use export/import if filter settings, in order to later transfer corrected filters to other computers. A warning message will of course be posted beforehand.

If user-specific properties are present, then they appear in the dialog for specifying the properties to be included in a sensor's spec sheet :



User-specific properties are not given consideration by imc CANSAS and imc DEVICES/STUDIO when setting up channels. This is because these software packages don't know what these properties refer to.

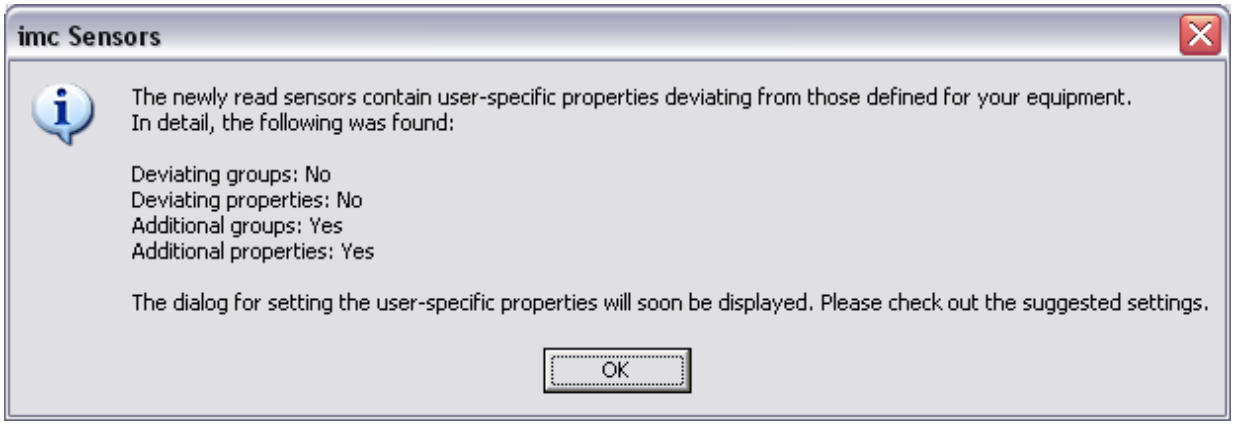
3.16.1 Exchanging sensors with user-specific properties

Via the Clipboard, sensors with all their properties can be exchanged. This also can be accomplished by means of import and export.

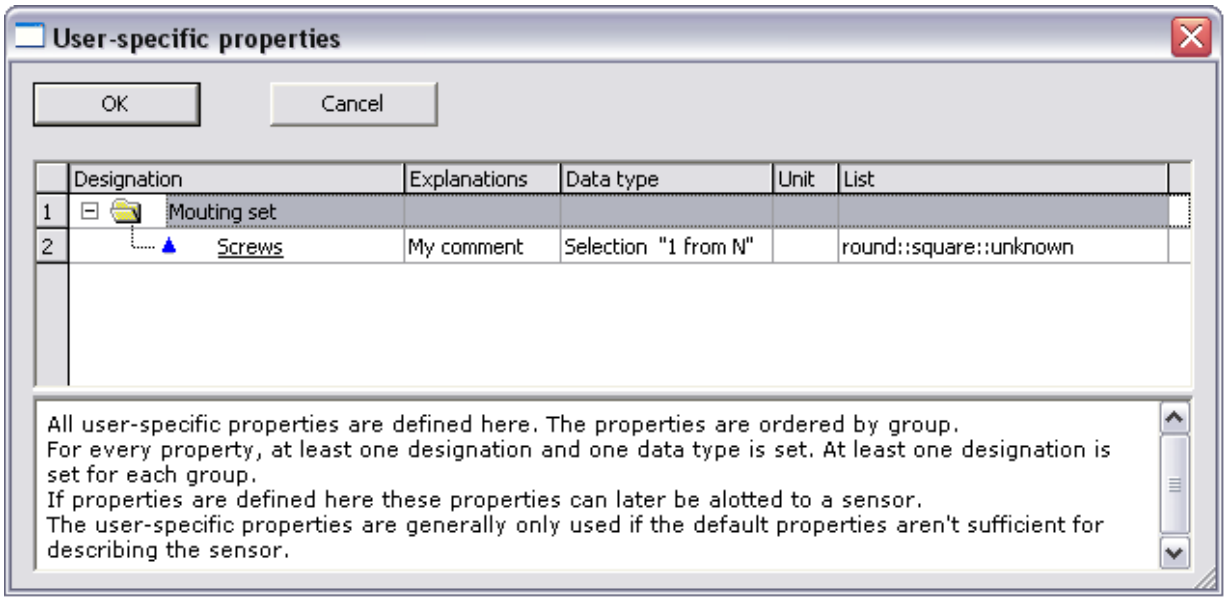
If the sensors possess user-specific properties, they can only be edited in imc SENSORS if the property's name, unit (if appropriate), data type, etc. are known.

This information is available in the transport files and in the Clipboard, too.

If user-specific properties are defined, they will also be reflected in the data exchange. The memory block which is exchanged also contains the information about the defined user-specific properties along with the sensor information (upon using Export or copying to the Clipboard). When the sensor information is read back in (Import or pasting from the Clipboard), the system checks whether new user-specific properties are present along with new sensor information. if so, the following message appears:



This displays information on whether properties or groups are to be added, or even whether properties were exchanged in the meantime by the information's creator. After this note, the dialog for setting the user-specific properties appears.



Here you must confirm by pressing "OK" so that any changes are applied. Otherwise, the user-specific properties you previously defined remain in effect.

Here, too, the last modification principle applies. Each group and each property has a time stamp stating when the last modification took place. When previously existing properties are merged with others which were either changed or newly added by Import, the newer ones are always used.

Additionally, the information about the user-specific properties and their meanings is in the file

UserSensorProps.XML.

When opening a database, the user-specific properties are imported from the database. The file will be updated on this occasion.

If multiple users are working with user-specific properties, it would be best to agree on a set of shared properties of that kind. The same applies when working with multiple databases.

The reference to this file is in the System Registry.

In order to make the user-specific properties match across different databases, it is possible to export a sensor from one database and to import it into another database. If the import actually works, the user-specific properties are also assimilated. The user is given the opportunity to accept, modify, or reject this result.

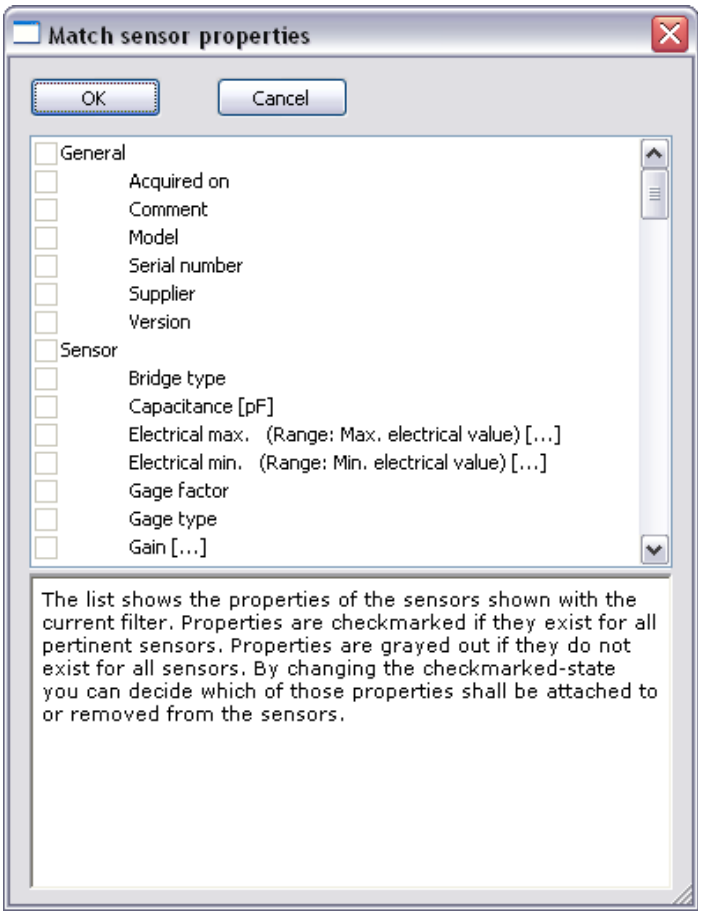
3.17 Match properties

Using this dialog it is possible to obtain the same properties for multiple sensors. If multiple sensors have been defined differently, some may have, for instance, the property "*Supplier*" while others don't have this property. Using the dialog, all the sensors can be assigned the "*Supplier*" property, or conversely, this property can be deleted form all the sensors.

The issue is the presence of the property, not its content. Thus, to continue with the above example, it is possible to arrange for all sensors to have the property "*Supplier*", but each sensor may still have a different supplier..

The dialog modifies all sensors displayed in the current filter. The selection of sensors in the table on the right side has no effect.

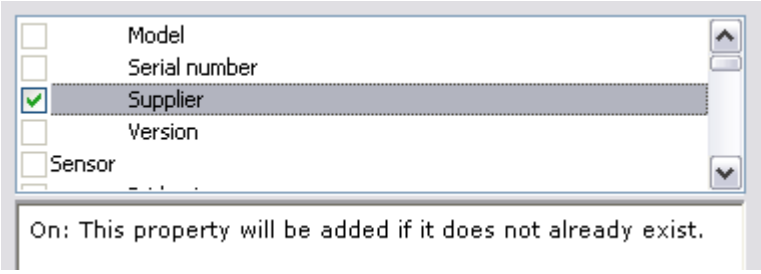
This functionality is called via the menu item "*Tools / Match properties…*". The following dialog appears:



The dialog displays the set of all properties which are possessed by any of the sensors displayed. If all sensors are to be assigned a whole new property by this means, at least one sensor must already possess the property due to a previous cause.

For each of the properties, it is possible to select by mouse-click from among the following three options:

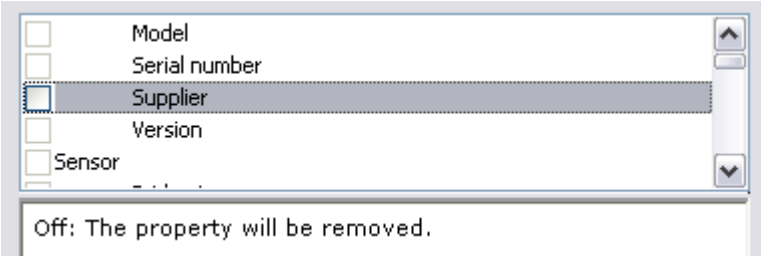
Adding the property:



A checkmark is set. If the sensor did not already possess the property in question, it receives it now. The property's content is initially empty or a default value.

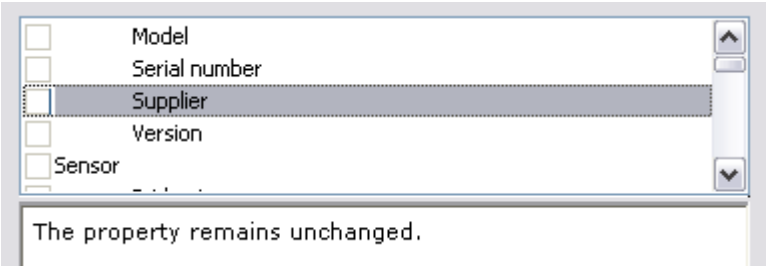
If the sensor does already possess this property, the property's content remains unchanged.

Removing the property:



The checkmark is removed. The checkbox's frame becomes bolder. If the sensor already possesses this property, it is removed along with its content. If the sensor did not already have this property, there is no effect in regard to this property.

Property remains unchanged:



The box's frame is seen to appear in gray. Whether or not the sensor possessed the property in question, the property remains unaffected. This means the property is neither added nor deleted.

Please note that the visual distinction between "*Delete*" and "*leave unchanged*" is very slight. It helps to pay attention to the current help text which appears in the lower portion of the dialog.

3.17.1 Keeping properties consistent

When manually editing sensor properties, the following rules apply:

- If the user changes the value of the property "*Calibrated on*", then the property "*Calibration valid until*" is adapted accordingly if the property "*Calibration interval*" exists and is valid.
- If the user changes the value of the property "*Calibration interval*", then the property "*Calibration valid until*" is adapted accordingly if the property "*Calibrated on*" exists and is valid.

3.18 Accessing the sensor-Eprom

A sensor's technical specs, in other words the description of its properties, are administered in imc SENSORS. This spec sheet can also be saved to a chip (sensor-Eprom). The sensor-Eprom and the sensor in conjunction typically form one unit. Then, if a sensor-Eprom is connected to a measurement amplifier, the measurement amplifier can read the settings noted in the sensor-Eprom and adjust itself accordingly.

If imc measurement equipment is used, there is a good chance that it is able to read and write to the sensor's electronic data sheet.

With imc SENSORS, there is also a direct way to access the sensor-Eprom without any measurement amplifiers. This is accomplished via a USB-adapter connected to the PC, which in turn is connected to the sensor-Eprom.

3.18.1 Sensor-Eprom

The following chips from DALLAS MAXIM are supported:

DS2433	4 k-Bit 1-Wire EEPROM	Standard applications
DS28EC20	20k-Bite 1-Wire EEPROM	special applications with special memory requirements

Note

- Even if sensor-Eprom is the generally mentioned term, only such chips are supported which contain a EEPROM which can be deleted and written to without a programming voltage.
- Numerous technologies exist for attaching the chip to the terminal, cable, or sensor. For this purpose, imc offers a number of practical solutions.

3.18.2 USB Adapter

USB-adapters are supported which emulate the Dallas DS2480B adapter serially on 1-wire. DS2480B is the basis for the Dallas DS9097 series. In exceptional cases, it may not be possible to ensure that an adapter functions. The following adapters have been tested by imc:

Test USB-adapters:

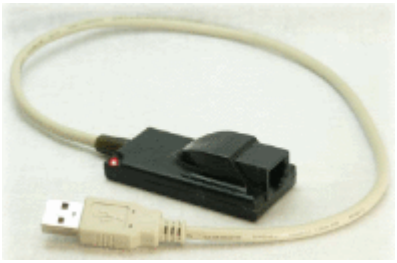
Product: COM To 1-Wire USB Adapter

Manufacturer: eclo

Tested 2011-03: Result: Recommended

Product: LinkUSB™

Manufacturer iButtonLink, LLC



Tested 2011-03: Result: The adapter sometimes reacts with great sensitivity when the sensor-Eprom connected is changed. Frequently the adapter must be unplugged from the computer's USB socket and then re-plugged.

These are adapters which replicate a virtual COM-port (e.g. COM4: or COM5). In such a case, a program (such as imc SENSORS) does not detect a USB device, but rather a device which appears to be connected to a serial interface.

These adapters do not come included with the imc SENSORS package.

The adapters do not come with any terminal for the chip. One would have to be supplied by the user, which is adapted to the terminal and chip-housing used.

Note

Please note before connecting these USB-adapters the notes and manufacturer's instructions, as well as any system prerequisites.

3.18.3 Data format

The data formats which can be read are "IMC" and IEEE 1451.4. At the present time, writing can only be performed in the format "IMC". The format "IMC" is described below in detail in the section "Notes for Developers". Only this format (as of early 2011) enables the whole spectrum of properties and their combinations to be recorded in the sensor-Eprom.

3.18.4 Supported scenarios

There is a way to select a USB adapter or check whether one is present. It is possible to access the sensor-Eprom via the USB-adapter to which it is connected. The contents of a sensor-Eprom can be written to a file, or vice-versa, such a file's content can be written to the sensor-Eprom. Further, a sensor in imc SENSORS can be selected for having its properties written to the sensor-Eprom. And conversely, the sensor-Eprom can be read in order to then set up a new sensor to have the properties read from imc SENSORS.

3.18.5 Plug & Measure

Using imc SENSORS it is possible to write to a sensor-Eprom. If it is then connected to an imc measurement amplifier in conjunction with a sensor, then the amplifier can automatically be parameterized appropriately by means of Plug & Measure technology, so that measurement can begin right away.

3.18.6 Sensor-Eprom content: Technical data sheet

A sensor in imc SENSORS is described by its technical data sheet. The same kind of technical data sheet is recorded in the sensor-Eprom. Ultimately, the database and the sensor-Eprom are simply two different storage locations for the spec sheet. In both cases the technical spec sheet is saved electronically, explaining the designation TEDS: **T**ransducer **E**lectronic **D**ata **S**heet.

Naturally, the sensor-Eprom is subject to the constraints typical of its very small memory of 512 bytes. It may occur that not the entire data sheet can be stored on the sensor-Eprom. However, in every case the most important properties such as the sensor type and scaling specifications must be included. The easiest element to dispense with (if necessary) is commentary.

3.18.7 Database assignment and sensor-Eprom

In the database, each sensor has its own unique identifier reflecting its properties, internal administration, and identity. This is a 64-bit number made readable in ASCII format.

For the sensor-Eprom, there is an alternative possibility for unique assignment: Every chip from Dallas has its own distinctive Eprom ROM-ID. This is 64 bits long and permanently burned into the chip, so the user has no ability to change it.

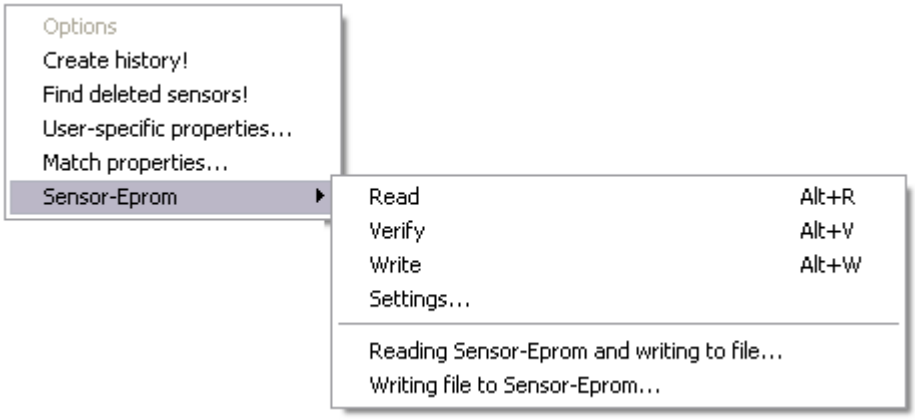
When writing to a sensor-Eprom via imc SENSORS, then the sensor-Eprom's ROM-ID is recorded in the database as a sensor property which was just written to the sensor-Eprom. This property can also be found in the group "Internal administration". It can not be edited by the user.

In the database, at most one Eprom ROM-ID can be recorded for each sensor. In general, this is the most useful approach when unique assignment is to be possible. There are also applications where unique assignment is not necessary. For instance, if there is only one sensor entry "Thermocouple Type K" in the sensor database, there may be multiple sensors of this type set up and thus also multiple sensor-Eproms with associated recorded data. In this case, however, the unique assignment is lost since in imc SENSORS only the Eprom ROM-ID of the last Eprom writing procedure is recorded. If that is not desirable, then consequently there must be multiple sensors of the same sort in imc SENSORS.

When reading a sensor-Eprom, the Eprom ROM-ID recorded in the database determines whether the sensor is already entered in the database.

3.18.8 Menu functions

The "*Extras*" menu contains a "*Sensor-Eprom*" submenu.



The following items are available in the toolbar:

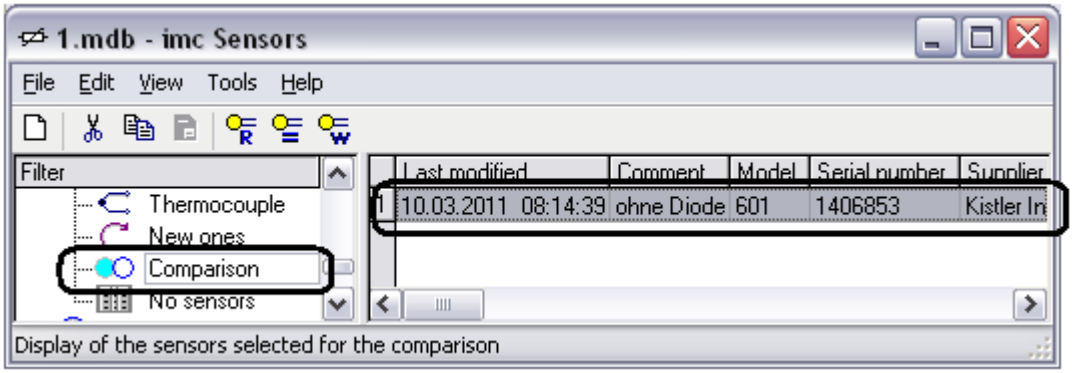
	Read
	Verify
	Write

List of menu items:

- *Read*:

  This menu item is used to set up a new sensor in the database, where there is a sensor-Eprom.

  The sensor-Eprom contents are read. If the sensor does not yet exist in the database, it is imported into it. The view “Comparison” is opened. There, the new sensor is set up. If the sensor already exists, it is displayed. If there are multiple matching or almost matching sensors in the database, then these are displayed. If a sensor newly set up by import is not to be entered permanently in the database, it can be deleted again immediately.



“Comparison” view with a sensor newly set up

- *Verify*

  This menu item is used to compare the sensor in the database with the one connected.

  The sensor currently selected in imc SENSORS is compared with the sensor-Eprom connected. This determines whether the two have the same content, in other words the same properties with the same values. Further, the system checks whether the connected sensor’s Eprom ROM-ID is also already recorded for the selected sensor in the database.

- *Write*:

  This menu item is used to write a sensor’s data to the sensor-Eprom.

  The content of the sensor selected in in imc SENSORS is written to the connected sensor-Eprom. After conclusion of the writing procedure, the system counter-checks the content. Only once this has also been concluded, the user is notified of the writing procedure’s successful conclusion.

  If the sensor-Eprom does not provide enough memory, any unnecessary properties such as the comment are omitted, and a warning is posted. When in doubt, it is possible to carry out the “Read” command again for the sensor-Eprom, in order to find out what has (not) been written to it.

- *Settings*:

  A dialog for selection of the USB-adapter. See below.

- *Reading Sensor-Eprom and writing to file…*

  The content of the sensor-Eprom is read, but not interpreted, rather it is written unchanged in binary code to a *.1WI file. The user is prompted to enter the filename for this file to be generated.

We strongly recommend against modifying the *.1WI files. Its content is binary.

- Writing file to Sensor-Eprom…

  The content of a *.1WI file is imported and written unchanged to the connected sensor-Eprom. The *.1WI file is a binary file which typically is generated when the sensor-Eprom is read and its content written in binary code to a file.

  We strongly recommend against modifying the *.1WI files. Its content is binary.

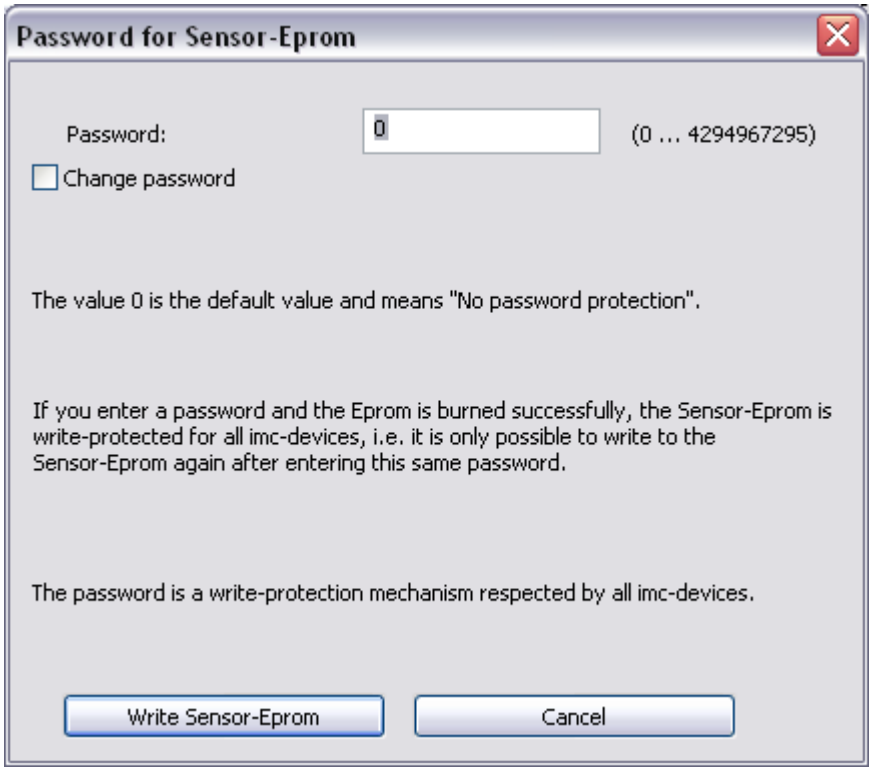
3.18.9 Password

The sensor-Eprom in 1-wire technology has no hardware-based password protection or write-protection. As well, the IEEE 1451.4 standard does not stipulate that it should. However, in the format “IMC”, all imc programs provide password protection: Only if the correct password is entered when writing to a sensor-Eprom is the writing procedure carried out. The password is 32-bit number.

Password protection is especially worthwhile for preventing unintended overwriting of the sensor-Eprom.

By default, there is no password protection for sensor-Eprom content in the format “IMC”. This is equivalent to a password of (0).

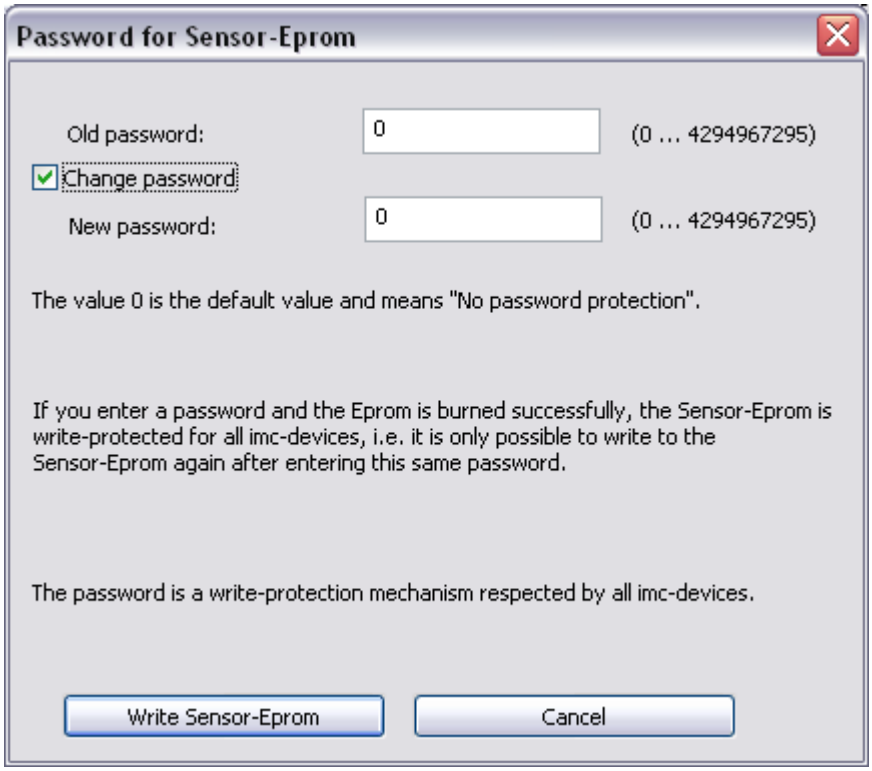
If it is necessary to enter a password, the following dialog will appear:



Under “*Password*” enter the password protecting the sensor-Eprom. Next, click on the button “*Write Sensor-Eprom*”. The password is then checked. If it is correct, the writing process will commence, otherwise, an error message is posted.

If you click on the button “*Cancel*”, not only will this dialog be closed, but the entire writing procedure will be canceled. The sensor-Eprom remains unchanged.

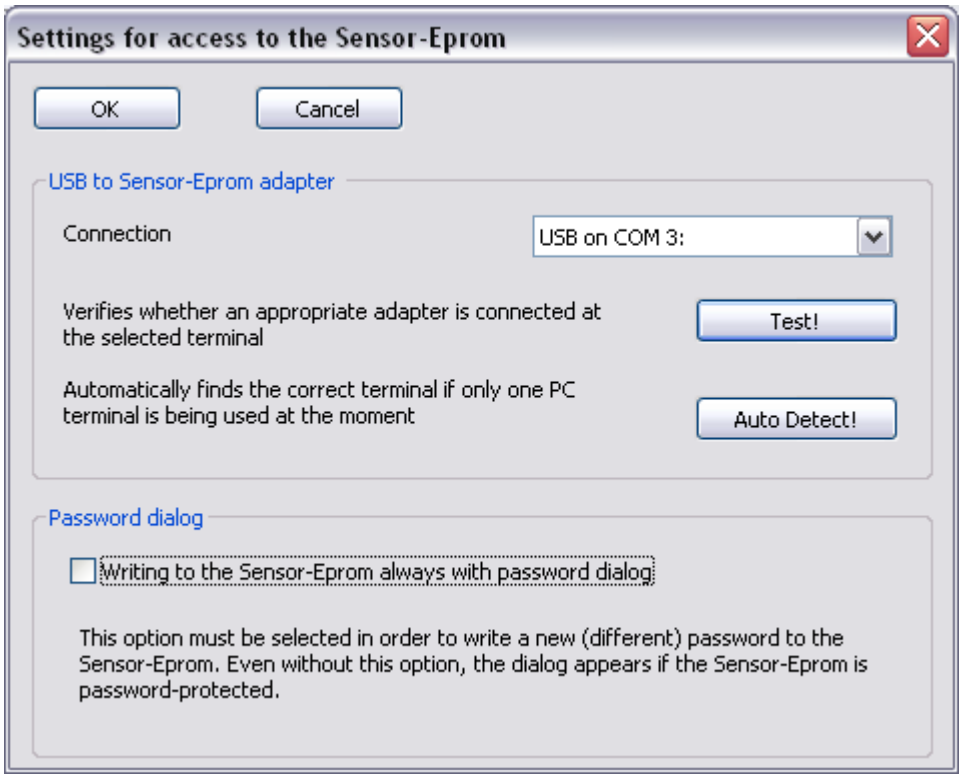
The dialog offers the option to change the password. To do this, select the option “*Change password*”:



Under “*Old password*”, enter the existing password which is at present still protecting the sensor-Eprom. Enter 0 (zero) if there is no password protection at the moment. Under “*New password*”, enter the password which is to count as the valid from the next procedure of writing to the sensor-Eprom onward. Enter 0 (zero) if you no longer wish to keep the password protection.

3.18.10 Settings

By means of this dialog, the USB-adapter is selected.



The operating system associates the connected USB-adapter with a virtual serial port (COM-Port). The available options are COM Ports 3 ..7. You can select the COM-Port from the pop-down list, and then test whether it is the right one by clicking on “Test”. The system posts a notification to state whether your selection was successful or incorrect.

Please note that while doing this, no other USB devices which simulate COM-Ports may be connected to the computer.

The button “Auto Detect!” is very helpful for avoiding having to test every COM-Ports manually. When the system detects the correct one, it is automatically selected in the list “Connection”.

Unfortunately, the operating system assigns the virtual COM-Port’s number. It may not even be the same number every time.

In this dialog, it is also possible to select whether the password dialog is to appear every time data are written to the sensor-Eprom. In practice, the dialog will appear unbidden anyway if the sensor-Eprom is password-protected and thus a password must be entered by the user. However, there are situations in which the dialog is also needed even though the connected sensor-Eprom is not password-protected. For instance, this is the case if a sensor-Eprom not previously password-protected is then provided with password protection, so that a new password must be entered.

The settings made in this dialog are recorded permanently.

3.18.11 Possible errors and their causes

- USB-adapter not found
  - The USB-adapter is not connected properly.
  - Use the dialog “Extras / Sensor-Eprom / Settings” and Auto-Detect. The USB-adapter may (in the meantime) have been assigned to a different COM-Port.
  - Reversed polarity of the sensor-Eprom. With some electrical errors, such as a chip connected with the polarity reversed, or a short circuit, or other problem with the 1-Wire side of the USB-adapter, the USB-adapter is not found by the system because it is not working correctly itself in consequence of the other electrical problem.
- Hourglass appears upon accessing the sensor-Eprom

  No error message appears, but neither does the progress indicator bar for reading/ writing procedures. Instead, only an hourglass appears. The program cannot even be closed by means of the MS Windows Task Manager: The combination of USB-adapter and USB-driver has “crashed”. The USB-adapter must temporarily be unplugged. Then the software may need to be rebooted.
- Error messages stating that the driver was not found, e.g. notes on IB*.DLL files.

  Upon installation, these files are written to the imc SENSORS program folder. If any files of the same name already exist in the Windows\System32 folder, which are no compatible, problems may result.
- The USB-adapter does not appear to be working.

  imc Sensor relies on the USB-adapter working. There are no diagnostics functions available. On the Dallas Maxim webpage, there are tools for accessing the 1-Wire Eprom. See also

  http://www.maxim-ic.com/products/ibutton/example/

  search keywords: Maxim / Products / ibutton / Software Resources

4 Connecting to a Database

4.1 Selecting an MS Access file

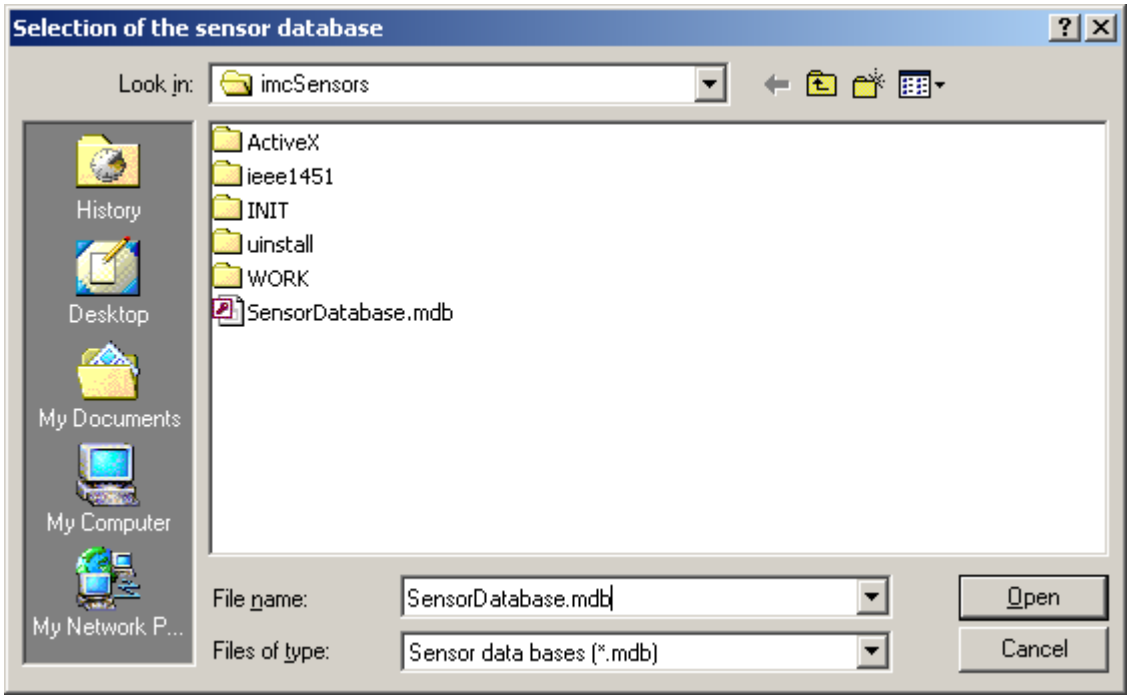
Upon original installation, a sample database SensorDatabase.mdb is available. This is an MS Access database.

However, you can select another file instead of this mdb-file, but it must also be a sensor database. This means that the tables it includes must take the correct shape and content.

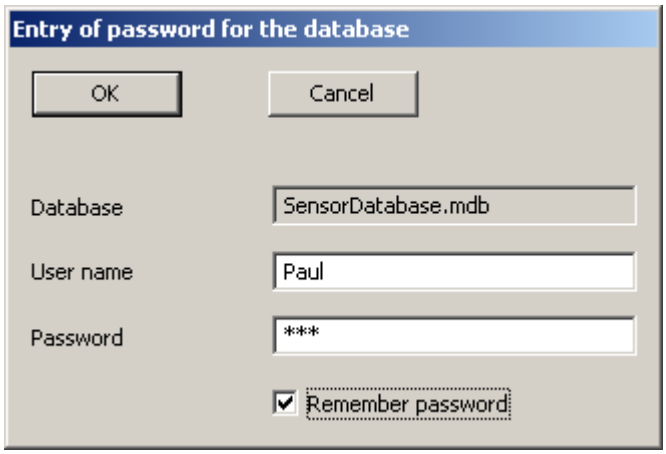
In general, you can only create a suitable file by copying the mdb file using the Windows-Explorer and renaming it. Note: Copying only works if the database (in other words the mdb file) isn't already open.

In the menu "*File*", the four last opened files are presented as selection for quick access.

Select the menu item "*File / Select database (*.mdb)*". Then select a *.mdb file. This file is then loaded.



Next you are prompted to enter the password:



The password and user name can also be empty. The complimentary database comes without any password and with the user name empty.

However, your system administrator can assign a password to the database. In that case it must be entered.

You can choose whether the software is to remember the password for this file. If that is your wish, you no longer need to enter it upon opening a new session. Otherwise, you will be prompted at each new session (even with automatic opening at the program's start) to enter the password.

Note Notes on the file sensordatabase.mdb

- This file comes complimentary with installation. Upon original installation, it contains some imaginary sensors. Of course you can delete these sensors when you use the database. The purpose of these sensors is to have an example of each type, which would be an aid in making duplicates.
- This database may have been created and installed in Access 95 format. If your computer has a newer version of MS Access which you wish to use to edit the database, then you can convert the database in MS Access. Access always requires conversion to its current format in order to be able to perform editing. Make a backup copy before converting and make sure that imc SENSORS is actually able to edit the converted database. imc SENSORS can also convert Access 2002 databases.

4.2 MS Access in the network

If multiple users access the same mdb database via a network, observe the instructions for MS Access. For that case, there is a password file which all participants must use. Refer, for example, to the workgroups.

There are difficult cases in which the mdb file cannot be opened directly. On this matter, refer also to the next section in which it is shown how a "true connection" to the database system can be set up even in the case of an Access file. This connection contains many more parameters and options than the direct opening of the file offered here.

Please also note that MS Access is not optimized for simultaneous use by multiple users. Even with just a few simultaneous users, its power is drastically reduced (speaking of MS Access 2002). For such applications, a more powerful database management system is recommended.

4.3 Connecting to a database management system (server)

The application "imc SENSORS" requires a database to work on, although it is not bound to any particular database system. Access is provided via the ADO (ActiveX Data Objects) interface. Via this interface, an application can access any database server for which an ODBC driver or an OLE DB-Provider is installed.

An important criterion for successful access to the database system is the connection string. This string provides information needed by a provider for opening the connection to a data source.

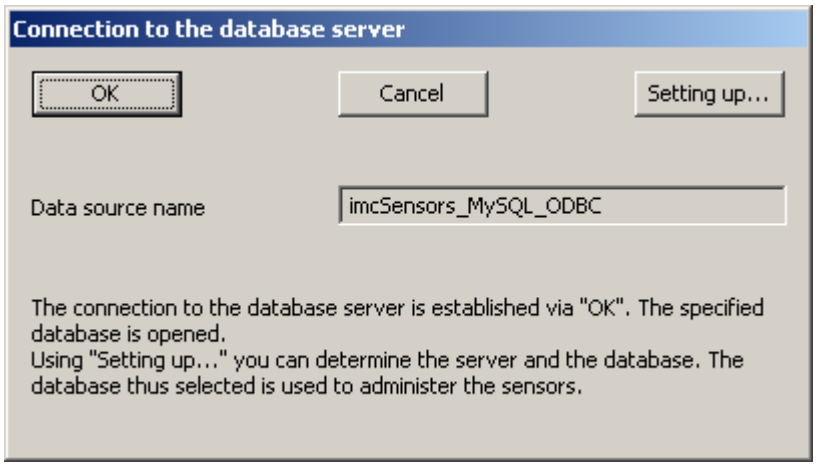
The database connection wizard provides an all-purpose tool for supplying the application with a provider, a data source, user name and password. Once the wizard has succeeded in opening the data source, it checks whether the necessary tables exist and reflect the required scheme. If not, both are created.

For the application "imc SENSORS", two database tables ("sensors" and "SERSORSVERSION") are needed.

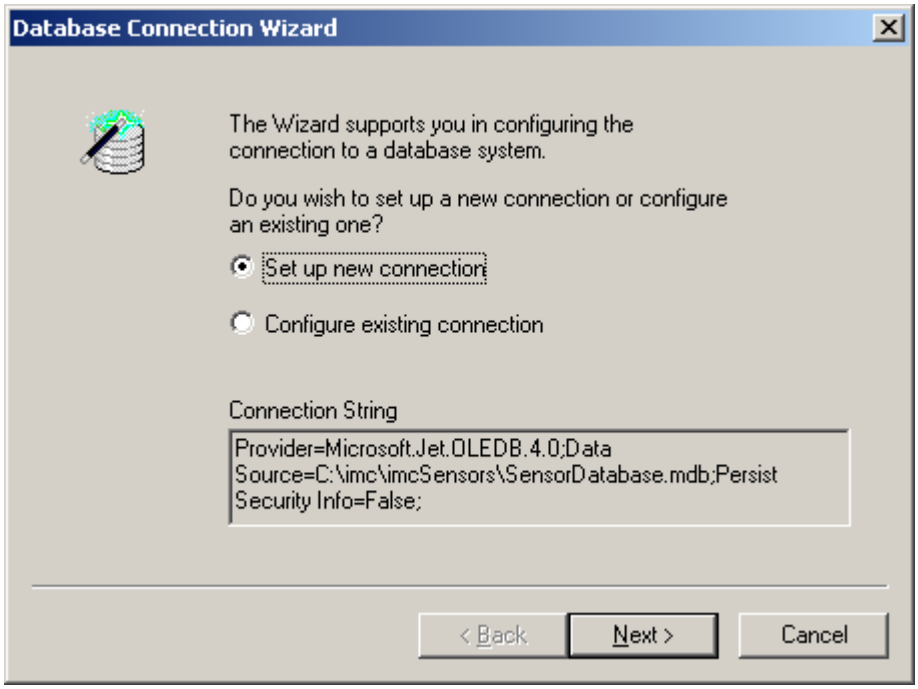
4.3.1 Operation

The database connection wizard guides you through a series of steps to create the connection string.

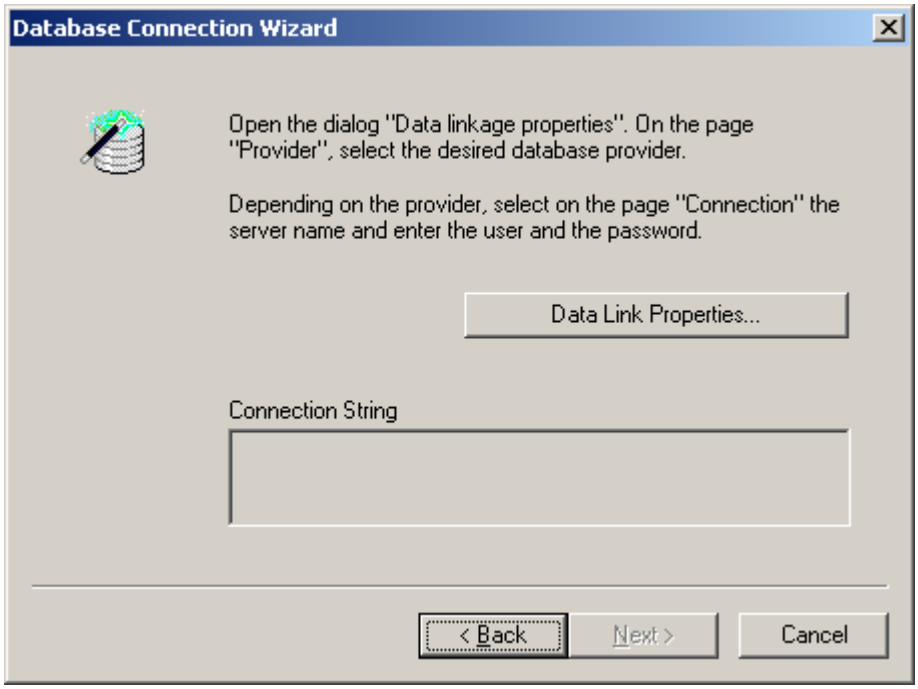
Selecting the menu item "*File > Connecting to database server...*" calls the dialog:



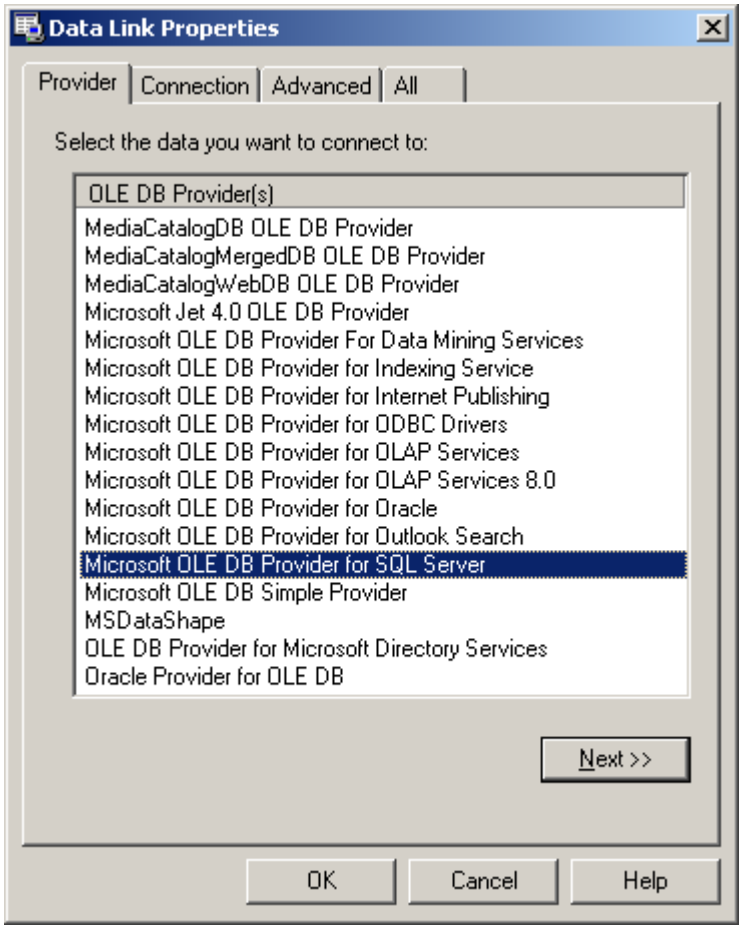
Press the button "*Setting up...*" to start the wizard.



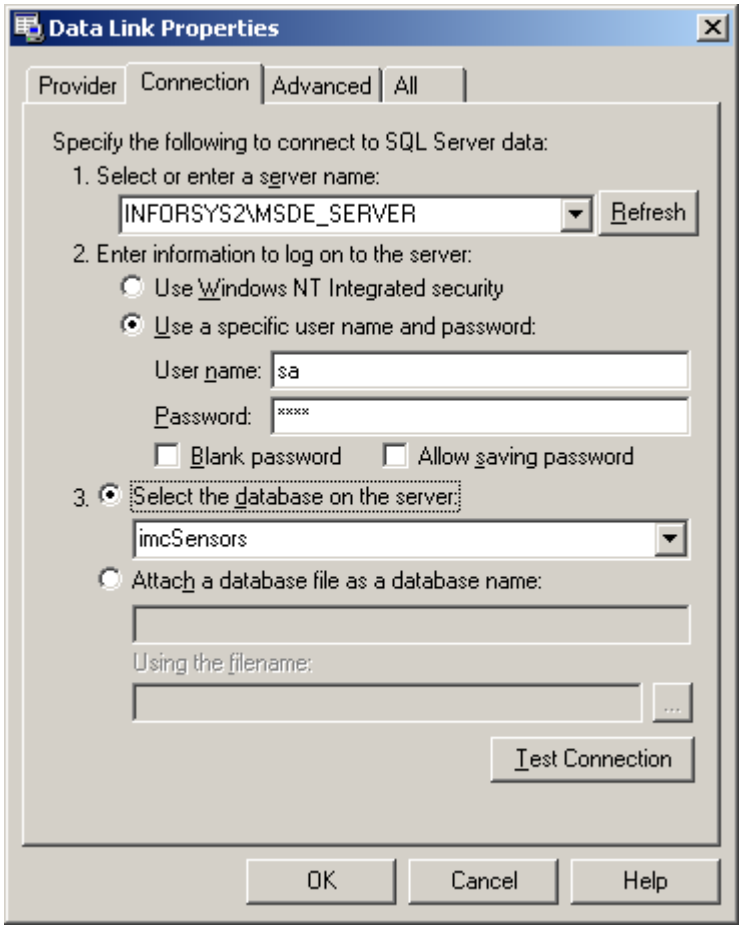
In the first step, decide whether a new connection is to be set up or an existing one to be edited and corrected. In the lower portion of each page of properties in the wizard, the current connection string is displayed.



In the second step, you are prompted to set the data link properties. The obtained result is a new connection string. By pushing the button "*Data Link Properties…*", you open the dialog box "*Data Link Properties*".



On the first page ("*Provider*"), all available providers, which are installed on your PC, are offered. In the next section, a few examples illustrate which provider is adapted for which database system. Select a provider on this properties page and click on "*Next*", in order to display the dialog box's second page.



The structure of the properties page "*Connection*" depends on the provider selected. In this case, the settings for the Microsoft SQL server are shown.

Select a server from the list, or state the location in the server at which the desired database is located.

Two options are available for registering with the database server: "Use Windows NT Integrated security" or "Use a specific user name and password".

Choose the option "Use Windows NT Integrated security" to specify that the provider request a secure (or trusted) connection to a SQL Server running on Microsoft Windows NT. When selected, SQL Server uses integrated login security to establish connections using this data source, regardless of the current login security mode at the server. Any login ID or password supplied is ignored.

Choose the option "Use a specific user name and password" to use a supplied user name and password to authenticate your logon information to the data source.

The option "Blank password" enables the specified provider to return a blank password in the connection string.

The option "Allow saving password" enables the password to be saved with the connection string. This option is not relevant to the application, since the user name and password are saved separately. However, the database connection wizard can extract the password from the connection string in the next step, and you need not re-enter the login information.

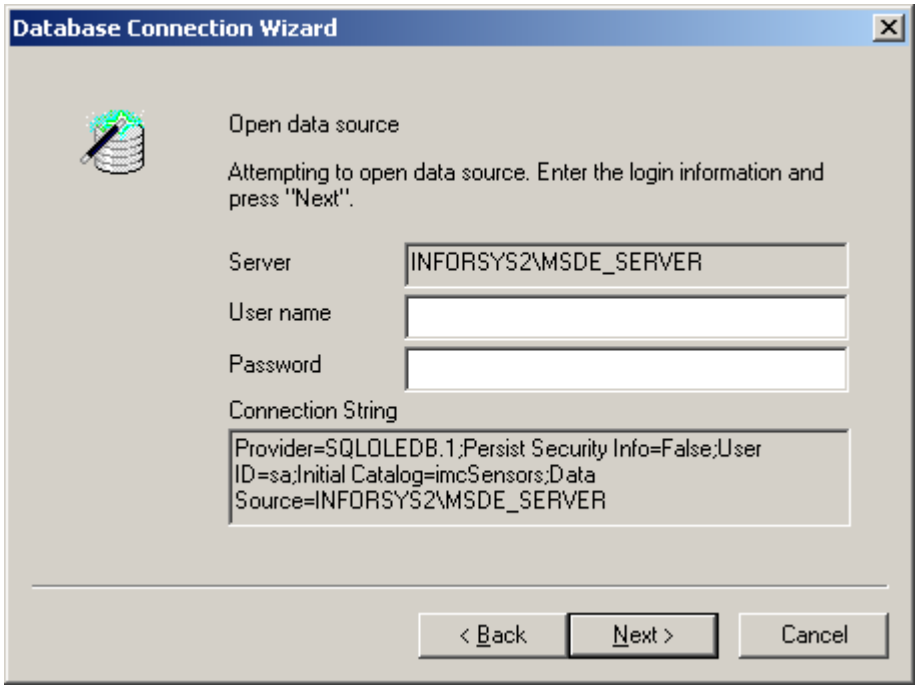
As the last step, select the database on the Server.

Now you can push the button "Test connection" in order to ascertain that the connection is working. If a message stating that the test was successful appears, you can exit the "Data Link Properties" dialog by pressing "OK". If an error message appears, then please check whether the settings are correct. Causes of a failed connection can include writing errors or incorrect upper-/lowercase spelling.

As the result of the database link properties set, you see the new connection string in the dialog's lower portion. Before continuing to the next page, a check is made of whether the connection string contains a provider, a data source (Server), and, for some database systems, a database. A provider must always be specified.

With the Microsoft.JET.OLEDB.4.0 provider, if no data source is stated, you can decide whether you wish to create a new ACCESS database for this application.

If you have selected the Microsoft OLE DB Provider for SQL Server and not selected a database, then there is the possibility to create a new database.



In the next step an attempt is made to open the data source. If needed, enter the user name and password.

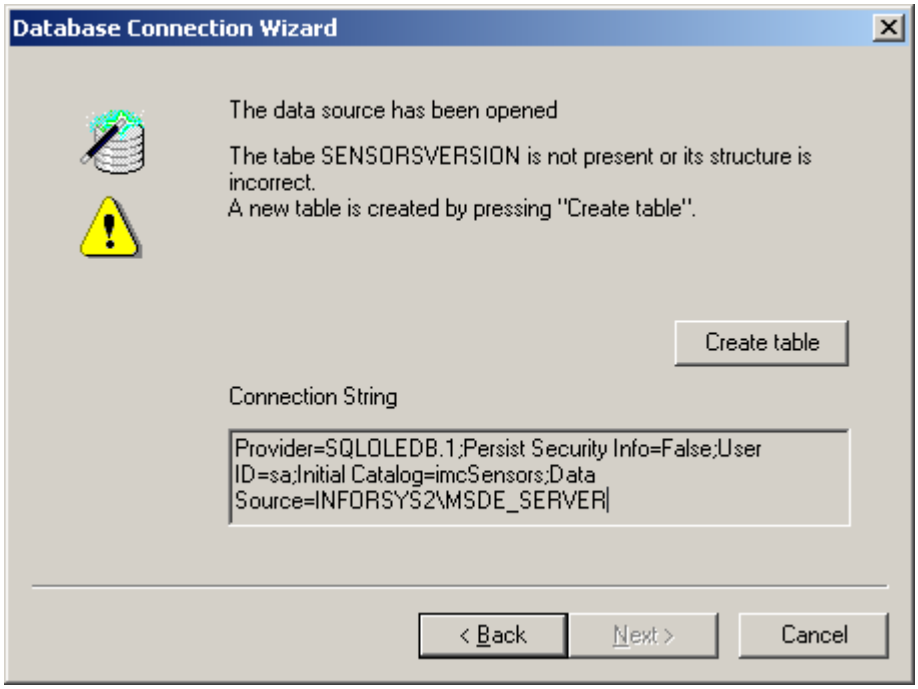
After successfully opening the data source, the following tests are conducted:

Is the table "SENSORSVERSION" present and does it have the required structure?

Is the required version information present in the table?

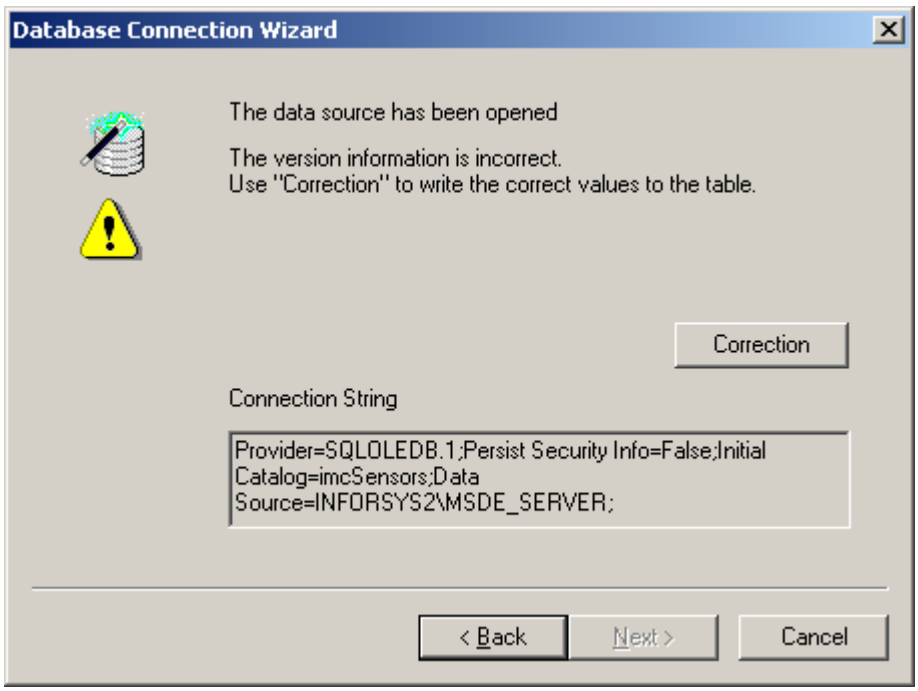
Is the table "sensors" present and does it have the required structure?

If the wizard doesn't find the table "SENSORSVERSION", the subsequent step is to create this table. This step also is needed if a table of the same name exists but has the wrong structure.



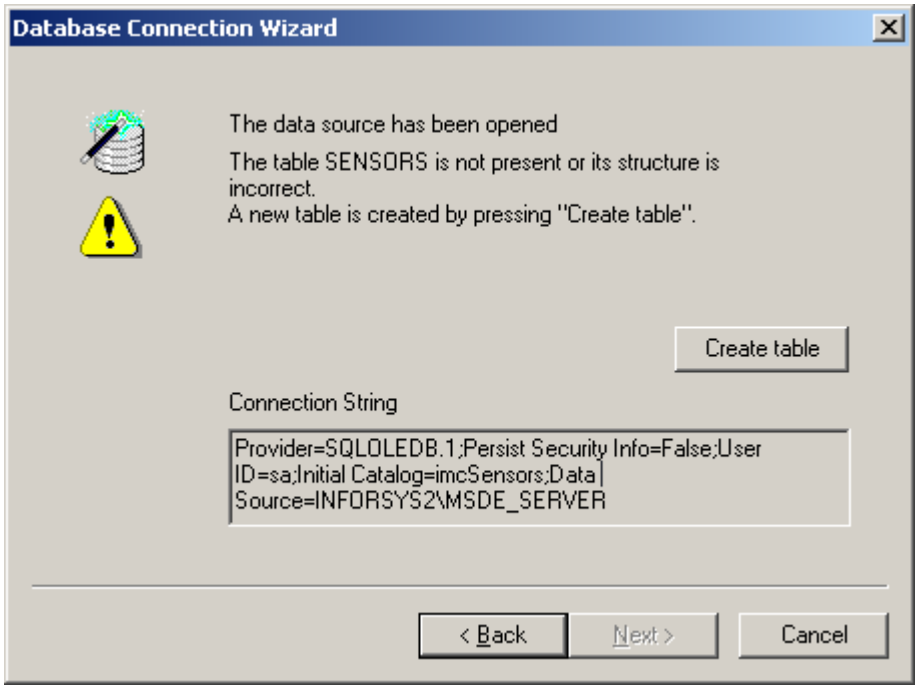
Click on the button "*Create table*". The table "SENSORVERSION" is created and the correct version information is written to it. Then the system automatically turns to the page "*Finish*".

If the table "SENSORSVERSION" already exists but contains invalid version information, the step for writing the correct version information to this table follows.



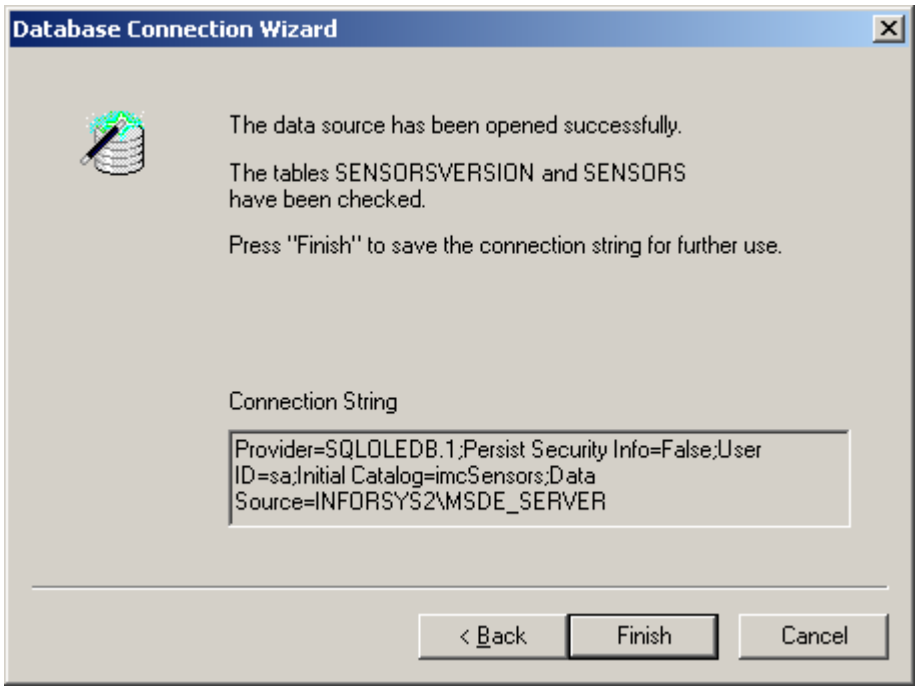
Click on the button "*Correct*". This writes the correct version information to the table "SENSORVERSION". Then the system automatically turns to the page "*Finish*".

If the table "SENSORS" isn't available, the subsequent step is to create this table. This step also is needed if a table of the same name exists but has the wrong structure.



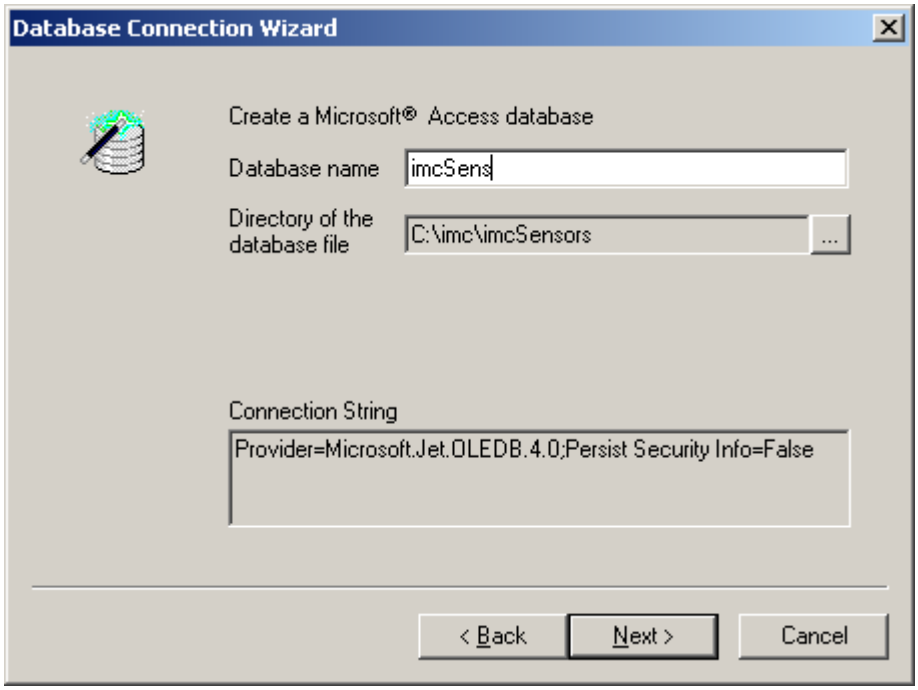
Click on the button "*Create table*". The table "SENSORS" is created. Then the system automatically turns to the page "*Finish*".

In the final step, the connection string created is displayed. By clicking on "*Finish*", you exit the wizard and pass the connection string to the application.



4.3.1.1 Creating an ACCESS database

If you have selected the Microsoft.JET.OLEDB.4.0-Provider and not specified a data source, then you can create a new database. The following properties page appears :

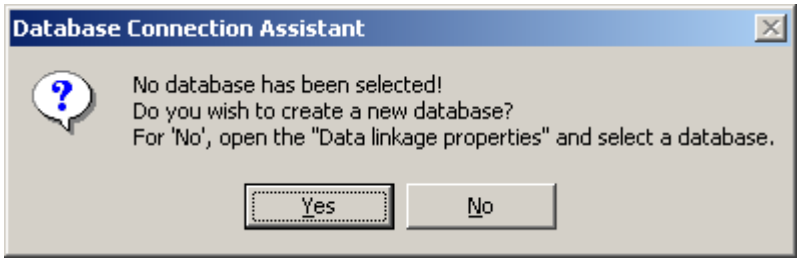


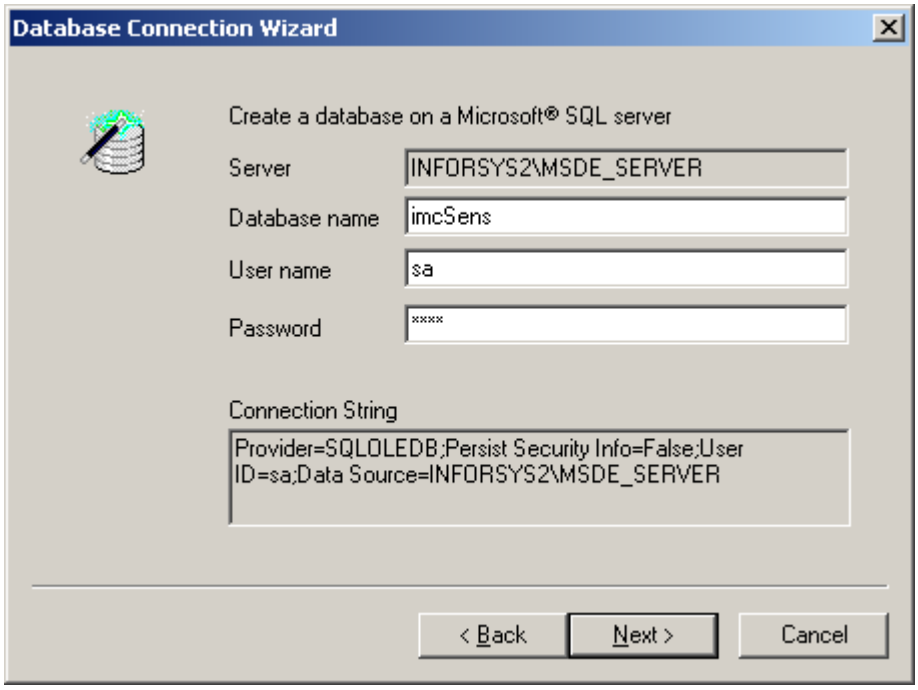
Enter a name for the new database. You can also select the directory for the database.

By clicking on "Next", the database is created. The two tables "SENSORVERSION" and "sensors" are created in the database. Finally, the correct version information is written to the table "SENSORVERSION". Then the system automatically turns to the page "*Finish*".

4.3.1.2 Creating a database on a Microsoft SQL Server

If you haven't selected any database in the dialog "*Data Link Properties*", you are asked in the next dialog whether you wish to create a new one.



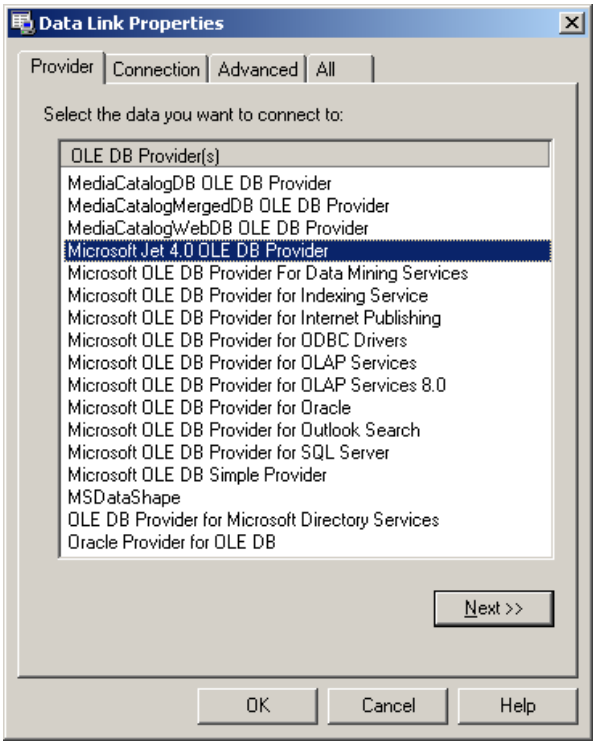


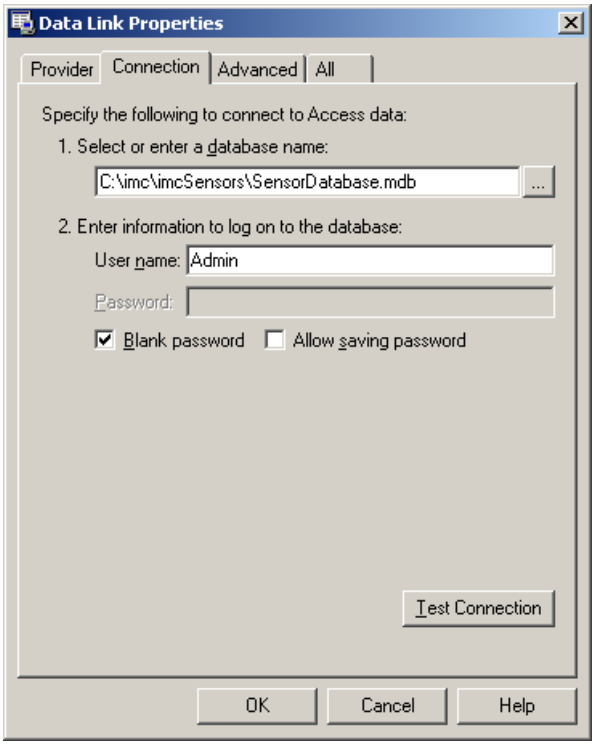
On this page, enter the name of the new database, the user name and the password. By clicking on "*Next*", the new database is created, along with the two tables "SENSORVERSION" and "SENSORS". Finally, the correct sensor information is written to the table "SENSORVERSION". Then the system automatically proceeds to the "*Finish*" page.

4.3.2 Examples of connection to database systems

4.3.2.1 Accessing an Access database via the Microsoft.JET.OLEDB.4.0-Provider

The most effective way to access an Access database is via the Microsoft.JET.OLEDB.4.0-Provider.





On the page "*Provider*", select the Microsoft.JET.OLEDB.4.0 provider. On the page "*Connection*", you only need to select the Access database.

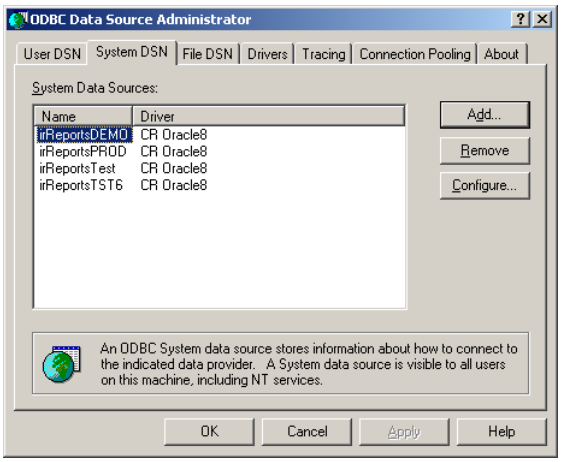
The resulting connection string then takes the form:

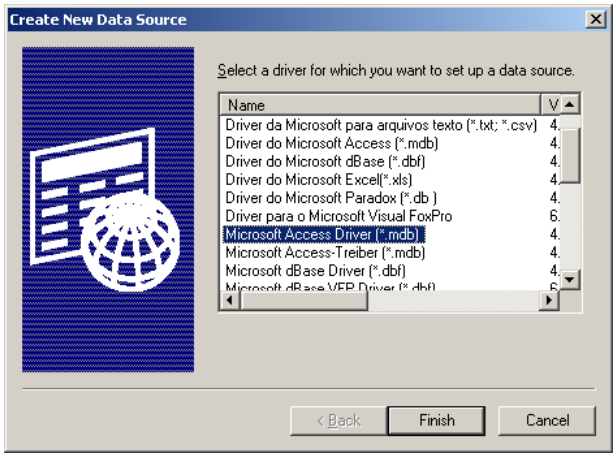
```
Provider=Microsoft.Jet.OLEDB.4.0;Data Source=c:\somepath\sensordatabase.mdb;
User Id=admin; Password=
```

4.3.2.2 Accessing an Access database via ODBC

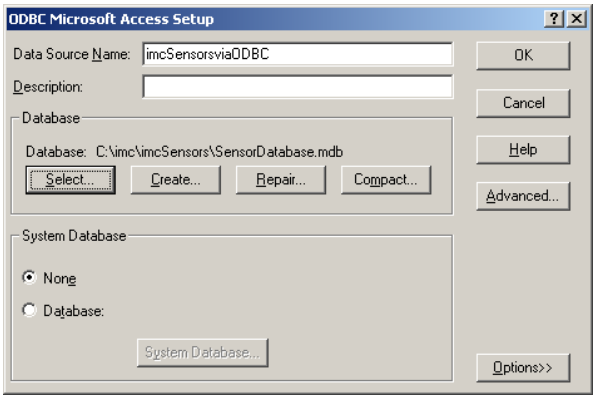
An Access database can also be accessed via the ODBC. To do this, you must first set up a data source in the ODBC manager. The ODBC manager is reached via "*Programs>Settings>System Control>Administrative tools>Data sources (ODBC)*".

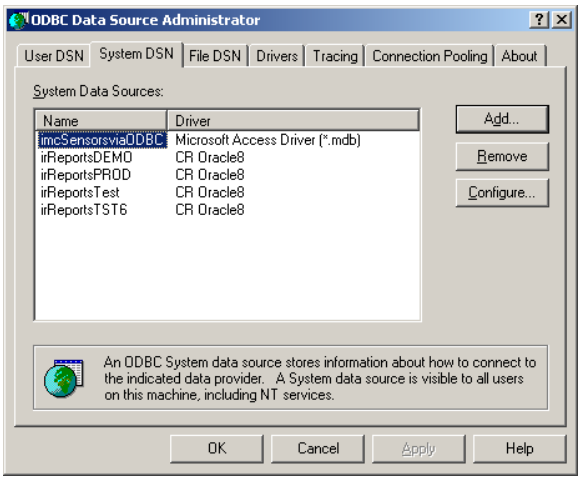
Turn to the page "*System-DSN*" and click on "*Add*".





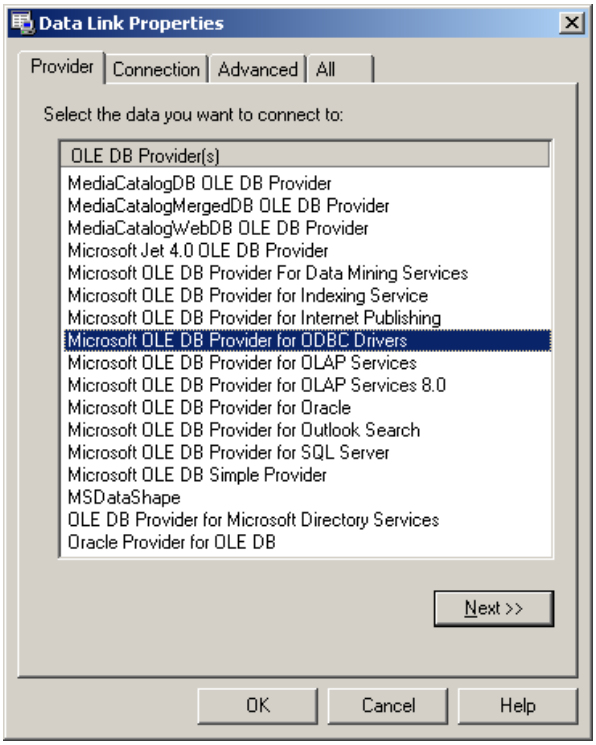
In the dialog "*Create new data source*", select the Microsoft Access driver and click on "*Finish*".

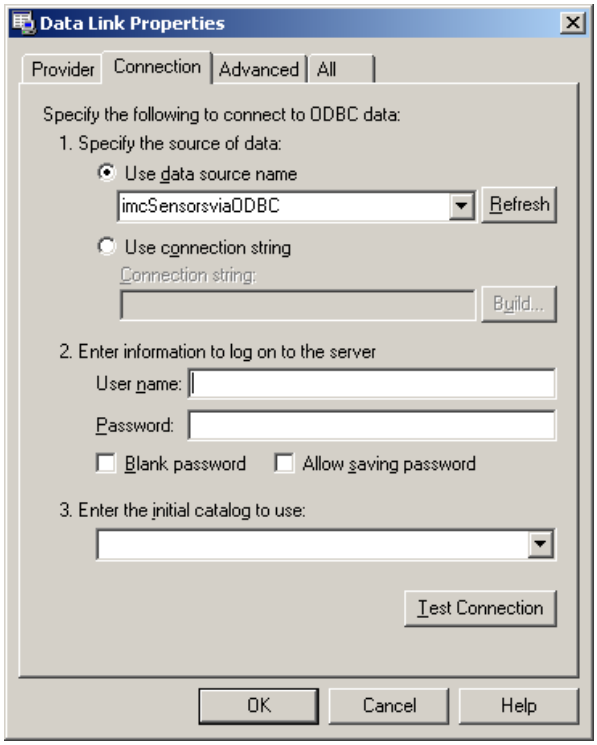




In the dialog "*ODBC Microsoft Access Setup*", enter a name for the data source. Then select the database to which this data source is to be linked. To do this, press the button "*Select*". When you exit the dialog with "OK", the data source appears in the list of the system data sources. Then the ODBC manager can be closed.

In the database connecting wizards "Data Link properties", select Microsoft OLE DB Provider for ODBC Drivers as the provider. On the page "Connection", the data source must appear in the list "Data source name". Select this and enter any user name or password necessary.



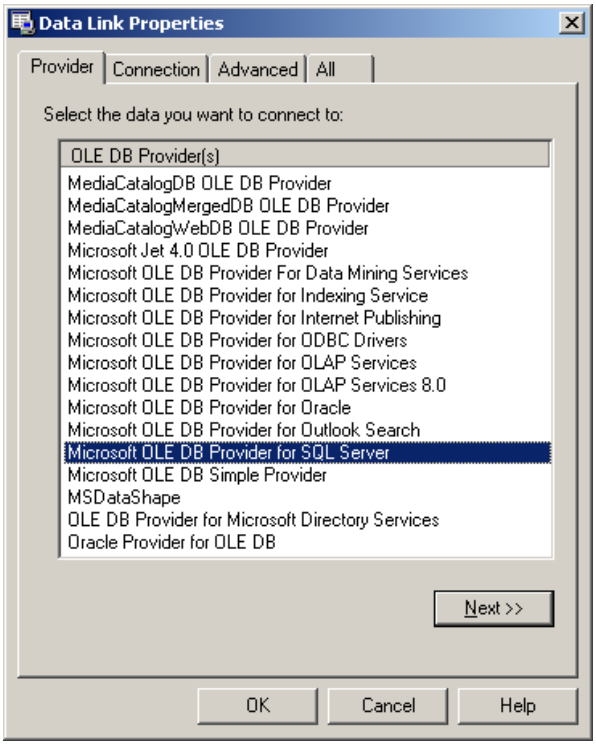


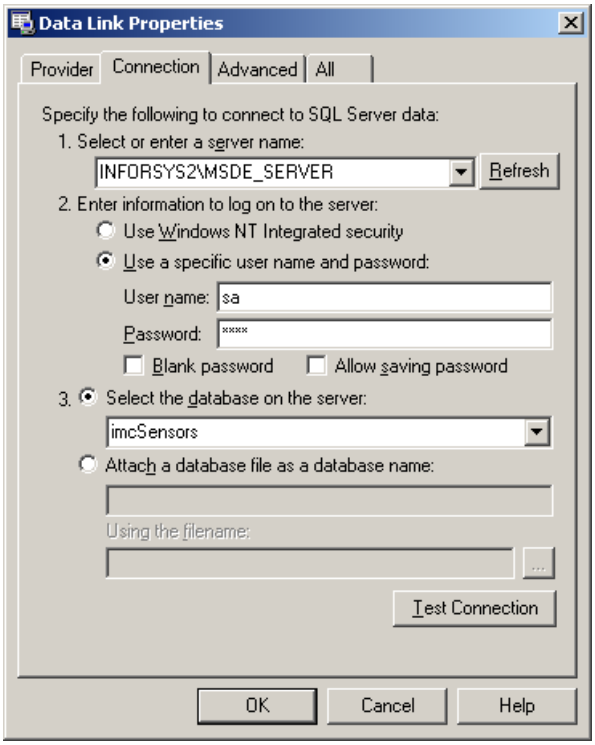
The resulting connection string then takes the form:

```
Provider=MSDASQL;Persist Security Info=False;Data Source=imcSensorviaODBC
```

4.3.2.3 Accessing the Microsoft SQL Server

To make this access available, use the Microsoft OLE DB Provider for SQL Server.





On the properties page "Connection", first select the server. Then enter the user name and password. Then you must select a database. Use the button "Test connection" to verify that the connection to the Server is working.

The resulting connection string then takes the form:

```
Provider=SQLOLEDB.1;Persist Security Info=False;User ID=sa;Initial Catalog=imc
SENSORS;Data Source=INFORSYS2\MSDE_SERVER
```

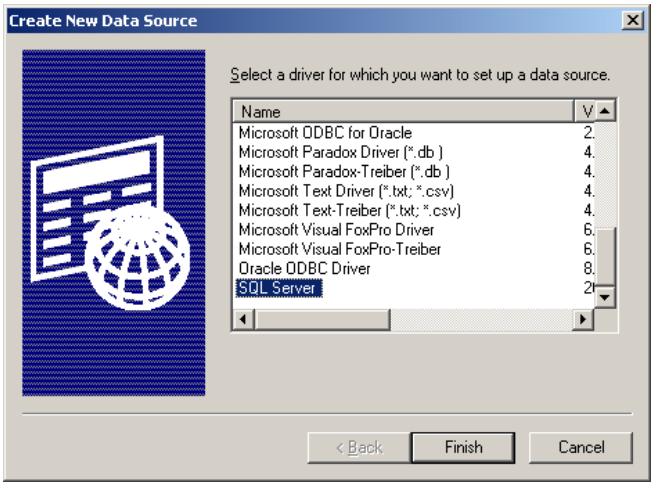
4.3.2.4 Access to the Microsoft SQL Server via ODBC

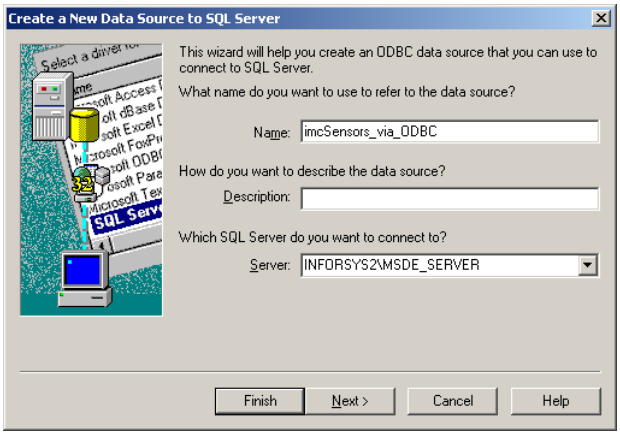
For access via ODBC, you must first set up a data source in the ODBC manager. The ODBC manager is reached via this path:

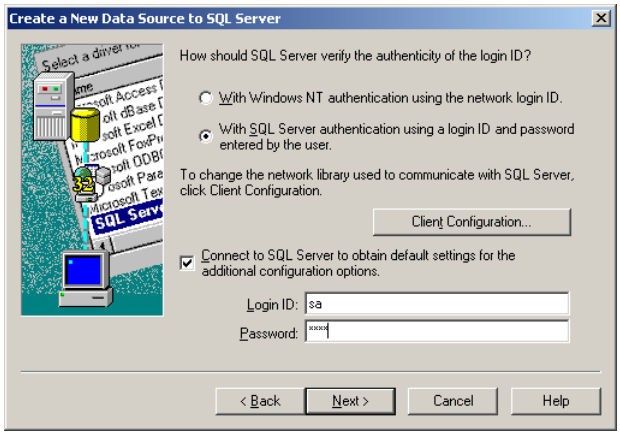
"*Programs>Settings>Control Panel>Administration tools>Data sources (ODBC)*".

Turn to the page "*System-DSN*" and click on "*Add*".

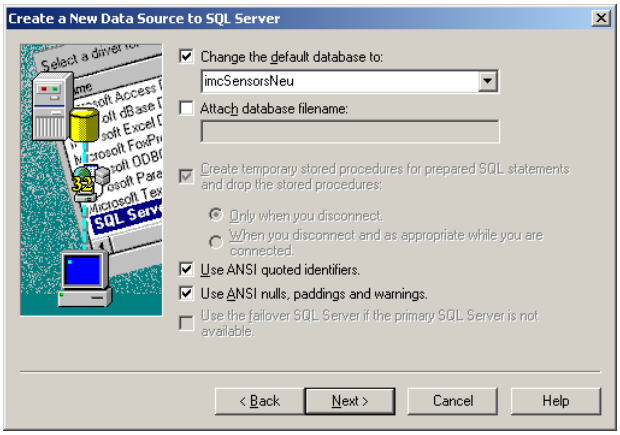
Select the driver "*SQL Server*" and go to "*Finish*".

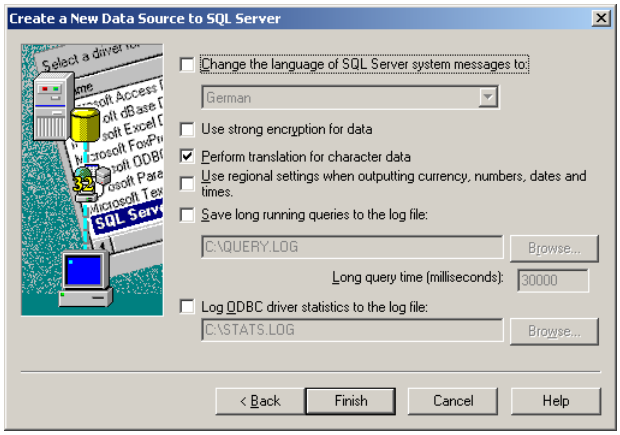




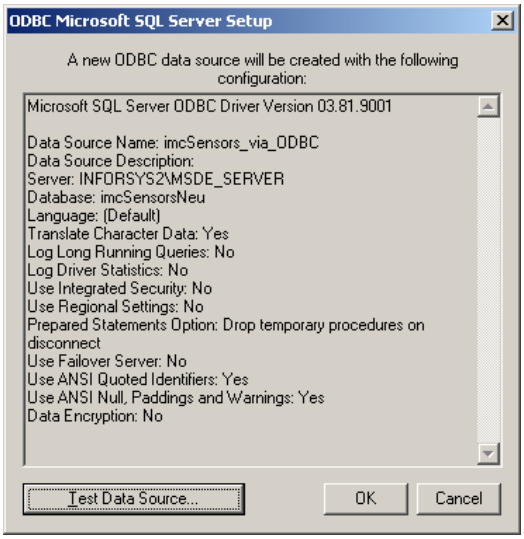


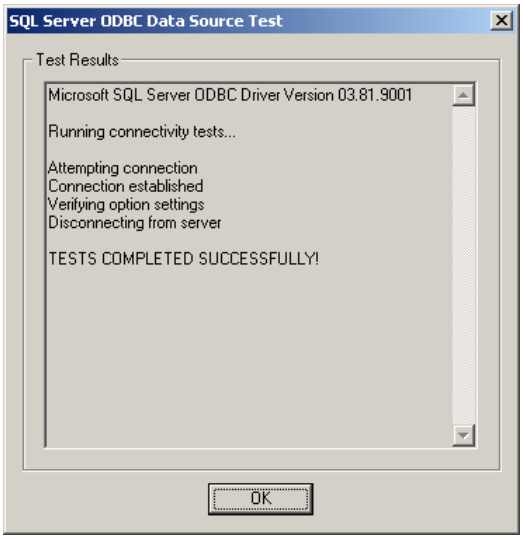
On the first Properties-page, enter a name for the data source and select the server. On the second page, enter the user name and password.





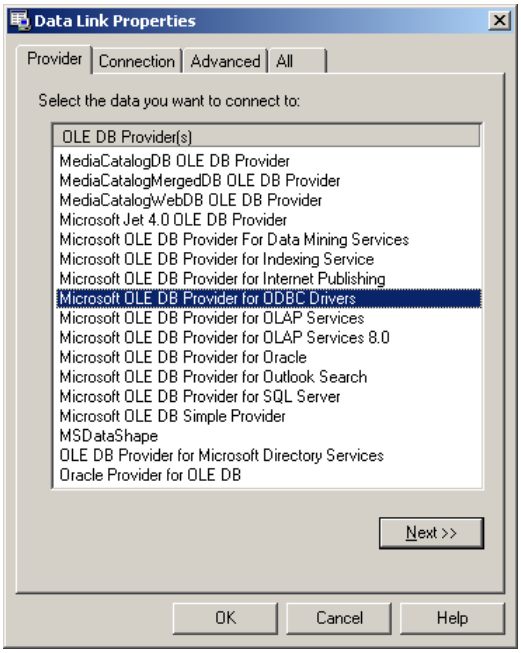
On the third page, change the default database to the database to be used by the application. On the fourth page, the default settings can remain intact. After you press "*Finish*", a dialog box with a summary of the settings appears.

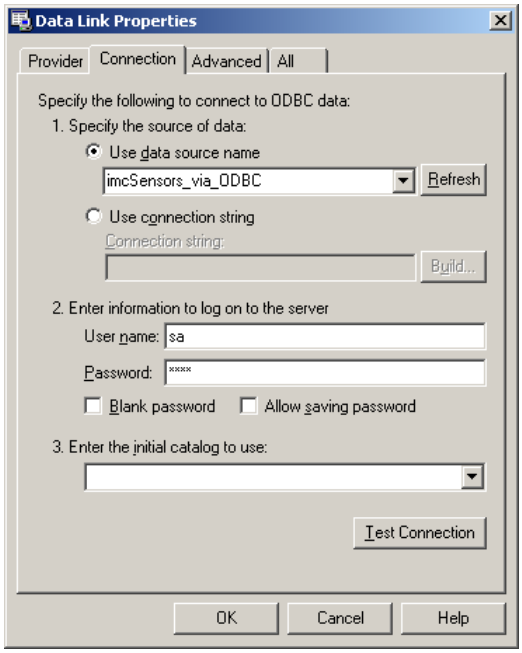




At this point, you can test the access to the data source and subsequently see the test results. In consequence, setup of the ODBC data source is complete.

In the database connection wizard's "*Data Link properties*", select as the provider "*Microsoft OLE DB Provider for ODBC Drivers*". On the page "*Connection*", the data source must appear in the list "Data source name". Select this and enter the user name and password. The initial catalog can remain empty, since the database already was linked with the data source in the ODBC manager.





The resulting connection string then takes the form:

```
Provider=MSDASQL.1;Persist Security Info=False;User ID=sa;Data Source=imc
SENSORS_via_ODBC
```

4.3.2.5 Accessing an Oracle Server via ODBC

For access to an ORACLE database system, an oracle client must be installed on the PC. If this isn't the case, and you attempt to create a data source in the ODBC manager for an Oracle database, the following error message appears:

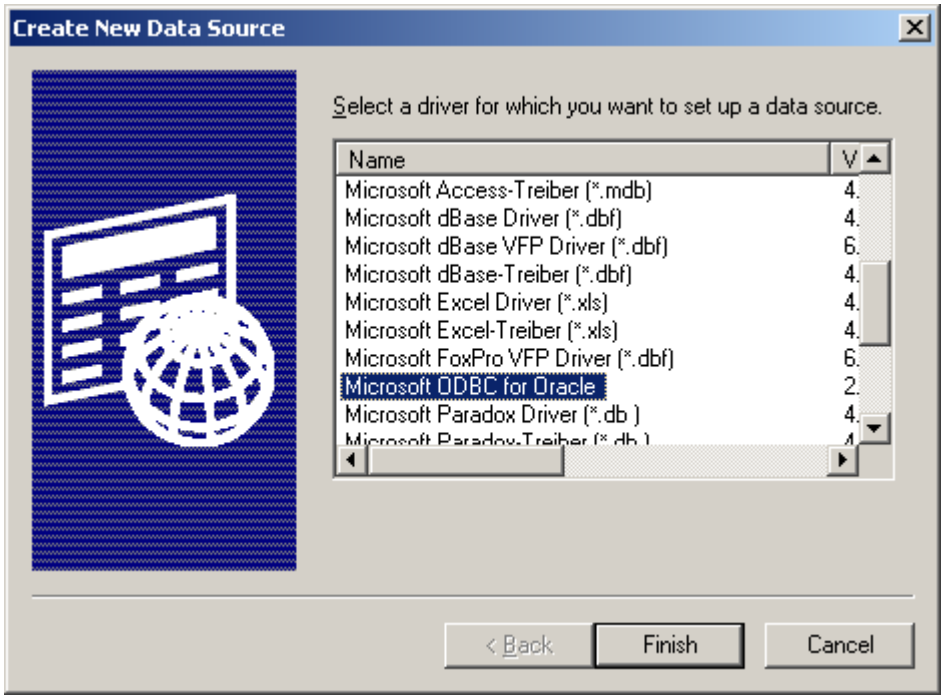
Ask your system administrator to install Oracle's client software on your PC.

First set up the data source in the ODBC manager. To do this, make this call:

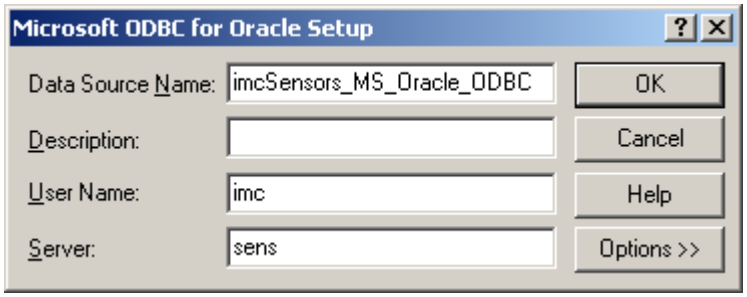
"Programs>Settings>Control Panel>Administration Tools>Data sources (ODBC)".

Turn to the page "*System-DSN*" and click on "*Add*".

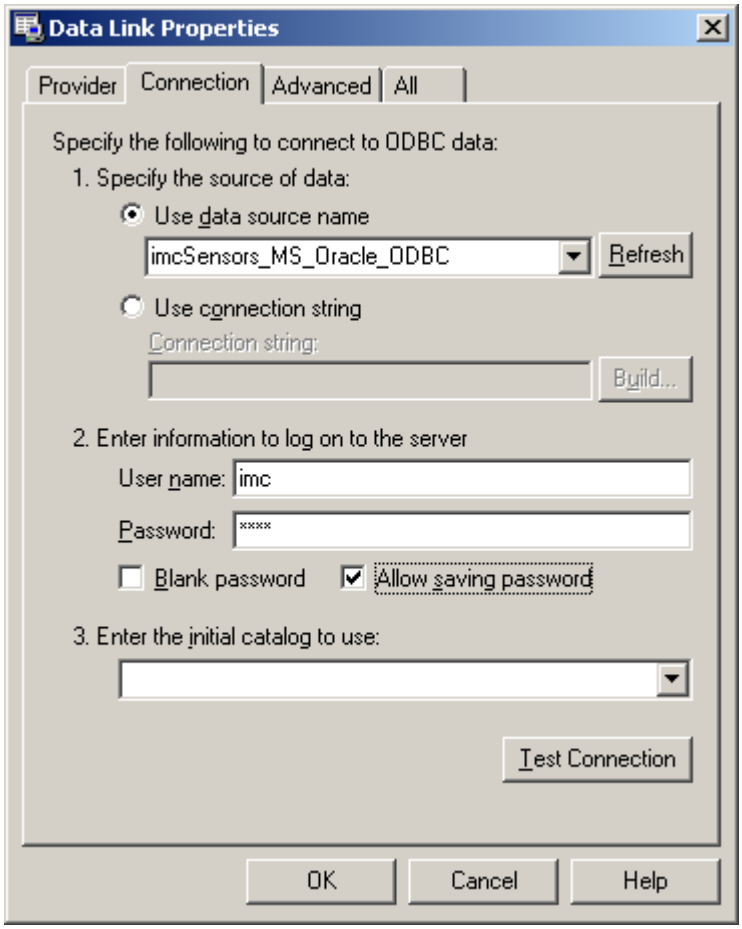
Select the driver "*Microsoft ODBC for Oracle*" and go to "*Finish*". Alongside this driver, the driver "*Oracle ODBC Driver Version 8.01.07.00*" also exists, but don't use it for this application.



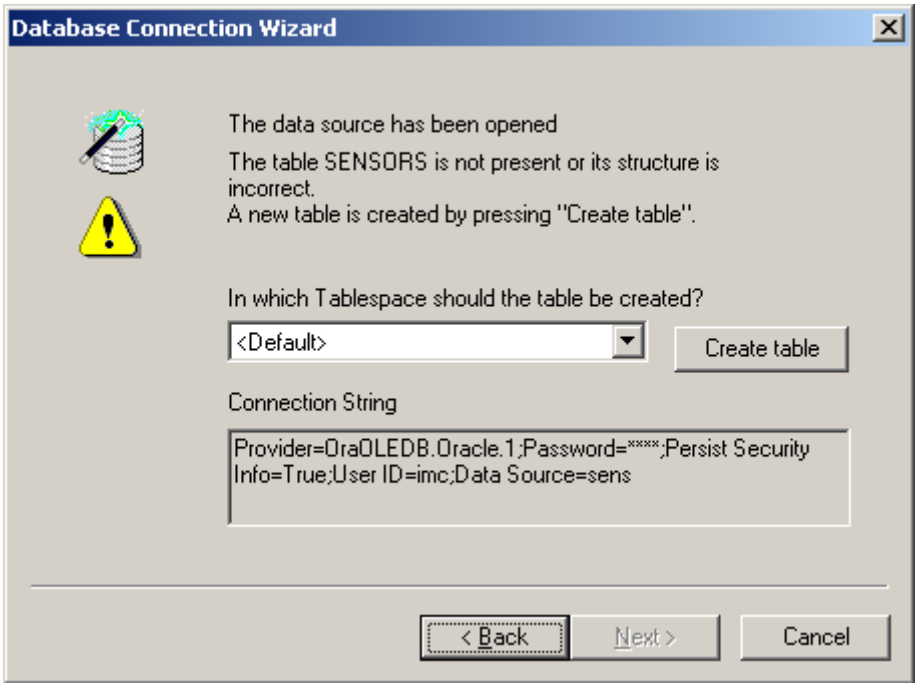
In the following dialog, enter the name for the data source. Furthermore, enter the user name and the name of the Oracle instance. When you press "*OK*", this data source then appears in the ODBC manager.



Once the data source is set up in the ODBC manager, call the database wizard. In the database link properties, select as the provider "*Microsoft OLE DB Provider for ODBC Drivers*". On the page "*Connection*", the data source must appear in the list "*Data source name*". Select it and enter the user and password.



After you exit the "*Data Link properties*", the wizard tries to open the data source. Once this step is completed, the required database tables are checked. If any of these isn't available, the Properties-page "Create Table" appears. Here, be aware of a particular feature.



Here you can select the tablespace in which the table is to be saved. A table space is a container for data in an Oracle database. The tablespace consists of one or more data files, whose size and location are determined by the database administrator. Before data or tables can be added to an Oracle database, the tablespace must be set up.

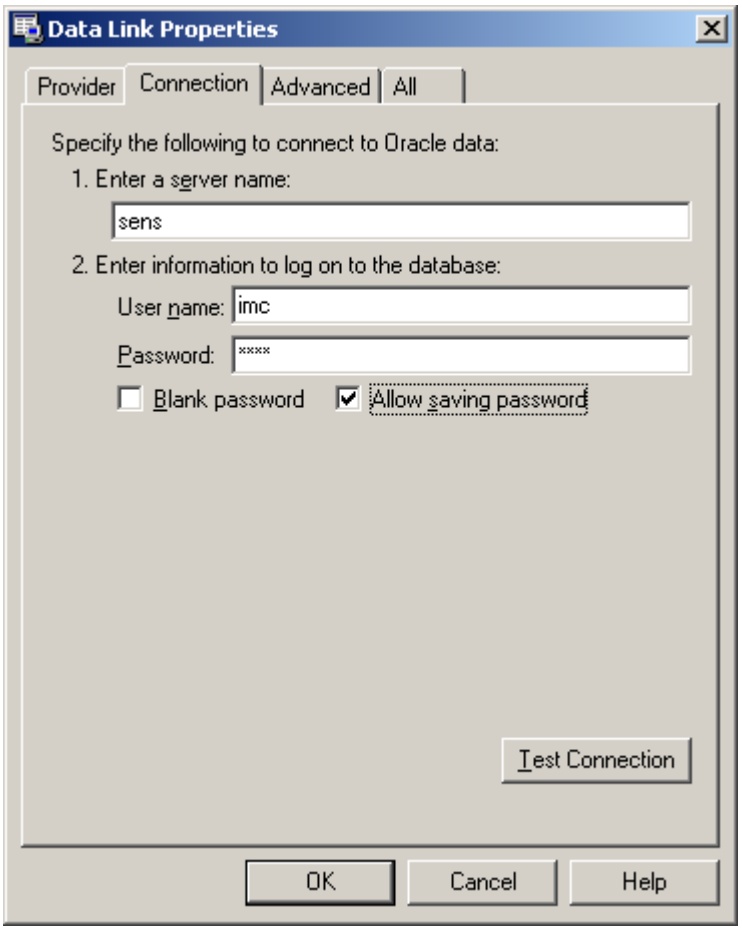
Find out which table pace you can use. If you select the entry "<Default>", the database system takes the default tablespace.

The resulting connection string then takes the form:

```
Provider=MSDASQL.1;Password=****;Persist Security Info=True;User ID=imc;Data Source=imc
SENSORS_MS_Oracle_ODBC
```

4.3.2.6 Accessing the Oracle Server

There are two providers for accessing via an OLE DB-Provider.You can choose either "*Microsoft OLE DB Provider for Oracle*" or the "*Oracle Provider for OLE DB*". The prerequisite is that the Oracle Client software is installed.



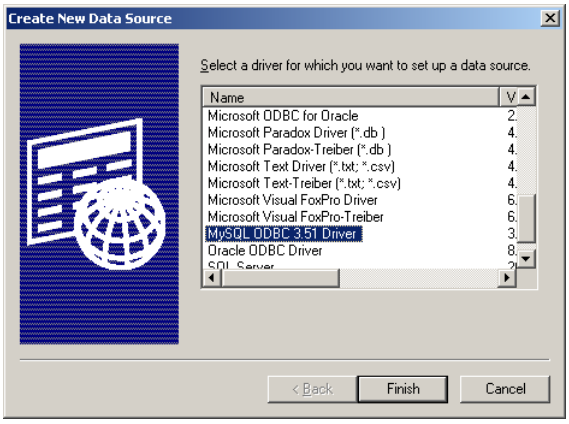
The settings on the Properties-page "*Connection*" are similar for both providers. As the server name, enter the name of the Oracle instance. Then enter the user name and password.

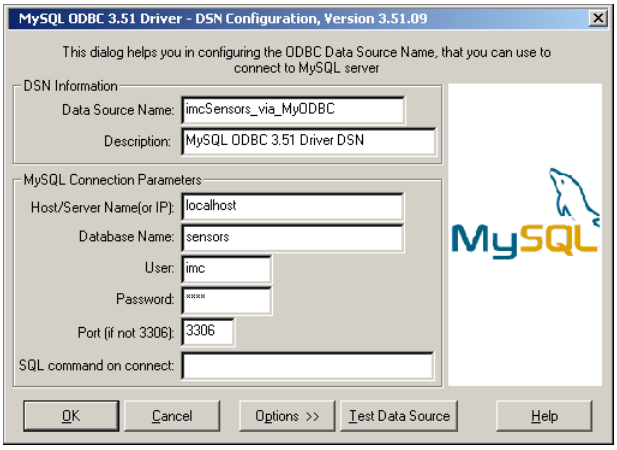
If the database tables still need to be created, you need to select a tablespace. On this topic, read the previous section.

4.3.2.7 Accessing a MySQL Server via ODBC

Access to a database in the MySQL-Server is most reliable via the ODBC. In the following, the MYSQL ODBC Driver Version 3.51.09.00 was used.

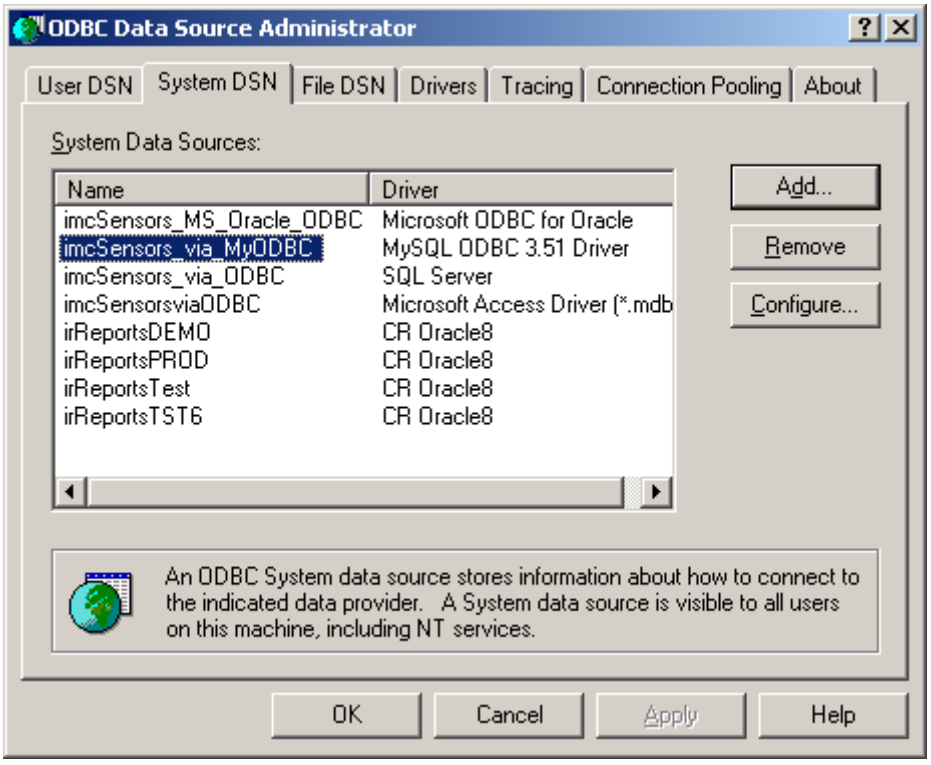
Call the ODBC manager and turn to the page "*System-DSN*". Here, click on "*Add*". Select the driver "*MySQL ODBC 3.51 Driver*" and proceed to "*Finish*".



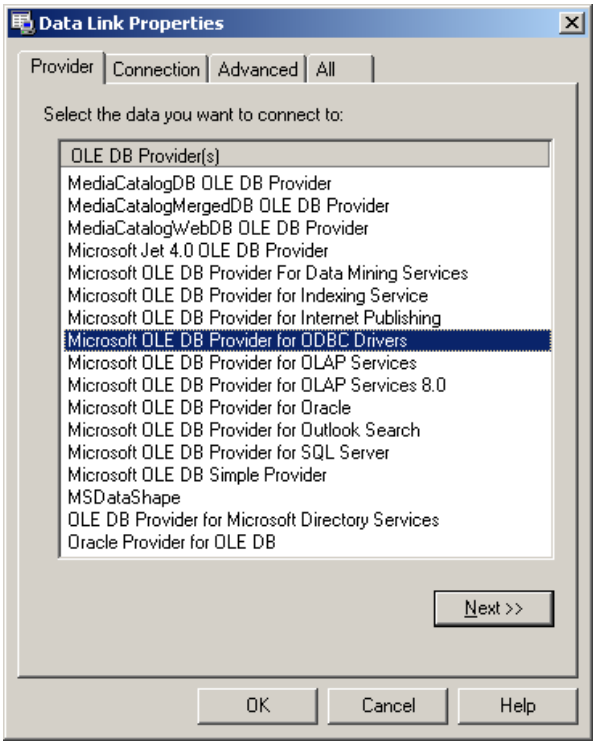


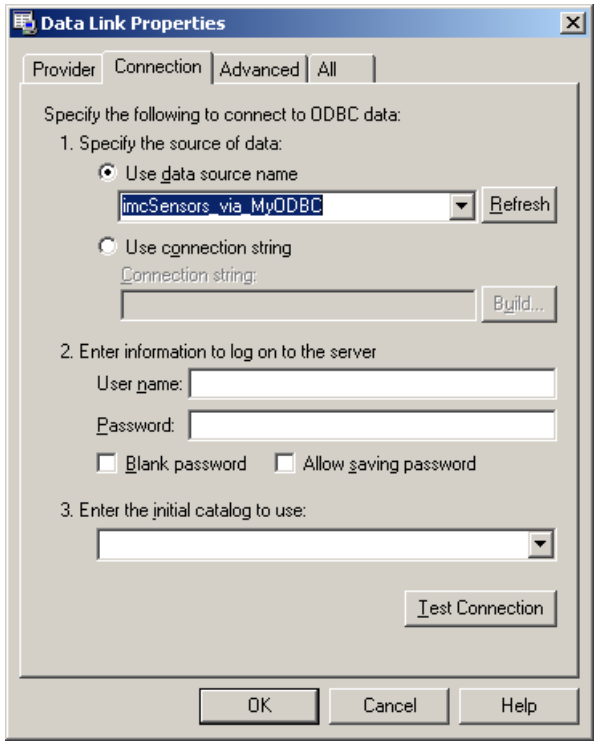
In the dialog "*DSN Configuration*...", enter a name for the data source. Select a name which reflects the database name and the intended use. Under "*Host/Server Name (or IP)*", enter the name or IP-number of the PC on which the MySQL Server runs. If it's a local PC, then "*localhost*" is specified here. As the "Database Name", enter the database which you whish to access. In the boxes "*User*" and "*Password*", you can enter the user name and the password for accessing the database. Under "Port", the IP-port can be specified if it isn't 3306 (default). If the MySQL Server is running on another PC and there is a firewall between the PCs, then Port 3306 must be opened. You can check the access to the data source using the button "*Test Data Source*".

The settings on the page "*Options*" must not be changed.



Following that, the data source is entered in the ODBC manager.





In the database connection wizard, select the provider "Microsoft OLE DB Provider for ODBC Drivers" in the "Data Link Properties". On the page "Connection", the data source must appear in the list "Data source name". Select it. If the user and password were already defined in the ODBC manager, the entries here can remain empty.

The resulting connection string then takes the form:

```
Provider=MSDASQL.1;Persist Security Info=False; Data Source=imc SENSORS_via_ODBC;
```

Along with the ODBC-driver, there is also an OLE-DB-driver ("MySQL.OLEDB Provider"). However, this one is not matured; it causes problems accessing the data source.

4.4 Working with multiple databases

In general, it is recommended to have only a single sensor database (mdb file). Multiple mdb files locally on one PC are basically not recommended.

Nonetheless, it may make sense to have a central database and another one locally on the notebook. This local database can also be used if there is no connection to the Server at the moment.

The user is left with the problem of ensuring the databases match.

For instance, you can work with replicas. Your system administrator may be able to set that up.

If you don't change the local database, but only treat it as a snapshot copy of the central database, no problems should result. The local copy will then not always be perfectly up-to-date, but further matching problems aren't to be expected.

If the local database is also to be edited, refer to the next section.

4.5 Working locally with Notebook and Server database

For independent working on a local copy of the central database, it's recommended that after editing the local database you copy all sensors edited (or for simplicity's sake, everything) in a transport file. This can then be imported to the central database (possibly by the administrator).

Since a sensor's modification date is noted upon importing, only new modifications are adopted. imc SENSORS has no strategy for the scenario, that the same sensor is edited both locally and centrally. However, it is recommended that circles of users work out their own rules for updating sensor information. For instance, maybe only the calibration lab may edit sensors, but a user can set up a new sensor on-site.

4.6 Working with multiple users

If there are multiple users working with a single database, the administrator needs to assign the appropriate rights. Not every user should have the right to write to the database. Another administrative task is to determine who may change what in the database.

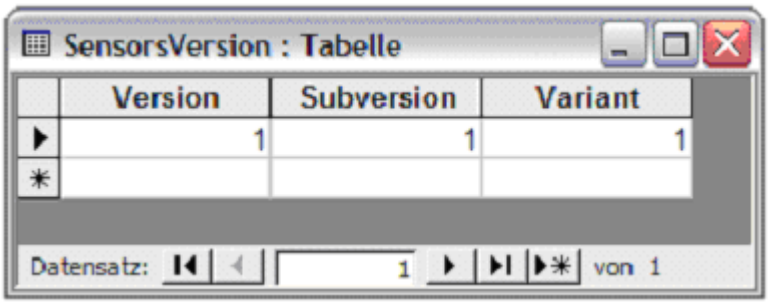
The database stores information on sensors and user-specific properties. Try to ensure that the same element is not edited from multiple terminals.

5 Notes for Developers

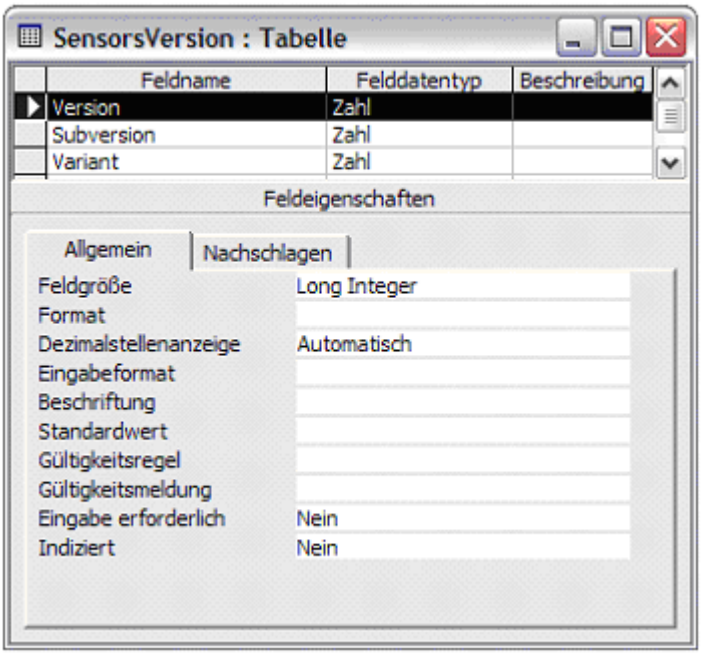
5.1 Database structure

The database consists of two tables.

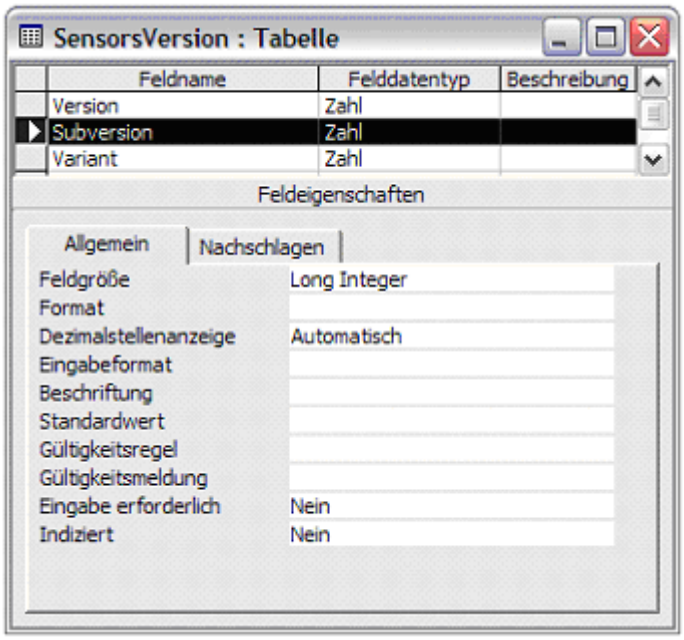
SensorsVersiontable:



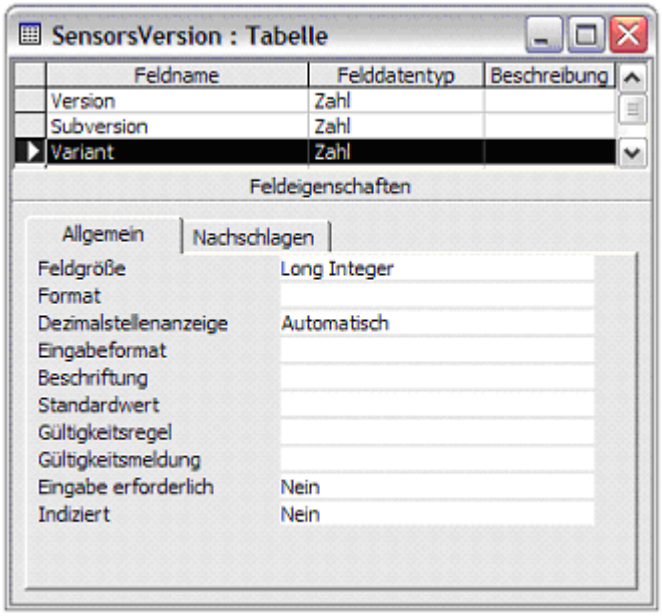
Column "*Version*":



Column "*Sub-version*":



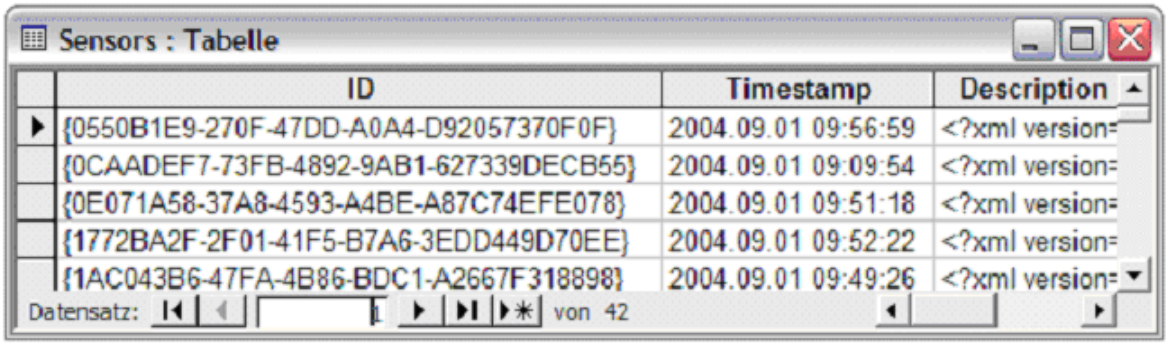
Column "*Variant*":



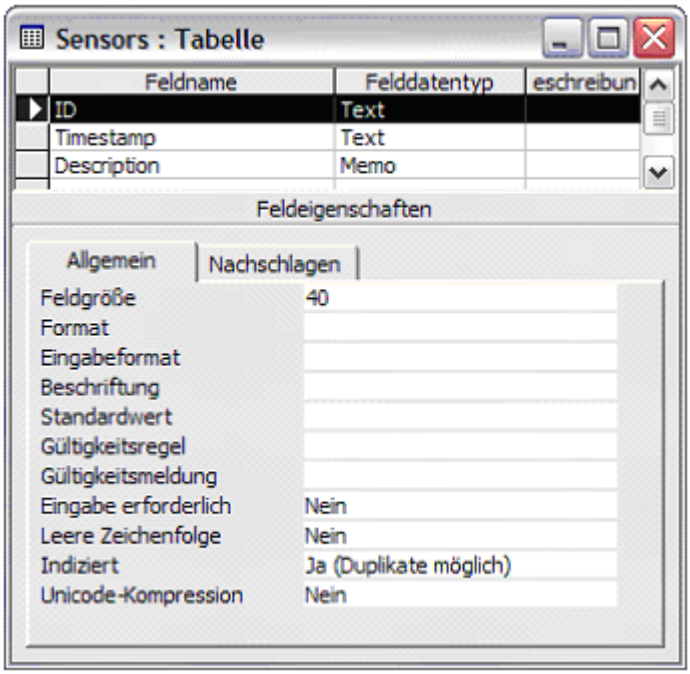
Contents: This table contains a data set with the values

- Version = 1
- Subversion = 1
- Variant = 1

Table "*Sensors*" .



Column "*ID*":



The ID is a valid GUID (global unique identifier). It must be assigned by the operating system and be unique. The GUID format is universally standardized. The ID identifies a sensor uniquely. Any two different sensors also have two different IDs. But a single sensor can have an old and a new state. In that case there are different timestamps, but the ID remains the same.

Example of a GUID: {00BD3094-3E9A-4116-AE8E-340D123CAE7C}

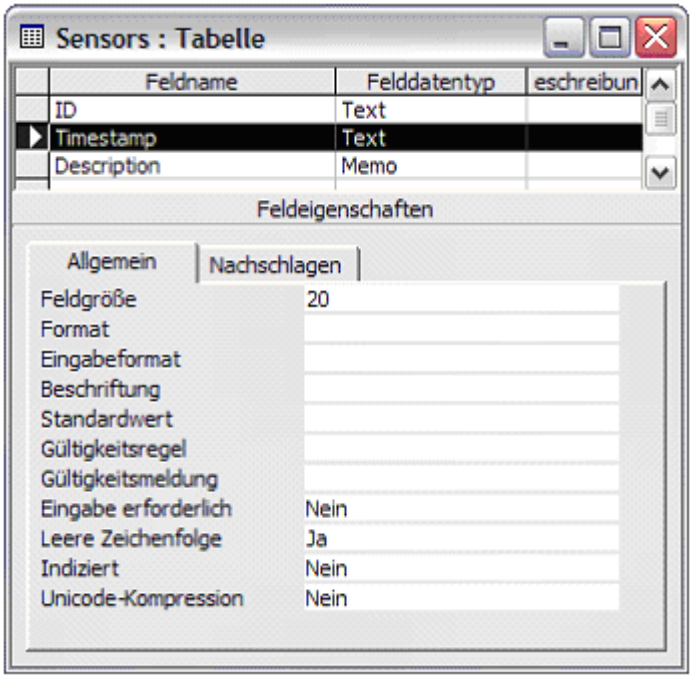
Special function "Sensor-UserProps" :

If the ID contains the text Sensor-UserProps, then that isn't a sensor description, but the description of the user-specific properties. These properties are administered like the properties of a sensor, in other words by means of a history record.

Future special function:

When reading a cell, check whether the first character is "{". In that case it should contain a valid GUID. Otherwise it must be assumed that it's a special function.

Column "Timestamp":



The timestamp is the date when the sensor was last modified. The format is fixed and independent of the country. Note in particular, that it is recorded in text format, enhancing its portability.

Format:

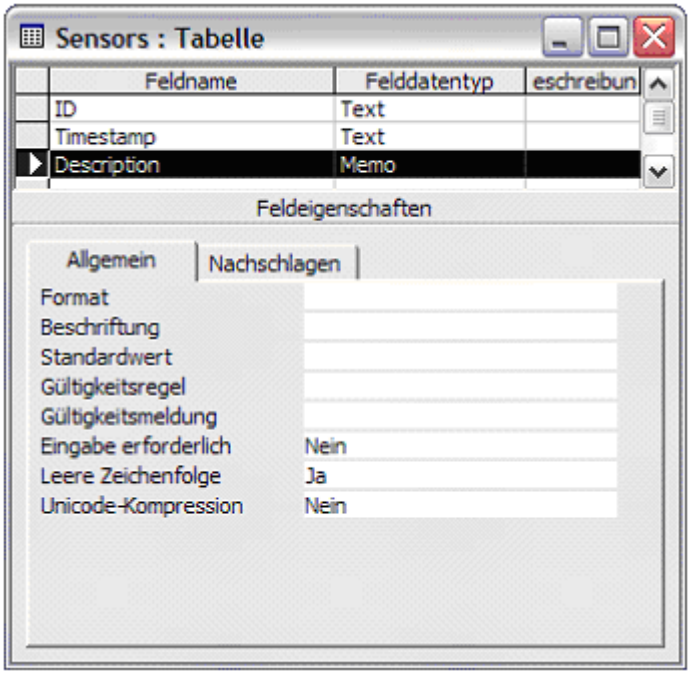
- 4 digits for the year, e.g. 1004
- 1 point
- 2 digits for the month, if appropriate with an initial zero, e.g. 01 or 12
- 1 point
- 2 digits for the day, if appropriate with an initial zero, e.g. 01 or 31
- 1 space (blank)
- 2 digits for the hour, if appropriate with an initial zero, e.g. 00 or 23
- 1 colon (":").
- 2 digits for the minute, if appropriate with an initial zero, e.g. 00 or 59
- 1 colon (":").
- 2 digits for the second, if appropriate with an initial zero, e.g. 00 or 59

By default, imc SENSORS displays a sensor's newest information, in other words the info with the latest date.

In the history which can be recorded in imc SENSORS for a selected sensor, all data sets pertaining to the ID are recorded chronologically.

When a sensor is deleted, a data set with the timestamp of the deletion is also recorded. The description is then empty. These sensors are then only displayed by imc SENSORS when the "*Deleted sensors*" are found.

Column "*Description*":



In this column, the xml-text with the sensor description is recorded. The text is recorded in ASCII format (not Unicode). It always begins with "<?xml". The field can contain very long texts. Newer versions of MS Access support texts larger than 64k.

The field is empty if a sensor is deleted. This applies to the data set which represents a deleted sensor. Naturally, there can be a history for the same sensor. In the history, a valid xml text is given in each data set.

Examples and descriptions are available below in the section "*Sensor description structure*".

In the case of special functions, the xml format in the description is different than for sensors.

Content: This table contains (at least) one data set for each sensor.

Index:

For the cells "*ID*" and "*Timestamp*", it can be advantageous to have a compound index. That makes the various database-accessing procedures somewhat more efficient.

Remarks:

- Use of the history is recommended but not obligatory. An application can determine to record for a sensor just one current state in the database.
- The application can determine whether deleted sensors are branded as deleted (like in the Windows recycling bin). If you dispense with such branding, the sensor (in other words its corresponding data set) could also be deleted permanently. Then there would no longer be any data set with the deleted sensor's ID.

5.2 XML format in Clipboard and in Import/Export

For exporting and importing sensor information, an xml file format is used. Such a file may contain information on multiple sensors. When copying / pasting via the Windows Clipboard, the same format is used.

The file complies with the general rules for xml files. In particular, be sure that the content of elements doesn't contain the characters "<", "&", "'", "“". Instead, use "&tt;", "&", "'", """. Instead of ">", you can also use "<". Refer to the general xml specifications. Elements may not have attributes.

Example:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<SList>
<LU><p></p></LU>
<L>
<LF>0000000000000000</LF>
<LT>2004.09.23 07:38:11</LT>
<LG>{780729ED-593E-4B50-9078-36CFEEC4A4A1}</LG>
<LS><s>
     <S>
          <St>0</St>
     </S>
</s></LS>
</L>
</SList>
```

The elements

- Beginning: Depends on the character set used. E.g. in Central Europe:
  - o <?xml version="1.0" encoding="ISO-8859-1"?>
  - o For a detailed list, see below in the section "Sensor description structure".
- <SList>: The root-element. There is exactly one of these.
- <L>: This element is present either multiple times, once, or not at all in <SList>:. This element is recorded once for each sensor which the file is supposed to contain.
- <LF>: Reserved for future use. At the moment its value is "0000000000000000".
- <LU>: The user-specific properties. The contents of the file SensorUserProps.xml without their header. This enables the user-specific properties of the sensors further below to be interpreted upon later use of Import. This element is used only once (for the first sensor).
- <LT>: The sensor information's timestamp. See "Timestamp" in the database on the format, in the section "Database structure".
- <LG>: GUID: The sensor's ID. See "ID" in the database on the format, in the section "Database structure".
- <LS>: This is where the sensor's actual description is, which contains the <s> element.
- <s>: The sensor description's root. The xml-prefix <?xml... does not appear again here.

5.3 Storage of xml texts in the TEDS sensor

The functions (e.g. imc CANSAS COM, imc DEVICES COM, imc SENSORS COM) which exchange the sensor description generally transfer the GUID (the sensor ID) separately or don't even have it. The plain sensor description always includes the root-element <s>. This root-element is also used in a TEDS sensor's Eprom.

The comprehensive transfer with <SList> is used for complete transport of one or more sensors' information.

Example:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<s>
    <S>
        <St>O</St>
    </S>
</s>
```

5.4 Sensor description structure

Here is where the substance of the sensor's description is.

Example:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<s>
     <G>
          <GM>Burster</GM>
     </G>
     <S>
          <SA>500</SA>
          <SI>-500</SI>
          <Sa>0.05</Sa>
          <Si>0</Si>
          <St>O</St>
     </S>
     <U>
          <Un>5</Un>
     </U>
</s>
```

5.4.1 Language groups and XML-encoding

At the beginning of the xml text, the encoding is stated. The following types are supported:

Encoding	Language group
ISO-8859-1	Western Europe
ISO-8859-5	Cyrillic
ISO-8859-7	Greek
ISO-8859-9	Turkish
ISO-8859-8	Hebrew
ISO-8859-6	Arabic
ISO-8859-11	Thai
Shift_JIS	Japanese
GB2312	Chinese
EUC-KR	Korean
Big5	Taiwan
UTF-8	Unicode 8 bit, universal

Not only the language, but the encoding of the characters, in other words, the character set (codepage) is crucial.

For good data compression:

* Use one of the suggested beginning texts. Adhere to the string exactly, including the selected character set from this list. The upper-/lowercase spelling must also be adhered to, also for encoding.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<?xml version="1.0" encoding="ISO-8859-5"?>
<?xml version="1.0" encoding="ISO-8859-7"?>
<?xml version="1.0" encoding="ISO-8859-9"?>
<?xml version="1.0" encoding="ISO-8859-8"?>
<?xml version="1.0" encoding="ISO-8859-6"?>
<?xml version="1.0" encoding="ISO-8859-11"?>
<?xml version="1.0" encoding="Shift_JIS"?>
<?xml version="1.0" encoding="GB2312"?>
<?xml version="1.0" encoding="EUC-KR"?>
<?xml version="1.0" encoding="Big5"?>
<?xml version="1.0" encoding="UTF-8"?>
```

5.4.2 Data types for elements

Only property elements (e.g. <St>) possess true content. The data type is determined by imc SENSORS. For the standard properties, the data type is determined according to the following section. For user-specific properties, the user determines the data type.

The xml file naturally always contains text. But depending on the data type to be represented, there are restrictions on the text.

The following data types are defined:

- Text: Any text is allowed. Example: <GM>Burster</GM>. Attention: Comply with xml syntax and special characters.
- Integers. Positive and negative integers, e.g. 128, -200
- Real numbers: Any real numbers, in either fixed-point or floating-point format, e.g. 1, -0.7, 3.4E-3, -1e-10. Use decimal point (not comma). The "+" character is only allowed in the exponent.
- Date, always with 4, 2, 2 digits and points as separators; the order is always year, month, day, e.g. <Cv>2006.09.23</Cv>.
- Date and time (at the moment only for internal use). See "Timestamp" in the database on the format, in the section "Database structure".
- Color: The color value is stated as a RGB-value in decimal form. RGB-value = red-component + 256 * green-component + 65536 * blue-component. E.g. <K6>255</K6> for "red".
- Selection 1 among N: In the xml-file there is only a short text, which stands for a particular value of a property as a placeholder or language-independent substitute. The exact specification and assignment of placeholders for descriptions For standard properties, the specifications and assignment of placeholders are noted in the section below; for user-specific properties, they are made using imc SENSORS. E.g. <St>T</St> and <St>A</St>.
- Sequence of real numbers: Multiple individual real numbers are separated by <n/>. E.g. <Cr>-17.3<n/>17.2</Cr>
- Link: File name including path. E.g. \\server\dastasheet\0045.pdf

5.4.3 Rules (especially syntax)

- The text must be well-formed (in the xml sense).
- The root-element is <s>
- Below the root-element there are one or more tags denoting the groups. All elements of one character in length are reserved for fixed definitions, e.g. <G> for "General". These groups are listed in the following section. There may be more in future and they are therefore reserved. Elements with greater lengths, e.g. "AB" are user-specific.
- Below a group-element you have the property-elements. All elements of two characters in length are reserved for fixed definitions, e.g. "St" for "Sensor type". These properties are listed in the section below. Others can follow and are therefore reserved for the future. Elements with longer lengths, e.g. "AB0" are user-specific. User-specific properties are at the moment only supported on user-specific groups.
- Within the tag texts, the following strings beginning with "&" can be used: ">", "<", "&", "'", """
- Upper- and lower-case spelling of the properties and groups are distinguished and must be observed.
- Attributes (xml attribute at a tag) are not possible.
- On the group level (e.g. <S>) and above (<s>), there are no texts. Texts are only entered directly in the property-elements (e.g. <St>).
- There are no other element levels.

- Element <o/>: New output. This element comes after a completed group. This element indicates that all the subsequent groups and properties belong to the next sensor output. The subsequent output inherits all properties of the first output (not of its predecessor!). All deviating properties must be stated explicitly.

  Example:

```
<s>
    <S>
        <St>A</St>
    </S>
    <o/>
    <S>
        <St>A</St>
    </S>
</s>
```

- Element <n/>: Next numerical value in a sequence of numbers.

  Example:

```
<s>
    <S>
        <St>A</St>
    </S>
    <C>
        <Ce>1.2<n/>2.3<n/>4.00</Ce>
    </C>
</s>
```

- imc SENSORS only takes known properties and groups into account. This applies both to standard defined and user-specific ones.
- For good compression (especially important when writing sensor information to an Eprom!) :
  - No spaces around numbers.
  - No spaces around texts.
  - Only the suggested character sets should be used. No 2-byte Unicode (16bit).
  - For line breaks, it can be advantageous to use <cr> (ascii 13) or <cr><lf> (ascii 13, 10) or <lf> (ascii 10). For indentation, up to 3 tabs can also be added 0..3 Tabs (ascii 9).
  - Texts should be kept short.
  - Have few or short user-specific properties.

5.5 Eprom contents

The Eprom for sensor recognition can be describes as per IEEE 1451.4. This is usually the case with sensors which are directly equipped by the manufacturer with a Prom or Eprom.

imc SENSORS administers a sensor's properties in the form of an xml text. In 2004-Sept., IEEE 1451 does not yet define xml texts. For that reason, a so-called manufacturer-specific format (free form TED) must be used.

5.5.1 Format of the Flash contents

Offset	Content	Keyword	Description
0	2 Byte WORD intel	1451 freeform TEDS	As per IEEE 1451 the necessary ID of a freeform TEDS: Value = 2
2	2 Byte WORD intel	magic	Magic number for recognition of Flash content. Default zero.
4	4 Byte DWORD intel	password	Number used as a password. The sensor Flash can only be edited upon entering the same password. Zero is not a password. Default zero.
8	2 Byte WORD, intel	body length	The body is this many bytes long. Incl. the first 14 bytes
10	2 Byte WORD, intel	format	body format 3: Ascii in XML 4,5,6: XML compressed.@
12	2 Byte WORD, intel	version	version of body; 1:
14	Array BYTE [ ]	body	Actual content. XML block, terminated and filled in with 0x00 (00H)
510	2 Byte WORD, intel	checksum	checksum as per CCITT

5.5.2 Exchange of Eprom content via CANSAS COM and imc Devices COM:

Beginning of the binary data block (byte array), determined when the sensor Flash Eprom is read:

Offset	Content	Keyword	Description
0	2 byte WORD intel	wsensorstatus	SENSOR_STATUS_*. Is a sensor connected and if yes, is its Flash in order and suitable for the module?
2	2 byte WORD intel	wSensorDetectCode	OR-operator applied to SENSOR_DETECT_*. With a sensor missing, an info about externally connected wire jumpers which are also supposed to characterize a certain sensor.
4	8 byte with DWORD [2] intel	dwFlashUnique	The 64 ID (ROM-ID) of the 1-wire Flash: 8 + 48 + 8 bit
12		Eprom-content	

In this context, wsensorstatus in the table above can take one of the following values:

Codes for wsensorstatus	Value	Definition
SENSOR_STATUS_NO	0	no sensor connected
SENSOR_STATUS_PRESENT	1	sensor present, no error detected (yet)
SENSOR_STATUS_CHECKSUM	2	sensor with invalid Flash Eprom contents connected, incorrect content checksum
SENSOR_STATUS_FAMILYCODE	3	sensor-Flash has incorrect family code. Only 23H is allowed
SENSOR_STATUS_CRCTESTER	4	CRC tester of the sensor flash's ROM-ID is incorrect
SENSOR_STATUS_READ	5	error in read-access to sensor Flash
SENSOR_STATUS_FILLED	6	incorrect statement of length in the sensor-Flash header, entry wFlashBytesFilled
SENSOR_STATUS_NOISE	7	Disturbed signal. Sensor-Flash signal not stable enough to read
Other values @	< 16	error
Other values @	>=16	warnings, but Eprom is read

And the list of the wSensorDetectCode:

Bit from wSensorDetectCode	Value	Definition
SENSOR_DETECT_VOID	0x0000	/* no particularities
SENSOR_DETECT_SHORTCIRCUIT	0x0001	A permanent short-circuit detected at the sensor Flash's input (Pins D and E). If not set, either there is an Eprom connected or E-D permanently on High
SENSOR_DETECT_FDLOW	0x0002	/* The voltage F-D is about < 1.2V. This means: it can either be the jumper F-G for Type K thermocouple or a PT100, potentiometer, bridge,...
other		reserved

Customer-specific decision table:

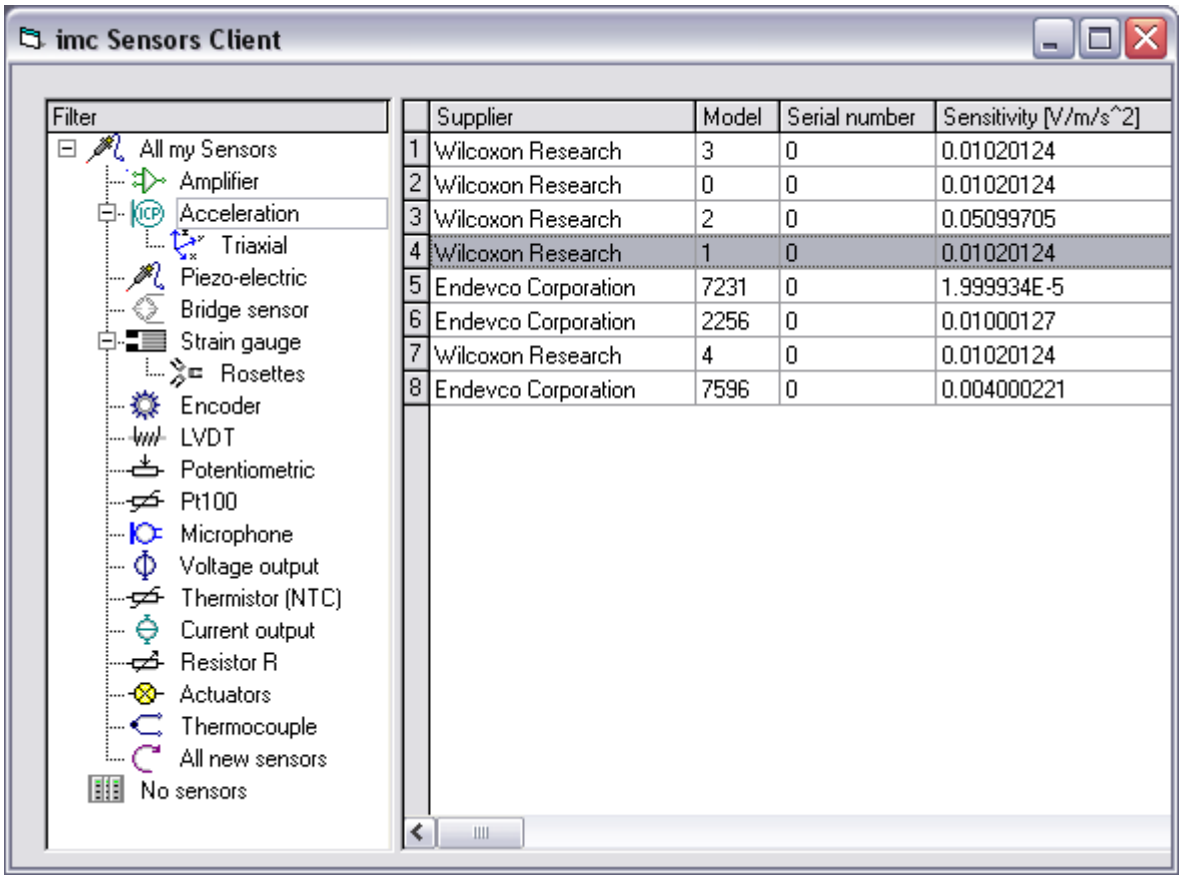
Eprom situation wsensorstatus =	**Bridge situation:** wSensorDetectCode =	**Conclusion**
SENSOR_STATUS_PRESENT	any	Sensor Eprom present. Its content must be evaluated.
SENSOR_STATUS_NO	SENSOR_DETECT_VOID	No information on connected sensor available. User-specific interpretation: no measurement source
SENSOR_STATUS_NO	SENSOR_DETECT_FDLOW	User-specific interpretation: Type K thermocouple. Whether installed with or without ground reference is unknown. Suggestion: make settings for "installed with ground reference".
SENSOR_STATUS_NO	SENSOR_DETECT_SHORTCIRCUIT	No information on connected sensor available. User-specific interpretation: Unknown measurement source
SENSOR_STATUS_NO	SENSOR_DETECT_FDLOW und SENSOR_DETECT_SHORTCIRCUIT	Hardly any information on connected sensor available. Could be resistor, potentiometr. sensor, 3-wire PT100, 4-wire PT100 or a bridge. User-specific interpretation: maybe PT100
Other values	any	Sensor Eprom connected, but unreadable because wrong type, defective, interference, … No information on connected sensor available.

5.6 ActiveX Control

The key elements of the imc SENSORS user's interface are also available as ActiveX controls.

In addition, a COM library is also available.

All necessary aids, files and examples are installed in the .\ActiveX subfolder. Refer also to the chapters "*Installation*" and "*Installed files*".



6 Reference

6.1 Group General

- Description:
  In this group, properties are listed which can help identify and administer the sensor.
- Abbreviation: G
- One at most present: Yes

6.1.1 Property Supplier:

- Abbreviation: GM
- Description:
  Manufacturer's designation. If possible, a sensor should be equipped with the properties Supplier, Model and Serial number for identification purposes.
- Format: Text
- See also: Model, Serial number
- Applicability:

Sensor type	Usage
All others	Recommended

6.1.2 Property Model:

- Abbreviation: Gm
- Description:
  Model descriptor. A model designation by the manufacturer. The name the manufacturer gives this production series, type or model.

  If possible, a sensor should be equipped with the properties Supplier, Model and Serial number for identification purposes.
- Format: Text
- See also: Serial number, Supplier
- Applicability:

Sensor type	Usage
All others	Recommended

6.1.3 Property Serial number:

- Abbreviation: Gs
- Description:
  In general, the serial number is a text, not necessarily a number. The serial number must always be specified if the sensor even has one.

  If possible, a sensor should be equipped with the properties Supplier, Model and Serial number for identification purposes.
- Format: Text
- See also: Model,Supplier
- Applicability:

Sensor type	Usage
All others	Recommended

6.1.4 Property Manufacturer code:

- Abbreviation: Ga
- Description:
  The manufacturer's code assigned as per the standard IEEE 1451.4. The values 0..16 are not allowed, according to this standard. Values from 17 to 16382 are uniquely assigned to manufacturers. Assignment can be made only by IEEE 1451 committee.
  Manufacturer ID
- Format: Int
- Applicability:

Sensor type	Usage
All others	Unimportant

6.1.5 Property Barcode:

- Abbreviation: GA
- Description:
  The barcode by which the sensor is identified. the barcode is stated as an ASCII text.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

6.1.6 Property Acquired on:

- Abbreviation: Gb
- Description: Date of sensor acquisition
- Format: Date
- Applicability:

Sensor type	Usage
All others	Possible

6.1.7 Property Designation:

- Abbreviation: GB
- Description:
  Identifies this sensor. Especially if it's not possible to identify the sensor by its manufacturer, type or serial number.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible

6.1.8 Property Comment:

- Abbreviation: GC
- Description: Clarifying comments. The comment should be really brief!
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible

6.1.9 Property Batch:

- Abbreviation: Gc
- Description:
  Statement of the lot from which the sensor comes. Especially for sensor type Strain gauge bridge.
- Format: Text
- Applicability:

Sensor type	Usage
Strain gauge bridge	Possible
All others	Unimportant

6.1.10 Property Code:

- Abbreviation: GD
- Description:
  Further sensor ID. Especially for the sensor type Strain gauge bridge.
- Format: Text
- Applicability:

Sensor type	Usage
Strain gauge bridge	Possible
All others	Unimportant

6.1.11 Property Department:

- Abbreviation: Gd
- Description: The department in which the user works
- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

6.1.12 Property Device type:

- Abbreviation: Gg
- Description:
  Designation of device type, e.g. measurement device, controller, power adapter
- Format: Text
- Applicability:

Sensor type	Usage
No sensor	Recommended
All others	No

6.1.13 Property Inventory number:

- Abbreviation: Gi
- Description: The inventory number for the sensor assigned by the user
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible

6.1.14 Property Document:

- Abbreviation: Gk
- Description: Link to a document, or a file

  A complete filename including path is specified. A URL. The software must be able to locate the file anywhere from where the user calls the software. If e.g. a network is used, then the local filename (like c:/Datei.pdf) cannot be used.

  The document can be, for instance, a related pdf file or a picture.
- Format: Link
- Applicability:

Sensor type	Usage
All others	Possible

6.1.15 Property Assignment:

- Abbreviation: GI
- Description:
  A user-defined text for identifying the sensor. Often a number.

  This property is used if other properties such as Inventory number, Database reference, Barcode, Serial number are not sufficient or not appropriate.

  With the help of this text, the user can provide a unique assignment for the sensor in other systems (e.g. user software, RFID, stickers, Excel-tables).
- Format: Text
- See also: Inventory number, Database reference, Barcode, Serial number
- Applicability:

Sensor type	Usage
All others	Possible

6.1.16 Property Lot:

- Abbreviation: GL
- Description:
  Designation of the production lot to which the sensor belongs. Especially for sensor type Strain gauge bridge.
- Format: Text
- Applicability:

Sensor type	Usage
Strain gauge bridge	Possible
All others	Unimportant

6.1.17 Property Serial number:

- Abbreviation: Gn
- Description:
  An integer used depending on the application for sorting or identification, or reference...
- Format: Int
- Applicability:

Sensor type	Usage
All others	Unimportant

6.1.18 Property Property of:

- Abbreviation: Go
- Description:
  Owner. Whom does the sensor belong to? E.g. company, institute, person, department, test rig.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

6.1.19 Property Order code:

- Abbreviation: GO
- Description:
  This specification can be used to procure the same sensor again. Unique ID for purchasing, for the ordering procedure.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

6.1.20 Property Database reference:

- Abbreviation: Gp
- Description:
  Reference, link to operation- or measurement equipment database. Especially relevant if stored in the sensor chip itself.

  This property should only be filled in by the database management system.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible

6.1.21 Property Purchase price:

- Abbreviation: GP
- Description: Price incl. currency, e.g. 500 EUR
- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

6.1.22 Property Silicon Serial Number:

- Abbreviation: Gq
- Description:
  The unique identifier for an EProm or chips for sensor identification. Each chip produced should have its own individual identification.

  This records which chip the sensor data were transferred to, if the chip is equipped with an Eprom.

  However, a sensor can only be equipped with a chip having only one serial number. In that case the actual sensor information is not located in the chip. But with the help of this record, unambiguous assignment is possible.
  The Silicon Serial Number is also referred to as the ROM-ID.

  The ROM-ID consists of (1+6+1) Bytes. Each Byte is represented in hexadecimal. This results in a total of 16 characters. The Bytes are displayed in the exact order in which they appear in the chip.

  E.g. 23AB00AC00002C6A. The first Byte in the chip is the family code (here: 23). The following 6 Bytes are the actual ID. The 8th Byte (here: 6A) designates the CRC (Checksum).
- Format: Text
- See also: Database reference, EProm ROM-ID
- Applicability:

Sensor type	Usage
All others	Unimportant

6.1.23 Property Storage location:

- Abbreviation: GS
- Description: Site where the sensor is typically stored
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible

6.1.24 Property Contact:

- Abbreviation: GT
- Description:
  The contact person or department or position for all questions on the sensor.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible

6.1.25 Property TEDS binary:

- Abbreviation: Gt
- Description:
  If a sensor's entry in the administration was read in from an Eprom or ROM (chip), then the text contains the content of the binary file block in the original copy. In that case, every bit with the value zero is represented by the character"0" (ASCII 48), and the value 1 as the character "1" (ASCII 49).

  In contrast to the property Virtual TEDS, no further header is present.

  Note that this text's content is not automatically updated if other sensor properties are changed.
- Format: Text
- See also: Virtual TEDS
- Applicability:

Sensor type	Usage
All others	Unimportant

6.1.26 Property Virtual TEDS:

- Abbreviation: GV
- Description:
  If a sensor's entry in the administration was imported in a "Virtual TEDS" file (*.TED), then this text contains the file's content in the original. In that case, every bit with the value zero is represented by the character"0" (ASCII 48), and the value 1 as the character "1" (ASCII 49).

  In contrast to the property TEDS binary, there is an additional header which is also recorded here.

  Note that this text's content is not automatically updated if other sensor properties are changed.
- Format: Text
- See also: TEDS binary
- Applicability:

Sensor type	Usage
All others	Unimportant

6.1.27 Property Version:

- Abbreviation: Gv
- Description:
  System version. Particularly for more complex systems subject to a version management, e.g. V1.2

- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

6.1.28 Property Warning:

- Abbreviation: Gw
- Description:
  Important note. This text absolutely should be attended to. It can be a not on the sensor's properties or its correct use.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible

6.1.29 Property Special treatment:

- Abbreviation: GZ
- Description:
  If a special treatment for this sensor is necessary, then the keyword to identify this specialty is defined here.

  The keyword should not be too short and should not be a word used in colloquial language.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible

6.1.30 Property Condition:

- Abbreviation: Gz
- Description:
  Text describing the state, e.g. "dropped", "dented". Notes on damage or forbidden usage conditions, for instance, "10x overload".
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible

6.2 Group Sensor

- Description:
  Group of the sensor's main properties, its input-/output signals and its response characteristic
- Abbreviation: S
- One at most present: No

6.2.1 Property Sensor type:

- Abbreviation: St
- Description:
  The main sensor specification, which associates it with a type (or class). What other sensor properties exist depends on what this type is.
- Format: CodeText
- Codes:

Code	Definition	Description
V	Sensor with voltage output	All sensors which return an electric voltage at their outputs. The magnitude of the voltage depends on the magnitude of the physical quantity to be measured. The actually measured physical quantity can by anything, for instance a force.
I	Sensor with current output	Current loop output. All sensors which return an electric current as their measurement output. The magnitude of the current is proportional to the physical quantity to be measured.
T	Thermocouple	Thermocouple, based on Seebeck effect
P	PT100, RTD	Resistance thermomenter, typically PT100 or PT1000.
S	Strain gauge bridge	A single strain gauge or a combined circuit as a bridge.
B	Sensor in bridge configuration	A sensor whose internal structure corresponds to a measurement bridge, e.g. a load cell. The differential voltage in the bridge is proportional to the physical quantity to be measured.
O	Potentiometric sensor	A sensor consisting of a resistance divider, e.g. a potentiometric displacement sensor.
L	LVDT	AC Linear/rotary Variable Differential Transformer (LVDT, RVDT). differential coil. Fed with AC. E.g. for displacement sensors
A	IEPE (ICP), accelerometer	Accelerometer or a microphone functioning according to the IEPE (ICP) principle. Fed with constant current. The output voltage in AC setting is measured.
M	Microphone	Microphone with voltage output. With or without pre-amplifier. Also for hydrophones. The output voltage is measured. For microphones based on the IEPE (ICP) principle, the sensor type IEPE (ICP), accelerometer is used.
C	Amplifier	Amplifier or pre-amp. With voltage output. E.g. microphone or charge amplifier.
R	Resistance	sensors which work by a resistive process. The ohmic resistance is proportional to the physical quantity actually measured.

Code	Definition	Description
H	Thermistor	Resistance thermometer with negative temperature coefficient (high-temperature conductor, NTC). Its response characteristics are described by the Steinhart-Hart equation.
Q	Piezoelectric sensor	Piezoelectric sensor. Without built-in electronics. This sensor requires connection of a charge amplifier.
E	Encoder, impulse-, frequency output	For ncremental rotation encoders, angular encoders, for measurement rulers, for sensors, which encode the physical quantity to actually be measured as a frequency or an impulse signal.
D	Digital out	For sensors returning Boolean data, in other words, a Yes/No statement. Typically for On/Off.
d	Actor digital IN, relay	For actuators (not for sensors!) with a digital input.
v	Actuator voltage input	For actuators (not sensors), which take an electric voltage at their inputs and convert this voltage to any other physical quantity, e.g. a drive's rotation.
i	Actuator current input	For actuators (not sensors), which take an electric current at their inputs and convert this current to any other physical quantity, e.g. a drive's rotation.
e	Actuator frequency input	For actuators (not sensors), which take a pulse or frequency signal at their inputs and convert this to any other physical quantity, e.g. a drive's rotation.
-	No sensor	This value is used as the selection if a generic device, e.g. a measurement device is meant.
=	Like Output 1	This value is used for making selections, if an additional sensor output the 2nd or 3rd output) is defined in exactly or substantially the same way as the 1st. This output is given all properties of the 1st output. If any properties are to deviate, then they are stated explicity. Each explicitly stated value has priority.

- Applicability:

Sensor type	Usage
All others	Necessary

6.2.2 Property Linearization:

- Abbreviation: Cw
- Description:
  Application specific calibration data
  imc FBG-Temp Senor
  Coefficients for the polynomial needed for the linearization. The version number, wavelength and four polynomial coefficients are entered into the channel property "*Linearization (polynomial)*" as text.

  These data are composed of the following pattern:

			3rd degree polynomial		
Version	***Conductor wavelength***	d	***ax***	ax^2	ax^3

  Example: 1;***1549.88308909***;24.93686663;***105.506495243***;-14.1850773611;***2.79517368873***
- Format: Text

- Applicability:

Sensor type	Usage
Fiber optic temperature sensor	Yes

6.2.3 Property Physical unit:

- Abbreviation: Su
- Description:
  To be stated in SI-units. Usually without milli, etc.; but: kg.

  Every sensor type has a default unit which is used if this property isn't explicitly present. With the properties Physical max. and Physical min., for instance, it can be read off.

  With some sensor types, e.g. Thermocouple, the unit is fixed and can't be changed.
- Format: Text
- See also: Physical max., Physical min.
- Applicability:

Sensor type	Usage
All others	Recommended
Strain gauge bridge	No
Actor digital IN, relay	No
Digital out	No
Thermocouple	No
Thermistor	No
PT100, RTD	No
No sensor	Unimportant

6.2.4 Property Physical max.:

- Abbreviation: Sa
- Description:
  Maximum physical value. Expressed in physical units as specified by the property Physical unit.

  The sensor's physical side is the side directed towards the physical process, not the side connected to the measurement system. The sensor is understood to convert a physical quantity to a (directly) measurable electrical quantity.

  The value specified here is the maximum permitted value for regular measurement operation. This generally is the top value for which the sensor's specifications are valid. The value can also be interpreted as the nominal load, especially with sensors whose minimum is the same magnitude with negative sign, or 0.0.

  The value of this property must be more than the one in the property Physical min..
- Format: Real
- See also:
  Electrical max., Physical min., Measurement points (electr.), Measurement points (physical), Overload max., Actual level, max, Max. level
- Unit: Physical
- Applicability:

Sensor type	Usage
All others	Recommended
Actor digital IN, relay	No
Digital out	No
No sensor	No

6.2.5 Property Physical min.:

- Abbreviation: Si
- Description:
  Minimum physical value. Expressed in physical units as specified by the property Physical unit.

  The sensor's physical side is the side directed towards the physical process, not the side connected to the measurement system. The sensor is understood to convert a physical quantity to a (directly) measurable electrical quantity.

  The value specified here is the minimum permitted value for regular measurement operation. This is generally the lowest value for which the sensors specs are valid.

  The value of this property must be more than the one in the property Physical min..
- Format: Real

- See also: Physical max., Electrical min., Measurement points (electr.), Measurement points (physical), Actual level, min
- Unit: Physical
- Applicability:

Sensor type	Usage
All others	Recommended
Actor digital IN, relay	No
Digital out	No
No sensor	No

6.2.6 Property Electrical max.:

- Abbreviation: SA
- Description:
  Electrical sensor output value resulting from the sensor detecting the maximum physical value (as per the property Physical max.).

  The sensor is understood to transform a physical quantity into a (directly) measurable electrical quantity.
  This electrical value is interpreted in electrical units.

  The value specified here is really the maximum of the electric output, if input and output change in the same direction.

  For sensors with inverting response, the value for the property Electrical max. may be less than for Electrical min..

  With sensors whose connected measurement amplifier must carry out a tare-function (e.g. with strain gauges, see also the property Tare), the electrical value is only in effect subsequent to running the tare-function.
- Format: Real
- See also: Physical max., Electrical min., Measurement points (electr.), Measurement points (physical), Bridge offset, Tare
- Unit: Electrical

- Applicability:

Sensor type	Usage
Thermocouple	Possible
PT100, RTD	Possible
All others	Recommended
Actor digital IN, relay	No
Digital out	No
No sensor	No

6.2.7 Property Electrical min.:

- Abbreviation: SI
- Description:
  Electrical sensor output value resulting from the sensor detecting the minimum physical value (as per the property Physical min.).

  The sensor is understood to transform a physical quantity into a (directly) measurable electrical quantity.
  This electrical value is interpreted in electrical units.

  The value specified here is really the minimum of the electric output, if input and output change in the same direction.

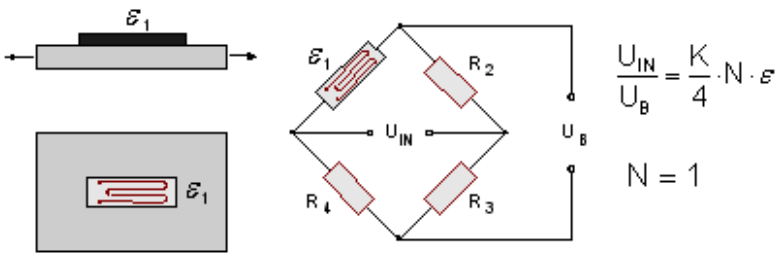
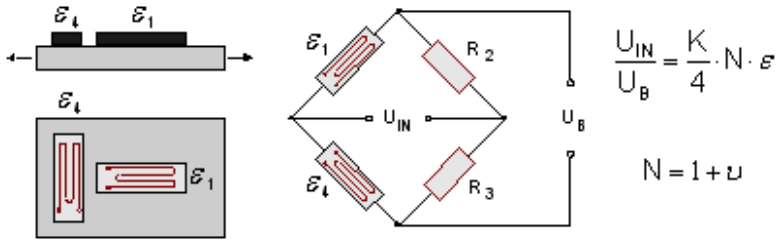
  For sensors with inverting response, the value for the property Electrical max. may be less than for Electrical min..

  With sensors whose connected measurement amplifier must carry out a tare-function (e.g. with strain gauges, see also the property Tare), the electrical value is only in effect subsequent to running the tare-function.
- Format: Real
- See also: Electrical max., Physical min., Measurement points (electr.), Measurement points (physical), Tare, Bridge offset
- Unit: Electrical
- Applicability:

Sensor type	Usage
Thermocouple	Possible
PT100, RTD	Possible
All others	Recommended
Actor digital IN, relay	No
Digital out	No
No sensor	No

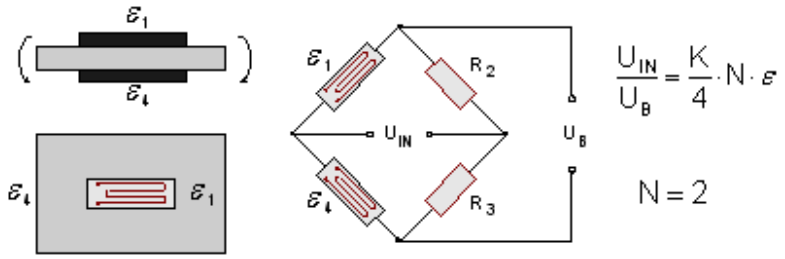
6.2.8 Property Gage type:

- Abbreviation: Sb
- Description:
  Bridge configuration for sensor type Strain gauge bridge. How are the strain gauges wired and positioned?
  Gage type
- Format: CodeText
- See also: Poisson coefficient, Gage factor, Geometric arrangement
- Codes:

Code 0: Quarter bridge	
Description: Quarter bridge with one active strain gauge. Single element.	
Code 1: Poisson half-bridge	
Description: 2 Poisson resistors. Half bridge with 2 active strain gauges, 1 strain gauge along the main strain, the other perpendicular.	
Code 2: Half-bridge with 2 active strain gauges in uniaxial direction	

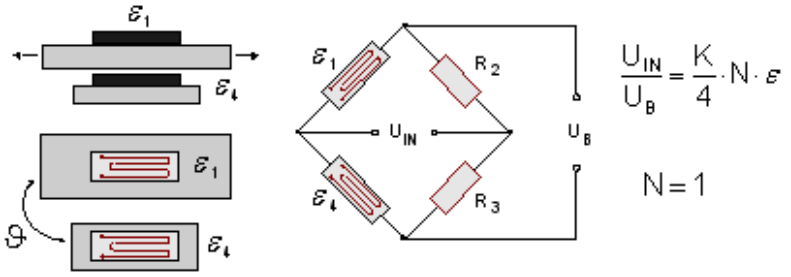
Code 0: Quarter bridge

Description: Half bridge with 2 active strain gauges in single-axis direction under equal strain with opposite sign.



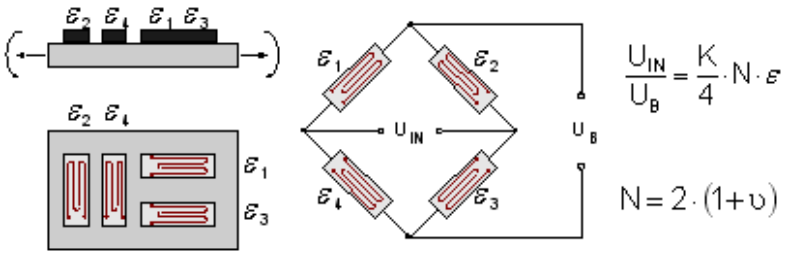
Code 3: Half-bridge with one active and one passive strain gauge

Description: Half bridge with one active strain gauge and one passive strain gauge for temperature compensation



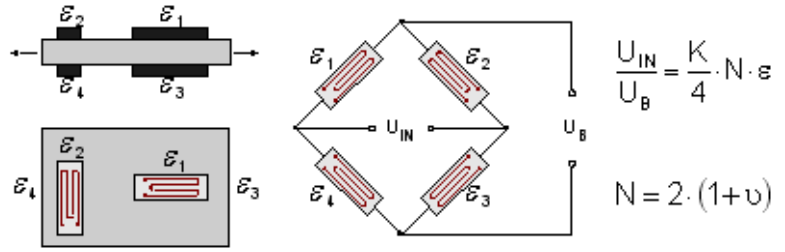
Code 4: Full bridge with Poisson strain gauge in opposing arms

Description: Full bridge with 4 active strain gauges



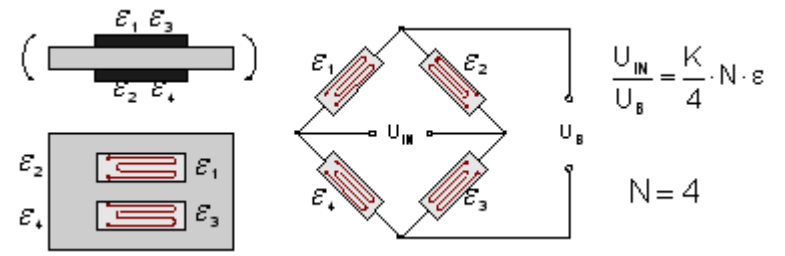
Code 5: Full bridge with Poisson strain gauges in adjacent branches

Description: Full bridge with 4 active strain gauges

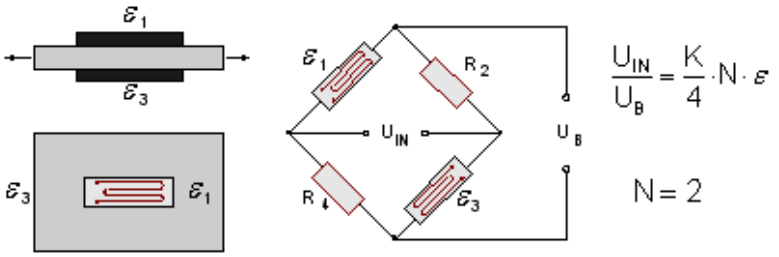


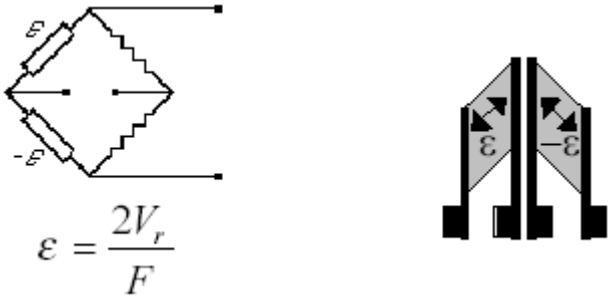
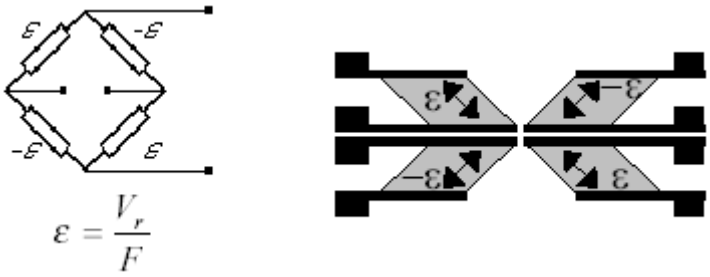
Code 6: Full bridge with 4 active strain gauges in uniaxial direction

Description: Full bridge with 4 active strain gauges, of which two are under compression and two under equal tension.



Code 7: Tension-compression-bar

Code 4: Full bridge with Poisson strain gauge in opposing arms	
Description: Two elements, same sign, opposite arms.	

Code 9: Shearing, 2 strain gauges	
Description: Two elements, chevron orientation	
Code 8: Shearing, 4 strain gauges	
Description: Four elements, dual chevron	

- Standard: 0
- Applicability:

Sensor type	Usage
Strain gauge bridge	Necessary
All others	No
No sensor	No

6.2.9 Property Bridge type:

- Abbreviation: SB
- Description: Bridge arrangement for sensor type Sensor in bridge configuration.
- Format: CodeText

- Codes:

Code	Definition	Description
1	Quarter bridge	Single (resistive) element.
2	Half-bridge	Two (resistive) elements in series
4	Full bridge	Complete four element bridge.

- Standard: 1
- Applicability:

Sensor type	Usage
Strain gauge bridge	Necessary
All others	No
No sensor	No

6.2.10 Property Upper cutoff frequency:

- Abbreviation: Sc
- Description:
  3dB frequency. Cutoff frequency of a sensor with low-pass response (to high frequencies). Frequency range, bandwidth
- Format: Real
- See also: Frequency, Low-pass, Lower cutoff frequency
- Unit: Hz
- Applicability:

Sensor type	Usage
All others	Possible

6.2.11 Property Capacitance:

- Abbreviation: SC
- Description: The transducer's capacity
  For the sensor type Microphone also Cstray

  The capacitor positioned parallel to the sensor's electrical output.
- Format: Real
- Unit: pF

- Applicability:

Sensor type	Usage
All others	Unimportant
Piezoelectric sensor	Possible

6.2.12 Property Digital signal type:

- Abbreviation: Sd
- Description:
  For digital/ Boolean or 2-state/ logical signals. For sensors (and actuators) which are controlled digitally. In the case of a sensor (e.g. sensor type Digital out or Encoder, impulse-, frequency output), this property describes this property of the sensor output. Its output is the side to which a measurement device is attached.

  With an actuator (e.g. sensor type Actor digital IN, relay or Actuator frequency input), this is also the description of an output. But it is the description of the control system's output, which controls the actuator.
- Format: CodeText
- Codes:

Code	Definition	Description
0	Switch to ground	Open collector, sinking, NPN-Transistor, open-drain, contact to ground. Generally a debounced or electronic switch.
1	Switch to Vcc	sourcing, PNP-Transistor, open emitter, contact to power. A high-side switch. Generally a debounced or electronic switch.
10	Switch not debounced to frame Ground	Mechanical switch or relay contact which is not debounced. The switch closes to frame Ground.
11	Switch not debounced to Vcc	Mechanical switch or relay contact which is not debounced. The switch closes to Supply (Vcc).
2	Voltage, active low	Active low voltage. Voltage output which outputs both a HIGH and a LOW level.
3	Voltage, active high	Active high voltage, which outputs both a HIGH and a LOW level voltage.
4	Bipolar voltage	Bipolar voltage, outputting both a HIGH and a LOW level. The two levels are of different sign.

- Applicability:

Sensor type	Usage
Digital out	Recommended
Encoder, impulse-, frequency output	Recommended
Actor digital IN, relay	Recommended
Actuator frequency input	Recommended
All others	No

6.2.13 Property Sensitivity:

- Abbreviation: Se
- Description:
  Given as "Change in electrical signal" per "Change in physical signal". E.g. 2V/N for a sensor which converts force to an voltage.
  Especially with sensors having linear transfer behavior..

  The sensitivity is expressed in the unit "Electrical unit / Physical unit".

  The sensitivity is used for parameterizing a connected measurement device, unless other specifications such as value pairs correlating electrical to physical values make them redundant.

  If, in addition to the property Sensitivity all the properties Physical min., Physical max., Electrical min. and Electrical max. are also specified, then that is more than necessary. If an offset of 0.0 is derived from the the Min/Max-values, then the specification for the property Sensitivity is given priority.

  But if the properties Measurement points (electr.) and Measurement points (physical) are also used, then they are always the valid ones.
- Format: Real
- See also:
  Offset, Physical min., Physical max., Electrical min., Electrical max., Polarity, Measurement points (electr.), Measurement points (physical), Transverse sensitivity
- Unit: Electrical/Physical

- Applicability:

Sensor type	Usage
IEPE (ICP), accelerometer	Recommended
Piezoelectric sensor	Recommended
Microphone	Recommended
All others	Possible
Thermocouple	No
PT100, RTD	No
Actor digital IN, relay	No
Digital out	No
Thermistor	No
No sensor	No

6.2.14 Property Number of encoder signals:

- Abbreviation: SE
- Description:
  In the case of an encoder the amount of signals. Only relevant then, because there are encoders which generate 2 digital tracks offset by 90°.

  sensors having a totally regular impulse or frequency output don't require this specification.
- Format: CodeText
- Codes:

Code	Definition	Description
1	1-signal digital	This is the default value which is assumed even if this property isn't present.
2	2-signal digital	Two tracks separated by 90°

- Standard: 1
- Applicability:

Sensor type	Usage
All others	No
Encoder, impulse-, frequency output	Recommended

6.2.15 Property Microphone capacity:

- Abbreviation: SF
- Description: Microphone capacitance, "Cmic" in the image.
- Format: Real
- Unit: pF
- Applicability:

Sensor type	Usage
All others	No
Microphone	Recommended

6.2.16 Property Gage factor:

- Abbreviation: Sg
- Description:
  Gauge factor. For the sensor type Strain gauge bridge. The strain, stated in "µm/m", is multiplied with the gage factor and results in the voltage change, stated in "mV/V".
- Format: Real
- See also: Bridge offset, Transverse sensitivity, Temperature coefficient gage-factor, Temperature dependence of strain
- Applicability:

Sensor type	Usage
All others	No
Strain gauge bridge	Recommended

6.2.17 Property Geometric arrangement:

- Abbreviation: SG
- Description:
  For the sensor type Strain gauge bridge and rosettes. For rosettes, either two or three measurement channels are needed.

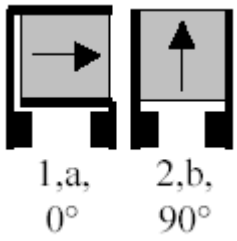
  A rosette can be regarded as a sensor with more than one output, e.g. a sensor with two or three outputs.

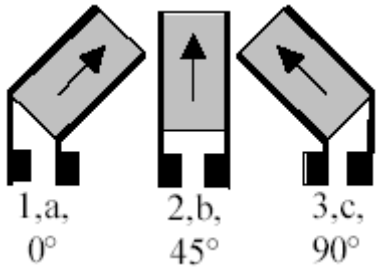
  An output is assigned to each strain gauge. If the properties of all outputs are the same, it's sufficient to specify a single output. Otherwise, the sensor must be defines as having the corresponding number of outputs.

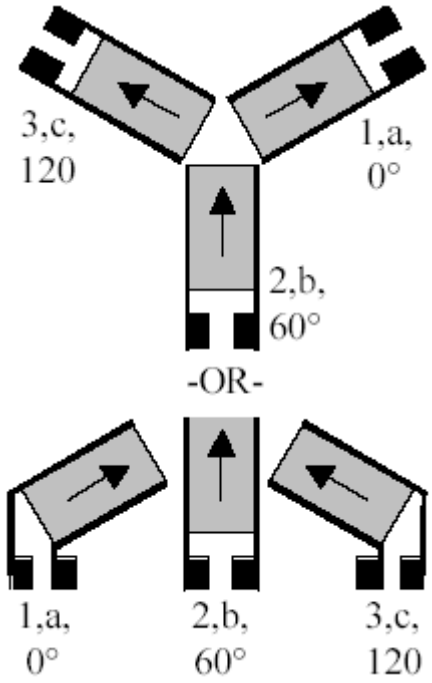
  If this information is stored in a chip on the sensor (in an EProm), then there is only 1 EProm at the first channel. For automatic recognition, it is assumed that the remaining grids (2 or under some circumstances 3) are connected to the channels following directly afterwards on the same measurement board (in the same module).

  According to IEEE 1451, there should be one EProm per output. Therefore, if each of a rosette's individual grids receives its own sensor description, then the property Grid denotes which grid (A, B, C) is meant.
- Format: CodeText
- See also: Grid
- Codes:

Code 1: 1 strain gauge or bridge, only Grid1	
Description: Universal strain gauge. This value is assumed if the property isn't specified at all. There is no kt-factor.	-

Code 2: T-rosette	
Description: Tee rosette grid. T configuration: Grid1 at 0°, Grid2 at 90°	

Code 3: Rectangular rosette	
Description: Rectangular rosette. Grid1 at 0°, Grid2 at 45°, Grid3 at 90°	

Code 4: Delta rosette	
Description: Delta rosette. Grid1 at 0°, Grid2 at 60°, Grid3 at 120°	

- Standard: 1
- Applicability:

Sensor type	Usage
All others	No
Strain gauge bridge	Recommended

6.2.18 Property Offset (electric):

- Abbreviation: Sh
- Description:
  Offset given in electrical units. This is the value of the electrical output, if the physical input of the sensor has a value equal to zero.

  Especially with sensors having linear transfer behavior, and for which the property Sensitivity is defined.

  The offset is used for parameterizing a connected measurement device, unless other specifications such as value pairs correlating electrical to physical values make them redundant.

  E.g. if the offset of a relative pressure sensors is equal to 0.01V, then at a relative pressure of 0bar the voltage at the output will be 0.01V.
- Format: Real
- See also:
  Offset, Sensitivity, Physical min., Physical max., Electrical min., Electrical max., Polarity, Measurement points (electr.), Measurement points (physical), Transverse sensitivity
- Unit: Electrical
- Applicability:

Sensor type	Usage
All others	Possible
Thermocouple	No
PT100, RTD	No
Actor digital IN, relay	No
Digital out	No
Thermistor	No
No sensor	No

6.2.19 Property Offset (physical):

- Abbreviation: SH
- Description:
  Offset given in physical units. This is the value of the physical input if the electrical output of the sensor has a value equal to zero.

  Especially with sensors having linear transfer behavior, and for which the property Sensitivity is defined.

  The offset is used for parameterizing a connected measurement device, unless other specifications such as value pairs correlating electrical to physical values make them redundant.

  E.g. if the offset of a relative pressure sensor is 0.01bar, then at a relative pressure of 0.01bar the voltage at the sensor output will be 0V.
- Format: Real
- See also:
  Offset, Sensitivity, Physical min., Physical max., Electrical min., Electrical max., Polarity, Measurement points (electr.), Measurement points (physical), Transverse sensitivity
- Unit: Physical
- Applicability:

Sensor type	Usage
All others	Possible
Thermocouple	No
PT100, RTD	No
Actor digital IN, relay	No
Digital out	No
Thermistor	No
No sensor	No

6.2.20 Property Output current max.:

- Abbreviation: Sj
- Description:
  Maximum current at sensor output. This much current can be driven.

  Unless the current exceeds this limit, the stated output signal accuracy is valid.
  A connected measurement device may not draw greater current.
  For sensors with voltage output
- Format: Real
- Unit: mA

- Applicability:

Sensor type	Usage
All others	Unimportant
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
Thermistor	No
PT100, RTD	No
Resistance	No
Sensor with current output	No
Actuator current input	No

6.2.21 Property Input capacitance:

- Abbreviation: Sk
- Description:
  Input capacitance, in pF. With amplifiers, the capacitance of the input on the physical side, not on the side towards the connected measurement device.

  For actuators, the input impedance, on the side of the connected control system.
- Format: Real
- See also: Input impedance, Output impedance, Resistance
- Unit: pF
- Applicability:

Sensor type	Usage
Thermocouple	No
Thermistor	No
Resistance	No
PT100, RTD	No
Digital out	No
Strain gauge bridge	No
Sensor in bridge configuration	No
Potentiometric sensor	No
Encoder, impulse-, frequency output	No
All others	Unimportant
Amplifier	Possible
Actuator voltage input	Possible

6.2.22 Property Shunt, max.:

- Abbreviation: SK
- Description:
  For sensors, the current output of the maximum shunt resistance which can be connected.

  This property is not designed for supply (feed) of a sensor via an external current source, but rather for output with the measurement signal.
- Format: Real
- Unit: Ohm
- Applicability:

Sensor type	Usage
All others	No
Sensor with current output	Possible

6.2.23 Property Lower cutoff frequency:

- Abbreviation: SL
- Description:
  3dB-frequency. A sensor's lower cutoff frequency with high-pass response (at low frequencies).
  Typically for sensor type Microphone and IEPE (ICP), accelerometer.
  High-pass cutoff frequency
- Format: Real
- See also: High-pass, Frequency, Coupling, Upper cutoff frequency
- Unit: Hz
- Applicability:

Sensor type	Usage
All others	Unimportant
IEPE (ICP), accelerometer	Possible
Piezoelectric sensor	Possible
Microphone	Possible

6.2.24 Property Input impedance:

- Abbreviation: Sm
- Description:
  Input impedance, in Ohm. For sensors, the impedance of the input on the physical side, not on the side of the connected measurement instrument.

  For actuators, the input impedance, on the side of the connected control system.
- Format: Real
- See also: Input capacitance, Output impedance, Resistance

- Unit: Ohm
- Applicability:

Sensor type	Usage
Thermocouple	No
Thermistor	No
Resistance	No
PT100, RTD	No
Digital out	No
Strain gauge bridge	No
Sensor in bridge configuration	No
Potentiometric sensor	No
Encoder, impulse-, frequency output	No
All others	Unimportant
Amplifier	Possible
Actuator voltage input	Possible

6.2.25 Property Overload max.:

- Abbreviation: SM
- Description:
  Max. value of physical quantity which doesn't damage the sensor. The limit at which measurements can be taken within the specified error margin is generally lower.
- Format: Real
- See also: Physical max.
- Unit: Physical
- Applicability:

Sensor type	Usage
All others	Possible

6.2.26 Property Thermocouple:

- Abbreviation: Sn
- Description: Non-linear characteristic curve for sensor type Thermocouple.

  If electrical voltages are stated, they are referenced to 0°C.
  Characteristic, thermocouple type
- Format: CodeText
- See also: Thermocouple, Measurement points (electr.)

- Codes:

Code	Definition	Description
B	Type B: Pt30%Rh / Pt6%Rh	-
E	Type E: Ni-Cr / Cu-Ni	-
J	Type J: Fe / Cu-Ni	-
K	Type K: Ni-Cr / Ni	-
L	Type L: Fe / Cu-Ni	-
N	Type N: Ni-Cr-Si / Ni-Si	-
R	Type R: Pt13%Rh / Pt	-
S	Type S: Pt10%Rh / Pt	-
T	Type T: Cu / Cu-Ni	-
-	Non-standard	This value is selected if none of the other properties apply. In that case, a separate characteristic curve can be specified with the help of the property Measurement points (electr.).

- Standard: K
- Applicability:

Sensor type	Usage
All others	No
Thermocouple	Necessary

6.2.27 Property Encoder zero-impulse:

- Abbreviation: SN
- Description:
  Zero-impulse for encoders. An additional output at the encoder, which generates a pulse at the zero position.

  This property only exists with rotation encoders and other incremental encoders, but not with sensors having general pulse or frequency outputs.
- Format: CodeText
- Codes:

Code	Definition	Description
0	No zero-impulse	This value is assumed if this property isn't used.
1	With zero-impulse	An additional digital signal, returning a pulse in the zero position.

- Standard: 0
- Applicability:

Sensor type	Usage
All others	No
Encoder, impulse-, frequency output	Possible

6.2.28 Property Output impedance:

- Abbreviation: So
- Description:
  Output impedance, in Ohm. With sensors, the output's impedance on the electrical side, towards the connected measurement device.

  With actuators, the impedance at the output, on the process side, not the side of the connected control system.
- Format: Real
- See also: Input impedance, Resistance
- Unit: Ohm
- Applicability:

Sensor type	Usage
Thermistor	No
Resistance	No
PT100, RTD	No
Strain gauge bridge	No
Sensor in bridge configuration	No
Potentiometric sensor	No
All others	Unimportant
Amplifier	Possible
Actuator voltage input	Possible

6.2.29 Property Measurement principle:

- Abbreviation: Sp
- Description:
  Description of the physical effect or of the principle on which the sensor is based.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant
No sensor	No

6.2.30 Property Marking count:

- Abbreviation: SP
- Description:
  Only for the sensor type Encoder, impulse-, frequency output and even then only for incremental rotation encoders. The property denotes the amount of markings per rotation.

  The encoder has this many markings per revolution, if it's a rotation encoder.

  For single-signal encoders, the amount of pulses generated per revolution.

  With two-signal encoders, only the simple amount of markings is specified here, too. The amount of pulse slopes which can be evaluated merely increases.

  Typically the amount of markings is an integer, but sometimes a real number: especially if the encoder is mounted on a gear system but not on the shaft whose rotation is actually to be measured. In that case, the number of markings is weighted by the gear ratio.
  In any case, the count is not zero.

  This property only applies to incremental rotation encoders. Other sensors having a pulse or frequency output don't possess this property.
- Format: Real
- Standard: 1
- Applicability:

Sensor type	Usage
All others	No
Encoder, impulse-, frequency output	Recommended

6.2.31 Property Transverse sensitivity (gauge kt):

- Abbreviation: SQ
- Description: Transverse sensitivity of a strain gauge
  Gauge's transverse sensitivity
- Format: Real
- See also: Geometric arrangement, Gage factor, Poisson coefficient, Transverse sensitivity
- Applicability:

Sensor type	Usage
All others	No
Strain gauge bridge	Possible

6.2.32 Property Transverse sensitivity:

- Abbreviation: Sq
- Description: Lateral sensitivity of a transducer
  Transverse sensitivity

  E.g. with accelerometers, the sensitivity not in the main direction, but perpendicular to it. In other words, the undesired sensitivity for lateral accelerations.

  With the sensor type Strain gauge bridge, the property Transverse sensitivity is used.
- Format: Real
- See also: Sensitivity, Transverse sensitivity
- Unit: Electrical/Physical
- Applicability:

Sensor type	Usage
IEPE (ICP), accelerometer	Possible
Piezoelectric sensor	Possible
Strain gauge bridge	No
Thermocouple	No
PT100, RTD	No
Actor digital IN, relay	No
Digital out	No
Thermistor	No
No sensor	No

6.2.33 Property Resistance:

- Abbreviation: Sr
- Description:
  Resistance in Ohm. For sensors based on one or more ohmic resistors.

  For sensor type PT100, RTD, this is the resistance value at 0°C, for instance, 100 Ohm

  For the sensor types Sensor in bridge configuration and Strain gauge bridge, the resistance of a single resistor (not the total resistance), for instance 120 Ohm or 350 Ohm.

  For the sensor type Potentiometric sensor, the total resistance, e.g. 5000 Ohm.

  For the sensor type Thermistor, the resistance at the specified reference temperature, e.g. 25°C.
- Format: Real
- See also: Reference temperature
- Unit: Ohm

- Standard: 100
- Applicability:

Sensor type	Usage
All others	No
Strain gauge bridge	Recommended
Sensor in bridge configuration	Recommended
Potentiometric sensor	Recommended
Thermistor	Possible
PT100, RTD	Necessary

6.2.34 Property Resonance frequency:

- Abbreviation: SR
- Description:
  For sensors which have a pronounced resonance in their frequency response. Eigen-frequency Resonance frequency
- Format: Real
- See also: Quality at resonance frequency
- Unit: Hz
- Applicability:

Sensor type	Usage
All others	Unimportant
IEPE (ICP), accelerometer	Possible
Piezoelectric sensor	Possible

6.2.35 Property Max. pulse frequency:

- Abbreviation: ST
- Description:
  For the sensor type Encoder, impulse-, frequency output, the maximum occurring pulse frequency. Especially relevant for pulse tallies, displacement and angle measurements. Thus, this affects the input range or divider which can be set for the measurement device.

  For PWM-signals, also relevant. If the pulse frequency of the PWM signal is not variable this max. pulse frequency is also the currently used or typical one.
- Format: Real
- Unit: Hz

- Applicability:

Sensor type	Usage
All others	No
Encoder, impulse-, frequency output	Recommended
Actuator frequency input	Possible

6.2.36 Property Pulse measurement type:

- Abbreviation: Sv
- Description:
  Pulse measurement type. Detailed specification of the measurement type for the sensor type Encoder, impulse-, frequency output.

  See the comments below on the interpretation of the electrical unit.
- Format: CodeText
- See also: Digital signal type

- Codes:

Code	Definition	Description
0	Frequency	Information about the measured value is derived from the signal's frequency.
5	Pulse count	The pulses must be counted. The desired information can be derived from the number of pulses.
90	RPMs, incr. rotation encoder	There is one incremental rotation encoder primarily for measuring the RPMs.
91	Rotation angle	There is one incremental rotation encoder primarily for measuring the rotation angle.
92	Velocity	An incremental encoder measures the velocity
93	Displacement	There is one incremental rotation encoder for measuring the displacement (or distance, length).
1	Period duration	The desired information is to be derived from the period duration of the pulses in the pulse sequence.
4	PWM, duty cycle	The ratio of the time for ON to the total period duration. Pulse-width modulated signal (PWM).
2	On-time	On: when the contact is closed. For determining which level signifies ON or OFF, refer also to the property Digital signal type. The desired information is to be derived from the ON-time of the pulses in the pulse sequence.
3	Off-time	OFF: When the contact is not closed. For determining which level signifies ON or OFF, refer also to the property Digital signal type. The desired information is to be derived from the OFF-time of the pulses in the pulse sequence.

- Standard: 0
- Applicability:

Sensor type	Usage
All others	No
Encoder, impulse-, frequency output	Necessary
Actuator frequency input	Necessary

6.2.37 Property Gain:

- Abbreviation: SV
- Description:
  An amplifier's gain factor. Stated as "Output voltage" per "Input voltage" or in general "Electrical signal change" per "Physical signal change".
  For linear amplifiers
- Format: Real

- See also: Sensitivity
- Unit: Electrical/Physical
- Applicability:

Sensor type	Usage
Amplifier	Recommended
All others	No
No sensor	Unimportant

6.2.38 Property Short-circuit protected:

- Abbreviation: Sx
- Description:
  May the output be short-circuited without damaging the sensor?
- Format: CodeText
- Codes:

Code	Definition
0	No
1	Yes

- Applicability:

Sensor type	Usage
All others	Possible
PT100, RTD	No
Thermistor	No
Resistance	No
Thermocouple	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
LVDT	No
Strain gauge bridge	No
Sensor in bridge configuration	No
Potentiometric sensor	No
No sensor	Unimportant

6.2.39 Property Max. level:

- Abbreviation: SX
- Description:
  the maximum sound pressure level which can be measured by a microphone. the upper end of the input range.
  Sound pressure level.

  The value is calculated from the sound pressure by means of the formula: SPL = 20 * log10 (sound pressure [Pa] / p0). Here, p0 = 0.00002Pa is assumed for air. With typical microphones for airborne sound, the maximum sound pressure level lies in the range 120 .. 160dB.
- Format: Real
- See also: Physical max.
- Unit: dB
- Applicability:

Sensor type	Usage
All others	No
Microphone	Recommended

6.2.40 Property Measured physical quantity:

- Abbreviation: Sy
- Description: Physical quantity at sensor input
- Format: CodeText

- Codes:

Code	Definition	Code	Definition	Code	Definition
0	Force	20	Length, displacement	43	Capacitance
1	Mass	21	Area	44	Inductivity
2	Torque	22	Volume	45	Electr. charge
3	Pressure	23	Velocity	46	Magnetic flux
4	Power	24	Acceleration	47	Electr. field strength
5	Energy	25	Angle	48	Electr. conductivity
6	Mechan. tension	26	Angular velocity	49	Magnetic flux density
7	Density	27	Angular acceleration	50	Magnetic field intensity
8	Weight density	28	Strain	51	Induction
9	Elasticity modulus	29	RPMs	52	Power factor
10	Torsion modulus	30	Frequency	53	Reactive power
11	Angular momentum	31	Time	54	Apparent power
12	Moment of inertia	40	Electr. voltage	55	Current density
13	Impulse	41	Electr. current	56	Spec. resistance
14	Specif. volume	42	Electr. resistance		

Code	Definition	Code	Definition	Code	Definition
70	Temperature	100	Percentage	127	Sound intensity level
71	Heat quantity	101	Amount	128	Specific loudness
72	Enthalpy	102	Relative humidity	129	Sharpness
73	Spec. heat capacity	103	Level	130	Roughness
74	Spec. heat	104	Efficiency	131	Tonality
80	Molar mass, molar number	105	Concentration	160	Luminous intensity
81	Molar volume	106	Damping	161	Luminance
82	Molar mass per volume	107	Logical state	162	Brightness
83	Therm. resistance	108	Information unit	163	Luminous flux
84	Surface tension	109	Transfer rate	164	Refraction power
85	Work function	120	Sound pressure level	165	Luminous efficiency
86	Particle density	121	Sound power level	166	Luminous emittance
87	Dynamic viscosity	122	Speed	180	Radioactive concentration
88	Kinematic viscosity	123	Loudness	181	Radioactivity
89	Flow rate	124	Sound intensity	182	Dosage equivalent
90	Mass flow rate	125	Sound power	183	Energy dosage
91	Consumption	126	Volume level	184	Radiation exposure

- Applicability:

Sensor type	Usage
All others	Unimportant
No sensor	No

6.2.41 Property Microphone type:

- Abbreviation: SY
- Description:
  The type or optimization for the microphone. For sensor type Microphone.
- Format: CodeText

- Codes:

Code	Definition	Description
0	Free-field	Free-field
1	Diffuse-field	Diffuse-field
2	Pressure	Pressure
3	Other	Other types or a combination of the above

- Applicability:

Sensor type	Usage
All others	No
Microphone	Unimportant

6.2.42 Property Number of missing markings:

- Abbreviation: SZ
- Description:
  Only for the sensor type Encoder, impulse-, frequency output, and there in particular, only with increment rotation encoders.

  This property denotes the number of missing markings. This many markings (pulses, cogs) per revolution are missing from the encoder.

  This property is only useful in conjunction with the property Marking count.

  If the rotation encoder has, for example, 60 markings and 1 missing marking, then one marking corresponds to 360° / 60 = 6°, and one is missing; only 59 are present.
  The first marking after the gap denotes the zero-angle.

  Both the amount of markings and of missing markings must be integers.
- Format: Int
- See also: Marking count
- Standard: 0
- Applicability:

Sensor type	Usage
All others	No
Encoder, impulse-, frequency output	Possible

6.2.43 Property Signal level min.:

- Abbreviation: S1
- Description:
  With discrete (digital) signals, the minimum level; the LOW level.

  With the sensors (e.g. sensor types Digital out and Encoder, impulse-, frequency output), the output is described by this property. Its output is the side to which the measurement device is connected.

  With actuators (e.g., type Actor digital IN, relay and Actuator frequency input), this is also the description of an output. But it's the description of the control system's output, which controls the actuator.
- Format: Real
- See also: Signal level max., Switching threshold
- Unit: V
- Applicability:

Sensor type	Usage
All others	No
Encoder, impulse-, frequency output	Recommended
Actuator frequency input	Recommended
Digital out	Recommended
Actor digital IN, relay	Recommended

6.2.44 Property Signal level max.:

- Abbreviation: S2
- Description:
  With discrete (digital) signals, the maximum level; the HGH level.

  With the sensors (e.g. sensor types Digital out and Encoder, impulse-, frequency output), the output is described by this property. Its output is the side to which the measurement device is connected.

  With actuators (e.g., type Actor digital IN, relay and Actuator frequency input), this is also the description of an output. But it's the description of the control system's output, which controls the actuator.
- Format: Real
- See also: Signal level min., Switching threshold
- Unit: V

- Applicability:

Sensor type	Usage
All others	No
Encoder, impulse-, frequency output	Recommended
Actuator frequency input	Recommended
Digital out	Recommended
Actor digital IN, relay	Recommended

6.3 Group Supply

- Description:
  This group lists all properties concerning the sensor's voltage or current supply.
- Abbreviation: U
- One at most present: Yes

6.3.1 Property Excitation amplitude, nominal:

- Abbreviation: U1
- Description:
  The voltage's nominal value, especially for the sensor type LVDT and for AC excitation
  Excitation amplitude, nominal

  For instance, for a sinusoidal excitation in the range -5V .. +5V and an RMS-value of 3.54V, a 5 is returned (for 5V).
- Format: Real
- Unit: V
- Applicability:

Sensor type	Usage
All others	Unimportant
LVDT	Recommended
Thermocouple	No
Thermistor	No
PT100, RTD	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No

6.3.2 Property Excitation amplitude, max.:

- Abbreviation: U2
- Description:
  The voltage's maximum amplitude value, especially for the sensor type LVDT and AC excitation.
  Excitation amplitude, max

  For instance, for a sinusoidal excitation in the range -5V .. +5V and an RMS-value of 3.54V, a 5 is returned (for 5V).

  It is not permitted to connect a higher amplitude voltage to the sensor.
- Format: Real
- Unit: V
- Applicability:

Sensor type	Usage
All others	Possible
LVDT	Recommended
Thermocouple	No
Thermistor	No
PT100, RTD	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No

6.3.3 Property Supply max.:

- Abbreviation: Ua
- Description:
  For sensors with voltage supply, the maximum supply voltage in V. Higher voltages may not be applied to the sensor.

  For DC, the positive value specification, for AC the RMS-value.
- Format: Real
- Unit: V

- Applicability:

Sensor type	Usage
All others	Possible
Thermocouple	No
Thermistor	No
PT100, RTD	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No

6.3.4 Property Microphone supply:

- Abbreviation: Ub
- Description: How is the microphone, or its pre-amp, supplied with power?
  Only with the sensor type Microphone.

  This property determines what type of supply the measurement device's input must make available.
- Format: CodeText
- See also: Pre-polarization available?, Polarisation voltage
- Codes:

Code	Definition	Description
i	Current supply	For ICP-microphones
u	Voltage feed	Voltage feed is generally required for condenser microphones.

- Applicability:

Sensor type	Usage
All others	No
Microphone	Recommended

6.3.5 Property Controlled voltage necessary?:

- Abbreviation: Uc
- Description:
  The sensor requires a controlled supply and also provides the necessary Sense line. E.g. with Nippon Denso pressure sensor.

  The value of this property determines what Sense lines are available.
  Only for sensors with voltage supply
- Format: CodeText

- Codes:

Code	Definition	Description
0	No (not controlled)	-
1	Yes, without Sense-line	No separate Sense-line available
2	Yes, 2 Sense-lines	-
3	Yes, 1 Sense-line plus	The Sense line is positioned at the supply's plus-contact.
4	Yes, 1 Sense-line minus	The Sense line is positioned at the supply's minus-contact.

- Standard: 0
- Applicability:

Sensor type	Usage
All others	Unimportant
Thermocouple	No
Thermistor	No
PT100, RTD	No
Resistance	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No

6.3.6 Property Excitation frequency min.:

- Abbreviation: Uf
- Description:
  The minimum value for the supply voltage's frequency, especially for the sensor type LVDT and for AC excitation.
  Excitation frequency, min

  Minimum frequency of the sinusoidal voltage. The frequency may not fall below this value, otherwise the sensor could sustain damage.
- Format: Real
- Unit: Hz

- Applicability:

Sensor type	Usage
Thermocouple	No
Thermistor	No
PT100, RTD	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
All others	Unimportant
LVDT	Recommended

6.3.7 Property Excitation frequency max.:

- Abbreviation: UF
- Description:
  The maximum value for the supply voltage's frequency, especially for the sensor type LVDT and for AC excitation.
  Excitation frequency, max

  Maximum frequency of the sinusoidal voltage. The frequency may not exceed this value, otherwise the sensor could sustain damage.
- Format: Real
- Unit: Hz
- Applicability:

Sensor type	Usage
Thermocouple	No
Thermistor	No
PT100, RTD	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
All others	Unimportant
LVDT	Recommended

6.3.8 Property Nominal supply current:

- Abbreviation: UI
- Description:
  Nominal value of the supply current if the sensor is current fed. Stated in mA
- Format: Real
- See also: Max. supply current, Min. supply current

- Unit: mA
- Applicability:

Sensor type	Usage
Thermocouple	No
PT100, RTD	Recommended
Thermistor	Recommended
All others	Recommended

6.3.9 Property Supply, min.:

- Abbreviation: Ui
- Description:
  For voltage supply of the sensor, the minimum supply voltage in V.
  For bipolar supply, the minimum positive value.

  For quarter bridges, the supply for the total bridge, not just of the single resistor

  For DC, the positive value specification, for AC the RMS-value.
- Format: Real
- Unit: V
- Applicability:

Sensor type	Usage
Thermocouple	No
Thermistor	No
PT100, RTD	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
All others	Possible

6.3.10 Property Power consumption:

- Abbreviation: UL
- Description:
  Power consumption at reference temperature and nominal supply voltage.
- Format: Real
- Unit: W
- Applicability:

Sensor type	Usage
No sensor	Possible
All others	Unimportant

6.3.11 Property Min. supply current:

- Abbreviation: Um
- Description:
  Minimum value of the supply current for sensors with current feed in mA
- Format: Real
- See also: Max. supply current, Nominal supply current
- Unit: mA
- Applicability:

Sensor type	Usage
Thermocouple	No
All others	Unimportant

6.3.12 Property Max. supply current:

- Abbreviation: UM
- Description:
  Maximum value of the supply current for sensors with current feed in mA
- Format: Real
- See also: Min. supply current, Nominal supply current
- Unit: mA
- Applicability:

Sensor type	Usage
Thermocouple	No
Thermistor	Recommended
PT100, RTD	Recommended
Resistance	Recommended
All others	Possible

6.3.13 Property Nominal supply voltage:

- Abbreviation: Un
- Description:
  For sensors with voltage supply, the nominal supply voltage in V
  Nominal value

  For DC, the positive value specification, for AC the RMS-value.
- Format: Real
- Unit: V
- Applicability:

Sensor type	Usage
Thermocouple	No
Thermistor	No
PT100, RTD	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
All others	Recommended

6.3.14 Property Supply connector:

- Abbreviation: Uo
- Description:
  For sensors with current output, the supply can be provided via the current loop itself. Or there is a separate supply connection. Only for the sensor type Sensor with current output.
- Format: CodeText
- See also: Min. supply, Supply max.
- Codes:

Code	Definition	Description
0	External	Default. Besides Frame Ground (or -Vcc), the sensor has a supply input Vcc+ and a separate current output for the measurement signal. The connected measurement device includes a shunt through which the current (corresponding to the measurement signal) flows.
1	Via current loop	Besides Frame Ground, the sensor has only one connector for the supply voltage, Vcc+. The current corresponding to the measurement signal is the current drawn by the supply via these pins. The measurement device connected, then, must measure the current in the supply line, e.g. via a shunt in the measurement device.

- Applicability:

Sensor type	Usage
All others	No
Sensor with current output	Possible

6.3.15 Property Pre-polarization available?:

- Abbreviation: Up
- Description:
  Is the microphone already pre-polarized? Only for sensor type Microphone.
  Pre-polarized

  The value of this property s the inverse of the answer to the question: "Is an external polarization voltage needed?"
- Format: CodeText
- See also: Polarisation voltage, Microphone supply
- Codes:

Code	Definition	Description
0	No	Pre-polarization not given. This value means that application of an external polarization voltage is needed.
1	Yes	Pre-polarization given. This value means that application of an external polarization voltage is not needed.

- Applicability:

Sensor type	Usage
All others	No
Microphone	Possible

6.3.16 Property Polarisation voltage:

- Abbreviation: UP
- Description:
  For the sensor type Microphone, the polarization voltage, e.g. 28V or 200V

  This property is only specified if this voltage must be additionally applied from the outside.
- Format: Real
- See also: Pre-polarization available?, Microphone supply
- Unit: V

- Applicability:

Sensor type	Usage
All others	No
Microphone	Possible

6.3.17 Property Excitation frequency nominal:

- Abbreviation: Uq
- Description:
  The supply voltage's frequency, especially for the sensor type LVDT and for AC excitation.
  Excitation frequency, nominal
  Target value of frequency of sinusoidal voltage
- Format: Real
- Unit: Hz
- Applicability:

Sensor type	Usage
Thermocouple	No
Thermistor	No
PT100, RTD	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
All others	Unimportant
LVDT	Recommended

6.3.18 Property Max. current consumption:

- Abbreviation: Us
- Description:
  With sensors having a voltage supply, the maximum current drawn by the voltage supply. Valid at reference temperature and nominal supply voltage. With AC, the RMS-value; with DC the positive rated maximum value.
- Format: Real
- Unit: mA

- Applicability:

Sensor type	Usage
Thermocouple	No
Thermistor	No
PT100, RTD	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
All others	Possible

6.3.19 Property Voltage level max.:

- Abbreviation: US
- Description:
  For sensors supplied with current, the necessary source strength in V (Volt). The supply current source must be able to generate this voltage.

  This specification is useful because no technically feasible current source can drive current through any resistor, no matter how strong. Instead, connecting the current source to a circuit limits the volt<age value which can be achieved.
- Format: Real
- Unit: V
- Applicability:

Sensor type	Usage
Thermocouple	No
All others	Possible

6.3.20 Property Supply type:

- Abbreviation: Ut
- Description:
  Type of voltage or current supply. Only to be specified if the sensor requires a certain type.

  For bridges (also strain gauge bridges), the physics of the system doesn't determine whether the bridge's supply needs to be DC or AC.

  Since a some measurement devices for bridges can only generate unipolar DC current, an otherwise useful specification of DC bipolar would be useless, since the measurement device couldn't comply.

  In other words, if no resistor bridges actually require it, the supply type should not be specified.
- Format: CodeText

- Codes:

Code	Definition	Description
0	DC	A unipolar supply. For voltages of, for instance, 0..5V. For current, a 1mA current source, for example.
1	DC bipolar	A bipolar supply. Only in conjunction with voltage supply. E.g. -10V, 0V, +10V.
2	AC	Generally only for voltage supply, e.g. a sinusoidal voltage of 5V amplitude.

- Standard: 0
- Applicability:

Sensor type	Usage
Thermocouple	No
All others	Possible

6.3.21 Property Inverse-polarity protection supply:

- Abbreviation: Uv
- Description:
  May the polarity of the supply be reversed without damaging the sensor?
- Format: CodeText
- Codes:

Code	Definition
0	No
1	Yes

- Applicability:

Sensor type	Usage
All others	Unimportant
Thermistor	No
Thermocouple	No
PT100, RTD	No
Resistance	No

6.3.22 Property Ripple supply:

- Abbreviation: Uw
- Description:
  For sensor supply with voltage, the maximum permitted ripple (peak-to-peak value) of the supply voltage

- Format: Real
- Unit: V
- Applicability:

Sensor type	Usage
Thermocouple	No
Thermistor	No
PT100, RTD	No
Resistance	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
All others	Unimportant

6.4 Group Calibration

- Description:
  This group contains all specifications affecting calibration and inspection.
- Abbreviation: C
- One at most present: No

6.4.1 Property Calibrator:

- Abbreviation: Cc
- Description:
  Designation of the calibrator used, e.g. manufacturer, type, serial number, all stated in a text.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible

6.4.2 Property Conformity:

- Abbreviation: CC
- Description:
  Statement of the guidelines according to which CE conformity is attested
- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

6.4.3 Property Calibrated on:

- Abbreviation: Cd
- Description: Calibration date. The sensor was last inspected on this day.
- Format: Date
- See also: Calibration interval, Calibration interval, Calibration valid until
- Applicability:

Sensor type	Usage
All others	Possible

6.4.4 Property Measurement points (electr.):

- Abbreviation: Ce
- Description:
  Electrical values of the characteristic curve or of measured points

  When a sensor is calibrated or inspected, it is usual for many pairs of measurement values to be recorded. A pair of measured values consists of a physical value and an electrical value.

  Here is where the sequence of electrical values for these measurement points is given.
  The individual values are separated by spaces.

  The values are ordered, either in increasing or decreasing order.

  They correspond to the associated values in the property Measurement points (physical).

  When the transfer behavior of sensors is linear, then 2 measured points are generally recorded, e.g. "plus full scale" and "minus full scale". The specification isn't necessary with linear sensors if, for instance, the transfer behavior is already specified by means of properties such as Sensitivity or the combination of the properties Physical min., Physical max., Electrical min. and Electrical max.. If the measured points are still given here again, then they are given special weight as precisely re-measured values.

  When the transfer behavior of sensors is non-linear, then multiple points should be recorded.

  With the sensor types Thermocouple, PT100, RTD or Thermistor, if the non-linear characteristic curve is given by the type or other coefficients, then measured values given here are only optional control values.

  The measured values given here are generally static values or values applicable at reference conditions.
- Format: RealList
- See also:
  Measurement points (physical), Physical min., Physical max., Electrical min., Electrical max., Sensitivity, Characteristic curve interpolation
- Unit: Electrical

- Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.4.5 Property Magnitude:

- Abbreviation: Cb
- Description:
  The magnitude values of the frequency response reference points. The values are ordered in the same way and matching to the frequency values in the property Frequency. A magnitude of 1.0 is a full, undampened transfer. For a sensor with 1st-order low-pass response, the magnitude value start at 1.0, and end at about 0.0.

  The magnitude is given for the sensor's transfer behavior "electrical output", in reference to its "physical input". For actuators, too, the output is referenced to the input.
- Format: RealList
- See also: Frequency, Phase, Upper cutoff frequency or Lower cutoff frequency
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.4.6 Property Frequency:

- Abbreviation: Cf
- Description:
  The frequency values of the measured frequency response points. The points are listed in order of increasing frequency. Each frequency value must have an associated amplitude value in the property Magnitude. The property Phase is optional if the phase is known.

  This property Frequency is only used when the frequency response is to be determined precisely at multiple positions. For many typical frequency responses, which can be described as simple low-pass or high-pass response, the properties Upper cutoff frequency or Lower cutoff frequency can also be used.
- Format: RealList
- See also:
  Magnitude, Phase, Upper cutoff frequency or Lower cutoff frequency, High-pass or Low-pass
- Unit: Hz
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.4.7 Property Phase:

- Abbreviation: Cp
- Description:
  The phase values of the frequency responses reference points. The values are ordered in the same way and always correspondingly to the frequency values in the property Frequency.

  The phase is stated for the sensor's transfer response "electrical output", in reference to its "physical input". For actuators, too: output referenced to input.

  The phase is stated in degrees. the frequency response can also be stated without phase if the phase isn't important. For a sensor with 1st order low-pass response, the phase values start at 0.0 and end at -90.0 degrees.
- Format: RealList
- See also: Frequency, Magnitude
- Unit: Degrees
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.4.8 Property Measurement points (physical):

- Abbreviation: Cr
- Description:
  Physical values of the characteristic curve or of measured points

  The values correspond to the associated values in the property Measurement points (electr.). For further descriptions, see the property Measurement points (electr.).
- Format: RealList
- See also: Measurement points (electr.)
- Unit: Physical
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.4.9 Property Test level:

- Abbreviation: Cg
- Description:
  For the sensor type Microphone, the test signal's output level.
  Test gain

- Format: Real
- Unit: dB
- Applicability:

Sensor type	Usage
All others	No
Microphone	Unimportant

6.4.10 Property Calibration interval (Int):

- Abbreviation: Ck
- Description:
  Distance in time between the sensor's necessary calibrations (inspections).
  Calibration period
  Stated in days
- Format: Int
- See also: Calibration interval, Calibrated on, Calibration valid until
- Unit: Days
- Applicability:

Sensor type	Usage
All others	Unimportant

6.4.11 Property Calibration interval (Real):

- Abbreviation: CK
- Description:
  Distance in time between the sensor's necessary calibrations (inspections).
  Calibration period

  Specified in years. The number of years need not be an integer.
- Format: Real
- See also: Calibration interval, Calibrated on, Calibration valid until
- Unit: Years
- Applicability:

Sensor type	Usage
All others	Possible

6.4.12 Property Characteristic curve interpolation:

- Abbreviation: CL
- Description:
  If a nonlinear characteristic curve is defined by a sequence of values using the poperties Measurement points (electr.) and Measurement points (physical), then the property determines the type of interpolation between these values.

  In general an interpolation with splines will be preferred. Then this property need not be used. Only if linear interpolation is required, then the value of this property needs to be set accordingly.
- Format: CodeText
- See also: Measurement points (physical), Measurement points (electr.)
- Codes:

Code	Definition
0	Spline
1	Linear

- Applicability:

Sensor type	Usage
All others	Unimportant

6.4.13 Property Frequency response type:

- Abbreviation: Cm
- Description:
  Sensor type Microphone: This parameter specifies the type of response given by the transfer function, either actuator or corrected response.
  Defined in IEEE 1451.4
- Format: CodeText
- Codes:

Code	Definition
0	Actuator
1	Corrected

- Applicability:

Sensor type	Usage
All others	No
Microphone	Unimportant

6.4.14 Property Responsible:

- Abbreviation: Cn
- Description:
  Name of entity responsible for the sensor's calibration or inspection. This could be a person, laboratory, department, company or test rig, for example.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

6.4.15 Property Standards:

- Abbreviation: CN
- Description:
  The standards with which the sensor complies. Here you can also state standards according to which the sensor was inspected. If there are multiple standards, they can be separated by commas.
  E.g. EN 60584-1 (1995), IEC 751
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible

6.4.16 Property Calibration OK:

- Abbreviation: Co
- Description:
  Findings. Summarized results of the sensor's calibration / inspection.
- Format: CodeText
- Codes:

Code	Definition	Description
0	Not OK	The sensor is not calibrated (correctly).
1	OK	Sensor calibrated successfully

- Applicability:

Sensor type	Usage
All others	Possible

6.4.17 Property Test voltage:

- Abbreviation: Cu
- Description:
  The inspection was carried out with this voltage. E.g. for isolation tests or general overvoltage protection.
- Format: Real
- See also: Standards
- Unit: V
- Applicability:

Sensor type	Usage
All others	Unimportant

6.4.18 Property Calibration valid until:

- Abbreviation: Cv
- Description: The date until which the sensor's calibration is valid.
  Calibration due date, valid till
- Format: Date
- See also: Calibration interval, Calibration interval, Calibrated on
- Applicability:

Sensor type	Usage
All others	Recommended

6.4.19 Property Steinhart A:

- Abbreviation: C1
- Description:
  A coefficient of the Steinhart-Hart equation for the sensor type Thermistor.

  T[°C] + 273.15°C = 1 / (A + B * ln (R) +C * (ln R) ^3).

  In this case R is the resistance in Ohm. The temperature T is stated in °C.

  The 3 coefficients A, B, C are determined, if appropriate, by measurements or calibration, or are taken from the manufacturer's spec sheet.
- Format: Real
- See also: Steinhart B, Steinhart C
- Unit: 1/°C
- Standard: 0

- Applicability:

Sensor type	Usage
All others	No
Thermistor	Necessary

6.4.20 Property Steinhart B:

- Abbreviation: C2
- Description: B coefficient in Steinhart-Hart equation

  For a description refer to the property Steinhart A. Use only in conjunction with this property.
- Format: Real
- See also: Steinhart A, Steinhart C
- Unit: 1/°C
- Standard: 0
- Applicability:

Sensor type	Usage
All others	No
Thermistor	Necessary

6.4.21 Property Steinhart C:

- Abbreviation: C3
- Description: C coefficient in Steinhart-Hart equation

  For a description refer to the property Steinhart A. Use only in conjunction with this property.
- Format: Real
- See also: Steinhart A, Steinhart B
- Unit: 1/°C
- Standard: 0
- Applicability:

Sensor type	Usage
All others	No
Thermistor	Necessary

6.4.22 Property Coefficient A:

- Abbreviation: C4
- Description: The A coefficient in the Callendar-Van Dusen equation.

  Optional sensor type PT100, RTD. Not used only in special cases, if the standard characteristic curve for PT100, PT1000 as per IEC 751 doesn't apply.
  Calculated for temperature in °C.
  Equation:

  R = R0 * (1 + A * T + B * T^2 + (T - 100°C) * C * T^3.

  The reference resistance R0, stated in Ohm, is derived from the property Resistance.

  The relevant standards for these PTC resistors are IEC 751, DIN 43760, BS-1904, JIS C 1604.

  The values A = 3.9083e-3, B = -5.7750e-7, C = -4.183e-12 comply with IEC 751 and are (in approximation) also used in imc measurement devices as the default values.
- Format: Real
- See also: Coefficient B, Coefficient C, Resistance
- Unit: °C^-1
- Applicability:

Sensor type	Usage
All others	No
PT100, RTD	Possible

6.4.23 Property Coefficient B:

- Abbreviation: C5
- Description:
  The coefficient B for the Callendar-Van Dusen equation. Only in conjunction with the coefficient A.
- Format: Real
- See also: Coefficient A
- Unit: °C^-2
- Applicability:

Sensor type	Usage
All others	No
PT100, RTD	Possible

6.4.24 Property Coefficient C:

- Abbreviation: C6
- Description:
  The coefficient C for the Callendar-Van Dusen equation. Only in conjunction with the coefficients A and B. The coefficient C is only used if the temperature falls below0°C.

  In the literature, the unit is given either as °C^-3 or °C^-4. The former is used in IEEE 1451.4 and for that reason also here. However, this doesn't affect the coefficient's numerical value and its definition.
- Format: Real
- See also: Coefficient A
- Unit: °C^-3
- Applicability:

Sensor type	Usage
All others	No
PT100, RTD	Possible

6.5 Group Specifications of precision

- Description:
  This group contains all specifications affecting accuracy, stability, and other quantities, as well as extra information helpful for improving the quality of a measurement.
- Abbreviation: P
- One at most present: No

6.5.1 Property Amplitude slope:

- Abbreviation: Pa
- Description: Amplitude slope in the sensor's frequency response
  Value a in the expression H(f) = (j * f / fref) ^ (a / ln (10))
  amplitude slope, constant relative slope

  Only for sensors whose frequency response is well approximated by this equation.
- Format: Real
- See also: Reference frequency
- Unit: %/Decade
- Applicability:

Sensor type	Usage
All others	Unimportant
IEPE (ICP), accelerometer	Possible
Piezoelectric sensor	Possible

Sensor type	Usage
Thermistor	No
Thermocouple	No
PT100, RTD	No
Digital out	No
Actor digital IN, relay	No

6.5.2 Property Temperature coefficient gage-factor:

- Abbreviation: Pd
- Description:
  For the sensor type Strain gauge bridge and for especially exact analyses the specification of how the gage factor depends on the temperature. The reference value is given by the property Reference temperature, e.g. 20°C.
- Format: Real
- See also: Reference temperature, Temperature dependence of strain, Gage factor
- Unit: %/100°C
- Applicability:

Sensor type	Usage
All others	No
Strain gauge bridge	Possible

6.5.3 Property Temperature dependence of strain:

- Abbreviation: PD
- Description:
  The temperature coefficient for the strain. It is given for the polynomial:

  Apparent strain [µm/m] = K0 + K1 * T + K2 * T^2 + K3*T^3 + K4*T^4

  T in °C. Valid within the temp. range specified by the properties Temperature min. and Temperature max..

  5 numerical values K0, ..K4 are given. All 5 numbers are separated by spaces.
- Format: RealList
- See also: Temperature coefficient gage-factor, Gage factor
- Applicability:

Sensor type	Usage
All others	No
Strain gauge bridge	Possible

6.5.4 Property Accuracy:

- Abbreviation: Pg
- Description:
  Precision class, accuracy referenced to the spread of the physical signal. The sensor's relative accuracy. Maximum error. Stated as a real number percentage value.

  The specification in percent points refers to the total spread of the physical input range.

  For instance, a sensor with the range 0V..5V and an accuracy rating of 1% has a maximum absolute error of 0.05V.

  For instance, a sensor with the range -5V..+5V and an accuracy rating of 1% has a maximum absolute error of 0.1V, since the total range spread is 10V.
- Format: Real
- See also: Long-term stability
- Unit: %
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.5.5 Property Reference frequency:

- Abbreviation: Pf
- Description:
  Especially for oscillation sensors. In that case, the reference frequency. For the sensor type IEPE (ICP), accelerometer, for instance, it could be the frequency used for calibration, 159.15 Hz. Otherwise it can be a frequency to which other properties (Sensitivity, ...) refer.
- Format: Real
- Unit: Hz

- Applicability:

Sensor type	Usage
IEPE (ICP), accelerometer	Recommended
Piezoelectric sensor	Recommended
All others	Possible
Thermocouple	No
Thermistor	No
PT100, RTD	No
Digital out	No
Actor digital IN, relay	No
No sensor	Unimportant

6.5.6 Property Hysteresis:

- Abbreviation: PH
- Description:
  Maximum or specified hysteresis, stated in terms of the physical unit. The physical signal must reverse direction by this amount before the electrical output begins to follow suit.
- Format: Real
- See also: Resolution
- Unit: Physical
- Applicability:

Sensor type	Usage
All others	Unimportant

6.5.7 Property Long-term stability:

- Abbreviation: PL
- Description:
  How measured values change over the long term. Stated in percent of the input range's total spread, per year.
- Format: Real
- See also: Accuracy
- Unit: %/year
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.5.8 Property Non-linearity:

Abbreviation: PN

Description:
Linearity error. Maximum deviation from linear transfer behavior.

The specification in percent points refers to the total spread of the physical input range.

Format: Real

See also: Accuracy

Unit: %

Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.5.9 Property Zero point drift:

Abbreviation: Pn

Description:
How far the zero-point deviates as a function of the temperature. The reference point is the reference temperature. The further the temperature deviates from the reference temperature, the greater the error.

The specification in percent points refers to the total spread of the physical input range.

Format: Real

See also: Reference temperature, Accuracy

Unit: %/°C

Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.5.10 Property Pressure coefficient:

- Abbreviation: PP
- Description:
  How strongly does the measurement signal change in response to ambient pressure. The reference point is the reference pressure. The further the pressure deviates from the reference pressure, the greater the error.

  The specification in percent points refers to the total spread of the physical input range.
- Format: Real
- See also: Reference pressure, Accuracy

- Unit: %/kPa
- Applicability:

Sensor type	Usage
All others	Unimportant
Microphone	Possible
PT100, RTD	No
Thermistor	No
Thermocouple	No

6.5.11 Property Phase error:

- Abbreviation: Pp
- Description:
  The phase error occurring at reference frequency. A phase correction is proportional to the phase error but with opposite sign. The phase error is the phase angle in the sensor's transfer function (electrical output signal in relation to physical input signal) at the reference frequency.
- Format: Real
- Unit: °
- Applicability:

Sensor type	Usage
All others	Unimportant
IEPE (ICP), accelerometer	Possible
Piezoelectric sensor	Possible

6.5.12 Property Quality at resonance frequency:

Abbreviation: Pq

Description:
Quality at resonance frequency. For sensors whose transfer behavior features a marked resonance, e.g. sensor types Microphone and IEPE (ICP), accelerometer.
Quality factor at resonance frequency

Format: Real

See also: Resonance frequency

Applicability:

Sensor type	Usage
All others	Unimportant
IEPE (ICP), accelerometer	Possible
Piezoelectric sensor	Possible
Microphone	Possible

6.5.13 Property Resolution:

- Abbreviation: Pr
- Description:
  Smallest change of the physical signal at which a corresponding change of the electrical signal takes place. Stated in the physical quantity's units.
  Resolution, threshold
- Format: Real
- See also: Hysteresis
- Unit: Physical
- Applicability:

Sensor type	Usage
All others	Unimportant

6.5.14 Property Reproducibility:

- Abbreviation: PR
- Description:
  How well can the same measured value be reproduced? After changes to the environmental conditions have taken place, and the exact same situation is restored, how precisely does the sensor's output signal match the previous value?

  The specification in percent points refers to the total spread of the physical input range.
- Format: Real
- Unit: %
- Applicability:

Sensor type	Usage
All others	Unimportant

6.5.15 Property Temperature error:

- Abbreviation: Pt
- Description:
  Temperature coefficient. Temperature drift. How strongly does the measured value change with the temperature. The reference point is the reference temperature. The further the temperature deviates from the reference temperature, the greater the error.

  The specification in percent points refers to the total spread of the physical input range.
  The sensor's transfer function:
  H(T) = 1 + TC * (T-Tref)

  where TC = temperature error, e.g. = 1%=0.01; T = temperature, Tref = reference temperature
- Format: Real

- See also: Reference temperature
- Unit: %/°C
- Applicability:

Sensor type	Usage
No sensor	Possible
All others	Unimportant

6.5.16 Property Noise (mV):

- Abbreviation: Pu
- Description:
  RMS-value of the output noise. Disturbance noise interfering with the useful signal.
- Format: Real
- See also: Noise
- Unit: mV
- Applicability:

Sensor type	Usage
All others	Unimportant

6.5.17 Property Noise(dB(A)):

- Abbreviation: PU
- Description:
  RMS-value of the output noise. Disturbance noise interfering with the useful signal.
- Format: Real
- See also: Noise
- Unit: dB (A)
- Applicability:

Sensor type	Usage
All others	Unimportant

6.5.18 Property Residual ripple:

- Abbreviation: Pw
- Description: Residual ripple in electric output signal
  Ripple.
- Format: Real
- Unit: Electrical

- Applicability:

Sensor type	Usage
All others	Unimportant

6.6 Group Construction

- Description:
  All properties are listed in this group, which pertain to the mechanical construction and the frame. Or properties immediately dependent upon the mechanical properties.
- Abbreviation: R
- One at most present: Yes

6.6.1 Property Diameter (mm):

- Abbreviation: Ra
- Description: Diameter, especially for a circular cross-section.
- Format: Real
- See also: Diameter, Length, Width, Height, Housing, Area
- Unit: mm
- Applicability:

Sensor type	Usage
All others	Unimportant

6.6.2 Property Diameter (inch):

- Abbreviation: RA
- Description:
  Diameter. Especially for the sensor type Microphone, the diameter is stated in the unit inches.
- Format: Real
- See also: Diameter
- Unit: inch
- Applicability:

Sensor type	Usage
Microphone	Possible
All others	Unimportant

6.6.3 Property Area:

- Abbreviation: Rb
- Description:
  The area dependent on the sensor type and geometry. E.g. for sensor type Strain gauge bridge.
  Also: Gage area
- Format: Real
- See also: Diameter, Length, Width
- Unit: mm^2
- Applicability:

Sensor type	Usage
All others	Unimportant

6.6.4 Property Service life (revolutions):

- Abbreviation: Rc
- Description:
  Minimum service life. For sensors with rotating components. The service life can be stated in terms of the number of revolutions.
- Format: Real
- See also: Service life, Service life
- Unit: Revolutions
- Applicability:

Sensor type	Usage
All others	Possible

6.6.5 Property Service life (cycles):

- Abbreviation: RC
- Description:
  Minimum service life. For sensors whose service life is affected by switching processes or load changes, or any other processes which can be referred to as cycles. The service life depends on the number of cycles.
- Format: Real
- See also: Service life, Service life
- Unit: Cycles
- Applicability:

Sensor type	Usage
All others	Possible

6.6.6 Property Delay time:

- Abbreviation: Rd
- Description:
  Throughput time for the change in an input signal to effect a change in the output signal. A signal's transit time.
- Format: Real
- See also: Reaction time, Sampling interval
- Unit: ms
- Applicability:

Sensor type	Usage
All others	Unimportant

6.6.7 Property Spring force:

- Abbreviation: RF
- Description:
  The spring force. For sensors containing a spring. Maximum value.
- Format: Real
- Unit: N
- Applicability:

Sensor type	Usage
Thermocouple	No
PT100, RTD	No
Thermistor	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
Microphone	No
All others	Unimportant

6.6.8 Property Light spot:

- Abbreviation: Rf
- Description: Description of the light spot, e.g. type and size
- Format: Text

- Applicability:

Sensor type	Usage
Thermocouple	No
PT100, RTD	No
Thermistor	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
Microphone	No
All others	Unimportant

6.6.9 Property Threading:

- Abbreviation: RG
- Description: Threading designation, e.g. M20 * 1.5
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible

6.6.10 Property Seismic mass:

- Abbreviation: Rg
- Description: With accelerometers, the inertial mass in the sensor.
  Mass below gage
- Format: Real
- See also: Mass
- Unit: g
- Applicability:

Sensor type	Usage
All others	Possible

6.6.11 Property Housing:

- Abbreviation: Rh
- Description:
  Designation or description of the housing, its shape or properties.
- Format: Text
- See also: Length, Width, Height, Diameter

- Applicability:

Sensor type	Usage
All others	Possible

6.6.12 Property Isolation voltage:

- Abbreviation: Ri
- Description:
  The isolation is able to withstand the specified voltage over the long term.
- Format: Real
- See also: Reference temperature, Isolation resistance
- Unit: V
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.6.13 Property Light source:

- Abbreviation: Rl
- Description: Description of the light spot, e.g. color, type, power
- Format: Text
- Applicability:

Sensor type	Usage
Thermocouple	No
PT100, RTD	No
Thermistor	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
Microphone	No
All others	Unimportant

6.6.14 Property Service life:

- Abbreviation: RL
- Description:
  Minimum service life. For sensors for which the time in use is a measure of the lifespan.
- Format: Real
- See also: Service life, Service life

- Unit: Years
- Applicability:

Sensor type	Usage
All others	Possible

6.6.15 Property Breakaway torque:

- Abbreviation: Rm
- Description:
  Motion starts at this moment. Especially for rotating (but also for linear motion) components.
- Format: Real
- Unit: mNm
- Applicability:

Sensor type	Usage
Thermocouple	No
PT100, RTD	No
Thermistor	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
Microphone	No
All others	Possible
No sensor	Unimportant

6.6.16 Property Mass:

- Abbreviation: RM
- Description: The sensor is this heavy in grams.
- Format: Real
- Unit: g
- Applicability:

Sensor type	Usage
All others	Possible

6.6.17 Property Oscillator frequency:

- Abbreviation: Ro
- Description: The frequency of sensors with built-in oscillators.
- Format: Real

- Unit: Hz
- Applicability:

Sensor type	Usage
Thermocouple	No
PT100, RTD	No
Thermistor	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
Microphone	No
Strain gauge bridge	Unimportant

6.6.18 Property Pre-amplifier:

- Abbreviation: Rp
- Description:
  Does the sensor have a built-in pre-amplifier. A typical option for the sensor type Microphone.
- Format: CodeText
- Codes:

Code	Definition
0	No
1	Yes

- Applicability:

Sensor type	Usage
Microphone	Recommended
All others	Possible
PT100, RTD	No
Thermistor	No
Resistance	No
Thermocouple	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
LVDT	No
Strain gauge bridge	No
Sensor in bridge configuration	No
Potentiometric sensor	No
No sensor	Unimportant

6.6.19 Property Isolation resistance:

- Abbreviation: Rr
- Description:
  The minimum isolation resistance. Generally applies at reference temperature and in the specified humidity range.
- Format: Real
- See also: Reference temperature, Isolation voltage
- Unit: MOhm
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.6.20 Property Reaction time:

- Abbreviation: RR
- Description:
  Time interval for a noticeable change of the electrical output, expressed in ms.

  If you only observe the electrical output, then it doesn't seem necessary to take readings of the output more quickly than specified here. This is because in the meantime not much has happened.

  This does not refer to the cycle time from a change in the physical input to a change in the electrical output.

  If a digitalized measurement device is connected, this time interval can be used as the sampling time, for example.
  Response time.
- Format: Real
- See also: Delay time, Sampling interval
- Unit: ms
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.6.21 Property Self-heating:

- Abbreviation: Rs
- Description: Self-heating coefficient
  Self-heating constant

  Especially with temperature sensors which are heated by the power delivered via the power supply. Typical for sensor types PT100, RTD and Thermistor.
- Format: Real
- Unit: mW/°C

- Applicability:

Sensor type	Usage
All others	Unimportant
Thermistor	Possible
PT100, RTD	Possible
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
Digital out	No
Actor digital IN, relay	No
Actuator frequency input	No
Encoder, impulse-, frequency output	No

6.6.22 Property Stiffness:

- Abbreviation: RS
- Description: With force sensors, the stiffness Stiffness
- Format: Real
- See also: Sensitivity
- Unit: N/µm
- Applicability:

Sensor type	Usage
IEPE (ICP), accelerometer	Unimportant
Piezoelectric sensor	Unimportant
Sensor with current output	Unimportant
Sensor with voltage output	Unimportant
Sensor in bridge configuration	Unimportant
Strain gauge bridge	Unimportant

6.6.23 Property Moment of inertia:

- Abbreviation: RT
- Description: Moment of inertia of rotating part
- Format: Real
- Unit: gcm^2

- Applicability:

Sensor type	Usage
All others	Unimportant

6.6.24 Property Warm-up time:

- Abbreviation: Rt
- Description:
  This much time after having been activated, the sensor returns a signal within the specifications. Stated in seconds.
  Warm-up time
- Format: Real
- Unit: s
- Applicability:

Sensor type	Usage
All others	Possible

6.6.25 Property Equivalent volume:

- Abbreviation: Rv
- Description:
  For the sensor type Microphone, the equivalent microphone volume
  Equivalent microphone volume
- Format: Real
- Unit: m^3
- Applicability:

Sensor type	Usage
All others	No
Microphone	Unimportant

6.6.26 Property Length:

- Abbreviation: Rx
- Description: Length of sensor (part of dimensions)
- Format: Real
- See also: Width, Height, Diameter, Housing, Area
- Unit: mm

- Applicability:

Sensor type	Usage
All others	Unimportant

6.6.27 Property Width:

- Abbreviation: Ry
- Description: Width of sensor (part of dimensions)
- Format: Real
- See also: Length, Height, Diameter, Housing, Area
- Unit: mm
- Applicability:

Sensor type	Usage
All others	Unimportant

6.6.28 Property Height:

- Abbreviation: Rz
- Description: Height of the sensor (one of its dimensions)
- Format: Real
- See also: Length, Width, Diameter, Housing
- Unit: mm
- Applicability:

Sensor type	Usage
All others	Unimportant

6.7 Group Environmental conditions

- Abbreviation: E
- One at most present: Yes

6.7.1 Property Storage temperature max.:

- Abbreviation: EA
- Description: Maximum permitted storage temperature, stated in °C
  Non-operating temperature max. (storage)
- Format: Real
- See also: Storage temperature min., Temperature max.
- Unit: °C

- Applicability:

Sensor type	Usage
All others	Possible

6.7.2 Property Temperature max.:

- Abbreviation: Ea
- Description:
  Maximum permitted ambient temperature during operation, stated in °C
  Operating temperature max.
- Format: Real
- See also: Storage temperature max., Temperature min., Reference temperature
- Unit: °C
- Applicability:

Sensor type	Usage
All others	Possible

6.7.3 Property Conditions:

- Abbreviation: Eb
- Description:
  Here, all the conditions which are hard to state as fixed properties are listed in textual form; peculiarities and exceptions.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible

6.7.4 Property Condensation:

- Abbreviation: Ec
- Description: Is condensation permitted?
- Format: CodeText
- Codes:

Code	Definition
0	No
1	Yes

- Applicability:

Sensor type	Usage
All others	Unimportant

6.7.5 Property Min. humidity:

- Abbreviation: Eh
- Description: Minimum allowed relative humidity, stated in percent
- Format: Real
- Unit: %
- Applicability:

Sensor type	Usage
All others	Possible

6.7.6 Property Max. humidity:

- Abbreviation: EH
- Description: Maximum allowed relative humidity, stated in percent
- Format: Real
- Unit: %
- Applicability:

Sensor type	Usage
All others	Possible

6.7.7 Property Temperature min.:

- Abbreviation: Ei
- Description:
  Minimum permitted ambient temperature during operation, stated in °C
  Operating temperature min.
- Format: Real
- See also: Temperature max., Storage temperature min., Reference temperature
- Unit: °C
- Applicability:

Sensor type	Usage
All others	Possible

6.7.8 Property Storage temperature min.:

- Abbreviation: EI
- Description: Minimum permitted storage temperature, stated in °C
  Non-operating temperature min. (storage)
- Format: Real
- See also: Storage temperature max., Temperature min.
- Unit: °C
- Applicability:

Sensor type	Usage
All others	Possible

6.7.9 Property Max. height:

- Abbreviation: EL
- Description:
  The sensor may be operated at up to this elevation above sea level.
  Altitude (max)
- Format: Real
- Unit: m
- Applicability:

Sensor type	Usage
All others	Unimportant

6.7.10 Property Pressure resistance:

- Abbreviation: EP
- Description: The sensor may be operated up to this maximum pressure.
- Format: Real
- Unit: bar
- Applicability:

Sensor type	Usage
All others	Possible

6.7.11 Property Reference pressure:

- Abbreviation: Ep
- Description:
  This is the reference pressure. The other specifications apply at this pressure level.
- Format: Real

- See also: Reference temperature
- Unit: bar
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.7.12 Property Protection type:

- Abbreviation: ES
- Description:
  Description of the protection type, specification of fulfilled guidelines, e.g. IP65
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible

6.7.13 Property Shock protection:

- Abbreviation: Es
- Description:
  Shock protection. Maximum permitted impact, as a short-term peak value
  Shock
- Format: Real
- Unit: m/s^2
- Applicability:

Sensor type	Usage
All others	Possible

6.7.14 Property Reference temperature:

- Abbreviation: Et
- Description: Reference temperature in °C
- Format: Real
- See also: Reference pressure
- Unit: °C

- Applicability:

Sensor type	Usage
All others	Possible

6.7.15 Property RPM max.:

- Abbreviation: Eu
- Description:
  The sensor may be used up to this maximum RPM-value. For sensors with rotating components.
- Format: Real
- Unit: RPM
- Applicability:

Sensor type	Usage
PT100, RTD	No
Thermistor	No
Thermocouple	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
All others	Unimportant

6.7.16 Property Vibration max.:

- Abbreviation: Ev
- Description:
  Vibration protection, the max. withstandable vibration. Stated as RMS.
- Format: Real
- Unit: m/s^2
- Applicability:

Sensor type	Usage
All others	Possible

6.7.17 Property Radial shaft load capacity:

- Abbreviation: Ew
- Description: Maximum axle load capacity in radial direction
- Format: Real
- Unit: Nm

- Applicability:

Sensor type	Usage
PT100, RTD	No
Thermistor	No
Thermocouple	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
All others	Unimportant

6.7.18 Property Axial shaft load capacity:

- Abbreviation: EW
- Description: Maximum axle load capacity in axial direction
- Format: Real
- Unit: N
- Applicability:

Sensor type	Usage
PT100, RTD	No
Thermistor	No
Thermocouple	No
IEPE (ICP), accelerometer	No
Piezoelectric sensor	No
All others	Unimportant

6.8 Group Assembly

- Description:
  In this group all properties are listed which pertain to how the sensor is fastened to its application site. How and where is the sensor mounted, connected, wired? What are the attributes of the installation site? These entries can only be made, of course, if it is known where the sensor is installed.
- Abbreviation: M
- One at most present: Yes

6.8.1 Property Bridge offset:

- Abbreviation: Mb
- Description:
  Once the bridge has been constructed, particularly after the strain gauges have been glued down, the bridge will typically have an offset even at the process' rest position. A nonzero bridge voltage differential is measurable.

  This measured value, however, is to correspond to zero of the physical units.

  For example, consider a beam in its resting position, bearing no load. With a strain gauge bridge, it is measured at 2.5mV/V. This measured value corresponds to a load of 0.0N/mm^2 and is the bridge offset.

  The typical bridge offset is in the range of up to 3mV/V. With a bridge amplifier, it is usually compensated already on the analog side. This is because in wire strain gauge measurement, input ranges as narrow as 1mV/V are common, while the relatively large bridge offset must still be compensated.

  Usually the bridge offset is not recorded for the long term but is updated by means of the bridge amplifier's tare function.

  If electrical min./max. values are specified for a sensor (see properties Electrical min., Electrical max.), then they are valid. The bridge offset is taken into account only if they aren't provided.

  The bridge offset must be specified primarily when the tare function can't be carried out afterwards, e.g. because the rest state cannot be restored.
  Gage offset
- Format: Real
- See also: Electrical min., Electrical max., Gage factor, Tare
- Unit: mV/V
- Applicability:

Sensor type	Usage
Sensor in bridge configuration	Unimportant
Strain gauge bridge	Possible
PT100, RTD	Unimportant
LVDT	Unimportant
All others	No
No sensor	No

6.8.2 Property Cable capacity:

- Abbreviation: Mc
- Description:
  The capacitance of the connection cable. Total, not per meter.
  Cable capacitance
- Format: Real
- Unit: pF
- Applicability:

Sensor type	Usage
Microphone	Possible
All others	Unimportant

6.8.3 Property Process side connection:

- Abbreviation: MC
- Description:
  Description of the sensor's connection to the measurement object. The connection to the physical process. E.g. coupling and nipples, with a pressure sensor.
  A description in text form
  Connection to process
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.8.4 Property Elasticity modulus:

- Abbreviation: Me
- Description:
  The material constant of the material to which the sensor is attached. Typical for the sensor type Strain gauge bridge. Especially if not only a strain analysis but also a tension analysis is desired.

  Despite specifying the elastic modulus, the physical quantity at the sensor is the strain (e.g. in the properties Physical min. and Physical max.), and not the tension.
  Young's modulus, elastic modulus
- Format: Real
- See also: Poisson coefficient
- Unit: GPa
- Applicability:

Sensor type	Usage
Strain gauge bridge	Possible
All others	Unimportant
No sensor	No

6.8.5 Property Elastic limit:

- Abbreviation: Mg
- Description: The material's stretching is linear within this range.
  Yield point
- Format: Real
- Unit: MPa
- Applicability:

Sensor type	Usage
All others	Unimportant
No sensor	No

6.8.6 Property Grid:

- Abbreviation: MG
- Description: For rosettes, the grid's number. For sensor type Strain gauge bridge.

  If only one sensor description is used for the whole Rosette (possibly having several outputs), then this property isn't used. In that case the outputs 1, 2 and 3 also designate Grids 1, 2 and 3 (or A, B, C).

  However if there is one sensor description per strain gauge, then this property is important for positioning the grids with the correct orientation.
- Format: CodeText

- See also: Geometric arrangement
- Codes:

Code	Definition	Description
1	1 (A)	Grid 1 or A
2	2 (B)	Grid 2 or B
3	3 (C)	Grid 3 or C

- Applicability:

Sensor type	Usage
All others	No
Strain gauge bridge	Unimportant

6.8.7 Property Cold junction compensation:

- Abbreviation: MJ
- Description:
  If this property exists, the sensor is already provided with cold junction compensation. The thermo-wire is at a constant, defined temperature all the way up to its contact point. From this point on, the connection to the measurement circuitry is no longer with thermal wire, but with normal wire.

  The measurement device then may no longer carry out a cold junction compensation. Here, the temperature of the available cold junction connection point is given.
  Cold junction compensation
- Format: Real
- See also: Thermocouple
- Unit: °C
- Applicability:

Sensor type	Usage
All others	No
Thermocouple	Unimportant

6.8.8 Property Cable length:

- Abbreviation: ML
- Description: Length of electric connection cable
- Format: Real
- Unit: m

- Applicability:

Sensor type	Usage
All others	Unimportant

6.8.9 Property Material:

- Abbreviation: Mm
- Description:
  The material with which the sensor is in contact. For strain gauges, for instance, the material to which the strain gauge adheres, e.g. steel. The designation or description of the material is to be entered.
- Format: Text
- Applicability:

Sensor type	Usage
Strain gauge bridge	Possible
All others	Unimportant

6.8.10 Property Measurement position:

- Abbreviation: Mn
- Description:
  Designation of the measurement position. The sensor is installed at this position, and the measurement quantity is measured.

  The designation of the measurement position can be used as the channel designation by a connected measurement device. While it is possible for the measurement position to be described in any fashion, if a channel name is derived from its designation, and even used later in formulas, it may make sense to adhere to a particular syntax.

  In contrast to the property Installation location, the exact position is described in great detail.
- Format: Text
- See also: Measurement location ID, Installation location, Channel designation
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.8.11 Property Measurement location ID:

- Abbreviation: Mo
- Description:
  An integer which identifies the measurement location. Only for special applications in which a number provides sufficient description.
  Measurement location ID (IEEE 1451.4)
- Format: Int
- See also: Measurement position, Installation location, Channel designation
- Applicability:

Sensor type	Usage
All others	Unimportant
No sensor	No

6.8.12 Property Installation location:

- Abbreviation: Mp
- Description:
  A more general description of the location where the sensor is installed, e.g. 'Rack' or 'Vehicle engine room'. The precise and detailed specification, like for the property Measurement position, is not made given here, but rather the environment, area, overall machine or apparatus.
- Format: Text
- See also: Measurement position, Measurement location ID, Channel designation
- Applicability:

Sensor type	Usage
All others	Unimportant

6.8.13 Property Poisson coefficient:

- Abbreviation: MP
- Description:
  Material constant of the material to which the sensor is glued. Typical for the sensor type Strain gauge bridge, necessary for Poisson bridge arrangements.
  Poisson coefficient
- Format: Real
- See also: Gage type, Gage factor, Poisson coefficient

- Applicability:

Sensor type	Usage
All others	Unimportant
Strain gauge bridge	Recommended
No sensor	No

6.8.14 Property Electr. connection:

- Abbreviation: Ms
- Description:
  Specifications concerning the electrical connection, e.g. designation and description of the connector.
  Plug, connector
- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

6.8.15 Property Horizontal position:

- Abbreviation: Mx
- Description:
  A detail of the description of the installation location. Typically column, x-position, x-coordinate, slot.

  When installing in a rack, all the way left is number 1, counting higher going right.
  For enumerable items
- Format: Real
- Applicability:

Sensor type	Usage
All others	Unimportant

6.8.16 Property Vertical position:

- Abbreviation: My
- Description:
  A detail in the description of the installation location. Typically row, height, y-position. For stacked racks, the top is number 1, counting higher going down.
- Format: Real
- Applicability:

Sensor type	Usage
All others	Unimportant

6.9 Group Data acquisition

- Description:
  To capture the sensor's signal, the sensor is connected to a data acquisition system. In this group, properties are listed which the measurement system should have in order to be able to measure the sensor's signal correctly and in a suitable manner.
- Abbreviation: A
- One at most present: No

6.9.1 Property Actual level, max:

- Abbreviation: Aa
- Description:
  Maximum modulation of the physical value. Although the sensor itself can correctly convert higher physical values, (in this special arrangement) the physical value specified here is the highest value expected.

  This is the modulation which the measurement device really needs, in order to be able to adjust the input range.

  E.g. Actual level, min = -0.1 and Actual level, max = +0.1, if a sensor having the range -10Nm ... + 10Nm is only modulated in the range -0.1 ..+0.1Nm. Note in this case that the specification here is expressed in physical, not electrical units.

  The value specified here is always greater than the one specified in the property Actual level, min. It should lie within the range Physical min. .. Physical max..
  Max. actual level
- Format: Real
- See also: Actual level, min, Physical max., Physical min.
- Unit: Physical

- Applicability:

Sensor type	Usage
All others	Possible
No sensor	No

6.9.2 Property Actual level, min:

- Abbreviation: Ai
- Description:
  Minimum modulation of the physical value. Although the sensor itself can correctly convert lower physical values, (in this special arrangement) the physical value specified here is the lowest value expected.

  This is the modulation which the measurement device really needs, in order to be able to adjust the input range.

  E.g. Actual level, min = -0.1 and Actual level, max = +0.1, if a sensor having the range -10Nm ... + 10Nm is only modulated in the range -0.1 ..+0.1Nm. Note in this case that the specification here is expressed in physical, not electrical units.

  The value specified here is always less than the one specified in the property Actual level, max. It should lie within the range Physical min. .. Physical max..
  Min. actual level
- Format: Real
- See also: Actual level, max, Physical min., Physical max.
- Unit: Physical
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	No

6.9.3 Property Coupling:

- Abbreviation: Ac
- Description:
  Is the measurement to be connected to the sensor with AC- or DC coupling?
  Coupling
- Format: CodeText
- See also: High-pass, Sensor output to ground, Lower cutoff frequency

- Codes:

Code	Definition	Description
0	DC	Default. The coupling is direct, without any capacitor connected in between. This makes measurement of very low frequencies possible, too.
1	AC	The measurement device is coupled via a capacitor. Thus the measurement device is isolated from the sensor for DC voltage. Any offset present is suppressed.

- Applicability:

Sensor type	Usage
All others	Possible
Resistance	No
Thermistor	No
PT100, RTD	No
Thermocouple	No
No sensor	No

6.9.4 Property Switching threshold:

- Abbreviation: AD
- Description:
  The recommended comparator switching threshold at the measurement device's input
  For sensor types Digital out and Encoder, impulse-, frequency output.
  Switching between levels high/low occurs at this level
- Format: Real
- See also: Signal level min., Signal level max., Hysteresis for slope forming
- Unit: V
- Applicability:

Sensor type	Usage
All others	No
Encoder, impulse-, frequency output	Recommended
Digital out	Recommended

6.9.5 Property Direction:

Abbreviation: Ad

Description:
The sensor's sensitivity is oriented in this direction. Especially for the sensor type IEPE (ICP), accelerometer.

Format: CodeText

Codes:

Code	Definition
x	x
y	y
z	z

Applicability:

Sensor type	Usage
All others	Unimportant
IEPE (ICP), accelerometer	Recommended
Piezoelectric sensor	Recommended
Microphone	Possible
No sensor	No

6.9.6 Property Hysteresis for slope forming:

- Abbreviation: AH
- Description:
  The recommended hysteresis for a comparator at the measurement device's input. The comparator is configured as a Schmitt-trigger.
  Especially for the sensor types Encoder, impulse-, frequency output and Digital out.

  This hysteresis provides reliable high/low switching. The hysteresis serves to suppress minor interference in the signal.
- Format: Real
- See also: Signal level min., Signal level max., Switching threshold
- Unit: V
- Applicability:

Sensor type	Usage
All others	No
Encoder, impulse-, frequency output	Recommended
Digital out	Recommended

6.9.7 Property High-pass:

- Abbreviation: Ah
- Description:
  Necessary high-pass filter cutoff frequency in order to suppress offset and drift effects. Especially for the sensor type IEPE (ICP), accelerometer, but also generally in conjunction with AC coupling.

  A high-pass filter with the specified lower cutoff frequency should be provided at the measurement device's input.
  Highpass cutoff frequency
- Format: Real
- See also: Coupling, Low-pass, Lower cutoff frequency, Frequency
- Unit: Hz
- Applicability:

Sensor type	Usage
All others	Possible
IEPE (ICP), accelerometer	Recommended
Piezoelectric sensor	Recommended
Digital out	No
Encoder, impulse-, frequency output	No
Actuator frequency input	No
Actor digital IN, relay	No
No sensor	No

6.9.8 Property Sensor output to ground:

- Abbreviation: AI
- Description:
  Isolation. Is the sensor's electrical output coupled to Ground or frame Ground?

  For resistance sensors, measurement bridges and ICPs (the PCB trademarked name for IEPE), where the voltage supply is provided directly by the measurement device, thus determining the electrical output voltage's potential, this property doesn't exist. These sensors are usually installed with electrical isolation.
- Format: CodeText
- See also: Coupling, Measurement device input

- Codes:

Code	Definition	Description
0	Not isolated, electr. coupling	The sensor, e.g. a thermocouple, is glued or welded to a grounded metal body. The sensor has a small voltage differential (typically a few mV) to ground. The sensor's electrical output is thus ground-referenced.
1	Isolated, no electr. coupling	The sensor is installed and wired in such a way that its electrical output signal has no reference to ground potential. In the case of a thermocouple, for instance, it's glued to a nonconducting plastic body.

- Standard: 0
- Applicability:

Sensor type	Usage
All others	Possible
Thermocouple	Possible
No sensor	No

6.9.9 Property Low-pass:

- Abbreviation: AL
- Description:
  A low-pass filter's necessary cutoff frequency for smoothing signals and suppressing (higher-frequency) noise.

  At the measurement device's input, a low-pass filter with the specified upper cutoff frequency should be provided.
  Lowpass cutoff frequency
- Format: Real
- See also: Low-pass, Upper cutoff frequency, Frequency
- Unit: Hz
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	No

6.9.10 Property Channel designation:

- Abbreviation: AN
- Description:
  This channel name is to be used as the channel designation by a connected measurement device. If it's later used formulas, then it's recommended to adhere to a particular syntax.

- Format: Text
- See also: Measurement location ID, Installation location, Measurement position
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	Unimportant

6.9.11 Property Connection of resistor:

- Abbreviation: Ap
- Description:
  With how many lines is the resistor connected, in what configuration? Especially for the sensor type PT100, RTD, more rarely for other resistance measurements.
- Format: CodeText
- See also: Measurement device input
- Codes:

Code	Definition	Description
2	2-wire	2-wire configuration. The resistance is connected to the measurement device by two lines. This technique is always allowed if the line is short. With longer cables, the voltage drop along the cable causes distortion.
3	3-wire	3-wire configuration. With this technique, one side of the resistance is connected to the measurement device by one line. The supply current is carried by this line, which also serves to measure the voltage. The other side of the resistance is connected to the measurement device by two lines. One of these lines carries the supply current, the other is current-free and is used to measure the voltage. The measurement system is then able to determine the voltage drop along the current-bearing line itself. Provided that both cable resistance values are the same, the voltage drop along the other cable can also be found. As long as this condition is met, precise measurement is possible. This connection technique makes special demands on the measurement device, however.
4	4-wire	4-wire configuration. This is the standard connection technique. This is the setting assumed if the property is not present. The resistance is fed with current via two lines. The voltage drop is directly communicated to the measurement device via two additional current-free wires (Sense-lines) and the resistance. This technique is precise even when the lines are long.

- Standard: 4

- Applicability:

Sensor type	Usage
PT100, RTD	Recommended
Resistance	Possible
Thermistor	Possible
All others	No

6.9.12 Property Polarity:

- Abbreviation: AP
- Description:
  Do the output and the input have the same sign, or is the polarity reversed? This property is only extra information. When a full 2-point scaling is specified with the properties Physical min., Physical max., Electrical min. and Electrical max., the polarity is already completely expressed. The polarity receives additional attention if the property Sensitivity is set.
- Format: CodeText
- See also: Physical min., Physical max., Electrical min., Electrical max. und Sensitivity
- Codes:

Code	Definition	Description
p	Positive	Standard. No inversion, no phase rotation
n	Negative	Phase rotation by 180°. In other words: the signal needs to be inverted. The connected measurement device must perform this inversion.

- Applicability:

Sensor type	Usage
All others	Unimportant
IEPE (ICP), accelerometer	Possible
Piezoelectric sensor	Possible
Thermocouple	No
Resistance	No
PT100, RTD	No
Thermistor	No
No sensor	No

6.9.13 Property Programming:

- Abbreviation: AR
- Description:
  Can the device be programmed? This property is especially interesting for amplifiers whose gain factor is adjustable: either by means of switches or electronically via an electrical interface.
  There are also sensors with adjustable sensitivity.

  This technology can mainly be found in microphones and other vibration sensors.
- Format: CodeText
- See also: Physical min., Physical max., Electrical min., Electrical max. und Sensitivity
- Codes:

Code	Definition	Description
0	None	Default. Not programmable
1	Switch	The device can be set using switches.
2	Electronically	The device is set electronically.

- Applicability:

Sensor type	Usage
All others	Unimportant

6.9.14 Property Measurement device input:

- Abbreviation: As
- Description:
  Of what type is the measurement device's input? Single end or differential? Is ground-referenced (single-wire) measurement taken? Here, the minimum or recommended measurement device input configuration is specified.
- Format: CodeText
- See also: Coupling, Sensor output to ground, Connection of resistor
- Codes:

Code	Definition	Description
1	Single end	1-wire sensor connection. The measurement device and sensor have a common ground reference. Thus, the demands on the measurement device aren't too high. However, use of the common ground can lead to measurement errors due to transient currents and the voltage drops they cause.
2	Differential	2-wire configuration of the measurement device. The measurement device has a differential amplifier at its input. This places higher demands on the device.

- Applicability:

Sensor type	Usage
All others	Possible
No sensor	No

6.9.15 Property Sampling interval:

- Abbreviation: At
- Description:
  The suggested sampling interval for a connected measurement device
- Format: Real
- See also: Reaction time, Sampling interval
- Unit: ms
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	No

6.9.16 Property Measurement device requirements:

- Abbreviation: Ax
- Description:
  This is where any special measurement device requirements are noted. These may include special requirements for the signal conditioning or the measurement amplifier.

  The world of sensor technology is full of variety. There are always exceptions and peculiarities.
- Format: CodeText
- See also: Reference frequency
- Codes:

Code	Definition	Description
0	-	There are no special requirements.
1	Integrator	The amplifier needs to perform integration once. The remaining sensor scaling specifications are valid for the reference frequency, but only after one integration procedure.
2	Charge amplifier	Charge amplifier integrated in connector, with AC/DC coupling. Requires reset.

- Applicability:

Sensor type	Usage
All others	Possible
No sensor	No

6.9.17 Property Tare:

- Abbreviation: Az
- Description:
  Balancing of the zero point required. Tare function. There are sensors whose zero point drifts or depends on where the measurement object is installed. Very typical for the sensor type Strain gauge bridge and for scales. Taring is commonly performed before each measurement but at least after glueing down the strain gauge.

  Zero-taring is performed when the measurement process or the measurement object is at rest. But there are also other sensors, e.g. Nippon Denso pressure sensors, for which occasional taring makes sense.

  The Tare function has the following effects on the properties Electrical min. and Electrical max., as illustrated by an example: A beam can be loaded at 0.0N to 1000N force, and an attached measurement bridge returns the corresponding measured values 2mV/V .. 3mV/V. If a Tare function is desired, the force 0.0N is set and the amplifier compensates the 2mV/V. Afterwards, it returns over the entire force range 0mV/V .. 1mV/V. Thus, if a taring is desired or necessary for the application, the values of the properties Electrical min. and Electrical max. are set to 0mV/V and 1mV/V, respectively. Conversely, if no taring is desired or possible, then the properties Electrical min. and Electrical max. must be set to 2mV/V and 3mV/V to achieve correct measurements.
- Format: CodeText
- See also: Electrical max., Electrical min., Bridge offset
- Codes:

Code	Definition	Description
0	Not necessary	Standard
1	Necessary	-

- Standard: 0
- Applicability:

Sensor type	Usage
All others	Possible
No sensor	No

6.10 Group Connector configuration

- Description:
  The connectors are described in this group if the sensor or actuator is equipped with a connector plug or socket on its electrical side.
- Abbreviation: B
- One at most present: No

6.10.1 Property IN+ pin:

- Abbreviation: B0
- Description:
  Designation of the pin to which the input signal's (IN = input signal) positive pole is connected.

  IN+ is to be considered the same as IN if the input signal is frame-ground referenced.

  Especially for actuators. The 'input' is from the device's point of view. A sensor usually has an electrical output.

  E.g. 3 (if the connector's contacts are designated 1, 2, 3, ...) or C (if the connector's contacts are designated A, B, C, ...).

  With certain functions, e.g. OUT+ and Vcc+, it is possible to specify the same connection, if an appropriate sensor is involved. For instance, this could apply to a 2-wire connection for a PT100.
- Format: Text
- See also: IN- pin, Frame Ground pin, IN+ color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.2 Property IN- pin:

- Abbreviation: B1
- Description:
  The designation of the pin at which the input signal's (IN = input signal) negative pole is connected.

  The negative pole is not always separate; it often is joined with Frame Ground. In that case Ground is entered.

  Especially for actuators. The 'input' is from the device's point of view. A sensor usually has an electrical output.

  E.g. 3 (if the connector's contacts are designated 1, 2, 3, ...) or C (if the connector's contacts are designated A, B, C, ...).
- Format: Text

- See also: IN+ pin, Frame Ground pin, IN- color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.3 Property Vcc+ pin:

- Abbreviation: B2
- Description:
  The designation of the pin to which the supply voltage's (V= Voltage) positive pole is connected

  E.g. 3 (if the connector's contacts are designated 1, 2, 3, ...) or C (if the connector's contacts are designated A, B, C, ...).

  With certain functions, e.g. OUT+ and Vcc+, it is possible to specify the same connection, if an appropriate sensor is involved. For instance, this could apply to a 2-wire connection for a PT100.
- Format: Text
- See also: Frame Ground pin, Vcc- pin, Vcc+ color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.4 Property Vcc- pin:

- Abbreviation: B3
- Description:
  Designation of the pin representing the supply voltage's (V= Voltage) negative pole.

  The negative pole is usually only used with bipolar supply (-10V, 0V, +10V). With single-pole supply, frame Ground is used.

  E.g. 3 (if the connector's contacts are designated 1, 2, 3, ...) or C (if the connector's contacts are designated A, B, C, ...).
- Format: Text
- See also: Frame Ground pin, Vcc+ pin, Vcc- color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.5 Property Frame Ground pin:

- Abbreviation: B4
- Description:
  The designation of the pin at which Ground is connected. Ground is the electrical reference, which is at 0V. This refers to the analog Ground available to a standard sensor, in contrast to a digital ground which mixed digital / analog systems have.

  E.g. 3 (if the connector's contacts are designated 1, 2, 3, ...) or C (if the connector's contacts are designated A, B, C, ...).

  If the signal is connected to multiple pins, these can be listed, separated by commas.
  The connector pod can also be entered (as text).
- Format: Text
- See also: Vcc+ pin, Ground pin, Digital frame Ground pin, Frame Ground color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.6 Property Ground pin:

- Abbreviation: B5
- Description:
  The designation of the pin to which (protection) Ground is connected. This ground, in contrast to frame ground is not the 0V reference signal but serves to provide shielding and protection from overload.

  E.g. 3 (if the connector's contacts are designated 1, 2, 3, ...) or C (if the connector's contacts are designated A, B, C, ...).

  If the signal is connected to multiple pins, these can be listed, separated by commas.
  The connector pod can also be entered (as text).
- Format: Text
- See also: Vcc+ pin, Frame Ground pin, Ground color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.7 Property OUT+ pin:

- Abbreviation: B6
- Description:
  The designation of the pin to which the output signal's (OUT = Output signal) positive pole is connected.

  OUT+ is to be considered the same as OUT if the input signal is referenced to frame Ground.

  sensors generally have an electrical output, while actuators have an electrical input.

  E.g. 3 (if the connector's contacts are designated 1, 2, 3, ...) or C (if the connector's contacts are designated A, B, C, ...).

  With certain functions, e.g. OUT+ and Vcc+, it is possible to specify the same connection, if an appropriate sensor is involved. For instance, this could apply to a 2-wire connection for a PT100.
- Format: Text
- See also: Frame Ground pin, OUT- pin, OUT+ color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.8 Property OUT- pin:

- Abbreviation: B7
- Description:
  the designation of the pin to which the output signal's (OUT = output signal) negative pole is connected.

  The negative pole is not always separate; it often is joined with Frame Ground. In that case Ground is entered.

  sensors generally have an electrical output, while actuators have an electrical input.

  E.g. 3 (if the connector's contacts are designated 1, 2, 3, ...) or C (if the connector's contacts are designated A, B, C, ...).
- Format: Text
- See also: Frame Ground pin, OUT+ pin, OUT- color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.9 Property Sense+ pin:

- Abbreviation: B8
- Description:
  Designation of the pin at which a Sense lead for the positive pole of the monitored signal is connected.

  Note: Resistance sensors also sometimes use a technique involving a Sense line. In that case, the actual measurement signal is detected with the help of a Sense line. For this purpose, the properties OUT+ pin and OUT- pin are used.

  With measurement bridges, the Sense line technique is also used frequently to capture the supply voltage directly at the bridge.

  The Sense line is generally used to regulate a voltage, for instance, the supply. It is used when the voltage drop along the feed line disturbs the signal.

  E.g. 3 (if the connector's contacts are designated 1, 2, 3, ...) or C (if the connector's contacts are designated A, B, C, ...).
- Format: Text
- See also: Sense- pin, Vcc+ pin, Sense+ color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.10 Property Sense- pin:

- Abbreviation: B9
- Description:
  Designation of the pin at which a Sense lead for the negative pole of the monitored signal is connected.

  Note: Resistance sensors also sometimes use a technique involving a Sense line. In that case, the actual measurement signal is detected with the help of a Sense line. For this purpose, the properties OUT+ pin and OUT- pin are used.

  With measurement bridges, the Sense line technique is also used frequently to capture the supply voltage directly at the bridge.

  The Sense line is generally used to regulate a voltage, for instance, the supply. It is used when the voltage drop along the feed line disturbs the signal.

  E.g. 3 (if the connector's contacts are designated 1, 2, 3, ...) or C (if the connector's contacts are designated A, B, C, ...).
- Format: Text
- See also: Sense+ pin, Vcc+ pin, Sense- color

- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.11 Property Unused pin:

- Abbreviation: Ba
- Description: Designation of one or more unused pins.
  Not connected, reserved

  E.g. 3 (if the connector's contacts are designated 1, 2, 3, ...) or C (if the connector's contacts are designated A, B, C, ...).
- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.12 Property Digital frame Ground pin:

- Abbreviation: Bb
- Description:
  Designation of the pin at which the ground of the device's digital portion (Digital Ground, DGND) is connected. The ground is the electrical reference at which the potential is 0V.

  If, for instance, the sensor is equipped with a TEDS Eprom having a separate ground connection, then that is the digital ground.

  E.g. 3 (if the connector's contacts are designated 1, 2, 3, ...) or C (if the connector's contacts are designated A, B, C, ...).

  If the signal is connected to multiple pins, these can be listed, separated by commas.
  The connector pod can also be entered (as text).
- Format: Text
- See also: Frame Ground pin, Digital Ground color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.13 Property Special function pin:

- Abbreviation: Bc
- Description:
  Designation of the special function pin. The pin and its function can be specified in the text.
- Format: Text
- See also: Unused pin, Special function color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.14 Property L1 pin:

- Abbreviation: Bd
- Description:
  Designation of the pin at which the mains voltage's corresponding phase is connected.
- Format: Text
- See also: L2 pin, N pin, L1 color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.15 Property L2 pin:

- Abbreviation: Be
- Description:
  Designation of the pin at which the mains voltage's corresponding phase is connected.
- Format: Text
- See also: L1 pin, N pin, L1 color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.16 Property L3 pin:

- Abbreviation: Bf
- Description:
  Designation of the pin at which the mains voltage's corresponding phase is connected.
- Format: Text
- See also: L1 pin, N pin, L3 color

- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.17 Property N pin:

- Abbreviation: Bg
- Description:
  Designation of the pin which represents the mains voltage's return line.
- Format: Text
- See also: L2 pin, N color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.18 Property OUT2+ pin:

- Abbreviation: Bh
- Description:
  Designation of the pin representing a sensor's second output signal's positive pole. E.g. the 2nd output of a 2-track incremental encoder.
- Format: Text
- See also: OUT+ pin, OUT2+ color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.10.19 Property TEDS pin:

- Abbreviation: Bi
- Description:
  Designation of the pin representing the positive pole of an Eprom for sensor recognition.
- Format: Text
- See also: Digital frame Ground pin, TEDS color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11 Group Connection cable

- Description:
  In this group, the connection cables are described if the sensor or actuator comes with a connection cable on its electrical side. Especially if no fixed connector is attached to the cable, but the cable can instead be connected to a variety of connection terminals.
- Abbreviation: K
- One at most present: No

6.11.1 Property IN+ color:

- Abbreviation: K0
- Description:
  The color of the line representing the input signal's (IN = input signal) positive pole.

  IN+ is to be considered the same as IN if the input signal is frame-ground referenced.

  Especially for actuators. The 'input' is from the device's point of view. A sensor usually has an electrical output.

  With certain functions, e.g. OUT+ and Vcc+, it is possible to specify the same connection, if an appropriate sensor is involved. For instance, this could apply to a 2-wire connection for a PT100.
- Format: Color
- See also: IN- color, Frame Ground color, IN+ pin
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.2 Property IN- color:

- Abbreviation: K1
- Description:
  The color of the line representing the input signal's (IN = input signal) negative pole.

  The negative pole is not always separate; it often is joined with Frame Ground. In that case Ground is entered.

  Especially for actuators. The 'input' is from the device's point of view. A sensor usually has an electrical output.
- Format: Color
- See also: IN+ color, Frame Ground color, IN- pin

- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.3 Property Vcc+ color:

- Abbreviation: K2
- Description:
  The color of the line representing the supply voltage's (V = Voltage) positive pole.

  With certain functions, e.g. OUT+ and Vcc+, it is possible to specify the same connection, if an appropriate sensor is involved. For instance, this could apply to a 2-wire connection for a PT100.
- Format: Color
- See also: Frame Ground color, Vcc- color, Vcc+ pin
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.4 Property Vcc- color:

- Abbreviation: K3
- Description:
  The color of the line representing the supply voltage's (V = Voltage) negative pole.

  The negative pole is usually only used with bipolar supply (-10V, 0V, +10V). With single-pole supply, frame Ground is used.
- Format: Color
- See also: Frame Ground color, Vcc+ color, Vcc- pin
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.5 Property Frame Ground color:

- Abbreviation: K4
- Description:
  Color of the line representing the frame Ground. The frame Ground is the electrical reference at which the potential is 0V. This means a sensor's standard analog ground, in contrast to a digital ground which is what comes with mixed digital/ analog systems.
- Format: Color
- See also: Vcc+ color, Ground color, Digital Ground color, Frame Ground pin

- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.6 Property Ground color:

- Abbreviation: K5
- Description:
  The color of the line representing (protection) Ground. This ground, in contrast to frame ground is not the reference signal with a level of 0V, but rather serves the purpose of shielding and protection from overvoltage.
- Format: Color
- See also: Vcc+ color, Frame Ground color, Ground pin
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.7 Property OUT+ color:

- Abbreviation: K6
- Description:
  The color of the line representing the output signal's (OUT = output signal) positive pole.

  OUT+ is to be considered the same as OUT if the input signal is referenced to frame Ground.

  sensors generally have an electrical output, while actuators have an electrical input.

  With certain functions, e.g. OUT+ and Vcc+, it is possible to specify the same connection, if an appropriate sensor is involved. For instance, this could apply to a 2-wire connection for a PT100.
- Format: Color
- See also: Frame Ground color, OUT- color, OUT+ pin
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.8 Property OUT- color:

- Abbreviation: K7
- Description:
  The color of the line representing the output signal's (OUT = output signal) negative pole.

  The negative pole is not always separate; it often is joined with Frame Ground. In that case Ground is entered.

  sensors generally have an electrical output, while actuators have an electrical input.
- Format: Color
- See also: Frame Ground color, OUT+ color, OUT- pin
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.9 Property Sense+ color:

- Abbreviation: K8
- Description:
  Color of the line representing a Sense line for the positive pole of the signal to be monitored.

  Note: Resistance sensors also sometimes use a technique involving a Sense line. In that case, the actual measurement signal is detected with the help of a Sense line. For this purpose, the properties OUT+ color and OUT- color are used.

  With measurement bridges, the Sense line technique is also used frequently to capture the supply voltage directly at the bridge.

  The Sense line is generally used to regulate a voltage, for instance, the supply. It is used when the voltage drop along the feed line disturbs the signal.
- Format: Color
- See also: Sense- color, Vcc+ color, Sense+ pin
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.10 Property Sense- color:

- Abbreviation: K9
- Description:
  Color of the line representing a Sense line for the negative pole of the signal to be monitored.

  Note: Resistance sensors also sometimes use a technique involving a Sense line. In that case, the actual measurement signal is detected with the help of a Sense line. For this purpose, the properties OUT+ color and OUT- color are used.

  With measurement bridges, the Sense line technique is also used frequently to capture the supply voltage directly at the bridge.

  The Sense line is generally used to regulate a voltage, for instance, the supply. It is used when the voltage drop along the feed line disturbs the signal.
- Format: Color
- See also: Sense+ color, Vcc+ color, Sense- pin
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.11 Property "Unused" color:

- Abbreviation: Ka
- Description: Color of the line which isn't used
  Not connected, reserved
- Format: Color
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.12 Property Digital Ground color:

- Abbreviation: Kb
- Description:
  Color of the line representing the ground for the device's digital part (Digital Ground, DGND). The ground is the electrical reference at which the potential is 0V.

  If, for instance, the sensor is equipped with a TEDS Eprom having a separate ground connection, then that is the digital ground.
- Format: Color
- See also: Frame Ground color, Digital frame Ground pin

- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.13 Property Special function color:

- Abbreviation: Kc
- Description: Designation of the line with a special function
- Format: Color
- See also: "Unused" color, Special function pin
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.14 Property L1 color:

- Abbreviation: Kd
- Description:
  Designation of the line representing the corresponding mains voltage phase.
- Format: Color
- See also: L2 color, N color, L1 pin
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.15 Property L2 color:

- Abbreviation: Ke
- Description:
  Designation of the line representing the corresponding mains voltage phase.
- Format: Color
- See also: L1 color, N color, L1 pin
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.16 Property L3 color:

- Abbreviation: Kf
- Description:
  Designation of the line representing the corresponding mains voltage phase.
- Format: Color
- See also: L1 color, N color, L3 pin
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.17 Property N color:

- Abbreviation: Kg
- Description:
  Designation of the line representing the mains voltage's return line.
- Format: Color
- See also: L2 color, N pin
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.18 Property OUT2+ color:

- Abbreviation: Kh
- Description:
  Color of the line representing the positive pole of a sensor's second output signal. E.g., the 2nd output of a 2-track incremental encoder.
- Format: Color
- See also: OUT+ color, OUT2+ pin
- Applicability:

Sensor type	Usage
All others	Unimportant

6.11.19 Property TEDS color:

- Abbreviation: Ki
- Description:
  Color of the line representing the positive pole of an Eprom for sensor recognition.
- Format: Color

- See also: Digital Ground color, TEDS pin
- Applicability:

Sensor type	Usage
All others	Unimportant

6.12 Group Internal administration

- Description:
  Internal information which cannot be processed by the user. In rare cases, useful additional information.
- Abbreviation: I
- Internal: 1
- One at most present: Yes

6.12.1 Property Identification:

- Abbreviation: Ii
- Description:
  The sensor's ID within the database. Each sensor has its own unique ID. The ID is generated by the MS Windows operating systme and unique among computers all over the world having netwrk cards.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Possible

6.12.2 Property Last modified:

- Abbreviation: Il
- Description:
  Date the sensor information was last modified. The extra sensor data is generated automatically and therefore can't be modified by the user.
- Format: DateTime
- Applicability:

Sensor type	Usage
All others	Possible

6.12.3 Property Size:

- Abbreviation: Is
- Description:
  The size of the information saved to the sensor, stated in Bytes.

- Format: Int
- Unit: Bytes
- Applicability:

Sensor type	Usage
All others	Possible

6.12.4 Property Sensor-Fit-1:

- Abbreviation: I0
- Description:
  A sequence of numbers. They serve to adapt a measurement amplifier to an active sensor, where the active sensor is quite similar to the one originally used for the measurement.
  For a sensor's 1st output
  The first number is a code for the sensor's type.
  The second number is the scaling factor.
  The third number is the offset.
  This is the formula used:

  (Physical value) := (measured electric value) * factor + offset

  If factor and offset are empty, then there isn't any linear scaling.
  The number sequence cna be extended.
- Format: RealList
- Applicability:

Sensor type	Usage
All others	Possible

6.12.5 Property Sensor-Fit-2:

- Abbreviation: I1
- Description: For a sensor's 2nd output
- Format: RealList
- See also: Sensor-Fit-1
- Applicability:

Sensor type	Usage
All others	Possible

6.12.6 Property Sensor-Fit-3:

- Abbreviation: I2
- Description: For a sensor's 3rd output
- Format: RealList
- See also: Sensor-Fit-1
- Applicability:

Sensor type	Usage
All others	Possible

6.12.7 Property EProm Format:

- Abbreviation: IF
- Description:
  Internal value for the format in which the Eprom is described.

  Only valid if the sensor information was read out of an Eprom.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

6.12.8 Property EProm Version:

- Abbreviation: IV
- Description:
  Internal value for the version of the format in which the Eprom is described.

  Only valid if the sensor information was read out of an Eprom.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

6.12.9 Property EProm Code:

- Abbreviation: IC
- Description:
  Extra code for connections besides the Eprom, which indicate the sensor's properties.

  Only valid if the sensor information was read out of an Eprom.

- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

6.12.10 Property EProm ROM-ID:

- Abbreviation: IE
- Description:
  An Eprom chip's unique ID. Every chip manufactured should have one.

  The ROM-ID consists of (1+6+1) Bytes. Each Byte is represented in hexadecimal. This results in a total of 16 characters. The Bytes are displayed in the exact order in which they appear in the chip.

  E.g. 23AB00AC00002C6A. The first Byte in the chip is the family code (here: 23). The following 6 Bytes are the actual ID. The 8th Byte (here: 6A) designates the CRC (Checksum).

  This field is only generated automatically. It then contains the ID of the chip which was really read in.
- Format: Text
- See also: Silicon Serial Number
- Applicability:

Sensor type	Usage
All others	Unimportant

6.12.11 Property EProm Fill Level:

- Abbreviation: If
- Description: The Eprom is filled with this many Bytes.

  Only valid if the sensor information was read out of an Eprom.
- Format: Int
- Unit: Bytes
- Applicability:

Sensor type	Usage
All others	Unimportant

6.12.12 Property EProm Size:

- Abbreviation: Ig
- Description: The Eprom's size in Bytes

  Only valid if the sensor information was read out of an Eprom.
- Format: Int
- Unit: Bytes
- Applicability:

Sensor type	Usage
All others	Unimportant

6.12.13 Property EProm Type:

- Abbreviation: It
- Description: The Eprom type

  Only valid if the sensor information was read out of an Eprom.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

6.12.14 Property Connection test:

- Abbreviation: IP
- Description:
  The result of the test of the connected connector, in textual form. E.g. what kind of jumpers were detected.
- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

6.12.15 Property Connection: Code:

- Abbreviation: Ip
- Description:
  Internal code word for the connecterd sensor's definition. E.g., what sort of jumpers were detected.
- Format: Int

- Applicability:

Sensor type	Usage
All others	Unimportant

6.12.16 Property Recognition:

- Abbreviation: IR
- Description: Comment text on the recognition or recognition technology
- Format: Text
- Applicability:

Sensor type	Usage
All others	Unimportant

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