Metrology

MANUAL

ComGage Professional
Software

Document No. : D2F711 010
Edition : March 2022

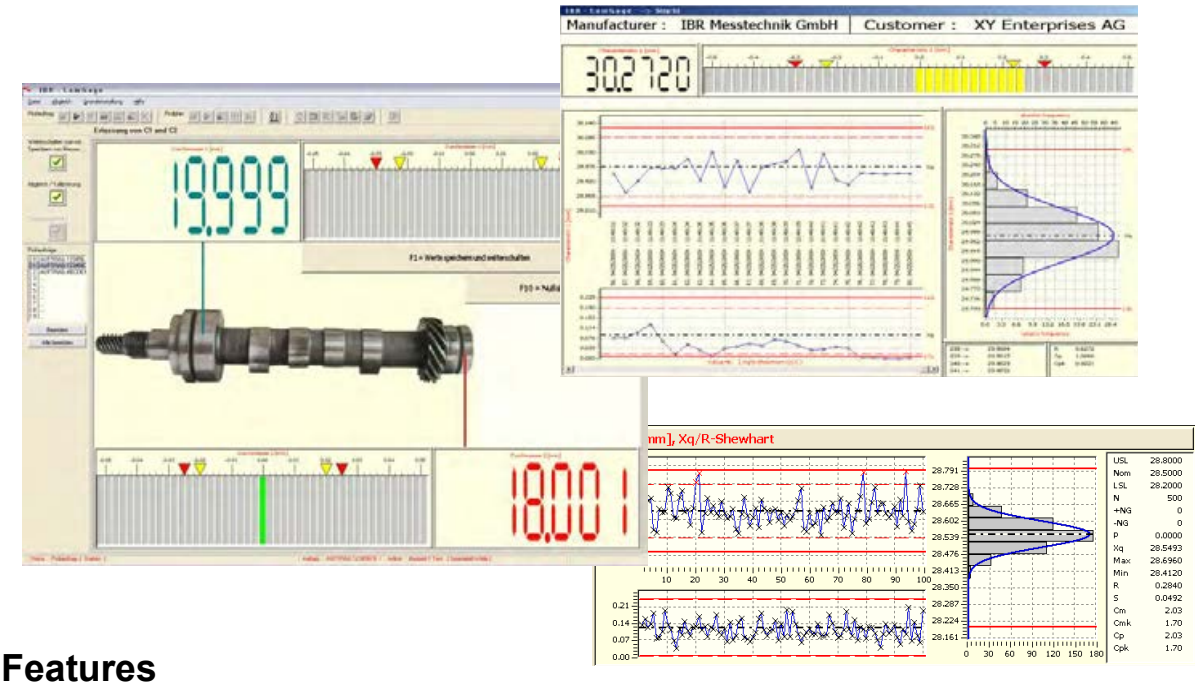
Messtechnik GmbH & Co. KG

Contents

1. Introduction

ComGage is a universal software for metrology and statistical process control in manufacturing facilities.

The software allows testing of components with various characteristics. Additionally, the software provides information for controlling production processes by means of the statistical functions included.



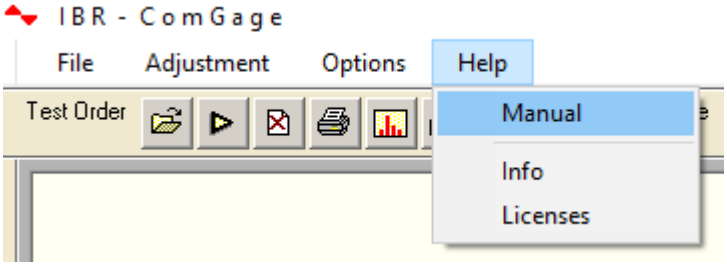
2. Features

- *Connection of all gauges and sensors via interfaces at the PC, via universal measuring bus "IMBus", universal sensor bus "ISi-Bus" and the radio module series "IBRit-rf1" and "ISM"*
- *Test orders for saving and analysing of measurement values*
- *Test schemes for defining components and their characteristics*
- *Inclusion of reference information (machines, operators, batch numbers, …) in test orders and test schemes*
- *Simultaneous opening of several test orders or test schemes for parallel collection of measurement data on different production lines*
- *Up to 128 characteristics can be assigned to each component*
- *Free definition of gauges with mathematical functions (such as sin, cos, tan, min, max, …)*
- *Static and dynamic measuring modes*
- *Extensive possibilities for definition of the measurement displays (visual design of the display windows)*
- *Statistical displays (such as Control Charts, Histograms, Statistical Data, Run Charts, …)*
- *Automatic and manual saving of measurement values*
- *Automatic and manual switching between test steps*
- *Zero adjustment and calibration of gauges*
- *Opening of zero adjustment and gauge calibration window by function key, foot switch, or automatically on temperature change, by timer or by number of measured components*
- *Reference test for performing fixture check*
- *Test of measuring probe validity as well as measuring probe free lift control for safeguarding measurements and calibrations*
- *Control functions by digital inputs and outputs, Profibus, Profinet or EtherCAT*
- *Converting of measurement values to different formats (Q-DAS, Excel, …)*
- *Analysis of measurement values with protocol function*
- *User management (for assigning rights to the different users)*
- *Optional IBR_AQDEF module incl. K-field configurator, K-field editor, Test reason configurator, Start mask configurator*

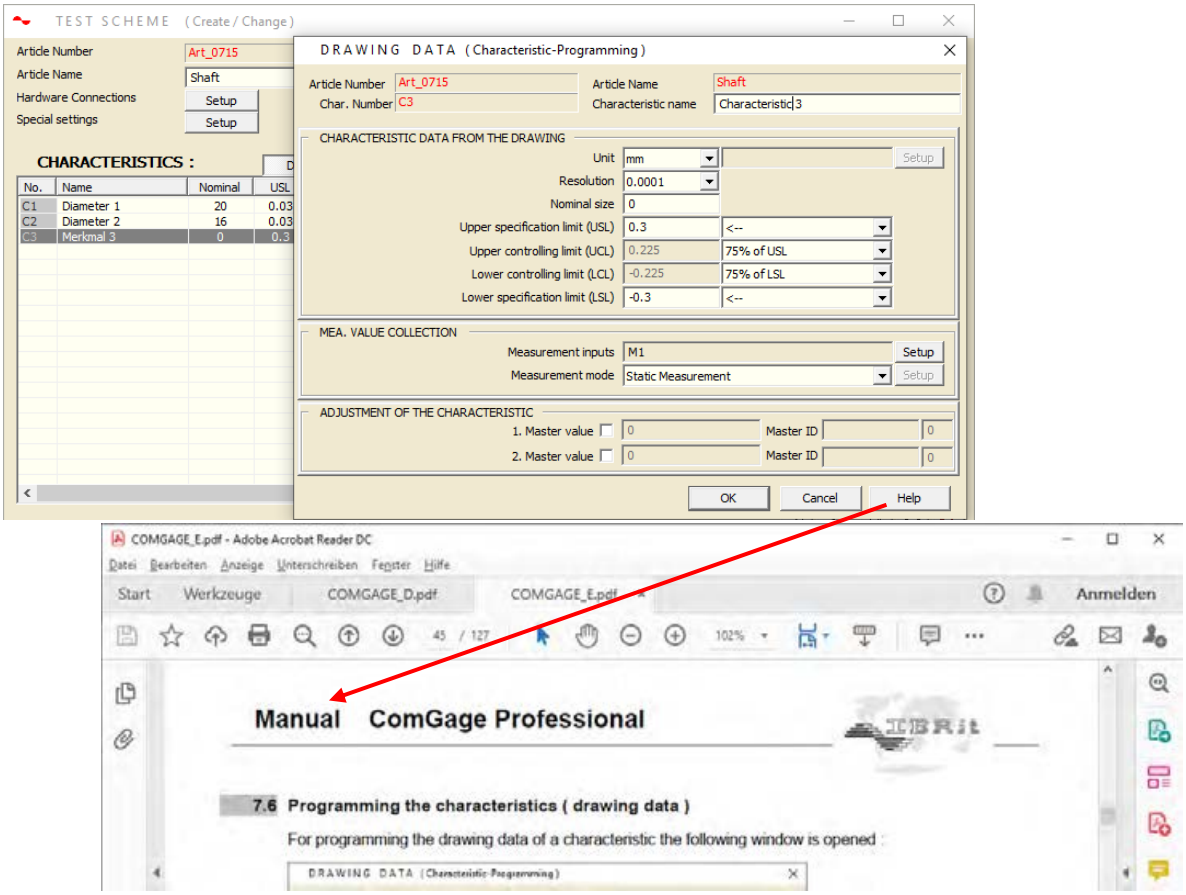
3. Introduction to ComGage Professional

3.1 Access to the ComGage Professional instruction manual

You can always access the instruction manual via the menu „Help / Manual“ :



Every **Help** button opens the chapter of the instruction manual related to the current dialogue window :



3.2 Access to the ComGage Professional training materials

Training materials with practical examples can be found on the CD :
IBR Software for Metrology and SPC, in the folder **ComGage_Training.**

3.3 Test schemes and test orders in ComGage Professional

In ComGage you can create test schemes and test orders :

a) Test scheme :

A test scheme contains the definition of the component with its characteristics (nominal size, tolerances, …). In addition it contains information defining how the measurements are done (measurement sequences, static / dynamic measurements, probe mixings, …) as well as the display window design.
Programming of display windows is done via a graphical user interface. The layout and colours of measuring and SPC display elements can be defined without limitations – always seeing the programming result or information on the screen (visual programming).
No measurement data can be saved when running a test scheme.

b) Test order :

A test order serves to assign measurement and test data to the corresponding production lots or customer orders. A test order contains a test scheme, which defines all characteristics of the component. Reference information (machines, operators, batch numbers, …) can be stored in the test order.
During the creation of a test order, the number of components to be tested can be entered.
The measurement data of a test order can be saved, converted (Excel, QS-Stat, …), analysed and printed.

The integrated user management allows deactivating certain menus for different users (e.g. the menus for creating test schemes and test orders can be deactivated for the operators at the manufacturing facilities).

The programming of test schemes and test orders is described in detail in this manual.

3.4 Modular structure of ComGage Professional

The ComGage software consists of 6 modules :

1.) IBR_TSH (**T**est **S**cheme **H**andler) for creating test schemes.
2.) IBR_TOH (**T**est **O**rder **H**andler) for creating, analysing, printing and converting test orders
3.) IBR_WGL (**W**indow **G**auge **L**ibrary) for measuring
4.) IBR_SPC (**S**tatistical **P**rocess **C**ontrol) for Statistical Process Control display elements
5.) IBR_PLC (**P**rogrammable **L**ogical **C**ontrol) for controlling of digital inputs and outputs
6.) IBR_AQDEF : additional license for use of the AQDEF functions for sequence control and the data export to the DFQ format

Example of a company's usage of the first 5 modules (without AQDEF) :

In the company there is a PC in the supervisor's office (for creating test schemes, test orders and analysis of the measurement values) and there are 5 measuring PCs with online SPC.
On the supervisor's PC the following modules are needed : IBR_TSH, IBR_TOH and IBR_SPC.
On the 5 measuring PCs the following modules are needed : IBR_WGL and IBR_SPC (if so IBR_PLC).

3.5 General information about ComGage

ComGage is programmed with C++ using standard API functions only. This allows optimum speed, less usage of resources and the possibility to generate a Windows CE version of ComGage.

In addition to universal measuring routines and online SPC functions for manufacturing facilities an easy understandable shell, multiple languages (European and Asian), operation only by a small keyboard and less usage of PC resources (for working on small Windows CE PCs – e.g. Pocket PCs) were important points on the development of ComGage.

3.6 Overview of the ComGage files

File	File contents
ComGage.cfg	→ ComGage programme settings (like data directories, language, …)
ComGage.ddk	→ ComGage hardware settings
ComGage.rif	→ Reference information settings and tables
ComGage.usr	→ User management information
DisObj.cfg	→ Current settings of menu “Options / Display Elements”
IBR_DDK.idt	→ Text comments on ISM / IBRit-rf1 modules
*.dwc	→ Stored display window contents of test schemes
*.rto, *.cto	→ Test orders
*.sch	→ Display element design schemes from menu “*Options → Display elements*”
*.tod	→ Measurement data of test order
*.tsf	→ Test schemes
*.tsc	→ Test scheme documentation Ix / Qx / Rx
*.dirconfig	→ Directory Configurations of the menu “Options / Data Directories”

Files of the IBR_AQDEF module (hereafter short “AQDEF module”) **:**

File	File contents
ComGage.qdascfg	→ Configuration of the K-Field configurator
KField_Tables.ini	→ Catalogue with identifiers (selection tables for the K-Fields which are configured for selection from catalogue, in the INI data format (optional)) → The content is specified by Q-DAS Example for K2004 : [K2004] 0=variable 1=attribute 2=variable classified 3=ordinal 4=nominal 5=error type 6=error log sheet
catalog.dfd	→ Q-DAS catalogue (selection tables for the K-Fields which are configured for selection from catalogue, in the DFD data format (optional)) → The content is not specified by Q-DAS. Instead it is freely selectable (e.g. table of machines, table of operators, …).
workplace.wpDFD	→ K-Field configuration for the editing level *Workplace*
startmask.smDFD	→ K-Field configuration for the editing level *Start mask*
<Order number>.toDFD	→ K-Field configuration for the editing level *Test order*
<Article number>.tsDFD	→ K-Field configuration for the editing level *Test scheme (general)*
testreason.ini	→ Test reason configuration in the INI data format
startmask.csv	→ Configuration of the Start mask configurator in the CSV data format
measurement.ini	→ Information needed for controlling the measurement

Note : The data structure of the files belonging to the AQDEF module is described in Appendix C of this manual.

4. Installation and brief overview

The following chapter portrays a brief overview of the steps necessary for installing the software and configuring the ComGage basic settings. It also describes how to create a small measuring programme (= test scheme). Notes for the individual configuration of the installation can be found in Appendix D.

4.1 Installation

Hardware requirements :
Pentium 1000
≥ 1 GB Ram
≥ 100 MB free hard disk space

Software requirements :
Windows 2000 / XP / Vista / 7 / 8 / 10 / 11 (32 bit and 64 bit)
Windows CE

Installation via CD :

1. Insert the CD **IBR Software for Metrology and SPC** into your CD-drive.
2. Go to **Start / Run** and enter
   <Letter of CD-Drive>: \ ComGage \ ComGage_INST.
   Start the installation by clicking the **OK** - button.

   The installation programme then requests the installation parameters in a few windows.
3. The first window asks you to accept the license agreement.
   Confirm by clicking the choice box and then the **Next >** - button.
4. The second window requests the destination location for the ComGage software.
   Confirm the standard folder or enter the desired installation folder and acknowledge by clicking the **Next >** - button.
5. The third window requests the directory for the ComGage configuration files.
   Confirm the standard folder or enter the desired folder and acknowledge by clicking the **Next >** - button.

   Important notes :
   This “Directory for configuration files” initially also serves as default path for the data directories of the “Options / Data Directories” menu (see chapter 6.4).
   On multiple installation of ComGage on a PC - for use of the ComGage multi-start option (software module 70 required) - the individual directory paths as per 4. and 5. must be identic for each installation.
   The Directory for the ComGage configuration files can be changed by using the software **CG_SetConfigPath** (to be found under Start menu → ComGage).
6. The fourth window allows you to select optional creation of a desktop shortcut, a Quick Launch shortcut or also an autostart shortcut.
   Click the **Next >** - button to confirm.

   Installation is now executed !!!
7. Close the programme installer by clicking the **Finish** - button, after the installation procedure has been completed successfully. Initial operation of the software can take place directly after completion of the installation procedure. In order to do so, leave the box **“Launch ComGage”** checked and click the **Finish** - button.

Installation via internet :

1. Download the file **COMGAGE.zip** from the Homepage ***www.IBR.com***.
   Go to **Downloads \ Software** in order to do so or download it directly from http://www.ibr.com/download/COMGAGE.zip. Then unzip the file.
2. Start the unzipped installation file **ComGage_Inst.exe**.
3. Execute the above-described steps 3. to 7. for Installation.

4.2 Brief overview

1

Installation

ComGage-CD zur Installation einlegen.
USB - Treiber und ComGage installieren.
Es öffnet sich das Fenster für die Einstellung der Messgeräteanschlüsse automatisch.

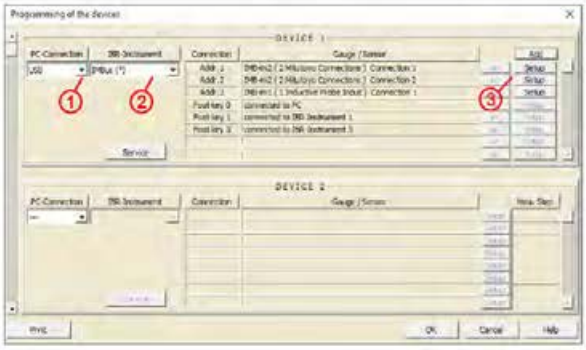
Mess- bzw. Interfacegeräte am PC anschließen.

Auswahl der angeschlossenen Mess- und Interfacegeräte :

① Auswahl des PC-Anschlusses, an dem das Messgerät bzw. Interface angeschlossen ist.

② Auswahl des angeschlossenen Gerätetypes.

③ ***Optional***
Einstellung der Messeingänge z.B. Auflösung, Messrichtung, ...



Installation

Insert ComGage CD for installation.
Install USB driver and ComGage.
The window for setting up the connected instruments opens automatically.

Connect measuring or interface instruments to the PC.

Selection of the connected measuring and interface instruments :

① Selection of the PC connection to which the gauge or interface is connected to.

② Selection of the connected instrument type.

③ ***Optional***
Measuring input configuration e.g. resolution, direction, ...

2

Prüfplan

Beim Einsatz von Software in der Messtechnik muss für jede Prüfaufgabe ein Prüfplan erstellt werden. Der Prüfplan enthält alle Informationen über die Messaufgabe und legt den Prüfablauf für die Software fest.

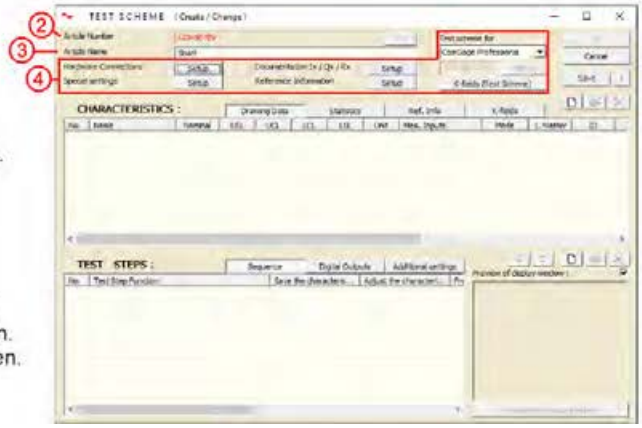
Prüfplan-Erstellung mit ComGage

① Menü : *Prüfplan / Anlegen.*

② Artikelnummer eingeben.

③ Artikelbezeichnung eingeben.

④ ***Optional***
Stammdaten eingeben (Prüfer, Maschine, ...).
Sondereinstellungen, Hardware-Konfiguration und Programmvariante auswählen.
Register & I/Os dokumentieren.



Test scheme

On the use of software in metrology a test scheme must be created for each measuring application. The test scheme contains all information about the measuring application and defines the measuring sequence for the software.

Creation of a test scheme with ComGage

① Menu : *Test Scheme / Create.*

② Enter article number.

③ Enter article name.

④ ***Optional***
Input reference information (operator, machine, ...).
Select special settings, hardware configuration and program type.
Document registers and I/Os.

3

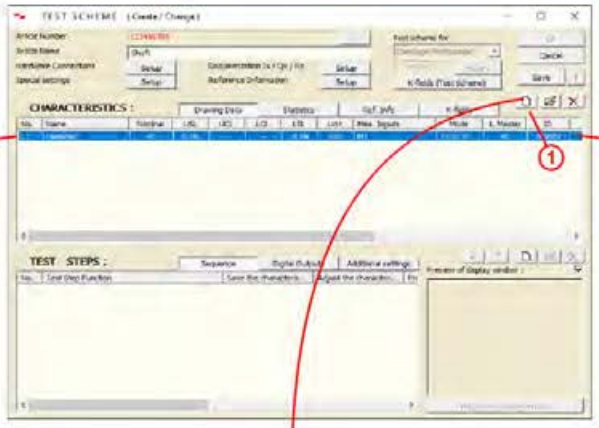
Merkmale

In der Messtechnik werden die zu prüfenden Maße eines Prüflings als Merkmale bezeichnet. Jedes Merkmal muss zunächst im Prüfplan beschrieben werden.

Merkmal - Erstellung im ComGage - Prüfplan

① Auf Neu-Button zum Anlegen eines Merkmals klicken.

Beispiel :
Das angelegte Merkmal C1 mit Durchmesser 40 mm und den Toleranzen +/-0.06 mm wird über Messeingang M1 erfasst.

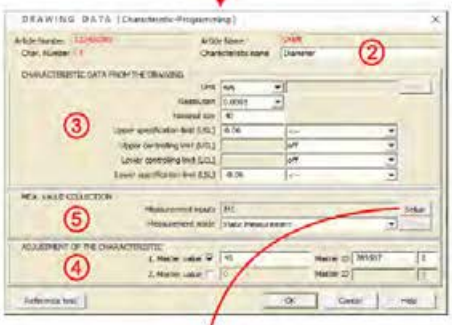


② Merkmalbezeichnung eintragen.

③ Merkmaldaten (Einheit, Nennmaß, Toleranzen) aus Zeichnung übernehmen.

④ ***Optional***
1 oder 2 Meisterwerte für Induktivtaster- oder Luftmessdornkalibrierung eintragen.

⑤ Auswahl eines Messmodes und Messeingangs.



⑥ Messeingang eintragen.

Optional können beliebige Formeln und Verknüpfungen eingegeben werden, z.B. M1+M2.

Alternativ können Messwerte oder attributive Merkmale per Tastatur erfasst werden.

Durch wiederholte Betätigung des Neu-Buttons können weitere Merkmale von dem zu prüfenden Teil angelegt werden.

Characteristics

In metrology the measured dimensions are called characteristics. Each characteristic must be described initially in the test scheme.

Creation of characteristics in ComGage test scheme

① Click on New-Button for creating a characteristic.

Example :
The created characteristic C1 with diameter 40 mm and tolerances of +/-0.06 mm is collected via measuring input M1.

② Enter characteristic name.

③ Enter characteristic data (unit, nominal size, tolerances) from the drawing.

④ ***Optional***
Enter 1 or 2 Master values for calibration of e.g. inductive probes or air plugs.

⑤ Selection of a measuring mode and measuring input.

⑥ Enter measuring input.

Optionally free formulas for probe-mixings can be entered, e.g. M1+M2.

Alternatively measurement values or attributive characteristics can be input by keyboard.

Additional characteristics of the component can be added by repeatedly clicking on the New-Button.

4

Prüfablauf

Der Prüfablauf enthält die einzelnen Prüfschritte mit den Anzeigefenstern.

Prüfschritt - Erstellung im ComGage - Prüfplan

① Auf Neu-Button zum Anlegen eines Prüfschritts klicken.

Beispiel :
In dem Prüfschritt kann während der Messung Merkmal C1 über Fußtaster gespeichert werden.

② ***Optional***
Beschreibung der Funktion des Prüfschritts eintragen.

③ Ausführbare Funktion für den Prüfschritt auswählen.

④ Merkmale zur Funktion zuordnen.

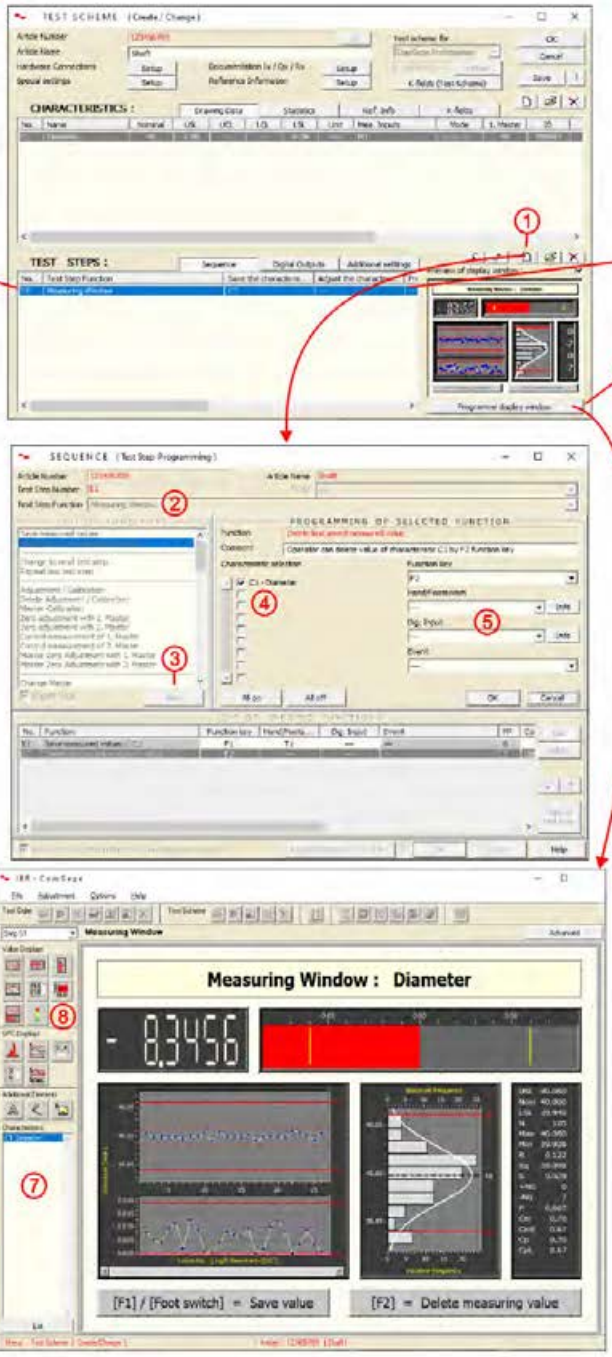
⑤ Fußtaster, Funktionstaste, ... zum Ausführen der Funktion auswählen.

Beispiel :
Im Prüfschritt S1 wird der letzte Messwert von Merkmal C1 über F2-Taste gelöscht und ein neuer Messwert wird über Fußtaster T1 / F1-Taste gespeichert.

⑥ Gestaltung des Anzeigefensters aufrufen.

⑦ Anzuzeigendes Merkmal aus Liste auswählen.

⑧ Anzeigeelement für angewähltes Merkmal auswählen und platzieren.



Durch wiederholte Betätigung des Neu-Buttons können weitere Prüfschritte angelegt werden.

Test sequence

The test sequence contains the single test steps with the display windows.

Creation of test steps in ComGage test scheme

① Click on New-Button for creating a test step.

Example :
In the test step the characteristic C1 can be saved by foot switch in measuring mode.

② ***Optional***
Enter test step function description.

③ Select executable function for test step.

④ Assign characteristics to function.

⑤ Select foot switch, function key, ... for execution of function.

Example :
In step S1 the last measured value of characteristic C1 is deleted by F2-key and a new measured value is saved by foot switch T1 / F1-key.

⑥ Call programming menu for display window.

⑦ Select characteristic for display from list.

⑧ Select and place display element for selected characteristic.

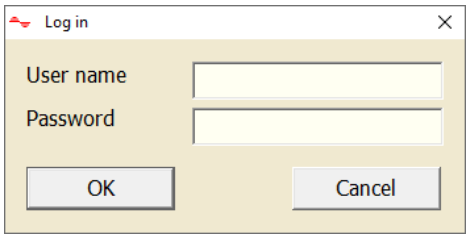
Additional test steps can be added by repeatedly clicking on the New-Button.

Der Prüfplan ist nun erstellt und die Prüfung der Teile kann beginnen.

The test scheme is now created and the inspection of components can be started.

5. User login

On activated user management (see chapter 6.5) the user must log in after starting ComGage :



After successfully logging in, the main window of ComGage is displayed.

The user management is deactivated in ComGage by default setting.
Only one user exists after installing the software :

User name = admin
Password = admin

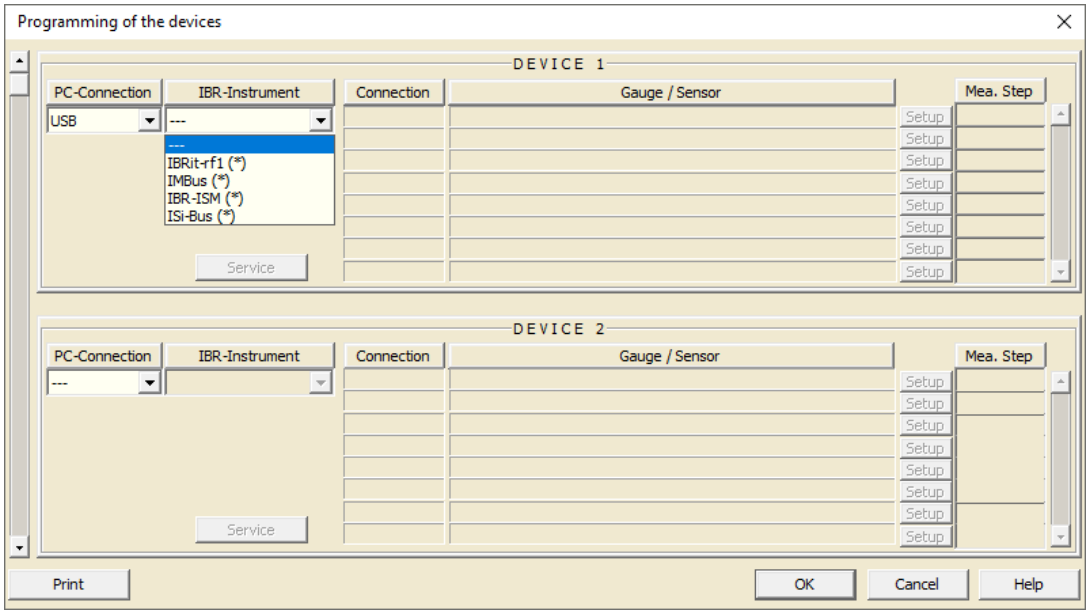
Note : ***Capitalization of user name and password is not checked.***

6. Getting started / Basic settings

On initial operation of the ComGage software there are several important settings that have to be made within the programme. By choosing the **Options** menu, these basic settings can also be modified later on. In the following the submenus of the **Options** menu are described.

6.1 Connections

In the **Options / Connections** menu (Button : ) the connected interfaces and measuring instruments are selected and - if necessary - configured (by clicking the **Setup** - buttons).
ComGage automatically opens the window of the Options / Connections menu on initial operation.

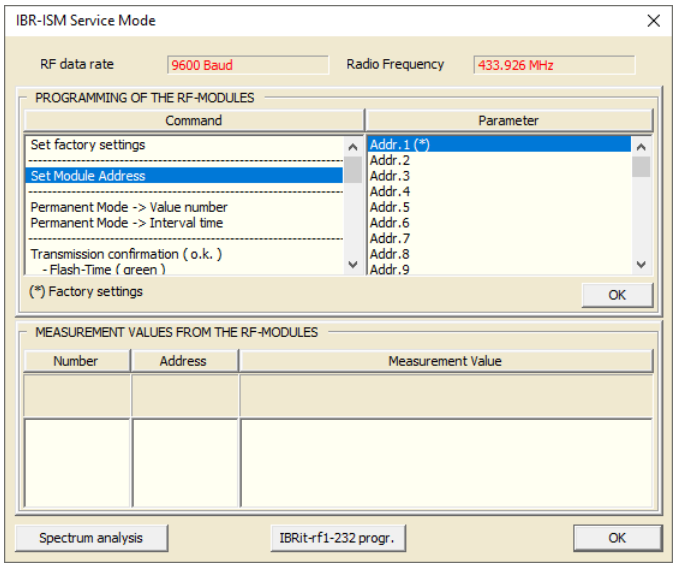


Note : *On initial operation of the software the window shown above is displayed in the language of the Windows operating system. If this language is not supported by ComGage, display occurs in English language.*

At first select the PC-Connection and then the connected IBR-Instrument.

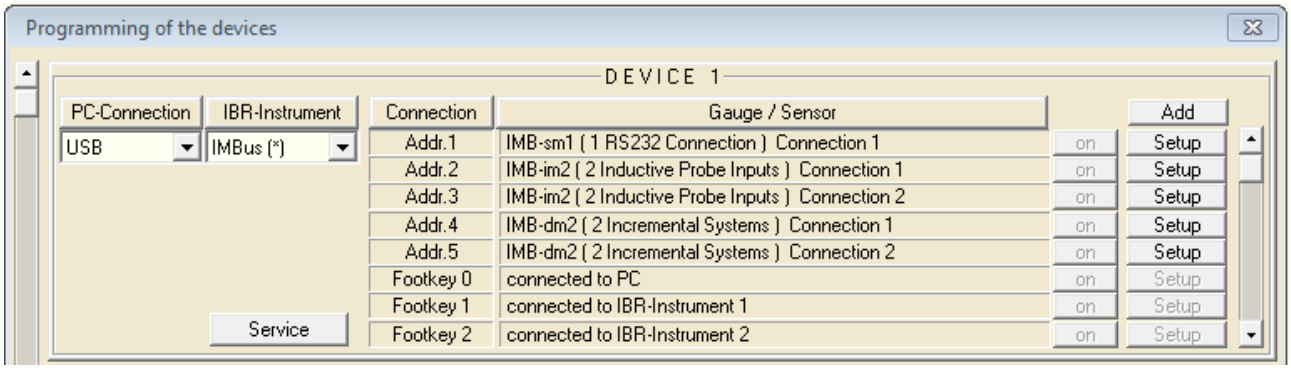
IBRit-rf1 / ISM :

In case of IBRit-rf1 / ISM radio modules you can access the menu for module configuration (e.g. setting module address) by clicking the **Service** - button. ➔ *Please refer to the IBRit-rf1 / ISM manual.*

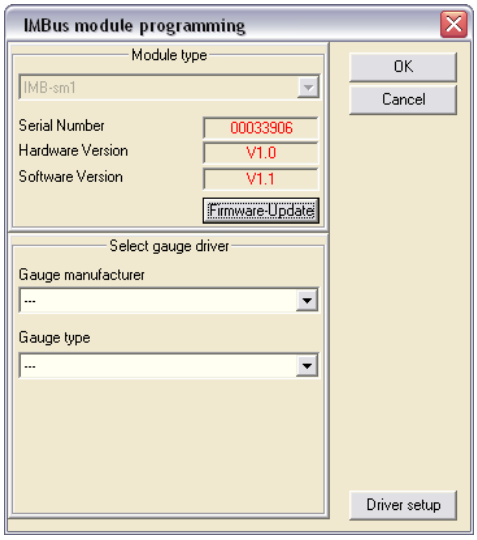


IMBus :

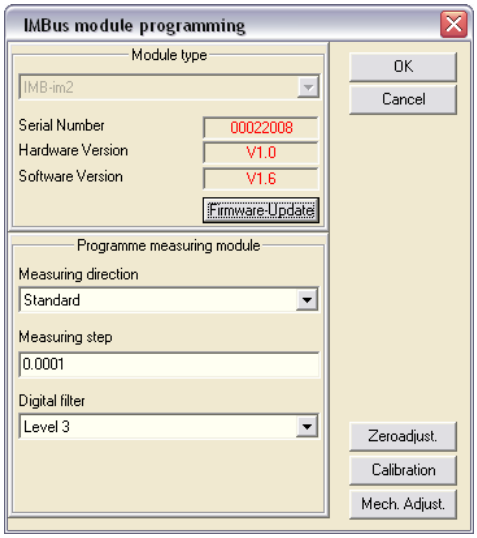
After selecting **IMBus** as **IBR-Instrument,** the measuring bus is analysed and all connected IMBus modules are displayed.



You can select e.g. the gauges connected to the IMBus interface modules (IMB-sm1…4, IMB-pm1, …) by means of the **Setup** - buttons for the individual measuring inputs :

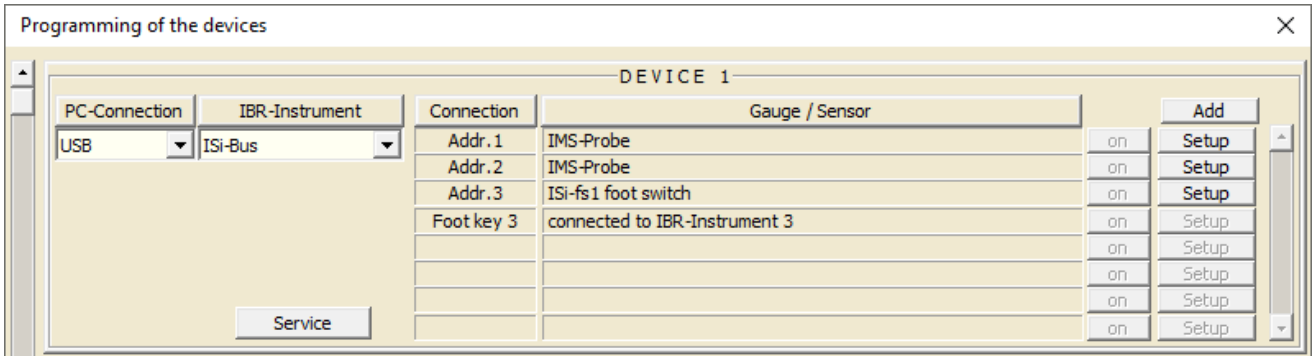


In case of IMBus measuring modules (IMB-im1…8, IMB-dm1…4, IMB-tc1…4, IMB-ai1…8, IMB-ae1, …) you can select the resolution, measuring direction and more :

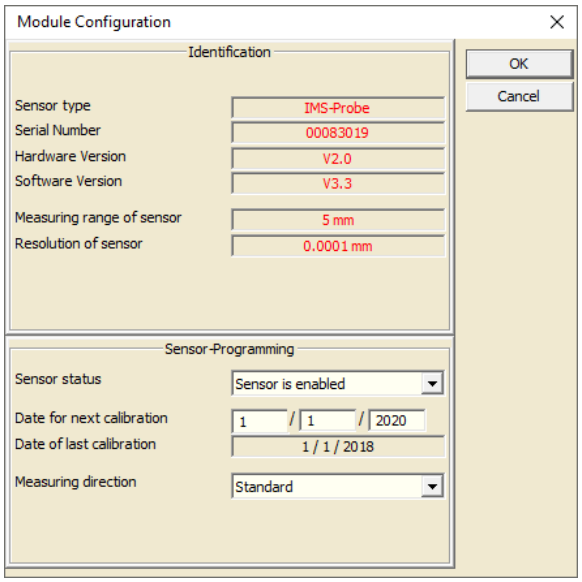


ISi-Bus

After selecting **ISi-Bus** as **IBR-Instrument** the sensor bus is analysed and all connected sensors and control elements are displayed :



Via the **Setup** buttons of the measuring inputs you can for example select the sensor status and measuring direction of the IMS probes or enter the date for the next calibration :



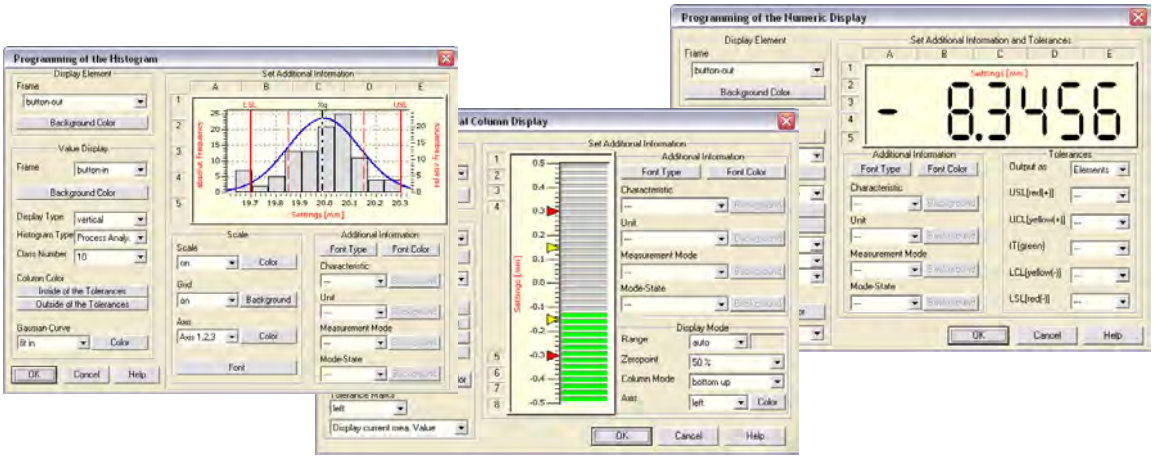
Other IBRit instruments (such as IBRit-mc / -md, IBRit-di8 / -de8 / -da8, C100, C200, …) can be released by the IBR support department, after consultation.
For this you must have the license no. 75 “Old Hardware Support” activated in the license dongle.

The following steps must be executed additionally :

- Click the right mouse button on the desktop icon of your ComGage shortcut.
- Select the entry “Properties” from the displayed context menu.
- Select the “Shortcut” tab in the displayed “Properties” window.
- Add the amendment „ **/o**“ (with space character!) to the entry in the field “Target:”, as shown below.

6.2 Display elements

By choosing the **Options / Display Elements** menu (Button : ) the window for the definition of the display element colours and the individual design of all measurement- and statistical display elements is opened. In the main window you get a preview of the display elements, when you use your mouse to point at a particular button or when a button is selected. The Programming of the display elements is self-explanatory and is supported by a preview of the display element in the programming window (see illustration below).
It is also possible to define basic settings for the display window, e.g. the background colour and the grid that shall be used.
In addition, you can define, save and delete schemes including a colour palette, grid and the settings of the display elements. The currently selected display scheme is used in each test scheme when inserting display elements while programming in the menu *create test scheme*. The settings of the display elements can be changed afterwards in each test scheme if required.

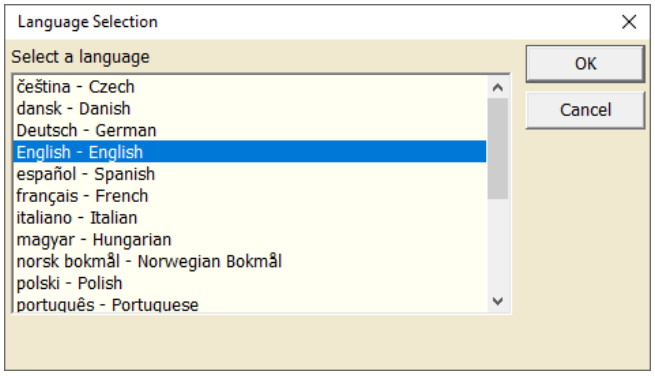


Modifications of display elements done in the menu *Options / Display Elements* do not affect display elements already present in existing test schemes and test orders.

Important notice regarding display elements :
Many of the display elements available can be programmed to display either the current measurement value (option : “Display current mea. Value”) or the last saved measurement value (option : “Display mea. Value from file”) of the characteristic they are assigned to. Depending on the specific case, if you want to programme a “live” display of the characteristic’s value or rather a result display of the recent measurement, you must select the appropriate display option here while programming the test scheme.

6.3 Language selection

You can select the language by choosing the **Options / Language** menu (Button : ). On language selection a window containing a list of the available languages is displayed.



Select your language and confirm by clicking the **OK** - button.

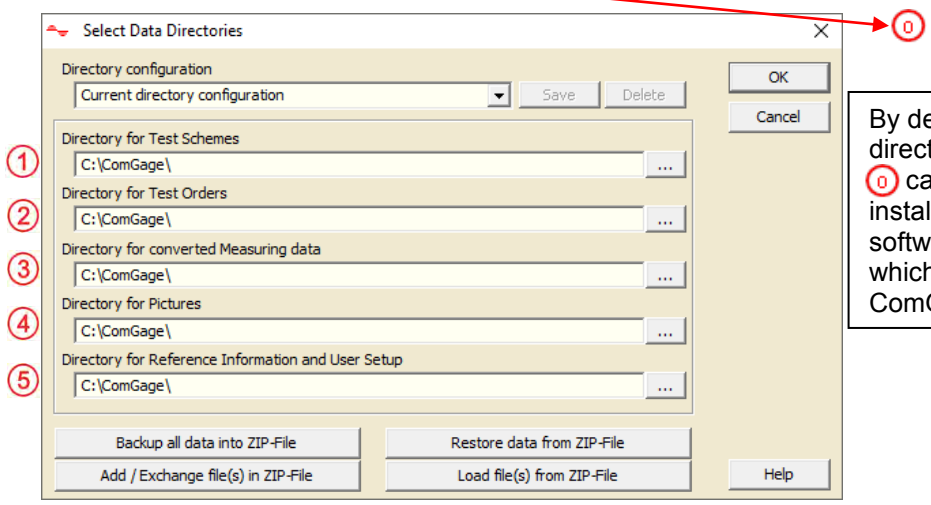
Note : *On initial operation of the software the language is automatically set according to the language settings of the Windows operating system. If this language is not supported by ComGage, then English is automatically selected as language.*

6.4 Selection of data directories

By choosing the **Options / Data Directories** menu (Button : ) you can choose the directories, to which ComGage saves its data or from where ComGage loads its data :

- ① Directory for the test scheme files
- ② Directory for the test order files and collected measurement data
- ③ Directory for the converted measurement data (Excel files, QDAS files, …)
- ④ Directory for the pictures (*.bmp, *.png, *.jpg files)
- ⑤ Directory for the reference information and user management data

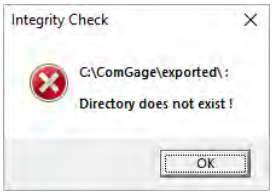
After installing the ComGage software all directory paths of this menu are initially set to the directory, which was specified as “Directory for configuration files” on installation of the software.

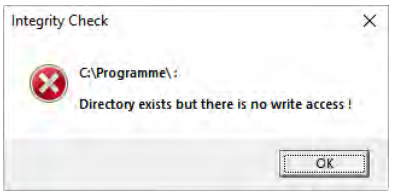


By default the ComGage installation directory is selected as ⓪. ⓪ can be changed during the installation or by the additional software CG_SetConfigPath.exe which can be found in the ComGage installation directory.

The button … opens a separate dialogue which allows you to select a directory. In this dialogue you can additionally find the button **Make New Folder** to create new directories.

Note : *You can type in only the names of existing directories. The ComGage software will not create any new directories. On selection of the data directories ComGage checks, if they exist and if write access is granted for them. If the data directory doesn't exist or write access is not granted for the directory, you will receive one of the integrity check error messages shown below.*





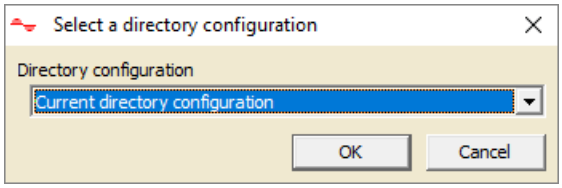
ComGage – files and their storage location :

File		File contents	Storage location (see directories above)
ComGage.cfg	→	ComGage programme settings	0
ComGage.ddk	→	ComGage hardware settings	0
ComGage.rif	→	Reference information settings	5
ComGage.usr	→	User management information	5
DisObj.cfg	→	Current settings of menu "Options / Display Elements"	5
IBR_DDK.idt	→	Text comments on ISM / IBRit-rf1 modules	0
*.dwc	→	Stored display window contents	1
*.rto, *.cto	→	Test orders	2
*.sch	→	Display element design scheme	5
*.tod	→	Measurement data of test order	2
*.tsf	→	Test schemes	1
*.tsc	→	Test scheme documentation Ix / Qx / Rx	1
IBR_AQDEF module :			
*.tsDFD	→	K-field configuration on test scheme level	1
*.toDFD	→	K-field configuration on test order level	2
other files (see chapter 3)			5

Directory configuration :

With the directory configuration in the upper area of the dialogue you can save or load different combinations of data directories.
To save a directory configuration, please select the desired directories under ① … ⑤, enter a name for the configuration in the field *Directory configuration* and confirm by pressing the **Save** button.
Saved directory configurations can be selected in the field *Directory configuration*. The saved data directories are then filled into the respective fields.
After selecting a directory configuration, it can be removed by clicking the **Delete** button.

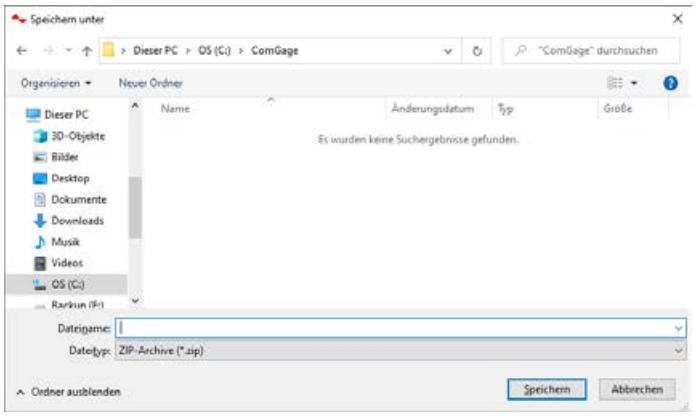
As soon as there is at least one saved directory configuration, the following dialogue is displayed when the ComGage software is started. Here you can select one of the directory configurations :



The "Current directory configuration" is always the one that was last selected. If no change is required, this option can be confirmed by pressing the **OK** button.

Backup all data into ZIP-File :

With this button, it is possible to store all files from the current data directories in a ZIP archive. A dialogue is opened where the folder and the name for the ZIP archive can be selected :



Note :
As soon as the entry for a data directory has been changed, the four buttons for creating, editing and restoring a backup are deactivated.
To reactivate the buttons, the change has to be confirmed by clicking **OK** and opening the dialogue
“Select Data Directories” again.

In addition to the content of the data directories, the Registry entries (see Appendix C) are exported to the file ComGage.reg in the ZIP archive. Additionally, the ComGage.ddk (contains the hardware configuration) and the ComGage.cfg (contains settings for the data directories, auto start of test schemes / test orders, …) are stored in the ZIP archive.

The ZIP archive contains 5 folders :

\dir1\ = ① Directory for the test scheme files
\dir2\ = ② Directory for the test order files and collected measurement data
\dir3\ = ③ Directory for the converted measurement data (Excel files, QDAS files, …)
\dir4\ = ④ Directory for the pictures (*.bmp, *.png, *.jpg files)
\dir5\ = ⑤ Directory for the reference information and user management data

Note : If changes are made to the entered data directories, they have to be confirmed by clicking the OK button before a backup ZIP archive is created.
Otherwise, the former entries are used.

Additionally, it is possible to add another folder (without subfolders), which has no connection to the ComGage installation, to the ZIP archive.
ComGage asks during the creation of the backup if this is required.
If a folder shall be added, a dialogue is opened in which the required folder can be selected.
The content of this folder is stored in the ZIP archive in folder **\dir6**.

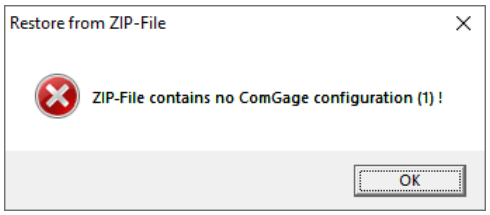
Restore data from ZIP-File :

With this button, an archived configuration can be loaded from a ZIP archive into the current data directories. A dialogue is opened in which a ZIP archive can be selected.

Attention : This function copies the files into the existing directories, which are configured in the menu *Options → Data directories*.
Already existing files are overwritten if the ZIP archive contains files with the same names.
Additionally, the entries in the file ComGage.reg from the ZIP archive are saved in the Registry.
Existing Registry entries are overwritten.

The files ComGage.ddk / .cfg / … with basic settings like language, data directories and settings for the automatic start can optionally be loaded from the ZIP archive and overwritten after confirmation by the user.

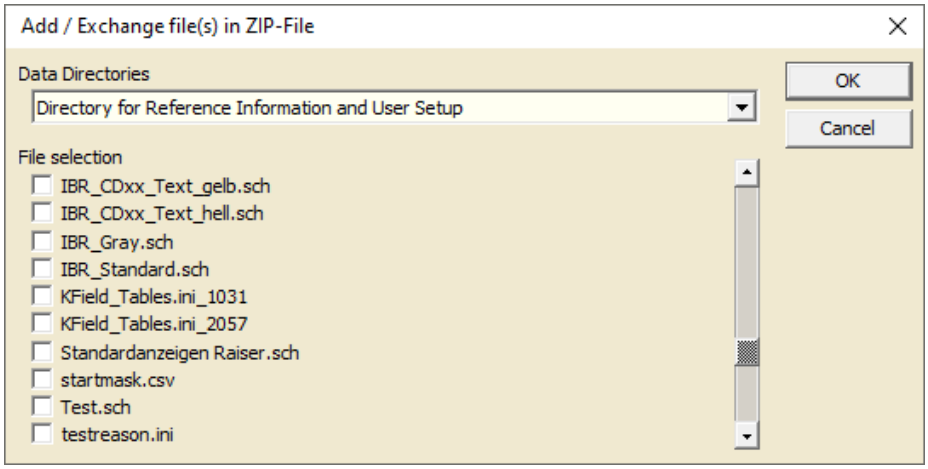
If the selected ZIP archive does not contain the above mentioned 5 folders, the following error message is displayed and no files are imported :



If an additional folder was added to the ZIP archive, ComGage asks if the content of this folder shall be exported, too. If this is the case, it can be selected if the original path shall be used. The directory is created if it does not exist.
If a different path shall be used, it can be selected in a separate dialogue.

Add / Exchange file(s) in ZIP-File

Via this button it is possible to add one or more files from a data directory to an existing ZIP archive.
When this button is clicked, the ZIP archive has to be selected to which the files shall be added.
Then a dialogue is displayed in which the required files from the data directories can be selected :



The data directory can be selected in the upper part of the dialogue.
Below, all files currently in this data directory are listed. After the required files have been selected and the selection has been confirmed by clicking the **OK** button, the ZIP archive is newly created with the additional files.
Files from different data directories can be selected by switching between the data directories and added to the ZIP archive together.

Load file(s) from ZIP-File

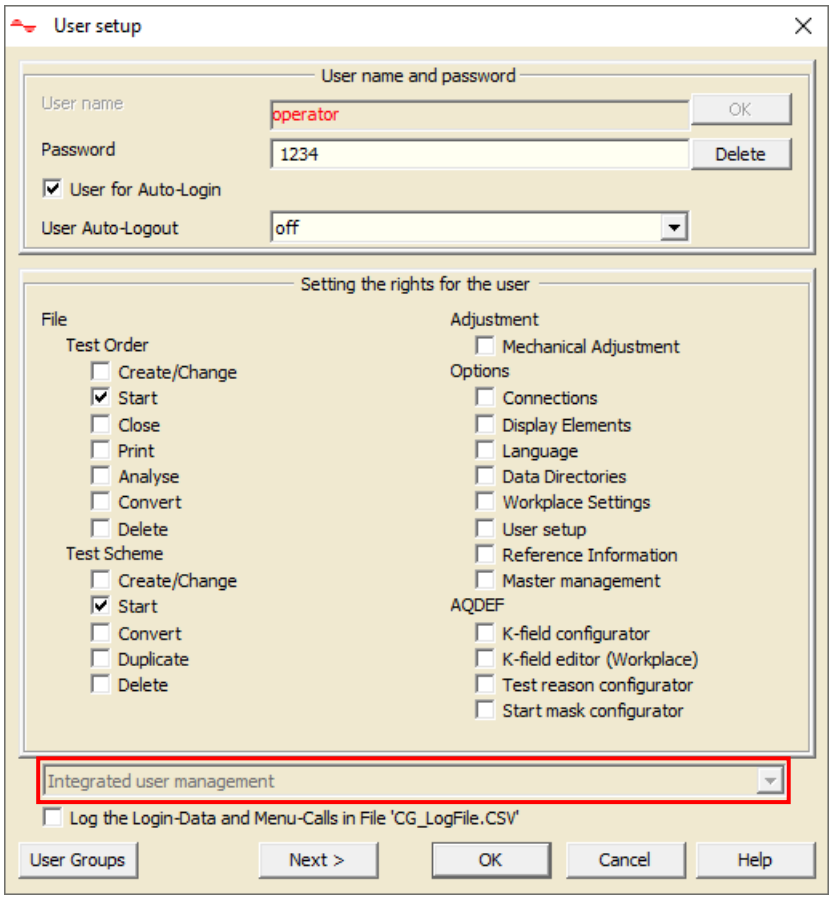
Via this button it is possible to export one or more files from an existing ZIP archive into a data directory.
When this button is clicked, the ZIP archive has to be selected from which the files shall be exported.
Then a dialogue is displayed in which the required files can be selected. This dialogue is similar to the dialogue displayed above for adding files to a ZIP archive.

The data directory can be selected in the upper part of the dialogue.
Below, all files currently in the related folder of the ZIP archive are listed. After the required files have been selected and the selection has been confirmed by clicking the **OK** button, the files are copied to the data directories.
Files from different folders of the ZIP archive can be selected by switching between the data directories and copied to the data directories together.

Attention : These buttons are deactivated in Windows CE. In Windows CE, the complete content of \FlashDisk\ has to be archived manually.

6.5 User management

In the window of the **Options / User setup** menu (Button : ) you can create and change user data.



The dropdown box (see red frame) allows you to choose between “User management off”, “Integrated user management” and “User management by Active Directory”.

The checkbox **Log the Login-Data and Menu-Calls in File “CG_LogFile.CSV“** (lower left corner) allows you to generally activate / deactivate logging of the login-data and menu-calls. The file CG_LogFile.CSV is stored in the directory for the ComGage configuration files.

1.) Integrated user management :

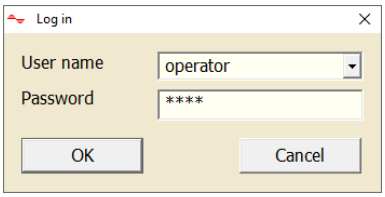
In order to change user data, please select the user from the list and press the **OK** button in the right upper window corner. In order to create a new user, please input the new user name and press the **OK** button in the right upper window corner.

After selecting the user you can :
- input the login password for this user,
- mark the checkbox **User for Auto-login** in order to choose this user for Auto-Login (i.e. this will then be the user, who is automatically logged in on ComGage start),
- activate a **User Auto-Logout** (after 1 minute … 1440 minutes), e.g. for the admin,
- delete this user,
- choose, which menus are activated / deactivated for this user.

The new settings of the currently programmed user are saved by clicking the **Next >** button and you can go on programming the next user.

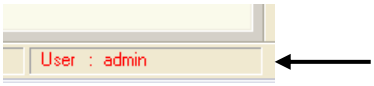
By clicking the **OK** – button you can save the new settings and close the User setup window.

By choosing the **Options / New login** menu you can log in again, using another user name :



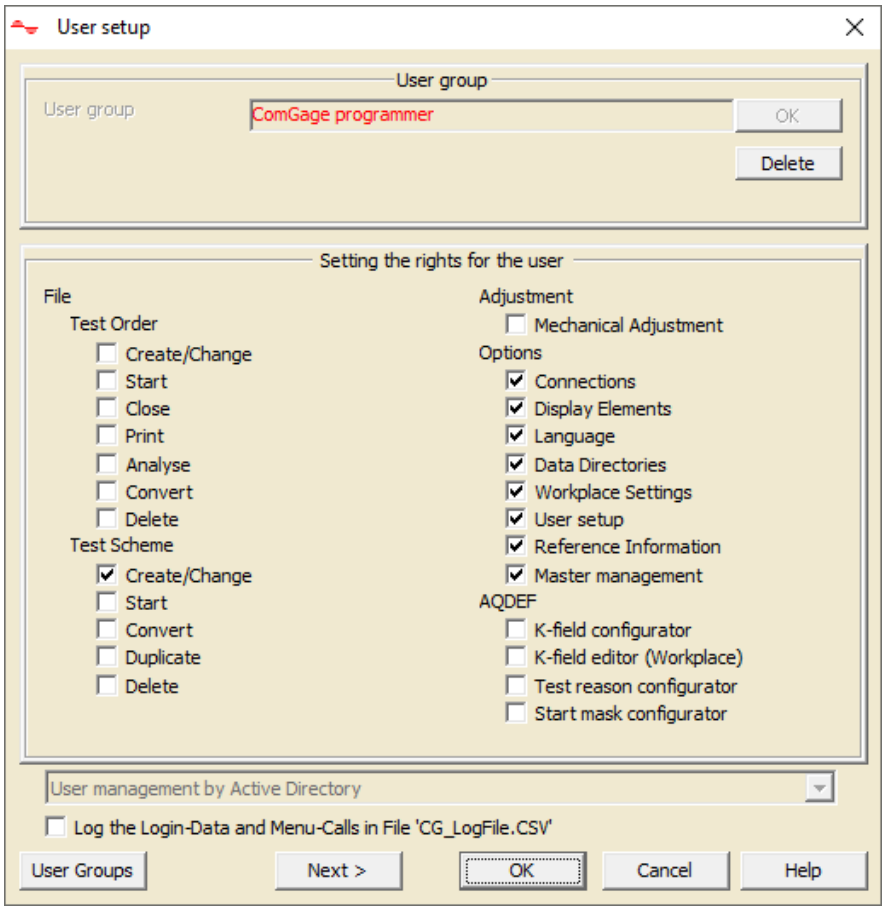
Notes : - ***The user can be selected from the list.***
- ***Capitalization of the password is not checked.***
- ***After an automatic logout, the "User for Auto-Login" is proposed for the login.***
If no auto-login user is configured, the last logged in user is proposed again.

The name of the user currently logged in is shown in the status bar at the right bottom corner :



2.) User management by Active Directory (not available on Windows CE systems)

By this setting it is possible to assign rights to Windows user groups. For this the required user groups have to be created in Windows and the Windows user must be assigned to one or more of these user groups. If the user is a member of several user groups he obtains the rights of all of these user groups. The ComGage login automatically happens with the Windows user name.



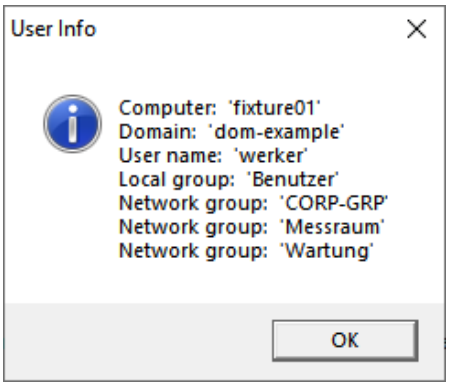
Note :
Upper and lower case of the characters used for the user group name are not checked.

Like under 1.), after entering the user group name you can select the rights to be assigned to this user group.

The new settings of the currently programmed user group are saved by clicking the **Next >** button and you can go on programming the next user group.

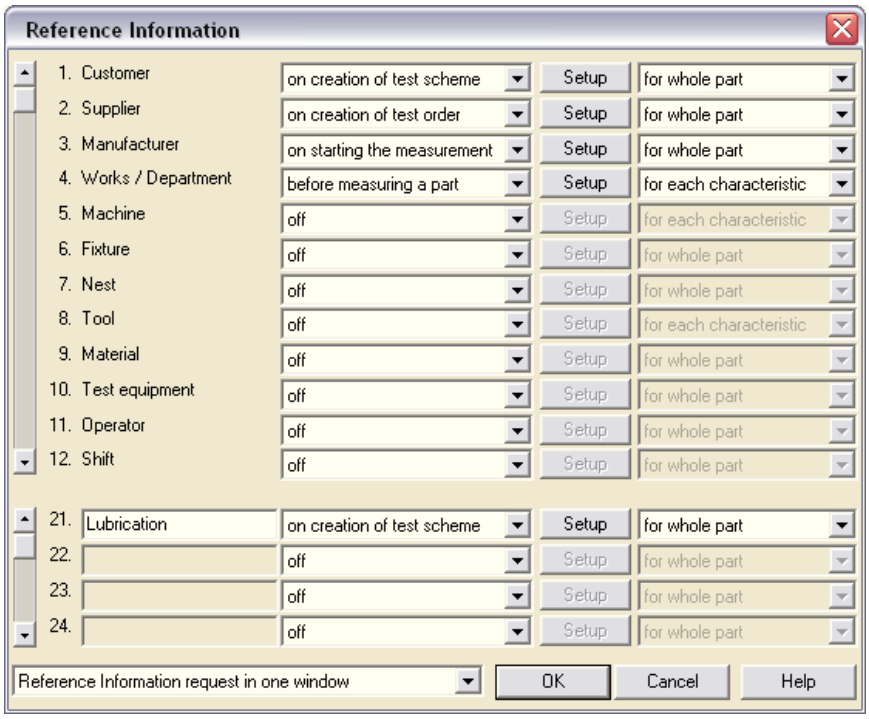
By clicking the **OK** button you can save the new settings and close the User setup window.

By clicking the button **User Groups**, more information about the currently signed in Windows user and to which user groups he belongs can be requested.
A dialogue like the one shown to the right is displayed :



6.6 Reference information (operators, machines, batch numbers, etc.)

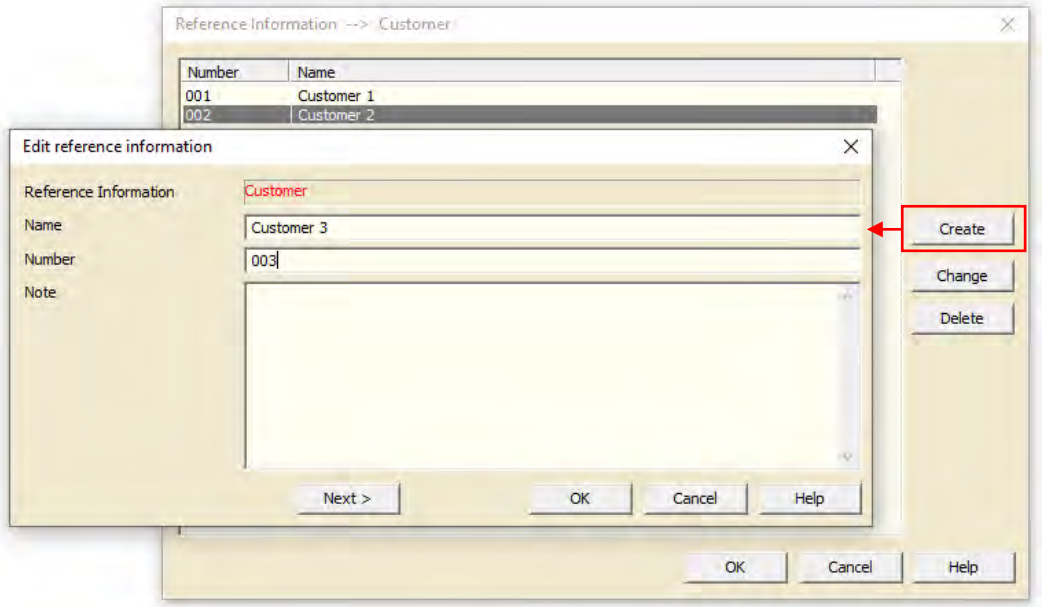
In the **Options / Reference Information** menu (Button : ) the window for programming the reference information and inputting the reference information tables is opened.
All reference information types - except the batch / serial number and the last 5 user defined reference information types (no. 26 – 30) - are selected from the reference information tables (see below). Only the batch / serial number and the last 5 user defined reference information types can be input in an editable field - they are not selected from a reference information table.



1.) For each data type you can select when the data is requested during programme execution :

off	- The data type is not used
on creation of test scheme	- The data type is requested when the test scheme is created (menu “Test Scheme / Create/Change”)
on creation of test order	- The data type is requested when the test order is created (menu “Test Order / Create/Change”)
on starting the measurement	- The data type is requested when the measuring mode is started (menu “Test Order / Start”)
before measuring a part	- The data type is requested for every component in measuring mode (e.g. for serial numbers, please also see chapter 7.9)

2.) By clicking the **Setup** - Button you can programme the table of the selected data type.



First of all you must mark a data set in the list or create a new one by clicking the **Create** button. After selecting it, you can change the data set by clicking the **Change** button or delete it by clicking the **Delete** button.

For each data set you can programme the following :

Name (90 characters)
Number (10 characters)
Note (650 characters)

After programming one data set you can save the settings and leave the window by clicking the **OK** button at the bottom of the window. The **Next >** button allows you to store the settings and directly go on with programming the next data set.

Note : All settings stored by clicking the "Next >" button do not get lost when the "Cancel" button is clicked.

3.) For each data type you can choose whether the data is to be requested for the whole part (component) or for each characteristic separately (e.g. one characteristic is measured using a calliper and an other one using a dial gauge).

4.) "Reference information request in one window" should be activated, if the reference information is to be selected using a mouse. "Sequential reference information request" should be activated, if the reference information is to be selected using a keyboard or barcode reader.

Note : In ComGage you can programme the following reference information data types :

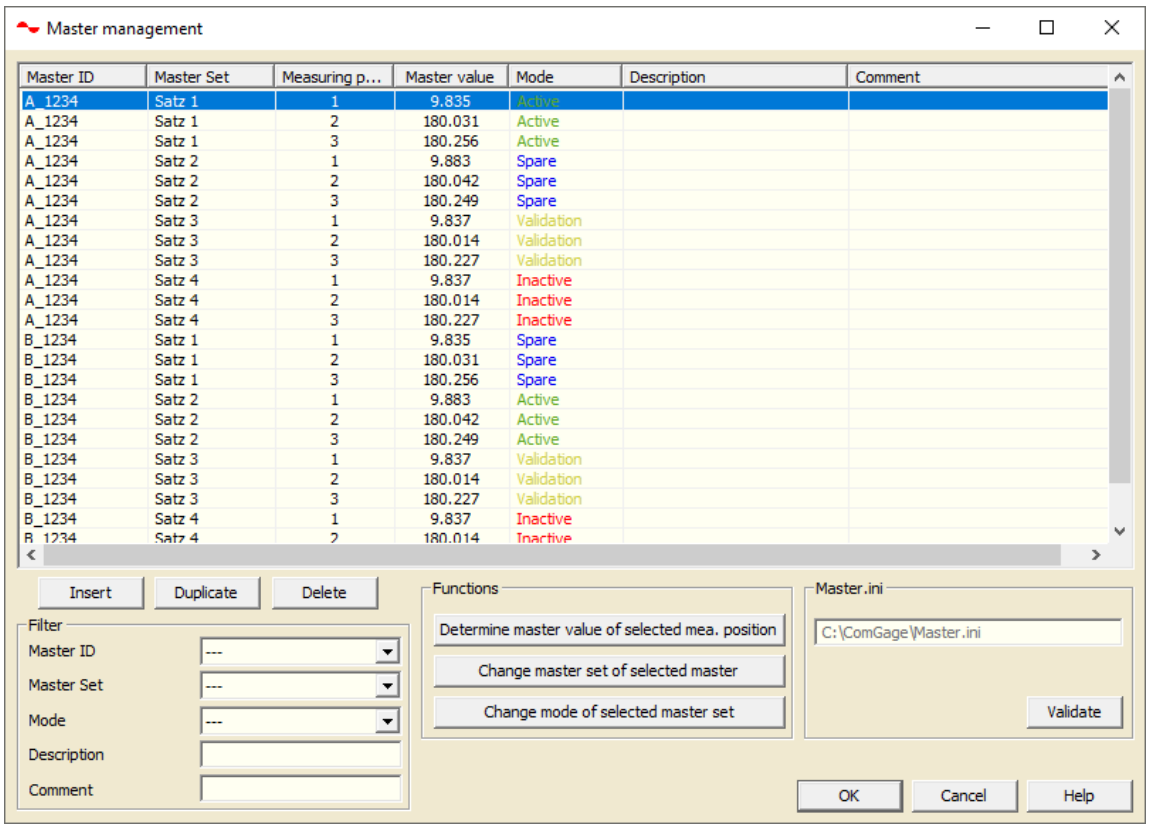
- Customer
- Supplier
- Manufacturer
- Works / Department
- Machine
- Fixture
- Nest
- Tool
- Material
- Test equipment
- Operator
- Shift
- Test place
- Storage place
- Production instruction
- Test instruction
- Events (Why a measurement value is out of tolerance?)
- Batch / Serial number
- Action (What has been done for process correction?)
- 5 user defined data types (Selection by tables in measuring mode)
- 5 user defined data types (Direct input by keyboard in measuring mode)

6.7 Master Management

In the menu **Options / Master Management** you can manage the available setting masters.

The master management is done in a table that contains the following columns :

Master ID :	free text, length max. 13 characters → assigned to characteristics (see chapter 7.6)
Master Set :	free text, length max. 10 characters
Measuring position :	integer values (0 … 255) → assigned to characteristics (see chapter 7.6)
Master value :	real number values (values can be entered with decimal point or comma)
Mode :	selection between “Active” / “Spare” / “Validation” / “Inactive”
Description :	free text
Comment :	free text



Several *Master Sets* can be assigned to one *Master ID*, for example the 20mm master ring can be physically available as 19.999 mm (Master set 1), as 20.001 mm (Master set 2), … .
Every *Master Set* itself can include several *Measuring positions*, e.g. the master for a 3-level plug gauge has three measuring positions for calibrating the three diameters..
The *Master values* are entered directly next to the respective measuring positions.

One of 4 different modes is assigned to each master set :

Active :	Master set is active, active master values are loaded into the test scheme by the test step function “*Load Master values*“.
Spare :	Master set is available as spare for the active master set.
Validation :	Master set is currently being examined and is not available as spare.
Inactive :	Master set is inactive and is not available as spare.

In the columns Description and Comment you can enter additional information, if needed.

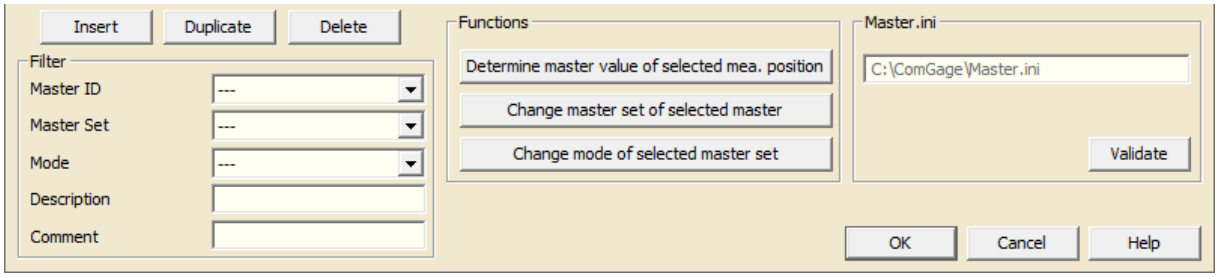
The entries can be made directly in the table. Please select a row by clicking it, then click on the table entry you want to edit. During the editing, you can navigate in the table by using the keyboard keys ↑, ↓, <TAB> and <Shift>+<TAB>.

By clicking a field in the header of the table you can sort the rows by the entries in this column ascending or descending.

The following buttons are additionally available for editing the table :

Insert : This button inserts a new row at the selected position in the table.
Duplicate : This button duplicates the selected row and inserts the duplicate directly below.
Delete : This button deletes the selected row from the table.

Below the table there are three more areas :



In the area "*Filter"* the displayed table entries can be filtered.
For the Master ID, the Master Set and the Mode there are drop-down boxes with all entries to choose from. For Description and Comment filter strings can be entered. Please note that upper and lower case must be as in the table.

In the area "*Functions"* there are buttons to simulate the test step functions which access the table (see chapter 7.9) :

Determine master value of selected measuring position :
The test step function "*Load Master values"* is simulated. This function loads the active master values from the table into the selected characteristics.
For the simulation the active master value of the selected measuring position is only read from the table and displayed on the screen.

Change Master Set of selected master :
The test step function "*Change Master*" is simulated. With this function the active Master Set can be changed while the test scheme / test order is running. All Master Sets with mode "Active" or "Spare" can be selected. The selected Master Set is set to "Active" and the one which was active before is set to "Spare".

The button „**Change mode of selected master set**" is not connected to a test step function. But it can be used to edit Master Sets in the table. The selected Master Set and with it all included measuring positions can be set to one of the four available modes.
No plausibility check is performed here.

The area "*Master.ini"* shows the location of the file Master.ini. The created table is saved in this file. Additionally, there is the button ***Validate***. With this button the created table can be checked for its plausibility (it is checked if there is exactly one active Master Set for each Master ID).

By clicking the **OK** button all changes are saved in the Master.ini and the dialogue is closed.

6.8 AQDEF

This menu point is only visible if the use of AQDEF has been activated in the Workplace settings (see chapter 6.11).

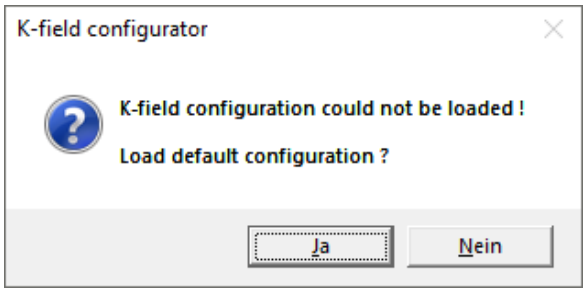
The data export according to the configuration set in this menu has to be executed with the test step function *AQDEF export* (see chapter 7.9).

The menu includes the following submenus :
- K-field configurator
- K-field editor (Workplace)
- Test reason configurator
- Start mask configurator

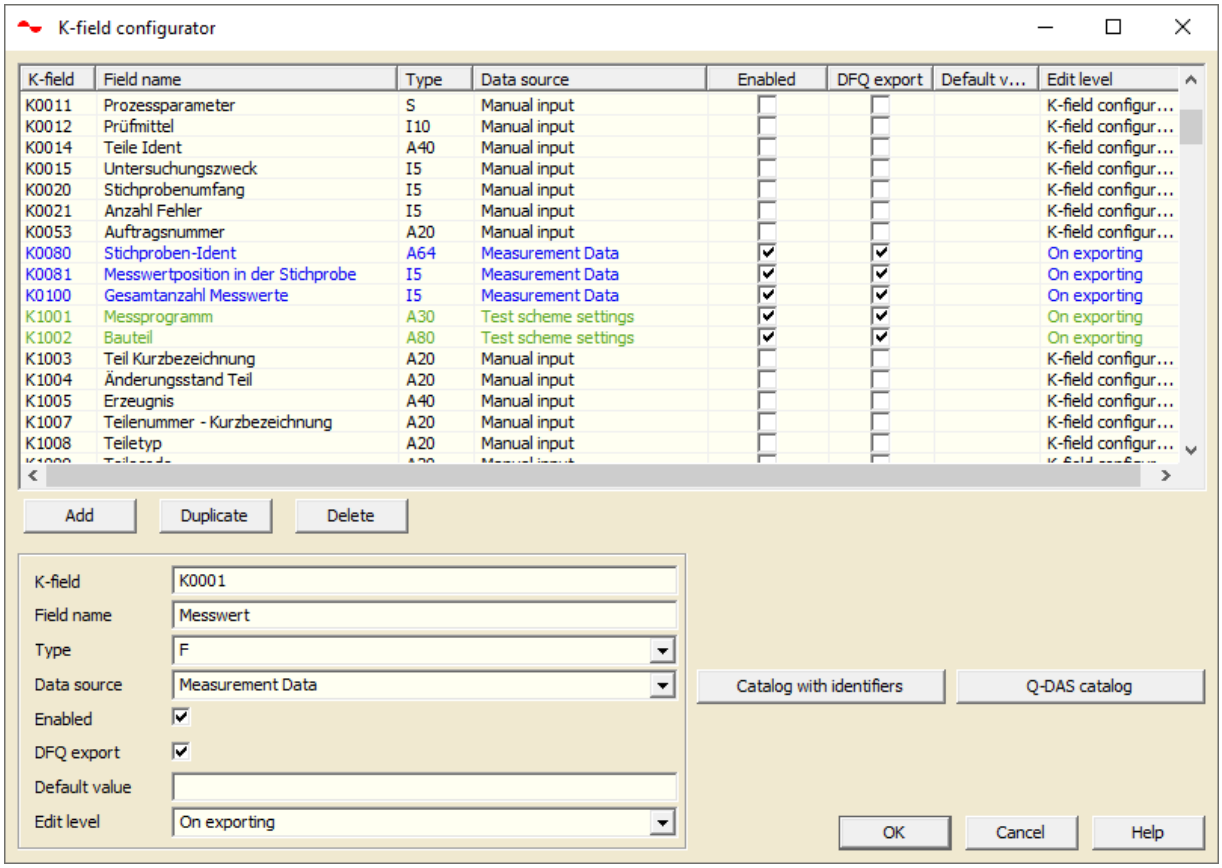
These submenus are described in the following chapters.

6.8.1 K-field configurator

The content of the K-fields which are exported to the DFQ file by the AQDEF export can be configured on different levels.
On starting the K-field configurator for the first time, the software offers to load a standard configuration. This is also the case, if no valid K-field configuration (file **ComGage.qdascfg**) was found in the data directory for *Reference information and user setup* :



The dialogue of the K-field configurator is structured as follows :



The selected entry can be edited in the lower left area. By clicking the **Add**, **Duplicate**, **Delete** buttons new entries can be added and a selected entry can be duplicated or deleted.

Existing entries can also be edited directly in the table. To activate the editing mode, please select a row by clicking, then click the table cell you would like to edit. In the editing mode you can navigate in the table by using the keyboard keys ↑, ↓, <TAB> und <SHIFT>+<TAB>.

By clicking a field in the header of the table you can sort the rows by the entries in this column ascending or descending.

K-fields which are highlighted in **blue** colour cannot be changed or deleted, because they are linked to programme functions of the ComGage software.
Those are the following K-fields : K0001, K0002, K0004, K0080, K0081, K0100, K1053, K1203, K2202, K2205, K2220, K2221 and K2222.

K-fields which are highlighted in **green** colour are by default filled with data from the test scheme / test order by the AQDEF export, but they can be changed or deleted.
Those are the following K-fields : K1001, K1002, K1342, K1343, K1344, K1900, K2001, K2002, K2022, K2101, K2110, K2111, K2112, K2113, K2120, K2121, K2130, K2131, K2142, K2211, K2212, K2900, K8500 and K8501.

Note : The standard configuration can be opened for editing by pressing <ALT>+<F10>. Please take care not to change the settings of the blue highlighted K-fields in the standard configuration. Otherwise, some programme functions may no longer be working correctly.

Every K-field can be configured only once, so it can be entered only once in the table.
The following parameters can be entered for every K-field :

K-field
Number of the K-field for the data export

Field name
Name / identifier of the K-field

Type
Allows the selection of all Q-DAS standard types (I3, I5, I10, F, D, S, A1…A255). A1 for example means a string of 1 and A255 a string of up to 255 characters.

Note : To be compatible to the format specified by Q-DAS, the data types of the K-fields have to match the specifications of the Q-DAS ASCII-Transfer format. For more information, please check the Q-DAS format documentation.
When the K-fields are filled later, e.g. in the test scheme, ComGage checks the plausibility of the entered data in regard to the selected type and accepts only compatible entries (exception : Data source = Reference information set or K-field).

Data source
The following data sources can be selected :

- Manual input
- Catalog with identifiers (= table with fix entries, defined by Q-DAS) (file **`KField_Tables.ini`**, data directory for reference information and user setup) → Can be opened for editing by clicking the button **Catalog with identifiers**.
- Q-DAS catalog (file **`catalog.dfd`**, data directory for reference information and user setup) → Can be opened for editing by clicking the button **Q-DAS catalog**.
- Test reason (by default only for K1203)
- Test order list (by default only for K1053)
- Test order settings (K-field is filled with information from the test order)
- Test scheme settings (K-field is filled with information from the test scheme)
- Measurement data (most of the blue highlighted K-fields, e.g K0001, K0002, …)
- ComGage reference information dataset (Customer, Supplier, …, User defined 10)
- Another K-field (K0001, …, K9999) → The repeated transfer of data from K-field to K-field is **not** possible. A K-field that receives its data from another K-field cannot be used as data source.
- Q-DAS catalog : K4xx2 / K4xx3 → With this option K-fields can be filled directly from the catalogues of the K-fields K40x2, 40x3, K41x2, K41x3, K42x2, K42x3, K43x2, K43x3, K44x2 und K44x3. (see „Q-DAS catalog“ / above)

Enabled
Determines if the K-field is requested

DFQ export
Determines if the K-field is exported

Default value
A default value for the K-field can be entered here, for example NULL.

Edit level
Determines the editing level for the K-field. The following editing levels are available :

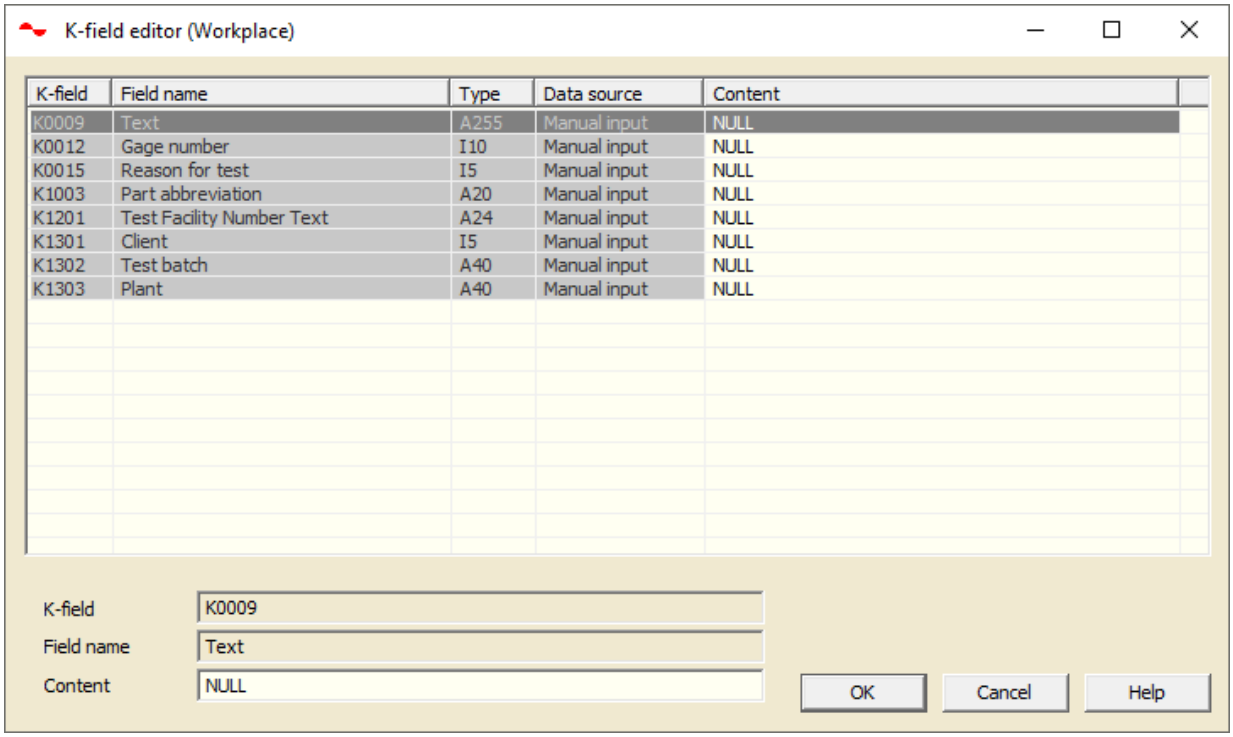
- *K-field configurator* - Changes are only possible in the K-field configurator
- *Workplace* - Editing of the K-field on workplace level (common)
- Start mask - Query of the K-fields in the start mask
- *Test order* - Editing of the K-field in the test order
- *Test scheme (common)* - Editing of the K-field in the test scheme (for whole test scheme)
- *Test scheme (characteristic)* - Editing of the K-field in the test scheme (each characteristic separately)
- *On exporting* - K-fields are filled directly before the AQDEF export

Important : By the K-field K1053 the start of the test order is controlled in the start mask. By the K-field K1203 the test reason is controlled. Both K-fields always have to be set up for editing via the start mask. The data source for K1053 has to be *Test order* and for K1203 *Test reason*!
For data source *Reference information*, only the editing level *On exporting* is allowed.
For data source *K-field,* only the editing level *On exporting* is allowed.
For data sources *Test order* and *Test reason*, only the editing level *Start mask* is allowed.

Note : If the editing level of a K-field shall be changed and it has already been filled, the content has to be deleted on the original editing level before the change (see 6.8.2).

6.8.2 K-field editor (Workplace)

Here the content of the K-fields whose editing level was set to *Workplace* can be configured :

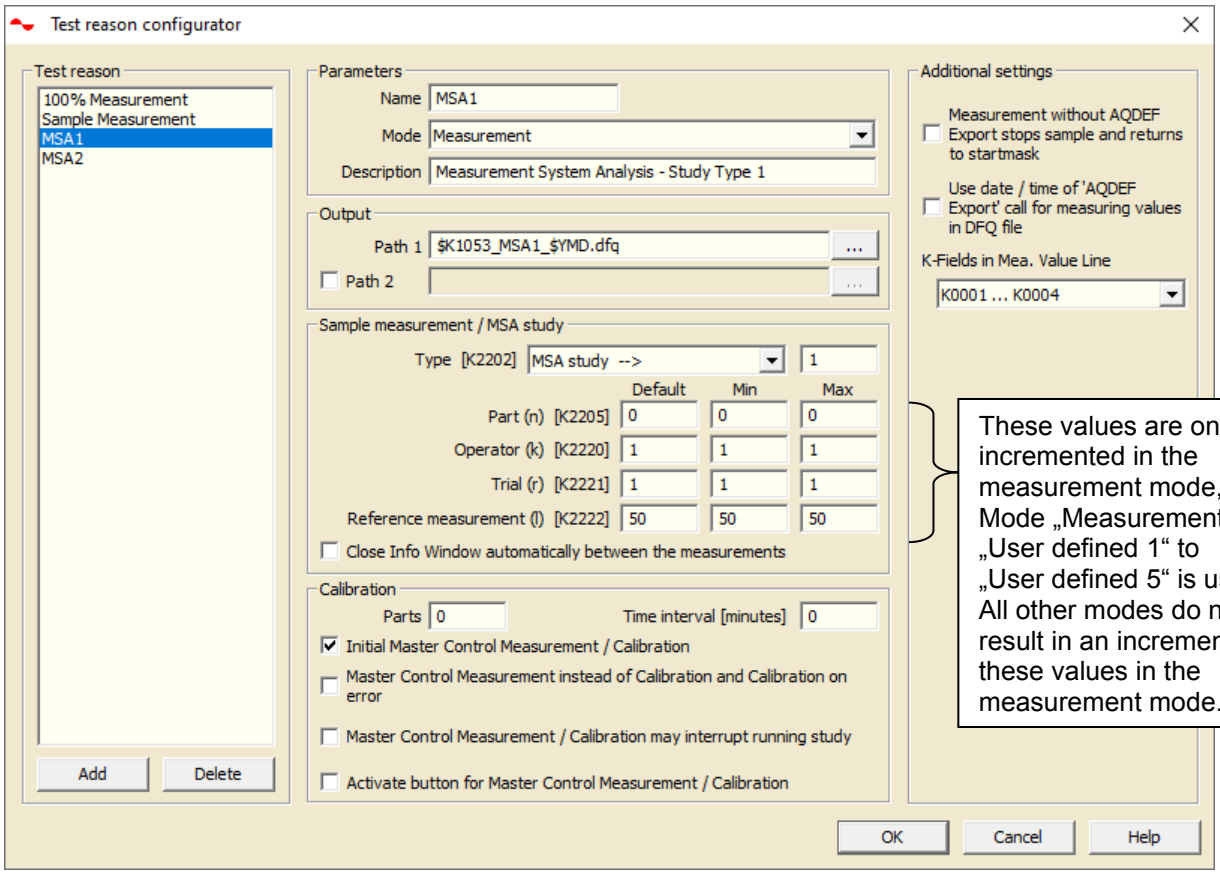


The content of the selected K-field can be edited in the lower left area. Alternatively, the editing mode of the table can be used. To activate the editing mode, please click the field *Content* of the selected row. This is the only field that can be edited here.
In the editing mode you can navigate in the table by using the keyboard keys ↑, ↓, <TAB> and <SHIFT>+<TAB>.
The K-field configuration for the workplace is stored in the file **`workplace.wpDFD`** in the ComGage data directory for *Reference information and user setup*.

By clicking a field in the header of the table you can sort the rows by the entries in this column ascending or descending.

6.8.3 Test reason configurator

Several test reasons can be created in the *Test reason configurator*. The settings of a test reason are used for controlling the measurement and the data export, if the measurement is started via a start mask. The test reason configuration is stored in the file **`testreason.ini`** in the ComGage data directory for *Reference information and user setup*.



In the area *Test reason* all already created test reasons are listed. If one of the test reasons is selected, its settings are displayed in the right part of the dialogue window and can be editied there.
New test reasons can be created and existing ones deleted by clicking the buttons **Add** and **Delete**.

The following settings can be determined for every test reason :

- Section *Parameter* :
  - Name - Name of the test reason
  - Mode - Test step mode → Measurement starts at the 1st test step with this mode (On how to determine the mode of a test step, please see chapter 7.9)
  - Description - Description of the test reason

Notes : - To sort the test reasons in the start mask, two numbers and the character “~” can be added at the beginning of the names (e.g. “03~MSA1”). These three characters are displayed in the start mask, but they are not exported to the DFQ file.
- The selected mode has to be activated for at least one test step in the test scheme. If this is not the case, the test order is started with the first test step, as usual.

- Section *Output* :
  - Path 1 - Output path and file name for the measurement results (*.dfq file)
  - Path 2 - Optional second output path and file name for the measurement results (*.dfq file)

Note : If no complete path, but only a file name is entered here, ComGage automatically uses the data directory for converted measuring data. Additionally, the path is hidden if ComGage recognises it as the current data directory for converted measuring data.
If no file name is entered, ComGage will not be able to do a data export and an error message will be displayed.

The following place holders can be used in *Path 1* and *Path 2* :

- $K0001 - $K9999 (K-fields K0001 – K9999)
- $REG1-$REG2000 (Registers 1 to 2000)
- $o0 (Order number)
- $o1 (Article number)
- $o2 (Article name)
- $o6 (Order text)
- $YMD (Date of the export, format YYYYMMDD, e.g. 20180831)
- $HMS (Time of the export, format HHMMSS, e.g. 153112)

- Section *Sample measurement / MSA study* :
  - Type - *Sample measurement* or *MSA study* can be selected (if MSA study is selected, the number of the study type has to be entered additionally → see Q-DAS documentation)
  - Part (n) - Number of parts to be measured
  - Operator (k) - Number of operators for the study
  - Trial (r) - Number of trials for measuring the part
  - Reference measurement (l) - Number of reference master measurements to be performed

For *Part*, *Operator*, *Trial* and *Reference measurement* a value has to be entered in the fields *Default*, *Min* and *Max*. (Exception : On selection of *Sample size = K8500* the number of parts for the sample measurement is imported from K8500. For this, the K-field K8500 has to be configured for editing in the K-field editor on workplace level, on Test order level or on Test scheme (common) level.)
At the beginning of a measurement the exact number for each is requested. The entered number has to lie between the values for *Min* and *Max*. The *Default* value is used as preset value.
The input of the same values for Min, Max and Default results in the deactivation of the worker's configuration options before the measurement.
The necessary values depend on the requirements of the selected MSA study. The fields that are not needed have to contain the value "0".

If the option *"Close Info Window automatically between the measurements"* is activated, the Info dialogue that is displayed between the measurements is instantly closed and the next measurement starts automatically. This can be used e.g. for automatic measurements.

- Section *Calibration* :
  - Parts - Number of parts to measure till the next calibration
  - Time interval [minutes] - Time interval till the next calibration
  - Initial Master Control Measurement / Calibration
    → Before the first measurement of this test reason, an initial master control measurement / a calibration has to be carried out (which of it depends on the next option).
  - Master Control measurement instead of Calibration and Calibration on error
    → If this option is activated, at first a master control measurement is carried out. If this is not successful, a calibration has to be carried out.
    If this option is not activated, a calibration always has to be carried out.

- Master Control Measurement / Calibration may interrupt running study
  → If this option is activated, a running study / sample measurement can be interrupted by a master control measurement or calibration triggered by the part counter or the time interval. If this option is not activated, a running study / sample measurement will not be interrupted by automatically triggered master control measurements or calibrations.
- Activate button for Master Control Measurement / Calibration
  → If this option is activated, an additional button is displayed in the Info dialogue that allows the worker so start a master control measurement or calibration manually.
  If the option "Master Control Measurement / Calibration may interrupt running study" is activated, the button is displayed between all measurements, else only before the first measurement of a sample or MSA study.

Note : If the following settings are made, the sequence control has to be implemented via test step functions as before and the measurement info dialogue is not displayed (see chapter 12.1) :
- no *Mode* is selected
- Sample measurement is selected as *Type [K2202]*
- for *Parts (n) [K2205]* "0" is entered as values for *Default*, *Min* and *Max*

- Section *Additional settings* :
  - Measurement without AQDEF Export stops sample and returns to startmask

    Behaviour with deactivated option : If the measurement mode is exited without executing an AQDEF export first, the sample counter / MSA counter remains unchanged and ComGage returns to the info window.

    Behaviour with activated option : If the measurement mode is exited without executing an AQDEF export first, the sample / MSA study is cancelled and ComGage returns to the startmask.
  - Use date / time of 'AQDEF Export' call for measuring values in DFQ file

    Behaviour with deactivated option : Date and time of the execution of the function "Save measured values" is used. Because of this, the exported date and time can be different for characteristics which are not saved together.

    Behaviour with activated option : Date and time of the execution of the function "AQDEF Export" is used for all characteristics.
  - K-Fields in Mea. Value Line

    This option allows to select which K-fields shall be written into the measuring value line of the DFQ file.
    Available are "K0001 … K0004" to "K0001 … K0008".
    The standard setting is "K0001 … K0004", which is also the behaviour of the SFct008 (Q-DAS Converter).
    The K-fields K0005 to K0008 which are not part of the measuring value line are listed below it.

6.8.4 Start mask configurator

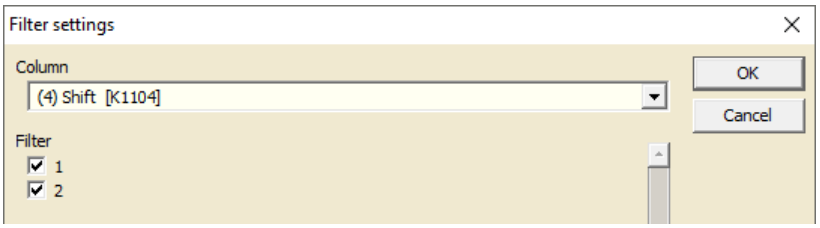
The valid configurations for the start mask are listed in the start mask configurator. Every valid configuration has to contain all (max. 12) K-fields which were set to editing level *Start mask* in the K-field configurator (see chapter 6.8.1).
Each column in the start mask configurator represents one of these K-fields. For every K-field of a configuration (= row) you can enter a value. If no value is entered for a K-field, that means that every available option is valid and can be selected in the start mask. For K-fields with data source *Manual input*, an input field is used, for other data sources you can make a selection from a list of available options.
The table of K-field combinations is stored in the file **`startmask.csv`** in the ComGage data directory for *Reference information and user setup*. Additional settings regarding DMC code, font type, colours and headlines are stored in the file **`measurement.ini`**.

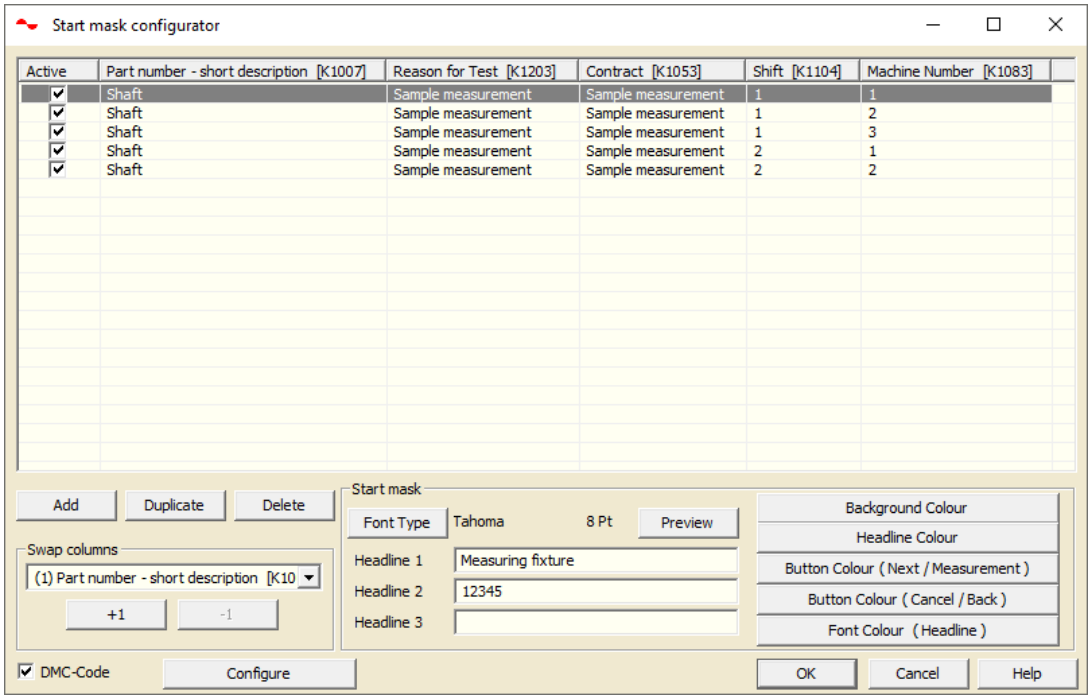
By clicking the buttons **Add**, **Duplicate**, **Delete**, new entries can be added and a selected entry can be duplicated or deleted.

The order of the columns determines in which order the K-fields are requested in the start mask.
In the lower left area you can change the position of a selected column via the buttons **+1** and **-1.**

The entries can also be edited directly in the table. To activate the editing mode, please select a row by clicking, then click the table cell you would like to edit. In the editing mode you can navigate in the table by using the keyboard keys ↑, ↓, <TAB> and <SHIFT>+<TAB>.

By clicking the headline of one of the columns, the displayed entries can be filtered.
The dialogue to the right can be used to configure the filter :





In this example the worker can only select one of five preconfigured combinations in the start mask. For example, he is not able to select a machine number 3 for shift 2.

In the lower middle area, the font type / font size for the start mask and the info dialogue that is displayed between two measurement cycles can be changed via the button **Font Type**. Please note that not every available font type can be used. To check if your selected font type works correctly, you can use the button **Preview**, which provides a preview of the start mask with your configuration.
Here you can additionally enter up to three headlines that are displayed in the start mask / info window above the input fields.

Note : When additional K-fields are configured for editing level *Start mask*, the *Start mask configurator* has to be opened at least once and closed by pressing the **OK** button. Only then, the new K-fields will appear in the start mask.

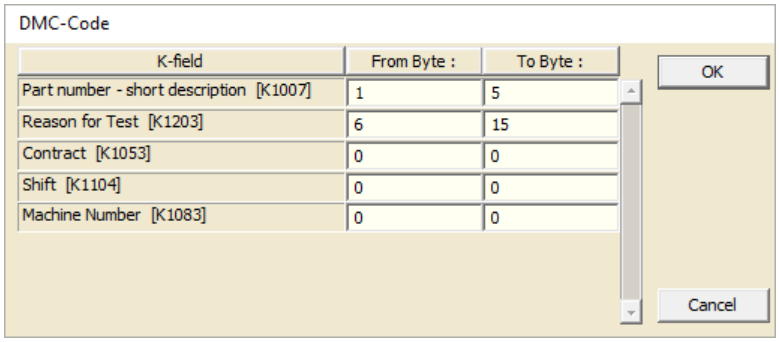
The colour design of the start mask and the info dialogue can be configured via the buttons :

- **Background Colour**
- **Headline Colour**
- **Button Colour (Next / Measurement)**
- **Button Colour (Cancel / Back)**
- **Font Colour (Headline)**

If one of these buttons is clicked, a dialogue for the colour selection is opened.

Only the background colour of the separate elements of start mask and info dialogue as well as the font colour for the headline can be configured. The font colour for other areas is always black.

Additionally, the option **DMC-Code** is available. If this option is activated, the start mask can be filled in by scanning the DMC code.
Via the button **Configure**, the following dialogue is opened in which the separate bytes of the DMC code can be assigned to the K-fields :



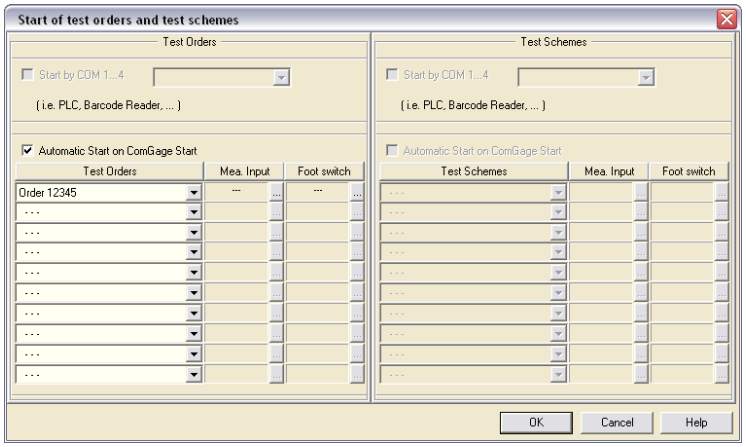
K-fields which need data from a DMC code always have to be filled first. So, the start mask has to be configured in such a way that these K-fields are listed at the top in the here displayed dialogue.
K-fields that have to be filled in by the worker always have to be listed below.

For all K-fields which were configured for the editing level *Start mask*, a range (From Byte / To Byte) of the scanned DMC code can be assigned.
For K-fields which are not filled in from the DMC code, the entries have to remain 0 / 0. The content of these K-fields has to be entered or selected in the start mask by the worker.

Note : The DMC code is requested in a separate dialogue when a test order is started.
Data which was imported via the DMC code cannot be overwritten by the worker in the start mask.
But if the dialogue for reading the DMC code is closed by clicking the button **Cancel**, the start mask is opened and the worker can fill in all fields manually.
K-fields which shall be filled from a DMC code have to be configured in the K-field configurator for Data source *Manual input* and Edit level *Start mask* (see chapter 6.8.1).

6.9 Automatic start

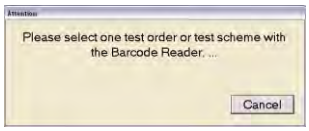
In the **Options / Automatic Start** menu you can activate automatic starting of test schemes or test orders when ComGage is started or a barcode reader is used for selection. The ComGage workplace settings (see chapter 6.11) allow setting a delay time for automatic start of test schemes / test orders on start of ComGage (default value is 3 sec.). A countdown display allows aborting the automatic start. In measuring mode, the selection of a test scheme or test order can be done by keyboard (keys : 0 … 9), foot switch, measuring input or barcode reader.



Note :
Even if the IBR_AQDEF module is activated, the automatic start starts the test orders in the same way as before, without regard to the AQDEF settings.

Test Orders & Start by COM1...4

→ On ComGage Start or on choosing the Menu *File / Test Order / Start* you are requested to select a test order by the barcode reader or another connected reading device :



The barcode reader or other connected reading device must use the transmission format 9600 Baud, 8 data bits, no parity and 1 stop bit. The test order number followed by “carriage return” must be transmitted to the COM port in order to select a test order for start.

Test Orders & Automatic Start on ComGage Start

→ After starting ComGage all selected test orders are started automatically for measurement data collection.

→ If an assigned measurement input **Mea. Input Mxx** detects a measurement value change then the test order belonging to it is automatically executed in the foreground. The measuring input can be selected by clicking the button ... .

→ If an assigned **foot switch Txx** is pressed, then the test order belonging to it is automatically executed in the foreground. The foot switch can be selected by clicking the button ... .

Test Schemes & Start by COM1...4

→ This function corresponds with the function “*Test Orders & Start by COM1...4”* as described above, but refers to test schemes instead of test orders.

Test Schemes & Automatic Start on ComGage Start

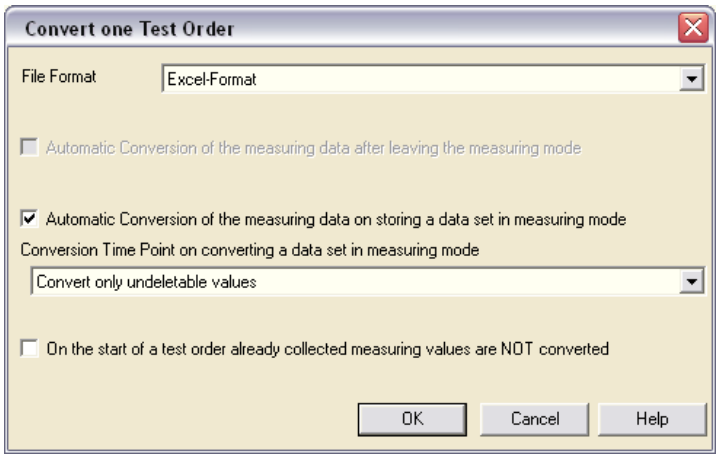
→ After starting ComGage all selected test schemes are started automatically.

→ If an assigned measurement input **Mea. Input Mxx** detects a measurement value change then the test scheme belonging to it is automatically executed in the foreground. The measuring input can be selected by clicking the button ... .

→ If an assigned **foot switch Txx** is pressed, then the test scheme belonging to it is automatically executed in the foreground. The foot switch can be selected by clicking the button ... .

6.10 Convert

In the menu **Options / Convert** the automatic conversion of measurement data can be activated for the measuring mode.



File format

→ Selection of the data format, into which the conversion shall occur :

QDAS – Format (File name : *Test order name .dfq*)
Excel – Format (File name : *Test order name .xls*)
Special Format (File name : *Test order name .txt*
→ An UDI Script for SPC Light from Lighthouse is available on request)

Automatic conversion of the measuring data after leaving the measuring mode

→ The conversion of the measuring data into the selected format occurs after leaving the measuring mode (i.e. conversion occurs on exiting ComGage or the ComGage measuring mode and also when a test order is unloaded).

Automatic conversion of the measuring data on storing a data set in measuring mode

→ The conversion of the measuring data into the selected format occurs while measuring

Important note :
This setting cannot be used together with the test step function “Excel-Export and delete all values” (see chapter 7.9). If this is tried, an error message is displayed on execution of the test step function “Excel-Export and delete all values” and the Excel-Export is disabled. However, all measurement values are deleted by the test step function.

Conversion Time Point on converting a data set in measuring mode

Convert only undeletable values
During measuring, the operator is authorised to delete only the last collected measurement value of a characteristic. All measurement values collected before cannot be deleted anymore. Hence, measurement values are automatically converted as soon as a further measurement value is collected, because they are then undeletable.

Convert all values directly
All measurement data is automatically converted when the test step function “Save measured values” is executed.

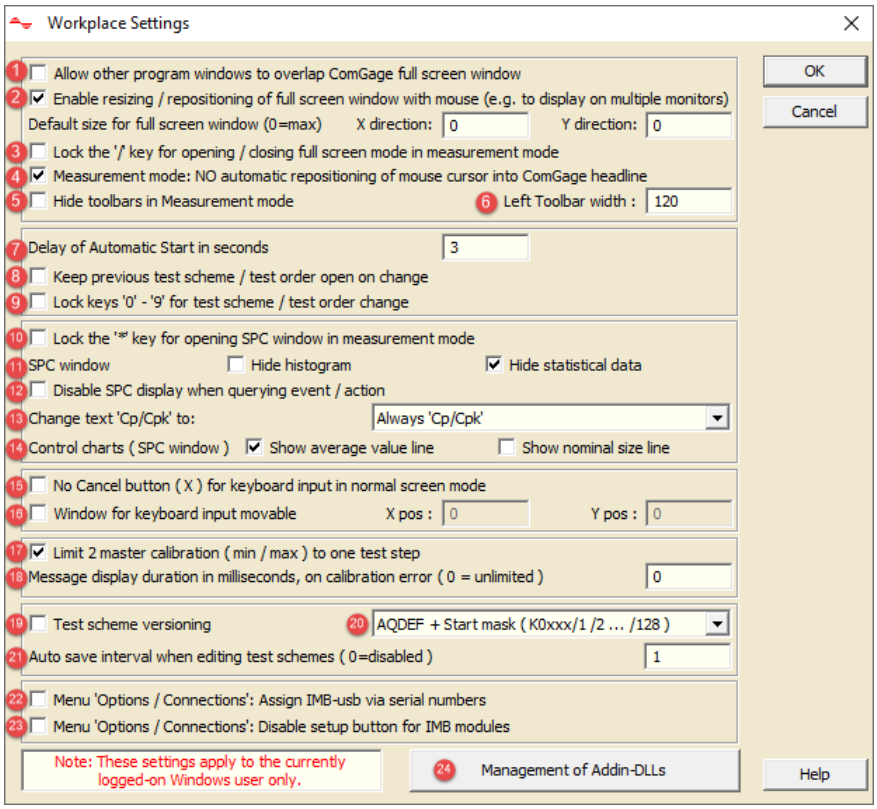
Convert the values after measuring the complete part
The measurement data is converted as soon as all characteristics of the component to be measured have been saved.

On the start of a test order already collected measuring values are NOT converted

→ Measuring values that are already saved when the test order is started are not converted.
→ This function only makes sense in connection with *File Format* = Special Format.

6.11 Workplace settings

In the menu **Options / Workplace Settings** you can make overall settings for the ComGage installation of a workplace. The default settings are shown in the window below.



The following settings can be made in this menu :

1. **Allow other program windows to overlap ComGage full screen window** (not under Win CE)
   With this option activated, the ComGage full screen window can be overlapped by windows of other applications. Otherwise, the ComGage full screen window always stays in the foreground.

2. **Enable resizing / repositioning of full screen window with mouse** (not under Win CE)
   With this option activated, resizing / repositioning of the ComGage full screen window is enabled. Otherwise, the size and position of the ComGage full screen window are fixed to default values and cannot be changed.
   The following additional settings can be made :
   Default size for full screen window → X direction / Y direction
   = 0 : The width / height of the ComGage full screen window goes to maximum display size for the currently used monitor.
   > 0 : Default setting for the width / height of the ComGage full screen window, as pixel value.
   → By these settings the ComGage full screen window can automatically be displayed on multiple monitors. For example, if two monitors have a resolution of 1920 x 1080 pixels each, it can be accomplished to split-up the ComGage full screen window on both monitors by entering the values 3840 (X direction) and 1080 (Y direction).

3. **Lock the "/" key for opening / closing full screen mode in measurement mode**
   With this option activated, the display mode cannot be toggled between normal and full screen mode by pressing the "/" key in measurement mode. Otherwise, the display mode can be toggled between normal and full screen mode by pressing the "/" key in measurement mode. Activating the full screen mode is still possible by using the appropriate test scheme special setting (see chapter 7.3).

4. **Measurement mode: NO automatic repositioning of mouse cursor into ComGage headline**
   With this option activated, the mouse cursor is not automatically repositioned into the ComGage headline in measurement mode. Otherwise, the mouse cursor is automatically repositioned into the ComGage headline on start of the measurement mode and every 30 seconds.

5. **Hide toolbars in measurement mode**
   With this option activated, the toolbars at the left and upper screen edge of the ComGage window in normal screen mode are hidden in measurement mode. (The ComGage window in normal screen mode is virtually displayed as full screen window.) Otherwise, the toolbars of the ComGage window in normal screen mode are displayed in measurement mode.

6. **Left Toolbar width**
   The width of the left toolbar in measurement mode can be changed with this option (min width 120 pixels).

7. **Delay of automatic start in seconds**
   Here you can set a delay time for the automatic start of test schemes / test orders on start of ComGage. The default value is 3 seconds. A countdown display allows aborting the automatic start. If a delay time of 0 seconds is set, no countdown display appears and the automatic start cannot be aborted.

8. **Keep previous test scheme / test order open on change**
   With this option enabled, on test order change the previous test scheme / test order is not removed from the list of started test orders.

9. **Lock keys '0' - '9' for test scheme / test order change**
   With this option the keys '0' - '9' cannot be used in measurement mode to change between test orders in the list of started test schemes / test orders.

10. **Lock the "*" key for opening SPC window in measurement mode**
    With this option activated, the "Look at, change and delete measuring values" window cannot be opened by pressing the "*" key in measurement mode. Otherwise, that window can be opened by pressing the "*" key in measurement mode (see chapter 12 / sub-item 11).

11. **SPC window → Hide histogram / Hide statistical data**
    With this option activated, the histograms / statistical data are hidden in the windows "Look at, change and delete measuring values" and "Analysation of test order". Otherwise, the histograms / statistical data are always displayed together with the run charts in these windows (see chapter 12 / sub-item 11).

12. **Disable SPC display when querying event / action**
    With this option the SPC display is disabled when event / action is requested from the worker.

13. **Change text "Cp/Cpk" to**
    Here you can influence the text displayed by the display elements "Statistical Data".
    The following options can be activated alternatively :

Always "Cp/Cpk"	:	The statistical data display elements always display the text "Cp / Cpk" for all standard deviation norms of the characteristics.
Pp/Ppk on Sigma = Sges	:	The statistical data display elements display the text "Pp / Ppk" instead of "Cp / Cpk" for characteristics using the standard deviation norm "Sigma = Sges".
Pp/Ppk on Sigma = Rq / Dn	:	The statistical data display elements display the text "Pp / Ppk" instead of "Cp / Cpk" for characteristics using the standard deviation norm "Sigma = Rq / Dn".
Pp/Ppk on Sigma = Sq / An	:	The statistical data display elements display the text "Pp / Ppk" instead of "Cp / Cpk" for characteristics using the standard deviation norm "Sigma = Sq / An".
Pp/Ppk on Sigma = sqr(…)	:	The statistical data display elements display the text "Pp / Ppk" instead of "Cp / Cpk" for characteristics using the standard deviation norm "Sigma = sqr(…)".

14. **Control chart → Show average value line / Show nominal size line**
    With this option activated, the average value line / nominal size line is shown in the control charts of the SPC window (opened by pressing the "*" key) (see chapter 12 / sub-item 11).

15. **No Cancel button (X) for keyboard input in normal screen mode**
    With this option activated, the "Cancel"-button (X) is hidden in the entry window on input of measuring values by keyboard, also in normal screen mode (in full screen mode it is always hidden). Otherwise, the "Cancel"-button (X) is displayed in the entry window on input of measuring values by keyboard in normal screen mode.

16. **Window for keyboard input movable → X pos / Y pos**
With this option activated, the ComGage window for keyboard input of characteristics values is movable by mouse / touch screen. Otherwise, the position of the ComGage window for keyboard input of characteristics values is not movable and is located in the lower left corner of the test step display window.
The following additional settings can be made :
X pos / Y pos
Determines the position of the upper left corner of the ComGage window for keyboard input of characteristics values referring to the upper left corner of the monitor, as pixel value.

17. **Limit 2 master calibration (min / max) to one test step**
With this option activated, the ComGage function “Adjustment / Calibration” must be executed completely in one test step for characteristics with two masters activated (i.e. on 2-master calibration). Otherwise, the ComGage function “Adjustment / Calibration” can be split to more than one test step for characteristics with two masters activated (i.e. on 2-master calibration).

18. **Message display duration in milliseconds, on calibration error (0 = unlimited)**
= 0 : The duration of the message output on calibration error (reference test), probe validity test error or probe free lift control error is unlimited and must be acknowledged by the operator.
= 1 : On selection of 1 millisecond as message output duration the message window is not displayed.
> 1 : The parameter value defines the duration of the message output in milliseconds, on calibration error (reference test), probe validity test error or probe free lift control error. If the message is acknowledged by the operator before the defined output duration time has expired, the message window is closed with the acknowledgment.

19. **Test scheme versioning**
With this option activated, version management for test schemes is enabled (see chapter 7.13).

20. **AQDEF**
With this option the use of AQDEF and one of two start masks can be activated (see chapter 6.8).
You can additionally select if the characteristic-related K-fields (K00xx) are exported only once with extension /0 or for every characteristic separately with extensions /1, /2, … .

21. **Auto save interval when editing test schemes (0 = disabled)**
With this option the auto save function during test scheme programming is activated. The interval is entered in minutes. Five backups are managed continuously. The backups are saved with the names „*.ts1“ … „*.ts5“. By renaming these files to „*.tsf“ you can recreate standard test scheme files.

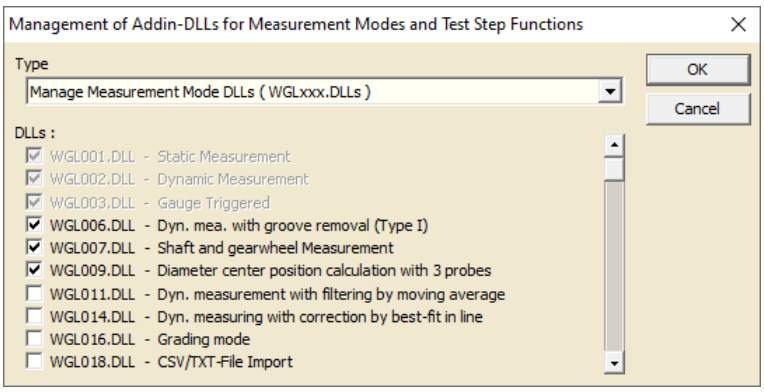
22. **Menu “Options / Connections”: Assign IMB-usb via serial numbers**
With this option activated, it is demanded to select the IMB-usb module’s serial number in the “Options / Connections” menu and in the “Hardware Connections” Setup menu of the “Test Scheme (Create / Change)” window, if “USB” is selected as *PC-Connection* and “IMBus” is selected as *IBR-Instrument*.
Measuring fixtures using IMB-usb connection modules can be hard-linked to a test scheme / test order by activating this option.

23. **Menu “Options / Connections”: Disable setup button for IMB modules**
With this option activated, the access to the particular Setup menus for programming the connected IMB modules is disabled in the “Options / Connections” menu and in the “Hardware Connections” Setup menu of the “Test Scheme (Create / Change)” window.

Note : (to 1. - 23.) If Win CE is used, the additional programme „Start → Colibri Tools → SaveReg” has to be executed to store the changed settings permanently.

24. Management of Addin-DLLs

A new dialogue window is opened by this button, in which the available test step functions and measurement modes can be activated / deactivated :

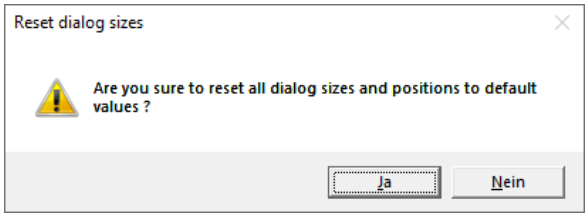


Under *Type* can be selected, if measurement modes (see chapter 7.6) or test step functions (see chapter 7.9) shall be managed. Depending on this selection, the WGLs or SFcts currently available in the ComGage programme directory are listed under *DLLs*.
DLLs can be activated / deactivated via the related checkboxes.
A deactivation of WGL001.DLL, WGL002.DLL and WGL003.DLL is not possible. These are the standard measurement modes.

Note : Several test step functions / measurement modes require an additional license stored in the dongle.
Additional information can be found in Appendix B, including a list of all available measurement modes / test step functions.

6.12 Reset dialog sizes

With this menu point the size of all dialogue windows can be reset to the standard settings.
Before the reset an additional confirmation is requested :



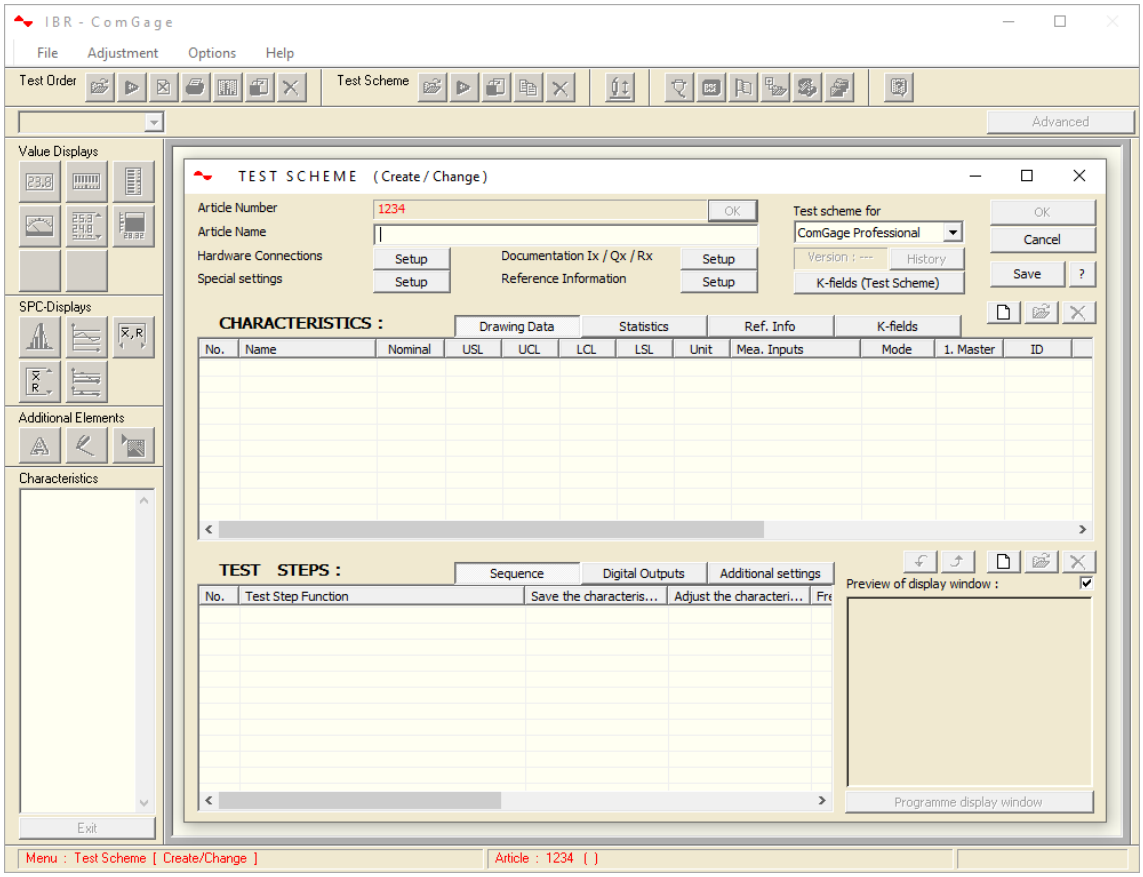
7. Creating a test scheme

In a test scheme the component, its characteristics and the measuring sequence are defined :

- *In the test scheme head the article number, the component name, the component reference information (operator, machine, batch, …) and the special settings are entered.*
- *Up to 128 characteristics can be created :*
  - *Characteristic name*
  - *Nominal size and tolerances*
  - *Probe mixing (with mathematical functions, such as sin, cos, tan, Min, Max, …)*
  - *Measuring modes (for static, dynamic [Min, Max, TIR, Mean], … measurements)*
  - *Master values for zero-adjustment or automatic gauge-calibration (for air gauging)*
  - *Sample size*
  - *Settings for the statistics (plausibility limits, distribution form, ...)*
- *Up to 128 test steps can be created :*
  - *Free design of display windows with numeric displays, column displays, analogue meters, control charts, histograms, ..., lines, texts, pictures*
  - *Assignment of foot switches, function keys, digital inputs and free definable conditions (with mathematical operators, logical operators, trigonometric functions, timers, ...) to the executable functions (e.g. saving of measurement values, deleting of measurement values, adjustment, …)*
  - *Setting of digital outputs*

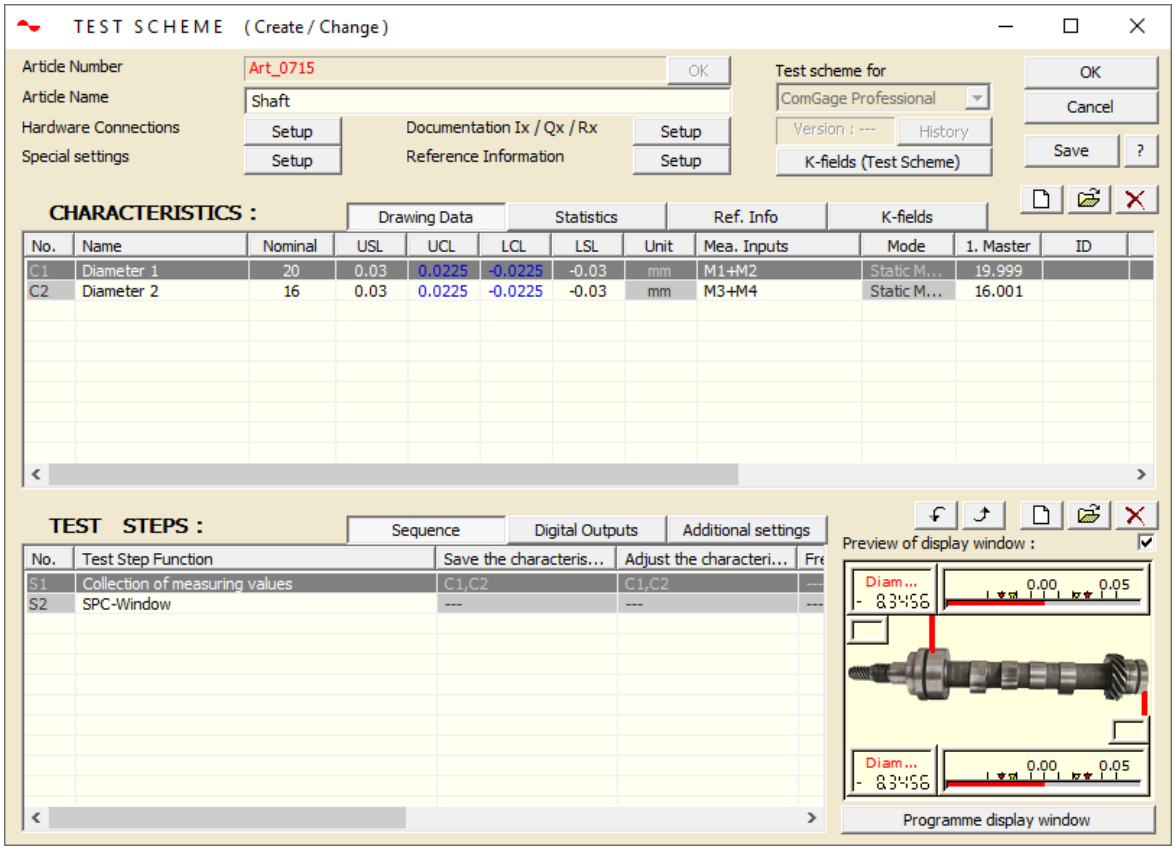
7.1 Programming the test scheme head

In the **File / Test Scheme / Create & Change** menu (Button : ) test schemes can be programmed :



At first you have to enter the *Article Number*. If you input an existing *Article Number* you can modify the particular test scheme, otherwise you create a new one.

A data path can be entered preceding the article number. This entered data path is relative to the data directory (see chapter 6.4) and already has to exist. ComGage does not create any new subdirectories.
*(Example : **Machine 1\Art-1234** ➔ The test scheme **Art-1234** is created in the subdirectory **Machine 1**)*



General information regarding this dialogue :

a) The white entries in the tables can be changed directly in the editing mode of the table.
To activate the editing mode, please select a row by clicking, then click the table cell you would like to edit. In the editing mode you can navigate in the table by using the keyboard keys ↑, ↓, <TAB> and <SHIFT>+<TAB>.

b) By clicking a field in the header of the table you can sort the rows by the entries in this column ascending or descending.

c) By right-clicking a white field in the able, its content can be copied, data from the Windows clipboard can be pasted and the content of the field can be assigned to all other fields in the same column of the table.

The following settings can be programmed in the test scheme :

1) **Article Name** (Name of the measured component, e.g. cylinder, bore, …)

2) **Hardware Connections** (For setting the hardware configuration of the test scheme, e.g. on modification of the hardware or for activating the simulation mode or the visualisation mode respectively.
➔ *See chapter 7.2*)

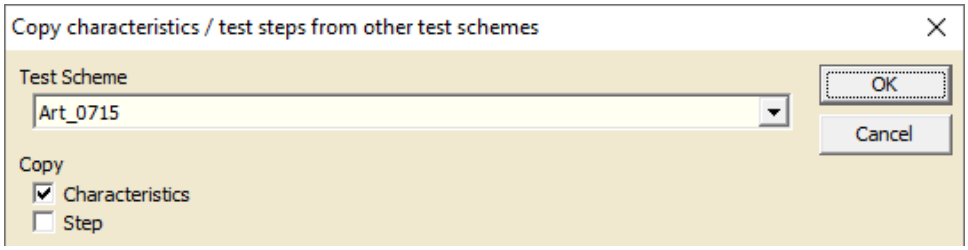
3) **Special settings** (Special settings for the test scheme, such as output of tolerances on the IBRit-rf1-LEDs, test of probe validity, ... ➔ *See chapter 7.3*)

4) **Documentation Ix / Qx / Rx** (Additional data for test scheme documentation, comprises function description of the digital inputs, digital outputs and registers. ➔ *See chapter 7.4*)

5) **Reference Information** (Additional data for test scheme documentation, e.g. manufacturer, supplier, customer, operator, batch, ... ➔ *See chapter 7.5*)

6) **Test scheme for** (Assignment of ComGage variant to the test scheme. Enables creating test schemes for all ComGage variants [Professional / Level 2 / Level 1] on a ComGage Professional system and must be selected on creation of the test scheme. A future modification of this setting to a higher programme variant is possible, in order to enable usage of existing test schemes from a lower programme variant after changing the programme variant in use, e.g. on upgrade from ComGage Level 1 to Level 2.)
7) **Version-Number / Version history** (Display of test scheme version-number as well as access to the version history on activated version management. ➔ *See chapter 7.13*)
8) **K-fields (Test Scheme)** (Only if the IBR_AQDEF module is activated → The content of the K-fields with editing level *Test scheme (common)* can be configured via this button. The K-field editor for this level is identical with the dialogue of the K-field editor on workplace level ➔ *see chapter 6.8.2*).
9) **Characteristics – Drawing data** (The drawing data of the characteristics consists of the characteristics basic data, such as e.g. name, nominal size and tolerances, master values, probe-mixing, … .
➔ *See chapter 7.6*)
10) **Characteristics – Statistics** (The statistical data consists of the optional settings for the statistical analysis of characteristics, such as sample size, plausibility limits, … . ➔ *See chapter 7.7*)
11) **Characteristics – Reference Information** (Data entered as characteristics – reference information can be e.g. the test equipment used. ➔ *See chapter 7.8*)
12) **Characteristics – K-fields** (Only if the IBR_AQDEF module is activated → The content of the K-fields with editing level *Test scheme (characteristic)* can be configured in the characteristics table (tab *K-fields*). The K-field configuration for test schemes is stored in the file **`<Article number>.tsDFD`** in the data directory for *Test schemes.*)
13) **Test Steps – Sequence** (Programming of the test sequence, e.g. : *In which test step of the test sequence is characteristic 2 saved? How is the saving of the characteristics called in the current test step?* … .
➔ *See chapter 7.9*)
14) **Test Steps – Digital Outputs** (Programming of the output values of the digital outputs in the particular test steps, for controlling external lamps, motors, for communicating with PLC, … . ➔ *See chapter 7.10*)
15) **Test Steps – Additional settings** (Programmable additional settings are for example : a sample plan or automatic recognition of plug gauges. ➔ *See chapter 7.11*)
16) **Test steps – Programme display window** (Design of the display windows for the particular test steps. ➔ *See chapter 7.12*)
17) **Save** (Allows to save the changes up to this moment in files with the name “*.ts1” … “*.ts5”.
Five backups are managed constantly. By renaming these to “*.tsf”, they can be changed to standard test scheme files.)

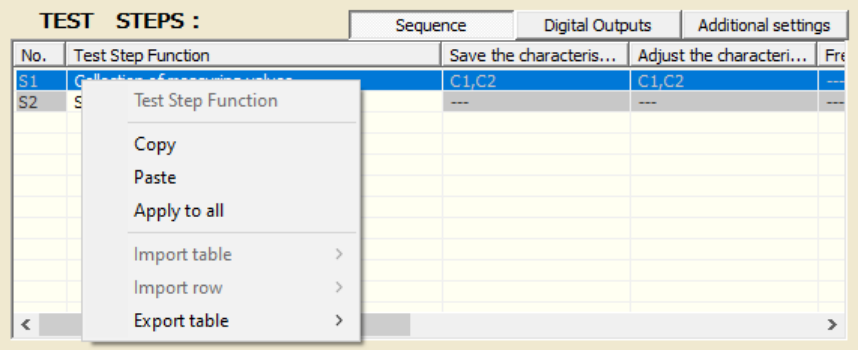
You can also import characteristics and / or test steps from other test schemes into your current test scheme. To do so, please press the key-combination **<Alt>+<I>** in the “Test Scheme (Create / Change)” window. Then the selection window shown below is displayed.



First of all you select out of the selective list at the top of the window the test scheme from which the characteristics and / or test steps come from, that are to be imported into your current test scheme. By the check-boxes you can then determine whether to import only characteristics, only test steps or characteristics and test steps from the selected test scheme. The imported contents are then added to the existing characteristics and test steps of the test scheme.

It is possible to export the content of the tables in programming dialogues (e.g. characteristics, test steps, …) to CSV files.

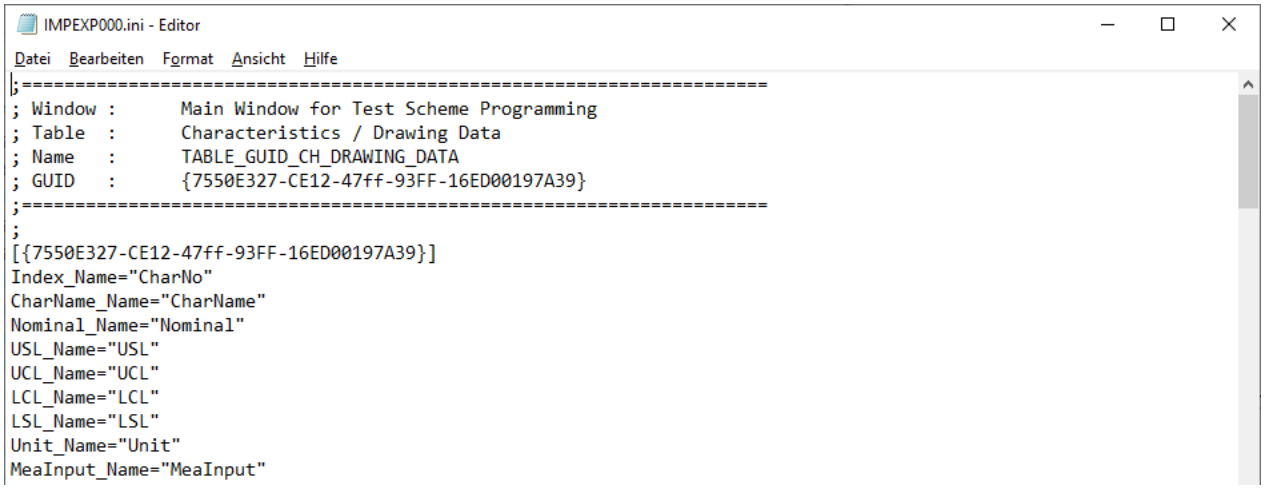
After right-clicking one of the changeable (not greyed out) fields, the following context menu appears :



The CSV export can be selected via “Export table”.

The menu items “Import table” and “Import row” are only available for the characteristics table.

The headlines of the columns in the CSV file can be changed in the file IMPEXP000.ini (in the ComGage installation directory) :

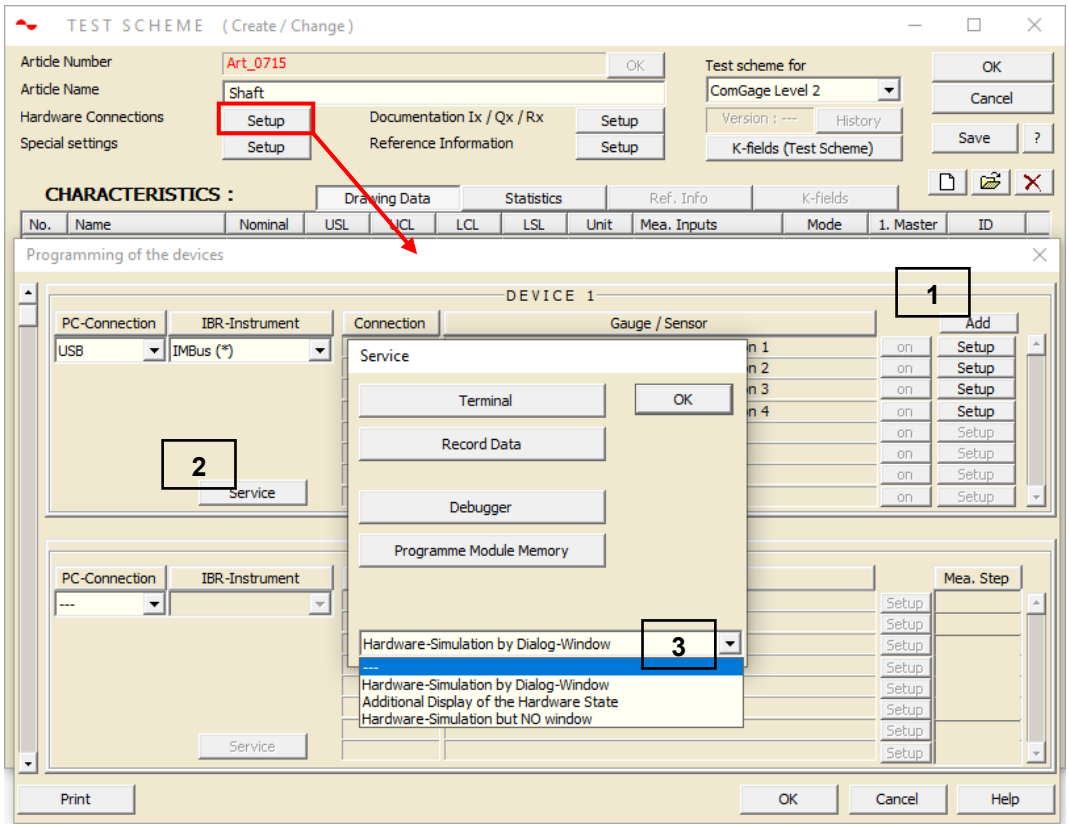


On the left you can always see the name of the column in ComGage. Next to it, in quotation marks (“”), stands the name of the column in the CSV file. By this, the imports and exports can be adjusted to the specifications of other software products. The import to ComGage only works, if the column name in the INI file matches the one in the CSV file.

During the import, the assignment of the rows to characteristics is done by the column “Index”. This column has to contain values from C1 to C128.
That means it is not necessary to list the characteristics in the CSV file in the correct order.
Example : If a row of the CSV file contains the value C1 in the column “Index”, it is imported as characteristic C1, even if it is row number 25 in the CSV file.

7.2 Programming the hardware settings

Programming of the hardware settings serves for setting the hardware configuration of the particular test scheme, e.g. on modification of the hardware, for programming of test schemes from other measuring systems on an Office-PC or for activating the simulation mode or the visualisation mode respectively. For this purpose you can click on the **Setup** - button of the option “Hardware Connections” for the particular test scheme (see illustration below). Thereupon the window for configuring the interface is displayed. (You can find a detailed description of this window in chapter 6.1.)



On selection of **IMBus** or **ISi-Bus** as **IBR-Instrument** you can call the functions specified in the following.

1. **Arrange hardware configuration without connecting hardware components to the PC**

   The window for selection of the hardware component is opened by clicking on the **Add** button (see illustration above). Select the desired module from the list and confirm with **OK**. Repeat the procedure until the desired configuration is completely arranged. On a false selection the complete list of so far selected components must be deleted by re-selecting **IMBus / ISi-Bus** as **IBR-Instrument**. The procedure for selection of the hardware components must then be started again once more.

2. **Calling the service window for activating the simulation mode or visualisation mode respectively**

   The service window containing additional selectable options is opened by clicking on the **Service** button (see illustration above).

3. Selection of the simulation mode or the visualisation mode respectively from the options list

Option “Hardware-Simulation by Dialog-Window” :
There must be no hardware connected in order to execute the test scheme / test order. The hardware is simulated and the information is input and output by means of the dialog window (illustration 1).

Option “Additional Display of the Hardware State” :
The hardware must be connected in order to execute the test scheme / test order. The hardware information is read-out and output in parallel by means of the hardware status window (illustration 2).

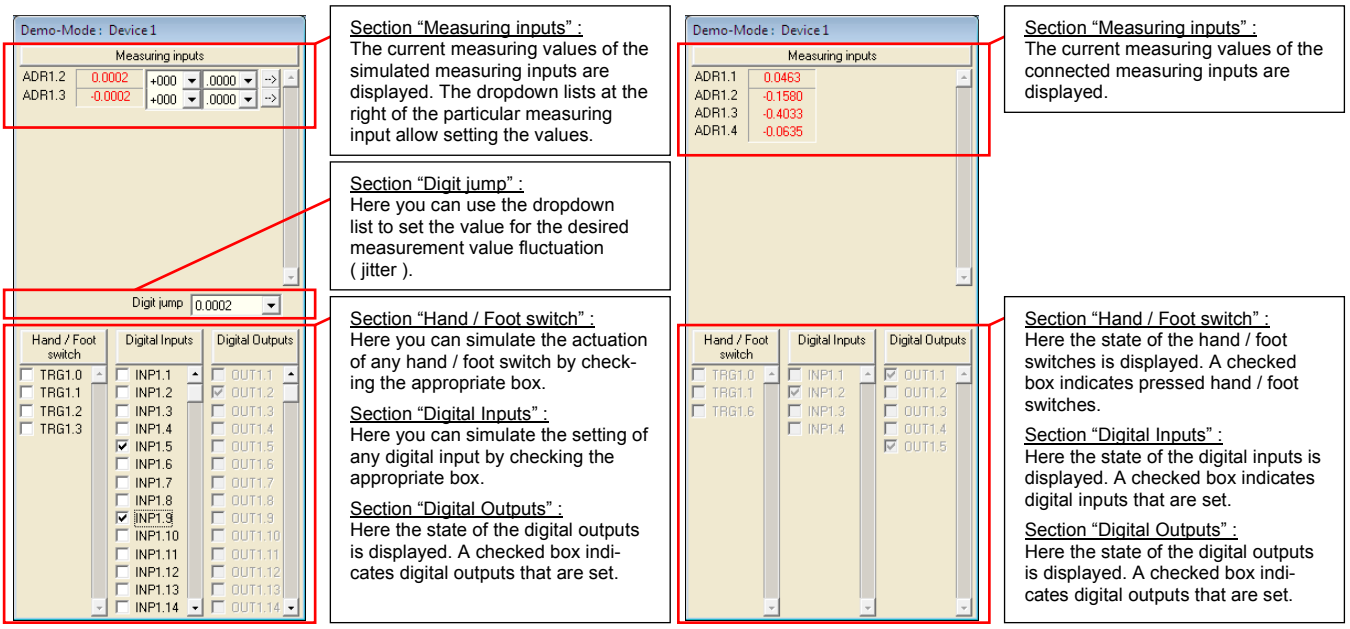
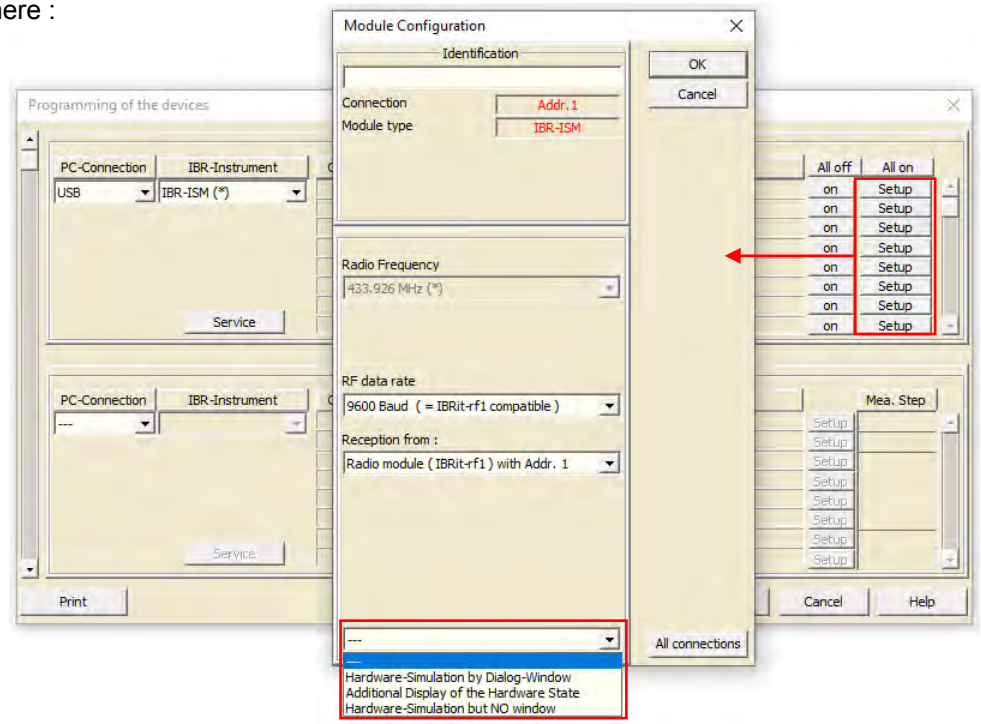


Illustration 1 : Dialog window

Illustration 2 : Hardware status window

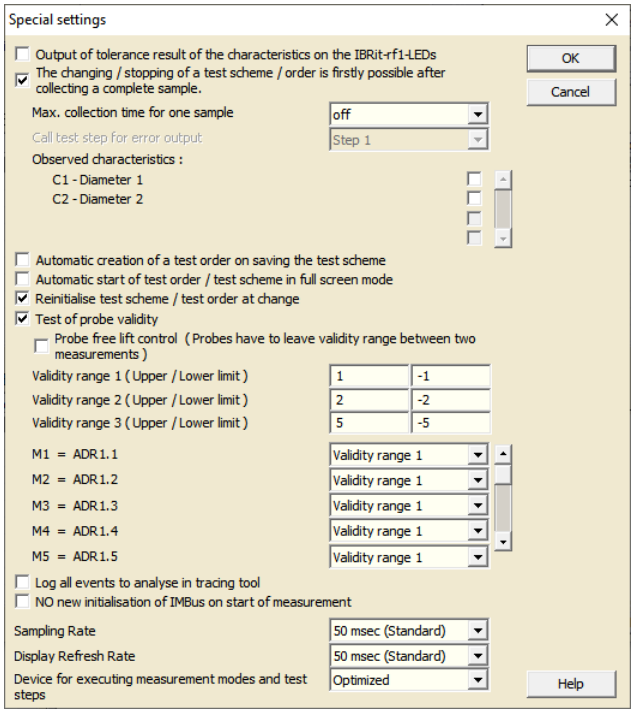
Option “Hardware-Simulation but NO Dialog-Window” :
No hardware has to be connected in order to execute the test scheme / test order. The hardware is simulated in the background. There is no dialogue window to control the simulation.

If **IBRit-rf1** or **IBR-ISM** are selected as **IBR-Instrument**, the hardware simulation can be activated as shown here :



7.3 Programming the special settings

Programming of the special settings serves to determine general settings for the test scheme.
For this purpose you can click on the **Setup** button of the option “Special settings” for the particular test scheme. Thereupon the window shown below is displayed, allowing to change the following settings :



Output of tolerance result of the characteristics on the IBRit-rf1-LEDs

With this option activated, the tolerance status of the currently measured characteristic is output on the LEDs of the IBRit-rf1 radio module on transmission and simultaneous saving of the measurement values by a IBRit-rf1 radio module (red = not okay / yellow = corrective action / green = okay).
(This function is not available when using IMB-rf1 / IMB-ism / ISM-usb receiver units.)

The changing / stopping of a test scheme / order is firstly possible after collecting a complete sample

With this option activated, changing / stopping of a test scheme / order is prevented, as long as there is an incomplete sample collection. In the submenu you can define a maximum collection time for one sample (in minutes) as well as the test step to be called for error output in case the defined collection time has been exceeded (on doing so, ComGage automatically deletes the measurement values of the incomplete sample). Additionally you can define which characteristics are to be observed by the sample supervision. The open sample quantity is stored in register R992 on activating the sample supervision. Register R992 is updated on every saving or deleting of a measurement value for the characteristics.

Automatic creation of a test order on saving the test scheme

With this option activated, a test order is automatically created when the test scheme is saved. The order number then corresponds to the article number of the test scheme.

Automatic start of test order / test scheme in full screen mode

With this option activated, the test order / test scheme is automatically executed in full screen mode on start of measuring mode.

Reinitialise test scheme / test order at change

When changing between test schemes / test orders, ComGage remembers the current test step, addresses for test step functions like “repeat current test step”, the part counter, the sample plan (Test Steps Advanced Settings) and the contents of Register 900..1000. Enabling this option will reset this information for the current test scheme / test order.

Test of probe validity

With this option activated, ComGage checks, on every call of the function “Save measured values” or “Adjustment / Calibration”, if the raw-values of the measurement inputs needed for the selected characteristics are within the assigned validity range. In the submenu you can define up to three validity ranges (values in unit of the measuring input, e.g. mm on IMB-im modules and Volt on IMB-ai modules). Additionally you can assign a validity range to every particular measurement input. If, on calling the function “Save measured values” or “Adjustment / Calibration” for the selected characteristics, a measurement input is outside the assigned validity range, then the measurement values are not saved or rather the characteristics are not calibrated. In addition an error message is output plus the register R995 is set to “1”, as soon as the error message has been acknowledged or rather its output duration time has expired. The register value of R995 is held until the following call of the function “Save measured values” or “Adjustment / Calibration”. The duration of the message output on error state can be determined by the ComGage workplace settings (see also chapter 6.11).

Probe free lift control

With this option activated, ComGage checks, on every call of the function “Save measured values” or “Adjustment / Calibration”, if the raw-values of the measurement inputs needed for the selected characteristics have left the assigned validity range since the last call of the function “Save measured values” or “Adjustment / Calibration”. If that was not the case for at least one of the selected characteristics on calling the function “Save measured values” or “Adjustment / Calibration”, then the measurement values are not saved or rather the characteristics are not calibrated. In addition an error message is output plus the register R996 is set to “1”, as soon as the error message has been acknowledged or rather its output duration time has expired. The register value of R996 is held until the following call of the function “Save measured values” or “Adjustment / Calibration”. The duration of the message output on error state can be determined by the ComGage workplace settings (see also chapter 6.11).

Log all events to analyse in tracing tool

With this option activated, the tracing tool for logging all events is automatically started on start of the test scheme / test order (see also chapter 15.2).

No new initialisation of IMBus on start of measurement

With this option activated, the re-initialisation of the IMBus is not performed on start of the test scheme or test order. A reset of the counters inside the IMB-dm and IMB-tc modules is thus prevented on switch over of test schemes or test orders.

Sampling rate

Adjustment of measurement speed. This parameter must be changed only in case of special applications. (Example : The connected gauge allows data request only every 300 msec.)
The “Maximum” setting allows the fastest possible measuring data collection under retention of parity based data security. The measuring data collection speed is thereby defined by the PC interface used and the connected measuring modules. The “Optimized for IMBus” setting achieves a further increase in speed of measuring data collection with IMBus modules by abandonment of parity based data security.

Display refresh rate

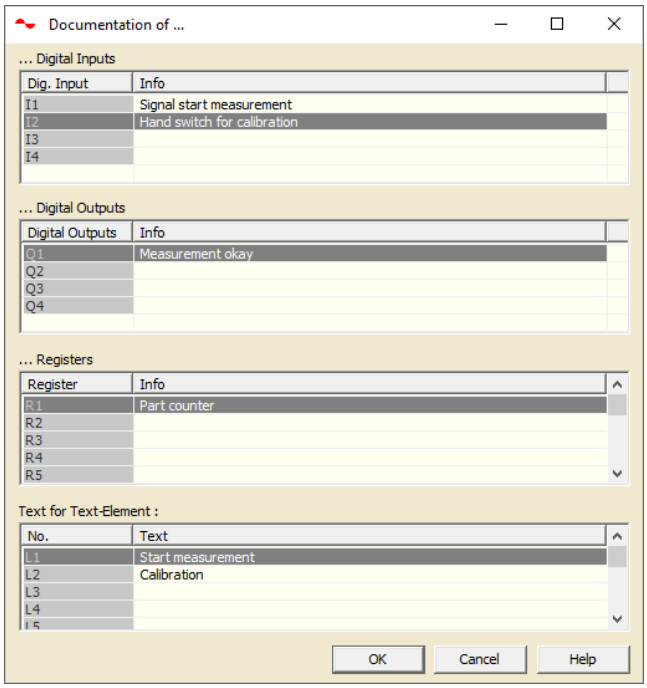
Adjustment of the display refresh rate. This parameter must be changed only in case of slow processors (e.g. Pentium 1000 or less), in order to keep the measurement rate as high as possible.

Device for executing measurement modes and test steps

Please always use the setting “Optimized” unless you are instructed otherwise by the IBR support personnel.

7.4 Input of additional test scheme information

The input of additional test scheme information serves to provide function descriptions of the digital inputs, digital outputs and registers which are being used in the test scheme.
For this purpose you can click on the **Setup** - button of the option “Documentation Ix / Qx / Rx” in the programming window of the particular test scheme. Thereupon the window shown below is displayed.



ComGage automatically adds the available digital inputs / digital outputs to the particular lists for documentation. Also, the 2000 available registers are automatically added to the list for register documentation.

Now you can enter a descriptive “Info”-text for the marked list entries of the 3 documentation categories, by first selecting an entry from the list and then clicking the input field. The input field is then opened for editing. In the editing mode you can navigate in the table by using the keyboard keys ↑, ↓.
Every entry can have a length of 260 characters.

Additionally, there is the table *Text for Text-Element*. Here you can enter text blocks that can for example be used in text elements via place holders (see chapter 7.12).
Note : The entered texts can contain placeholders themselves (for example $Cv2).

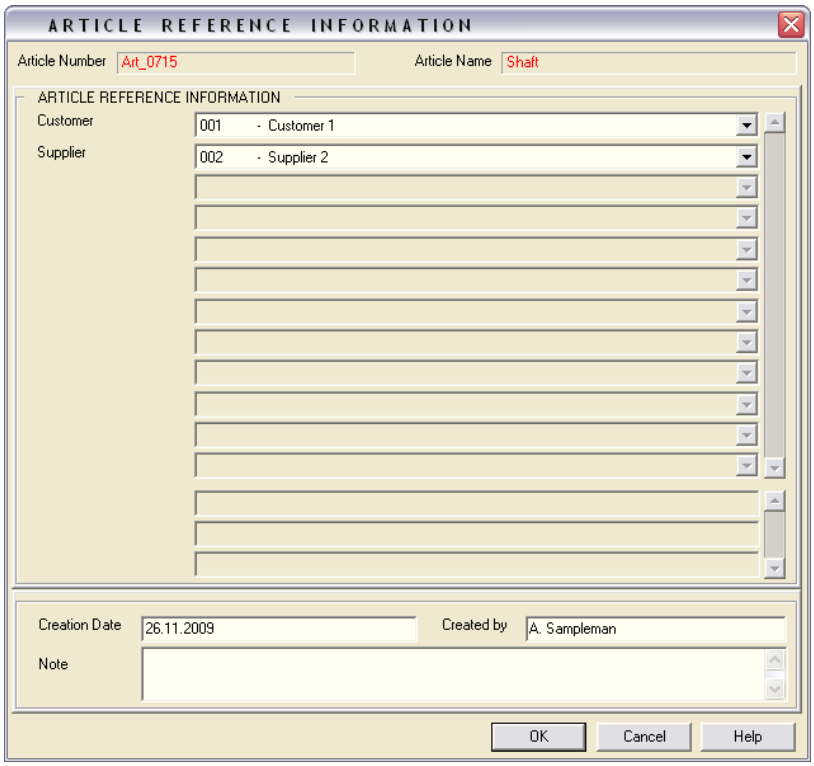
All modifications made are stored on exiting the entry window for additional test scheme information by clicking the **OK** button.
All modifications made are discarded on exiting the entry window for additional test scheme information by clicking the **Cancel** button.

The additional test scheme information entered here is stored in the file <*Test scheme name*>*.tsc*. This file is located in the data directory, which was selected as „Directory for Test Schemes“ in the ComGage menu “Options / Data Directories”. Furthermore, the additional test scheme information entered here is also output into the Word file on conversion of the test scheme (see also chapter 10.1).

The text blocks are stored in the file <*Test scheme name*>*.tsc*, too. This creates the possibility to store this file several times in different languages and, by exchanging the *.tsc file, to change the language of all texts used in the test scheme.

7.5 Programming the article reference information

Programming of the article reference information allows entry of those reference information data sets, which are activated in the ComGage menu “Options / Reference Information” and set to the options “on creation of test scheme” and “for whole part” (see also chapter 6.6).
For entry of the reference information data sets you can click on the **Setup** button of the option “Reference Information” of the particular test scheme. Thereupon the window shown below is displayed.



The entry options available here are shown in the following.

Article Reference Information :
In this window a data set must be selected or input for all reference information activated for the test scheme. The programming and activating of the reference information for the test scheme is described in chapter 6.6.

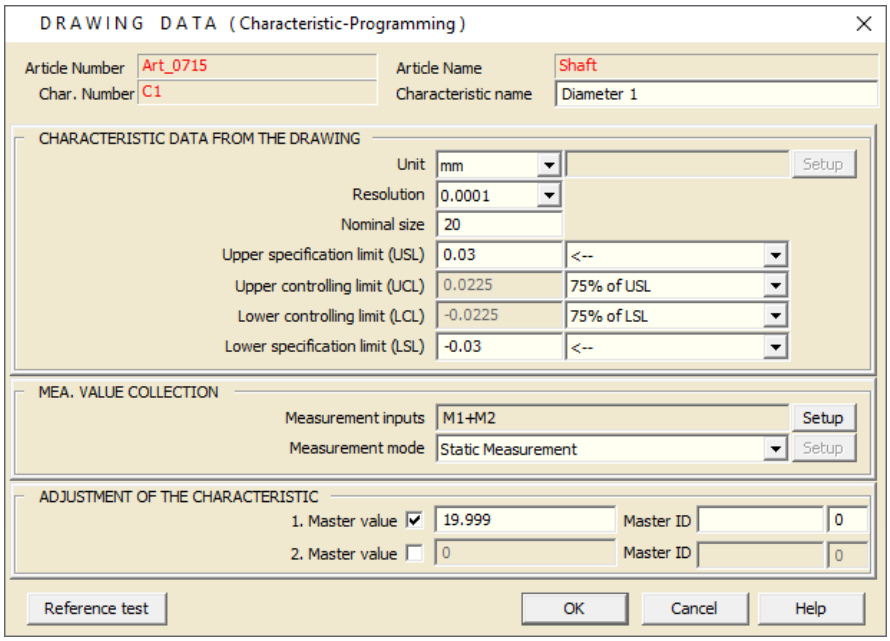
Creation date :
Creation date of the test scheme.

Created by :
Name of the operator, who has created the test scheme.

Note :
Free editable field for documentation (e.g. entry of test scheme history).

7.6 Programming the characteristics (drawing data)

For programming the drawing data of a characteristic the following window is opened :



1.) **Characteristic name :**
Name of the characteristic (e.g. diameter, length, …)

2.) **Unit :**
Selection of the Unit.
In the list you find the standard units.
Special units (**Setup →**) can be defined by clicking the **Setup** - Button. For a “special” unit you can define a *conversion offset* and a *conversion factor* (e.g. for converting °F to °C the factor is 5/9 and the offset is –160/9).

3.) **Resolution :**
Sets the resolution of the characteristic which is used as default for every new display element (can be changed to a user defined resolution inside each display element).

4.) **Nominal size** (of the characteristic)

5.) **Tolerances** (of the characteristic / are input relatively to the nominal size)

6.) **Measurement inputs :**
Connection of measurement inputs (probe mixing) for gauge definition → see page 49

7.) **Measurement mode :**
Measurement mode for calculating the measurement result (e.g. static, dynamic) → see page 51

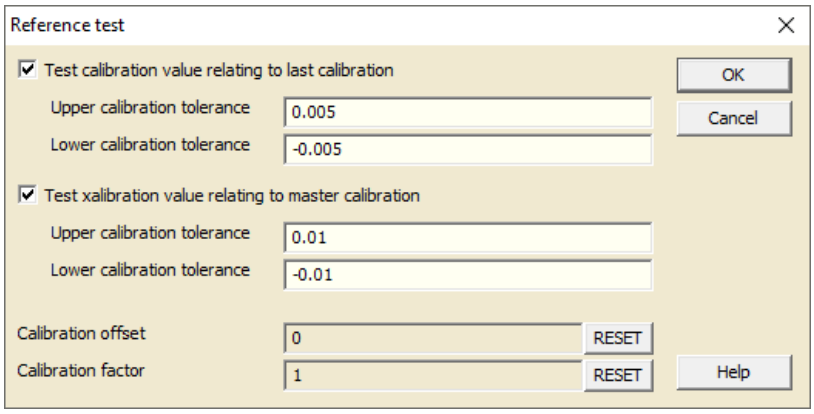
8.) **Master values :**

Input of the master values for this characteristic.
The input of *the 1.* master value is necessary to perform a *zero adjustment*, for performing a *gauge calibration* (e.g. air gauging) the input of *two* master values is necessary.
Next to the fields for the master values, you can additionally enter a Master ID and a measuring position (for more information see chapter 6.7, Master Management).

Note :
When using two masters it is necessary to make sure that the difference between both master values is minimum > 0.00001. The required minimum value difference was > 0.0003 for older ComGage versions.

9.) **Reference test :**

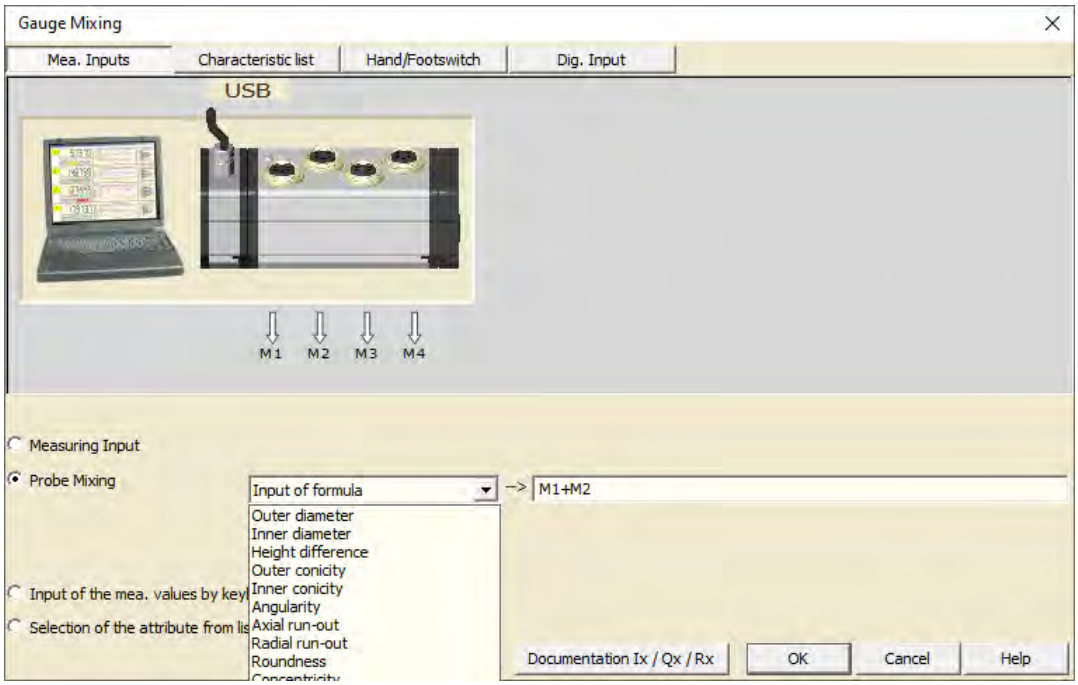
Allows activating calibration tolerances, optionally relating to the last calibration or the master calibration. Both options can be simultaneously activated. An upper and lower tolerance value is defined, using the unit of the characteristic. If the function “Adjustment / Calibration” is executed during the test sequence, then the tolerances defined here are used for calibration control (reference test). If the defined tolerance values are exceeded, then an error message is displayed and the register R990 is set (R990=1).
The duration of the error message output can be defined in the ComGage menu “Options / Workplace Settings” *(see chapter 6.11)*. Hence, this function is used to supervise the fixture (typical defects : probe tip got loose / masterpiece dirty / probe defective / …).



The calibration values, which were assigned to the characteristic by calibration, can be reset by clicking on the 2 **Reset** - buttons. By doing so the standard values „Offset = 0“ and „Factor = 1“ are loaded into the characteristic.

Notice :
The function “Master-Calibration” must be integrated in the ComGage test scheme for those characteristics for which the reference test is activated. The master-calibration is then to be executed prior to the very first regular calibration.

Measurement inputs (→ Setup)



In the gauge mixing window the following options are available for the calculation of the measuring value of a characteristic :

a) Selection of a single measurement input whose measurement values are adopted as measurement values of the characteristic
b) Selection of a probe mixing, e.g. measurement of outer diameter by the two measurement inputs M1 and M2 or input of a formula for any combination of measurement inputs, characteristics values, … .
c) Input of a measurement value by keyboard
d) Selection of an attribute from a list (e.g. red, green, blue) including the assignment of a numeric value as characteristic value (1. entry = 0 / 2. entry = 1 etc.). Hence, the tolerance limits can be set and used for tolerance evaluation also in this mode.

It is possible to switch the displayed graphics to selectively display the available measurement inputs, the list of characteristics, the available foot / hand switches or the available digital inputs (see the tabs at the upper edge of the window).

Formula :

In a formula for probe mixing the measurement inputs, results of other characteristics, footswitch inputs, digital inputs, register values, other numeric values and the time values can be combined in any way.

In the formulas the following *inputs* can be used :

Address	Input
Mx	Measuring input x
Cx	Current measuring value of characteristic x
Cx_File	Last measuring value from file of characteristic x
Cx_USL	If measuring value of characteristic x is > USL, then Cx_USL = 1
Cx_UCL	If measuring value of characteristic x is > UCL and < USL, then Cx_UCL = 1
Cx_ok	If measuring value of characteristic x is inside the controlling limits, then Cx_ok = 1
Cx_LCL	If measuring value of characteristic x is > LSL and < LCL, then Cx_LCL = 1
Cx_LSL	If measuring value of characteristic x is < LSL, then Cx_LSL = 1
Cx_NOM_Val	Nominal value of characteristic x, as programmed in the drawing data
Cx_USL_Val	Upper specification limit of characteristic x, as programmed in the drawing data
Cx_UCL_Val	Upper controlling limit of characteristic x, as programmed in the drawing data
Cx_LCL_Val	Lower controlling limit of characteristic x, as programmed in the drawing data
Cx_LSL_Val	Lower specification limit of characteristic x, as programmed in the drawing data

Address	Input
Cx_MA1_Val	1. Master value of characteristic x, as programmed in the drawing data
Cx_MA2_Val	2. Master value of characteristic x, as programmed in the drawing data
Ix	Digital input x (State „set“ = 1 / State „not set“ = 0)
Tx	Hand / Foot switch x (State „pressed“ = 1 / State „not pressed“ = 0)
Rx	Register x The following registers **cannot** be used in characteristic formulas : R256 / R512 / R768 / R1024 / R1280 / R1536 / R1792
Fx	Function key F1... F12

In the formulas the following *operators* can be used :

Operator	Function	Example
+	Addition of inputs, characteristics and numbers	M1+M10-34
-	Subtraction of inputs, characteristics and numbers	M1-M2+1.1e-4
*	Multiplication of inputs, characteristics and numbers	M3*0.5+M2*M1
/	Division of inputs, characteristics and numbers	M2/3
^	‘x power by y’ (e.g. 2^3 = 2*2*2 = 8)	M2^(1/2) = Square root of M2
%	Modulo-operator = carryover of a division (e.g. 5%3 = 2)	M2%2
ABS()	Absolute value	ABS(M1)
SIGN()	Delivers the sign of the parameter	SIGN(-5.23)=-1
ROUND()	Rounds to the next integer	ROUND(5.43)=5 / ROUND(5.53)=6
INT()	Rounds down to the next integer	INT(5.43)=5 / INT(5.53)=5
CEIL()	Rounds up to the next integer	CEIL(5.43)=6 / CEIL(5.53)=6
SIN()	Sine (unit : degree)	SIN(M2)
COS()	Cosine (unit : degree)	COS(M2)
TAN()	Tangent (unit : degree)	TAN(M2*3+M1)
ASIN()	Arc – Sine (unit : degree)	ASIN(M2/50.4)
ACOS()	Arc – Cosine (unit : degree)	ACOS(M2/50.4)
ATAN()	Arc – Tangent (unit : degree)	ATAN(M2/50.4)
PI	Pi (= 3.141592654)	SIN(M2*180/PI)
EXP()	Exponential function (2.7182818 ^{x})	EXP(M1)
LOG()	Natural logarithm	LOG(M1)
TIME(0)	Returns the number of milliseconds since midnight	TIME(0)
MONTH	Current month (1=January, 2=February, ...)	MONTH
DAY	Current day of month (1 ... 31)	DAY
DAYOFWEEK	Current day of week (0=Sunday, 1=Monday, ..., 6=Saturday)	DAYOFWEEK
HOUR	Current time : Hour (0 ... 23)	HOUR
MINUTE	Current time : Minute (0 ... 59)	MINUTE
SECOND	Current time : Second (0 ... 59)	SECOND
Min(;;;) Min()	Min-value of all elements in the list Min-value of all saved measuring values of the characteristic	Min(M1;M2;C3;M4+C5) Min(C3)
Max(;;;) or Max()	Max-value (see Min-function)	Max(M1;M2;C3;M4+C5) or Max(C3)
Avr(;;;) or Avr()	Average (see Min-function)	Avr(M1;M2;C3;M4+C5) or Avr(C3)
Tir(;;;) or Tir()	Max-value minus Min-value (see Min-function)	Tir(M1;M2;C3;M4+C5) or Tir(C3)
SD(;;;) or SD()	Standard deviation (see Min-function)	SD(M1;M2;C3;M4+C5) or SD(C3)

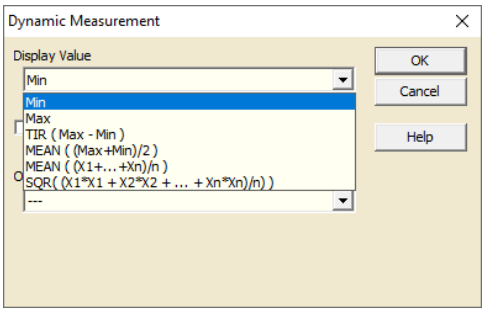
Measurement mode

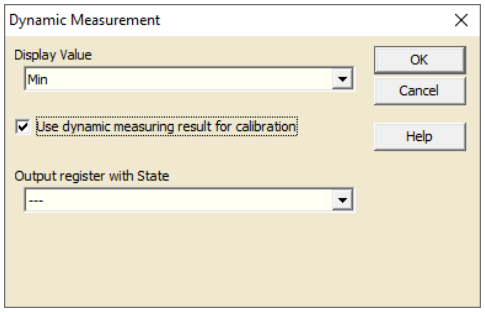
a) Static measurement

The component is measured statically, it is for example lying in a fixture during measurement. ComGage continuously measures and calculates the result of the characteristic. The display continuously outputs the current measurement value.

b) Dynamic measurement (→ Setup)

The component is moved (e.g. rotated) during measurement. During this movement of the component, the Minimum, Maximum, TIR and Mean values are searched.





Min	→	Determination of the smallest measurement value
Max	→	Determination of the biggest measurement value
TIR	→	Determination of the TIR Value (Max-Min)
MEAN ((Max+Min)/2)	→	Determination of the area Mean value ((Max+Min)/2)
MEAN ((X1+...+Xn)/n)	→	Determination of the arithmetic Mean value
SQR((X1*X1 + X2*X2 + … + Xn*Xn) / n))	→	Determination of the square root of the average of the squared measurement values

Use dynamic measuring result for calibration

In this mode adjustment / calibration is performed using the result of the last dynamic measurement. In order to do so, you must programme a corresponding test step in your test sequence performing a dynamic measurement followed by calling the function “Adjustment / Calibration”.

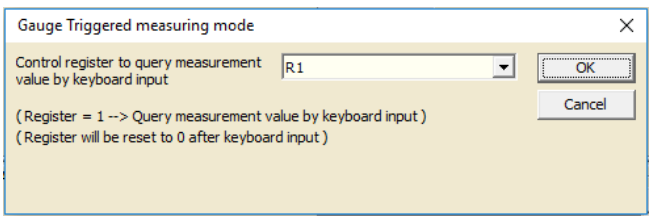
Output register with State

The current state of the dynamic measurement is continually written into the selected register (dyn. measurement inactive = 0 / dyn. measurement active = 1).

c) Gauge Triggered (→ Setup)

Only those measurement values are shown, which are transmitted by data key on the gauge. This mode is especially for hand gauges on which the measuring values are sent by the data key of the gauge or for e.g. balances which automatically send their measuring value at the end of measurement.

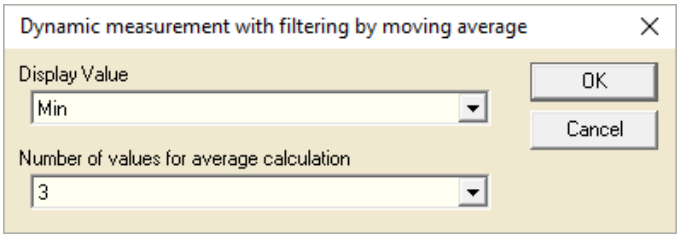
By clicking the “Setup” button you can activate a control register for querying the measurement value by keyboard input.



If the register value equals 1, measurement value collection takes place by keyboard input instead of the common gauge triggered collection.

d) Dyn. measurement with filtering by moving average

The component is measured statically or dynamically. The current measuring value is always calculated as the average of the last received values from the assigned measuring input. The dynamic measurement uses this average to search for Max, Min, … .
The number of values that are used to calculate the average can be freely selected from 1 till 200 :



As *Display Value* can be selected :

Min	→	Determination of the smallest measurement value
Max	→	Determination of the biggest measurement value
TIR	→	Determination of the TIR Value (Max-Min)
MEAN ((Max+Min)/2)	→	Determination of the area Mean value ((Max+Min)/2)
MEAN ((X1+...+Xn)/n)	→	Determination of the arithmetic Mean value
Static	→	Static measurement with filtering by moving average

e) Additional measurement modes

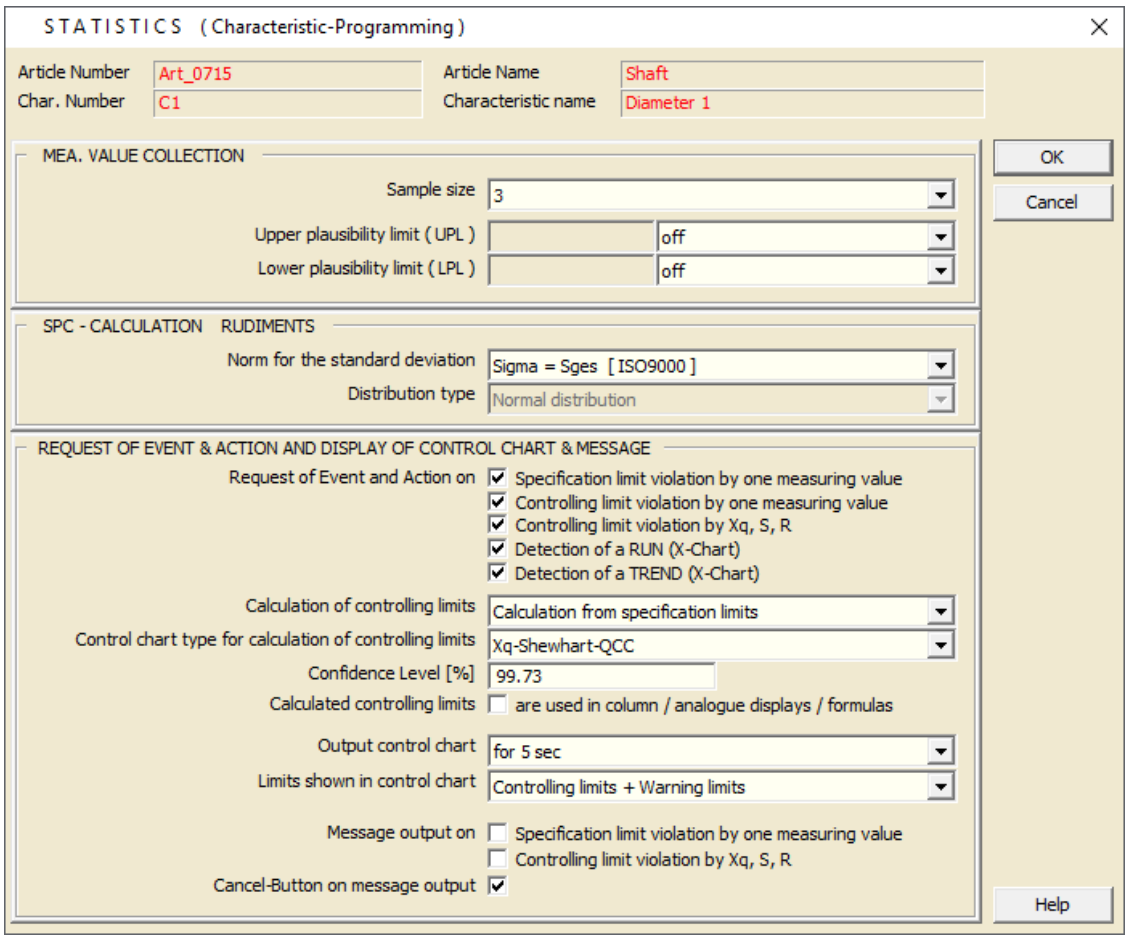
Notes : All following measurement modes are deactivated by default and have to be activated in the menu Options → Workplace settings (see chapter 6.11) to be available in the drawing data of the characteristics.
All available measurement modes are listed in Appendix B, including the information if additional licenses are required and if the measurement modes are available for Windows CE.

Name	Description
Dynamic measurement with groove removal (Type I)	With this measurement mode, a dynamic measurement can be performed. For computing the measurement result, the measurement values e.g. inside a groove, on a cog, … are not used. The detection is done by a programmable measurement value difference (hysteresis). It is possible to remove several grooves, cogs, … . *Note :* *A documentation file to this measurement mode (wgl006.dll) is located in the ComGage installation folder. The differences to the wgl022 are described in this document, too.*
Shaft and gearwheel Measurement	This measurement mode allows the calculation of various parameters of a shaft or a gearwheel (e.g. roundness). During a dynamic measurement, the measuring values of a probe are saved in relation to the values of a rotary pulse encoder. With the help of the measuring value tables, the centre offset of the shaft is compensated. Afterwards, the various parameters are calculated from the corrected measuring values. Additionally, errors of the measuring fixture can be compensated. *Note :* *A documentation file to this measurement mode (wgl007.dll) is located in the ComGage installation folder.*
Measurement of radial runout to cylinder axis	This measurement mode allows the measurement of a radial runout in relation to a calculated cylinder axis. The measuring values are compensated in relation to the cylinder axis and the radial runout is determined from these compensated measuring values. *Note :* *A documentation file to this measurement mode (wgl008.dll) is located in the ComGage installation folder.*

Name	Description
Diameter centre position calculation with 3 probes	Several parameters (X- / Y-coordinate, diameter, radius , …) of a circle can be determined from one or more combinations of 3 probes. *Note :* *A documentation file to this measurement mode (wgl009.dll) is located in the ComGage installation folder.*
Dynamic measurement with correction by best-fit line	This measurement mode allows a straightness measurement during which a probe is moved over the test piece. ComGage uses all measuring values to calculate a best-fit line. The difference to the best-fit line is determined for each measuring value. Min / Max / Max-Min / (Max+Min)/2 of these differences is output as measuring result. *Note :* *A documentation file to this measurement mode (wgl014.dll) is located in the ComGage installation folder.*
Measuring Value Reception over RS232	This measurement mode can be used to receive measuring values from a gauge that is connected to a COM port. It also allows the use of gauges which output their measuring values via a virtual COM port. *Note :* *A documentation file to this measurement mode (wgl015.dll) is located in the ComGage installation folder.*
Grading mode	The measuring values of a characteristic can be classified in up to 28 grades (the grades can have different ranges). The measuring value range of the grades can be edited in a running test scheme / test order. *Note :* *A documentation file to this measurement mode (wgl016.dll) is located in the ComGage installation folder.*
CSV/TXT-File Import	The ComGage measuring mode “CSV/TXT-File Import” allows to import measuring values from a CSV or TXT file. *Note :* *A documentation file to this measurement mode (wgl018.dll) is located in the ComGage installation folder.*
Flatness Measurement	Min, Max and flatness of a plane can be calculated with the help of a best-fit plane. Several options are provided to collect the measuring values at the different points of the plane. *Note :* *A documentation file to this measurement mode (wgl020.dll) is located in the ComGage installation folder.*
Dynamic measurement with groove removal (Type II)	With this measurement mode, a dynamic measurement can be performed. For computing the measurement result, the measurement values e.g. inside a groove, on a cog, … are not used. The detection is done by a programmable measurement value difference (hysteresis). It is possible to remove several grooves, cogs, … . *Note :* *A documentation file to this measurement mode (wgl022.dll) is located in the ComGage installation folder. The differences to the wgl006 are described in this document, too.*
Measurement of axial runout to cylinder axis	This measurement mode allows the measurement of an axial runout in relation to a calculated cylinder axis. The measuring values are compensated in relation to the cylinder axis and the axial runout is determined from these compensated measuring values. *Note :* *A documentation file to this measurement mode (wgl025.dll) is located in the ComGage installation folder.*
Static measurement with value correction by table	This measurement mode allows the correction (= linearisation) of the received measuring values during a static measurement. Up to 19 reference points with their related correction values can be entered. Between two of those reference points, the correction value is calculated by linear interpolation. *Note :* *A documentation file to this measurement mode (wgl027.dll) is located in the ComGage installation folder.*

Name	Description
Connection of Mahr / Sylvac wireless gauges	Measuring values can be received from Mahr / Sylvac wireless gauges via a virtual COM port. *Note :* *A documentation file to this measurement mode (wgl028.dll) is located in the ComGage installation folder.*
Receive measuring value over COM/TCP port	This measurement mode allows to receive measuring values from measuring instruments which are connected via a COM port or a TCP/IP connection. A compatible driver for the measuring instrument has to be available in the IBR driver database. This measurement mode also allows the use of measuring instruments which output their measuring values via a virtual COM port. *Note :* *A documentation file to this measurement mode (wgl029.dll) is located in the ComGage installation folder.* ***→ See test step function SFct071 for sending commands.***
Special calculations with best-fit line	This measurement allows to determine the angle of a best-fit line for up to 15 probes, as well as the distance of the specific measuring points to this calculated best-fit line. *Note :* *A documentation file to this measurement mode (wgl031.dll) is located in the ComGage installation folder.*

7.7 Programming the characteristics (statistics)



1.) **Sample size** (for measurement of the characteristic)

Note : *In case of 100% control it is not possible to display a control chart and Cp / Cpk. Select the lowermost list entry "I/MR-QCC" for using the I/MR control chart.*

2.) **Plausibility limits :**

If a measuring value is outside the plausibility limits on data saving, then the operator is asked, whether the measuring value should be saved or rejected. If the measuring value is rejected, then the measurement can be repeated instantly.

3.) **Norm for the standard deviation :**

Selection of the norm for calculation of the standard deviation (ISO9000 / QS9000); see appendix B.

4.) **Distribution type :**

Not available at this time. All statistical analysis is performed based on the normal distribution.

5.) **Request of event and action :**

You can choose under which conditions the event and the action are to be requested.

Terms and definitions used here :

Detection of a RUN on X-Chart = 7 entries in series on one side of the centre line,
Detection of a TREND on X-Chart = 7 entries in series, all increasing or decreasing.

6.) **Calculation of controlling limits :**

Off (inserted controlling limits are used)

The controlling limits defined in the characteristics “drawing data” are used.

Calculation from specification limits

The controlling limits are calculated from the tolerance limits, based on the Cp-formula and the control chart formulas.

Calculation by the first 125 collected samples

The controlling limits are calculated from the first 125 collected samples, based on the control chart formulas. Afterwards they are fixed.

Continuous calculation by all samples

The controlling limits are calculated from all collected samples every time a new sample is collected. Calculation is based on the control chart formulas.

7.) **Control chart type for calculation of controlling limits :**

Selection of the control chart type to be used (Xq = average chart, Xm = median chart, X = raw value chart, S = standard deviation and R = range), as well as calculation method for controlling limits (Shewhart or Acceptance).

8.) **Confidence level :**

Setting for calculation of controlling limits.

9.) **Calculated controlling limits are used in column / analogue displays / formulas :**

With this option deactivated, the controlling limits entered in the **drawing data** are used for tolerance interpretation by the column / analogue displays and formulas.

With this option activated, the calculated controlling limits are used for tolerance interpretation by the column / analogue displays and formulas.

This option can only be activated if : - Sample size ≥ 2
- 5.) or 10.) are activated

10.) **Output control chart :**

Activates fade in of the control chart for the span of time selected, whenever a complete sample has been collected.

11.) **Limits shown in control chart :**

Selection of the following settings can be made for the control chart that is faded in : “Controlling limits + Warning limits” or “Specification limits + Controlling limits”.

12.) **Message output :**

You can select when a warning message is to be output.

13.) **Cancel-Button on message output :**

The cancel - button can be enabled / disabled. If it is enabled, then the measurement values are not saved in case the cancel - button is clicked. The operator can repeat the measurement. (cf. plausibility limits)

7.8 Programming the characteristics (reference information)

Characteristic Reference Information :

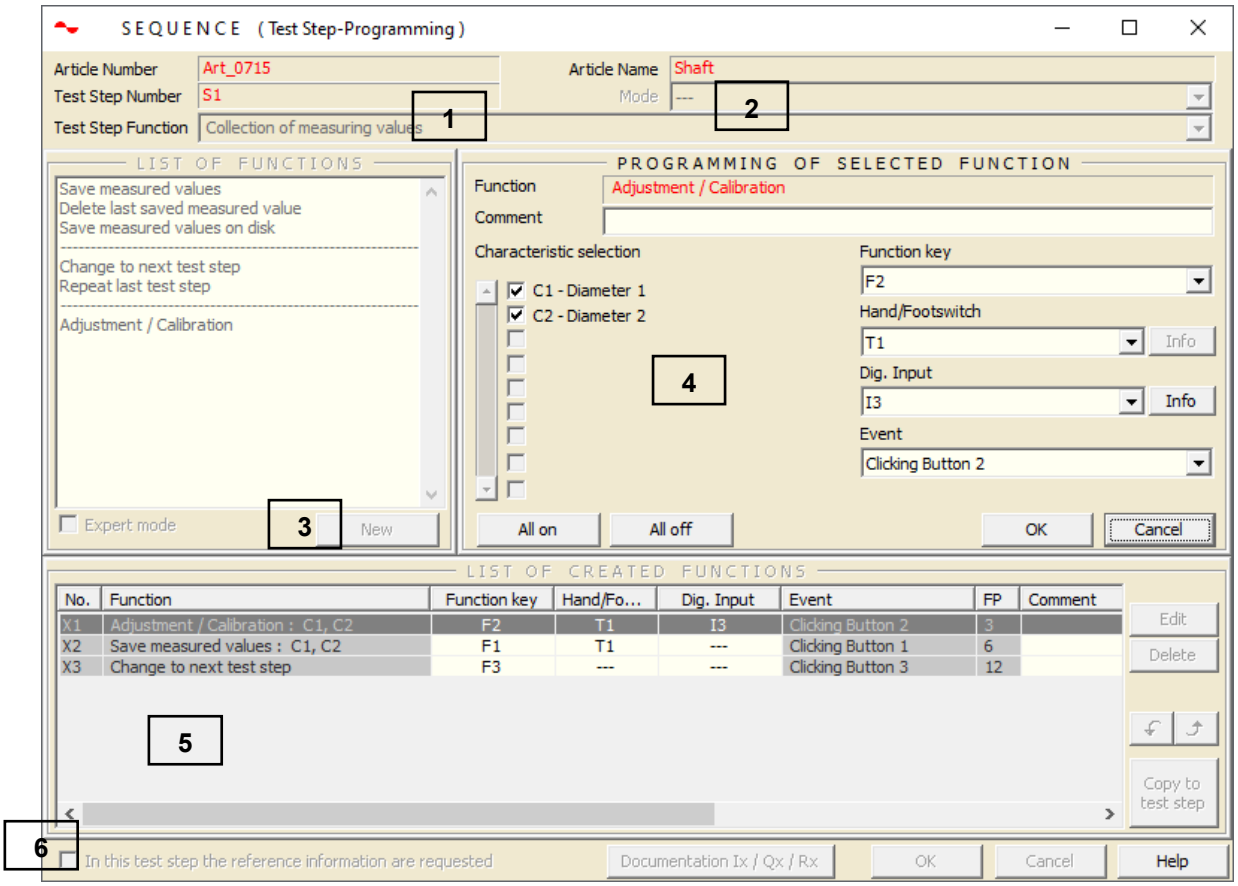
In this window a data set must be selected or input for all reference information activated for the characteristic. The programming and activating of the reference information for the characteristics is described in chapter 6.6.

Note :

Free editable field for documentation.

7.9 Programming the test steps (sequence control)

In this window the foot switches, function keys, digital inputs and events are assigned to the particular functions (save measured values, delete measured values, adjustment / calibration, ...) that are to be executed by them.



1. Input of test step function (e.g. Collection of characteristic C1...C5, Statistic window, …)
   Text field for documentation of the test step function !!
2. By selecting a **Mode** for a test step, it is possible to start the test scheme exactly in this test step if the related test reason and the start mask are configured respectively (see chapter 6.8 and 6.11). This field is only visible when the AQDEF module is activated.
3. Select a function from the list and click the **New** Button
   (All functions are available in the **Expert mode**.)

   Table of available functions :

Function by default : ✓ = activated / -- = deactivated (see chapter 6.11)

Name of function	Description of function	FP*	
Save measured values	The current measured values of the selected characteristics are saved. With probe validity test or probe free lift control activated, these are executed prior to saving values *(see chapter 7.3)*. An error on one of these two tests prevents saving values.	6	✓
Delete last saved measured value	The last saved measured value of the selected characteristics is deleted. But it is only possible to delete the last collected measured value. All measured values collected before are undeletable.	7	✓

Name of function	Description of function	FP*	
Change to next test step	Change to next test step or (in Expert mode) to a specified test step. By adding the function several times within one test step it is possible to branch to several test steps.	12	✓
Repeat last test step	The previous test step is called again.	13	✓
Adjustment / Calibration	Adjustment / Calibration of the selected characteristics. A possibly activated reference test is executed before (*see chapter 7.6*). If activated, probe validity test and probe free lift control are also executed prior to Adjustment / Calibration *(see chapter 7.3)*. An error on one of these three tests prevents executing Adjustment / Calibration of the selected characteristics.	3	✓
Delete Adjustment / Calibration	The stored offset values of the selected characteristics are deleted. On characteristics with 2 master values activated, stored calibration factors are also deleted. Thus the raw values of the characteristics are visible again. This function also terminates an incomplete 2 master calibration, whereupon the calibration data of the characteristics is deleted.	5	✓
Master-Calibration	Adjustment / Calibration of the selected characteristics is executed without the calibration tolerance check of the reference test (*see chapter 7.6*). Also a new reference point is set for future calibrations. If activated, probe validity test and probe free lift control are also executed prior to Master-Calibration *(see chapter 7.3)*. An error on one of these two tests prevents executing Master-Calibration of the selected characteristics. The function serves for initial fixture calibration or setting a new reference point.	4	✓
Zero adjustment with 1. Master Zero adjustment with 2. Master	Allows the zero adjustment of the selected characteristics with the first or second master, even if two master values are assigned to these characteristics. A possibly activated reference test is executed before (*see chapter 7.6*). If activated, probe validity test and probe free lift control are also executed prior to zero adjustment *(see chapter 7.3)*. An error on one of these three tests prevents executing zero adjustment of the selected characteristics. The functions allow simple offset compensation during measurement operation for characteristics with two master values.	3	✓
Control measurement of 1. Master / 2. Master	Allows a master control measurement with the first or second master. The performed tests are identical to those during the zero adjustment. But no new offset is calculated here. The functions allow a simple verification if a new zero adjustment is needed.	3	✓
Master Zero Adjustment with 1. Master / 2. Master	These functions work like the function „Master Calibration“. They have to be used for characteristics with two masters for which the zero adjustment shall be performed with only one of the masters	3	✓
Change Master	The active master set of a master can be selected. All master sets with mode “Active” or “Spare” are available for selection (see chapter 6.7 Master Management).	10	✓
Load Master values	The current master values of the respective measuring positions are loaded into the selected characteristics (see chapter 6.7 Master Management). For this, the Master IDs and measuring positions must be entered in the drawing data of the characteristics. If no Master IDs are entered or if the entered Master IDs are not found in the table, the master values remain unchanged.	10	✓
Dynamic measurement on / off	The dynamic measurement of the selected characteristics is switched on and on second function call switched off again. *Note :* *Changing to a different test step only works if dynamic measurement is switched off.*	1	✓

Name of function	Description of function	FP*	
Dynamic measurement on	The dynamic measurement of the selected characteristics is switched on.	1	✓
Dynamic measurement off	The dynamic measurement of the selected characteristics is switched off.	1	✓
Input of values by keyboard	The measuring values of the selected characteristics or the attributive list of the characteristics are requested by keyboard. The values input / selected by keyboard are automatically saved when the input is completed.	2	✓
Call subsequence	Change to next test step or to a specified test step as subsequence (after that return to origin). By this function you can change from several test steps to e.g. a calibration test step. After completion of the subsequence ComGage automatically changes back to the original test step.	14	✓
Return from subsequence	End of subsequence and return to original test step.	14	✓
Save measured values on disk	On calling of this function the measured values are saved on disk. (The function „Save measured values“ saves measured values only in RAM. On exiting measurement operation or calling this function the measured values are stored on disk.)	9	✓
Delete all measured values	All collected measured values of the selected characteristics are deleted.	8	✓
Excel-Export and delete all values	All collected measured values of all characteristics are at first exported into an Excel-file and then all collected measured values of the selected characteristics are deleted. The Excel-file has as filename the test order number with appended date / timestamp and counter. **Please pay attention to the important notice in chapter 6.10 of this manual on usage of this function.**	8	✓
Assign event & action	It is possible to assign an event to the collected measured data (e.g. breaking of tool) as well as a corrective action (e.g. exchange of tool). A corresponding register is set for each selected event or corrective action (R900 for event with reference data set number 0 to R939 for event with reference data set number 39; R940 for corrective action with reference data set number 0 to R979 for corrective action with reference data set number 39). Ensure having a clear numbering of the reference information data sets on usage of registers R9XX together with this function (see chapter 6.6). The registers must be manually reset by sequence control programming	10	✓
AQDEF export	This function triggers the data export for the selected characteristics, according to the configuration in the *Options* menu (*see chapter 6.8 AQDEF*). [If no measuring values have been saved, yet, a test export with the nominal values as measuring values can be executed.]	10	✓
Print the characteristics	The last data set of the selected characteristics is printed out in tabular form. On repeated call of the function all data sets are printed on one sheet, as long as enough space is available on page. After that a paging occurs.	10	✓
Print the characteristics on new page	The last data set of the selected characteristics is printed out in tabular form. On repeated call of the function each data set is printed on a new page.	10	✓
Simulation of a function key	The function which is assigned to the simulated function key in the test scheme is executed. It is possible to simulate e.g. the keys “0…9” to call another test order, directly call the menu “Test order / Start” or to simulate the key “*” to call the online SPC. *Note :* This function should not be used for toggling between normal and full screen mode (by simulating the key “/”), because it could otherwise cause timing problems. Instead, please use the appropriate special settings for switching screen mode on start of the test scheme / test order (*see chapter 7.3*).	11	✓

Name of function	Description of function	FP*	
Change characteristic parameters	By this function the operator is given the possibility to change characteristics parameters (e.g. master values, tolerances, …) of selected characteristics during measurement operation or to copy parameters between two characteristics / from registers. *Note :* *A documentation file to this function (SFct001.dll) is located in the ComGage installation folder.*	11	✓
Set measuring value of characteristic	The current measuring value of a characteristic can be set to a preconfigured value (for characteristics with a frozen static measurement or a stopped dynamic measurement). *Note :* *A documentation file to this function (SFct002.dll) is located in the ComGage installation folder.*	11	--
Printout / Bitmap of the screen contents	The current display window contents are printed out as form of screenshot and / or stored as Bitmap (*.bmp). This function should not be triggered by the event "Test Step Start", because it is possible in that case that the display elements of the display window are not yet filled on execution of this function (i.e. they are empty).	11	✓
Automatic generation of serial numbers	This function allows the automatic generation of serial numbers, which shall be saved as reference information and exported together with the measuring values. Test order-related serial numbers and serial numbers unrelated to a specific test order can be generated. *Note :* *A documentation file to this function (SFct004.dll) is located in the ComGage installation folder.*	11	✓
Output optical and acoustical message	It is possible to superimpose a message using a pop-up-window for an adjustable period of time (e.g. "calibration is executed"). The placeholders $L1 … $L1000 can be used for a longer message (see chapter 7.4). In addition an acoustical signal can be output by the sound card of the PC (or rather by the PC-speaker, if no sound card is available).	11	✓
Set current reference info. data set	By this function it is possible to assign reference information to measurement data or input reference information. Optionally this reference information can be copied from other reference information data sets (also partial strings), a length check of the reference information data set can be executed, the reference information data set can be compared with another reference information data set or the currently logged in ComGage user can be adopted as reference information data set. *Note :* *A documentation file to this function (SFct007.dll) is located in the ComGage installation folder.*	11	✓
Q-DAS Konverter **(AQDEF module not required)**	Provides export of measurement data as Q-DAS file. By this function it is possible to create Q-DAS files per data set as well as Q-DAS files containing several data sets. Additionally the exported K-Fields can be modified. *Note :* *A documentation file to this function (SFct008.dll) is located in the ComGage installation folder.*	11	✓
AQDEF - Overwrite K-Field with fix value	If the AQDEF function (and by this also the test step function "AQDEF export") is used, this test step function allows to fill a K-field (in the range from K1000 to K9999) with a fix value. The entries from the K-field editors or the start mask are overwritten. The maximum length of the content is 15 characters for this function.	11	✓
Communication with PLC over RS232	This test step function enables a PLC or other devices to set register values and reference information datasets in ComGage and it allows ComGage to set registers in the PLC. *Note :* *A documentation file to this function (SFct014.dll) is located in the ComGage installation folder.*	11	--

Name of function	Description of function	FP*	
Setting register(s)**	A specific register or a specific span of registers can be set to a definable, integer value, a characteristics value, a measuring input value, the status value of a digital input or a real number value. Additionally, tolerances, statistical values, error codes, … can be loaded. The definable, integer register values can - amongst others - also be incremented / decremented. *Note :* *A documentation file to this function (SFct015.dll) is located in the ComGage installation folder.*	11	✓
Copy measuring values between characteristics	It is possible to copy the saved measuring values of a characteristic into the measuring value memory of a second characteristic. Thereby different copy options are selectable. Already existing measuring values of the second characteristic are thereby not deleted. *Note :* *A documentation file to this function (SFct016.dll) is located in the ComGage installation folder.*	11	✓
Output of values over RS232	It is possible to output the current measurement values of a characteristic on a RS232 interface (PC COM port) using different multiplexer protocols. The different protocols are described in the Setup window of the function. *Note :* *A documentation file to this function (SFct017.dll) is located in the ComGage installation folder.*	11	✓
Set wildcard into mea. value file	This test step function allows to adjust the number of saved measuring values of selected characteristics, either by deleting measuring values or by adding wildcards. Additionally, it is possible to add a wildcard to the measuring value table of a specific characteristic, regardless of the number of saved values. *Note :* *A documentation file to this function (SFct019.dll) is located in the ComGage installation folder.*	11	--
Change to another test order	While a test order is running, this test step function allows to change to another test order. *Note :* *A documentation file to this function (SFct020.dll) is located in the ComGage installation folder.*		--
Device control by RS232 / TCP/IP	This test step function allows to send commands to a device (e.g. measuring instrument, motor, controller, PLC, …) which is connected via a COM port or TCP/IP port. Additionally, a response string can be received from the device and written into a TXT file. *Note :* *A documentation file to this function (SFct021.dll) is located in the ComGage installation folder.*		--
Send Email	Prepared emails can be sent out of a running test order. *Note :* *A documentation file to this function (SFct022.dll) is located in the ComGage installation folder.*		--
Correction value calculation	This test step function serves the purpose of calculating axle correction values for CNC machines. The calculated correction values can be transferred to the CNC machines by downstream functions. *Note :* *A documentation file to this function (SFct023.dll) is located in the ComGage installation folder.*		--

Name of function	Description of function	FP*	
Control by barcode reader / reference info. dataset	It is possible to call another test order by a barcode reader or a selectable reference information dataset. For this purpose the barcode must contain the test order number or the reference information dataset must match the test order number. As an alternative, the barcode that is read-in can be compared with the last reference information dataset of a selectable reference information data type. *Note :* *A documentation file to this function (SFct024.dll) is located in the ComGage installation folder.*	11	✓
Label-Printout by MS-Excel	The layout of the label and the printer settings are defined in a MS-Excel file (*.xls file). On call of the ComGage function “Label-Printout by MS-Excel”, MS-Excel is started in the background and the specified MS-Excel file is loaded, the placeholders are replaced and the printout of the label or the saving in XLS or PDF format are executed. *Note :* *This function requires an installed MS Excel 2010 … 2019 on the PC.* *A documentation file to this function (SFct026.dll) is located in the ComGage installation folder.*	11	--
Save / Load calibration data	It is possible to save the calibration data (offset values + calibration factors) for all characteristics of the current test scheme into a file and to load the calibration data into another test scheme. By this means no separated calibration is necessary in each test scheme. However, it is essential that the number of characteristics and their order are identic in the source and destination test scheme.	11	✓
Execution of a file	It is possible to execute a file (e.g. PDF, MP3, AVI, EXE, ...) and so it is possible to bestow the operator additional assistance during the measuring process. Also you can enter the parameters, which are to be transferred to the application on calling by the command line. *Note :* *A documentation file to this function (SFct031.dll) is located in the ComGage installation folder.*	11	✓
Duplicate current test order	During measurement operation the current test order CANNOT be accessed by a second PC for analysis. By this function all measured data can be written into a second test order in parallel, which can be opened by a second PC for analysis. This function also allows creating new test orders, with selectable options, during measurement operation. On copy of measuring data by this function, only that measuring data is copied to the new test order, that was stored on start of measurement operation or was saved on disk in the meantime (via function “Save measured values on disk”). If measuring data is to be copied, it is hence recommended to execute the function “Save measured values on disk” before executing this function.	11	✓
Correct measuring values	This function loads the saved values of the selected characteristic (measuring value table) or all characteristics, corrects the values according to the selected correction method (e.g. Remove middle point shift from value table / Remove Min-Value from value table / Moving average filter for value table / …) and saves them back. This function changes the measuring values that are saved in the test scheme for one or all characteristics. *Note :* *A documentation file to this function (SFct033.dll) is located in the ComGage installation folder.*	11	✓

Name of function	Description of function	FP*	
Save actual dataset in CSV-file	It is possible to store the current measurement values or optionally the measurement values from file of selected characteristics in a CSV-file. Optionally it is also possible to store the current measurement values without calibration (i.e. the characteristics raw values) in a CSV-file. The measurement data is thereby stored in the file <Test order name>.csv, which is located in the data directory that was selected as „Directory for converted Measuring data“ in the ComGage menu “Options / Data Directories”. In addition an Index can be assigned to the file name. If measurement values from file are selected, the maximum number of data sets per characteristic in the test order can be limited to 200.	11	✓
Calibration management	This test step function allows to assign characteristics to specific gauges with transfer of calibration factors and offsets of identical characteristics in different test schemes. Additionally, it is possible to check across several test orders if a gauge has been used for so many measurements that a new calibration is required. *Note :* *A documentation file to this function (SFct036.dll) is located in the ComGage installation folder.*	11	--
SESAME Export	This test step function allows the export of measuring values from ComGage into the data format used by the PSA group (SESAME = **S**aisies **E**t **S**tatistiques **A**ppliquées aux **ME**sures). *Note :* *A documentation file to this function (SFct037.dll) is located in the ComGage installation folder.*	11	--
End of measurement mode	It is possible to exit all test orders / test schemes or the current test order / test scheme during measurement operation. On exiting all test orders / test schemes you can additionally select if the computer is to be shut down, to be restarted or if ComGage is to be closed.	11	✓
Knäbel GmbH Slide Scan	This test step function provides all functions to calibrate, measure and visualize measuring results of Knäbel Slide Scan gauges for valve seats. *Note :* *A documentation file to this function (SFct040.dll) is located in the ComGage installation folder.*	11	--
Read bar code / data matrix code over RS232	This test step function allows to receive a bar code / data matrix code (DMC) from a bar code / DMC scanner connected to a COM port. This function should be used for reading barcodes in automated systems. The scan process can be triggered by sending a request command. *Note :* *A documentation file to this function (SFct041.dll) is located in the ComGage installation folder.*	11	--
Communication over IMB-sm Module	This test step function allows the RS232 communication with e.g. a measuring instrument, a PLC, … via an IMB-sm module. *Note :* *A documentation file to this function (SFct042.dll) is located in the ComGage installation folder.*	11	--
Freeze / Release measurement	It is possible to freeze the measurement values of selected characteristics. Thereby, the current values of the characteristics are retained (frozen) until they are explicitly released again. In addition you can select, if the display elements are to be reset on releasing the current values (e.g. for characteristics using gauge triggered mode or dynamic measurement mode). Numeric displays of these characteristics will then indicate “-----“ after reset. *Note :* *A documentation file to this function (SFct043.dll) is located in the ComGage installation folder.*	11	✓

Name of function	Description of function	FP*	
Convert mea. value into Binary/BCD format	A measuring value can be converted into Binary / BCD format. The converted measuring value is assigned to a group of registers and can in this way be used to output the value via digital outputs. *Note :* *A documentation file to this function (SFct044.dll) is located in the ComGage installation folder.*	11	--
Output of a polar diagram	This test step function allows to display the saved measuring values of a characteristic in a polar diagram. *Note :* *A documentation file to this function (SFct046.dll) is located in the ComGage installation folder.*	11	--
Universal Export Module (for export to TXT-, CSV-, … files)	This ComGage test step function allows to export measuring data from ComGage. The lines to be exported are freely definable in an Export-Definition-File. Wildcards in the Export-Definition-File will be replaced by the Universal Export Module with the corresponding values in test scheme / test order / measuring data. *Note :* *A documentation file to this function (SFct047.dll) is located in the ComGage installation folder.*	11	✓
SQL database interface	This test step function allows to write saved measuring values into an SQL database. Additionally, the software TxtToSql (available at www.withdata.com) is required. *Note :* *A documentation file to this function (SFct049.dll) is located in the ComGage installation folder.*	11	--
Passcode-Check	This function allows integrating password protection into the programme sequence using a freely definable passcode. The result of the passcode entry is stored in register R993 (R993=0 → entry correct / R993=1 → entry false). In addition a supervisor passcode can be defined. On entry the supervisor passcode enables online modification of the normal passcode. *Note :* *A documentation file to this function (SFct050.dll) is located in the ComGage installation folder.*	11	✓
Tolerance analysis	The ComGage test step function *Tolerance analysis* allows to analyse the measuring values of one or several characteristics regarding their position in the tolerance range or a value range. The result of this analysis is written into a selectable register. *Note :* *A documentation file to this function (SFct051.dll) is located in the ComGage installation folder.*	11	✓
Output of a X/Y / Scanning / F/D diagram	This test step function allows the display of measuring values as XY / Scanning / Force/Displacement diagram (F/D diagram). *Note :* *A documentation file to this function (SFct052.dll) is located in the ComGage installation folder.*	11	--
Search reference information dataset in table	The test step function “Search reference information dataset in table” uses a lookup table for reference information to assign a specific value to a register. The lookup table (text file) needs to be placed in the ComGage *Directory for test orders*. *Note :* *A documentation file to this function (SFct056.dll) is located in the ComGage installation folder.*	11	✓

Name of function	Description of function	FP*	
Communication over pb_adp / pn_adp	This function allows reading / writing up to 60 bytes of selectable data via the Profibus / Profinet. It can thus transmit e.g. measuring values, register values and reference information. Register values and reference information can also be received. The data format of the information to be transferred is configurable. For usage of this function the appropriate adapter is required (pb_adp / pn_adp), together with an IMB-sm module that is setup accordingly. *Note :* *A documentation file to this function (SFct057.dll) is located in the ComGage installation folder.*	11	✓
Master Calibration by averaging of several raw values	This test step function allows to execute a master calibration with the average of several raw values, instead of one single raw value. This increases the accuracy of the base for a master calibration and allows the output of an error message if the values are not sufficiently reproducible. *Note :* *A documentation file to this function (SFct058.dll) is located in the ComGage installation folder.*	11	--
Read/Write RFID memory cells by Balluff BIS C-6...	This test step function allows to use a Balluff BIS C-6… to read data from and write data into up to 16 consecutive memory cells of RFID chips. *Note :* *A documentation file to this function (SFct059.dll) is located in the ComGage installation folder.*	11	--
Output of characteristic value into keyboard buffer	This function allows using function key and key combination entries from other application programs (if the keyboard focus is set on them) to set registers in ComGage. These registers can then be used to output characteristics values of ComGage into the keyboard buffer. These values are then written to the current cursor position in the active application program. *Note :* *A documentation file to this function (SFct060.dll) is located in the ComGage installation folder.*	11	✓
Universal Label Printing	This test step function allows the designing and printing of a label with barcode / DataMatrix code / QR code and additional information. The format of the label is determined within a configuration file. *Note :* *A documentation file to this function (SFct061.dll) is located in the ComGage installation folder.*	11	--
Import of Reference Information from file	This function allows importing a selectable reference information dataset from a selectable text file. The text file can be deleted after importing the dataset. A register can be defined as result register for evaluating the import. *Note :* *A documentation file to this function (SFct064.dll) is located in the ComGage installation folder.*	11	✓
Communication over network socket	This test step function allows sending data from ComGage to a network server (e.g. SOAP). The sent data is configured in several text files that may contain wildcards, which ComGage replaces with the proper values while the test step function is executed. *Note :* *A documentation file to this function (SFct065.dll) is located in the ComGage installation folder.*	11	--
Show register values	This function displays the current values of registers. This is an analysis function in the ComGage measurement mode. *Note :* *A documentation file to this function (SFct069.dll) is located in the ComGage installation folder.*	11	✓

Funktionsbezeichnung	Funktionsbeschreibung	FP*	
Send command to measuring instrument	A command can be sent to a measuring instrument that is used by a characteristic with the ComGage Special measuring mode “Receive measuring value over COM/TCP port” (wgl029). → see chapter 7.6 This test step function can send commands only via a COM port or a TCP client connection (TCP server connections are currently not supported by the SFct071). *Note :* *A documentation file to this function (SFct071.dll) is located in the ComGage installation folder.*	11	--
Control of the measuring interval	This test step function allows to dynamically control the measuring interval of a characteristic that has to be measured only occasionally. *Note :* *A documentation file to this function (SFct072.dll) is located in the ComGage installation folder.*	11	--
Distribute measuring values	This test step function allows to distribute the saved measuring values of a characteristic to one or more different characteristics. *Note :* *A documentation file to this function (SFct073.dll) is located in the ComGage installation folder.*	11	--

Note : All available test step function are listed in Appendix B, including the additional information if an additional license is required and / or if these test step functions are also available for Windows CE.

*** : FP** indicates the function priority (1 = highest priority)
It specifies in which order those functions within a test step are executed, for which the execution conditions have become “true” in one specific cycle.

Functions with identic priority are executed according to their position in the list of created functions (top down).

If the value of a register changes during one specific cycle, in that cycle it still has influence (if the register value is programmed as event for executing another function) :

- on all functions with the same function priority (11), which are located further below in the list of created functions,
- on all functions with a lower function priority (>11).

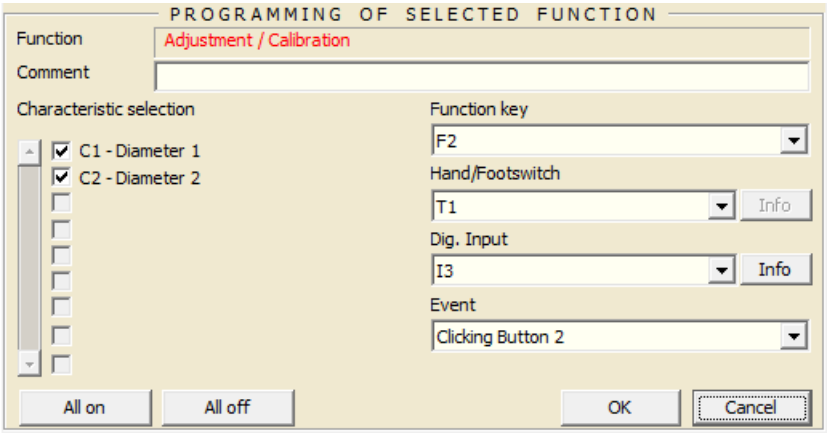
**** : Registers** are available and are used in ComGage as described in the following.

- The total range of available registers is 2000 (R1 to R2000),
- The Registers are arranged in four groups :
  - → R1 to R900 : Belong to the currently running test scheme / test order. Are 0 on starting the test scheme / test order and are set to 0 on varying test schemes / test orders.
  - → R901 to R1000 : Belong to the currently running test scheme / test order. Are 0 on starting the test scheme / test order and are not set to 0 on varying test schemes / test orders.
  - → R1001 to R1900 : Global registers, independent from test schemes / test orders. Are set to 0 after all running test schemes / test orders have been closed.
    (These registers allow test schemes / test orders to exchange data among themselves or rather to be controlled globally.)
  - → R1901 to R2000 : Global registers, independent from test schemes / test orders. Are set to 0 only when ComGage is started.
    (These registers allow test schemes / test orders to exchange data among themselves or rather to be controlled globally.)

- The following registers are used for programme internal functions (*) :
  → R900 to R939 : Hold the selection of events with reference data set numbers 0 to 39.
  → R940 to R979 : Hold the selection of corrective actions with reference data set numbers 0 to 39.
  → R990 : Evaluation of last calibration status. R990=0 → Calibration good / R990=1 → Calibration error.
  → R991 : Holds the cause of the last event and action request.
  R991=1 → Specification limit violation by one measuring value,
  R991=2 → Controlling limit violation by Xq, S, R,
  R991=3 → Detection of a RUN (X-Chart, 7 entries in series on one side of the centre line),
  R991=4 → Detection of a TREND (X-Chart, 7 entries in series - all increasing or decreasing).
  R991=5 → Controlling limit violation by one measuring value
  → R992 : Open sample quantity (only on supervision of sample collection time).
  → R993 : Evaluation of last passcode entry. R993=0 → Passcode correct / R993=1 → Passcode wrong.
  → R994 : Holds the source of the last calibration error.
  R994=0 → No calibration error has occurred, register is reset to this value on good calibration,
  R994=1 → Calibration error is caused by reference test relating to last calibration,
  R994=2 → Calibration error is caused by reference test relating to master-calibration,
  R994=3 → Calibration error is caused by both types of reference test.
  → R995 : Evaluation of probe validity test. R995=0 → No error / R995=1 → Error.
  → R996 : Evaluation of probe free lift control. R996=0 → No error / R996=1 → Error.
  → R997 : Contains the last occurred error code of the measuring loop
  R997=1 … 35 → see manual of the connected measuring instrument
  R997=36 → overrange
  R997=90 → not connected
  R997=91 → not defined (e.g. on division by zero)
  R997= -1 → communication error between PC and measuring instrument
  → R998 : Is set by default to “-1” when a test scheme is started and is set by default to the quantity entered on creation of the test order, when that test order is started.
  → R999 : Detection if test scheme or test order is being executed. R999=0 → Test scheme is being executed / R999=1 → Test order is being executed.
  → R1990 to R1995 : AQDEF (see chapter 12.1)

  * : Optional ComGage special functions may use further registers for function-related purposes.
  Please refer to the documentation of the particular ComGage special function for further details.

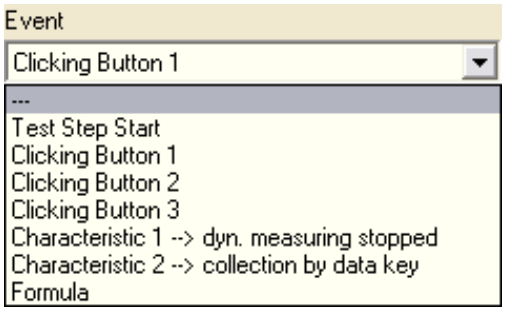
4. Assignment of specific parameters for the selected test step function.
   Entering a comment for this test step function and assignment of function keys, hand / foot switches, digital inputs and events for execution of the function :



Notes :

a) By clicking the **Info** button the available hand / foot switches or digital inputs are graphically illustrated in a picture.

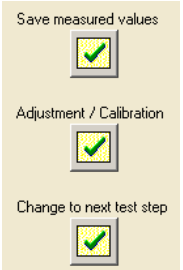
b) Available events :



Test Step Start : The function is executed automatically on the start of the test step, i.e. when ComGage changes to the test step.
With this event it is possible e.g. to start a dynamic measurement, when ComGage changes to the test step for dynamic measurement.

Dynamic measurement on : C1	---	---	---	Test Step Start
Dynamic measurement off : C1	---	---	---	Formula : Timer(17000,0)=1
Save measured values : C1	---	---	---	Characteristic 1 --> dyn. measuring ...

Clicking Button 1...3 : In the measuring window three buttons are available, which can be assigned to a function in the test scheme for execution of that particular function.



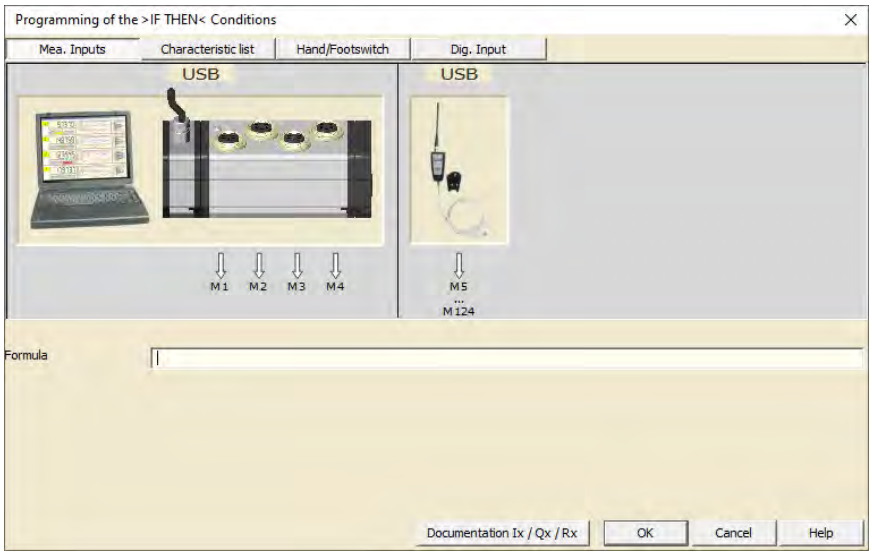
Characteristic x → dyn. meas... : If the dynamic measurement of characteristic x is stopped, then the assigned functions are executed.
With this event it is possible e.g. to save the result of all characteristics when the dynamic measurement is stopped :

Dynamic measurement on : C1	---	---	---	Test Step Start
Dynamic measurement off : C1	---	---	---	Formula : Timer(17000,0)=1
Save measured values : C1	---	---	---	Characteristic 1 --> dyn. measuring ...

Characteristic x → collection … : If a value from characteristic x is received, which is automatically sent from the gauge or transmitted by the data key of the gauge, then the function is executed.
With this event it is possible e.g. to directly save the received measuring value : (see chapter 8.2 / example 2)

Save measured values : C2	F1	---	---	Characteristic 2 --> collection by dat...

Formula : Free Input of a condition (by clicking the **Setup** - button).



The entered formula always consists of logical conditions : x>y, z=1, ... These logical conditions can be combined by Boolean operators (AND, OR, …). If the logical conditions of a formula are fulfilled, then the assigned function is executed.

It is possible to switch the displayed graphics to selectively display the available measurement inputs, the list of characteristics, the available hand / foot switches or the available digital inputs (see the tabs at the upper edge of the window).

As logical operators are available :

Operator	Function
&	AND conjunction between 2 conditions
|	OR conjunction between 2 conditions
=	The condition is fulfilled, if both parameters are equal
<	The condition is fulfilled, if parameter 1 is smaller than parameter 2
>	The condition is fulfilled, if parameter 1 is bigger than parameter 2
>=	The condition is fulfilled, if parameter 1 is equal or bigger than parameter 2
<=	The condition is fulfilled, if parameter 1 is equal or smaller than parameter 2

Example for a formula : ***(x>5 & y<=3) \| z=1***

In the formulas the following *inputs* can be used :

Address	Input
Mx	Measuring input x
Cx	Current measuring value of characteristic x
Cx_File	Last measuring value from file of characteristic x
Cx_USL	If measuring value of characteristic x is > USL, then Cx_USL = 1
Cx_UCL	If measuring value of characteristic x is > UCL and < USL, then Cx_UCL = 1
Cx_ok	If measuring value of characteristic x is inside the controlling limits, then Cx_ok = 1
Cx_LCL	If measuring value of characteristic x is > LSL and < LCL, then Cx_LCL = 1
Cx_LSL	If measuring value of characteristic x is < LSL, then Cx_LSL = 1
Cx_USL_File	If last measuring value from file of characteristic x is> USL, then Cx_USL_File = 1
Cx_UCL_File	If last measuring value from file of characteristic x is > UCL and < USL, then Cx_UCL_File = 1
Cx_ok_File	If last measuring value from file of characteristic x is inside the controlling limits, then Cx_ok_File = 1
Cx_LCL_File	If last measuring value from file of characteristic x is > LSL and < LCL, then Cx_LCL_File = 1
Cx_LSL_File	If last measuring value from file of characteristic x is < LSL, then Cx_LSL_File = 1
Cx_NOM_Val	Nominal value of characteristic x, as programmed in the drawing data
Cx_USL_Val	Upper specification limit of characteristic x, as programmed in the drawing data
Cx_UCL_Val	Upper controlling limit of characteristic x, as programmed in the drawing data
Cx_LCL_Val	Lower controlling limit of characteristic x, as programmed in the drawing data
Cx_LSL_Val	Lower specification limit of characteristic x, as programmed in the drawing data
Cx_MA1_Val	1. Master value of characteristic x, as programmed in the drawing data
Cx_MA2_Val	2. Master value of characteristic x, as programmed in the drawing data

Address	Input
Tx	If an actuation of hand / foot switch x is detected, then Tx = 1 is set
Tx_State	Current state of hand / foot switch x (State „pressed“ = 1 / State „not pressed“ = 0)
Ix	If a setting of digital input x is detected, then Ix = 1 is set
Ix_State	Current state of digital input x (State „set“ = 1 / State „not set“ = 0)
F1 ... F12	If an actuation of function key x is detected, then Fx = 1 is set
F1_State ... F12_State	Current state of function key x (State „pressed“ = 1 / State „not pressed“ = 0)
Rx	Register x

In the formulas the following mathematical *operators* can be used :

Operator	Function	Example
+	Addition of inputs, characteristics and numbers	M1+M10-34
-	Subtraction of inputs, characteristics and numbers	M1-M2+1.1e-4
*	Multiplication of inputs, characteristics and numbers	M3*0.5+M2*M1
/	Division of inputs, characteristics and numbers	M2/3
^	‘x power by y’ (i.e. 2^3 = 2*2*2 = 8)	M2^(1/2) = Square root of M2
%	Modulo-operator = carryover of a division (e.g. 5%3 = 2)	M2%2
ABS()	Absolute value	ABS(M1)
SIGN()	Delivers the sign of the parameter	SIGN(-5.23)=-1
ROUND()	Rounds to the next integer	ROUND(5.43)=5 / ROUND(5.53)=6
INT()	Rounds down to the next integer	INT(5.43)=5 / INT(5.53)=5
CEIL()	Rounds up to the next integer	CEIL(5.43)=6 / CEIL(5.53)=6
SIN()	Sine (unit : degree)	SIN(M2)
COS()	Cosine (unit : degree)	COS(M2)
TAN()	Tangent (unit : degree)	TAN(M2*3+M1)
ASIN()	Arc – Sine (unit : degree)	ASIN(M2/50.4)
ACOS()	Arc – Cosine (unit : degree)	ACOS(M2/50.4)
ATAN()	Arc – Tangent (unit : degree)	ATAN(M2/50.4)
PI	Pi (= 3.141592654)	SIN(M2*180/PI)
MONTH	Current month (1=January, 2=February, ...)	MONTH
DAY	Current day of month (1 ... 31)	DAY
DAYOFWEEK	Current day of week (0=Sunday, 1=Monday, ..., 6=Saturday)	DAYOFWEEK
HOUR	Current time : Hour (0 ... 23)	HOUR
MINUTE	Current time : Minute (0 ... 59)	MINUTE
SECOND	Current time : Second (0 ... 59)	SECOND
EXP()	Exponential function (2.7182818 ^{x})	EXP(M1)
LOG()	Natural logarithm	LOG(M1)

Min(;;;) Min()	Min-value of all elements in the list Min-value of all saved measuring values of the characteristic	Min(M1;M2;C3;M4+C5) Min(C3)
Max(;;;) or Max()	Max-value (see Min-function)	Max(M1;M2;C3;M4+C5) or Max(C3)
Avr(;;;) or Avr()	Average (see Min-function)	Avr(M1;M2;C3;M4+C5) or Avr(C3)
Tir(;;;) or Tir()	Max-value minus Min-value (see Min-function)	Tir(M1;M2;C3;M4+C5) or Tir(C3)
SD(;;;) or SD()	Standard deviation (see Min-function)	SD(M1;M2;C3;M4+C5) or SD(C3)

PartOK	=0, if the current measuring value of at minimum one characteristic is outside the tolerances =1, if the current measuring values of all characteristics are inside the tolerances	PartOK=1
PartOK_File	=0, if the last measuring value from file of at minimum one characteristic is outside the tolerances =1, if the last measuring values from file of all characteristics are inside the tolerances	PartOK_File=1
PartRework	=0, if the current measuring values of all characteristics are inside the controlling limits or if the current measuring value of at minimum one characteristic is outside the tolerances =1, if the current measuring value of at minimum one characteristic is outside the controlling limits and the current value of no characteristic is outside the tolerances	PartRework=1
PartRework_File	=0, if the last measuring values from file of all characteristics are inside the controlling limits or if the last measuring value from file of at minimum one characteristic is outside the tolerances =1, if the last measuring value from file of at minimum one characteristic is outside the controlling limits and the last measuring value from file of no characteristic is outside the tolerances	PartRework_File=1

Example of a formula : *45e-5 + sin(5*M1/M2)*cos(4*M3) – (C2+M3+4.5)^(1 / 2) + Min(sin(C1);cos(M2)/3;M2+M3;5) > 1000*

Additionally there are the following special functions for the formulas available :

Special function	Description
Timer	**Timer (time interval, num. of calls)** The Timer is initialised on the start of the particular test step and triggers the event on expiration of the time. On each leaving and new call of the test step the Timer is reset / started again. *time interval → Time interval after which the Timer triggers the event [in msec.]* *num. of calls → Number of Timer calls (e.g. 100 meas. values shall be saved every 100 msec.)* *0 = Special case : The Timer triggers the event unlimited times* *1 = The Timer triggers the event 1-time after test step start* *2 = The Timer triggers the event 2-times after test step start* *… (Maximum value = 255)*
GlobalTimer	**GlobalTimer (time interval, num. of calls)** The Timer is initialised on the FIRST start of the particular test step and triggers the event on expiration of the time, when the test step is currently active. It varies from the normal “Timer” in that way, that it is NOT reset after leaving and new call of the test step. *time interval → Time interval after which the Timer triggers the event [in msec.]* *num. of calls → Number of calls of the Timer (see Timer)*
PartCounter	**PartCounter (reset size)** The Part Counter counts the measured components since the start of the test scheme / test order. When the counter reaches the reset size then the counter is reset. (serves for e.g. a call on a component forced calibration) *reset size → Number of components after which the PartCounter is reset* *0 = Special case : The counter is never reset after starting measurement operation* *1 = The counter is reset after one component* *2 = The counter is reset after two components* *…*
NumOfVal	**NumOfVal (Number of the characteristic)** Returns the number of measuring values in file of the characteristic.

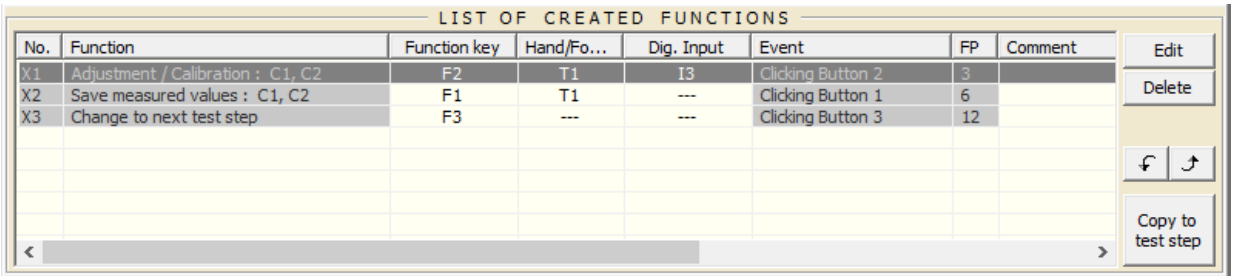
Special function	Description
StableValue	**StableValue (Number of the characteristic, begin, end, time, max. jump)** Detection of a stable value. *Characteristic* → *Number 1...128 of the observed characteristic* *begin & end* → *Measuring range in which the observation for a stable value takes place. After detection of a stable value the measuring range must be first left, before a new stable value can be detected.* *time & jump* → *Time period „time" in msec., in which the measuring value must not jump more than „jump" for detecting a stable value.* *Example : StableValue (3, 19.99, 20.01, 1000, 0.005) =1* The event is triggered, if the measuring value of characteristic *3* is within the measuring range of *19.99* to *20.01* and is stable, i.e. it jumps less than *0.005* for a time of *1000* msec.
MVChange	**MVChange (Number of the characteristic, Changing, Time)** Detection of a changing value. *Characteristic* → *Number 1...128 of the observed characteristic* *Changing* → *Minimal-required change of the measuring value for triggering the event* *Time* → *Time period in msec., where on its expiration the measuring value must have changed by at least „Changing" compared to the value at the time the function was called* *Example : MVChange (3, 0.1, 1000) =1* The event is triggered, if characteristic 3 has changed after *1000* msec. at minimum by *0.1*.

Example of a formula : Timer(1000,1)=1

5. All the created functions are shown in the list of created functions for the test step. These are automatically sorted in the function list by their function priority (see column "FP" in the list) and can be shifted within the same priority-group.
   The test step functions can be sorted by the content of a column by clicking the headline of this column. But this sorting does not influence the order in which the functions are executed.
   Next to the function priority there is an additional column where a comment can be added to every test step function.

   The fields which are not grey can be edited directly in the table. To activate the editing mode, please select a row by clicking, then click the table cell you would like to edit. In the editing mode you can navigate in the table by using the keyboard keys ↑, ↓, <TAB> and <SHIFT>+<TAB>.

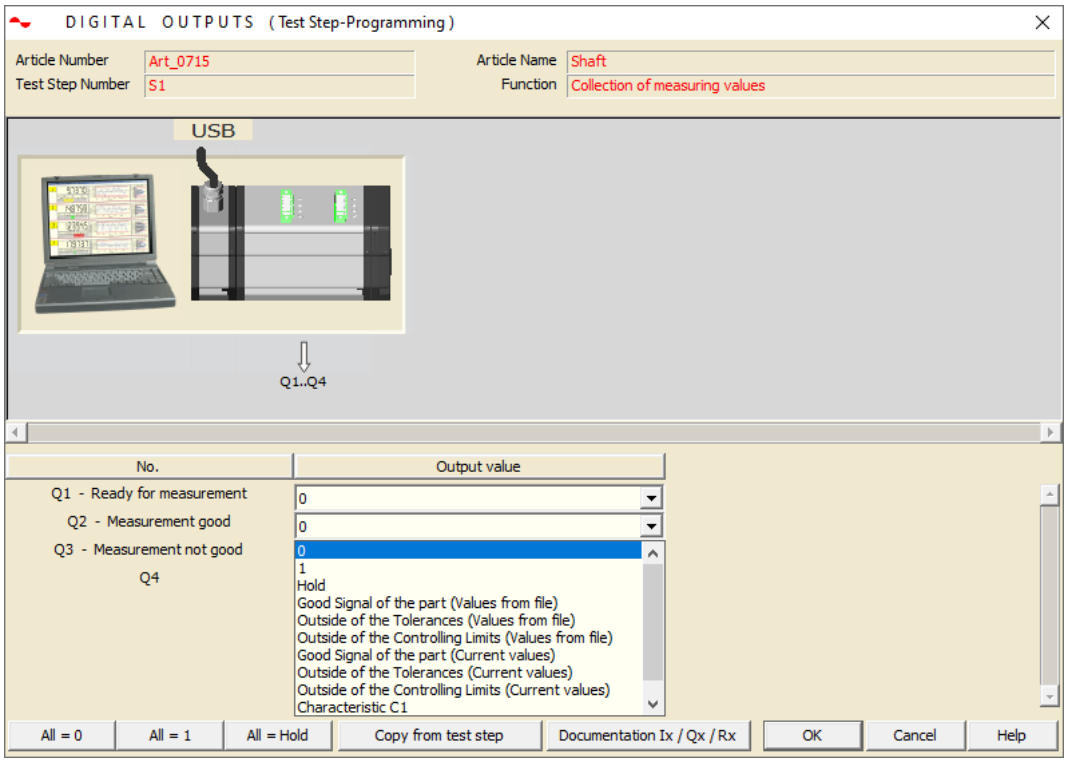
   In addition the created functions can be modified, deleted or copied to another test step :



6. In the "Reference information" - menu (see chapter 6.6) you can select that certain types of reference information are requested at the start of a component measurement. This could be for example the serial number of the component. By checking the box "*In this test step the reference information are requested*" you can define the test step in which these reference information types are requested. The option "*In this test step the reference information are requested*" should normally be activated only in one test step of the test scheme.

7.10 Programming the test steps (digital outputs)

In this window the output values of the digital outputs can be assigned to the single test steps (e.g. for controlling a machine) :

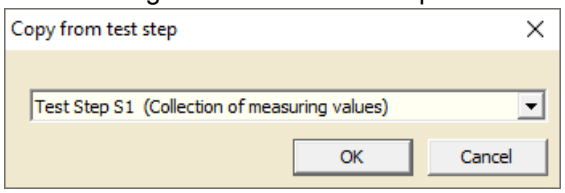


The digital outputs and their addresses are shown in the picture.

In the lower area the digital outputs are listed including the entered documentation (the dialogue for changing the documentation can be opened by pressing the button **Documentation Ix / Qx / Rx**). Directly next to the list of digital outputs, you can select the conditions on which each output shall be set (see following page).

Additionally, the following buttons are available :

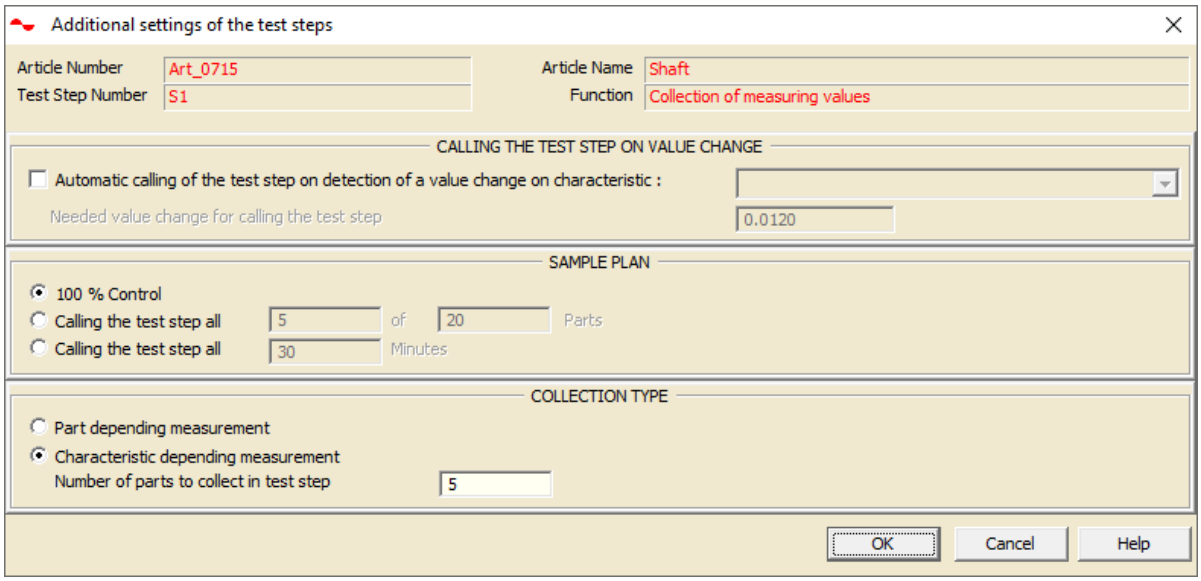
- **All = 0** : All digital outputs are set to “0” (inactive) for this test step.
- **All = 1** : All digital outputs are set to “1” (active) for this test step.
- **All = Hold** : All digital outputs are set to “Hold” for this test step.
  That means they keep the status that they had on entering this test step.
- **Copy from test step** : The configuration of all digital outputs is copied from another test step.
  The following selection window is opened :



For the digital outputs the following output values are available :

Output value	Output
0	The digital output is not set.
1	The digital output is set.
Hold	In the current test step the digital output keeps the status from the last test step.
USL of the part (Values from file)	The digital output is set, if the last saved measuring value of at minimum one characteristic is outside the upper specification limit (USL).
UCL of the part (Values from file)	The digital output is set, if the last saved measuring value of at minimum one characteristic is outside the upper controlling limit (UCL) and if no measuring value is outside the specification limits (USL & LSL).
Good Signal of the part (Values from file)	The digital output is set, if the last saved measuring value of all characteristics is within the controlling limits and within the specification limits.
LCL of the part (Values from file)	The digital output is set, if the last saved measuring value of at minimum one characteristic is outside the lower controlling limit (LCL) and if no measuring value is outside the specification limits (USL & LSL).
LSL of the part (Values from file)	The digital output is set, if the last saved measuring value of at minimum one characteristic is outside the lower specification limit (LSL).
Outside of the Tolerances (Values from file)	The digital output is set, if the last saved measuring value of at minimum one characteristic is outside the specification limits (USL & LSL).
Outside of the Controlling Limits (Values from file)	The digital output is set, if the last saved measuring value of at minimum one characteristic is outside the controlling limits (UCL & LCL) and if no measuring value is outside the specification limits (USL & LSL).
USL of the part (Current values)	The digital output is set, if the current measuring value of at minimum one characteristic is outside the upper specification limit (USL).
UCL of the part (Current values)	The digital output is set, if the current measuring value of at minimum one characteristic is outside the upper controlling limit (UCL) and if no measuring value is outside the specification limits (USL & LSL).
Good Signale of the part (Current values)	The digital output is set, if the current measuring value of all characteristics is within the controlling limits and within the specification limits.
LCL of the part (Current values)	The digital output is set, if the current measuring value of at minimum one characteristic is outside the lower controlling limit (LCL) and if no measuring value is outside the specification limits (USL & LSL).
LSL of the part (Current values)	The digital output is set, if the current measuring value of at minimum one characteristic is outside the lower specification limit (LSL).
Outside of the tolerances (Current values)	The digital output is set, if the current measuring value of at minimum one characteristic is outside the specification limits (USL & LSL).
Outside of the Controlling Limits (Current values)	The digital output is set, if the current measuring value of at minimum one characteristic is outside the controlling limits (UCL & LCL) and if no measuring value is outside the specification limits (USL & LSL).
Characteristic Cx	The digital output is set, if the current measuring value of characteristic Cx is within the specification limits.
Upper plausibility limit (UPL)	The digital output is set, if the current measuring value of at minimum one characteristic is outside the upper plausibility limit (UPL).
Lower plausibility limit (LPL)	The digital output is set, if the current measuring value of at minimum one characteristic is outside the lower plausibility limit (LPL).
Logic function of the output	Input of a formula → see formula editor in chapter 7.9

7.11 Programming the test steps (additional settings)



Automatic calling of the test step on detection of a value change on characteristic :

With this option activated and a characteristic assigned to it, the particular test step is automatically called if the measurement value of the assigned characteristic changes. Additionally you can define a minimum value change which serves as trigger level for the automatic call of the test step.

Example :

There are 3 bore gauges connected. For each one of them a test step with display window is created in ComGage. If you now assign characteristic 1 to the first test step, characteristic 2 to the second test step and so on, then ComGage always displays the measurement values of the active bore gauge, by automatically calling the particular test step.

Sample plan :

100 % Control

The test step is always called.

Calling the test step all x of y parts

The test step is only called x-times out of y-times, i.e. with this function the collection of uncritical characteristics can be skipped, so that these characteristics do not have to be collected for each component or a test step for calibration can be called all x of y parts. The program sequence must be programmed in a way that ensures the test step is being passed during program execution. In that case, the test step is either skipped automatically or executed, depending on the number of cycles.

Calling the test step all x Minutes

The test step is only called all x minutes, i.e. with this function a time-controlled execution of the test step can be programmed. This can be useful for example to execute a forced periodical calibration.
The program sequence must be programmed in a way that ensures the test step is being passed during program execution. In that case, the test step is either skipped automatically or executed, depending on the time period since last test step execution.

Collection type :

Part depending measurement

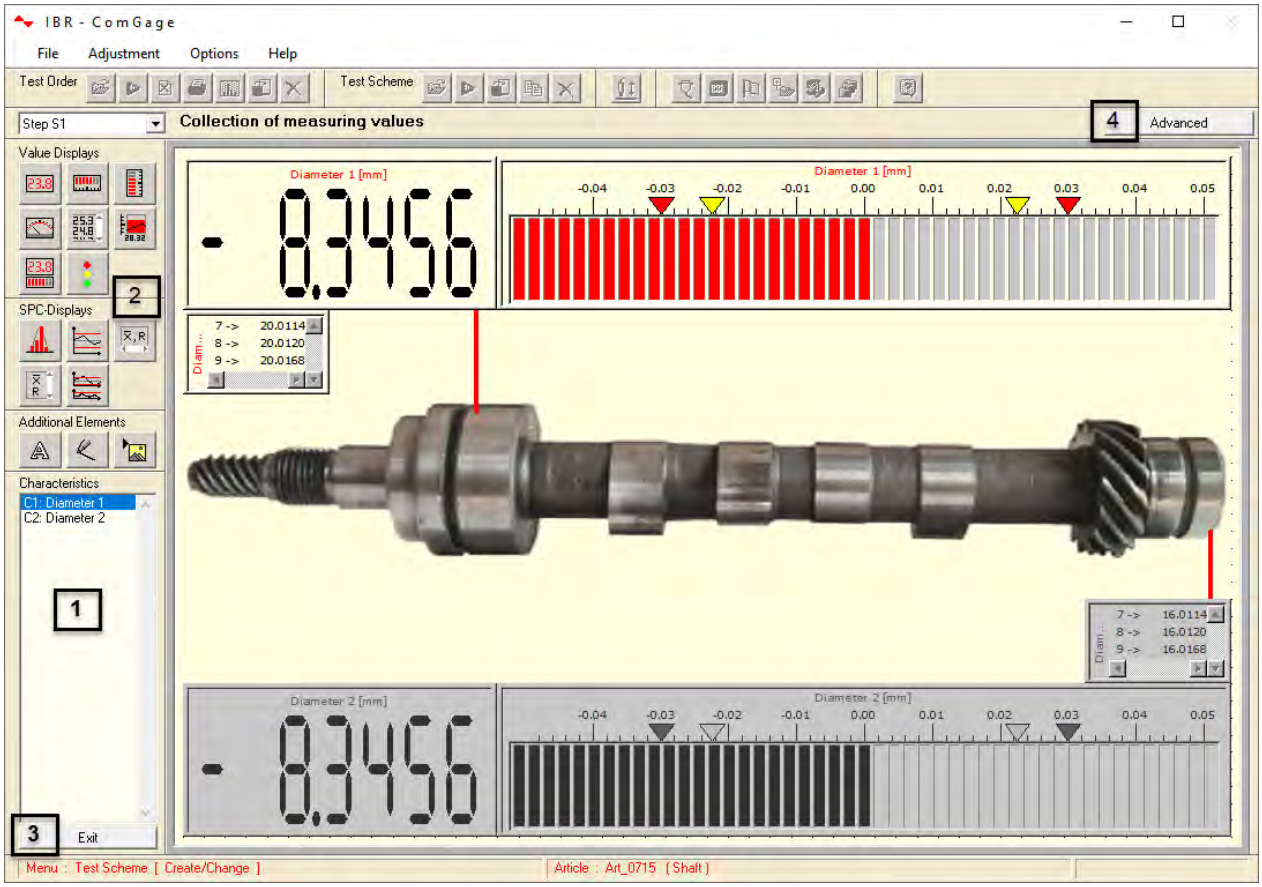
All characteristics of a component are measured one after the other before the next component is measured.

Characteristic depending measurement

At first characteristic 1 of x components is measured, then characteristic 2 of x components is measured and so on. With this option activated, ComGage firstly allows leaving the test step, when x components have been measured.

7.12 Programming the test steps (programming the display windows)

In this menu the display windows for the individual test steps can be created.



1.) Selection of the characteristic

Before creating a display element the characteristic must be selected, to which the new display elements shall belong.

2.) Creating display elements

You can create a display element by using the buttons. The new display elements belong to the currently selected characteristic (see 1.). The new display element is placed at the centre of the display and can then be moved.

3.) Leaving the programming menu

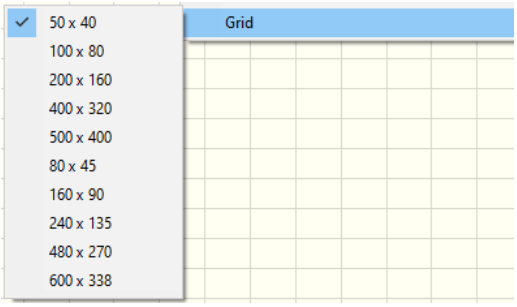
By clicking the **Exit** - button you can leave the menu for programming the display window.
In doing so, all modifications made in the display window are stored inside the test scheme.

4.) Advanced Functions

This button opens a menu with the following functions :

- **Display window** – Contains commands for automatic generation, copy, load, save and add of display windows. The automatic generation opens a dialog for selection of display elements for a list of characteristics and generates the display window automatically.
- **Scheme** – Allows the selection and the assignment of a colour scheme for the complete display window. (The grid of display window is NOT changed.)
- **Assign all display elements** – Assign all display elements to a particular characteristic.
- **Disable display window** – Disables the display window of the current test step. If this test step is called, the display window of the previous test step remains displayed. Measurement value displays are not updated.
- **Background colour** – Allows to change the background colour of the display window.
  Size – Adapts the display window to different screen sizes (e.g. Mecc, CD43, …).

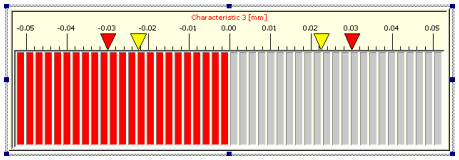
- **Grid**
  By default, the display window is divided into a 50 x 40 grid.
  Here, a different grid can be selected per test step, e.g. if more display elements shall be added for bigger screens or to be able to place elements like lines more accurately.



Note :
Display windows with a grid > 50 x 40 are not compatible to ComGage Professional versions before V5.10.

5.) Moving display elements

If you click on a display element then it gets activated. When it is activated you can move it or change its size using the mouse (alternative **cursor keys** : move the element / **shift+cursor keys** : change its size).

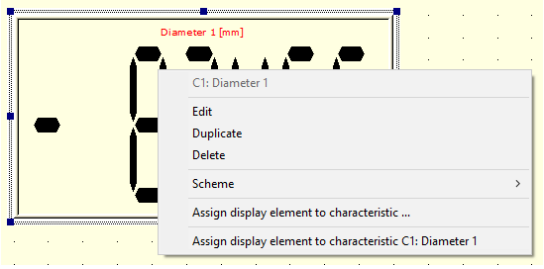


6.) Grey display elements

All display elements of the currently selected characteristic (see 1.) are shown in colour, the display elements of other characteristics are shown in grey.

7.) Editing, duplicating or deleting a display element

By clicking the right mouse button or pressing the ENTER key the following menu for programming the selected display element is opened :



By means of this menu the display elements can be edited (e.g. colour), duplicated, deleted or assigned to another characteristic and another colour scheme can be selected.
Alternatively, display elements can be opened for editing by double-clicking them.

Editing of display elements :

Measurement value displays and SPC displays

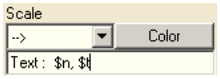
Most parameters of the display elements (such as colour or font) are independent from the characteristic. There are few parameters of the single display elements which are depending on the characteristic.

Display element type	Parameters depending on the characteristic
Numeric Display	- Resolution, number of digits
Column Display	- Zero point of the column (= nominal size) - Column range (A user defined range is possible)
Analogue Meter	- Zero point (= nominal size) - Display range (A user defined range is possible)
Histogram	- Histogram type (for process control or process analysis) - Number of classes

Display element type	Parameters depending on the characteristic
Run Chart	- Number of values shown in the chart - Scrollbar on / off
Statistical Data	- Selection of the statistical data (Min, Cp, Cpk, …) to be shown
Combination Display	- Resolution - Number of digits - Zero point of the Column (= nominal size) - Number of values shown in the chart
Control Chart	- Chart types (average chart [Xq], median chart [Xm], raw value chart [X], standard deviation chart [S], range chart [R], individual value / moving range chart [I/MR]) - Calculation of the controlling limits (Shewhart, Acceptance) - Number of values shown in the chart - Scrollbar on / off

Important notice regarding display elements :
Many of the display elements available can be programmed to display either the current measurement value (option : “Display current mea. Value”) or the last saved measurement value (option : “Display mea. Value from file”) of the characteristic they are assigned to. Depending on the specific case, if you want to programme a “live” display of the characteristic’s value or rather a result display of the recent measurement, you must select the appropriate display option here while programming the test scheme.

On control or run charts you can input a text which is used as axis label for each value.



In this text you can use the following variables :

Variable	Contents
$n	Number of the displayed measured value
$t	Time on which the measured value was collected
$d	Date on which the measured value was collected
$r1	Customer
$r2	Supplier
$r3	Manufacturer
$r4	Works / Department
$r5	Machine
$r6	Fixture
$r7	Nest
$r8	Tool
$r9	Material
$r10	Test equipment
$r11	Operator
$r12	Shift
$r13	Test place
$r14	Storage place
$r15	Production instruction
$r16	Test instruction
$r17	Events
$r18	Batch number
$r19	Action
$r21 - $r30	User definable reference information 1…10

Note : The variables $r1 - $r30 are only shown when you measure using a test order.

Text Elements
You can input freely definable text to a text element and select the font colour and the element colour.

For each text element you can activate an individual button function in order to simulate a key actuation or enable touch operation by clicking on the text element.
You can assign registers to the text elements. The registers then determine if the text element is to be displayed (register value >= 1) or is to be hidden (register value = 0). The text element is always displayed if no register was assigned to it. *Text elements controlled by registers should not overlap measurement displays, except if you want to hide them by displaying the text element.*
The text elements additionally allow the linking of variables :

Variable	Contents
$Ix	State of digital input Ix
$Mx	Measuring value of measuring input Mx
$Qx	State of digital output Qx
$REGx	Register value of register Rx
$F	Assigned function key, when text element configured as button (e.g. 'F1')
$o0	Order number
$o1	Article number
$o2	Article name
$o3	Order quantity
$o4	Creation date
$o5	Created by
$o6	Order text
$o7	Test step name
$o8	Test step number
$D0-A	Current system date (Format : MM/DD/YYYY)
$D1-A	Current system date (Format : DD.MM.YYYY)
$T0-A	Current system time (Format : HH:MM:SS)

On variables with reference to a characteristic (Cx), the text element always displays the particular value of the characteristic, which the text element has been assigned to. This is also applies to the variables $r1 - $r30, if reference information data has been activated for the characteristic that is assigned to the text element.

Variable	Contents
$Cv	Current measuring value of characteristic Cx
$Cv-0	Last stored measuring value of characteristic Cx
$Cv-1 ... $Cv-x	Second to last stored measuring value of characteristic Cx ... „x+1" to last stored measuring value of characteristic Cx
$Cv0	Characteristic number (1 … 128) of characteristic Cx
$Cv1	Characteristic name of characteristic Cx
$Cv2	Unit of characteristic Cx
$Cv3	Nominal size of characteristic Cx
$Cv4	Upper specification limit (USL) of characteristic Cx
$Cv5	Upper controlling limit (UCL) of characteristic Cx
$Cv6	Lower controlling limit (LCL) of characteristic Cx
$Cv7	Lower specification limit (LSL) of characteristic Cx
$Cv8	Sum of nominal size + upper specification limit (USL) of characteristic Cx
$Cv9	Sum of nominal size + lower specification limit (LSL) of characteristic Cx
$Cv10	1. Master value of characteristic Cx
$Cv11	2. Master value of characteristic Cx
$Cv12	Note (from characteristic's reference information) of characteristic Cx
$Cv13	Upper calibration tolerance of characteristic Cx, relating to last calibration
$Cv14	Lower calibration tolerance of characteristic Cx, relating to last calibration
$Cv15	Upper calibration tolerance of characteristic Cx, relating to Master-Calibration
$Cv16	Lower calibration tolerance of characteristic Cx, relating to Master-Calibration
$Cv17	ID of 1st master
$Cv18	ID of 2nd master

$D0-0	Date of the last stored measuring value of characteristic Cx (Format : MM/DD/YYYY)
$D0-1 ... $D0-x	Date of the second to last stored measuring value of characteristic Cx (Format : MM/DD/YYYY) ... Date of the „x+1“ to last stored measuring value of characteristic Cx
$D1-0	Date of the last stored measuring value of characteristic Cx (Format : DD.MM.YYYY)
$D1-1 ... $D1-x	Date of the second to last stored measuring value of characteristic Cx (Format : DD.MM.YYYY) ... Date of the „x+1“ to last stored measuring value of characteristic Cx

$T0-0	Time of the last stored measuring value of characteristic Cx (Format : HH:MM:SS)
$T0-1 ... $T0-x	Time of the second to last stored measuring value of characteristic Cx (Format : HH:MM:SS) ... Time of the „x+1“ to last stored measuring value of characteristic Cx

$n	Number of measurements of characteristic Cx
$s	Number of measurements of characteristic Cx from current sample On a sample size of 5 the values 0 ... 4 are assigned to $s

$L1 ... $L1000	User defined text blocks (see chapter 7.4)
$LReg1 ... $LReg2000	Variable user defined text blocks (see chapter 7.4) Reg1 to Reg2000 are registers. First, ComGage checks the value of the selected register. Depending on the register value, the corresponding user defined text block is inserted. In this way, the text of a text field or the labeling of a button can be changed by changing the value of a register. If the register has a value below 1 or above 1000, no text is inserted. Example : The placeholder $LReg1 is used. If the register R1 has a value of 1, the user defined text block L1 is inserted. If the register R1 has a value of 2, the user defined text block L2 is inserted.

$r1	Customer
$r2	Supplier
$r3	Manufacturer
$r4	Works / Department
$r5	Machine
$r6	Fixture
$r7	Nest
$r8	Tool
$r9	Material
$r10	Test equipment
$r11	Operator
$r12	Shift
$r13	Test place
$r14	Storage place
$r15	Production instruction
$r16	Test instruction
$r17	Events
$r18	Batch number
$r19	Action
$r21 - $r30	User definable reference information 1…10

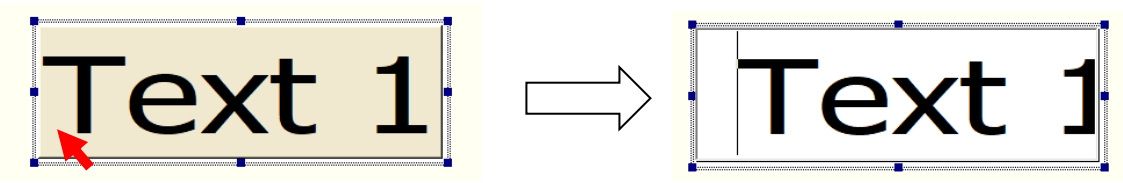
Note : The variables $r1 - $r30 and $o0 - $o7 are only shown when working with test orders.

By using the placeholders $r1 - $r30 the current content of the related reference information type is displayed. But it is also possible to display the reference information of saved values in text elements.
To do this, the placeholders above have to be extended in the following way (here as an example for reference information type 18) :

Variable	Contents
$r18-0	Batch number of the last stored measuring value of characteristic Cx
$r18-1 ... $r18-x	Batch number of the second to last stored measuring value of characteristic Cx ... Batch number of the „x+1“ to last stored measuring value of characteristic Cx

Additional to the above mentioned procedure for editing display elements that have already been set into the display window, the content of text elements can be edited directly.

To open a text element for editing, please double-click it :

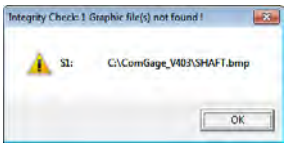


After the changes are made, press the <ENTER> button or click next to the text element to end the editing mode.

Line Elements
You can create line elements and define the thickness and colour of the line.

Picture Elements
A picture can be selected (only pictures in ***.bmp, *.png, *.jpg** format can be used).
The maximum number of picture elements that can be displayed in one test step is limited to 50.
This limit was set to 10 in older ComGage versions. You can assign registers to the picture elements. The registers then determine if the picture element is to be displayed (register value = 1) or is to be hidden (register value = 0). The picture element is always displayed if no register was assigned to it.
You can assign individual button functions to the picture elements, same as for text elements (see previous section “Text Elements”).

On opening a test scheme by the ComGage menu **File / Test Scheme / Create & Change** (button : )
an integrity check is executed concerning the physical presence of the graphic files used by the test scheme.
In case a graphic file used by the test scheme is missing, you will receive the error message shown below. The message indicates the affected test step as well as the name and path of the missing graphic file.



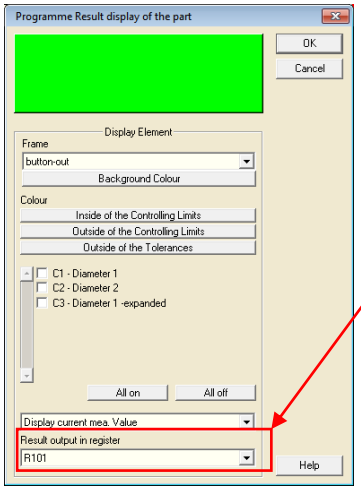
8.) Keys

The programming of the display elements can be done by using the following keys :

Key	Function
“TAB”	Moves the cursor from button to button and from display element to display element
“SPACEBAR”	Presses a button
Cursor keys	Moves a display element / Selection of menu points
“Shift” + Cursor	Changes the size of a display element
“Enter” or “Menu”	Opens the menu for editing and deleting the currently selected display element
“Del”	Deletes the currently selected display element
D	Duplicates the currently selected display element
“Ctrl” + “C”	The selected display element is copied to the Windows clipboard
“Ctrl” + “V”	The selected display element is inserted from the Windows clipboard
“Ctrl” + “Z”	The recent action on programming the display window is “undone”
“Ctrl” + “Y”	The recently cancelled action on programming the display window is “redone”
A	Loads the display elements from a saved display window content (.dwc-file) and adds these to the display window content of the current display window
L	Loads a saved display window content (.dwc-file) into the current display window and at the same time overwrites the previous display window content
S	Saves the current display window content as .dwc-file to a selectable directory
“PgUp” / “PgDn”	Changes to the display window of the previous / next test step
F	Opens a preview of the full screen window. The *Workplace Settings* for the full screen window are also used for this preview.

9.) Result displays with output in register

The result of a result display can be loaded into a register (see option marked below).



The selected register for output of the display element's result (here R101) will adopt one of the following values :

Rx = 0 → The result is inside the controlling limits or, if no controlling limits are activated, inside the tolerance limits (display colour : green)

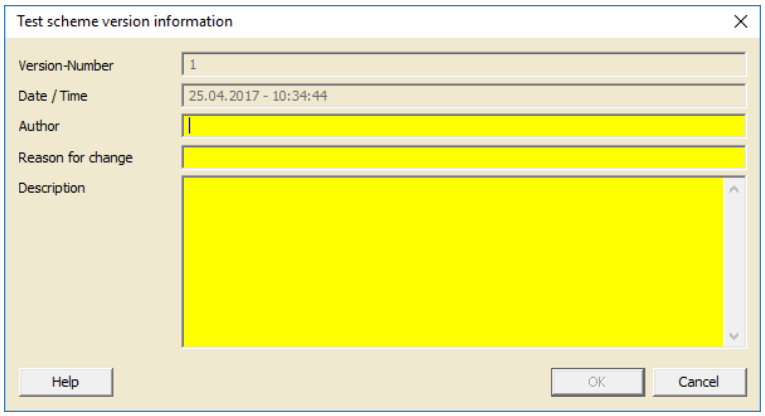
Rx = 1 → The result is inside the specification limits and outside the controlling limits (display colour : yellow)

Rx = 2 → The result is outside the specification limits (display colour : red)

7.13 Version management of test schemes

In order to use the version management of test schemes, the option “Test scheme versioning” has to be activated in the menu “Options / Workplace settings” (see chapter 6.11).

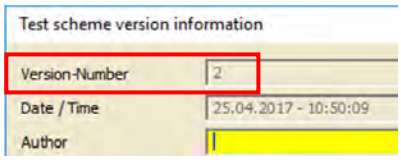
When a test scheme is now saved, the window “Test scheme version information” opens.



The Version-Number as well as Date / Time are entered automatically.
The Author, the Reason for change and a Description are to be added. With all fields filled, the entries can be confirmed by clicking the **OK** - button.

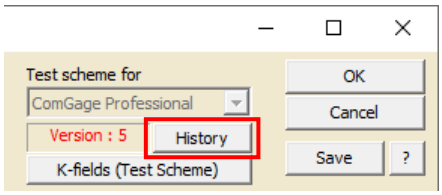
Note : The entries made cannot be changed anymore afterwards.

When this test scheme is saved again, the Version-Number automatically increases :



The old version of the test scheme is also not overwritten, but saved separately with an extended file name containing the hitherto existing Version-Number.
Example : When a new version of the test scheme “Test scheme.tsf” is saved, the old version is archived with file name “Test scheme.tsf.1”.
The old test scheme version can again be used as normal test scheme by simply removing the version number from the file name.

After a test scheme version 1 has been saved, the Version history is accessible :



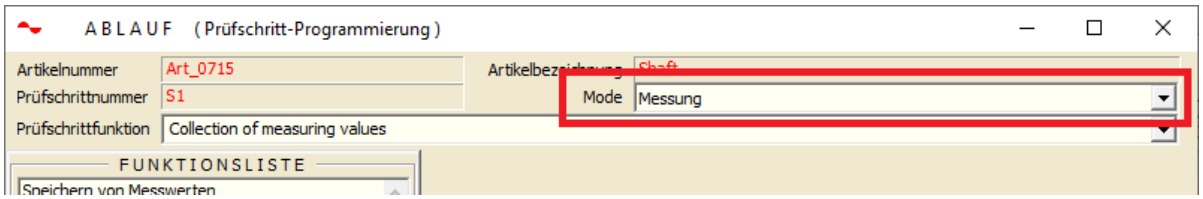
The Version history shows an overview of all hitherto existing versions incl. all recorded version information. By double-clicking one of the records in the overview, it is displayed in the window “Test scheme version information”.

Note : The version management cannot be disabled for a test scheme it was once enabled for.

If a test scheme with activated version management is duplicated, you can select whether or not the version information shall also be adopted.

7.14 Particularities of test scheme programming when using AQDEF

1. The test scheme has to be separated into several sections, e.g. one section for the measurement, one section for the calibration, one section for the master control measurement, … .
   The beginning of each section has to be marked by selecting an appropriate mode in the first test step of this section :



2. At the end of each test step, the measurement mode has to be exited. Only in this way the Info dialogue can get the control back before the next measurement.
   For this purpose, please add the test step function „Exit measurement mode“ at the end of each section to your test scheme.

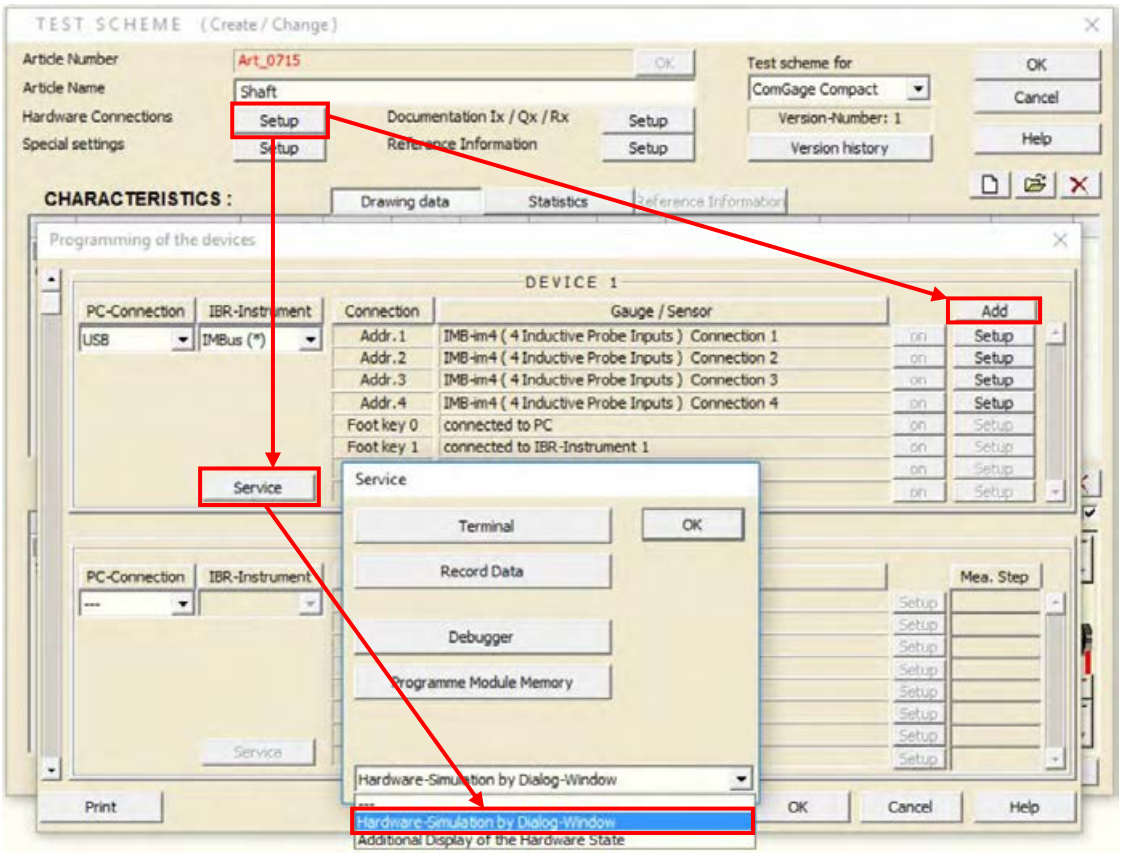
3. In sections for master control measurement and calibration the register R990 has to be set to 0 / 1, depending on the result of the master control measurement / calibration.
   Via this register, the info dialogue is informed about the result of the master control measurement / calibration.
   The already integrated functions for master control measurement, zero adjustment and calibration do this automatically.
   But if you create your own routine for e.g. a master control measurement, without using the provided functions, you have to manually save the result of the master control measurement in the register R990 by using the test step function „Setting register(s)“.

8. Programming examples

8.1 Example 1 (Multi gauging application with IMBus measuring hardware)

Basic settings :

Select the menu “Test Scheme [Create / Change]” to create a test scheme with article number „Art_0715“ and article name “Shaft”. Click on the **Setup** - button of the option “Hardware Connections” in the programming window of the particular test scheme. Arrange the hardware configuration (1 x IMB-im4) in the window for configuring the interface and activate the simulation mode, as described in chapter 7.2.

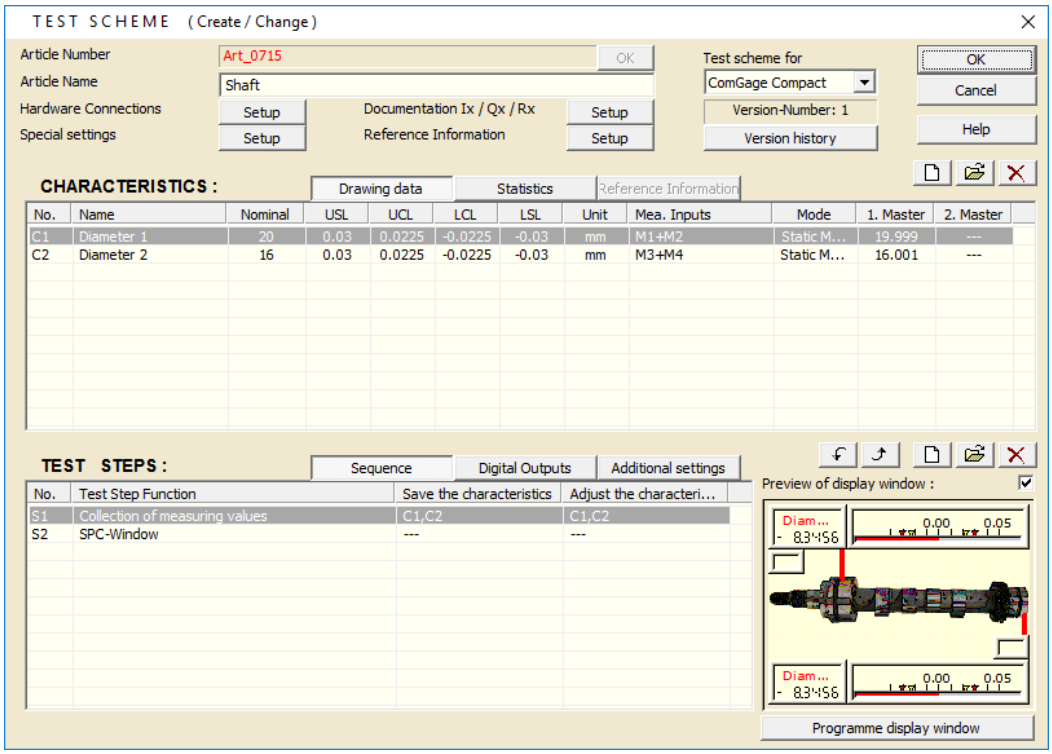


Application :

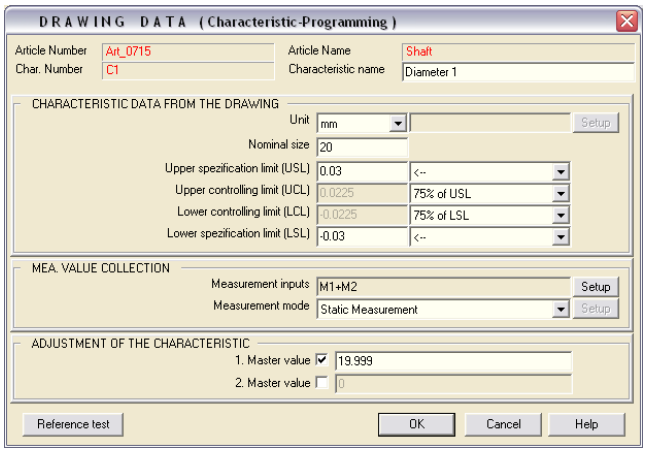
- Measurement of two diameters of a shaft.
- On pressing the **F1** - key the measuring values shall be stored in file.
- On pressing the **F2** - key the characteristics shall be calibrated.
- On pressing the **F3** - key the statistic window shall be opened.

Programming the test scheme :

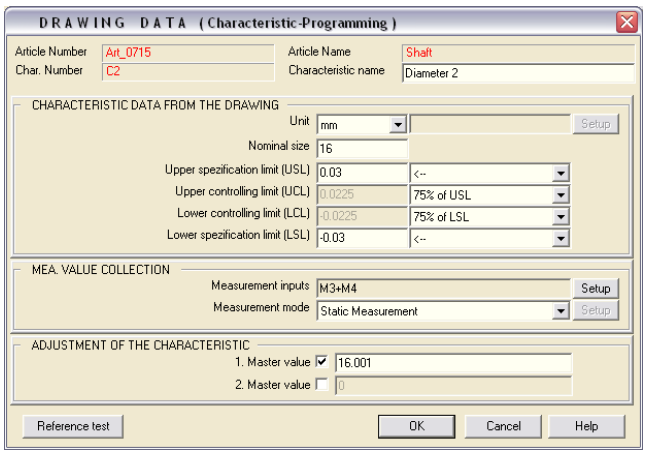
Programming the test scheme is done in the “Test scheme (create / change)” window.



Creation of both characteristics for measuring two diameters (see brief overview – chapter 4.2) :

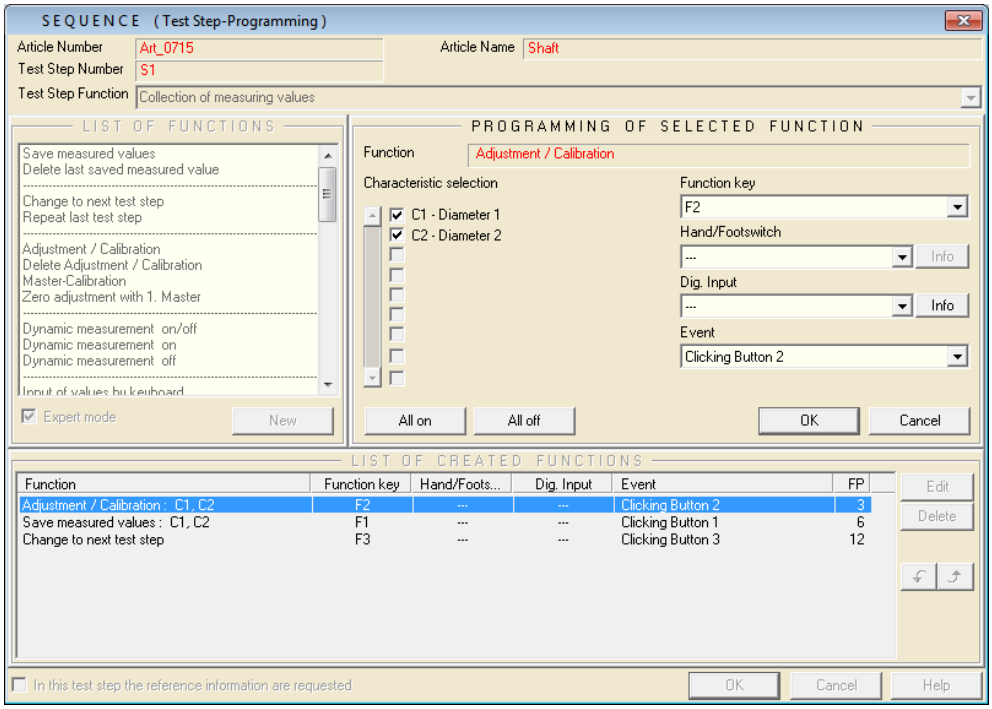


The diameter is calculated by the formula M1+M2 and is collected by a static measurement.



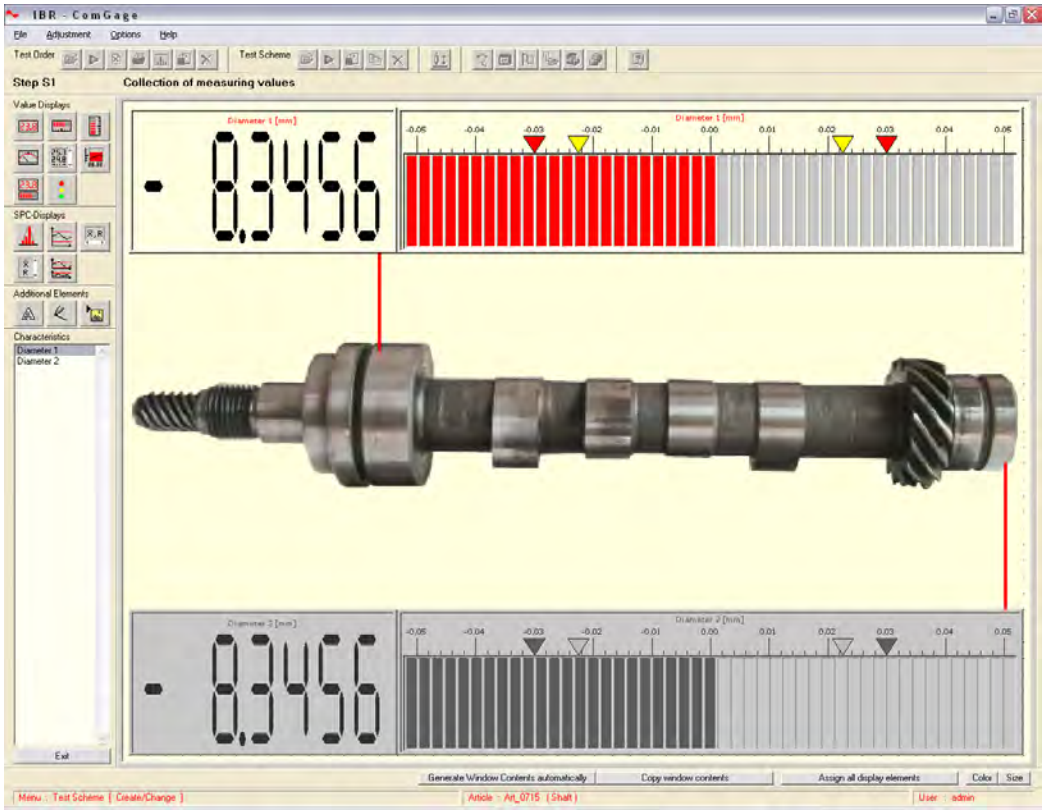
The diameter is calculated by the formula M3+M4 and is collected by a static measurement.

Creation of a test step for collecting the measuring values (see brief overview – chapter 4.2) :

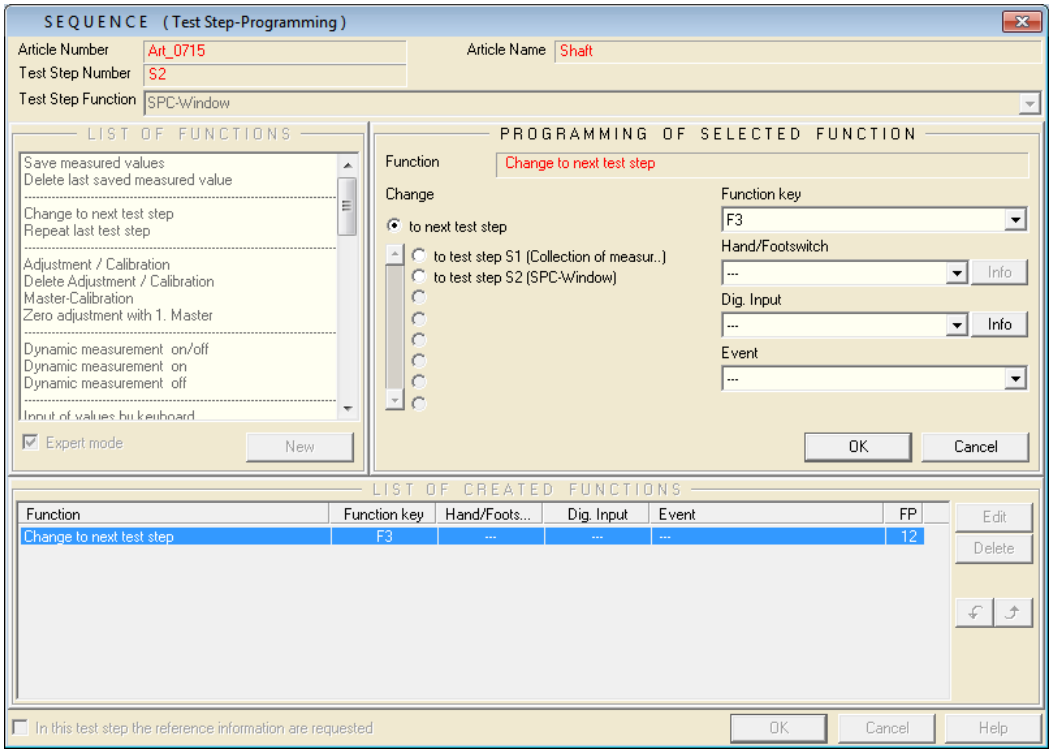


- On pressing the **F1** - key the measuring values are stored in file.
- On pressing the **F2** - key the characteristics are calibrated.
- On pressing the **F3** - key the statistic window is opened.

Creation of the following display window for test step S1 :

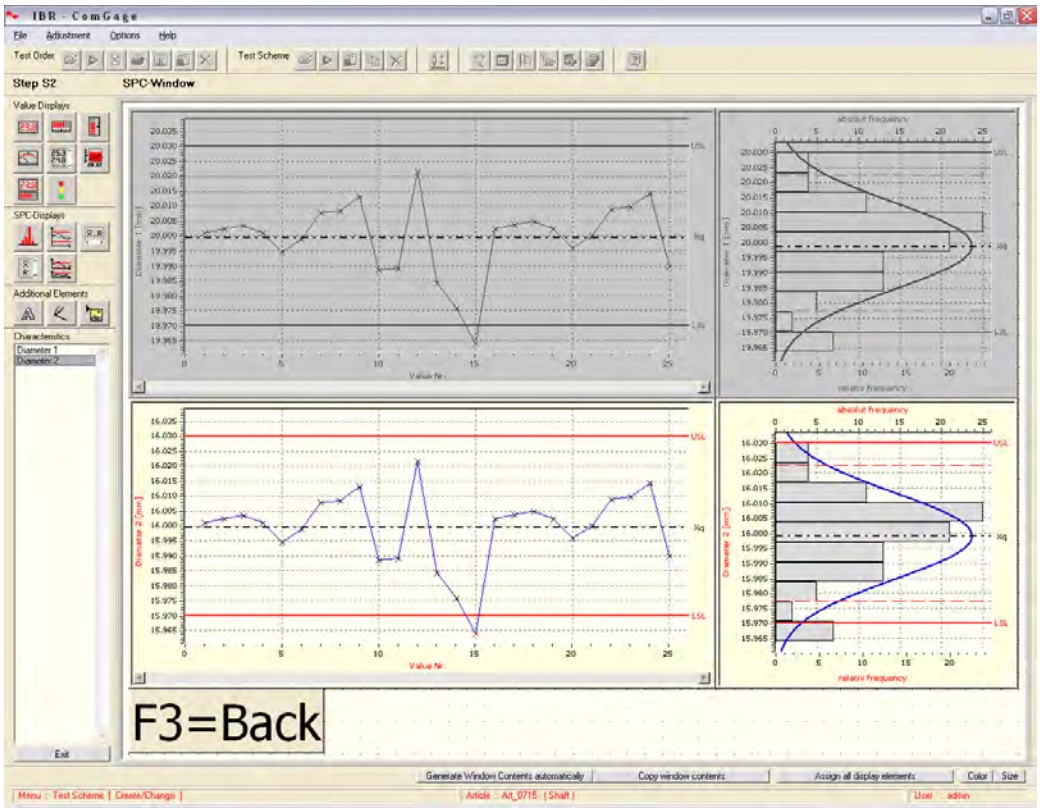


Creation of a second test step for statistic display (see brief overview - chapter 4.2) :



- On pressing the **F3** - key ComGage returns to measurement window (= test step S1).

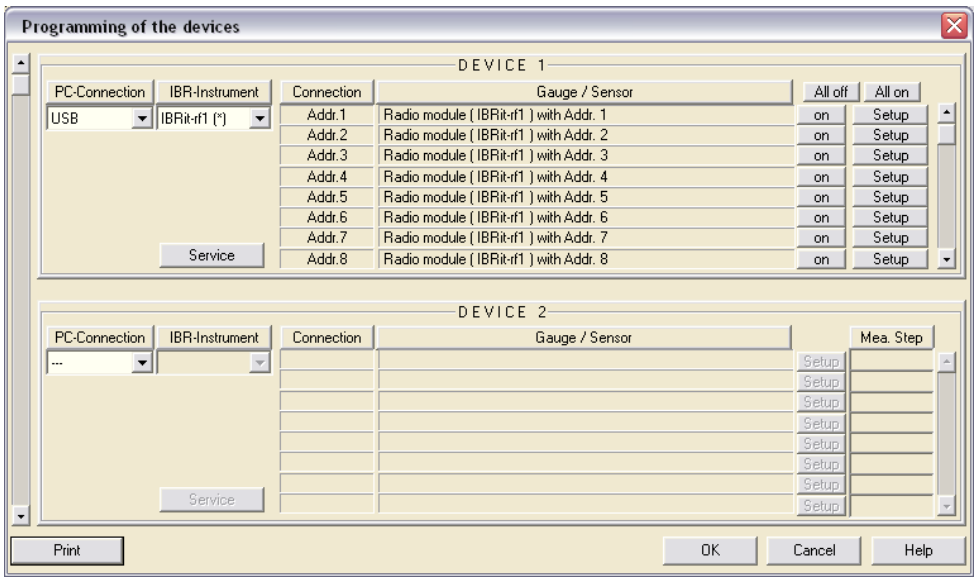
Creation of the following display window for test step S2 :



8.2 Example 2 (Collection of several characteristics one after the other with IBRit-rf1)

Basic settings :

Select the menu “Test Scheme [Create / Change]” to create a test scheme with article number „Art_0716“ and article name “Shaft”. Click on the **Setup** - button of the option “Hardware Connections” in the programming window of the particular test scheme. After connecting the IBRit-rf1-usb radio module to the PC you must select „USB“ as PC-Connection and „IBRit-rf1“ as IBR-Instrument (see chapter 7.2).



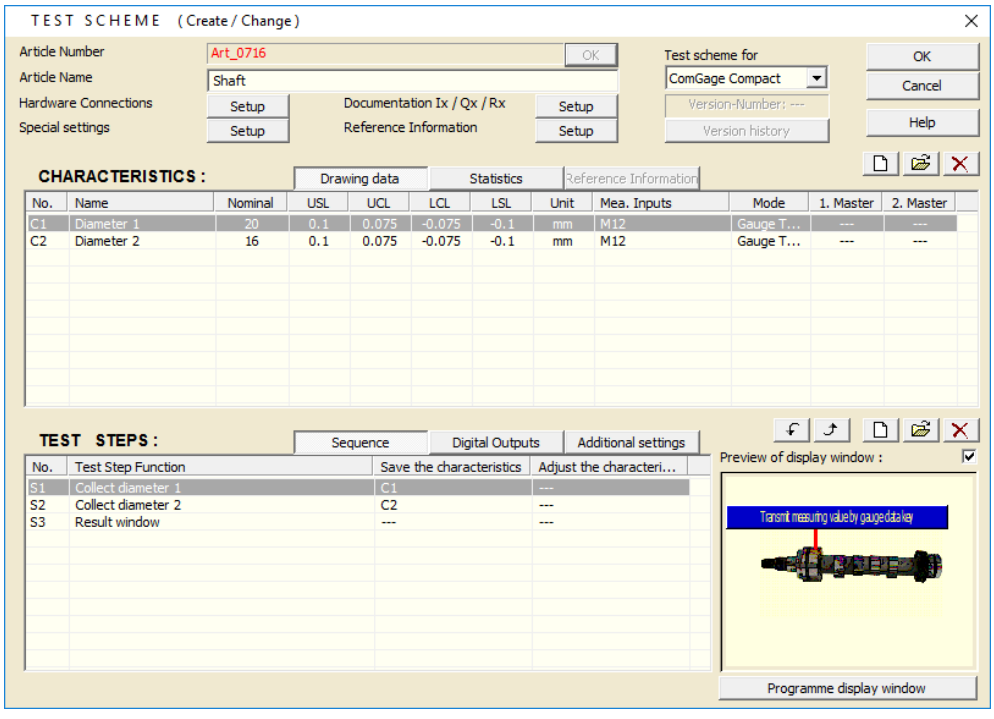
Note :
Starting with ComGage V5.0 the simulation mode can be activated for IBRit-rf1, too (see chapter 7.2).

Application :

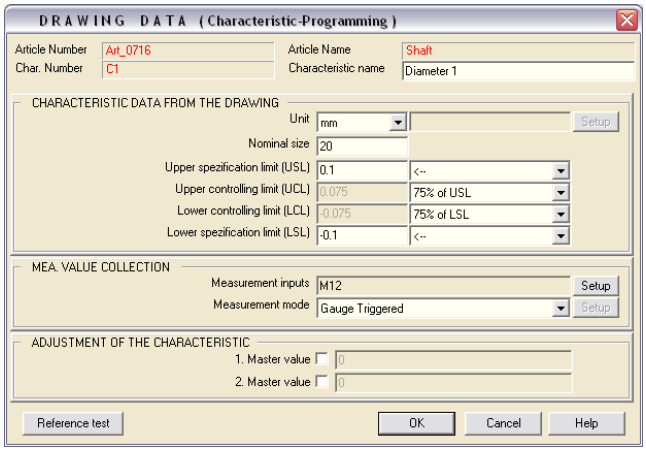
- Measurement of two diameters one after the other with a calliper.
- On pressing the **F10** - key the last collected measuring value shall be deleted and the collection shall be repeated.

Programming the test scheme :

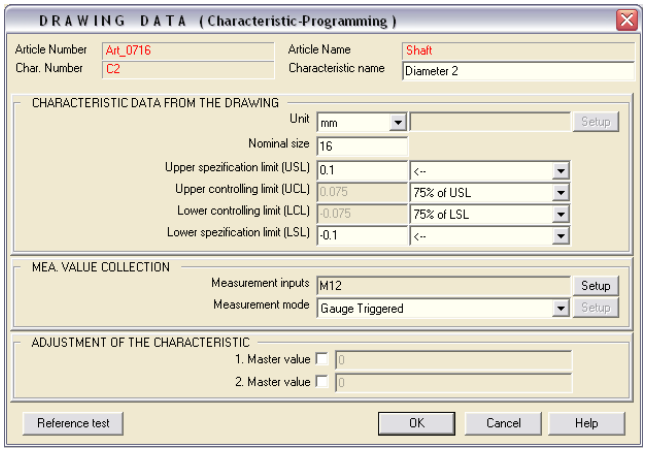
Programming the test scheme is done in the “Test scheme (create / change)” window.



Creation of both characteristics for measuring two diameters (see brief overview – chapter 4.2) :

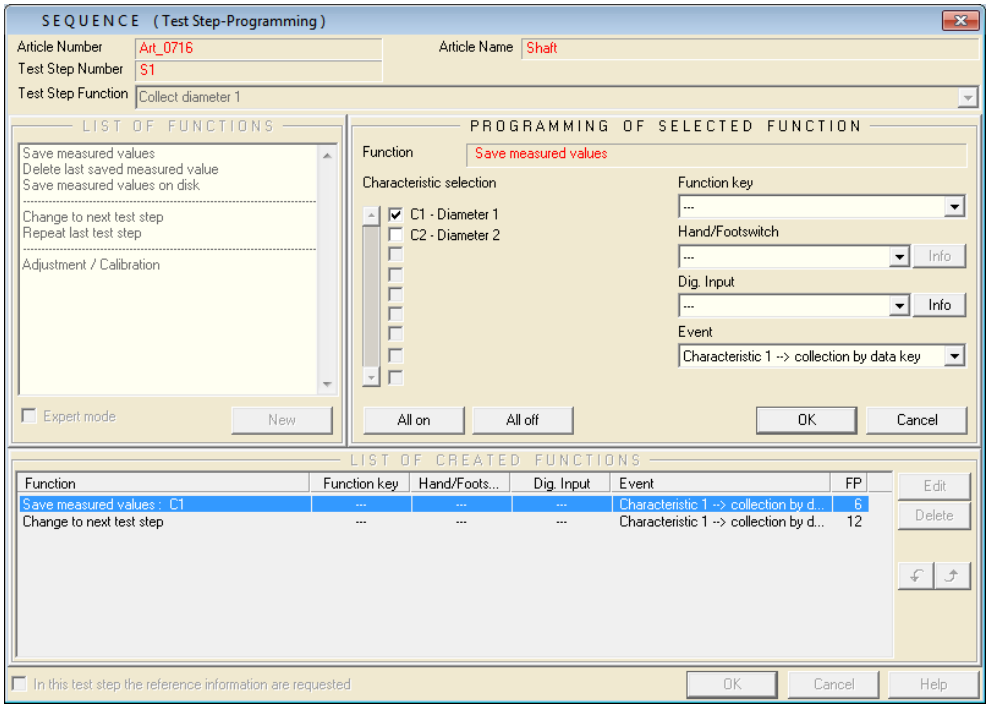


The diameter is transmitted by data key (gauge triggered mode) of radio module with addr. 12 (M12).
The zero adjustment does not occur in software but directly on calliper – so no master values are input.



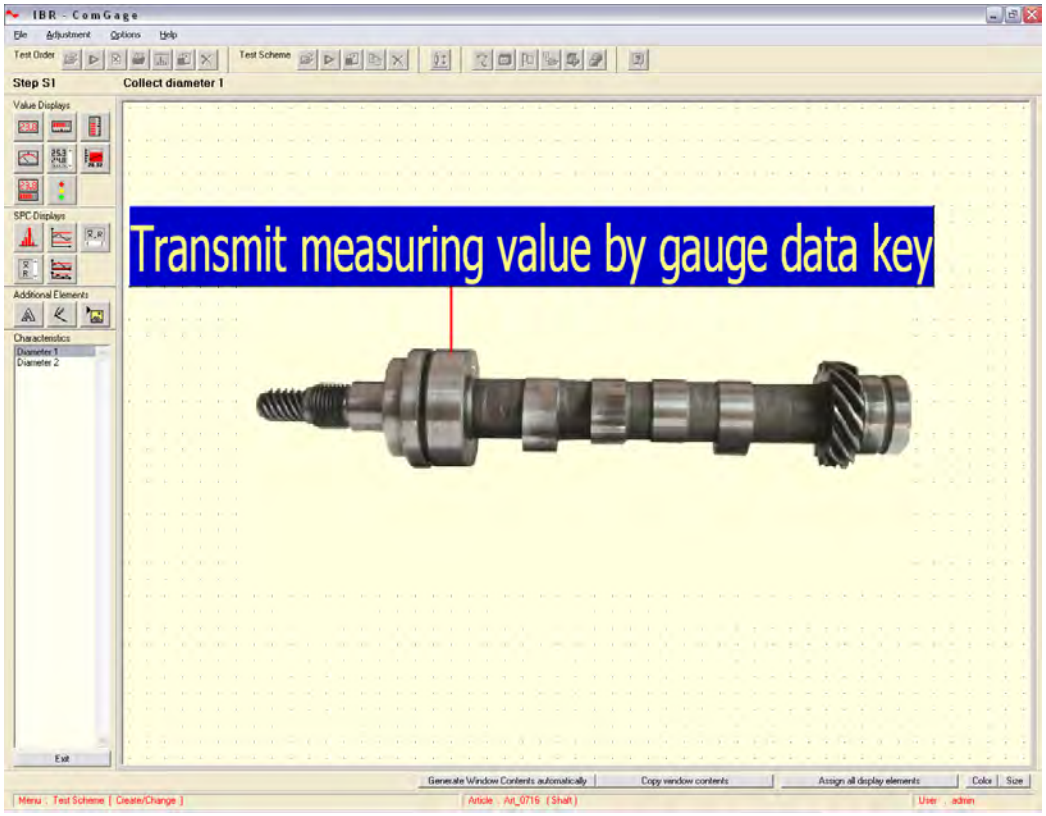
The diameter is transmitted by data key (gauge triggered mode) of same radio module.
The zero adjustment does not occur in software but directly on calliper – so no master values are input.

Creation of a test step for collecting diameter 1 (see brief overview - chapter 4.2) :

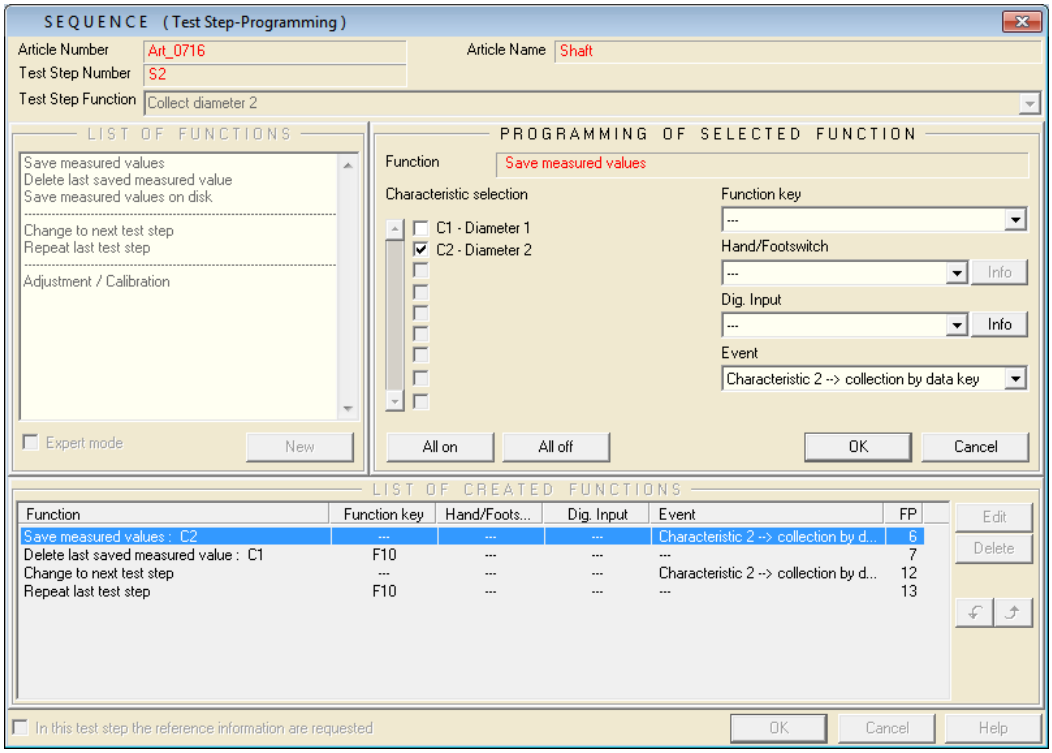


On transmission of a measuring value by data key of the radio module or calliper the received measuring value is automatically stored for characteristic C1. Then ComGage automatically switches to the next test step for collection of characteristic C2.

Creation of the following display window for test step S1 :

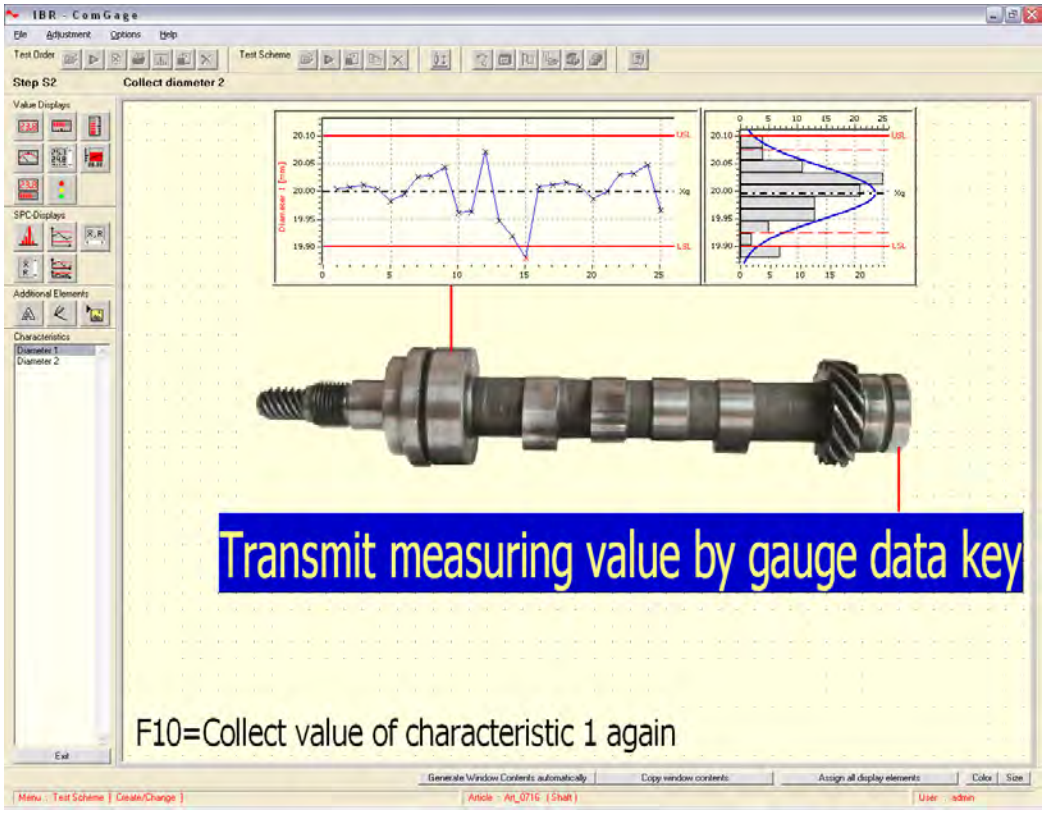


Creation of a second test step for collecting diameter 2 (see brief overview – chapter 4.2) :

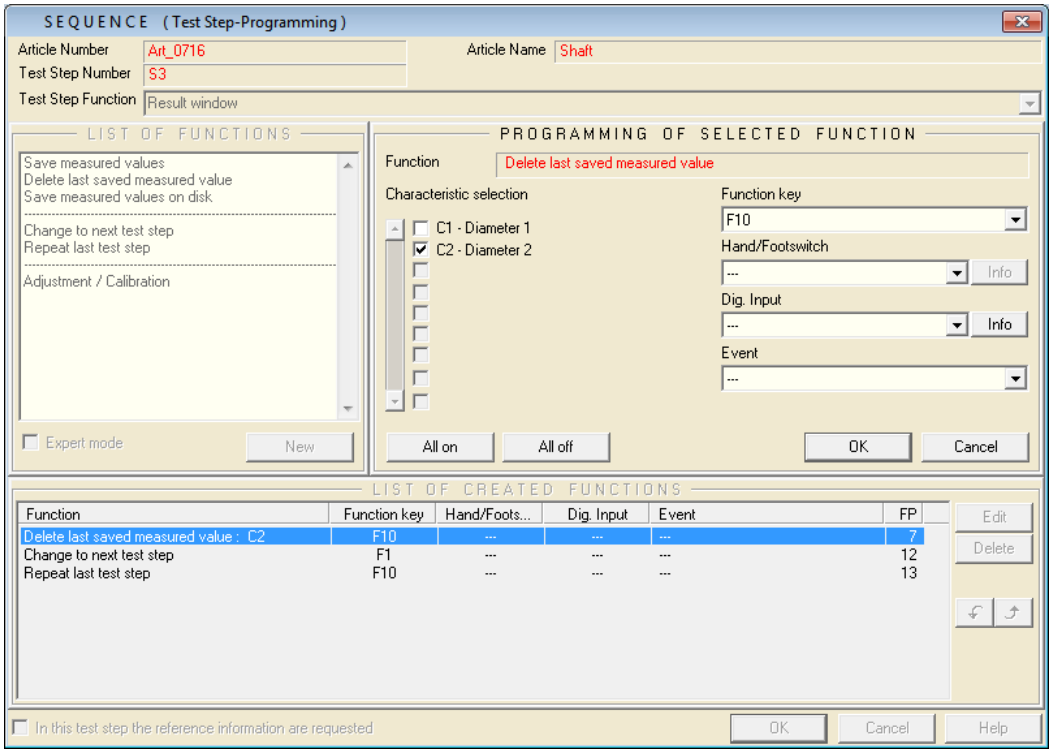


On transmission of a measuring value by data key of the radio module or calliper the received measuring value is automatically stored for characteristic C2. Then ComGage automatically switches to the next test step. On pressing the **F10** - key the last measuring value of characteristic C1 is deleted and ComGage returns to the previous test step for new measurement of characteristic C1.

Creation of the following display window for test step S2 :

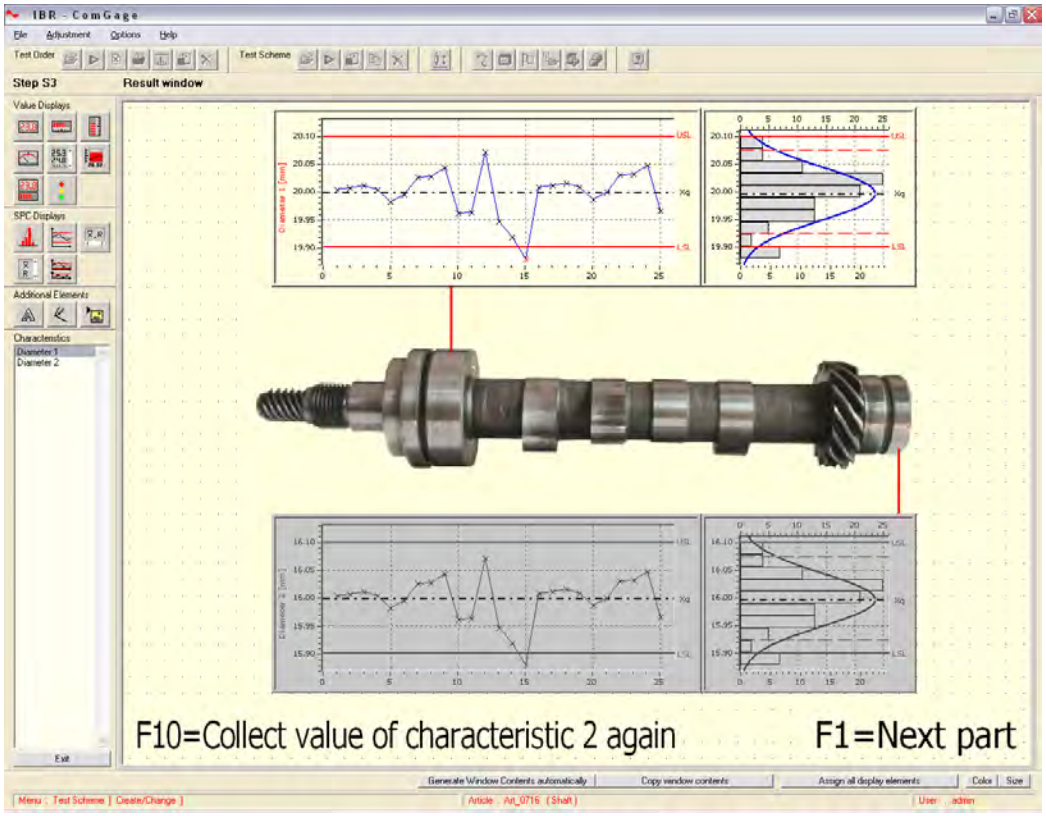


Creation of a third test step for displaying the collected measuring results of diameter 1 and diameter 2 :



On pressing the **F10** - key the last measuring value of characteristic C2 is deleted and ComGage returns to the previous test step for new measurement of characteristic C2.
On pressing the **F1** - key the measurement of the next component is started.

Creation of the following display window for test step S3 :



8.3 Example 3 (Keyboard input, static and dynamic measurements with IMBus)

Basic settings :

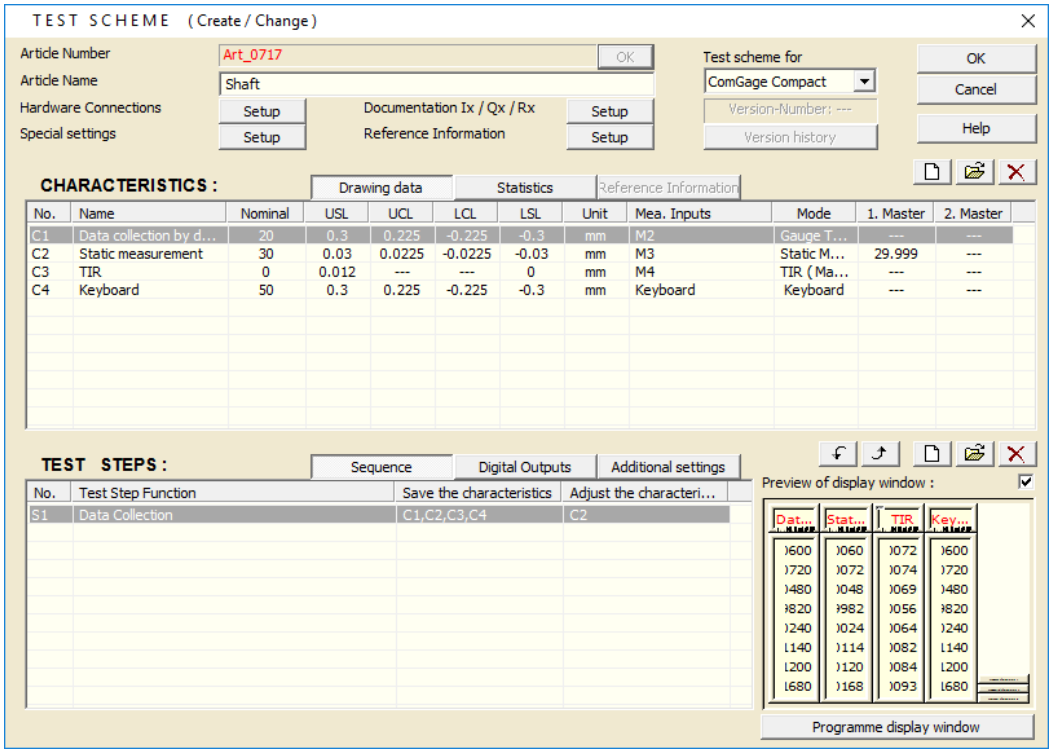
Select the menu “Test Scheme [Create / Change]” to create a test scheme with article number „Art_0717“ and article name “Shaft”. Click on the **Setup** - button of the option “Hardware Connections” in the programming window of the particular test scheme. As described in chapter 7.2, arrange the hardware configuration (1 x IMB-im4) in the window for configuring the interface and activate the simulation mode (see also chapter 8.1).

Application :

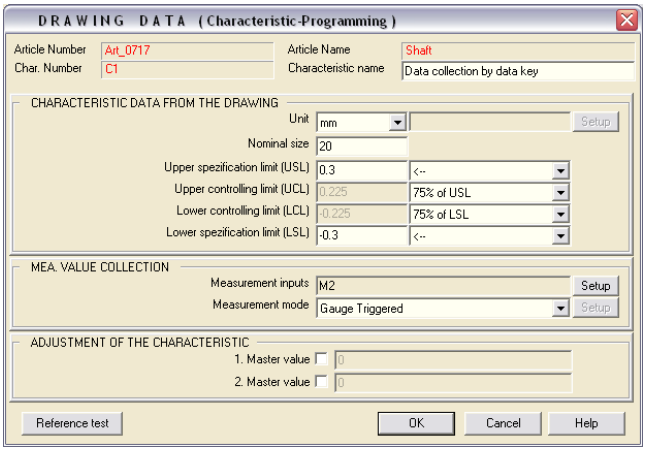
Collection of several characteristics by different measurement modes or keyboard input.

Programming the test scheme :

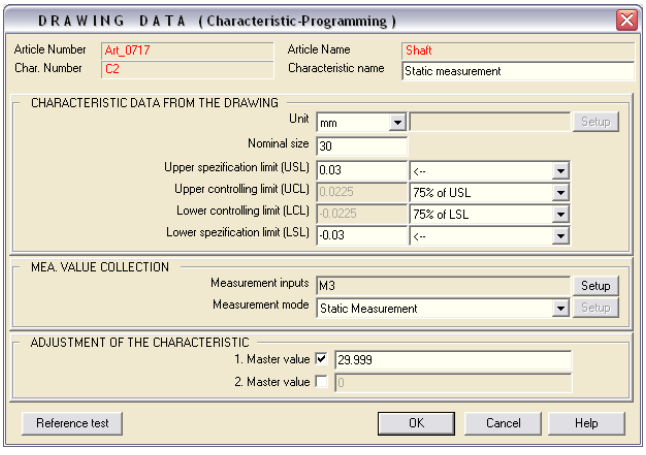
Programming the test scheme is done in the “Test scheme (create / change)” window.



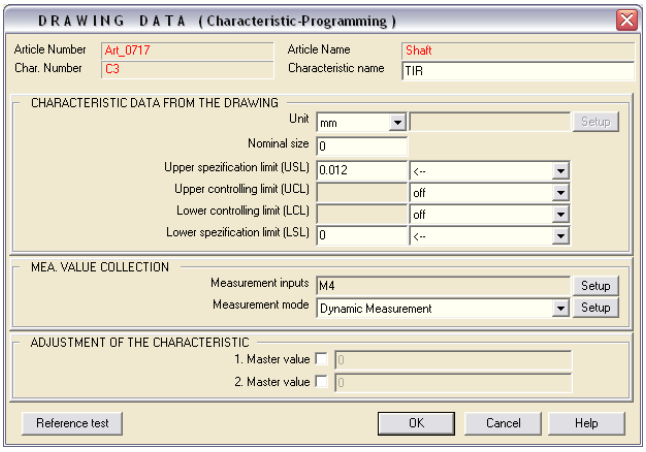
Creation of the characteristics for the measurements planned (see brief overview – chapter 4.2) :



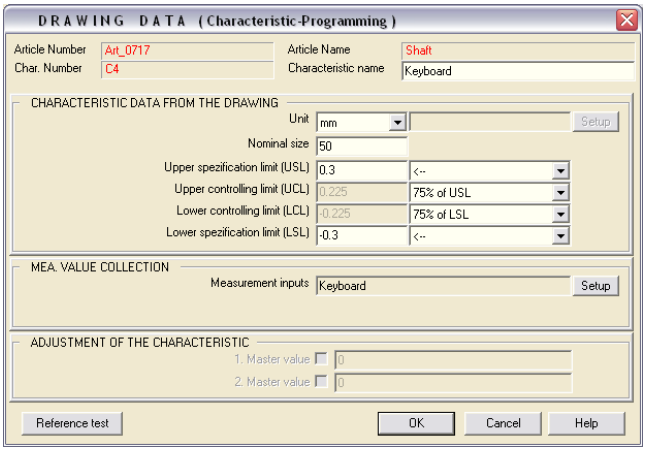
The measuring values of characteristic C1 are transmitted by data key of gauge (gauge triggered mode).



The measuring values of characteristic C2 are displayed continuously and shall be stored by function key (static mode).

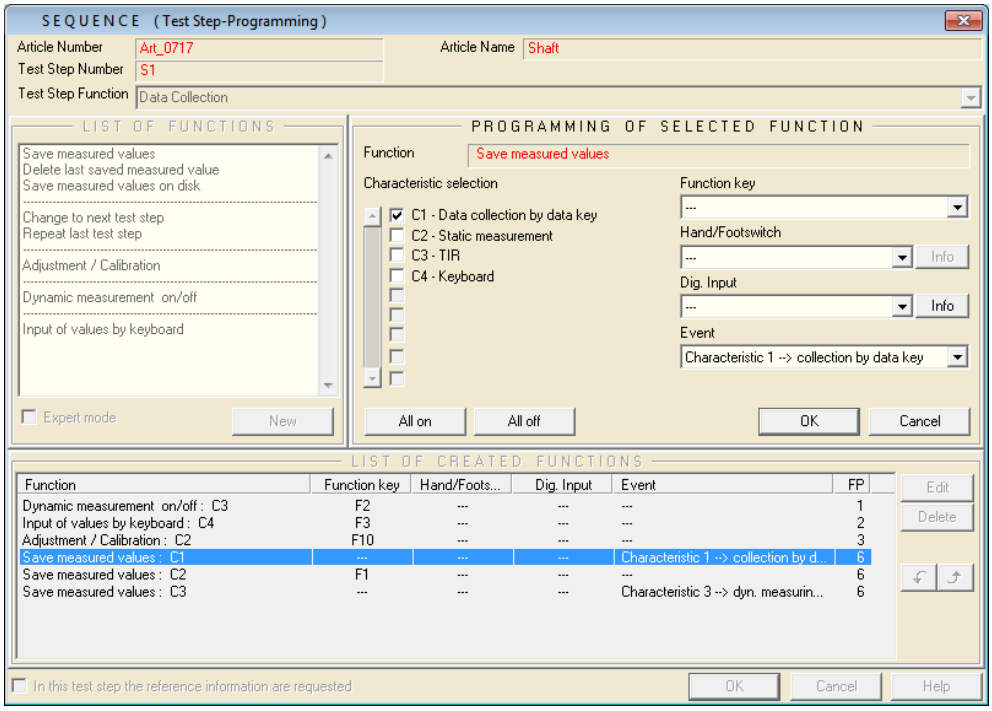


The TIR measurement of characteristic C3 shall be started by function key and stopped by a second pressing of function key. The TIR value shall be automatically saved on stopping the dynamic measurement (dynamic mode).



On pressing a function key the window for keyboard input shall be opened.

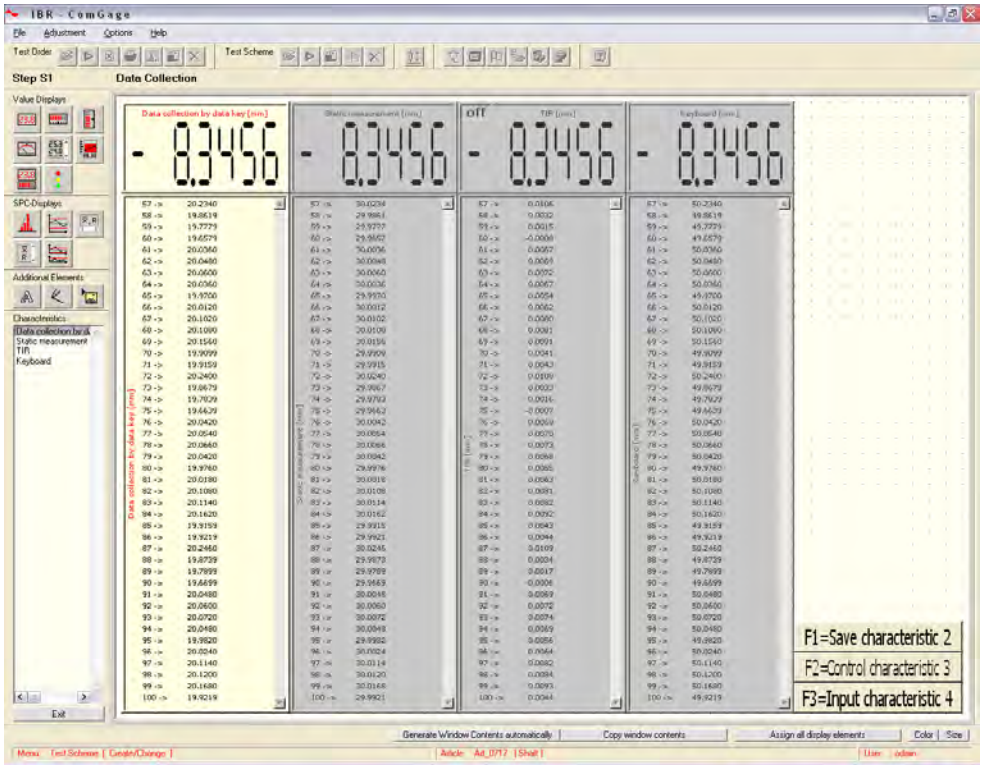
Creation of a test step for data collection (see brief overview – chapter 4.2) :



- All measuring values of characteristic C1 transmitted by data key of gauge are saved in file.
- On pressing the **F1** - key the measuring values of characteristic C2 are saved in file.

- On pressing the **F2** - key the dynamic measurement of characteristic C3 is started or stopped. On stopping the dynamic measurement the found TIR value is automatically saved in file.
- On pressing the **F3** - key the window for input of characteristic C4 by keyboard is opened.
- On pressing the **F10** - key the characteristic C2 is calibrated.

Finally, the display window for the test step must be created :



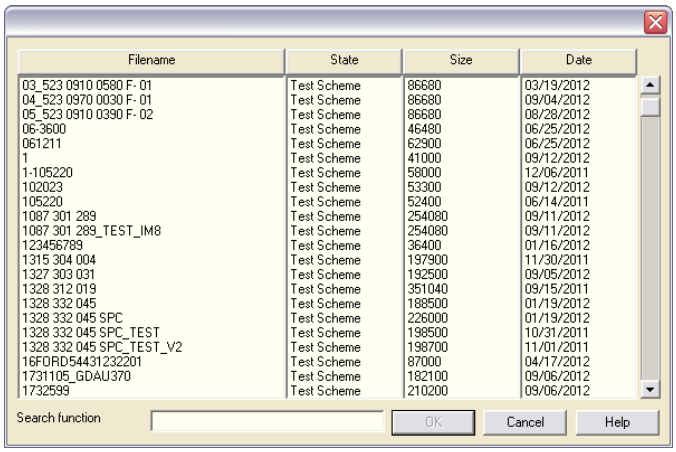
9. Starting the test scheme (measuring)

This menu is intended for testing the function of the test scheme before you create the test orders.

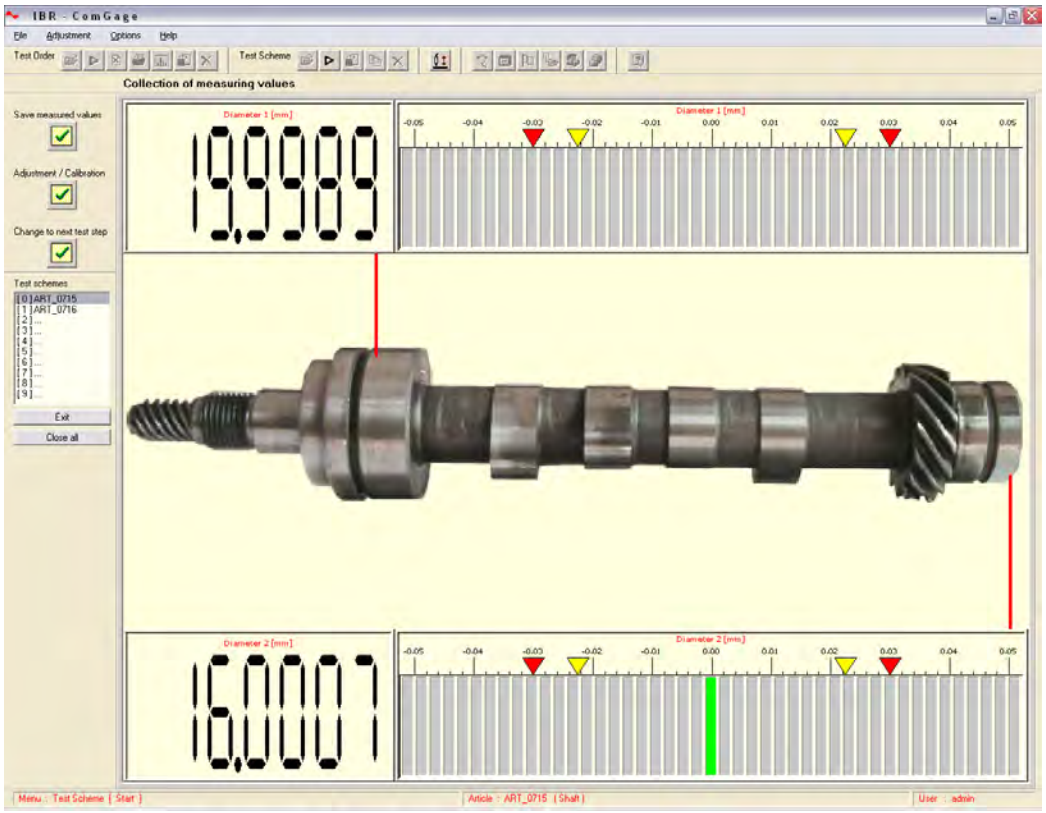
The measurement values you have collected in this menu are not saved and get lost, when you stop measurement operation.

You start the test scheme by clicking the **File / Test Scheme / Start** menu (Button : ).

After you have selected the menu you must select the test scheme / test schemes you want to start. You can easily find a specific test scheme among lots of existing test schemes by using the search function :



In this menu it is possible to start up to 10 test schemes at the same time.
After the start of a test scheme ComGage automatically assigns one of the keys 0 ... 9 to the test scheme.

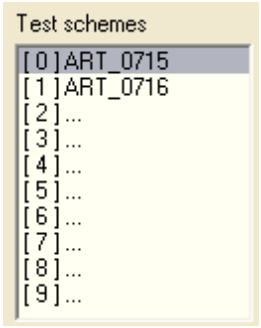


1.) Starting an additional test scheme

You can start an additional test scheme by clicking the **File / Test Scheme / Start** menu (Button: ). One of the keys 0 … 9 is then automatically assigned to the test scheme.

2.) List of started test schemes

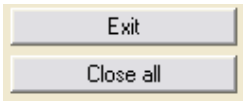
The started test schemes and their keys 0 ... 9 are shown in following list :



The number left of the article number (e.g. [0]) informs you which key you must press to start measuring with the particular test scheme. By clicking on the test scheme it is automatically started.

3.) Closing of one test scheme or all test schemes

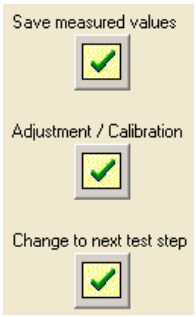
By clicking the **Exit** - Button you can close the currently measuring test scheme.
By clicking the **Close all** - Button you can close all started test schemes.



When all test schemes are closed the menu is left automatically.

4.) Buttons

The buttons are assigned to a function in the test scheme for execution of that particular function (see chapter 7.9).

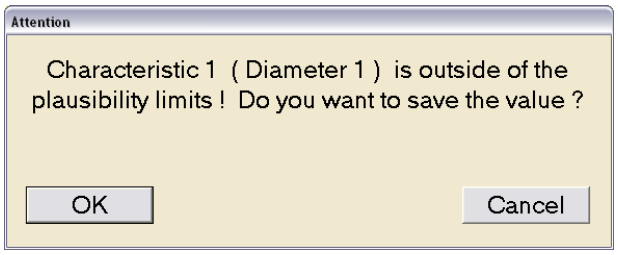


5.) Adjustment Button

By clicking the following button in the menu bar you can open the window *mechanical adjustment of inductive probes*. (See chapter 15.1 for menu description)

6.) Saving values

If a measurement value is outside the plausibility limits, then the following window is displayed.



By clicking the **Cancel** - button the measurement value is rejected, i.e. it is not saved.

!!! When this window is open, ComGage stops further measuring until the window is closed.

7.) Deleting values

If the operator has done a faulty measurement, he can delete the wrong measurement values of the last component and can repeat the measurement. But he cannot delete the measurement values of previously measured components.

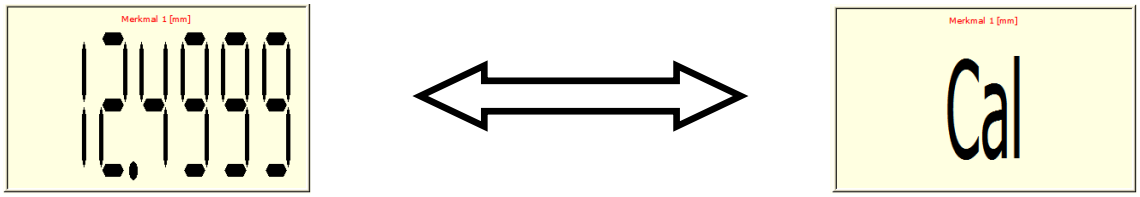
8.) Zero adjustment and gauge calibration

If the programmed condition for execution of the function “Adjustment / Calibration” is fulfilled, then a zero adjustment or gauge calibration is executed.

On zero adjustment the programmed master values are adopted as measurement values of the particular characteristics.

You must provide a numeric display in the display window of your test step in order to execute a gauge calibration with 2 masters. On gauge calibration the measured value is stored as first master value as soon as the programmed condition for execution of the function “Adjustment / Calibration” is fulfilled the first time. Afterwards the numeric display alternately indicates “Cal” and the measured value. As soon as the programmed condition for execution of the function “Adjustment / Calibration” is fulfilled the second time, the measurement value of the second master is adopted and the corresponding parameters (offset and factor) are calculated. The gauge calibration is completed.

So you must insert the first master into the fixture before the first fulfilment of the programmed condition for execution of the function “Adjustment / Calibration” and the second master before the second fulfilment of the programmed condition for execution of the function “Adjustment / Calibration”.



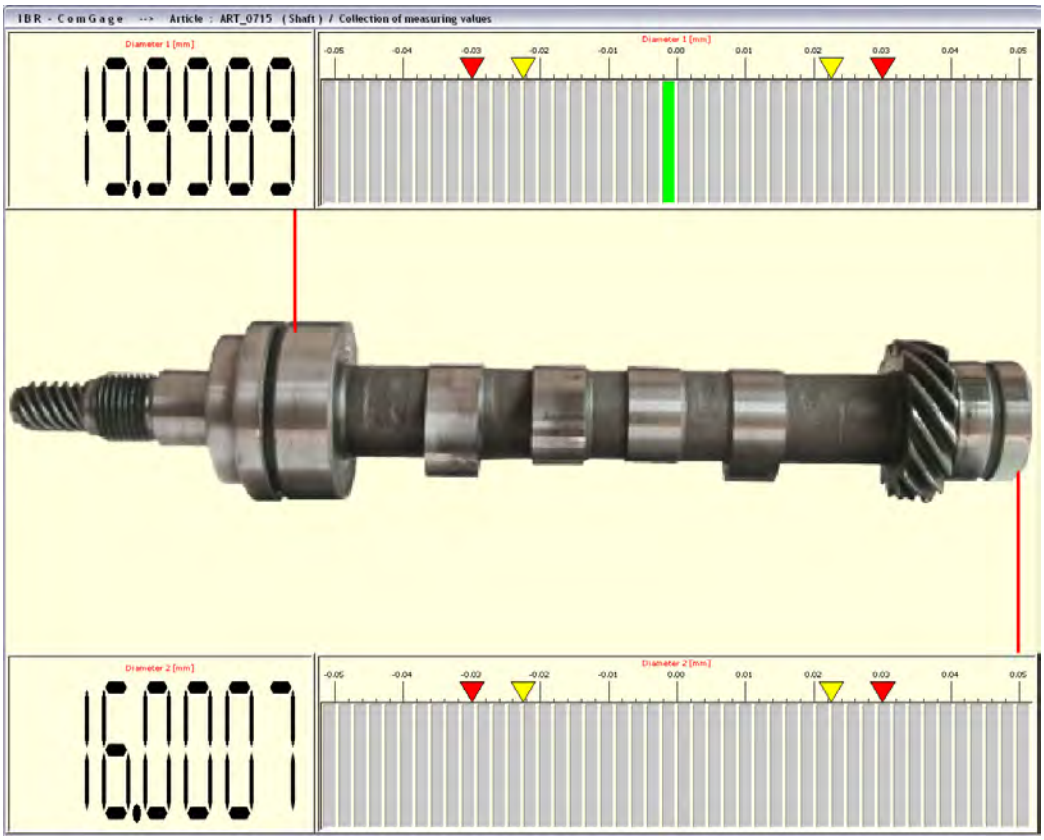
9.) Keys

The following function keys are available for operating the measurement mode :

Key	Function
TAB, +	Moves the cursor from button to button
SPACEBAR, ENTER	Presses the selected button
F1, F2, ...	The functions of the function keys are defined in the test scheme
/	Switches the window to full screen mode and back to normal mode
Cursor	Scrolling within the statistical display elements (with scrollbar)
0 … 9	Selection of a test scheme

10.)Full screen mode

Example of full screen mode :



10. Additional test scheme menus

10.1 Convert

By clicking the **File / Test Scheme / Convert** menu (Button : ) you can convert your test scheme into a Word-file for documentation purposes. At first you must select the test scheme, which you want to convert. You can easily find a specific test scheme among lots of existing test schemes by using the search function. At the beginning of the conversion process the message shown below will appear.

10.2 Duplicate

By clicking the **File / Test Scheme / Duplicate** menu (Button : ) you can duplicate a test scheme. At first you must select the test scheme, which you want to duplicate. You can easily find a specific test scheme among lots of existing test schemes by using the search function. After this you have to enter the article number of the new test scheme and at last you can modify the test scheme settings (see chapter 7 for details).
An existing K-field configuration on test scheme level (*.tsDFD) is duplicated together with the test scheme.

10.3 Delete

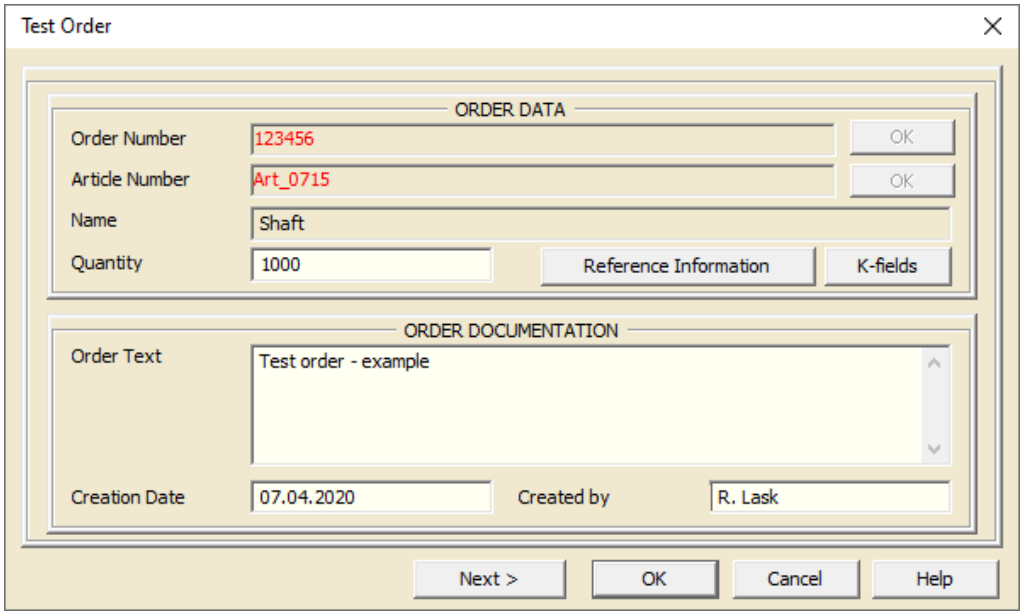
By clicking the **File / Test Scheme / Delete** menu (Button : ) you can delete one or more test schemes. You can easily find a specific test scheme among lots of existing test schemes by using the search function. After selecting the test schemes which are to be deleted, you can delete them by clicking the **OK** - button. Prior to deletion you must however confirm a warning message in order to avoid deleting by mistake.
An existing K-field configuration on test scheme level (*.tsDFD) is deleted together with the test scheme.

11. Creating a test order

A test order serves to assign measurement and test data to the corresponding production lots or customer orders.

At first the data of the test order head must be entered and then the test scheme of the component you want to produce and test is selected.

In the **File / Test Order / Create & Change** menu (Button : ) test orders can be programmed. For that, the window shown below is opened.



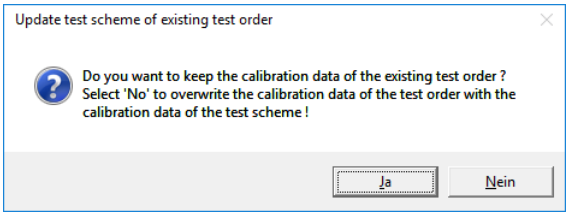
At first you have to enter the *Order Number*. If you input an existing *Order Number* you can modify the particular test order, otherwise you create a new one.

A data path can be entered preceding the order number. This entered data path is relative to the data directory (see chapter 6.4) and must already exist. ComGage does not create any new subdirectories.
*(Example : **Machine 1\Art-1234** → The test order **Art-1234** is created in the subdirectory **Machine 1**)*

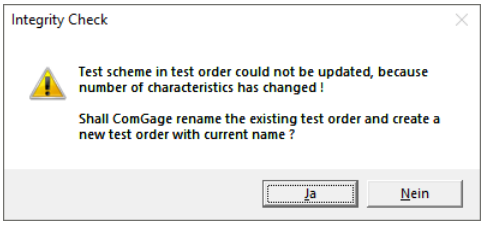
The next step is the selection of the test scheme. (Component you want to produce and measure.)
The field “Name” is thereby automatically filled with the information from the test scheme.

!!! Attention : When you have created a test order, the test scheme assigned to it can only be modified by clicking the **Update** - button. It is not possible to assign another test scheme to the test order at any later time.
So you should at first test the test scheme, before assigning it to a test order.

On updating the test scheme of an existing test order ComGage displays the dialog window shown below to ask, if the calibration data of the existing test order is to be kept. If not, this data will be overwritten with the calibration data of the test scheme.



If the number of characteristics in a test scheme has been changed, an update of an existing test order is not possible. In this case, ComGage will ask if a new test order with this name shall be created and if the original test order shall be renamed.



If this is confirmed by clicking “Yes”, the original test order files (*.rto / *.tod / *.toDFD) will get a new name in the following format : <Test order>_<Date>_<Time>.
Then a new test order with the original name is created from the changed test scheme.

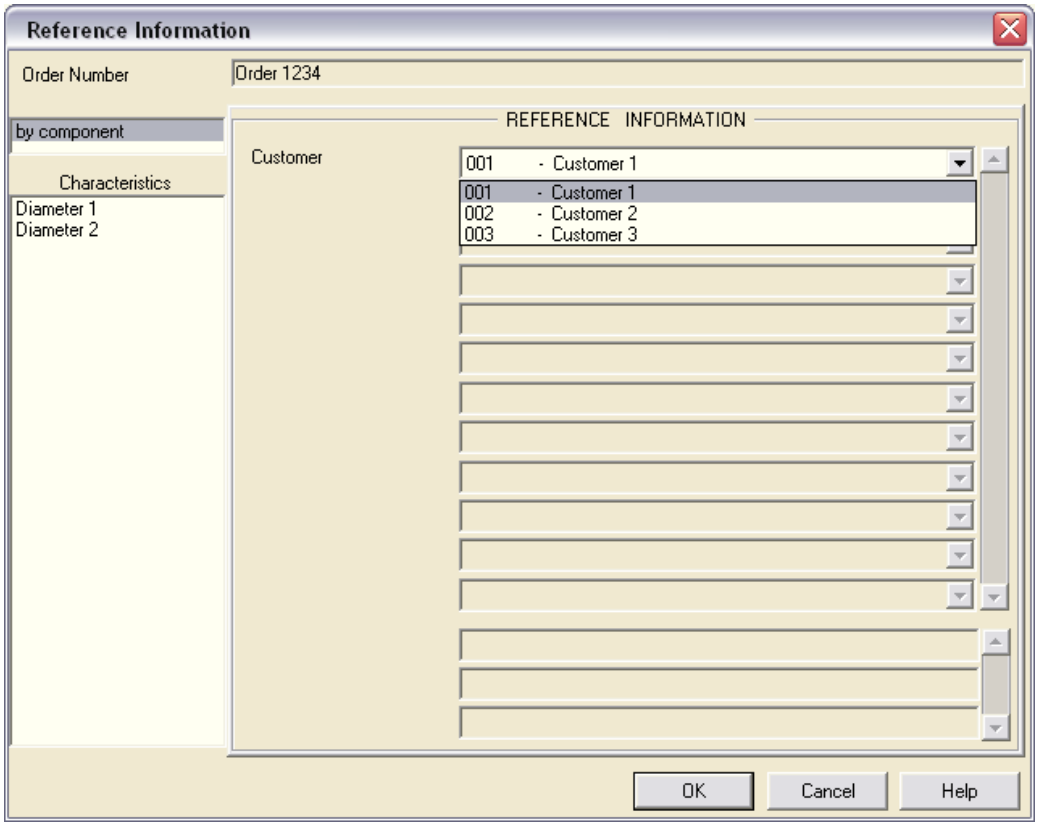
If “No” is clicked, the test order files remain unchanged. No update is executed.

On creating a test order, you can make the following entries :

1.) **Quantity** (Number of components you have to produce [depends on the customer’s order], this entry field may optionally remain empty. When the order quantity is reached a warning message pops up, but you can continue measuring further components)
2.) **Order Text** (Free editable text field for documentation of the test order)
3.) **Creation Date** (Creation date of the test order)
4.) **Created by** (Name of the operator, who created the test order)

By clicking the **NEXT>** - Button the settings of the current test order are saved and you can go on creating the next test order.

By clicking the **Reference Information** - button the window for selecting the reference information assigned to request in the test order is opened :



In this window a data set must be selected or input for all reference information, which are activated in the ComGage menu “Options / Reference Information” and set to the option “on creation of test order”.
The entry **by component** in the left column says that this reference information is assigned to all characteristics. After that you can select or input the reference information for each characteristic. In order to do so, please select the particular characteristic in the left column and programme its reference information.
The programming and activating of the reference information for the test order is described in chapter 6.6.

Note : ***Once you have started to collect measurement data with a test order, you cannot change the reference information of this test order any more.***
If reference information is to be requested at every beginning of measurement operation, it must have the mode ‘on starting the measurement’ assigned to it in the “Options / Reference Information” menu (see chapter 6.6).

The content of K-fields with editing level *Test order* can be configured by pressing the button **K-fields** (if AQDEF was activated). The configuration dialogue is identical to the dialogue of the K-field editor on workplace level (see chapter 6.8.2).
The K-field configuration for test orders is stored in the file **<Order number>.toDFD** in the ComGage data directory for test orders.

12. Starting the test order (measuring)

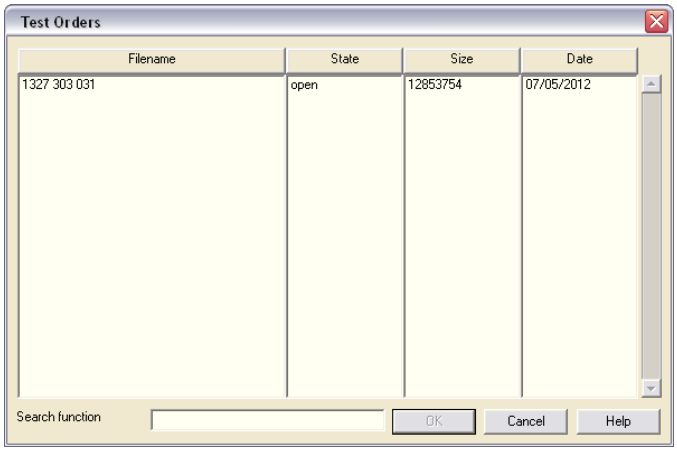
This menu contains the measurement mode of ComGage. The specific differences for measuring with the IBR_AQDEF module are described in chapter 12.1.

In this menu it is possible to start up to 10 test orders at the same time (for different production lines). After the start of a test order ComGage automatically assigns one of the keys 0...9 to the test order.

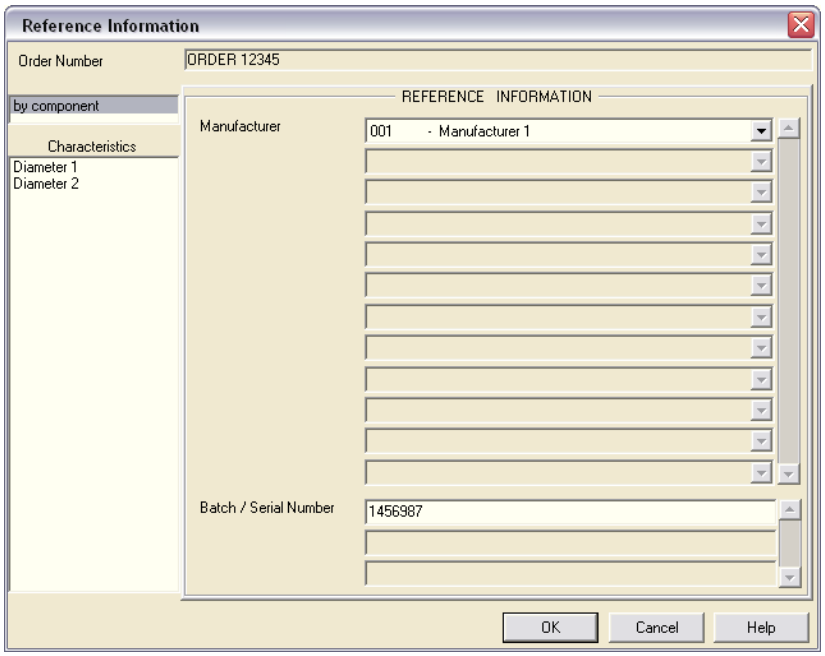
If an operator has to measure a component, he can select his test order by one of the keys 0…9 and can measure his sample. After this a second operator from a second production line can measure his component after by pressing the key assigned to his test order.

A test order can be started by clicking the **File / Test Order / Start** menu (Button : ).

After you have selected the menu you must select the test order / test orders you want to start. You can easily find a specific test order among lots of existing test orders by using the search function :

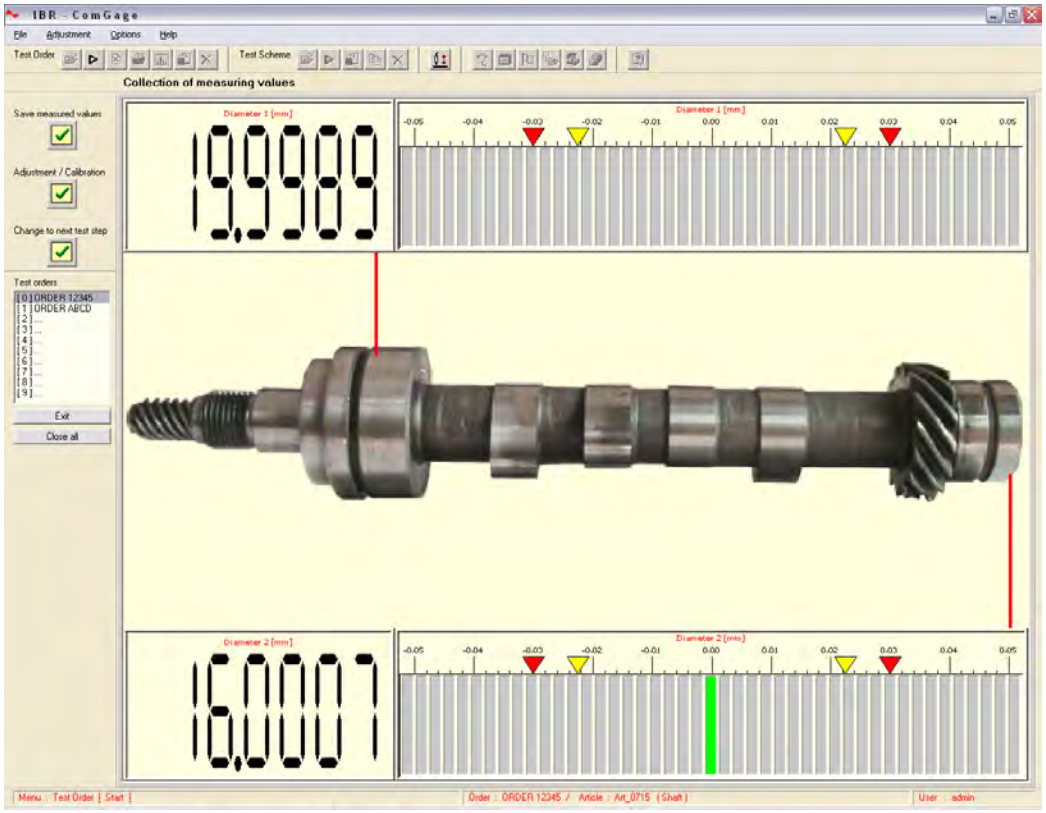


On the start of a test order, the reference information which has the mode *'on starting the measurement'* assigned to it, is requested :



For documentation of the window : See previous page.

After starting a test order, the main window of the measurement mode is opened as shown below.

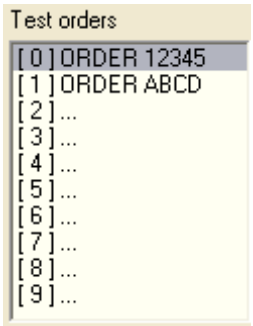


1.) Starting an additional test order

You can start an additional test order by clicking the **File / Test Order / Start** menu (Button: ). One of the keys 0 … 9 is then automatically assigned to the test order.

2.) List of started test orders

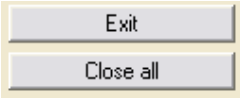
The started test orders and their keys 0 ... 9 are shown in following list :



The number left of the order number (e.g. [0]) informs you which key you must press to start measuring with the particular test order. By clicking on the test order it is automatically started.

3.) Closing of one test order or all test orders

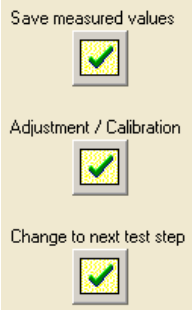
By clicking the **Exit** - Button you can close the currently measuring test order.
By clicking the **Close all** - Button you can close all started test orders.



When all test orders are closed the menu is left automatically.

4.) Buttons

The buttons are assigned to a function in the test scheme for execution of that particular function (see chapter 7.9).

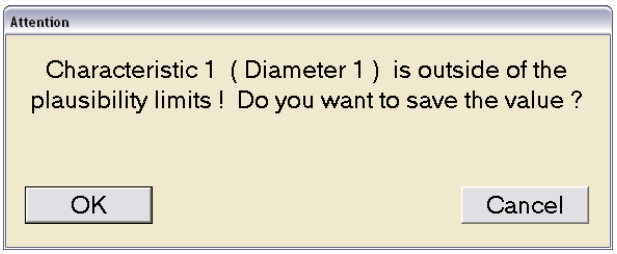


5.) Adjustment Button

By clicking the following button in the menu bar you can open the window *mechanical adjustment of inductive probes*. (See chapter 15.1 for menu description)

6.) Saving values

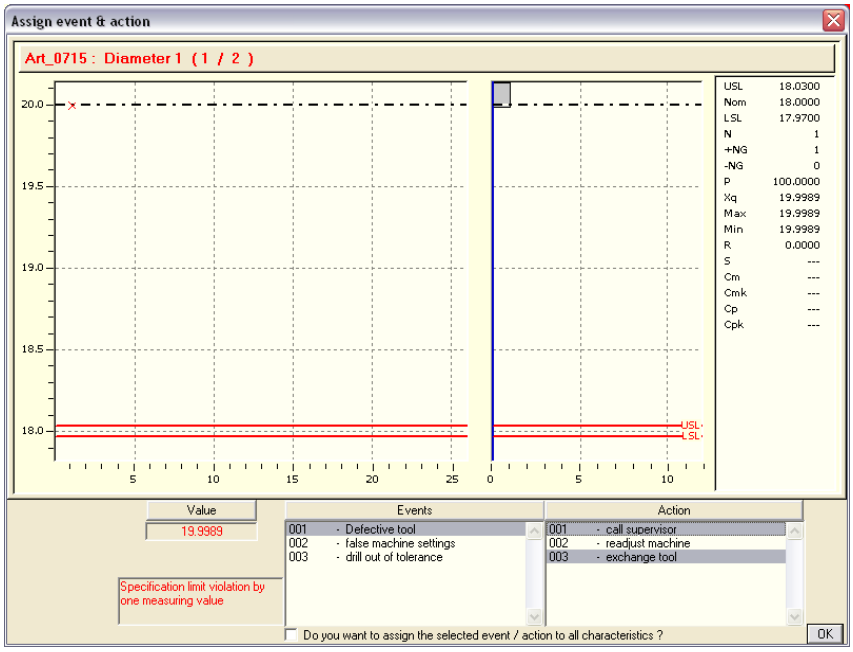
If a measurement value is outside the plausibility limits, then the following window opens.



By clicking the **Cancel** - button the measurement value is rejected, i.e. it is not saved.

!!! When this window is open, ComGage stops further measuring until the window is closed.

If you have activated **Events** and **Actions** (see chapters 6.6 and 7.7) and the measurement value is out of range or a sample violation has occurred, then you must select the event causing the measurement to run out of range or the violation of the sample (e.g. defective tool, …) and the corrective actions that have been taken (e.g. the supervisor was called, …).
A multiple choice is possible.



7.) Deleting values

If the operator has done a faulty measurement, he can delete the wrong measurement values of the last component and can repeat the measurement. But he cannot delete the measurement values of previously measured components.

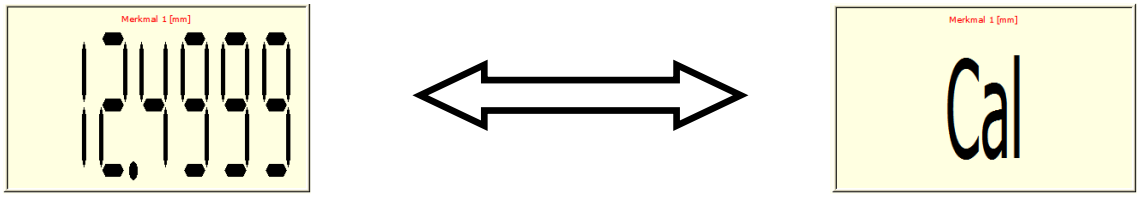
8.) Zero adjustment and gauge calibration

If the programmed condition for execution of the function “Adjustment / Calibration” is fulfilled, then a zero adjustment or gauge calibration is executed.

On zero adjustment the programmed master values are adopted as measurement values of the particular characteristics.

You must provide a numeric display in the display window of your test step in order to execute a gauge calibration with 2 masters. On gauge calibration the measured value is stored as first master value as soon as the programmed condition for execution of the function “Adjustment / Calibration” is fulfilled the first time. Afterwards the numeric display alternately indicates “Cal” and the measured value. As soon as the programmed condition for execution of the function “Adjustment / Calibration” is fulfilled the second time, the measurement value of the second master is adopted and the corresponding parameters (offset and factor) are calculated. The gauge calibration is completed.

So you must insert the first master into the fixture before the first fulfilment of the programmed condition for execution of the function “Adjustment / Calibration” and the second master before the second fulfilment of the programmed condition for execution of the function “Adjustment / Calibration”.



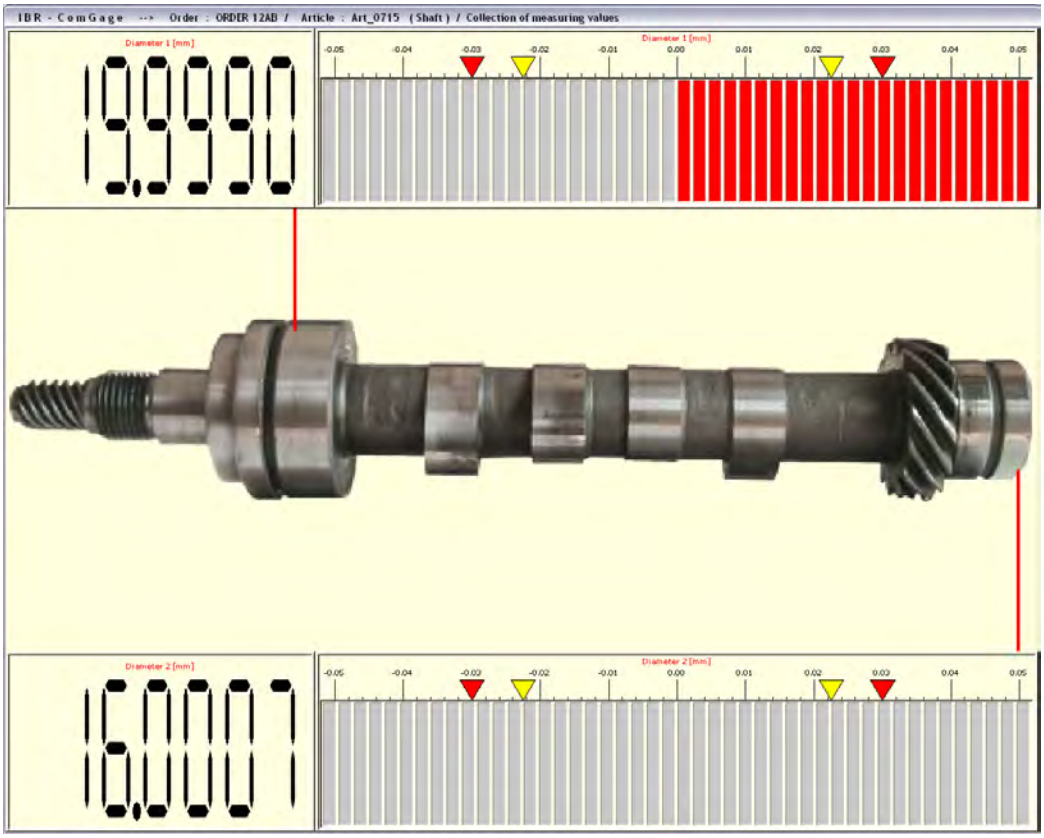
9.) Keys

The following function keys are available for operating the measurement mode :

Key	Function
TAB, +	Moves the cursor from button to button
SPACEBAR, ENTER	Presses the selected button
F1, F2, ...	The functions of the function keys are defined in the test scheme
/	Switches the window to full screen mode and back to normal mode
Cursor	Scrolling within the statistical display elements (with scrollbar)
0 … 9	Selection of a test order
*	Look at, change and delete measuring values

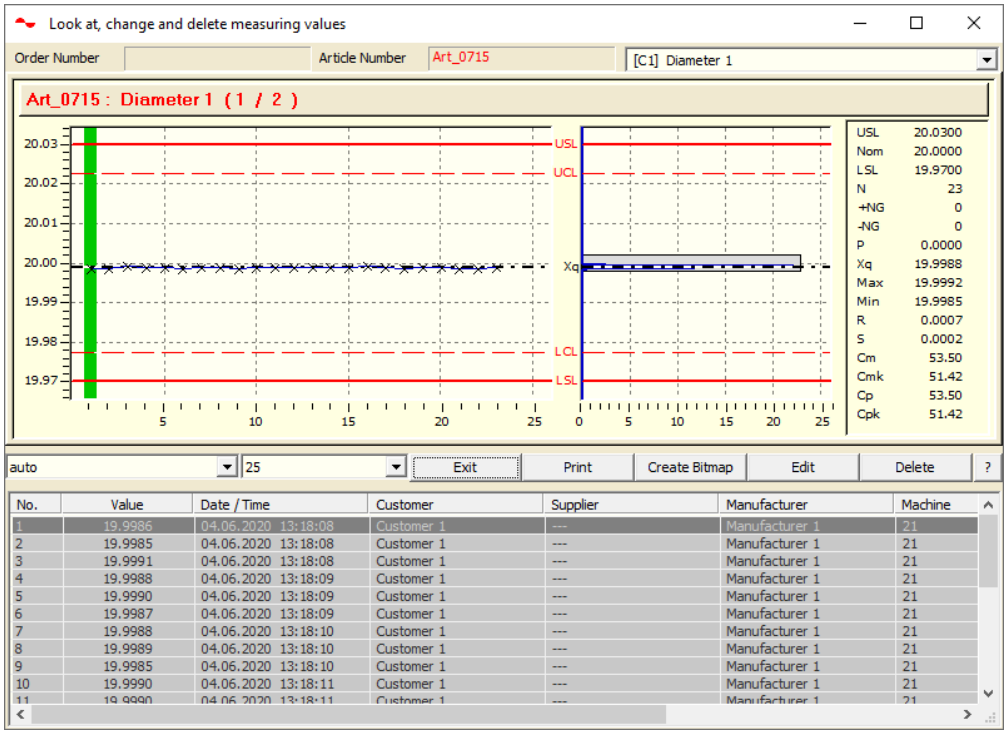
10.) Full Screen Mode

Example of full screen mode :



11.) Look at, change and delete measuring values

By pressing the * - key the **Look at, change and delete measuring values** menu is opened.



Via the drop down list in the upper right corner you can select the characteristic.

After selecting an entry in the table by clicking it, the **cursor** keys **up** and **down** can be used to scroll in the measuring value / reference information table. In the run chart / control chart the selected measuring value is highlighted green.

Additionally the most important statistical data and a histogram of the current characteristic are shown.

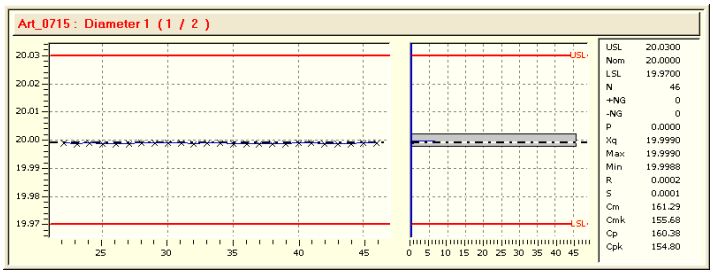
By the **left hand dropdown field** (standard entry : auto) you can select which chart type is to be used for displaying the run chart / control chart.

By the **right hand dropdown field** (standard entry : 25) you can select how many measurement values are to be displayed in the run chart / control chart.

By clicking the **Exit** - button you can exit the **Look at, change and delete measuring values** menu. The window will then be closed automatically.

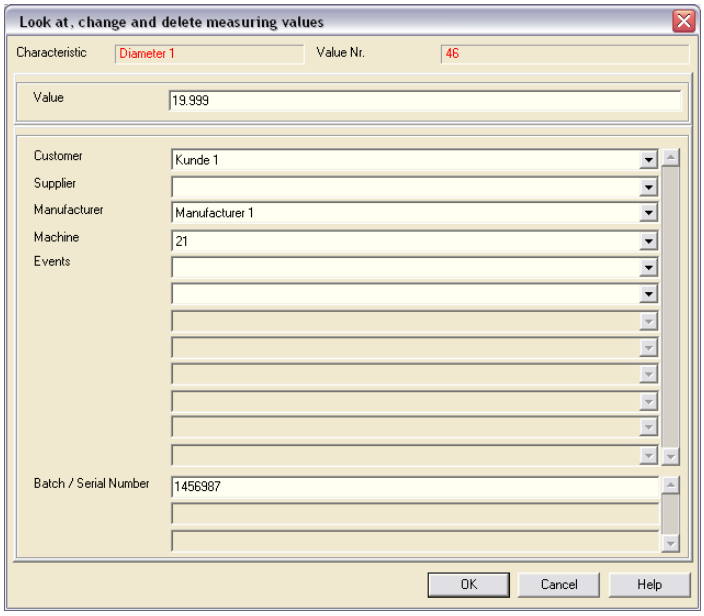
By clicking the **Print** - button you can generate a print-out of the run chart / control chart and the histogram of the current characteristic.

By clicking the **Create Bitmap** - button you can generate and save a bitmap picture of the run chart / control chart and the histogram of the current characteristic. An example is shown below.



By clicking the **Edit** button the current measurement value can be modified.
Before, the entry of a password is requested.

Note : The Password for editing is "sval".



By clicking the **Delete** - button the current measurement value can be deleted.
Before, the entry of a password is requested.

Note : The Password for deleting is "sval".

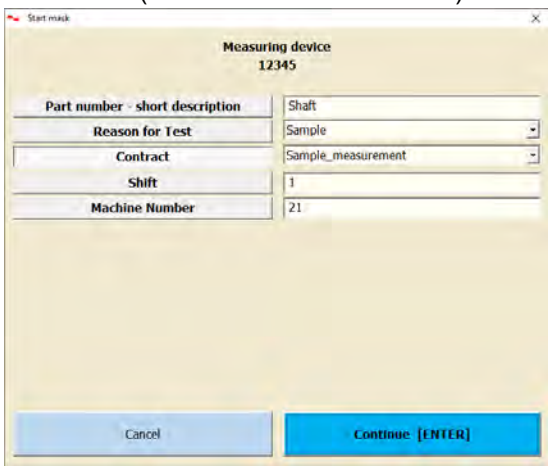
12.) Notes concerning the demo mode by entering the 30-day demo license key

- ComGage is exited automatically after 1 hour.
- Time / date are not saved together with the measuring values.
- The license key is queried on every start of ComGage.

12.1 Differences in case of activation of AQDEF

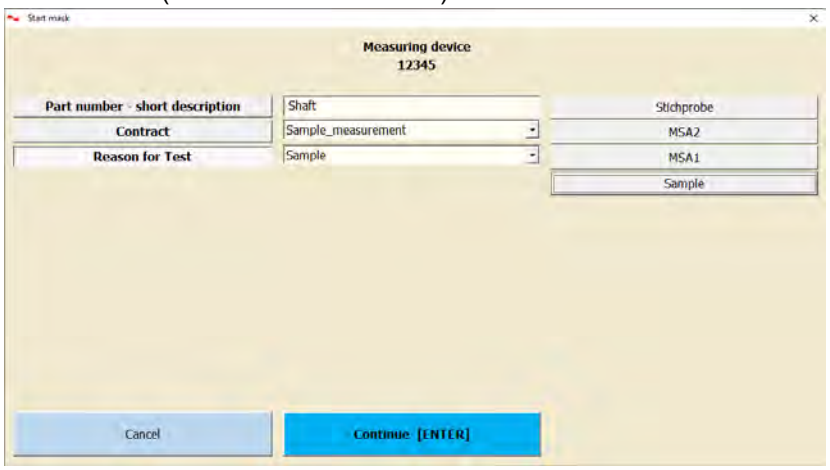
If the option *AQDEF + Start mask* or *AQDEF + Start mask 2* is activated in the workplace settings, the start mask is displayed instead of the dialogue for selecting and starting a test order :

Start mask (without selection buttons) :



Note :
If the option *DMC-Code* is activated in the Start mask configurator, an additional dialogue for scanning the DMC code is displayed before the start mask is opened.
The scanned DMC code has to be long enough to fill all K-fields according to the configuration in the Start mask configurator (see chapter 6.8.4).

Start mask 2 (with selection buttons) :



In the start mask the worker has to select one of the valid configurations that were defined in the Start mask configurator (see chapter 6.8.4).

In the start masks the content of those K-fields is queried, which were configured for the editing level *Start mask* (see chapter 6.8.1). The content of the K-fields is sequentially queried and every selection reduces the available options for the next K-field. If an already filled K-field is changed again, the selections for all following K-fields are reset.

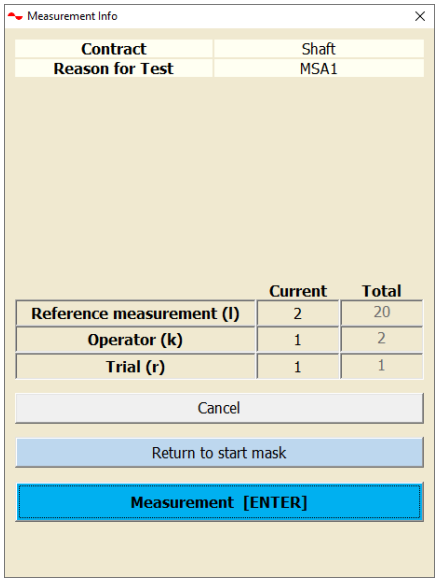
After selecting the content of all K-fields the measurement can be started by clicking the **Continue** button. The measurement is started as it was configured for the selected test reason in the Test reason configurator (see chapter 6.8.3).
The start of the test order can be cancelled by clicking the **Cancel** button.

Note : The last setting of the start mask is suggested on the next start again.

Exception : K-fields with type I3, I5, I10 have to be filled every time if their selection table does not contain exclusively the selectable integer values.

If AQDEF is used, the measurement mode is exited after each measurement and the following info dialogue is displayed. Only in this way, the software can lead the worker(s) through the correct number of measurements, as required for the selected sample measurement or study.

Before and between measurements an info dialogue with the relevant information is displayed :



By clicking the **Measurement** button the next measurement is started. By clicking Cancel or Return to start mask the running sample measurement or study is cancelled and ComGage returns to the main window / the start mask.
Additionally, there is the button **Master Control Measurement**, which allows the worker to start a master control measurement manually. If the option “Master Control Measurement / Calibration may interrupt running study” is activated in the Test reason configurator, the button is always active in the info dialogue. Else, only before the first measurement of a sample or a study.

If an initial calibration or calibration / master control measurement after x parts or x minutes was activated in the Test reason configurator, the button Measurement is replaced by another button as soon as such a calibration / master control measurement is required.

The values for Part, Operator, Trial and Reference measurement are written into the following registers and can thus be displayed on the screen during the measurements :

R1990 : Part / Reference measurement (Current)
R1991 : Part / Reference measurement (Total)
R1992 : Operator (Current)
R1993 : Operator (Total)
R1994 : Trial (Current)
R1995 : Trial (Total)

Note : The entries which were made in the start mask are saved in the file **startmask.smdfd** in the *Data directory for reference information and user management*.
The information that is needed for controlling the measurement are saved in the file **measurement.ini** in the *Data directory for reference information and user management*.
These two files are written solely for the internal control of the measurement by ComGage.

Note : If the following settings are made in the test reason configurator, the sequence control has to be implemented via test step functions as before and the measurement info dialogue is not displayed (see chapter 6.8.3) :
- no *Mode* is selected
- Sample measurement is selected as *Type [K2202]*
- for *Parts (n) [K2205]* “0” is entered as values for *Default*, *Min* and *Max*

13. Additional test order menus

13.1 Close

By clicking the **File / Test Order / Close** menu (Button : ) you can close a test order (when all components are produced). You can easily find a specific test order among lots of existing test orders by using the search function. Test orders which you have closed cannot be used for further measurements anymore, but they can be analysed or converted to different formats.

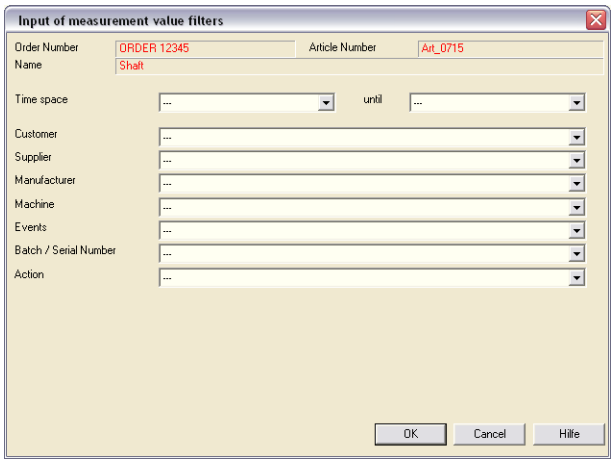
*Note : On closing a test order the file extension is renamed from *.rto to *.cto. You can simply rename the file extension from *.cto back to *.rto by using the Windows Explorer in order to reactivate the test order.*

13.2 Print

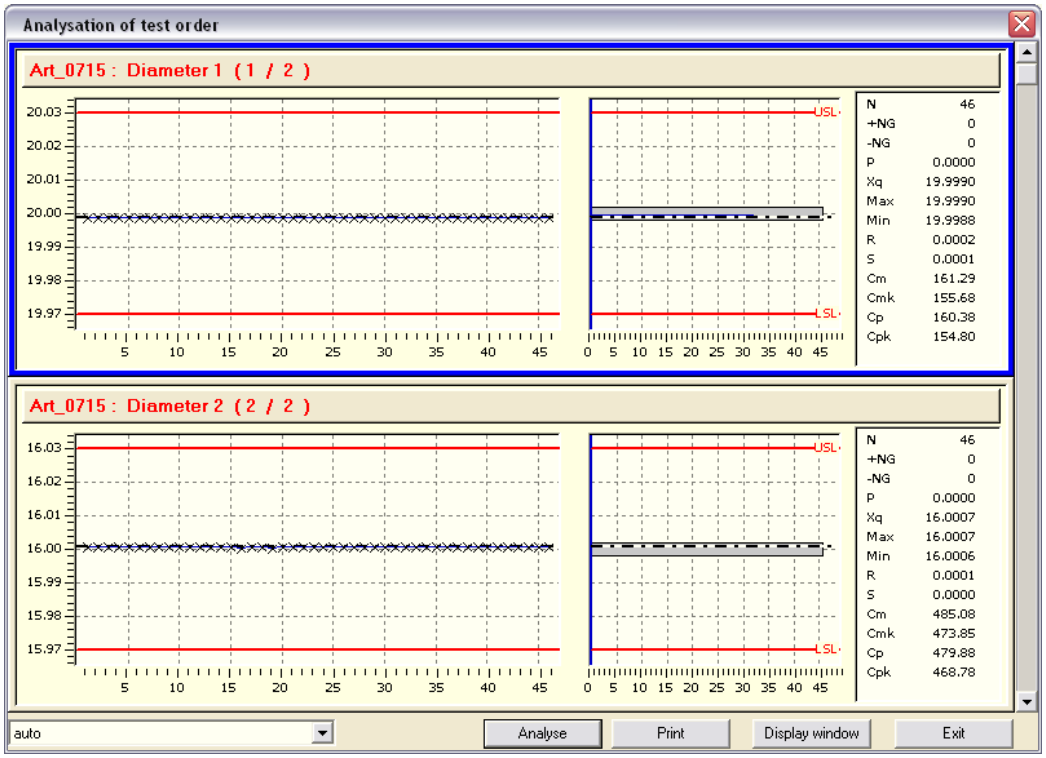
By clicking the **File / Test Order / Print** menu (Button : ) you can print the collected measurement values of a test order in tabular form. You can easily find a specific test order among lots of existing test orders by using the search function. After selection of the test order, you select which characteristics shall be printed. At last you have to select the printer.

13.3 Analyse

In the **File / Test Order / Analyse** menu (Button : ) you can analyse the measured values of a test order. You can easily find a specific test order among lots of existing test orders by using the search function. First of all you can select filters for the data you want to analyse (display of date and time occurs in the format determined by the Windows region settings) :



After clicking the **OK** - button the analysis window is opened, as shown below.



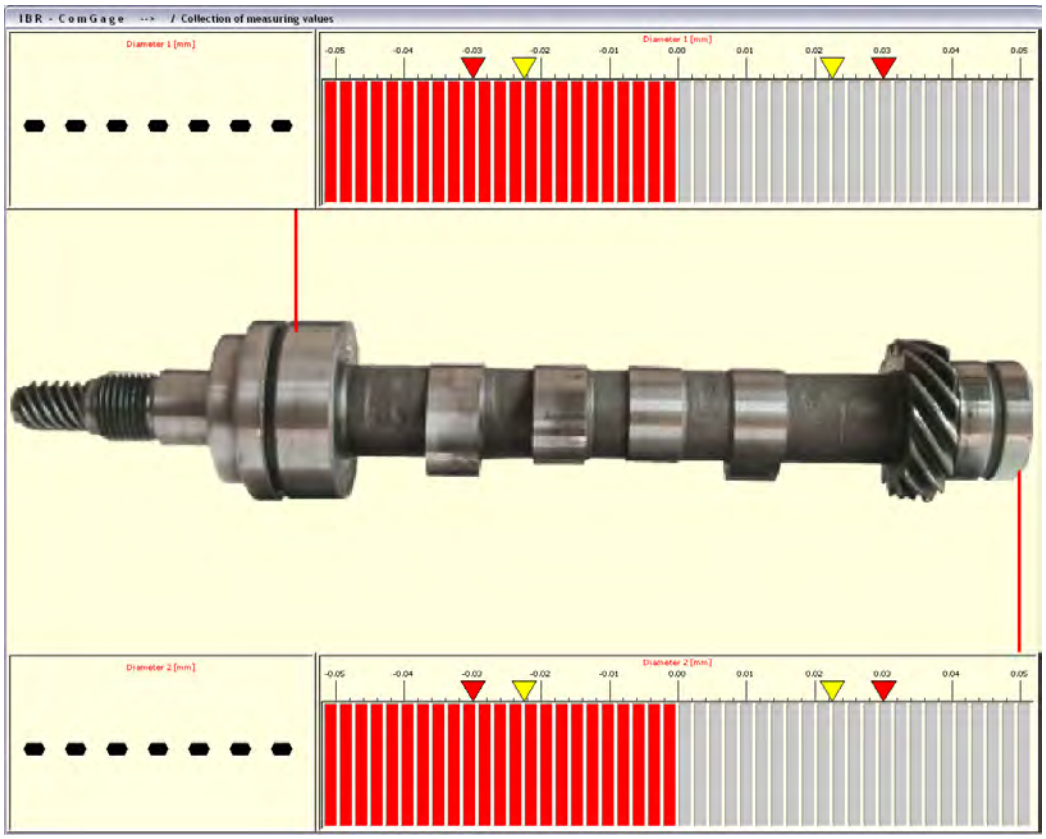
You can scroll through the individual characteristics by using the scrollbar at the right window side.

By the **left hand dropdown field** (standard entry : auto → = setting in the characteristic statistics settings of the test scheme) you can select which chart type is to be used for displaying the run chart / control chart.

By clicking the **Analyse** - button you can open the **Look at, change and delete measuring values** menu (see description in chapter 12 / subtopic 11).

By clicking the **Print** - button you can generate a print-out of the run charts / control charts and the histograms of the current test order.

By clicking the **Display window** button the measurement windows are opened in full screen mode (without measuring). By pressing the **PgUp** and **PgDn** keys you can switch to the SPC windows that have been defined in the test scheme. In doing so, the statistical displays contain the saved measured values of the test order, whereupon the filters selected at the beginning of the analysis are active.

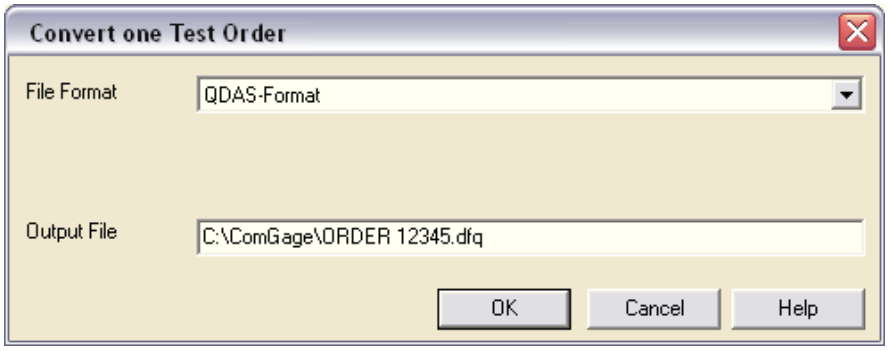


By pressing the **P** key you can print the window contents. You can exit the full screen mode by pressing the **ESC** key. ComGage then returns to the previous window.

By clicking the **Exit** button you can exit the **Analysation of test order** menu.
The window will then be closed automatically.

13.4 Convert

By clicking the **File / Test Order / Convert** menu (Button : ) you can convert the measurement values of a test order into a different format. You can easily find a specific test order among lots of existing test orders by using the search function. After selecting the test order you want to convert in the selection window, the window shown below is opened :



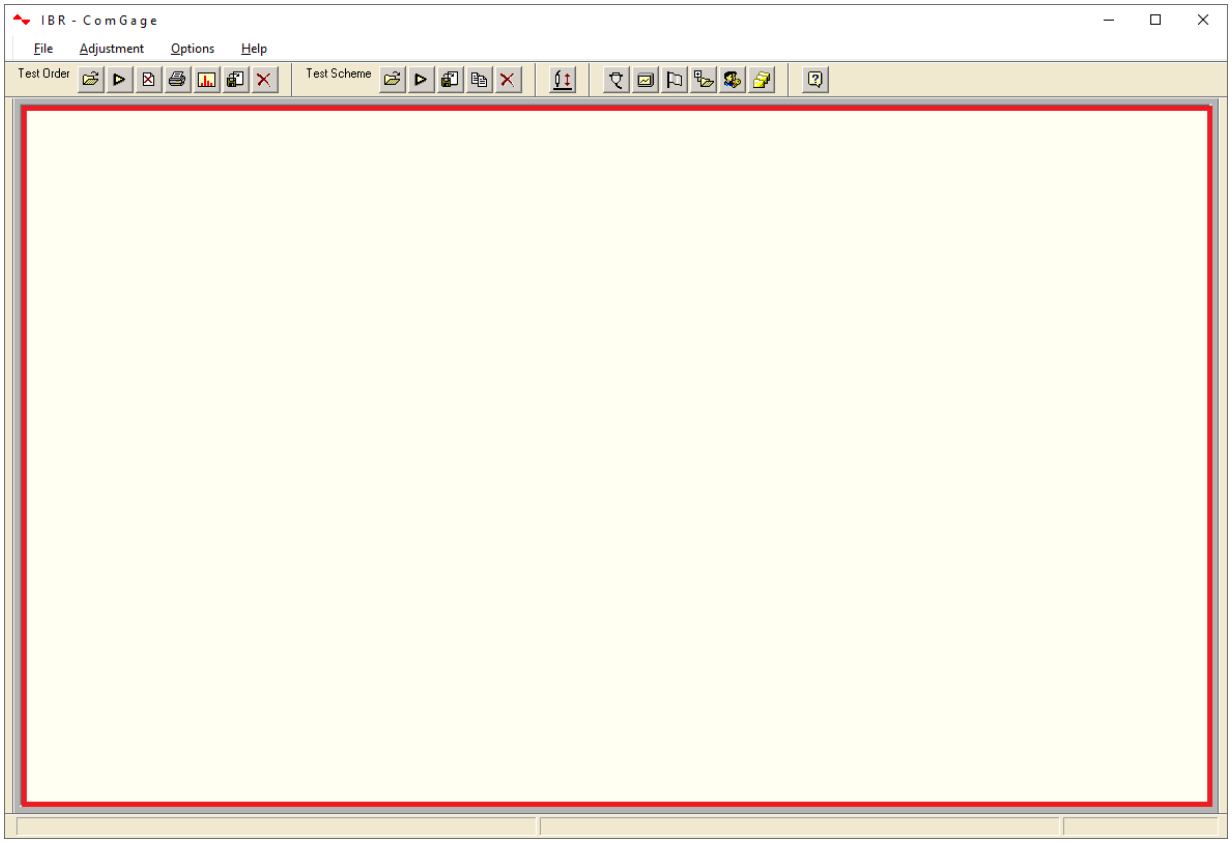
Now you can select the desired file format. On selecting the Excel format you can activate an additional filter for the measurement values. Then the output file is displayed including the path information. This automatically suggested path and file name can be edited by the user. By clicking the **OK** - button the conversion is triggered.

13.5 Delete

By clicking the **File / Test Order / Delete** menu (Button : ) you can delete one or more test orders. You can easily find a specific test order among lots of existing test orders by using the search function. After selecting the test orders you want to delete in the selection window, these will be deleted by clicking the **OK** - button. Before, you have to confirm a warning message in order to avoid deleting by mistake.
An existing K-field configuration on test order level (*.toDFD) is deleted together with the test order.

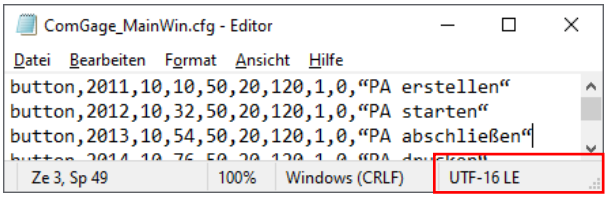
14. Customisation of the ComGage main window

ComGage provides the possibility to add buttons, text fields (labels) and pictures to the main window (red marked area) and place them freely in a grid of 320 x 240.



For this a text file with the name **ComGage_MainWin.cfg** has to be created in the ComGage programme directory. The file has to be save in the UTF-16 LE format.
In this configuration file all elements to be added are listed. Comment lines can be added to the configuration file as needed. To be recognised as such, it has to start with a " ; ".
The last line in the file has to contain a single #.

For example the Windows Editor can be used to create this file.



The format of the entries for the elements has to be according to the following examples :

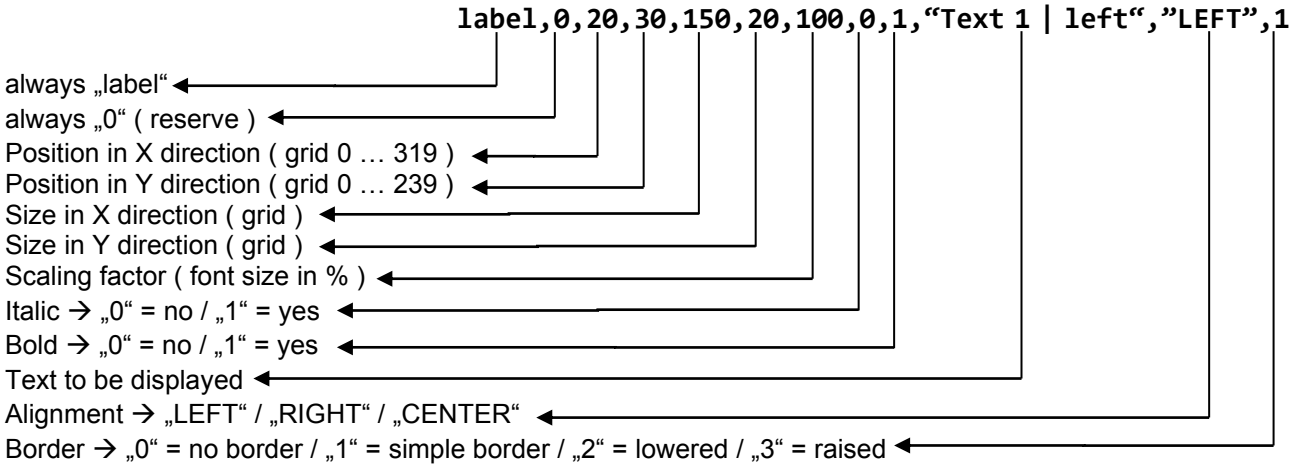
Pictures :

```
picture,0,220,20,90,90,0,SHAFT.bmp
```

Always „picture" (shows that a picture is added)
Menu ID for activation as button or „0" for a normal Picture
Position in X direction (grid 0 … 319)
Position in Y direction (grid 0 … 239)
Size in X direction (grid)
Size in Y direction (grid)
Fit picture → „0" = no / „1" = yes
Name of the file (under Windows CE complete path)

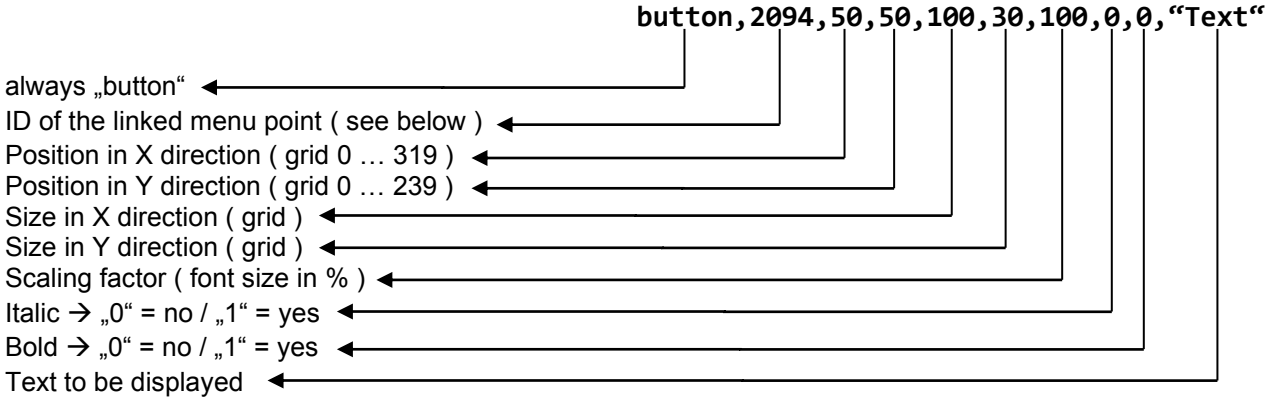
Pictures of the formats PNG, BMP and JPG can be used.
The available IDs for activation as button can be found on the next page under „Buttons".

Text fields (labels) :



The character “ | “ in the text above creates a line break at this position.

Buttons :



In the texts of the buttons a line break is possible by using the “ | “ character at every desired position, too.

For every button, the ID of the menu point to be linked, has to be selected.
The following IDs are available :

2011 :	Create / change test order	2064 :	Options → Data Directories
2012 :	Start test order	2065 :	Options → User setup
2013 :	Close test order	2066 :	Options → New login
2014 :	Print test order	2067 :	Options → Reference Information
2015 :	Analyse test order	2068 :	Options → Automatic Start
2016 :	Convert test order	2069 :	Options → Convert
2017 :	Delete test order	2070 :	Options → Mecc Touch Support
2021 :	Create / change test scheme	2071 :	Manual
2022 :	Start test scheme	2072 :	Info
2023 :	Convert test scheme	2073 :	Licenses
2024 :	Duplicate test scheme	2074 :	Workplace Settings
2025 :	Delete test scheme	2090 :	Master management
2042 :	Exit the programme	2091 :	K-field configurator
2051 :	Mechanical Adjustment	2092 :	K-field editor (Workplace)
2053 :	Tracing tool	2093 :	Start mask configurator
2061 :	Options → Connections	2094 :	Test reason configurator
2062 :	Options → Display Elements	2099 :	Opens a submenu for the menu items with IDs 2091 to 2094
2063 :	Options → Language		

Editing the colours :

The background colour of the main window can be selected by adding the following entry in the ComGage_MainWin.cfg :

```
mwcolor,0,220,20
        R G B
```

„mwcolor“ (Colour of the main window is specified)
RGB code of the required background colour

The background and font colours of labels can be edited with the following entry.
This specification only influences labels which follow this line in the ComGage_MainWin.cfg, up to the next line of this type (if present) or up to the end of the file.

```
labelcolor,0,255,0,90,90,0
           R G B R G B
```

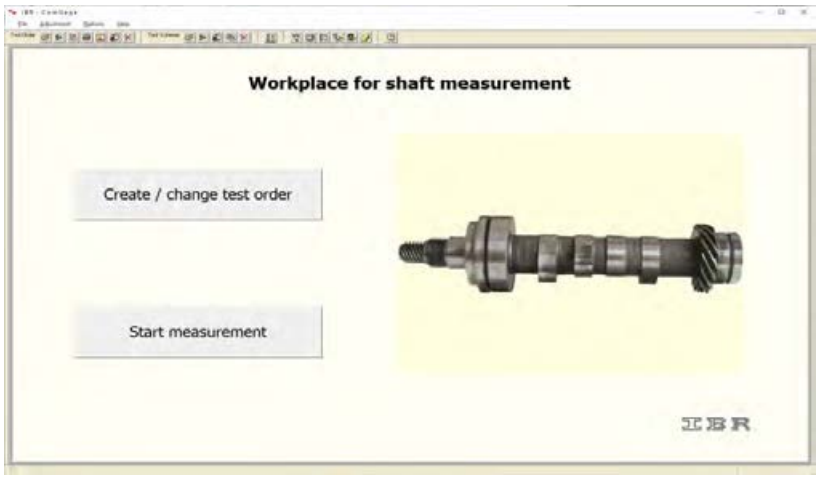
„labelcolor“ (Colours of the labels are specified)
RGB code of the required font colour
RGB code of the required background colour for the label

Note : Under Windows CE5 the settings for font size, bold and italic have no effect on the display on the screen.

Example :

```
; Comment 1
button,2011,25,70,100,30,300,0,0,Create / change test order
; Comment 2
button,2012,25,150,100,30,300,0,0,Start measurement
;
label,0,5,5,310,30,350,0,1,Workplace for shaft measurement,"CENTER",0
;
picture,0,155,50,140,140,1,SHAFT.bmp
picture,0,270,215,50,30,0,IBR.png
#
```

With this configuration file the following main window is created :

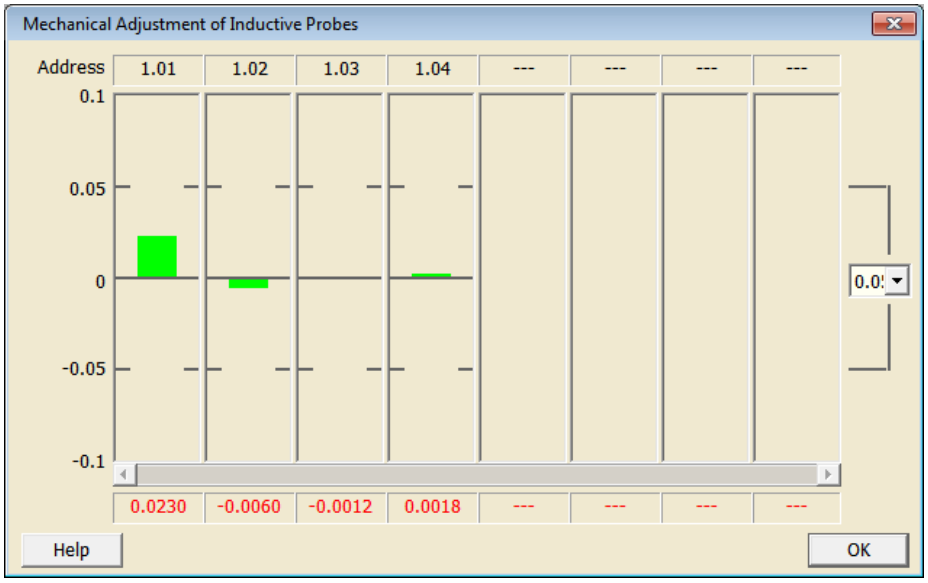


There are two buttons, one to create / change a test order and one to start the measurement, one text field (label) without border as headline and two pictures (the logo and the shaft, of which the picture of the shaft is fitted into the grid and the logo not).

15. Additional software tools for initial operation of measuring systems

15.1 Mechanical adjustment of inductive probes

By clicking on the **Adjustment / Mechanical Adjustment** menu (Button : ) the window for the mechanical adjustment of inductive probes in the fixture is opened.
(This is necessary because inductive probes only work optimal near their electrical zero-point.)



Adjustment process :

1. Selection of the probe which shall be adjusted **(Address).** If there are more than eight probes present, then you can scroll through the list of connected probes by using the scrollbar.
2. Insert the masterpiece or a working piece into the fixture.
3. Mechanical adjustments of the probes until all bars are within the green area. The green area of the bars is selectable (from +/- 0.01 mm to +/- 5 mm, default +/- 0.05 mm) by using the selection field at the right side of the window.
   Warning :
   It is absolutely necessary to set the green area to +/- 0.05 mm for correct mechanical adjustment of inductive probes.
4. By clicking the **OK** - button you can exit the window.

Note : The IBR IMS-5S probes are linearised over the complete measuring range, so the mechanical adjustment is not necessary for IMS-5S probes as it is for standard inductive probes.

15.2 Tracing tool for logging events with time reference

The window for analysing a recorded tracing file is opened by choosing the **Adjustment / Tracing-Tool** menu. For that purpose you must activate the option "**Log all events to analyse in tracing tool**" in the special settings of the test scheme (see chapter 7.3). In that case, the Tracing-Tool for logging all events is automatically started on start of the test scheme / test order. The recently stored tracing file *ComGage_Trace.dat* is thereby overwritten and the new file is located in the data directory, which was selected as „Directory for converted Measuring data" in the ComGage menu "Options / Data Directories". On call of the function **Adjustment / Tracing-Tool** the window for the timing diagram view is initially opened. You can change to the tabular view by clicking on the **Tab** - button. Additionally, ComGage asks if the content of the table shall be exported to a CSV file. You can change back to the timing diagram view by pressing the **Esc** - key.
The timing diagram can be printed by clicking on the **Print** - button.

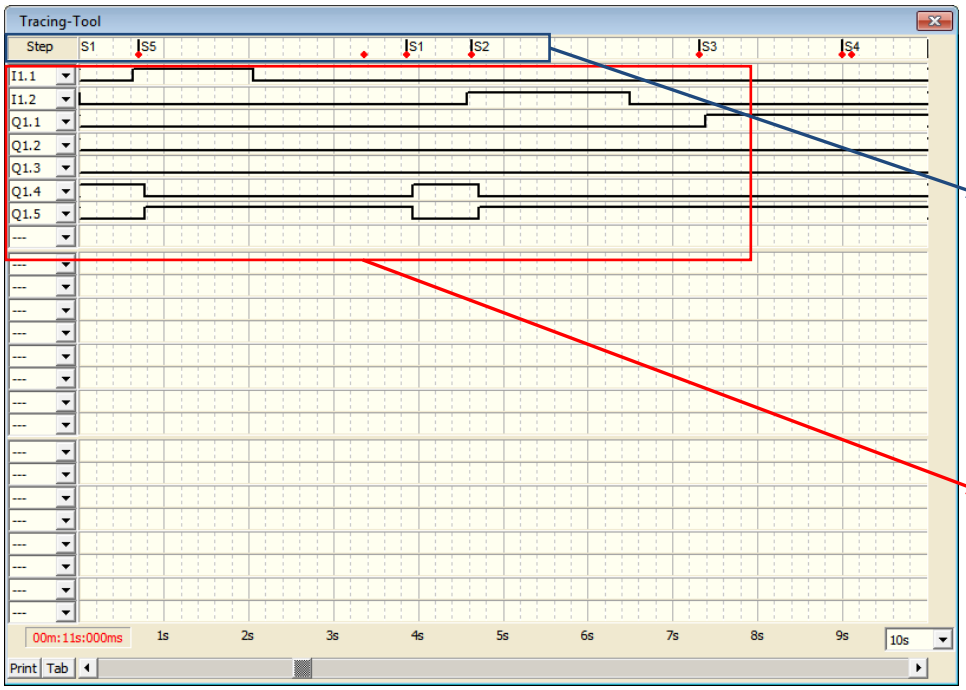
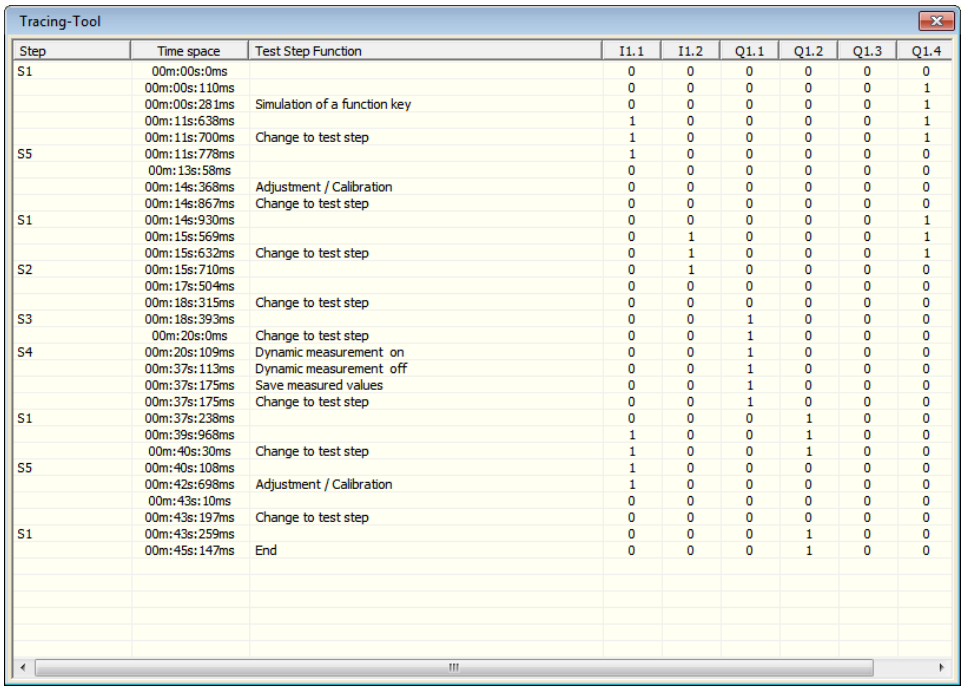


Illustration 1 : Timing diagram

Display of test steps and called test step functions (see red dots).
You can display the called test step functions, incl. time stamp, by clicking on the red dots.

Timing display of the selected digital inputs / outputs.



Tracing-Tool

Step	Time space	Test Step Function	I1.1	I1.2	Q1.1	Q1.2	Q1.3	Q1.4
S1	00m:00s:0ms		0	0	0	0	0	0
	00m:00s:110ms		0	0	0	0	0	1
	00m:00s:281ms	Simulation of a function key	0	0	0	0	0	1
	00m:11s:638ms		1	0	0	0	0	1
	00m:11s:700ms	Change to test step	1	0	0	0	0	1
S5	00m:11s:778ms		1	0	0	0	0	0
	00m:13s:58ms		0	0	0	0	0	0
	00m:14s:368ms	Adjustment / Calibration	0	0	0	0	0	0
	00m:14s:867ms	Change to test step	0	0	0	0	0	0
S1	00m:14s:930ms		0	0	0	0	0	1
	00m:15s:569ms		0	1	0	0	0	1
	00m:15s:632ms	Change to test step	0	1	0	0	0	1
S2	00m:15s:710ms		0	1	0	0	0	0
	00m:17s:504ms		0	0	0	0	0	0
	00m:18s:315ms	Change to test step	0	0	0	0	0	0
S3	00m:18s:393ms		0	0	1	0	0	0
	00m:20s:0ms	Change to test step	0	0	1	0	0	0
S4	00m:20s:109ms	Dynamic measurement on	0	0	1	0	0	0
	00m:37s:113ms	Dynamic measurement off	0	0	1	0	0	0
	00m:37s:175ms	Save measured values	0	0	1	0	0	0
	00m:37s:175ms	Change to test step	0	0	1	0	0	0
S1	00m:37s:238ms		0	0	0	1	0	0
	00m:39s:968ms		1	0	0	1	0	0
	00m:40s:30ms	Change to test step	1	0	0	1	0	0
S5	00m:40s:108ms		1	0	0	0	0	0
	00m:42s:698ms	Adjustment / Calibration	1	0	0	0	0	0
	00m:43s:10ms		0	0	0	0	0	0
	00m:43s:197ms	Change to test step	0	0	0	0	0	0
S1	00m:43s:259ms		0	0	0	1	0	0
	00m:45s:147ms	End	0	0	0	1	0	0

Illustration 2 : Display in tabular form

16. Important conditions concerning the use of ComGage

1. IBR Software products are not developed and tested for the high demands in the medical field, in combination with applications in the medical field or in critical components in life-saving systems whose malfunctions or failure can lead to personal injury.

2. On absolutely all applications the stability of the software can be influenced by different factors, i.e. fluctuations in the power supply, computer hardware errors, operating system errors, compiler errors, installation errors, software and hardware compatibility problems, not defined use or misuse or errors by the operator. (All kinds of these errors are called in the following document : SYSTEMERRORS)

3. All applications which contain the risk that SYSTEMERRORS can lead to damages or personal injuries should not only depend on electronic systems. To prevent damages or injuries the operator or system developer should create reasonable precautions against SYSTEMERRORS or their consequents (including backup or shutoff mechanisms).

4. Because all computer systems are adapted for the operator the systems are different in compare to the IBR test systems. Because the IBR products can also be integrated in applications not tested or not intended in this way by IBR the operator or system developer is completely responsible for the test and release of the applications in which IBR products are embedded. This contains the structure, the procedure and the security level of the application.

5. In no event IBR will be liable for any damages including lost profits for any special, indirect, incidental or consequential damages arising out of the use or inability to use the product, whether claimed under the safety instructions or otherwise.

6. Corporate guidelines and safety regulations enforced by the industrial trade associations for the prevention of industrial accidents must be strictly observed. Make sure to consult the safety officer at your company.

7. Use of the ComGage software in safety critical applications is not intended. Safety critical functions must be covered by external systems (e.g. PLC) in such applications.

8. All rights depend on German law.

9. All rights for the ComGage software belong to **IBR Messtechnik GmbH & Co. KG**

We reserve the right to change the design and technical data contained in our documentation without notifying our customers. IBR is not obliged to notify changes of the products to previous buyers.
IBRit *is a registered trademark of IBR.*

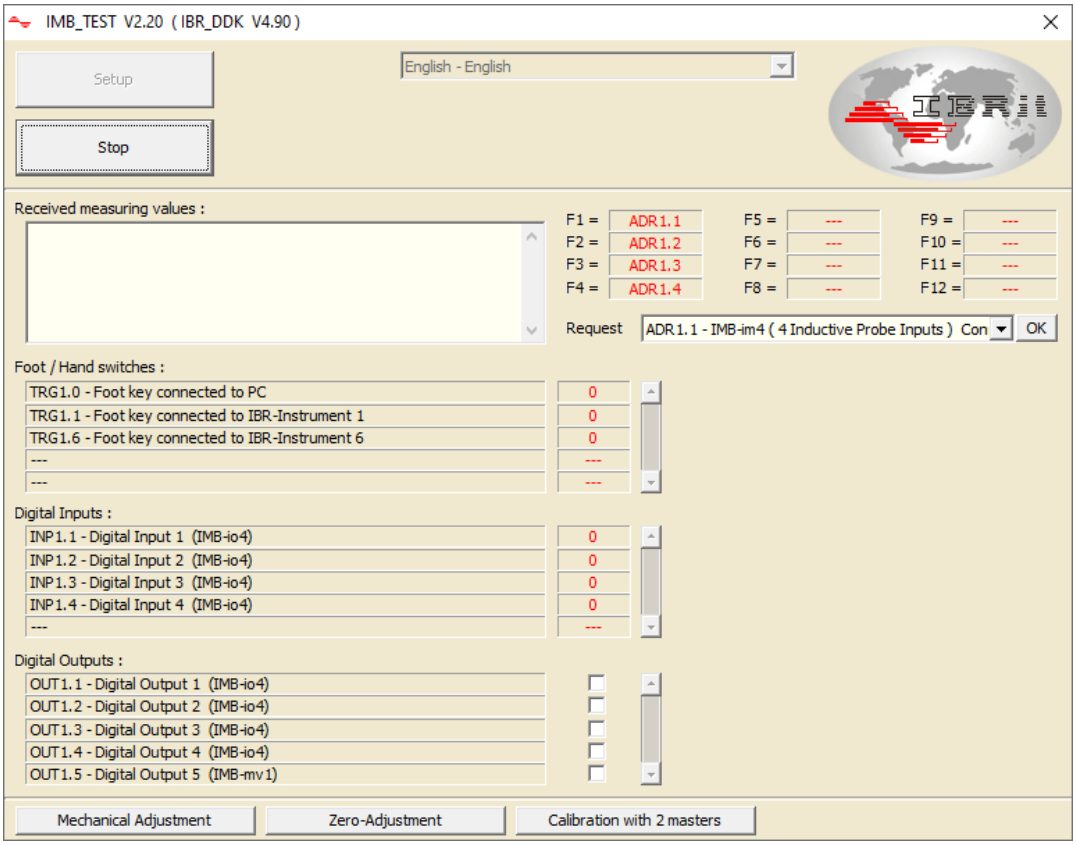
Appendix A

Additional software in the ComGage installation package

In Windows XP … 11 the additional software can be found in the start menu under Programs → ComGage or directly under ComGage.
In Windows CE you can find the software in the ComGage programme directory.

1. IMB_Test

The IMB_Test software is used for configuring and testing the connected hardware (IMBus, ISi-Bus, …).

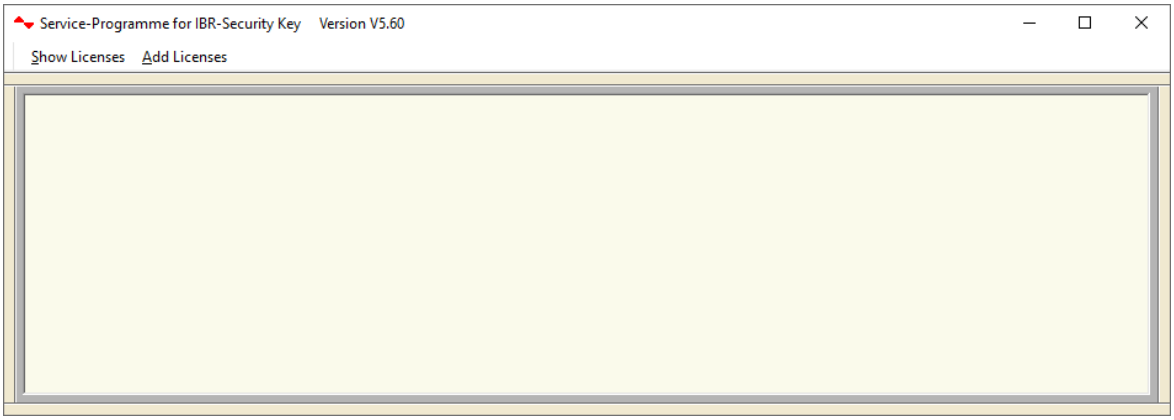


In the test window (see screenshot) the following options for testing the hardware are available :
- Requesting the raw values of the measuring inputs
- Display of received signals from foot / hand switches
- Display of received signals from digital inputs
- Setting digital outputs

Information regarding the installation, configuration and use of the IMB_Test software can be found in chapter 4.1 of the IMBus manual.
The setup window of the IMB_Test software is identical to the hardware configuration window of the ComGage software (see chapter 6.1).

2. IBR_Dongel

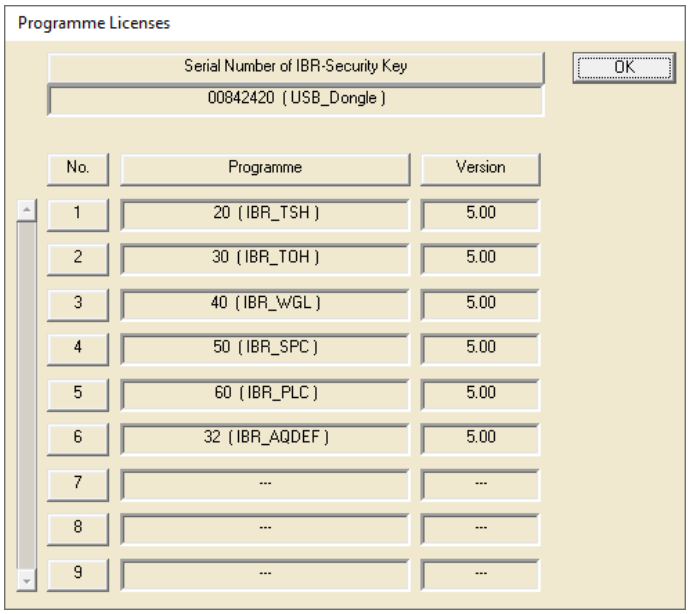
The software IBR_Dongel can be used to read out the content of a license dongle and to activate new licenses.

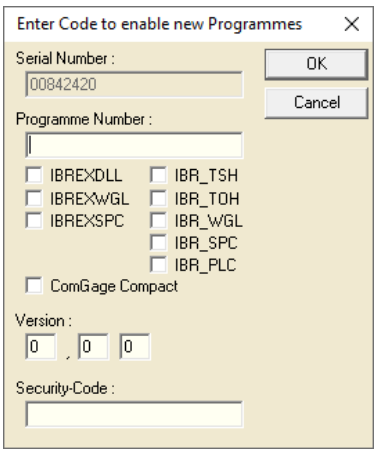


The following options are available :

- Show Licenses : displays an overview of the licenses stored on the dongle
- Add Licenses : allows the activation of additional licenses or newer license versions

Instructions for the activation of new licenses are sent together with the license codes.

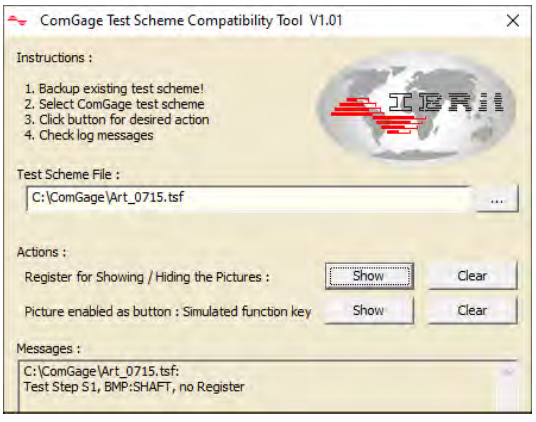




3. TestScheme Compatibility Tool

If test schemes are used that were created with ComGage versions <V3.95, there may be compatibility problems if pictures are used. In these cases the TestScheme Compatibility Tool can be used to make the test schemes compatible to newer versions. Instructions are included in the programme window.

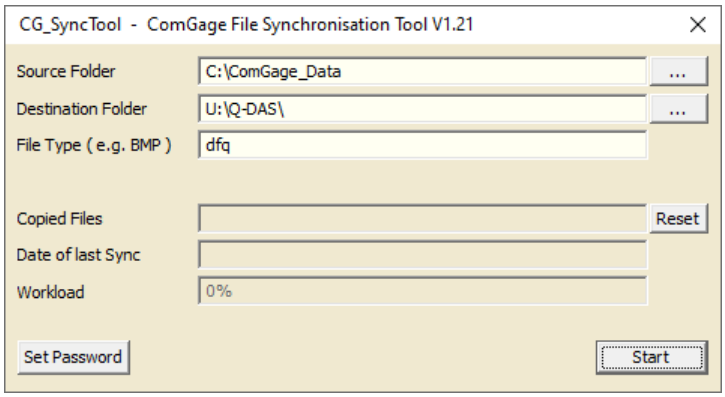
It is possible to show and clear the registers used for showing / hiding the pictures and the function keys that are simulated if the picture is enabled as button.



4. CG_SyncTool

The support software CG_SyncTool can be used to automatically move files with specific file extensions to another directory.

After starting the programme, the following dialogue is opened :



Enter the ***Source Folder***, the ***Destination Folder*** and the ***File Type***.
Up to 10 different file types can be entered, separated by semicolons.

Pressing the ... buttons opens a directory selection dialogue in which you can select or create the desired directory.

After entering the needed information the routine for monitoring and relocating the files can be activated by clicking the ***Start*** button.

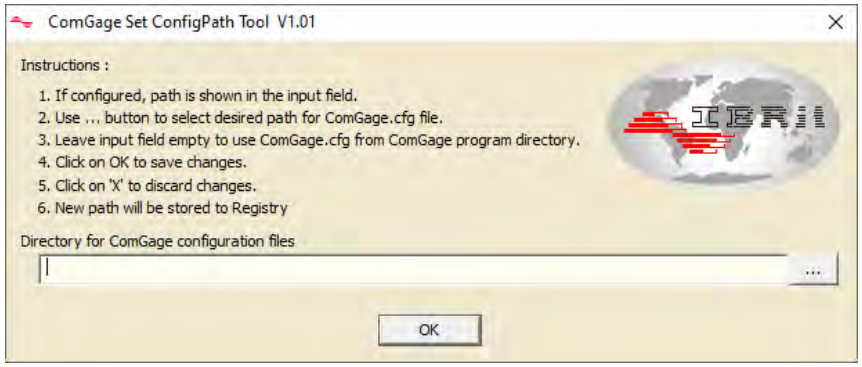
A password query can be activated as protection against unauthorised access. The password is required to stop the synchronisation and to close the software.

Note :

- For saving the settings in the file CG_SyncTool.cfg, the programme has to be closed after the entries have been made.
- If the settings have already been made and the software is started again, the routine for monitoring and relocating the files is activated automatically.
- For an automatic start in a standard Windows you can create a link in the Autostart directory. Under Windows CE (Mecc or IMB-pc1) please move the files CG_SyncTool.exe and CG_SyncTool.cfg to the directory \FlashDisk\AutoRun or \HardDisk\AutoRun.

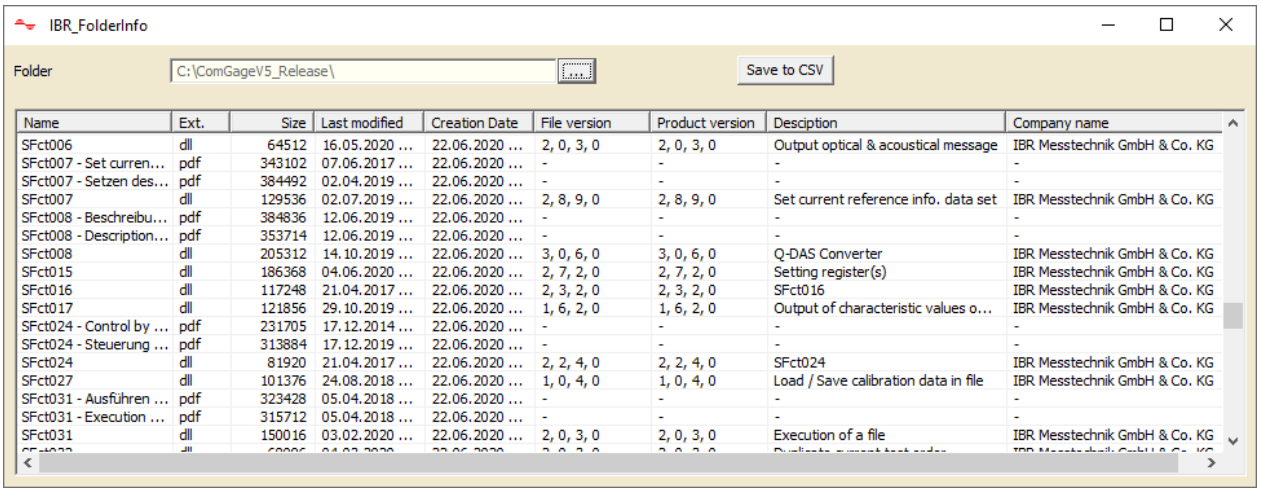
5. CG_SetConfigPath (not under Windows CE)

The software CG_SetConfigPath can be used to specify in which directory the ComGage configuration files are stored (see chapter 6.4).
Instructions are included in the programme window.



6. IBR_FolderInfo

The software CG_FolderInfo is used to display the version numbers of all .EXE and .DLL files of a ComGage installation in a directory.



Name	Ext.	Size	Last modified	Creation Date	File version	Product version	Desciption	Company name
SFct006	dll	64512	16.05.2020 ...	22.06.2020 ...	2, 0, 3, 0	2, 0, 3, 0	Output optical & acoustical message	IBR Messtechnik GmbH & Co. KG
SFct007 - Set curren...	pdf	343102	07.06.2017 ...	22.06.2020 ...	-	-	-	-
SFct007 - Setzen des...	pdf	384492	02.04.2019 ...	22.06.2020 ...	-	-	-	-
SFct007	dll	129536	02.07.2019 ...	22.06.2020 ...	2, 8, 9, 0	2, 8, 9, 0	Set current reference info. data set	IBR Messtechnik GmbH & Co. KG
SFct008 - Beschreibu...	pdf	384836	12.06.2019 ...	22.06.2020 ...	-	-	-	-
SFct008 - Description...	pdf	353714	12.06.2019 ...	22.06.2020 ...	-	-	-	-
SFct008	dll	205312	14.10.2019 ...	22.06.2020 ...	3, 0, 6, 0	3, 0, 6, 0	Q-DAS Converter	IBR Messtechnik GmbH & Co. KG
SFct015	dll	186368	04.06.2020 ...	22.06.2020 ...	2, 7, 2, 0	2, 7, 2, 0	Setting register(s)	IBR Messtechnik GmbH & Co. KG
SFct016	dll	117248	21.04.2017 ...	22.06.2020 ...	2, 3, 2, 0	2, 3, 2, 0	SFct016	IBR Messtechnik GmbH & Co. KG
SFct017	dll	121856	29.10.2019 ...	22.06.2020 ...	1, 6, 2, 0	1, 6, 2, 0	Output of characteristic values o...	IBR Messtechnik GmbH & Co. KG
SFct024 - Control by ...	pdf	231705	17.12.2014 ...	22.06.2020 ...	-	-	-	-
SFct024 - Steuerung ...	pdf	313884	17.12.2019 ...	22.06.2020 ...	-	-	-	-
SFct024	dll	81920	21.04.2017 ...	22.06.2020 ...	2, 2, 4, 0	2, 2, 4, 0	SFct024	IBR Messtechnik GmbH & Co. KG
SFct027	dll	101376	24.08.2018 ...	22.06.2020 ...	1, 0, 4, 0	1, 0, 4, 0	Load / Save calibration data in file	IBR Messtechnik GmbH & Co. KG
SFct031 - Ausführen ...	pdf	323428	05.04.2018 ...	22.06.2020 ...	-	-	-	-
SFct031 - Execution ...	pdf	315712	05.04.2018 ...	22.06.2020 ...	-	-	-	-
SFct031	dll	150016	03.02.2020 ...	22.06.2020 ...	2, 0, 3, 0	2, 0, 3, 0	Execution of a file	IBR Messtechnik GmbH & Co. KG

The selected directory can be changed by clicking the ... button.

The displayed list can be exported to a CSV file by clicking the ***Save to CSV*** button. This file can then be sent to the IBR support if necessary.

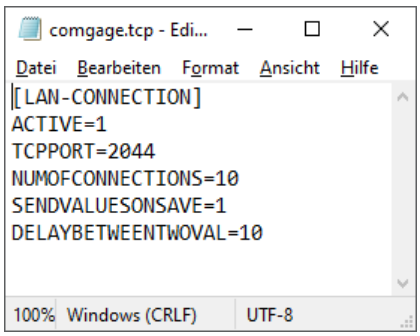
7. IBR_ComGage_Control

The IBR_ComGage_Control.dll allows another software to access ComGage by use of LAN commands (TCP/IP), e.g. for reading measuring values, setting / reading of registers or reference information datasets, setting / reading of tolerances, … (see below).
The DLL provides the needed functions for establishing a connection and for controlling ComGage. Examples for VC#, VB, … are available.

The following commands can be used with the listed or newer versions of ComGage :

Command	ComGage version
Return current characteristic value	≥ V3.92
Return characteristic value from file	≥ V3.92
Return number of values in file	≥ V3.92
Return date / time of characteristic value from file as 32 bit integer from 1.1.1970	≥ V5.00
Return register	≥ V3.92
Set register	≥ V3.92
Select test order / scheme	≥ V4.20
Name of actual test order	≥ V5.00
Name of actual test scheme	≥ V5.00
Name of actual test step	≥ V5.00
Read / Set name of characteristic Cx	≥ V5.03
Read / Set resolution of characteristic Cx	≥ V5.03
Read / Set reference information dataset	≥ V4.20
Read / Set nominal value of characteristic Cx	≥ V4.36
Read / Set USL of characteristic Cx	≥ V4.36
Read / Set UCL of characteristic Cx	≥ V4.36
Read / Set LCL of characteristic Cx	≥ V4.36
Read / Set LSL of characteristic Cx	≥ V4.36
Read / Set master 1 of characteristic Cx	≥ V4.36
Read / Set master 2 of characteristic Cx	≥ V4.36
Read / Set unit of characteristic Cx	≥ V5.00
Read statistic value of characteristic Cx	≥ V5.00

ComGage will only allow an access by another software if the file ComGage.tcp in the directory for the ComGage configuration (⓪) is configured correctly.



The following settings can be made :

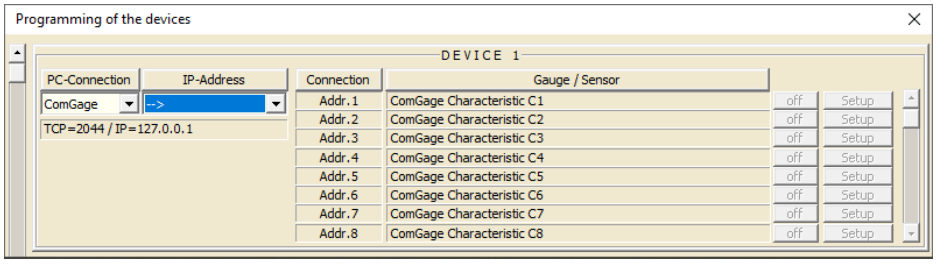
- ACTIVE : 0 = LAN connection deactivated / 1 = LAN connection activated
- TCPPORT : TCP port for establishing the connection (has to be 2044 if the IBR_DDK shall access ComGage)
- NUMOFCONNECTIONS : maximum number of simultaneous connections, ComGage shall allow (1 … 99)
- SENDVALUESONSAVE : 0 = values are not sent automatically when they are saved (when e.g. the IBR_ComGage_Monitor is used) 1 = values are sent automatically when they are saved (has to be used when the values shall be sent via the IBR_DDK, e.g. to the IBR_SimKey or IBR_VCP software)
- DELAYBETWEENTWOVAL : delay between the transmission of two measuring values in msec.

Note : On the first start of ComGage with activated LAN connection the Windows firewall will request that you permit this connection.
If the connection is not permitted, accessing ComGage from the outside is not possible.

Implementation via IBR_DDK.DLL

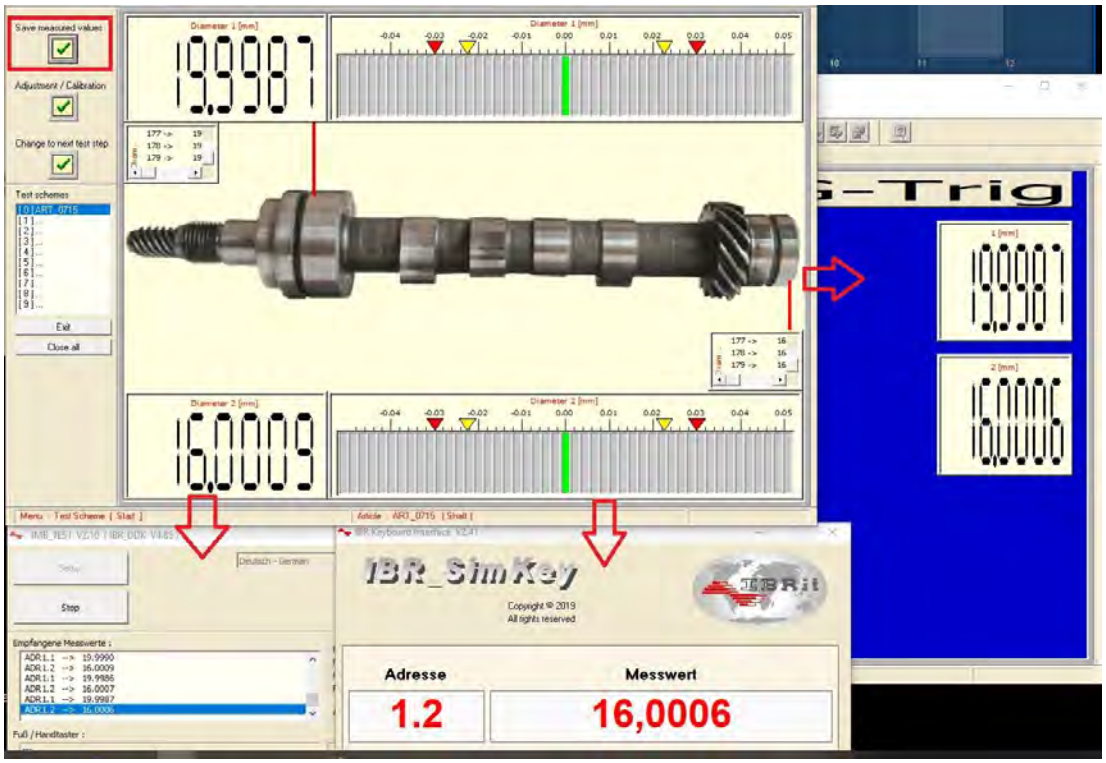
The IBR_ComGage_Control.DLL is implemented with reduced function range inside the IBR_DDK.DLL, this means measuring values which are saved in ComGage are received by IBR_DDK.DLL and forwarded to the application and the IBR_DDK.DLL can set ComGage registers.
If a software package has already the IBR_DDK.DLL implemented it can access directly ComGage.

If values shall be sent from ComGage to IBR_SimKey, IBR_VCP or other programmes with IBR_DDK, the following settings have to be made in the hardware setup of this programme :



Note : 127.0.0.1 is always the IP address of the local PC

Via the IBR_DDK.DLL on each data storage in ComGage measuring mode the measuring values are forwarded automatically to a different ComGage instance, to IMB_Test, to IBR_SimKey, to IBR_VCP, … . ComGage can forward the measuring values to up to 99 other applications at same time.



Implementation via IBR_ComGage_Control.DLL

If you want to use full function range (see table on previous pages), then the IBR_ComGage_Control.DLL must be implemented.
The **IBR_ComGage_Control.zip** which contains the .DLL, examples, … is automatically installed into ComGage installation directory together with ComGage >= V5.00.

The ZIP-file contains the following folders :

Folder name	Folder Contents
\DLL	Contains the IBR_ComGage_Control.DLL (32 bit or 64 bit version)
\INCLUDE	Contains the files to link the DLL into VB, VC++, VC# source code
\EXAMPLE	Contains different VB, VC++, VC# examples
\TEST	Contains the executable examples. These files can be used by all customers to communicate with ComGage, even if they do not want to develop an own software.

a) Installation of IBR_ComGage_Control.DLL for a 32 bit Windows application :

- Copy the **\ DLL \ x86 \ IBR_ComGage_Control.DLL** to local application directory.
- Or copy the **\ DLL \ x86 \ IBR_ComGage_Control.DLL** to **C: \ Windows \ System32** on a 32 bit Windows.
- Or copy the **\ DLL \ x86 \ IBR_ComGage_Control.DLL** to **C: \ Windows \ SysWOW64** on a 64 bit Windows.

b) Installation of IBR_ComGage_Control.DLL for a 64 bit Windows application :

- Copy the **\ DLL \ x64 \ IBR_ComGage_Control.DLL** to local application directory.
- Or copy the **\ DLL \ x64 \ IBR_ComGage_Control.DLL** to **C: \ Windows \ System32**.

c) Linking the IBR_ComGage_Control.DLL using Visual C++ :

- Link **\ INCLUDE \ IBR_ComGage_Control.h** and **\ INCLUDE \ IBR_ComGage_Control.lib** into the project.
- The .h file contains the description of all functions and informs which ComGage version is required.

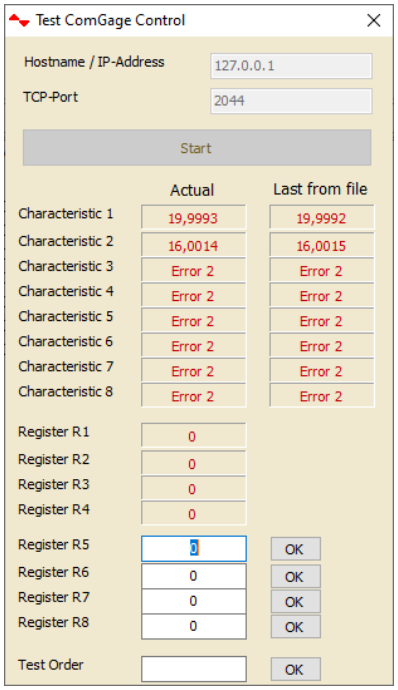
d) Linking the IBR_ComGage_Control.DLL using Visual C# :

- Link \ **INCLUDE** \ **IBR_ComGage_Control.cs** into the project.
- The .cs file contains the description of all functions and informs which ComGage version is required.

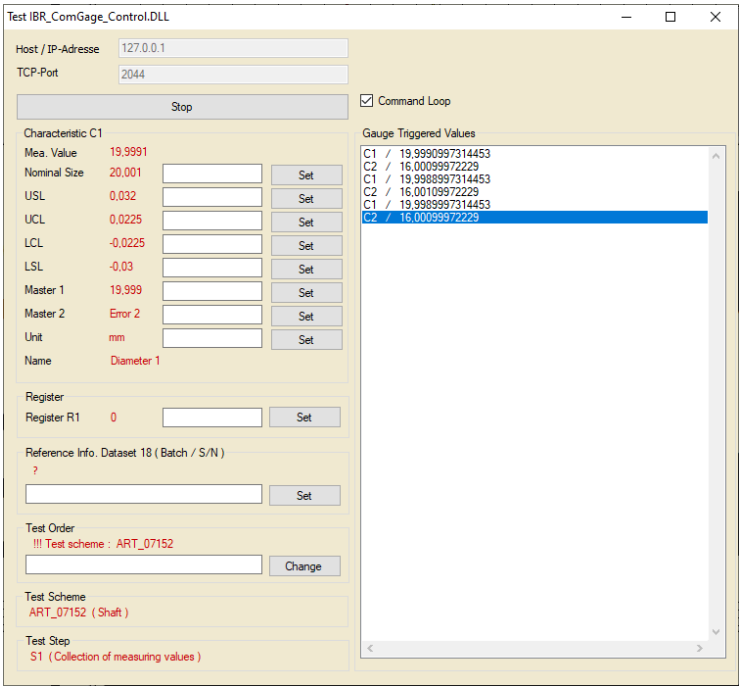
e) Linking the IBR_ComGage_Control.DLL using Visual VB.NET :

- Link \ **INCLUDE** \ **IBR_ComGage_Control.vb** into the project.
- The .vb file contains the description of all functions and informs which ComGage version is required.

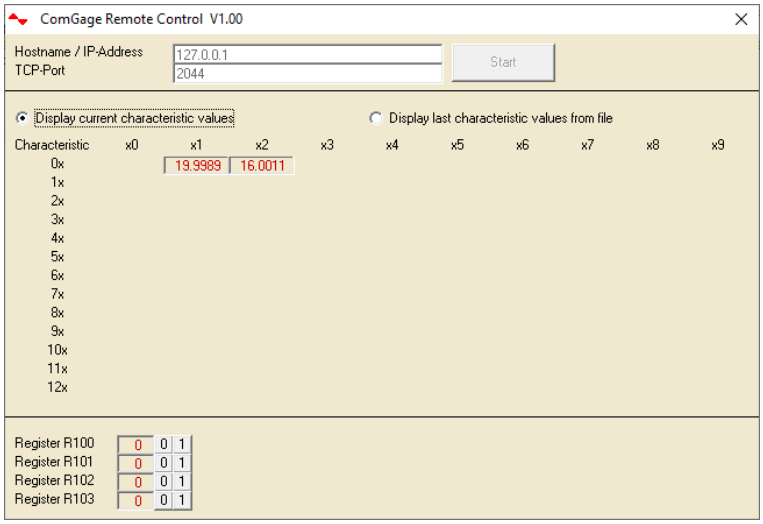
The following example programmes are included as source code (folder \ **example**) and as executable (folder \ **test**) in different programming languages.
The executables can be used by all customers to communicate with ComGage, even if they do not want to develop an own software.



ComGage_Control_xx.exe



ComGage_Control_VB.NET Type 2.exe



CG_RemoteCtrl.exe (for up to 128 characteristics and control of 4 ComGage registers)

Implementation using the direct TCP/IP-command set (without IBR_DDK.DLL / IBR_ComGage_Control.DLL)

The folder \ **DOC** inside **IBR_ComGage_Control.zip** which is automatically installed into ComGage installation directory together with ComGage >= V5.00 contains the documentation of the command set.

Appendix B

Overview of licenses / measurement modes / test step functions

ComGage Professional Erweiterungsmodul *ComGage Professional Expansion Module*	**Artikelnummer** *Article number*	**IBR-Dongle :** **Modulnr. / bezeichnung** *Module number / name*
Mehrfach-Start von ComGage auf einer Messstation *Several times starting of ComGage on a measuring station*	F716 010	Module 70 ComGage Multi-Start
Sonder-Messmodes und -Prüfschritt-Funktionen (siehe nachfolgende Liste) *Special Measuring Modes and Test step functions (see following list)*	F716 012	Module 72 ComGage Special Modules
Sonder-Messmodes und -Prüfschritt-Funktionen 2 (siehe nachfolgende Liste) *Special Measuring Modes and Test step functions 2 (see following list)*	F716 013	Module 73 ComGage Special Modules 2
Anbindung Mahr / Sylvac Geräte mit integr. Funk *Connection of wireless Mahr / Sylvac gauges*	F716 014	Module 74 Mahr / Sylvac wireless gauges
Unterstützung von alten Interface-Geräten in ComGage (IBRit-mc/md/di8/de8/da8/…) *Support of old interface instruments inside ComGage (IBRit-mc/md/di8/de8/da8/…)*	F716 015	Module 75 Old Hardware Support
Anbindung Knäbel SlideScan Messgerät *Connection of Knäbel SlideScan gauge*	F716 011	Module 71 Knäbel SlideScan

WGLxxx.DLL	**ComGage Professional Messmode** *ComGage Professional Measuring Mode*	**Verfügbar** *Availability* CE / XP..11	**Lizenz** *License*
WGL001.DLL	**Statische Messung** ***Static measurement***	☑ / ☑	-----
WGL002.DLL	**Dynamische Messung** ***Dynamic measurement***	☑ / ☑	-----
WGL003.DLL	**Geräte-Triggerung** ***Gauge Triggered***	☑ / ☑	-----
WGL004.DLL	*Reserved for Special Customer Project*		
WGL005.DLL	*Reserved for Special Customer Project*		
WGL006.DLL (*)	Dynamische Messung mit Nut-Ausblendung (Typ I) *Dynamic Measurement with groove removing (Type I)*	☑ / ☑	Module 72
WGL007.DLL (*)	Wellen- und Zahnrad-Messung (Rundheitsmessung mit Taster & Enkoder) *Wave and gearwheel Measurement (Roundness mea. with probe + encoder)*	☑ / ☑	Module 72
WGL008.DLL (*)	Messung Rundlauf zur Zylinderachse *Measurement of radial runout to cylinder axis*	☑ / ☑	Module 72
WGL009.DLL	Durchmesser- und Positions-Berechnung über 3 Messtaster *Diameter and Position calculation with 3 probes*	☑ / ☑	-----
WGL010.DLL	*Reserved for Special Customer Project*		
WGL011.DLL	**Dynamische Messung mit Filterung über gleitenden Mittelwert** ***Dynamic Measurement with Filtering by moving average***	☑ / ☑	-----
WGL012.DLL (*)	*Reserved for Special Customer Project*		
WGL013.DLL	*Reserved for Special Customer Project*		
WGL014.DLL (*)	Dynamische Messung mit Korrektur über Ausgleichsgerade (Taster wird über Teil gezogen und Geradheit wird bestimmt) *Dynamic measuring with correction by best-fit in line (Probe is pulled over part and straightness is to be determined)*	☑ / ☑	Module 72
WGL015.DLL (*)	Datenempfang über RS232 *Measuring Value Reception over RS232*	☑ / ☑	Module 74

WGLxxx.DLL	**ComGage Professional Messmode** *ComGage Professional Measuring Mode*	**Verfügbar** *Availability* CE / XP..11	**Lizenz** *License*
WGL016.DLL	*Selektierungsmessmode* Grading mode	☑ / ☑	-----
WGL017.DLL	*Reserved for Special Customer Project*		
WGL018.DLL	CSV/TXT-Datei Import *CSV/TXT-File Import*	☑ / ☑	-----
WGL019.DLL	*Reserved for Special Customer Project*		
WGL020.DLL (*)	Ebenheitsmessung *Flatness Measurement*	☑ / ☑	Module 72
WGL021.DLL	*Reserved for Special Customer Project*		
WGL022.DLL (*)	Dynamische Messung mit Nut-Ausblendung (Typ II) *Dynamic Measurement with groove removing (type II)*	☑ / ☑	Module 72
WGL023.DLL (*)	*Reserved for Special Customer Project*		
WGL024.DLL	*Reserved for Special Customer Project*		
WGL025.DLL (*)	Planlauf zur Zylinderachse *Measurement of axial runout to cylinder axis*	☑ / ☑	Module 72
WGL026.DLL	*Reserved for Special Customer Project*		
WGL027.DLL	Messwert-Korrektur über Linearisierungstabelle *Measuring Value Correction by Linearisation table*	☑ / ☑	-----
WGL028.DLL (*)	Mahr / Sylvac drahtlose Messgeräte *Mahr / Sylvac wireless gauges*	☒ / ☑	Module 74
WGL029.DLL (*)	Empfang von Messwerten über COM- / TCP-Port *Receive measuring value over COM / TCP port*	☑ / ☑	Module 74
WGL030.DLL	*Reserved for Special Customer Project*		
WGL031.DLL (*)	Sonderberechnungen für Ausgleichsgerade *Special calculations with best-fit in line*	☑ / ☑	Module 72

Bold : **Standardmäßig in ComGage Professional aktiviert**
Activated in ComGage ComGage Professional by default

(*) : Kostenpflichtiger ComGage Professional Erweiterungs-Messmode
ComGage Professional Expansion Measuring Mode with costs

Italic : *Sonder-Messmodes, die nur für spezielle Kundenprojekte entwickelt worden sind und nicht frei verfügbar sind.*
Special measuring modes only developed for special customer projects and not available for sale.

SFctxxx.DLL	**ComGage Professional Prüfschritt-Funktion** *ComGage Professional Test Step Function*	**Verfügbar** *Availability* CE / XP..11	**Lizenz** *License*
SFct000.DLL	**Simulation einer Funktionstaste (F1, F2, …, 0,1, …, /)** ***Simulation of a function key (F1, F2, …, 0,1, …, /)***	☑ / ☑	-----
SFct001.DLL	**Merkmals-Parameter ändern (wie Nennmaß, Toleranzen, …)** ***Change characteristic parameters (like nominal size, tol., master values)***	☑ / ☑	-----
SFct002.DLL	Messwert eines Merkmals setzen *Set measuring value of characteristic*	☑ / ☑	-----
SFct003.DLL	**Ausdruck / Bitmap eines Anzeigefensters generieren** ***Printout / Bitmap of the screen contents***	☑ / ☑	-----
SFct004.DLL	**Automatische Seriennummer-Generierung** ***Automatic generation of serial numbers***	☑ / ☑	-----
SFct005.DLL	*Reserved for Special Customer Project*		
SFct006.DLL	**Ausgabe einer optischen / akustischen Meldung** ***Output optical & acoustical message***	☑ / ☑	-----
SFct007.DLL	**Setzen des aktuellen Stammdatensatzes** ***Set current reference information data set***	☑ / ☑	-----
SFct008.DLL	**Q-DAS-Konverter** ***Q-DAS Converter***	☑ / ☑	-----
SFct009.DLL	AQDEF- K-Feld mit festem Wert überschreiben *AQDEF - Overwrite K-Field with fix value*	☒ / ☑	-----
SFct010.DLL	*Reserved for Special Customer Project*		

SFctxxx.DLL	ComGage Professional Prüfschritt-Funktion *ComGage Professional Test Step Function*	Verfügbar *Availability* CE / XP..11	Lizenz *License*
SFct011.DLL	*Reserved for Special Customer Project*		
SFct012.DLL	*Reserved for Special Customer Project*		
SFct013.DLL	*Reserved for Special Customer Project*		
SFct014.DLL (*)	Steuerung von ComGage über RS232 *Control of ComGage by PLC over RS232*	☒ / ☑	Module 72
SFct015.DLL	**Setzen eines Registers** ***Setting, incrementing, … a PLC Register***	☑ / ☑	-----
SFct016.DLL	**Messwerte zwischen Merkmalen kopieren** ***Copy of measuring values between characteristics***	☑ / ☑	-----
SFct017.DLL	**Ausgabe eines Merkmals-Werts über RS232** **(in MUX10, … Format)** ***Output of characteristic values over RS232*** ***(in MUX10, MDOS, … format)***	☑ / ☑	-----
SFct018.DLL	*Reserved for Special Customer Project*		
SFct019.DLL	Platzhalter in Messwert-Datei setzen *Set place holder into measuring value file*	☑ / ☑	-----
SFct020.DLL	Zu einem anderen Prüfauftrag wechseln (200 Prüfaufträge verwaltbar) *Change to another test order* *(200 different test orders can be selected)*	☑ / ☑	-----
SFct021.DLL (*)	Externe Geräte-Steuerung über RS232 / TCP-IP (z.B. Faulhaber-Motor) *Device-Control by RS232 / TCP-IP (e.g. Faulhaber motor)*	☑ / ☑	Module 72
SFct022.DLL (*)	Senden eines eMails *Sending an eMail*	☒ / ☑	Module 72
SFct023.DLL (*)	Korrekturwert-Berechnung *Correction value calculation*	☑ / ☑	Module 72
SFct024.DLL	**Steuerung über Barcode-Reader/Stammdatensatz** ***Control by barcode reader / reference info. dataset***	☑ / ☑	-----
SFct025.DLL	*Reserved for Special Customer Project*		
SFct026.DLL (*)	Label-Design und Ausdruck mit MS-Excel (**) *Label-Design and Printout by MS-Excel (**)*	☒ / ☑	Module 72
SFct027.DLL	**Laden / Speichern von Kalibrierdaten in Datei** ***Load / Save calibration data in file***	☑ / ☑	-----
SFct028.DLL	*Reserved for Special Customer Project*		
SFct029.DLL	*Reserved for Special Customer Project*		
SFct030.DLL	*Nicht mehr verfügbar / No longer available*		
SFct031.DLL	**Ausführen einer Datei** ***Execution of a file***	☑ / ☑	-----
SFct032.DLL	**Aktuellen Prüfauftrag duplizieren** ***Duplicate current test order***	☑ / ☑	-----
SFct033.DLL	**Messwert Korrektur** ***Measuring value correction***	☑ / ☑	-----
SFct034.DLL	**Aktuelle Messwerte aller Merkmale in CSV-Datei speichern** ***Save actual values of all characteristics in CSV-file***	☑ / ☑	-----
SFct035.DLL	*Reserved for Special Customer Project*		
SFct036.DLL	Kalibrier-Verwaltung *Calibration management*	☑ / ☑	-----
SFct037.DLL	SESAME Export (SPC Datenformat von PSA Peugeot & Citroen) *SESAME Export (SPC Value format of PSA Peugeot & Citroen)*	☑ / ☑	-----
SFct038.DLL	**Messmode beenden und Computer herunterfahren** ***End of measurement mode and shut down of computer***	☑ / ☑	-----
SFct039.DLL	*Reserved for Special Customer Project*		
SFct040.DLL (*)	Knäbel GmbH Slide Scan *Knäbel GmbH Slide Scan*	☒ / ☑	Module 71
SFct041.DLL	Barcode / Data Matrix Code über RS232 einlesen *Read barcode / data matrix code over RS232*	☑ / ☑	-----
SFct042.DLL	String über IMB-sm Kanal senden *Send String over IMB-sm channel*	☑ / ☑	-----

SFctxxx.DLL	ComGage Professional Prüfschritt-Funktion *ComGage Professional Test Step Function*	Verfügbar *Availability* CE / XP..11	Lizenz *License*
SFct043.DLL	**Einfrieren / Freigeben einer Messung** ***Freeze / Release static measurement***	☑ / ☑	-----
SFct044.DLL	Messwert in das Binär/BCD-Format konvertieren *Convert mea. value into Binary/BCD-Format*	☑ / ☑	-----
SFct045.DLL	*Reserved for Special Customer Project*		
SFct046.DLL (*)	Polardiagramm *Polar diagram*	☑ / ☑	Module 72
SFct047.DLL	**Universelles Export-Modul** ***Universal Export Module***	☑ / ☑	-----
SFct048.DLL	*Reserved for Special Customer Project*		
SFct049.DLL (*)	Daten-Export in SQL-Datenbank *Data-Export into SQL-Database*	☒ / ☑	Module 72
SFct050.DLL	**Passwort-Abfrage** ***Password-Request***	☑ / ☑	-----
SFct051.DLL	**Toleranzauswertung** ***Tolerance analysis***	☑ / ☑	-----
SFct052.DLL (*)	Ausgabe eines X/Y- / Scanning- / K/W-Diagrams *Output a of Output of a X/Y / Scanning / F/D diagram*	☑ / ☑	Module 72
SFct053.DLL	*Reserved for Special Customer Project*		
SFct054.DLL	*Reserved for Special Customer Project*		
SFct055.DLL	*Reserved for Special Customer Project*		
SFct056.DLL	**Stammdatensatz in Tabelle suchen** ***Search reference information dataset in table***	☑ / ☑	-----
SFct057.DLL	**Kommunikation über pb_adp / pn_adp** ***Communication over pb_adp / pn_adp***	☑ / ☑	-----
SFct058.DLL	Urkalibrierung über Mittelung mehrerer Rohwerte *Master calibration by averaging of several raw values*	☑ / ☑	-----
SFct059.DLL	Lesen/Schreiben von RFID Speicherzellen über Balluff BIS C-6… *Read/Write RFID memory cells by Balluff BIS C-6…*	☑ / ☑	-----
SFct060.DLL	**Merkmalswert in Tastaturpuffer ausgeben** ***Output of characteristic value into keyboard buffer***	☒ / ☑	-----
SFct061.DLL (*)	Universeller Labeldruck *Universal Label Printing*	☒ / ☑	Module 72
SFct062.DLL	*Reserved for Special Customer Project*		
SFct063.DLL	*Reserved for Special Customer Project*		
SFct064.DLL	**Import von Stammdaten aus Datei** ***Import of Reference Information from File***	☑ / ☑	-----
SFct065.DLL (*)	Kommunikation über Netzwerk-Socket *Communication over network socket*	☒ / ☑	Module 73
SFct066.DLL	*Reserved for Special Customer Project*		
SFct067.DLL	*Reserved for Special Customer Project*		
SFct068.DLL	*Reserved for Special Customer Project*		
SFct069.DLL	**Registerwerte anzeigen** ***Show register values***	☑ / ☑	-----
SFct070.DLL	*Reserved for Special Customer Project*		
SFct071.DLL	Befehl an Messgerät senden (erfordert WGL029.DLL) *Send command to measuring instrument (requires WGL029.DLL)*	☑ / ☑	-----
SFct072.DLL	Steuerung des Messintervalls *Control of the measuring interval*	☑ / ☑	-----
SFct073.DLL	Messwerte verteilen *Distribute measuring values*	☑ / ☑	-----

Bold : **Standardmäßig in ComGage Professional aktiviert**
Activated in ComGage ComGage Professional by default

(*) : Kostenpflichtige ComGage Professional Erweiterungs-Prüfschrittfunktion
ComGage Professional expansion test step function with costs

Italic : *Sonder-Prüfschrittfunktionen, die nur für spezielle Kundenprojekte entwickelt wurden und nicht frei verfügbar sind.*
Special test step functions only developed for special customer projects and not available for sale.

(**) : MS-Excel erforderlich
MS-Excel required

Appendix C

Registry keys of the workplace settings (according to chapter 6.11)

Path inside the Windows registry :

- **HKEY_CURRENT_USER\SOFTWARE\IBR\ComGage**

Registry keys and key parameters :

"WINPARAM **00**"*	= 0	:	The ComGage full screen window always stays in foreground
	= 1	:	The ComGage full screen window can be overlapped by another application
"WINPARAM **01**"*	= 0	:	Position and size of the ComGage full screen window are fixed to default values and cannot be changed
	= 1	:	Repositioning / resizing of the ComGage full screen window is enabled (see WINPARAM 08 and 09)
"WINPARAM **02**"	= 0	:	In measuring mode the mouse pointer is automatically relocated to the ComGage headline and the toolbars of the ComGage window are displayed in measurement mode
	= 1	:	In measuring mode the mouse pointer is NOT relocated to the ComGage headline and the toolbars of the ComGage window are displayed in measurement mode
	= 2	:	In measuring mode the mouse pointer is NOT relocated to the ComGage headline and the toolbars of the ComGage window are hidden in measurement mode
"WINPARAM **03**"	= 0	:	In measuring mode the "*" key opens the SPC-Window and the "/" key toggles between normal and full screen display mode
	= 1	:	In measuring mode the SPC-Window cannot be opened (the "*" key is disabled) and the "/" key toggles between normal and full screen display mode
	= 2	:	In measuring mode the "*" key opens the SPC-Window and the display mode cannot be toggled between normal and full screen mode (the "/" key is disabled)
	= 3	:	In measuring mode the SPC-Window cannot be opened (the "*" key is disabled) and the display mode cannot be toggled between normal and full screen mode (the "/" key is disabled)
"WINPARAM **04**"	= 0	:	The SPC-Window contains the following displays : run chart / histogram / statistical data
	= 1	:	The SPC-Window contains the following displays : run chart / histogram
	= 2	:	The SPC-Window contains the following displays : run chart / / statistical data
	= 3	:	The SPC-Window contains the following displays : run chart
"WINPARAM **05**"	= 0	:	On input of measuring values by keyboard the "Abort"-button (X) is displayed in the entry window when normal screen mode is active (in full screen mode it is always hidden)
	= 1	:	On input of measuring values by keyboard the "Abort"-button (X) is hidden in the entry window also when normal screen mode is active (in full screen mode it is always hidden)
"WINPARAM **06**"	= 0	:	The duration of the message output on calibration error (reference test), probe validity test error or probe free lift control error is unlimited (The message must be acknowledged by pressing the OK-button)
	> 0	:	The parameter value defines the duration of the message output in milliseconds, on calibration error (reference test), probe validity test error or probe free lift control error
"WINPARAM **07**"	= 0	:	The statistical data displays always display the text "Cp / Cpk" for all standard deviation norms of the characteristics
	= 1	:	The statistical data displays display the text "Pp / Ppk" instead of "Cp / Cpk" for characteristics using the standard deviation norm "Sigma = Sges"
	= 2	:	The statistical data displays display the text "Pp / Ppk" instead of "Cp / Cpk" for characteristics using the standard deviation norm „Sigma = Rq / Dn"
	= 3	:	The statistical data displays display the text "Pp / Ppk" instead of "Cp / Cpk" for characteristics using the standard deviation norm „Sigma = Sq / An"
	= 4	:	The statistical data displays display the text "Pp / Ppk" instead of "Cp / Cpk" for characteristics using the standard deviation norm „Sigma = sqr(…)"
"WINPARAM **08**"*	= 0	:	ComGage full screen window width goes to maximum screen size
	> 0	:	Default setting for ComGage full screen window width in pixels (requires that WINPARAM 01 is set to "1")
"WINPARAM **09**"*	= 0	:	ComGage full screen window height goes to maximum screen size
	= 1	:	Default setting for ComGage full screen window height in pixels (requires that WINPARAM 01 is set to "1")
"WINPARAM **10**"	= 0	:	The ComGage function "Adjustment / Calibration" must be executed completely in one test step for characteristics with two masters activated (i.e. on 2-master calibration)
	= 1	:	The ComGage function "Adjustment / Calibration" can be split to more than one test step for characteristics with two masters activated (i.e. on 2-master calibration)
"WINPARAM **11**"	= 0	:	IMB-USB are NOT assigned via serial numbers
	= 1	:	IMB-USB are assigned via serial numbers
"WINPARAM **12**"	= 0	:	Setup button for IMB modules is displayed in IBR-DDK setup window
	= 1	:	Setup button for IMB modules is NOT displayed in IBR-DDK setup window
"WINPARAM **13**"	= 0	:	Run chart: average value line is shown, nominal size line is NOT shown
	= 1	:	Run chart: average value line is shown and nominal size line is shown
	= 2	:	Run chart: average value line is NOT shown and nominal size line is NOT shown
	= 3	:	Run chart: average value line is NOT shown, nominal size line is shown
	= 8	:	Run chart : special appearance with red / yellow / green in the background

"WINPARAM **14**“	= 0	:	The ComGage window for keyboard input of characteristic values is not movable
	= 1	:	The ComGage window for keyboard input of characteristic values is movable (see WINPARAM 15 and 16)
"WINPARAM **15**“	= X	:	Determines the X-position of the upper left corner of the ComGage window for keyboard input of characteristic values referring to the upper left corner of the monitor, as pixel value (requires that WINPARAM 14 is set to “1”)
"WINPARAM **16**“	= Y	:	Determines the Y-position of the upper left corner of the ComGage window for keyboard input of characteristic values referring to the upper left corner of the monitor, as pixel value (requires that WINPARAM 14 is set to “1”)
"WINPARAM **17**“	= 0	:	Standard loading time of test schemes / test orders for measurement operation
	= 1	:	Reduced loading time with undefined control of screen displays during loading process
"WINPARAM **18**“	= n	:	The parameter value defines the duration of the delay time for automatic start of test schemes / test orders on start of ComGage in seconds
"WINPARAM **19**“	= 0	:	Test scheme versioning disabled, except for test schemes it has already been enabled for
	= 1	:	Test scheme versioning enabled for all test schemes
"WINPARAM **20**“	= 0	:	Change test scheme / order : remove old test order in list, change by keys ‘0’ - ‘9’ possible
	= 1	:	Change test scheme / order : keep old test order from list, change by keys ‘0’ - ‘9’ possible
	= 2	:	Change test scheme / order : remove old test order in list, change by keys ‘0’ - ‘9’ NOT possible
	= 3	:	Change test scheme / order : keep old test order from list, change by keys ‘0’ - ‘9’ NOT possible
"WINPARAM **21**“	= 0	:	AQDEF functions deactivated
	= 1	:	AQDEF functions + Start mask
	= 2	:	AQDEF functions + Start mask 2
"WINPARAM **22**“		:	Width of left tool bar in measurement mode (min. : 120)
"WINPARAM **23**“	= 0	:	SPC display during query of event / action activated
	= 1	:	SPC display during query of event / action deactivated
"WINPARAM **24**“		:	Auto save interval while editing test schemes in minutes (0 = deactivated)
"WINPARAM **25**“*		:	X position for full screen window, if the size is adjustable (is set automatically)
"WINPARAM **26**“*		:	Y position for full screen window, if the size is adjustable (is set automatically)
"WINPARAM **27**“*	= 0	:	Characteristic related K-fields (K00xx) are exported with extension /1, /2, … , /128
	= 1	:	Characteristic related K-fields (K00xx) are exported only once with extension /0

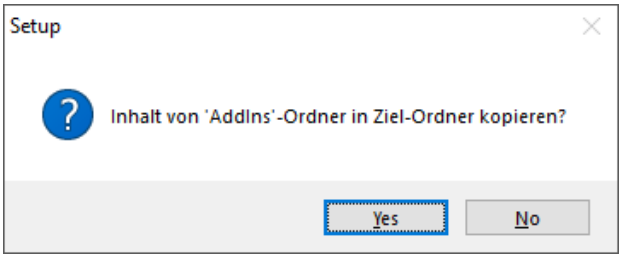
*** :** These WINPARAM registry keys have no effect on Windows CE based systems. System behaviour will correspond to value “0” for these registry keys, as shown in the list above.

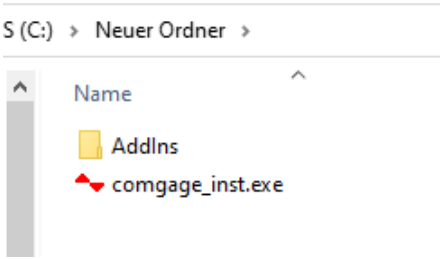
Appendix D

Configuration of the ComGage installation

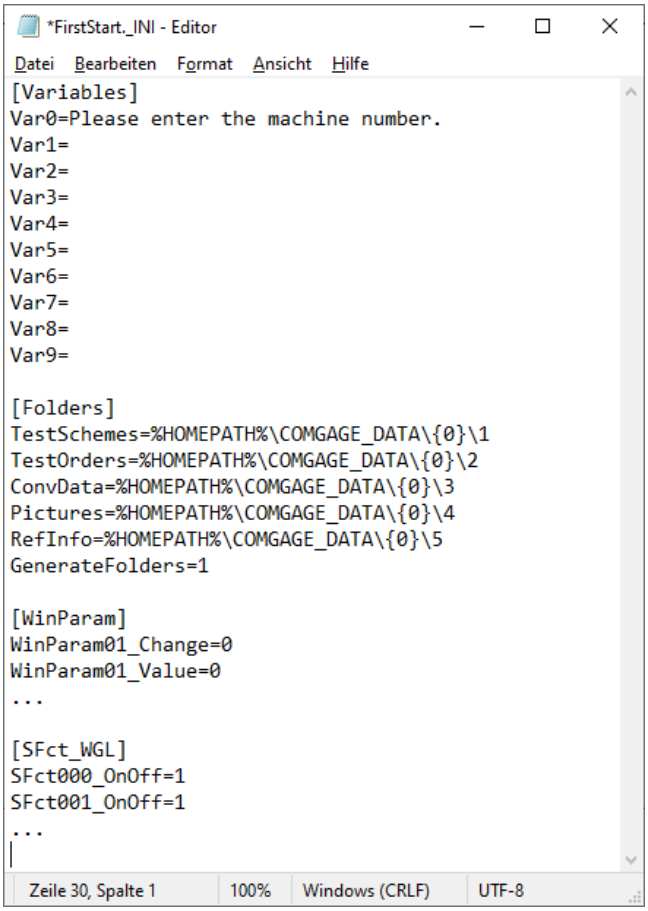
(not available under Windows CE)

ComGage provides the option to automatically copy additional files, e.g. created colour schemes / customer specific measurement modes and test step functions / … into the ComGage programme directory, when ComGage is installed on the PC.
For this, a subdirectory with the name “AddIns” has to be added to the folder which contains the installer. The files which shall be copied to the ComGage programme directory have to be placed in this subdirectory.
During the installation, a message dialogue is displayed to ask if the files from the subdirectory “AddIns” shall be copied to the ComGage programme directory :





This can also be used to let the installer copy the *FirstStart.INI*.
The setting from this INI file are always used. Usually, this is the case during the first start after the installation, but it can also be used later by copying this file into the ComGage programme directory. After the successful use of the settings from the *FirstStart.INI*, it is renamed to *FirstStart._INI*.
The *FirstStart.INI* can be used to configure the preparation of the environment by ComGage.
The settings listed under [Folders], [WinParam] and [SFct_WGL] can later be changed in ComGage in the *Options* menu.



The FirstStart.INI contains four sections :

[Variables] : Up to 10 variables (Var0 … Var9) can be queried. ComGage opens a separate dialogue windows for each variable, one after the other, which shows the entered text and allows a text input. These variables can then be used e.g. for an automatic configuration of the data directories (see [Folders]).
→ ***Varx=*** means that the variable is not queried.

[Folders] : In this section, the data directories can be specified. The variables queried under [Variables] can be used via the placeholders {0} to {9}. An example can be seen in the screenshot on the previous page.
With the option “GenerateFolders” can be determined, if the data directories shall be created, if they do not already exist (=0 : do not create directories / =1 : create directories).
→ **See chapter 6.4 for more information about the data directories.**

[WinParam] : The Registry entries which are used by ComGage can be configured in this section.
These Registry entries are related to the settings which can be configured in the ComGage software under *Options* → *Workplace settings*.
Only those WinParam are set to *_Value*, for whom *_Change=1* is set.
→ **See Appendix C with the list of all WinParams.**

[SFct_WGL] : Here can be selected, which test step functions (SFcts) and measurement modes (WGLs) are available in ComGage.
All SFcts and WGLs are present in the ComGage programme directory (even those, which require additional licenses). We recommend to deactivate the SFcts and WGLs which are not needed (=0 : SFct / WGL not available / =1 : SFct / WGL available).
→ **See Appendix B with the list of all measurement modes / test step functions.**

Note : An example of a *FirstStart._ini* file can be found in the installation directory. It can be changed with the Editor and renamed to *FirstStart.ini*.

Appendix E

Terms and formulas used by the ComGage SPC calculations

Average

The average value indicates the value around which the measuring results fluctuate. (corresponds with the maximum turning point of the bell-shaped curve)

Standard deviation

The standard deviation indicates with which absolute value the measuring results fluctuate around the average value. (corresponds with the width of the bell-shaped curve)

In the area of +/- one standard deviation around the average value are located on a normally distributed production process from statistical view : 68.26 % of all manufactured components.
In the area of +/- two standard deviations around the average value are located on a normally distributed production process from statistical view : 95.4 % of all manufactured components.
In the area of +/- three standard deviations around the average value are located on a normally distributed production process from statistical view : 99.73 % of all manufactured components.

Calculation of the estimated standard deviation σ :

Note: The standard deviation is estimated for Cp & Cpk values, because on measuring only samples of components there are not all measurement values of the manufactured components available for statistical calculations.

Method “Sigma = Sges” :

$$\sigma = s_{ges} = \sqrt{\frac{\sum_{i=1}^{n*k} (x_i - x_q)\text{^}2}{n*k-1}}$$

x_i : Measuring value i
x_q : Average of all measuring values
n : Sample size
k : Number of samples

Method “Sigma = Rq / Dn” :

$$r_j = \max\ j - \min\ j; \textit{range of sample } j$$

$$\sigma = \frac{\sum_{i=1}^{k} r_j}{k * d_n}$$

d_n : Table of constants, see DGQ – SPC2, page : 128

Method “Sigma = Sq / An” :

$$s_j = \sqrt{\frac{\sum_{i=1}^{n} (x_{i,\,j} - x_{q,\,j})\text{^}2}{n-1}}; \textit{Standard deviation of sample } j$$

$$\sigma = \frac{\sum_{i=1}^{k} s_j}{k * a_n}$$

a_n : Table of constants, see DGQ – SPC2, page : 128

Method “Sigma = sqr(…)” :

$$s_j = \sqrt{\frac{\sum_{i=1}^{n} (x_{i,\,j} - x_{q,\,j})\text{^}2}{n-1}}; \textit{Standard deviation of sample } j$$

$$\sigma = \sqrt{\frac{\sum_{j=1}^{k} s_j\text{^}2}{k}} = \sqrt{\frac{\sum_{j=1}^{k}\sum_{i=1}^{n} (x_{i,\,j} - x_{q,\,j})\text{^}2}{k*(n-1)}} = \sqrt{\frac{\sum_{j=1}^{k} sum2,\,j - \frac{sum1,\,j * sum1,\,j}{n}}{k*(n-1)}}$$

$$sum1,\,j = \sum_{i=1}^{n} x_{i,\,j}$$

$$sum2,\,j = \sum_{i=1}^{n} x_{i,\,j} * x_{i,\,j}$$

$x_{i,j}$: Measuring value i of sample j
$x_{q,j}$: Average of sample j
n : Sample size
k : Number of samples

C_p value

The C_p value is calculated as shown below :

$$C_p = \frac{USL - LSL}{6 * \sigma}$$

If the C_p value = 1, then from statistical view 99.73 % of the manufactured components are within the tolerance limits.
If the C_p value < 1, then from statistical view less than 99.73 % of the manufactured components are within the tolerance limits.
If the C_p value > 1, then from statistical view at least 99.73 % of the manufactured components are within the tolerance limits.

Note : For the calculation of the C_p value, the tolerance range T (= USL-LSL) is used. For a one-sided tolerated characteristic there is only one tolerance limit. So no tolerance range can be specified.
To be able to calculate a kind of C_p value anyway, the tolerance range is determined by the existing tolerance limit and the nominal value. In this case the resulting calculated "C_p" value is usually too low.
To differentiate this calculation method from the normal calculation method for the C_p - Value, the so calculated "C_p" value is marked as C_p in ComGage.*

C_{pk} value

The C_{pk} value is calculated as shown below :

$$C_{pk} = MIN\left(\frac{USL - Xq}{3 * \sigma}; \frac{Xq - LSL}{3 * \sigma}\right)$$

The C_{pk} value is > 1.33 for a capable process.
With a C_{pk} value between 1.00 and 1.33, the process must be constantly monitored.

If C_{pk} << C_p and C_p > 1.00, then the process centring must be improved.

*Note : If a one-sided tolerated characteristic has only an USL the C_{pk} value is calculated with the formula (USL - X_q) / (3*σ) and if it has only a LSL with the formula (X_q - LSL) / (3*σ).*
Since this procedure is different from the standard calculation of the C_{pk} value, in these cases the "C_{pk}" values are marked as C_{pk} in ComGage.*

Appendix F

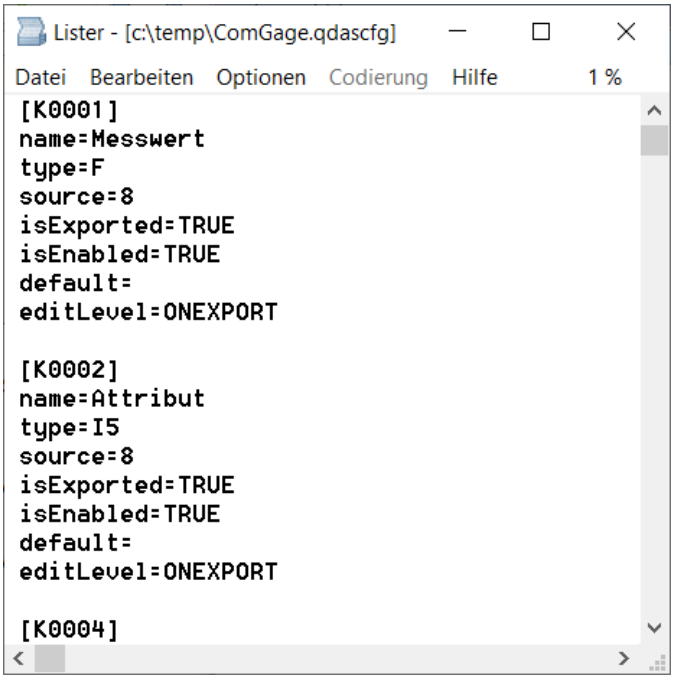
Files of the IBR_AQDEF module

File format ComGage.qdascfg

The configuration file of the *K-field configurator* is saved in the INI file format. For every K-field one section is written. The name of the section matches the K-field number with the prefix „K“ (e.g. [K0001]). Every section contains the following keys :

- name (name of the K-field in plain text)
- type (Q-DAS data type, e.g. I3, F, A20, …)
- source (reference to a data source, is assigned by ComGage)
  - 0 = Manual input
  - 1 = File KField_Tables.ini with identifiers
  - 2 = catalog.dfd
  - 3 = Test reason
  - 4 = Test order list
  - 6 = *.toDFD
  - 7 = *.tsDFD
  - 8 = Measurement Data
  - 21 = Reference inf. dataset 1 … 50 = Reference inf. dataset 30
  - 101 = K0001 … 10099 = K9999
  - 10200 = catalog.dfd : K4002 … 10249 = catalog.dfd : K4492
  - 10300 = catalog.dfd : K4003 … 10349 = catalog.dfd : K4493
- isExported (shows if the K-field is exported (TRUE) or not exported (FALSE))
- isEnabled (shows if the K-field is enabled (TRUE) or disabled (FALSE))
- default (Default value for the K-field)
- editLevel (Editing level)
  - WORKPLACE = Workplace level
  - TESTSCHEME = Test scheme (common)
  - TESTSCHEME_CHAR = Test scheme (characteristic)
  - TESTORDER = Test order
  - STARTMASK = Start mask
  - ONEXPORT = On exporting

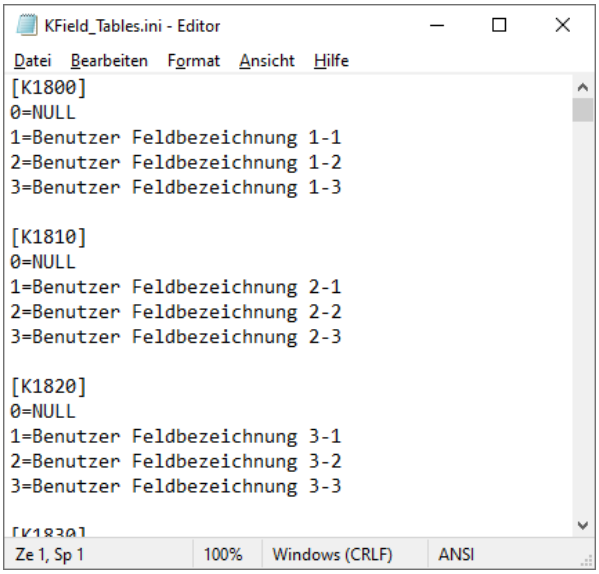
Example :



File format KField_Tables.ini / KField_Tables_xxxx.ini

In the *K-field configurator* you can create a catalogue with identifiers. In this catalogue you can provide a list of options for every K-field from which the user can make his selection. The catalogue is saved in the INI file format. For every K-field one section is written. The name of the section matches the K-field number with the prefix „K“ (e.g. [K0001]). The keys of the entries are numbers, the values are any desired texts. Please note that the length and format of the texts is limited by the selected type of the K-field (*K-field configurator*). To use the catalogue with identifiers for a K-field, it has to be selected as data source for this K-field.

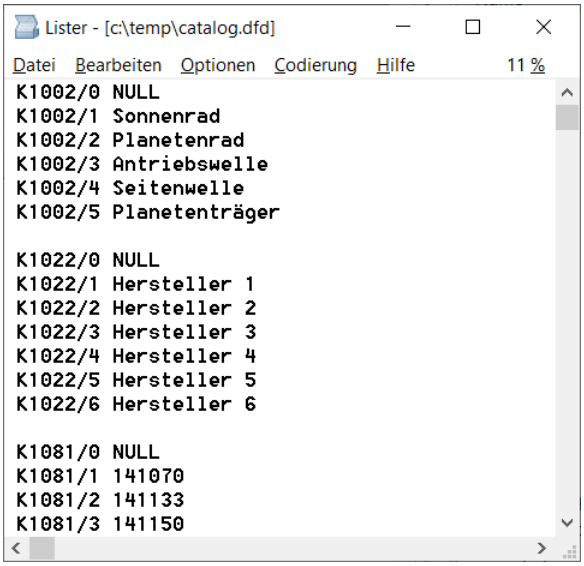
Example :



File format catalog.dfd

In the K-field configurator you can create a Q-DAS catalogue in which the available options for one or more K-fields can be defined. The Q-DAS catalogue is saved in the DFD data format. Only one entry is written in every line. The line always starts with the K-field and the index of the catalogue entry for this K-field, separated by a “/”. The content (value) of the entry is separated from the K-field and the index by one blank space. To use the Q-DAS catalogue for a K-field, it has to be selected as data source for this K-field.

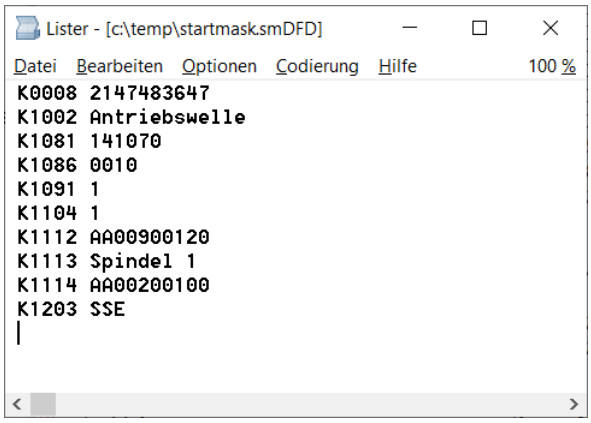
Example :



File format workplace.wpDFD, startmask.smDFD, <Order number>.toDFD, <Article number>.tsDFD

The K-field configuration is saved for every editing level (*Workplace*, *Test scheme*, *Test order* & *Start mask*) in a separate file in the DFD file format. For every configured K-field the K-field number is written in a line as prefix and the content of the K-field is separated from the prefix by one blank space. If the content of the K-field is defined for several characteristics, the number of the characteristic is added to the K-field number, separated by a "/".

Example :



Note : If the file *.tsDFD (contains the content of K-fields belonging to the test scheme or the characteristics) is renamed for use with a different test scheme with a different number of characteristics, ComGage behaves as follows :
If there are less characteristics in the new test scheme, the K-fields are filled with the first entries. The surplus entries in the *.tsDFD are ignored.
If there are more characteristics in the new test scheme, the first K-fields are filled with the entries from the *.tsDFD. The K-fields of the surplus characteristics stay empty.

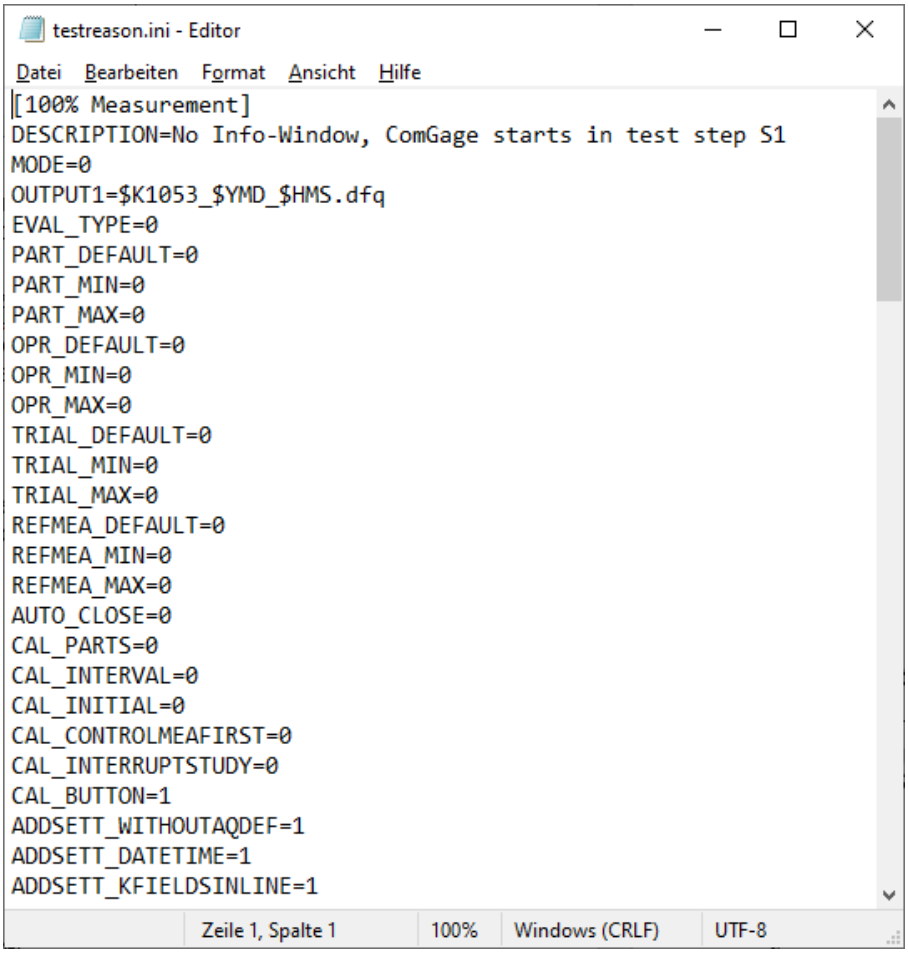
File format testreason.ini

The test reason configuration is saved in the INI file format. For every test reason a separate section is created. The name of the section matches the name of the test reason. For every test reason the following keys are saved :

- DESCRIPTION (Description of the test reason)
- MODE (Mode for the test reason)
  - 1 = Calibration
  - 2 = Master-Calibration
  - 3 = Master Control Measurement
  - 4 = Measurement
  - 5 = Test measurement
  - 10 = User defined 1
    …
  - 19 = User defined 10
- OUTPUT1 (Output file name for the test reason)
- OUTPUT2 (Output file name 2 for the test reason, optional)
- EvalType (Type of the Study) → see K2202 in the Q-DAS documentation
  - 0 = Sample measurement
  - 1 = Type 1
  - 2 = Type 2
  - 3 = Type 3
  - 4 = Cnomo 1
  - 5 = Cnomo 2
  - …
  - 65000 = Sample size = K8500
- PART_DEFAULT, PART_MIN, PART_MAX (Default, Min, Max for number of parts) → K2205

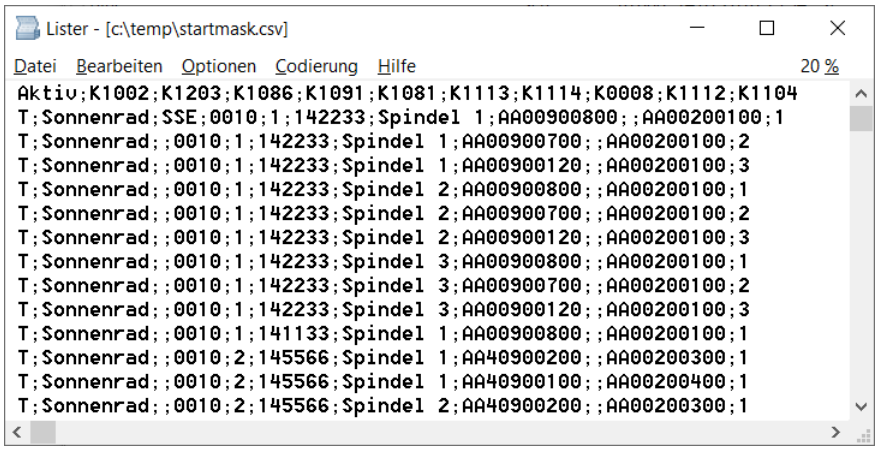
- OPR_DEFAULT, OPR_MIN, OPR_MAX (Default, Min, Max for Operator) → K2220
- TRIAL_DEFAULT, TRIAL_MIN, TRIAL_MAX (Default, Min, Max for Trial) → K2221
- REFMEA_DEFAULT, REFMEA_MIN, REFMEA_MAX (Default, Min, Max for number of measurements with reference master) → K2222
- AUTO_CLOSE (Close the Info dialogue between 2 measurements automatically)
- CAL_PARTS (Number of parts until next calibration is necessary)
- CAL_INTERVAL (Interval in sec. until next calibration is necessary)
- CAL_INITIAL (Initial Master Control Measurement / Calibration)
- CAL_CONTROLMEAFIRST (Master Control Measurement instead of Calibration and Calibration on error)
- CAL_INTERRUPTSTUDY (Master Control Measurement / Calibration may interrupt running study)
- CAL_BUTTON (Activation of a button in the info dialogue for manually calling a master control measurement or a calibration)
- ADDSETT_WITHOUTAQDEF (Cancel the study if the measurement mode is exited without AQDEF Export)
- ADDSETT_DATETIME (Use of date and time of the AQDEF export instead of date and time of saving the measuring values)
- ADDSETT_KFIELDSINLINE (Determination which K-fields the measuring value line of the DFQ file shall contain : 0 = K0001 … K0004 / 1 = K0001 … K0005 / …)

Example :



File format startmask.csv

The configuration of the *Start mask configurator* is saved in the CSV file format. All entries are separated by semicolons. The first line contains the headlines. The structure is identical to the displayed table in the *Start mask configurator*.



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