# SPS

# MANUAL

# ComGage Pro
## Software

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# Manual   ComGage

## 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 statistical process control by means of the statistical functions included.
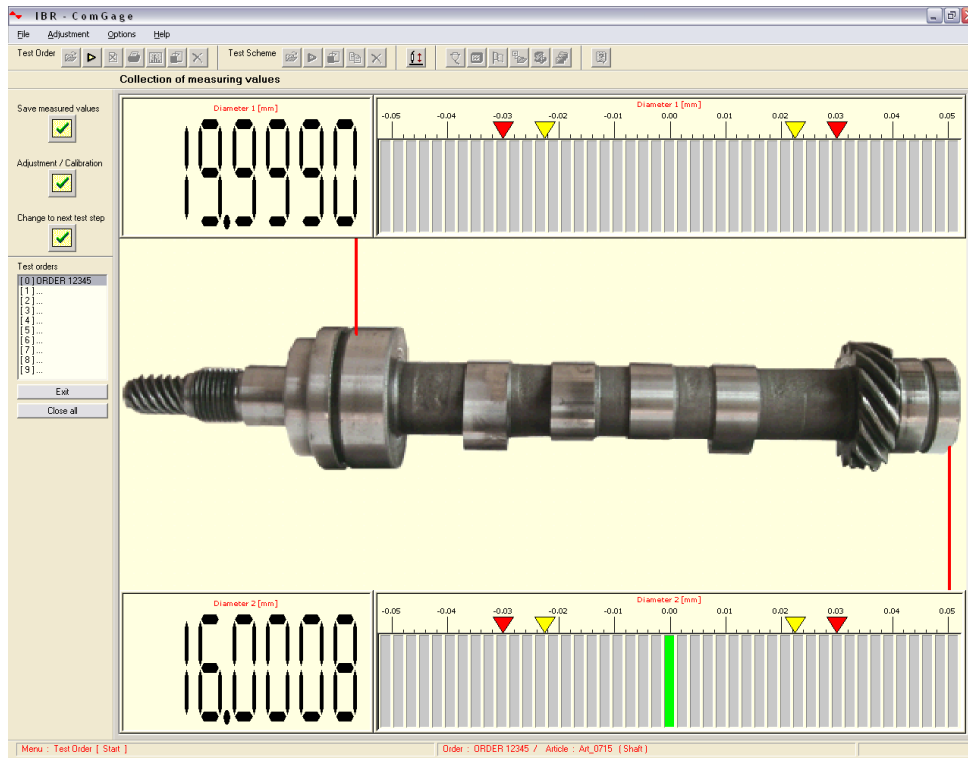
## 2. Features

◆ *Connection of all gauges and sensors via universal measuring bus "IMBus" and wireless system "IBRit-rf1"*
◆ *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 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 ( on air-gauging )*
◆ *Opening of zero adjustment and gauge calibration window ( = extra test step ) by function key, foot switch, timer or number of measured components*
◆ *Reference test for performing fixture check*
◆ *Test of probe validity as well as probe free lift control for safeguarding measurements and calibrations*
◆ *Control functions by digital inputs and outputs, Profibus or Profinet*
◆ *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 )*

## 3. General information about ( working with ) 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.

Programming in ComGage is done via a graphical user interface. The layout and colours can be defined without limitations – always seeing the programming result or information on the screen ( visual programming ).

In ComGage you can mainly programme two file types :
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, … ) and how the display windows are set-up. 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 must contain a test scheme ( which defines all parameters for the test of the component ) and can contain the number of components to be tested.
>  The measurement data of a test order can be saved, converted ( Excel, QS-Stat, … ), analysed and printed.

Test schemes and test orders can also contain reference information ( machines, operators, batch numbers, … ). The programming of test schemes and test orders is described in detail in this manual.

The ComGage software consists of 5 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

Example of a company's usage of the 5 modules :
>  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 ).

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 ).

**ComGage - files :**

| File | File contents | File | File contents |
|---|---|---|---|
| ComGage.cfg | → ComGage programme settings | *.rto, *.cto | → Test orders |
| ComGage.ddk | → ComGage hardware settings | *.sch | → Display element design |
| ComGage.rif | → Reference information settings | *.tod | → Measurement data |
| ComGage.usr | → User management information | | of test order |
| DisObj.cfg | → Current settings of menu "Options / Display Elements" | *.tsf | → Test schemes |
| | | *.tsc | → Test scheme documenta-tion Ix / Qx / Rx |
| IBR_DDK.idt | → Text comments on IMB / IBRit-rf1 modules | | |
| *.dwc | → Stored display window contents | | |

## 4.   Installation and brief overview

The following chapter portrays a brief overview of the steps necessary for installing the software and adjusting the ComGage basic settings. It also describes how to create a small measuring programme ( = test scheme ).

### 4.1  Installation

| Hardware requirements : | Software requirements : |
|---|---|
| Pentium 1000 | Windows 2000 / XP / Vista / 7 / 8 / 10 ( 32 bit and 64 bit ) |
| $\geq$ 1 GB Ram | Windows CE |
| $\geq$ 100 MB free hard disk space | |

### 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.

   <u>Important notes :</u>
   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 now is 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 in-
   stallation 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. Then unzip the file.

2. Start the unzipped installation file **ComGage_Inst.exe**.

3. Execute the above-described steps 3. to 7. for Installation.

# Manual   ComGage

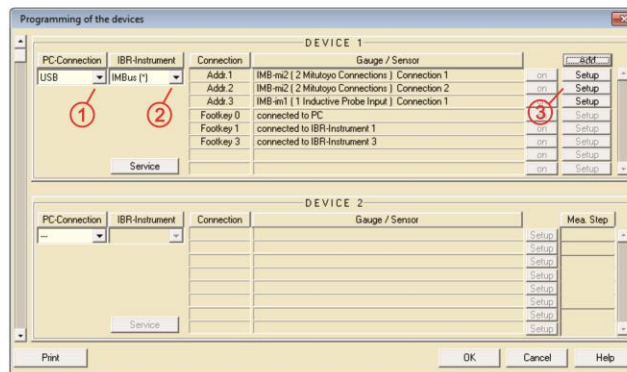## 4.2  Brief overview

### Installation — 1 — Installation

**ComGage-CD zur Installation einlegen.**
*Die Installation erfolgt automatisch und es öffnet sich das Fenster für die Einstellung der Messgeräteanschlüsse.*

**Mess- bzw. Interfacegeräte am PC anschließen.**

**Insert ComGage CD for installation.**
*The installation occurs automatically and a window for setting up the connected instruments opens.*

**Connect measuring or interface instruments to the PC.**

**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, ...

**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, ...

### Prüfplan — 2 — Test scheme

**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.**

**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.**

#### Prüfplan-Erstellung mit ComGage

#### Creation of a test scheme with ComGage

① Button : *Prüfplan / Anlegen.*

② Artikelnummer eingeben.

③ Artikelbezeichnung eingeben.

④ *Optional*
Stammdaten eingeben ( Prüfer, Maschine, ... ). Sondereinstellungen, Hardware-Konfiguration und Programmvariante auswählen. Registers & I/Os dokumentieren.
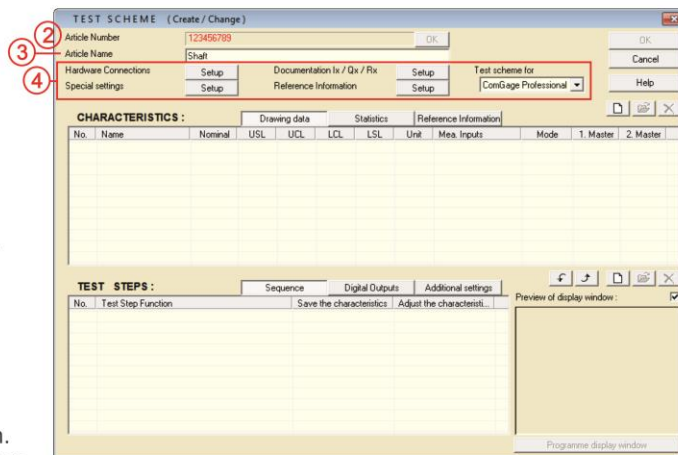
① Button : *Test Scheme / Create.*

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.

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

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

## Merkmal - Erstellung im ComGage - Prüfplan

## Creation of characteristics in ComGage test scheme

① Auf Neu-Button zum Anlegen eines Merkmals klicken.

① Click on New-Button for creating a characteristic.

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

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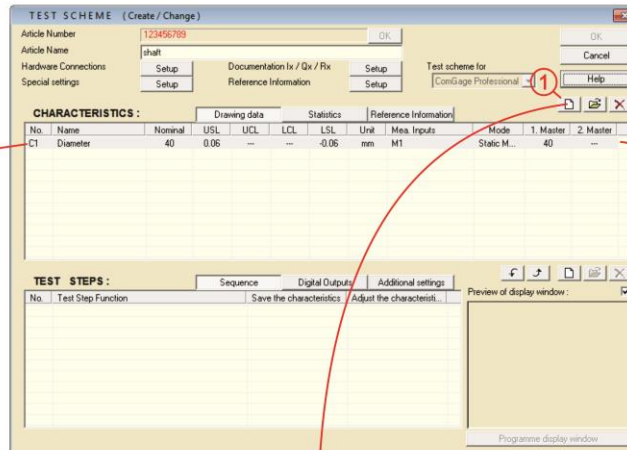


② Merkmalbezeichnung eintragen.

② Enter characteristic name.

③ Merkmaldaten ( Einheit, Nennmaß, Toleranzen ) aus Zeichnung übernehmen.
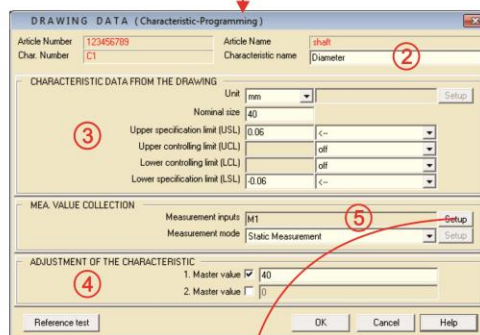
③ Enter characteristic data ( unit, nominal size, tolerances ) from the drawing.

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

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

⑤ Auswahl eines Messeingangs.

⑤ Selection of a measuring input.



⑥ Messeingang eintragen.

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

Alternativ können Messwerte oder attributive Merkmale per Tastatur eingegeben werden.

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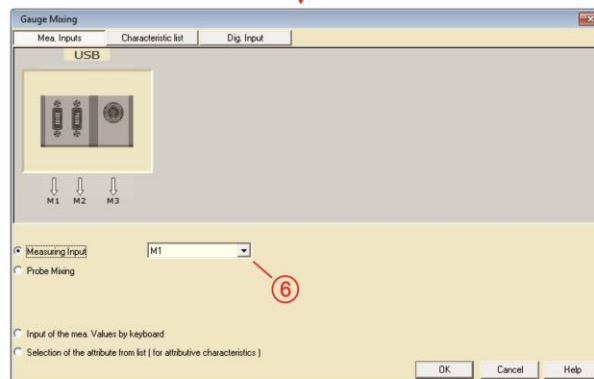
**Durch wiederholte Betätigung des Neu-Buttons können weitere Merkmale von dem zu prüfenden Teil angelegt werden.**

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

Der Prüfablauf enthält die einzelnen Prüfschritte mit den Anzeigefenstern.

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

## 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 F1-Taste gelöscht und ein neuer Messwert wird über T1 Fußtaster gespeichert.*

⑥ Gestaltung des Anzeigefensters aufrufen.

⑦ Anzuzeigendes Merkmal aus Liste auswählen.

⑧ Anzeigeelement für angewähltes Merkmal auswählen und platzieren.

## 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 F1-key and a new measured value is saved by T1 foot switch.*

⑥ Call programming menu for display window.

⑦ Select characteristic for display from list.

⑧ Select and place display element for selected characteristic.

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

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.**
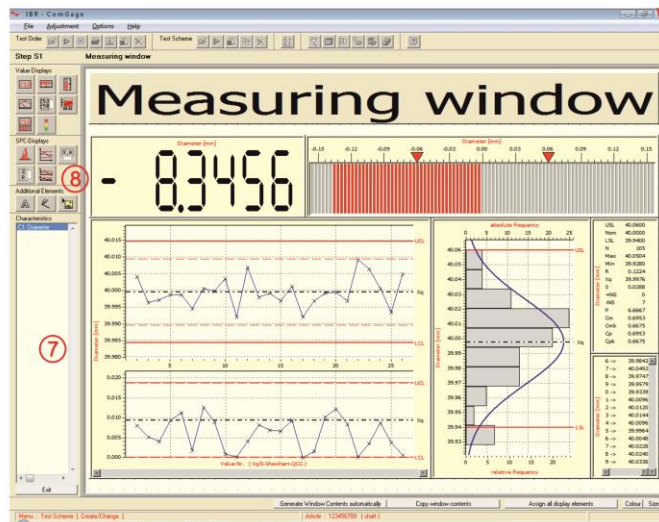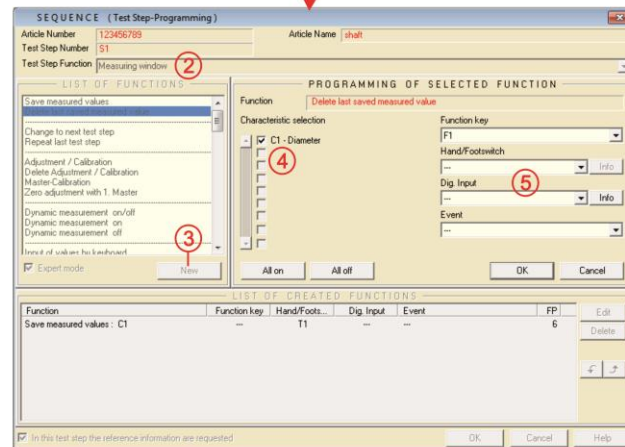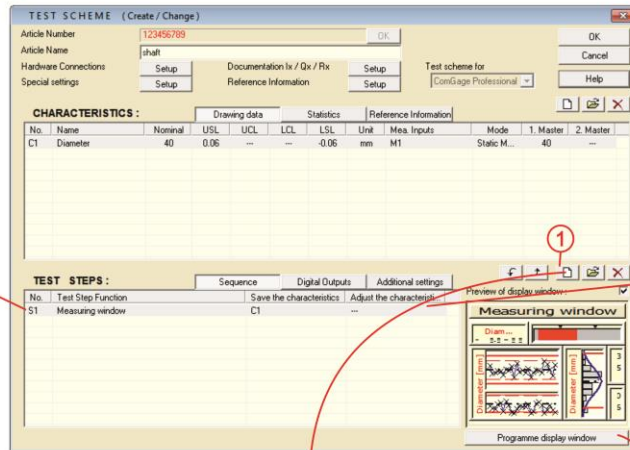
## 5.  User login

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

**Log in**

| | |
|---|---|
| User name | |
| Password | |

| OK | Cancel |
|---|---|
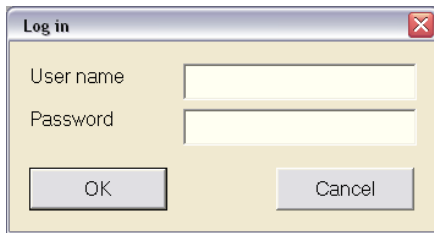
After successfully logging in, the main window of ComGage is displayed.

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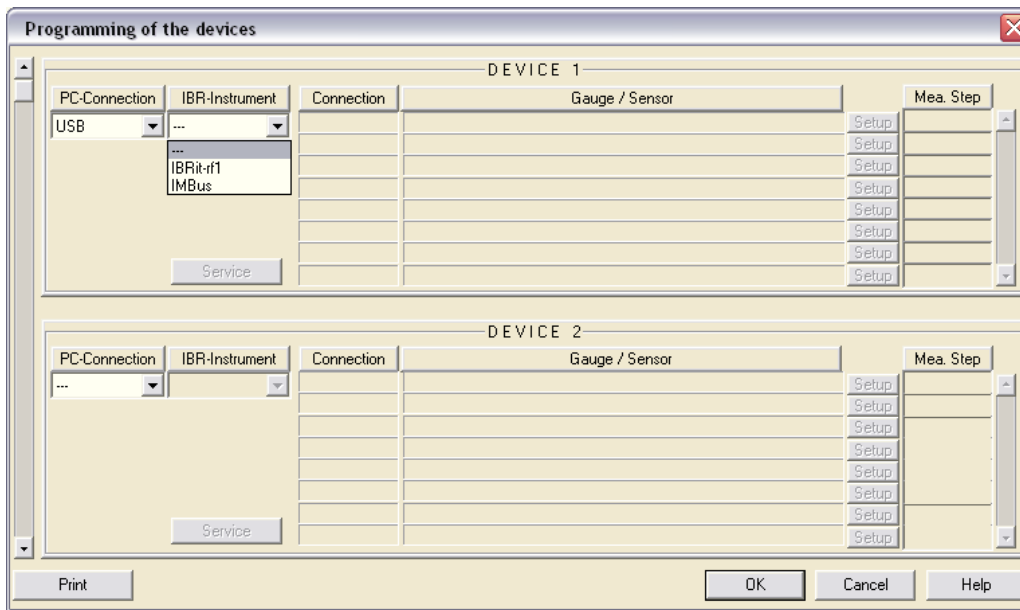
In the **Options / Connections** menu ( Button : [icon] ) the connected interfaces and measuring instruments are selected and - if necessary - configured ( by clicking the **Setup** - buttons ).
ComGage automatically opens the window of the Options / Connections menu on initial operation.



***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 :

In case of IBRit-rf1 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 manual.*

# Manual ComGage
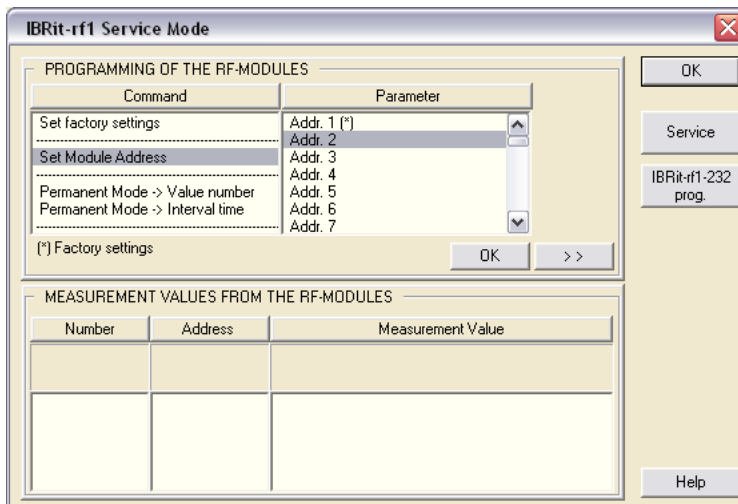
IMBus :

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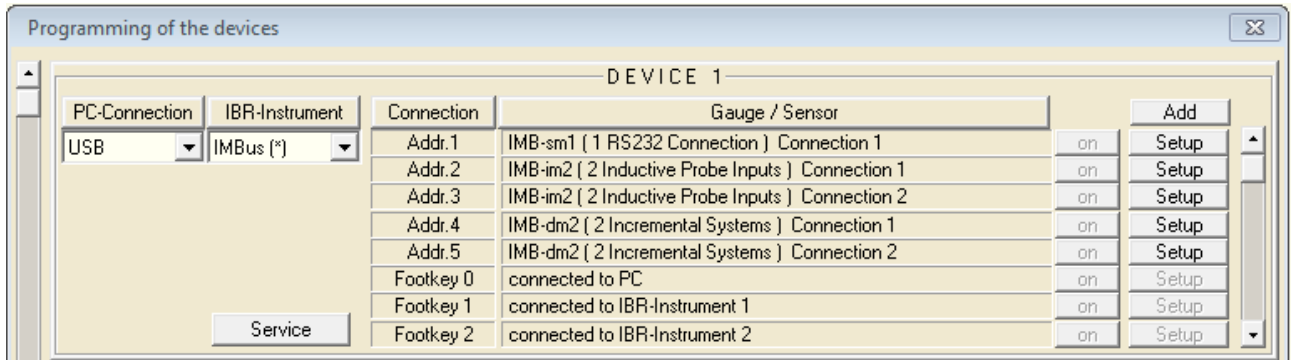


You can select e.g. the gauges connected to the IMBus interface modules ( IMB-sm1…4, IMB-pm1, … ) by means of the **Setup** - buttons for the individual measuring inputs :
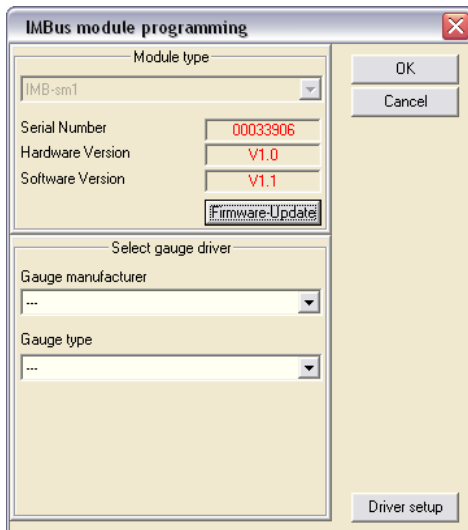


In case of IMBus measuring modules ( IMB-im1…8, IMB-dm1…4, IMB-tc1…4, IMB-ai1…8, IMB-ae1, … ) you can select the resolution, measuring direction and more :
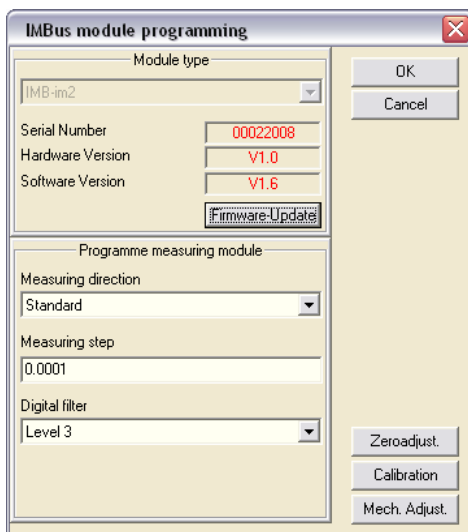
Other IBRit instruments ( such as IBRit-mc / -md, IBRit-di8 / -de8 / -da8, C100, C200, … ) can be released by the IBR support department, after consultation.
For this you must have the license no. 75 "Old Hardware Support" activated in the license dongle.

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.
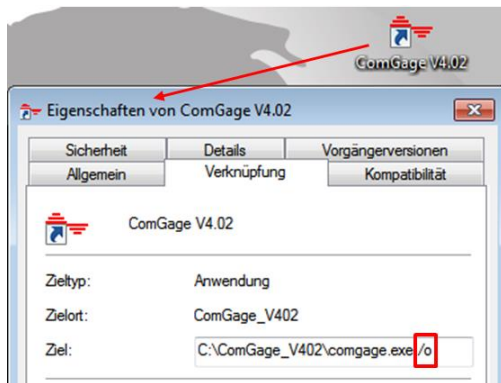
## 6.2   Display elements

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 ). In addition you can define, save and delete schemes including a colour palette 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.
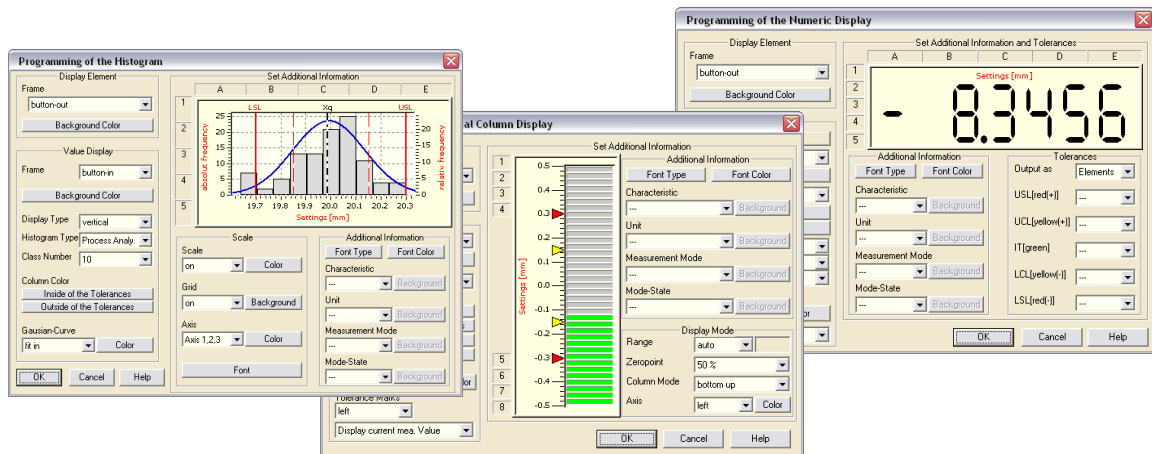
***Important notice regarding display elements :***
Many of the display elements available can be programmed to display either the current measurement value ( option : "Display current mea. Value" ) or the last saved measurement value ( option : "Display mea. Value from file" ) of the characteristic 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 :  [flag icon]  ). On language selection a window containing a list of the available languages is displayed.
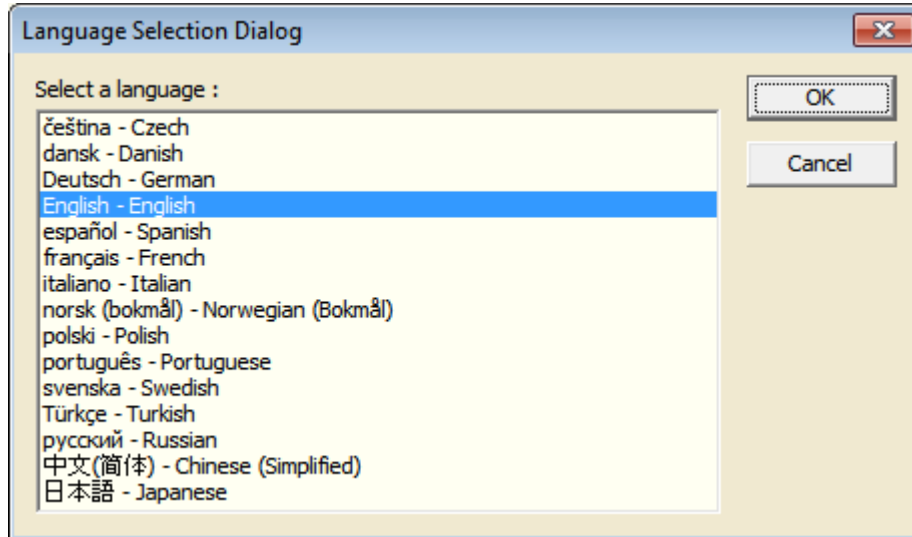


Select your language and confirm by clicking the **OK** - button.

*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 :

- Directory for the test scheme files
- Directory for the test order files and collected measurement data
- Directory for the converted measurement data ( Excel - files, QDAS - files, … )
- Directory for the pictures ( *.bmp, *.png, *.jpg - files )
- 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.
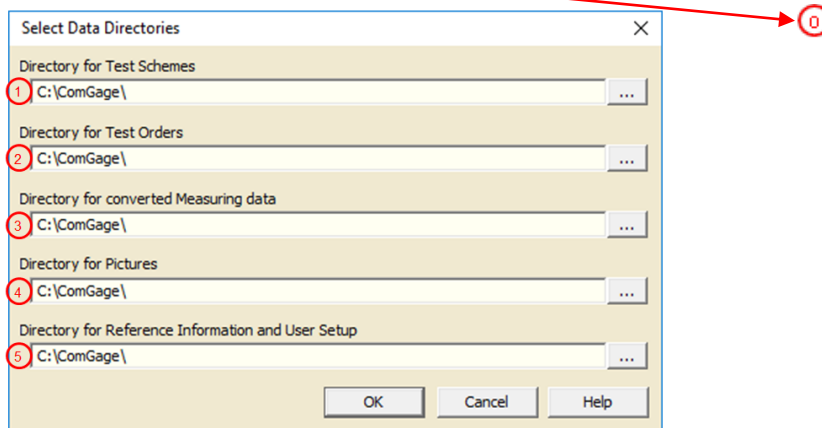


The button ... opens a separate dialog which allows you to select a directory.

***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.*
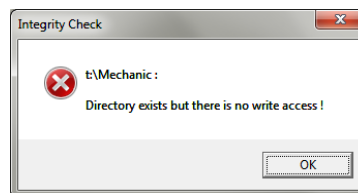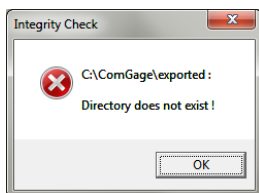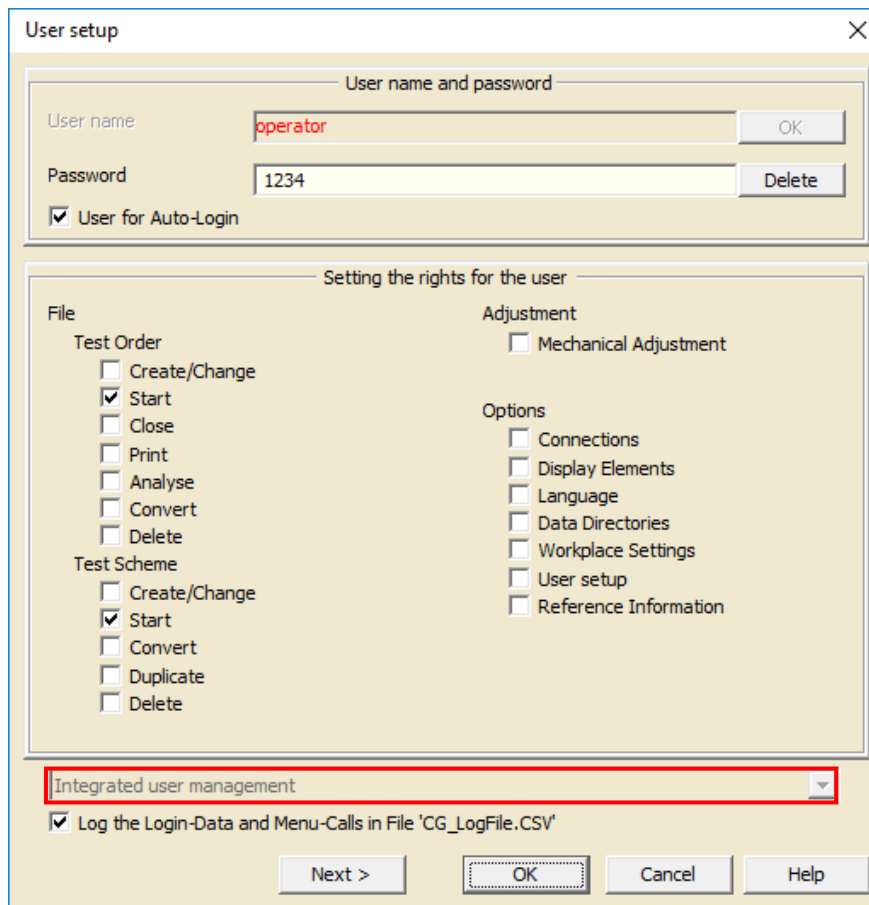


**ComGage – files and their storage location :**

| 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 IMB / IBRit-rf1 modules | ⓪ |
| *.dwc | → Stored display window contents | ① |
| *.rto, *.cto | → Test orders | ② |
| *.sch | → Display element design | ⑤ |
| *.tod | → Measurement data of test order | ② |
| *.tsf | → Test schemes | ① |
| *.tsc | → Test scheme documentation Ix / Qx / Rx | ① |

## 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"** ( left bottom window 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 ),
- 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 :
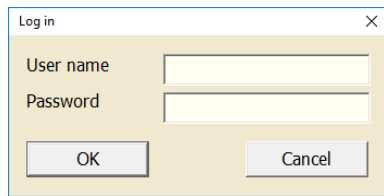


**Note :**   *Capitalization of user name and password is not checked.*

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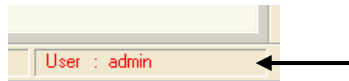


**2.)  User management by Active Directory** ( not available on Windows CE systems )

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.
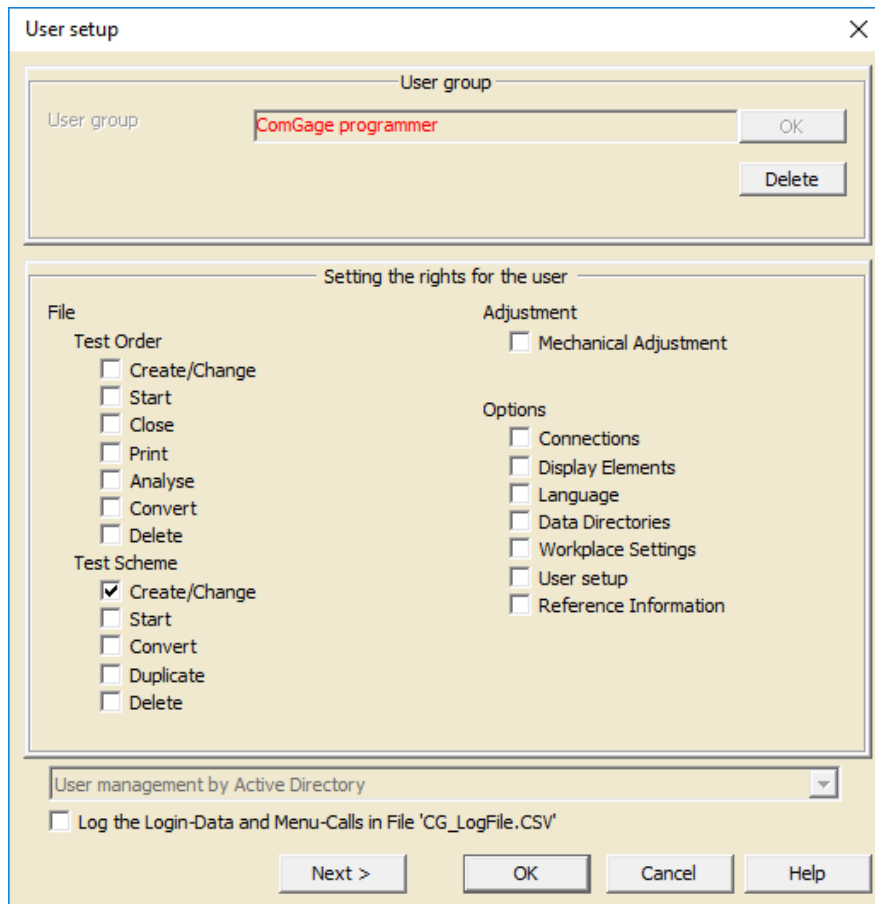


After entering the user group you can select the rights to be assigned.

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.

## 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.
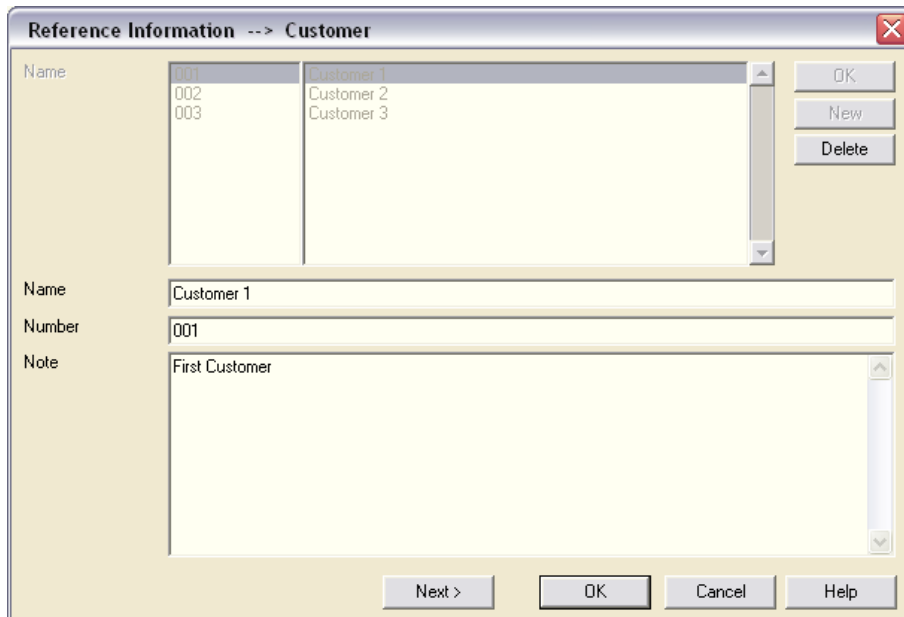


First of all you must mark a data set in the list and select it by clicking the **OK** - button in the right upper window corner or create a new one by clicking the **New -** Button. After selecting it, you can change the data set or delete it by clicking the **Delete** - button.

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 prompted 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 | - Operator |
| - Supplier | - Shift |
| - Manufacturer | - Test place |
| - Works / Department | - Storage place |
| - Machine | - Production instruction |
| - Fixture | - Test instruction |
| - Nest | - Events ( Why a measurement value is out of tolerance? ) |
| - Tool | - Batch / Serial number |
| - Material | - Action ( What has been done for process correction? ) |
| - Test equipment | |

- 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  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 6.9 ) 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.
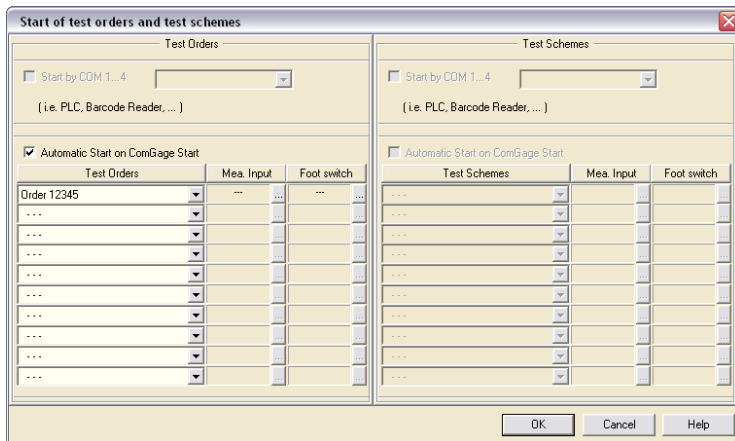


*Test Orders & Start by COM1...4*
→ On ComGage Start or on choosing the Menu *File / Test Order / Start* you are requested to select a test order by the barcode reader or another connected reading device :
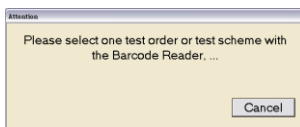


The barcode reader or other connected reading device must use the transmission format 9600 Baud, 8 data bits, no parity and 1 stop bit. The test order number followed by "carriage return" must be transmitted to the COM port in order to select a test order for start.

*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 .

## 6.8  Convert

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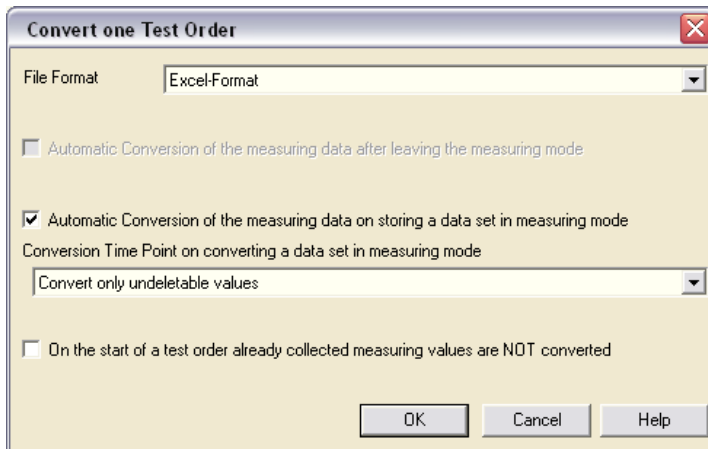


*File format*
→ Selection of the data format, into which the conversion shall occur :

   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.

## 6.9 Workplace settings



**Workplace Settings** ☒

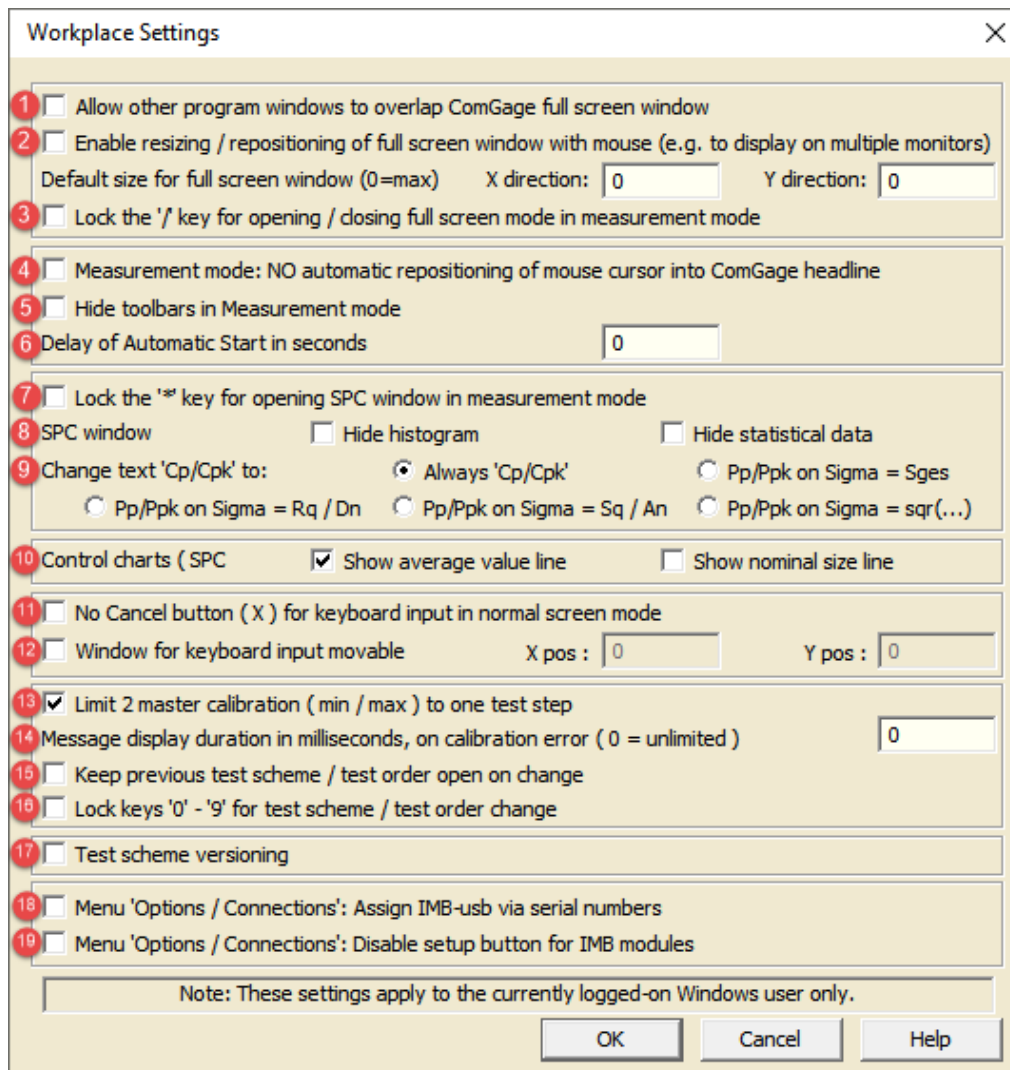1. ☐ Allow other program windows to overlap ComGage full screen window
2. ☐ Enable resizing / repositioning of full screen window with mouse (e.g. to display on multiple monitors)
   Default size for full screen window (0=max)    X direction: `0`    Y direction: `0`
3. ☐ Lock the '/' key for opening / closing full screen mode in measurement mode

4. ☐ Measurement mode: NO automatic repositioning of mouse cursor into ComGage headline
5. ☐ Hide toolbars in Measurement mode
6. Delay of Automatic Start in seconds    `0`

7. ☐ Lock the '*' key for opening SPC window in measurement mode
8. SPC window    ☐ Hide histogram    ☐ Hide statistical data
9. Change text 'Cp/Cpk' to:    ⦿ Always 'Cp/Cpk'    ◯ Pp/Ppk on Sigma = Sges
   ◯ Pp/Ppk on Sigma = Rq / Dn    ◯ Pp/Ppk on Sigma = Sq / An    ◯ Pp/Ppk on Sigma = sqr(...)

10. Control charts ( SPC    ☑ Show average value line    ☐ Show nominal size line

11. ☐ No Cancel button ( X ) for keyboard input in normal screen mode
12. ☐ Window for keyboard input movable    X pos : `0`    Y pos : `0`

13. ☑ Limit 2 master calibration ( min / max ) to one test step
14. Message display duration in milliseconds, on calibration error ( 0 = unlimited )    `0`
15. ☐ Keep previous test scheme / test order open on change
16. ☐ Lock keys '0' - '9' for test scheme / test order change

17. ☐ Test scheme versioning

18. ☐ Menu 'Options / Connections': Assign IMB-usb via serial numbers
19. ☐ Menu 'Options / Connections': Disable setup button for IMB modules

Note: These settings apply to the currently logged-on Windows user only.

[ OK ]    [ Cancel ]    [ Help ]

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**
   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**
   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. **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.

7. **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 ).

8. **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 ).

9. **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( … )". |

10. **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 ).

11. **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.

12. **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.

13. **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 ).

14. **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.
    > 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. If the message is acknowledged by the operator before the defined output duration time has expired, the message window is closed with the acknowledgment. On selection of 1 millisecond as message output duration the message window is not displayed.

15. **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.

16. **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.

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

16. **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.

17. **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.
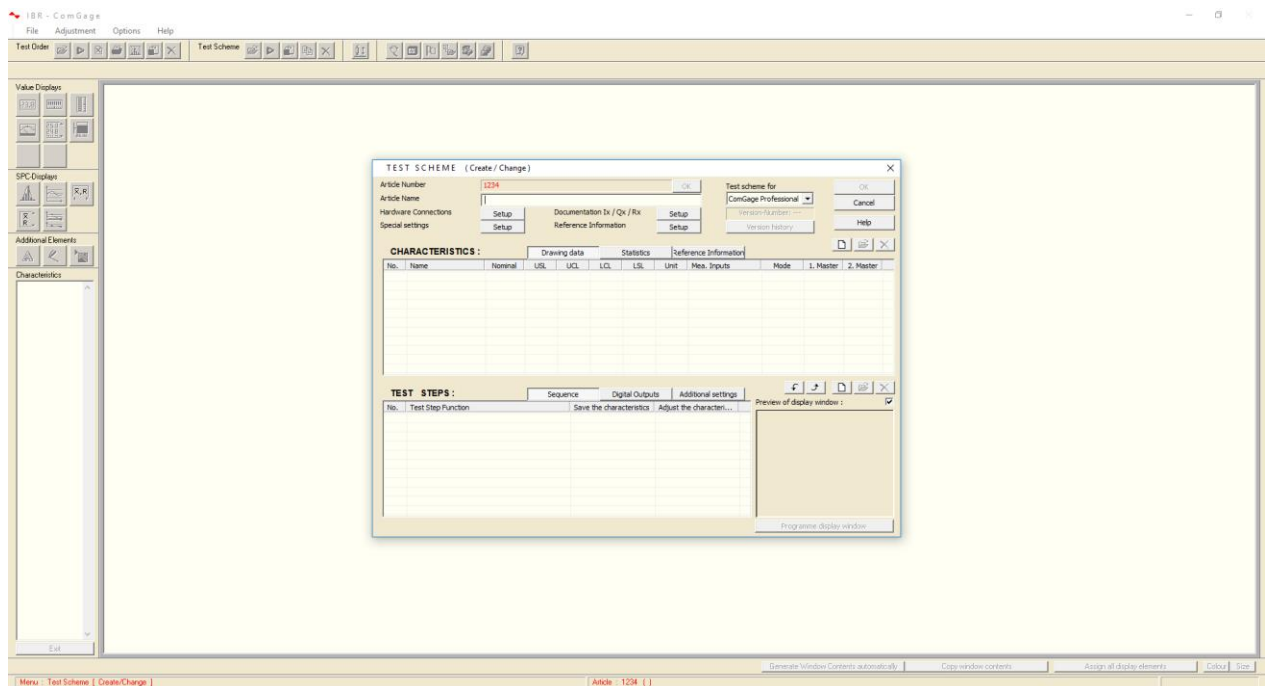
## 7.  Creating a test scheme

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 : [icon] ) 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 must already 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** )*



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 / Compact / 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 Compact. )

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) **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* )

9) **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* )

10) **Characteristics – Reference Information** ( Data entered as characteristics – reference information can be e.g. the test equipment used. ➔ *See chapter 7.8* )

11) **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* )

12) **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* )

13) **Test Steps – Additional settings** ( Programmable additional settings are for example : a sample plan or automatic recognition of plug gauges. ➔ *See chapter 7.11* )

14) **Test steps – Programme display window** ( Design of the display windows for the particular test steps. ➔ *See chapter 7.12* )

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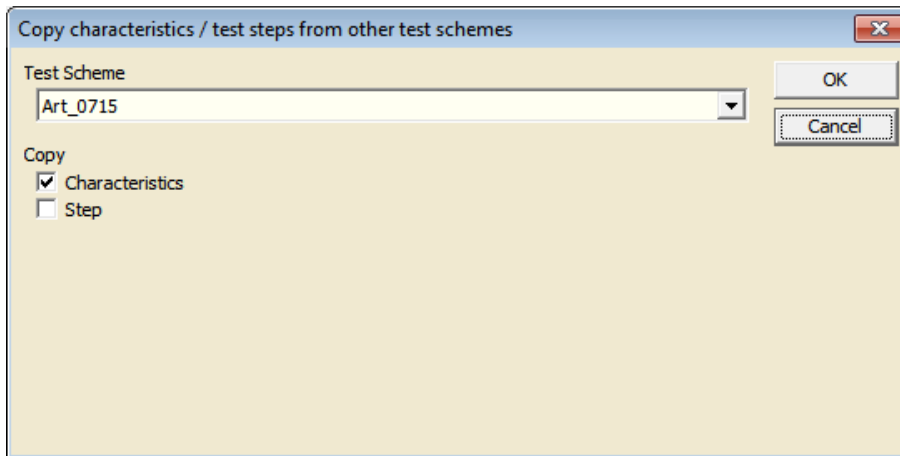


First of all you select out of the selective list at the top of the window the test scheme from which the characteristics and / or test steps come from, that are to be imported into your current test scheme. By the checkboxes you can then determine whether to import only characteristics, only test steps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

**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. )
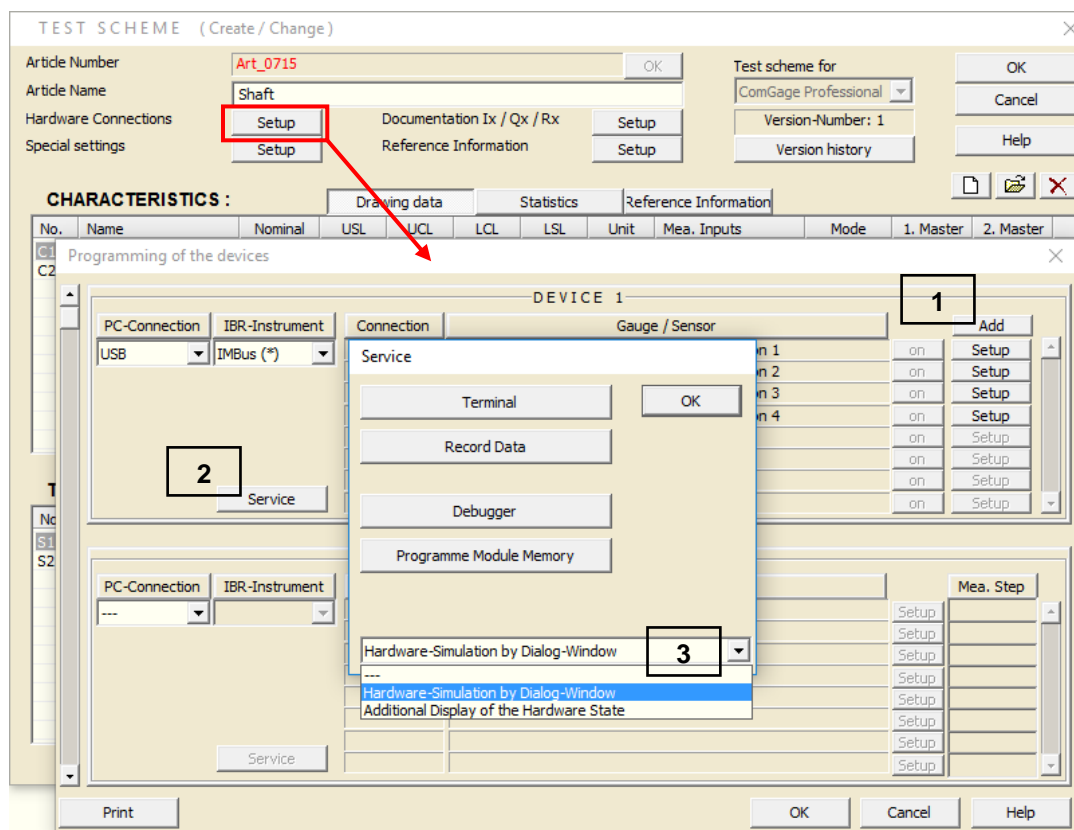


On selection of **IMBus** as **IBR-Instrument** you can call the functions specified in the following.

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 IMBus 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** 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 ).



Section "Measuring inputs" :
The current measuring values of the simulated measuring inputs are displayed. The dropdown lists at the right of the particular measuring input allow setting the values.

Section "Digit jump" :
Here you can use the dropdown list to set the value for the desired measurement value fluctuation ( jitter ).

Section "Hand / Foot switch" :
Here you can simulate the actuation of any hand / foot switch by checking the appropriate box.

Section "Digital Inputs" :
Here you can simulate the setting of any digital input by checking the appropriate box.

Section "Digital Outputs" :
Here the state of the digital outputs is displayed. A checked box indicates digital outputs that are set.

Illustration 1 : Dialog window

Section "Measuring inputs" :
The current measuring values of the connected measuring inputs are displayed.

Section "Hand / Foot switch" :
Here the state of the hand / foot switches is displayed. A checked box indicates pressed hand / foot switches.

Section "Digital Inputs" :
Here the state of the digital inputs is displayed. A checked box indicates digital inputs that are set.

Section "Digital Outputs" :
Here the state of the digital outputs is displayed. A checked box indicates digital outputs that are set.

Illustration 2 : Hardware status window

## 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 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 6.9 ).

**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 6.9 ).

**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 14.2 ).

**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.
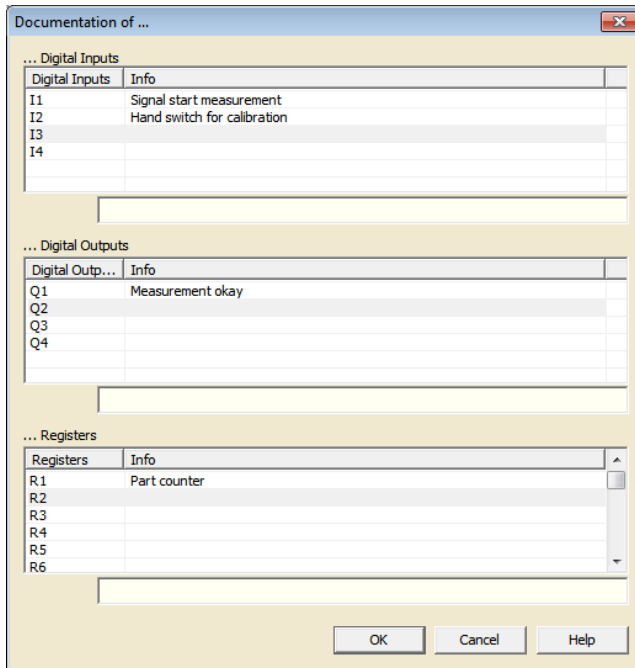


ComGage automatically adds the available digital inputs / digital outputs to the particular lists for documentation. Also, the 2000 available registers are automatically added to the list for register documentation.

Now you can enter a descriptive "Info"-text for the marked list entries of the 3 documentation categories, by writing this text into the entry field below the list of the corresponding documentation category. For making a new entry, you can simply mark the list entry for which you want to enter an "Info"-text.

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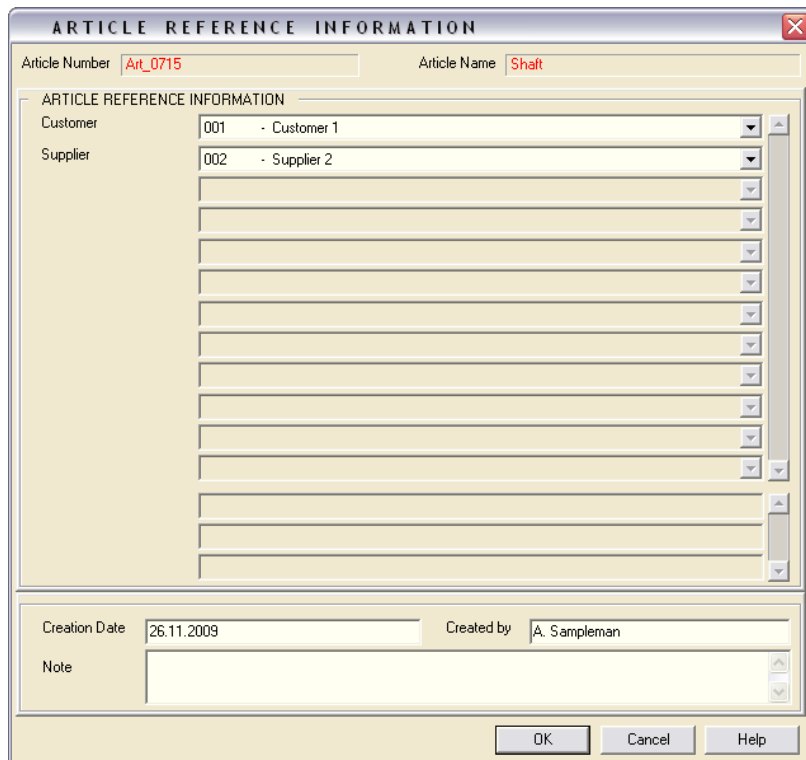
All modifications made are discarded on exiting the entry window for additional test scheme information by clicking on the **Cancel** - button.

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 ).

**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 ( may 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 37

7.) **Measurement mode :**
Measurement mode for calculating the measurement result ( e.g. static, dynamic ) → see page 39

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.

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 6.9 )*. 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. In 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 )**
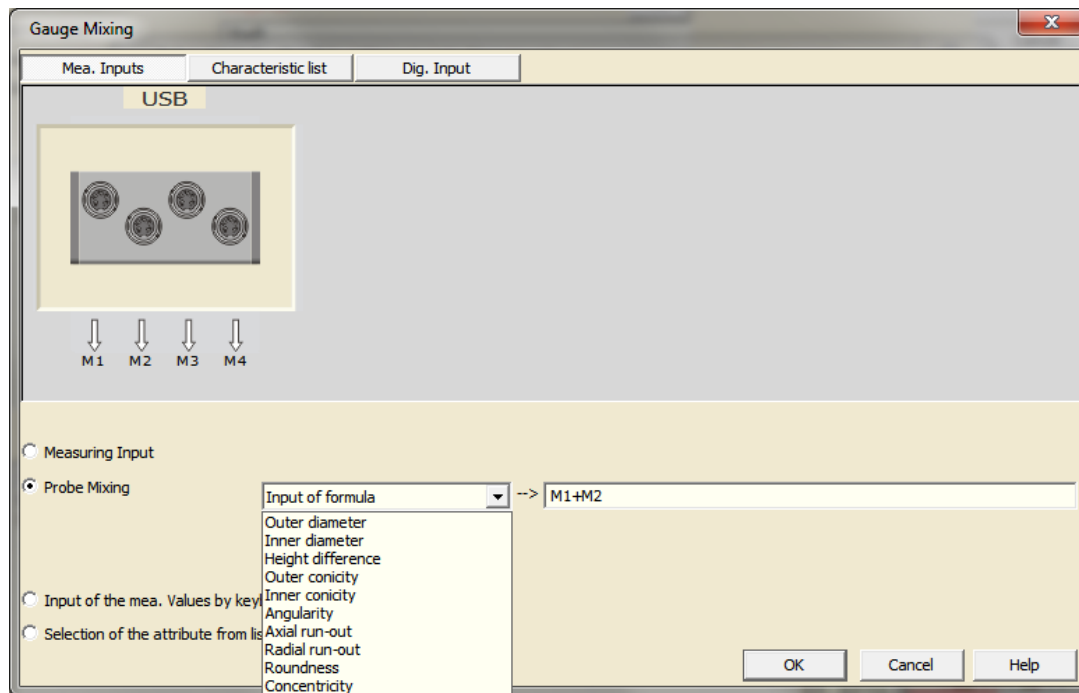


The following selection in the gauge mixing window is possible for the calculation of the measuring value of a characteristic :

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 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 |
| 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(;;;)<br>Min() | Min-value of all elements in the list<br>Min-value of all saved measuring values of the characteristic | Min(M1;M2;C3;M4+C5)<br>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.
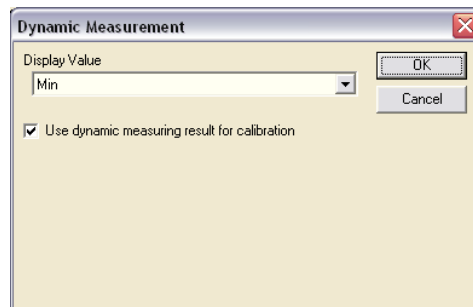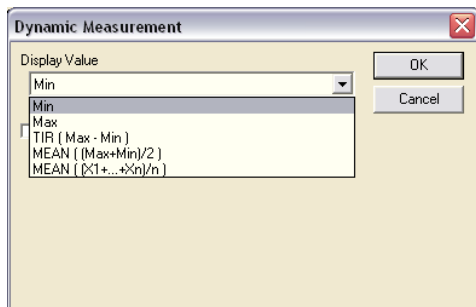


| | | |
|---|---|---|
| **Min** | → | Determination of the smallest measurement value |
| **Max** | → | Determination of the biggest measurement value |
| **TIR** | → | Determination of the TIR Value ( Max-Min ) |
| **MEAN ( (Max+Min)/2 )** | → | Determination of the area Mean value ( (Max+Min)/2 ) |
| **MEAN ( (X1+...+Xn)/n )** | → | Determination of the arithmetic Mean value ( Addition of all measurement values and division by the number of 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".

**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.
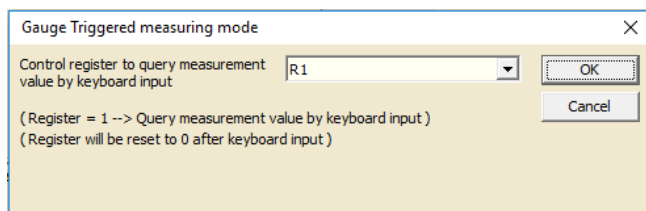


If the register value equals 1, measurement value collection takes place by keyboard input <u>instead of</u> the common gauge triggered collection.

Additional measuring modes ( e.g. for measuring flatness, roundness examination, dynamic measurement with groove removal, … ) are available on request.

## **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 directly repeated.

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 when 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.

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.
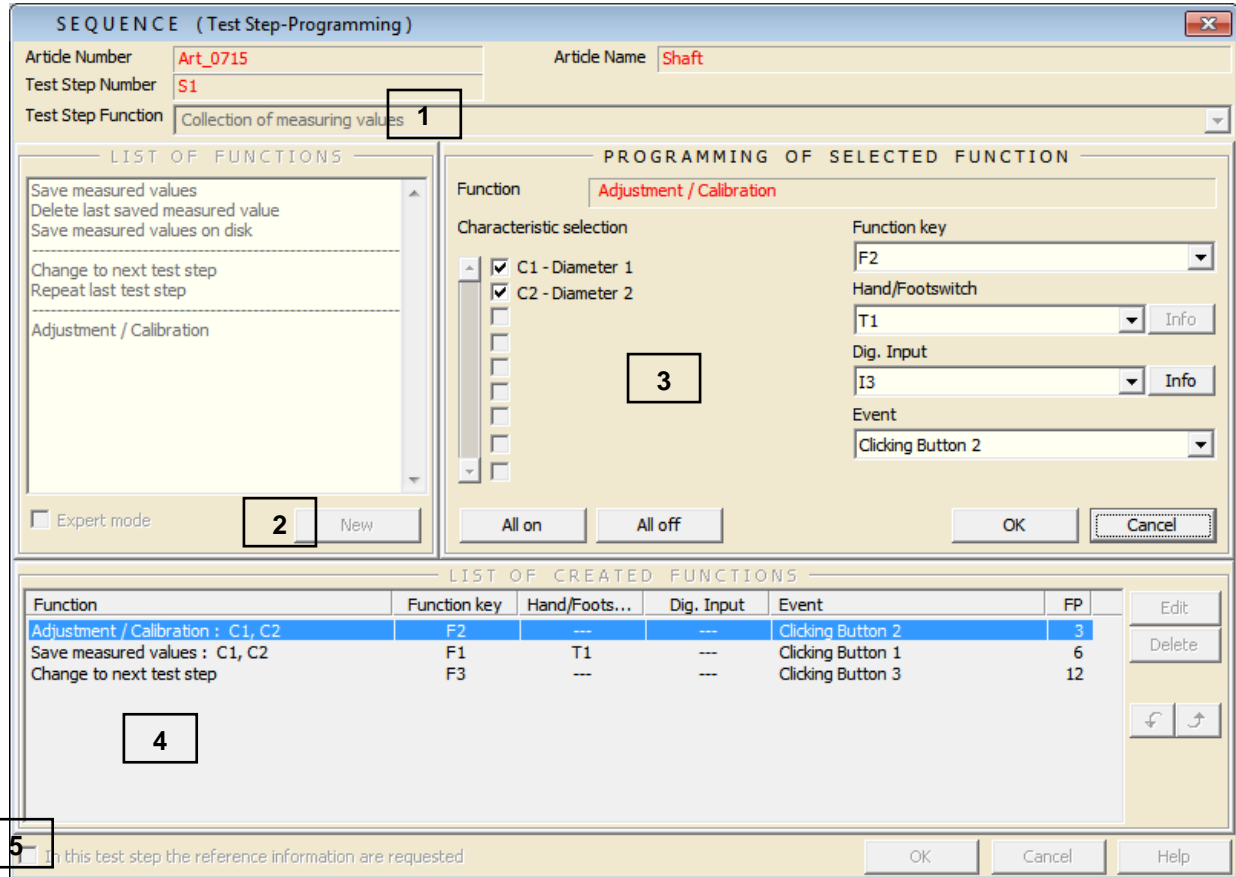


1. Input of test step function ( e.g. Collection of characteristic C1...C5, Statistic window, … )
   *Text field for documentation of the test step function !!*

2. Select a function from the list and click the **New** – Button
   ( All functions are available in the **Expert mode**. )

   Table of available functions :

| 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 |
| 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 |

| Name of function | Description of function | FP* |
|---|---|---|
| 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 | Allows the zero adjustment of the selected characteristics with the first 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 function allows simple offset compensation during measurement operation for characteristics with two master values. | 3 |
| Dynamic measurement on / off | The dynamic measurement of the selected characteristics is switched on and on second function call switched off again. <br> *Note :* <br> *Changing to a different test step only works if dynamic measurement is switched off.* | 1 |
| 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 6.8 of this manual on usage of this function.** | 8 |

| Name of function | Description of function | FP* |
|---|---|---|
| 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 ). <u>The registers must be manually reset by sequence control programming</u> | 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.<br>*Note :*<br>This function should <u>not</u> 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 |
| 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. | 11 |
| Printout / Bitmap of the screen contents | The current display window contents are printed out as form of screen-shot and / or stored as Bitmap ( *.bmp ). This function <u>should not be triggered by the event "Test Step Start"</u>, 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 |
| 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" ). 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.<br>*Note :*<br>*A documentation file to this function is located in the ComGage installation folder.* | 11 |
| Q-DAS Konverter | 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.<br>*Note :*<br>*A documentation file to this function is located in the ComGage installation folder.* | 11 |
| 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. The definable, integer register values can - amongst others - also be incremented / decremented. | 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. | 11 |

| Name of function | Description of function | FP* |
|---|---|---|
| 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. | 11 |
| 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.<br>_Note :_<br>_A documentation file to this function 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. | 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 |
| 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 |
| 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 |
| 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. | 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. | 11 |

| Name of function | Description of function | FP* |
|---|---|---|
| Special calculations | Special calculations can be executed for selectable characteristics or a specific span of characteristics. The calculation mode can be chosen from various predefined options. The calculation result is then loaded into a selectable register. | 11 |
| 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 <u>transmit</u> e.g. measuring values, register values and reference information. Register values and reference information can also be <u>received</u>. 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. | 11 |
| Output of characteristic value into keyboard buffer | This function allows using function key and key combination entries <u>from other application programs</u> ( 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 <u>written to the current cursor position in the active application program</u>. <br> *Note :* <br> *A documentation file to this function 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. <br> *Note :* <br> *A documentation file to this function is located in the ComGage installation folder.* | 11 |
| Show register values | This function displays the current values of registers. | 11 |

**\* :** **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 ( if the register value is programmed as event for executing another function ) still has  influence on :
- all functions with the same function priority ( 11 ), which are located further below in the list of created functions,
- 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 <u>not</u> 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 <u>only when ComGage is started</u>.
    ( 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 ).
  - → 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.
  - → 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.

  \* : 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.

3. Assignment of specific parameters for the selected test step function.
   Assignment of function keys, hand / foot switches, digital inputs and events for execution of the function :
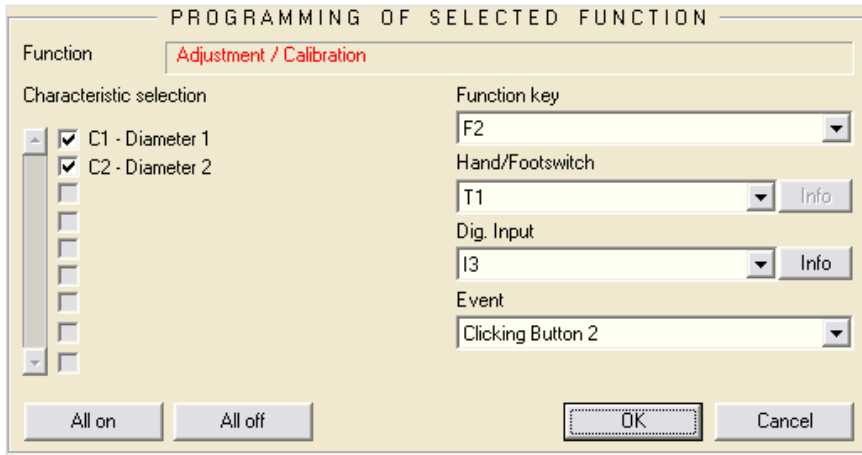


Notes :

a) By clicking the **Info** - Button the available digital inputs are graphically illustrated in a picture.

b) Available events :
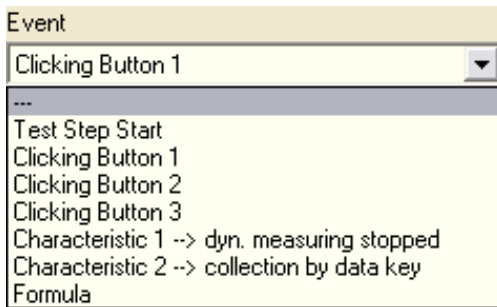


*Test Step Start* :    The function is executed automatically on the start of the test step, i.e. when ComGage changes to the test step.
With this event it is possible e.g. to start a dynamic measurement, when ComGage changes to the test step for dynamic measurement.



*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.
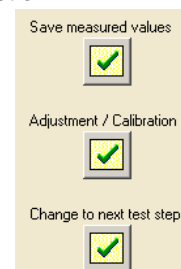
*Characteristic x → dyn. meas...* :    If the dynamic measurement of characteristic x is stopped, then the assigned functions are executed.

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 ).
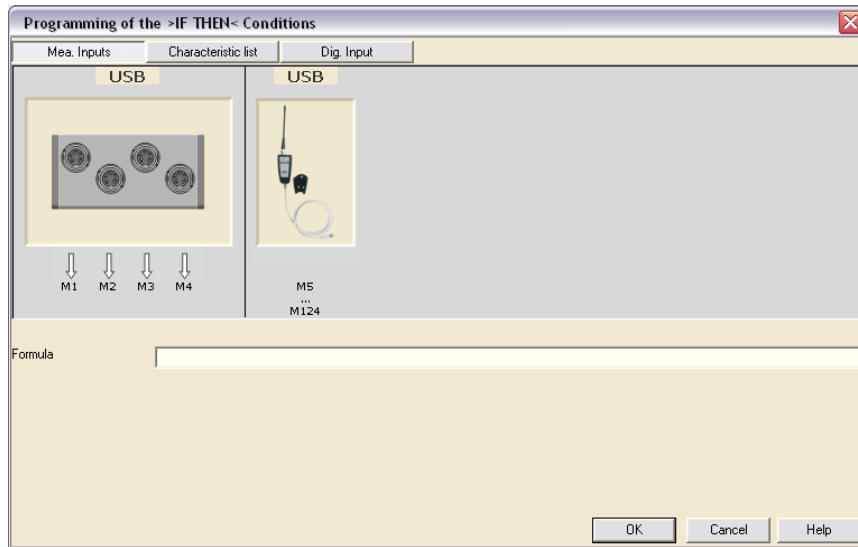


The entered formula always consists of logical conditions :   x>y, z=1, ... . These logical conditions can be combined by Boolean operators ( AND, OR, … ). If the logical conditions of a formula are fulfilled, then the assigned function is executed.

It is possible to switch the displayed graphics to selectively display the available measurement inputs, the list of characteristics 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(;;;)<br>Min() | Min-value of all elements in the list<br>Min-value of all saved measuring values of the characteristic | Min(M1;M2;C3;M4+C5)<br>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) |

| Operator | Function | Example |
|---|---|---|
| PartOK | =0, if the current measuring value of at minimum one characteristic is outside the tolerances<br>=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<br>=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<br>=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<br>=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 :*** $45e\text{-}5 + sin( 5*M1/M2 )*cos( 4*M3 ) - ( C2+M3+4.5 )^\wedge( 1 / 2 ) + Min( sin( C1 );cos( M2 )/3;M2+M3;5 ) > 1000$

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

| Special function | Description |
|---|---|
| Timer | **Timer ( time interval, num. of calls )**<br><br>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.<br><br>*time interval* → *Time interval after which the Timer triggers the event [ in msec. ]*<br>*num. of calls* → *Number of Timer calls ( e.g. 100 meas. values shall be saved every 100 msec. )*<br>*0 = Special case :  The Timer triggers the event unlimited times*<br>*1 = The Timer triggers the event 1-time after test step start*<br>*2 = The Timer triggers the event 2-times after test step start*<br>*… ( Maximum value = 255 )* |
| GlobalTimer | **GlobalTimer ( time interval, num. of calls )**<br><br>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.<br><br>*time interval* → *Time interval after which the Timer triggers the event [ in msec. ]*<br>*num. of calls* → *Number of calls of the Timer  ( see Timer )* |
| PartCounter | **PartCounter ( reset size )**<br><br>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 )<br><br>*reset size* → *Number of components after which the PartCounter is reset*<br>*0 = Special case :  The counter is never reset after starting measurement operation*<br>*1 = The counter is reset after one component*<br>*2 = The counter is reset after two components*<br>*…* |
| NumOfVal | **NumOfVal ( Number of the characteristic )**<br><br>Returns the number of measuring values in file of the characteristic. |
| StableValue | **StableValue ( Number of the characteristic, begin, end, time,  max. jump )**<br><br>Detection of a stable value.<br><br>*Characteristic* → *Number 1...128 of the observed characteristic*<br>*begin & end* → *Measuring range in which the observation for a stable value takes place.*<br>*After detection of a stable value the measuring range must be first left, before a new stable value can be detected.*<br>*time & jump* → *Time period „time" in msec., in which the measuring value must not jump more than „jump" for detecting a stable value.*<br><br>*Example :  StableValue ( 3, 19.99, 20.01, 1000, 0.005 ) =1*<br>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. |

| Special function | Description |
|---|---|
| MVChange | **MVChange ( Number of the characteristic, Changing, Time)** |
| | Detection of a changing value. |
| | *Characteristic* → *Number 1...128 of the observed characteristic*<br>*Changing* → *Minimal-required change of the measuring value for triggering the event*<br>*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*<br>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*

4.  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. In addition the created functions can be modified or deleted :



5.  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 ) :
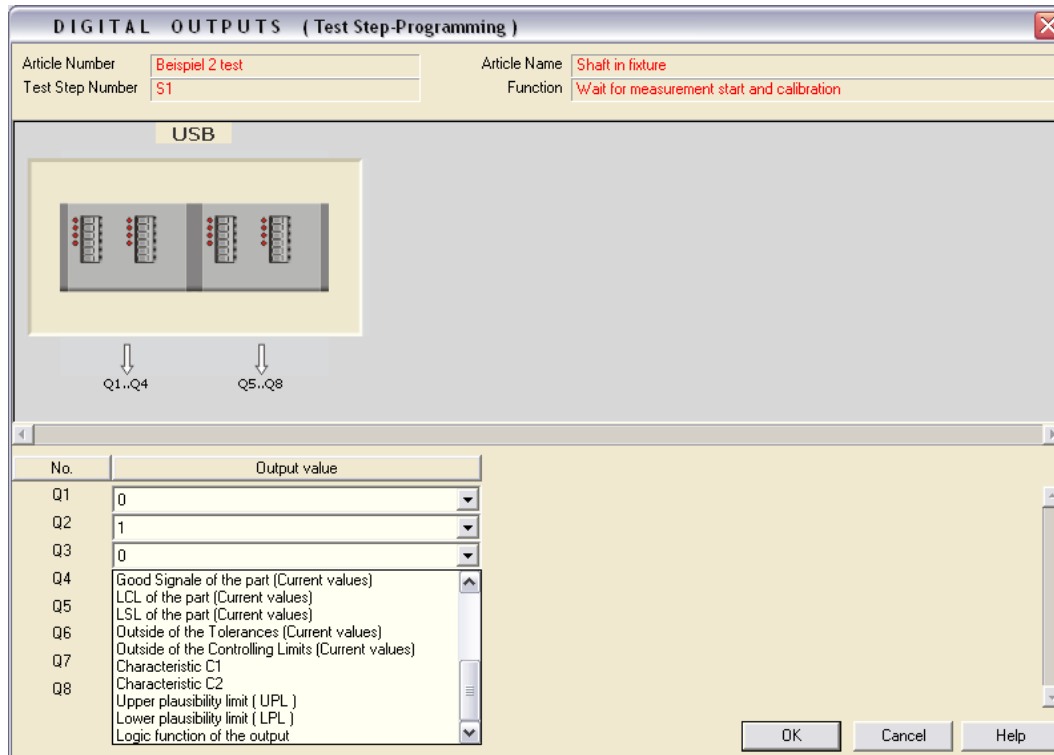


The digital outputs and their addresses are shown in the picture.

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. |
| 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 Signale 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 | The digital output is set, if the current measuring value of at minimum one charac- |

| (Current values) | teristic 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.
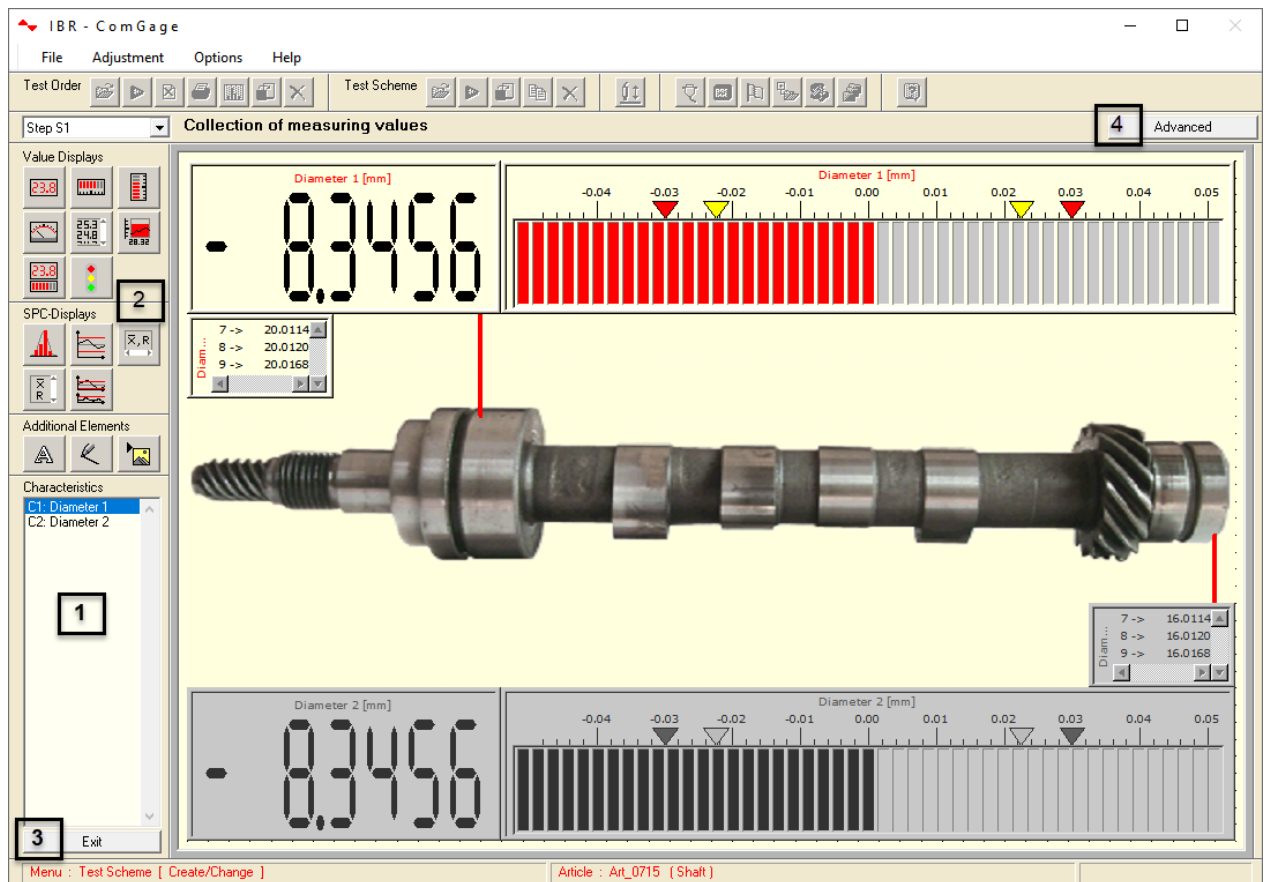


**1.) Selection of the characteristic**
Before creating a display element the characteristic must be selected, to which the new display elements shall belong.

**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.
- **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.

### 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 ).
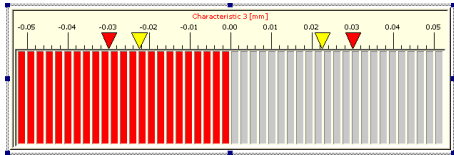


### 6.) Grey display elements

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 :
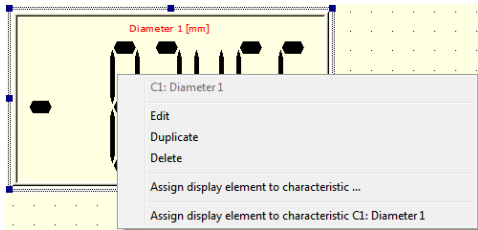


By means of this menu the display elements can be edited ( e.g. colour ), duplicated, deleted or assigned to another characteristic.

**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 ) <br> - Column range ( A user defined range is possible ) |
| Analogue Meter | - Zero point  ( = nominal size ) <br> - Display range ( A user defined range is possible ) |
| Histogram | - Histogram type ( for process control or process analysis ) <br> - Number of classes |
| Run Chart | - Number of values shown in the chart <br> - Scrollbar on / off |
| Statistical Data | - Selection of the statistical data ( Min, Cp, Cpk, … ) to be shown |
| Combination Display | - Resolution <br> - Number of digits <br> - Zero point of the Column ( = nominal size ) <br> - 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] ) <br> - Calculation of the controlling limits ( Shewhart, Acceptance ) <br> - Number of values shown in the chart <br> - 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 measure-ment, 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 en-able 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 dis-played ( 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.*
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.

| | |
|---|---|
| $Cv | Current measuring value of characteristic Cx |
| $Cv-0 | Last stored measuring value of characteristic Cx |
| $Cv-1 | Second to last stored measuring value of characteristic Cx |
| ...  $Cv-x | „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 |
| $D0-0 | Date of the last stored measuring value of characteristic Cx ( Format :  MM/DD/YYYY ) |
| $D0-1 | Date of the second to last stored measuring value of characteristic Cx ( Format :  MM/DD/YYYY ) |
| ...  $D0-x | ...  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 | Date of the second to last stored measuring value of characteristic Cx ( Format :  DD.MM.YYYY ) |
| ...  $D1-x | ...  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 | Time of the second to last stored measuring value of characteristic Cx ( Format :  HH:MM:SS ) |
| ...  $T0-x | ...  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 |
| $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.***

**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 page 60 ).

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.

Integrity Check: 1 Graphic file(s) not found !

⚠ S1:     C:\ComGage_V403\SHAFT.bmp

OK
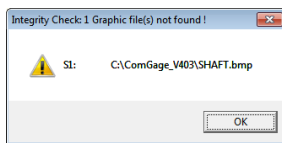
## 8.) Keys

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 |

## 9.) Result displays with output in register

The result of a result display can be loaded into a register ( see option marked below ).
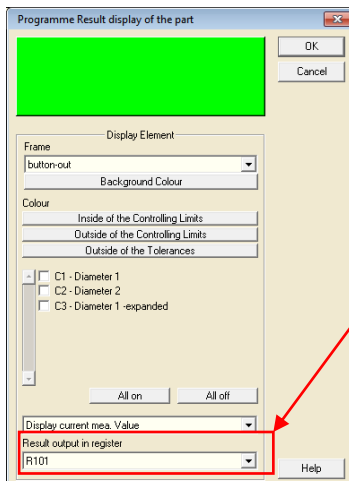
The selected register for output of the display element's result ( here R101 ) will adopt one of the following values :

Rx = 0 → The result is inside the controlling limits or, if no controlling limits are activated, inside the tolerance limits ( display colour : green )
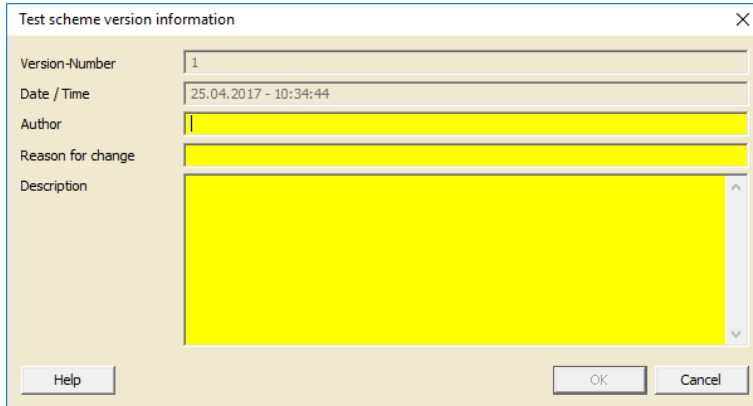
Rx = 1 → The result is inside the specification limits and outside the controlling limits ( display colour : yellow )

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 6.9 ).

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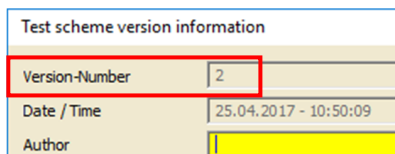


The Version-Number as well as Date / Time are entered automatically.
The Author, the Reason for change and a Description are to be added. With all fields filled, the entries can be confirmed by clicking the **OK** - button.

**Note :**  The entries made cannot be changed anymore afterwards.

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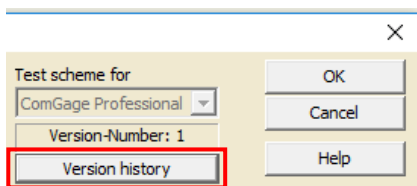


The old version of the test scheme is also not overwritten, but saved separately with an extended file name containing the hitherto existing Version-Number.
Example :   When a new version of the test scheme "Test scheme.tsf" is saved, the old version is archived with file name "Test scheme.tsf.1".
The 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.

# 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 program-
ming 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.
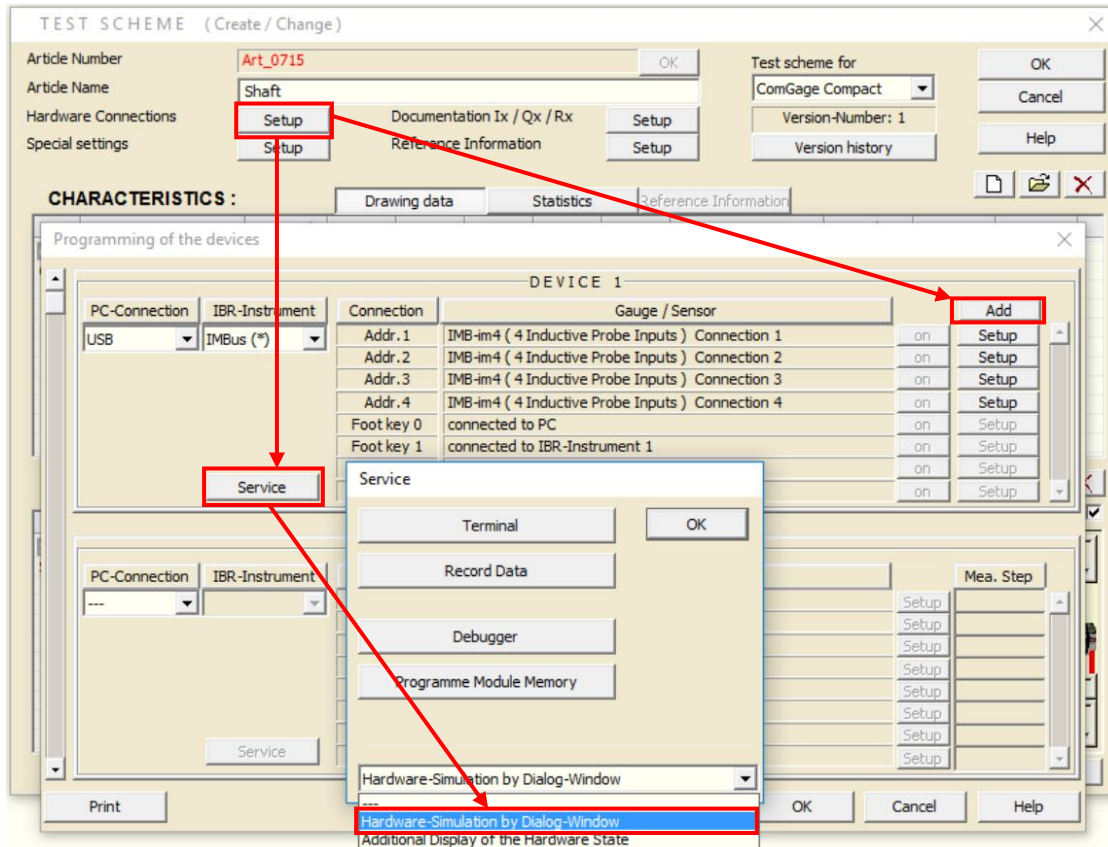


**Application :**

- 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.
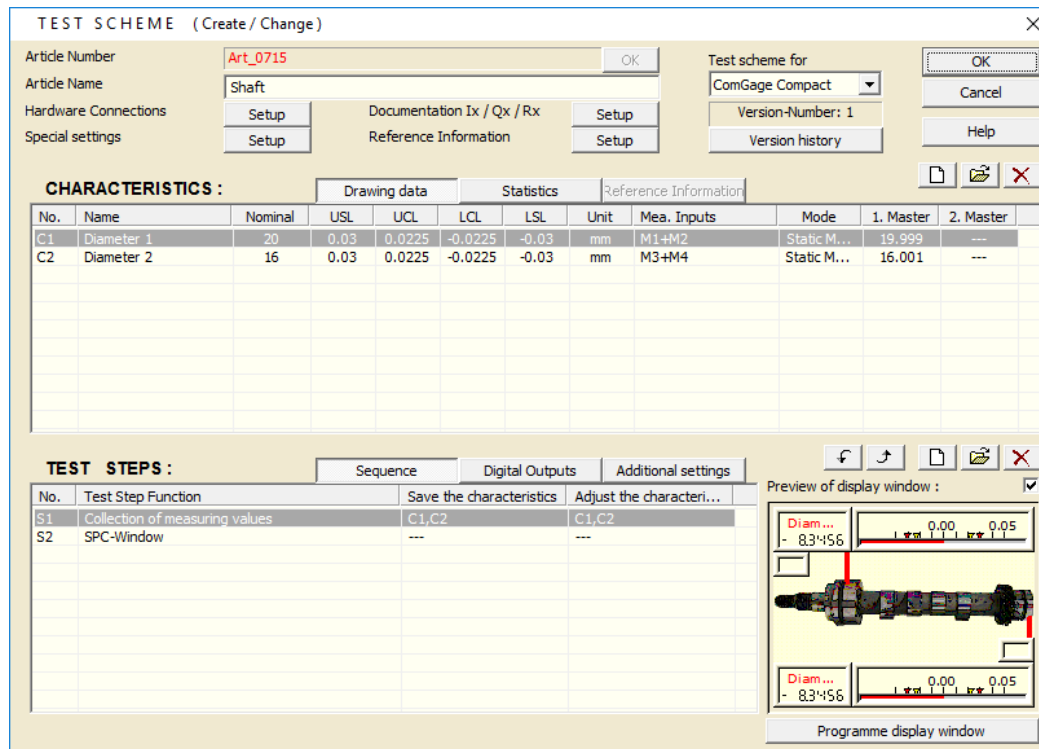


Creation of both characteristics for measuring two diameters ( see brief overview - page 9 ) :
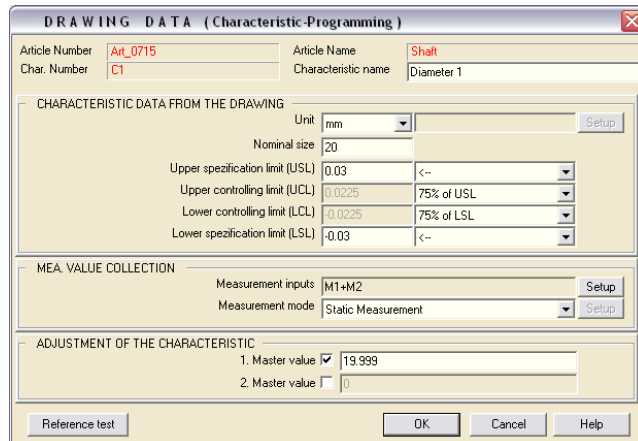


The diameter is calculated by the formula M1+M2 and is collected by a static measurement.
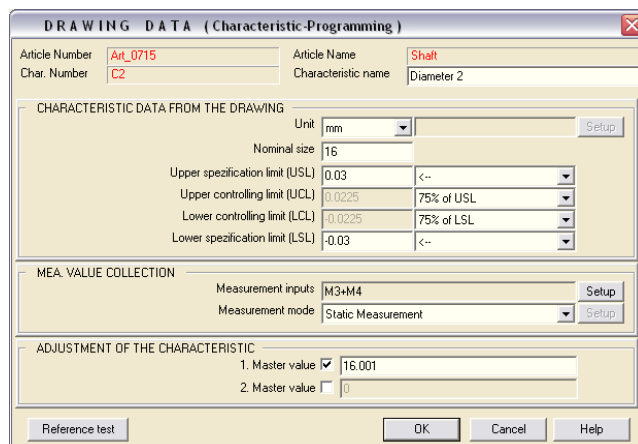


The diameter is calculated by the formula M3+M4 and is collected by a static measurement.

Creation of a test step for collecting the measuring values ( see brief overview - page 10 ) :
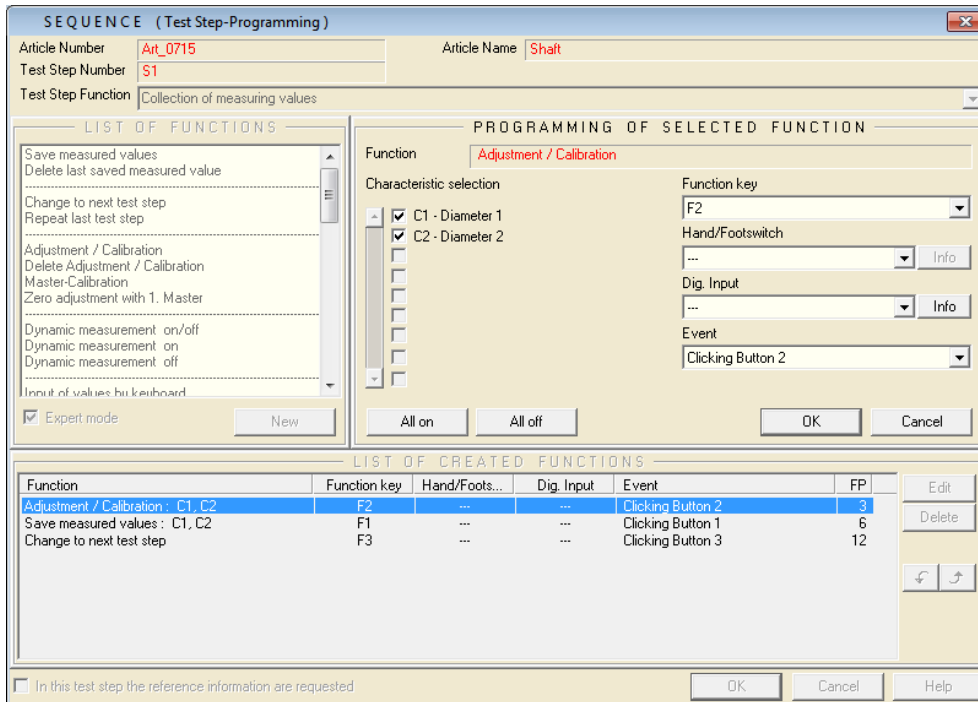


- On pressing the **F1** - key the measuring values are stored in file.
- On pressing the **F2** - key the characteristics are calibrated.
- On pressing the **F3** - key the statistic window is opened.

Creation of the following display window for test step S1 :
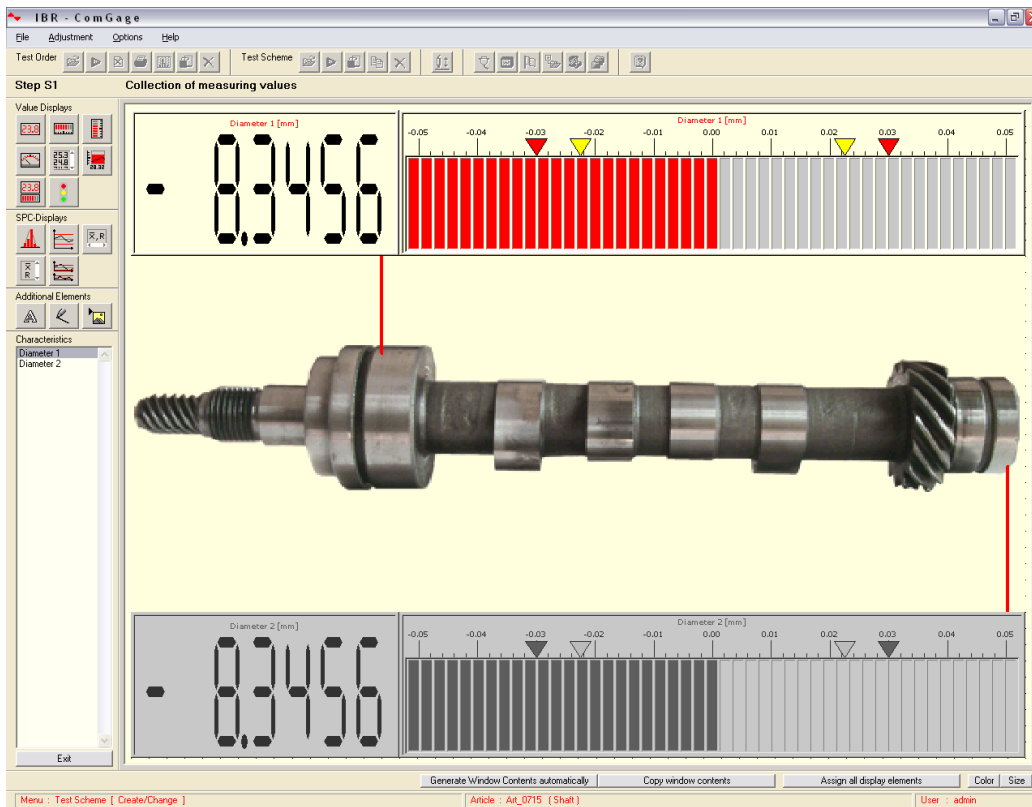
Creation of a second test step for statistic display ( see brief overview - page 10 ) :
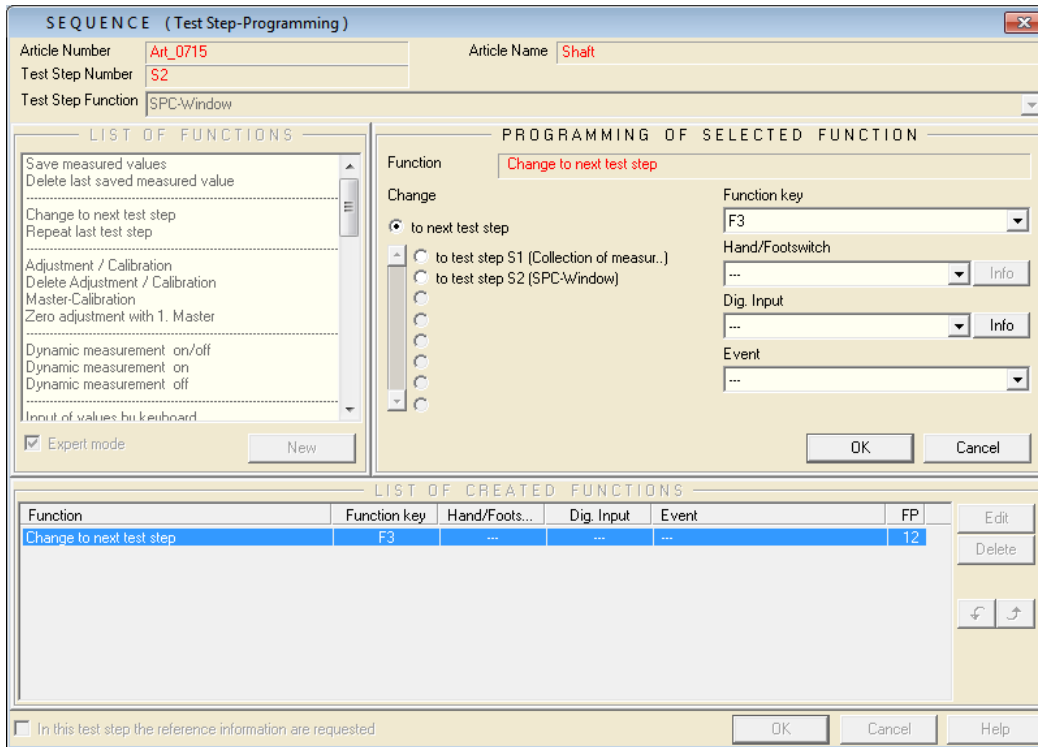


-    On pressing the **F3** - key ComGage returns to measurement window ( = test step S1 ).

Creation of the following display window for test step S2 :
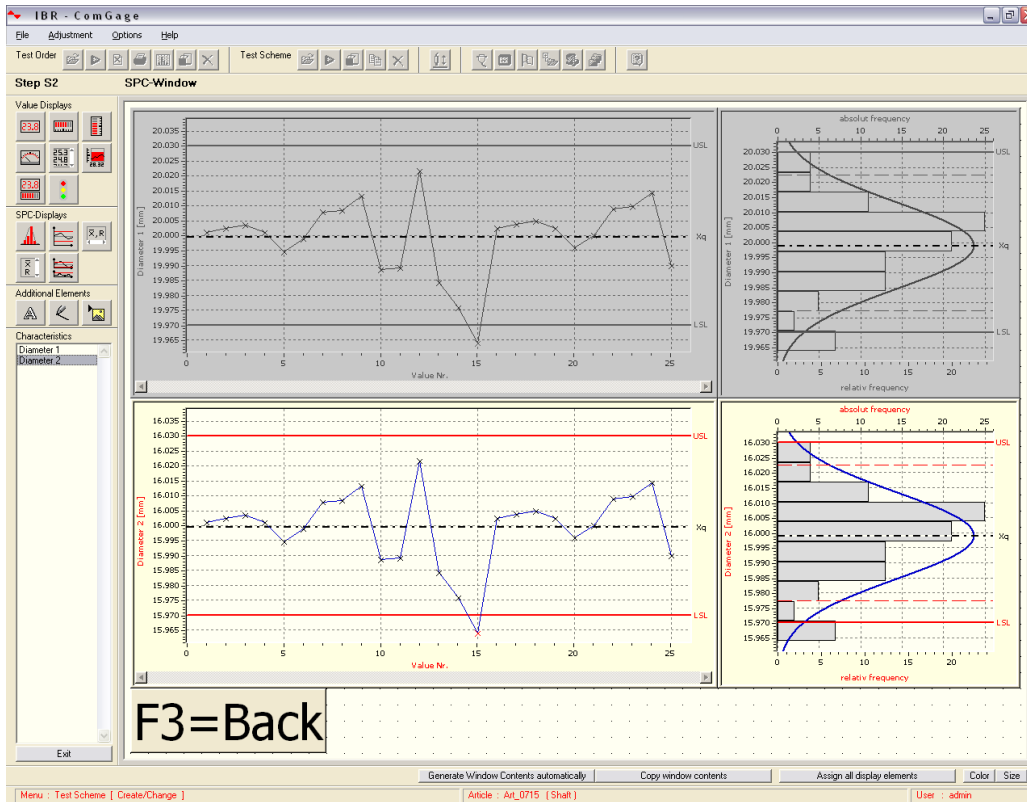
## 8.2  Example 2 ( Collection of several characteristics one after the other with IBRit-rf1 )

**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 program-
ming 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 ).
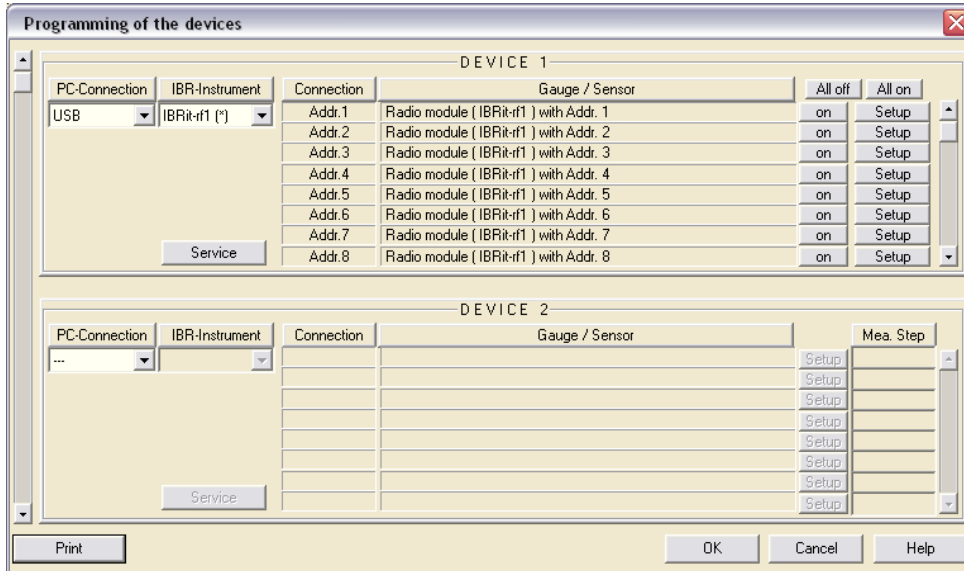


**Application :**

-   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 - page 9 ) :



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 - page 10 ) :



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.

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Creation of the following display window for test step S1 :
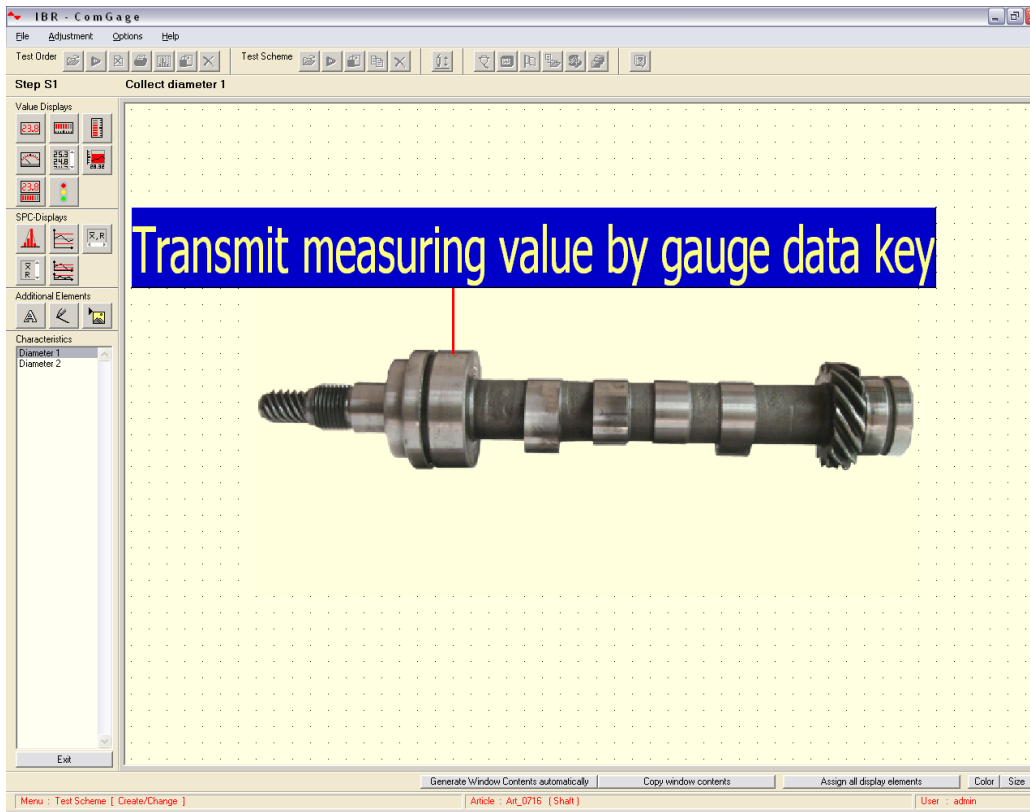


Creation of a second test step for collecting diameter 2 ( see brief overview - page 10 ) :
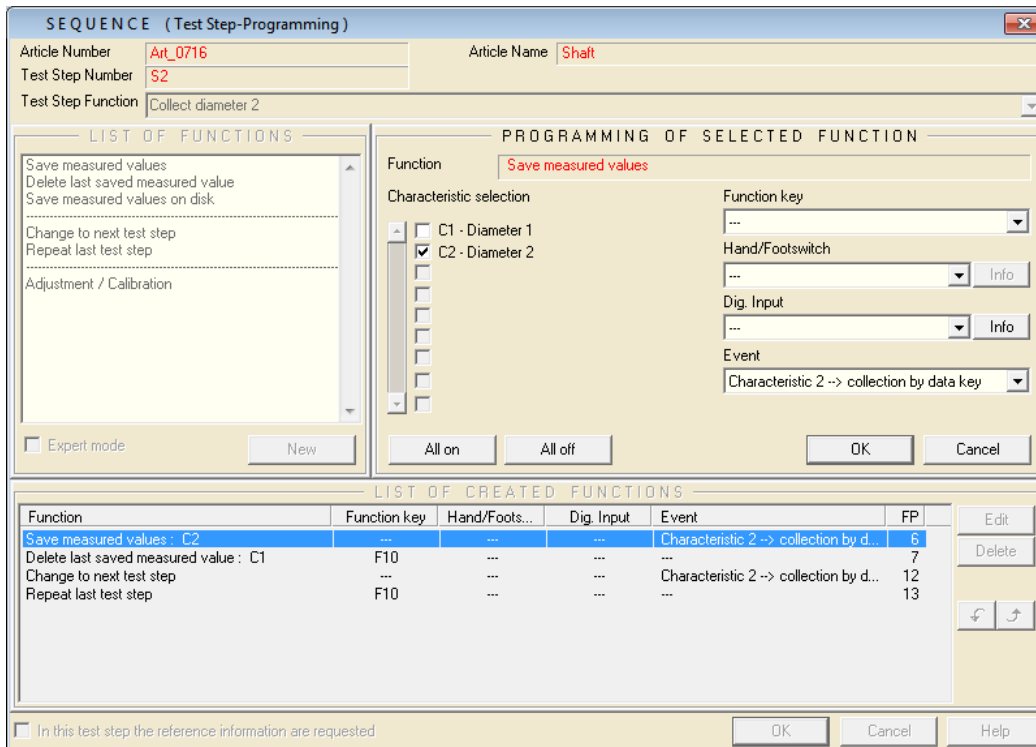


On transmission of a measuring value by data key of the radio module or calliper the received measuring value is automatically stored for characteristic C2. Then ComGage automatically switches to the next test step. On pressing the **F10** - key the last measuring value of characteristic C1 is deleted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

Creation of the following display window for test step S2 :
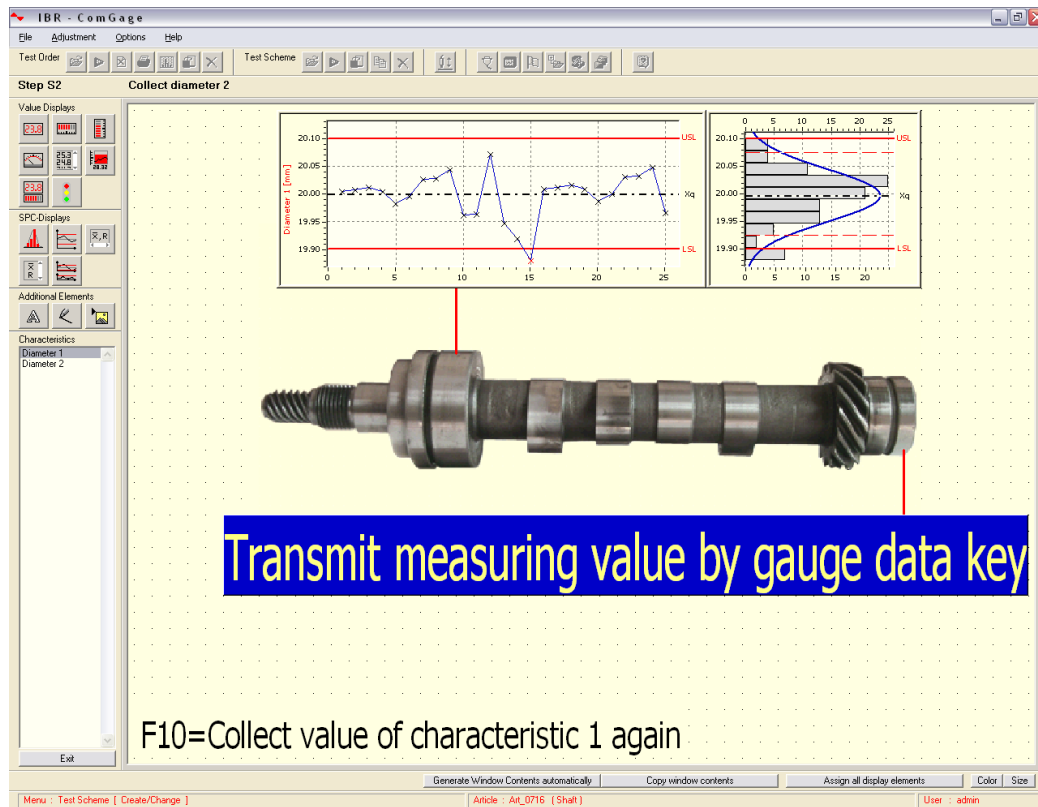


Creation of a third test step for displaying the collected measuring results of diameter 1 and diameter 2 :
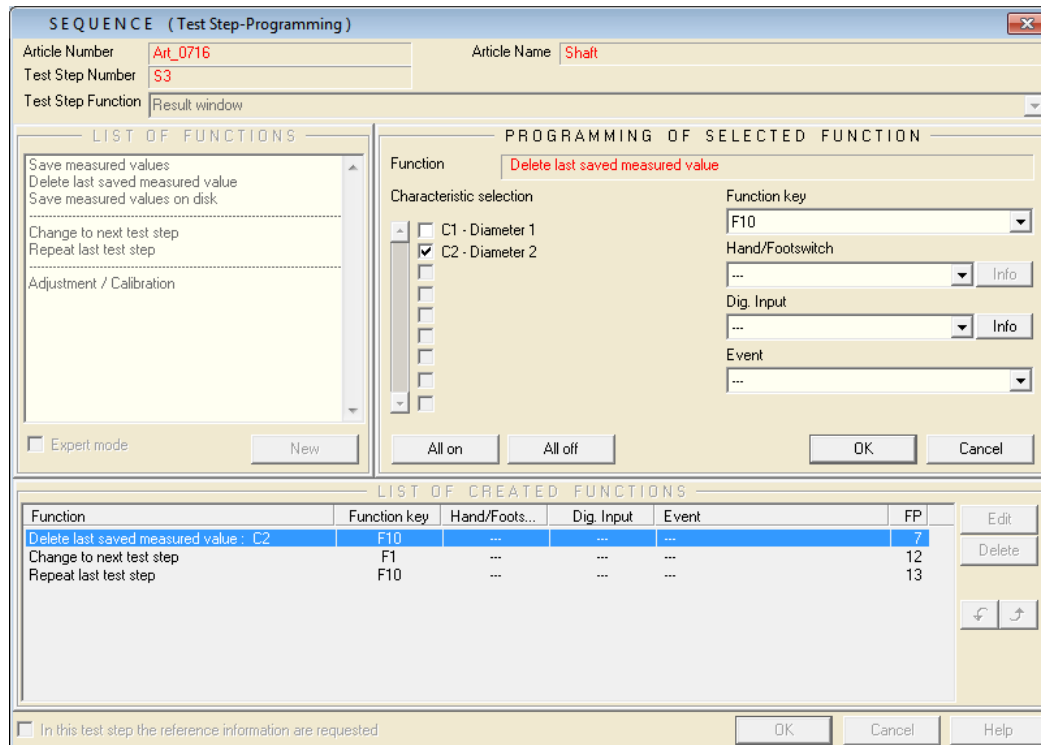


On pressing the **F10** - key the last measuring value of characteristic C2 is deleted and ComGage returns to the previous test step for new measurement of characteristic C2.
On pressing the **F1** - key the measurement of the next component is started.

Creation of the following display window for test step S3 :
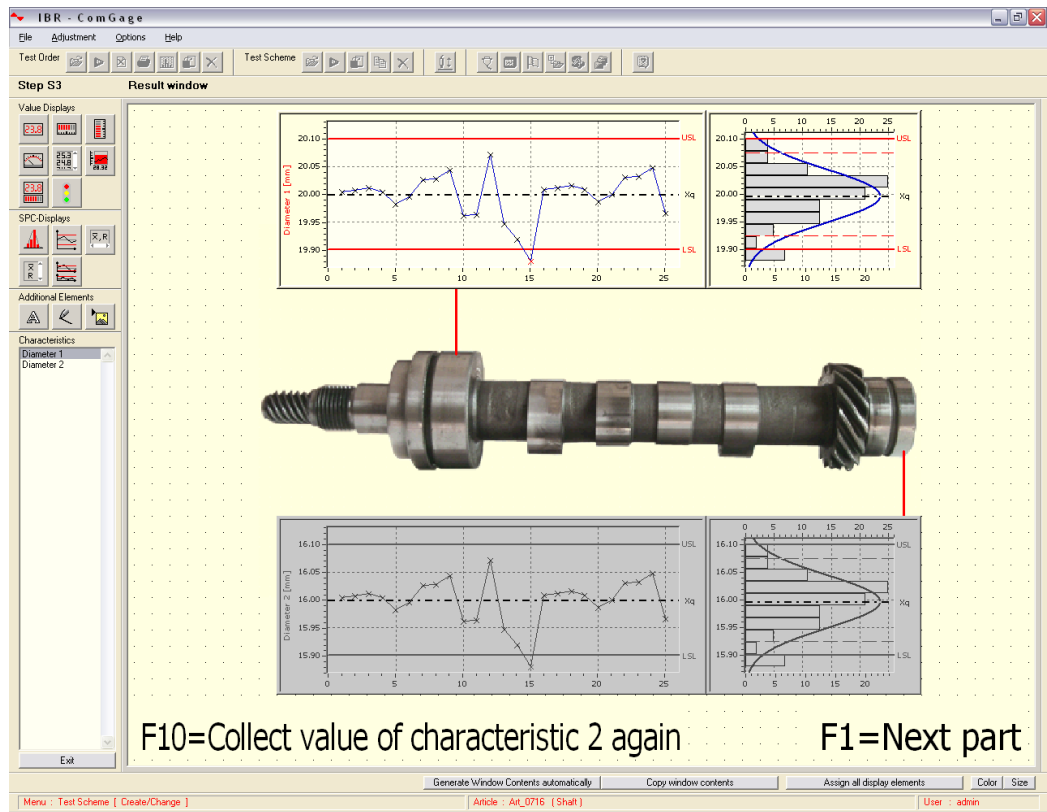


## 8.3   Example 3 ( Keyboard input, static and dynamic measurements with IMBus )

**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 program-
ming 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 chap-
ter 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 - page 9 ) :



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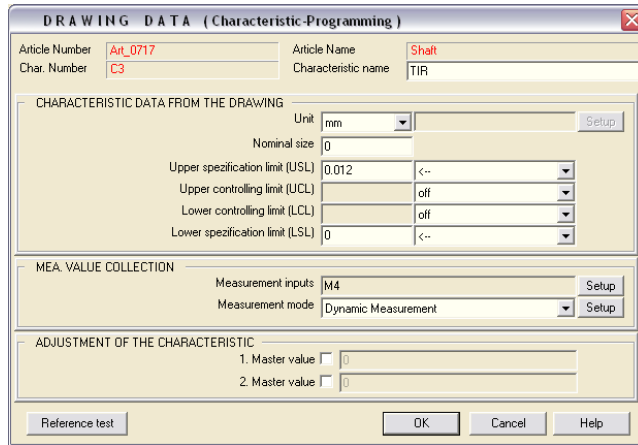
The TIR measurement of characteristic C3 shall be started by function key and stopped by a second pressing of function key. The TIR value shall be automatically saved on stopping the dynamic measurement ( dynamic mode ).
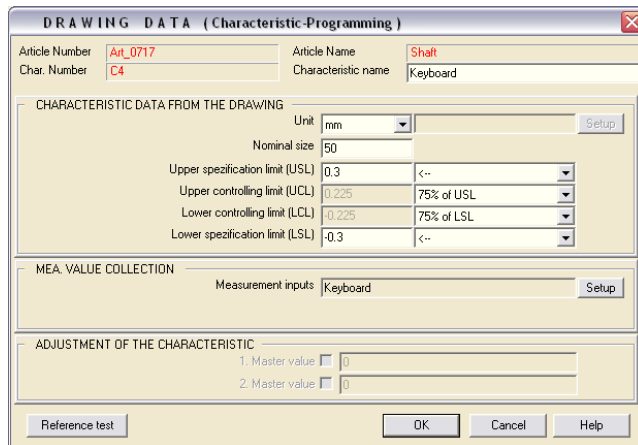


On pressing a function key the window for keyboard input shall be opened.

Creation of a test step for data collection ( see brief overview - page 10 ) :
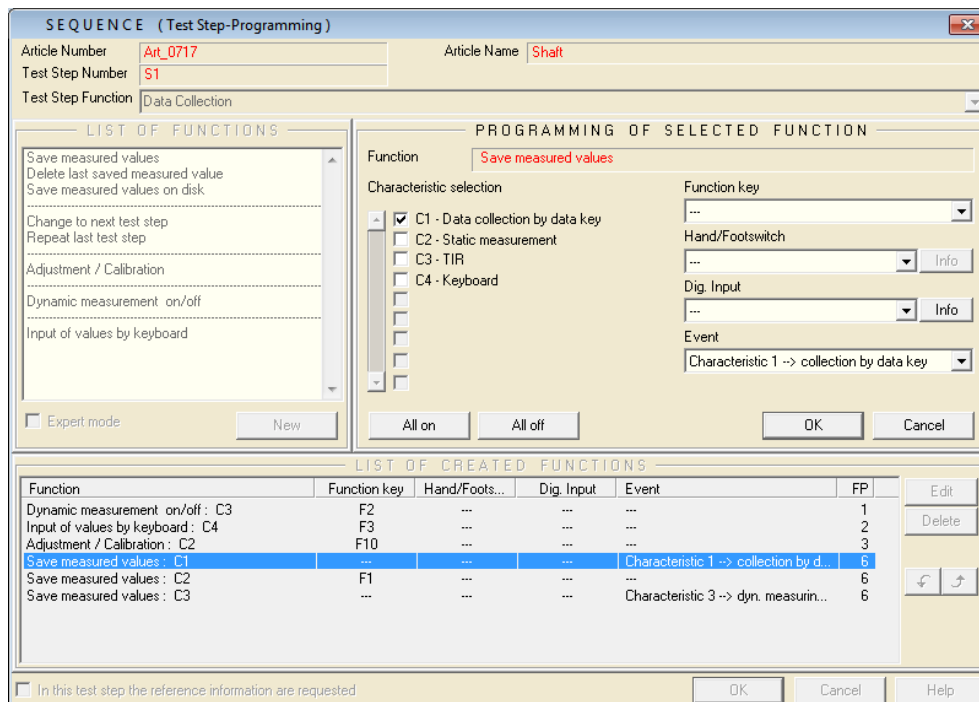


- All measuring values of characteristic C1 transmitted by data key of gauge are saved in file.
- On pressing the **F1** - key the measuring values of characteristic C2 are saved in file.

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- 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 :
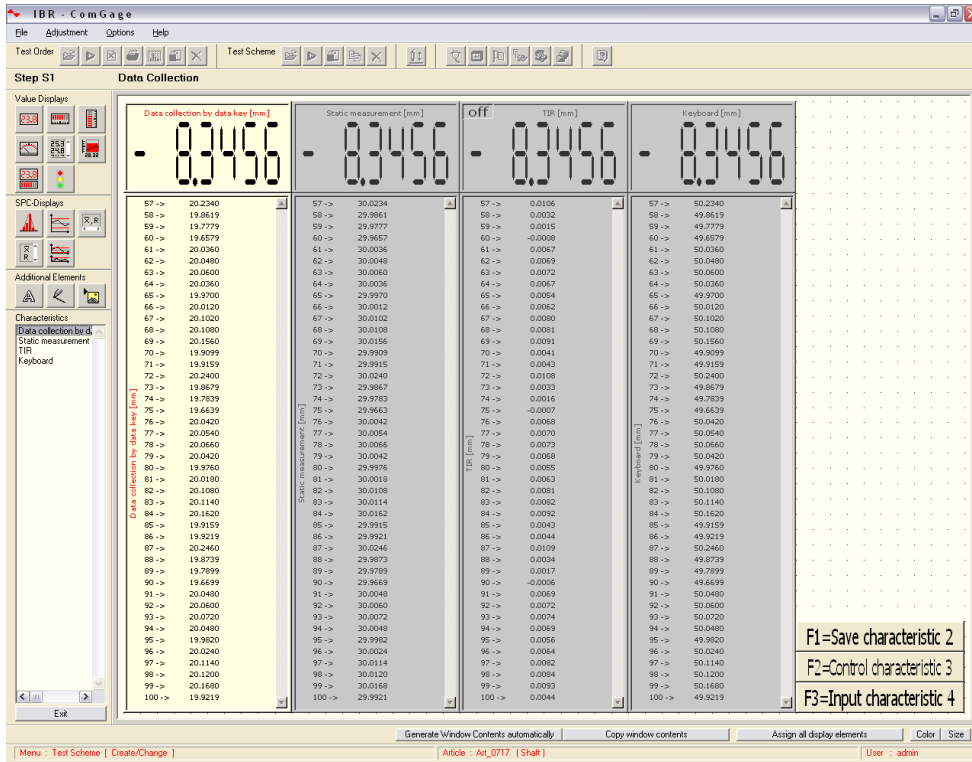
## 9. Starting the test scheme ( measuring )

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 :
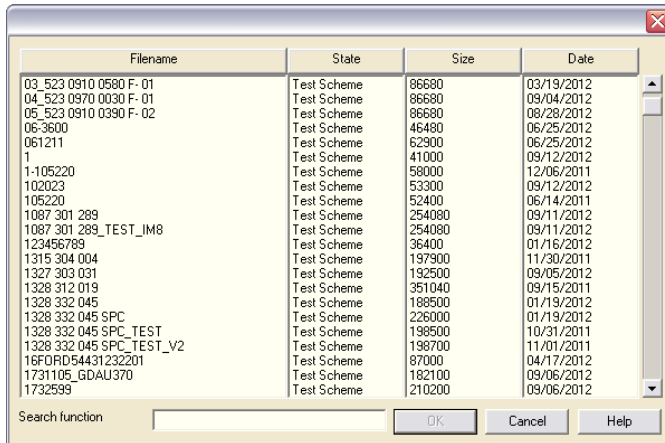


In this menu it is possible to start up to 10 test schemes at the same time.
After the start of a test scheme ComGage automatically assigns one of the keys 0  ... 9 to the test scheme.
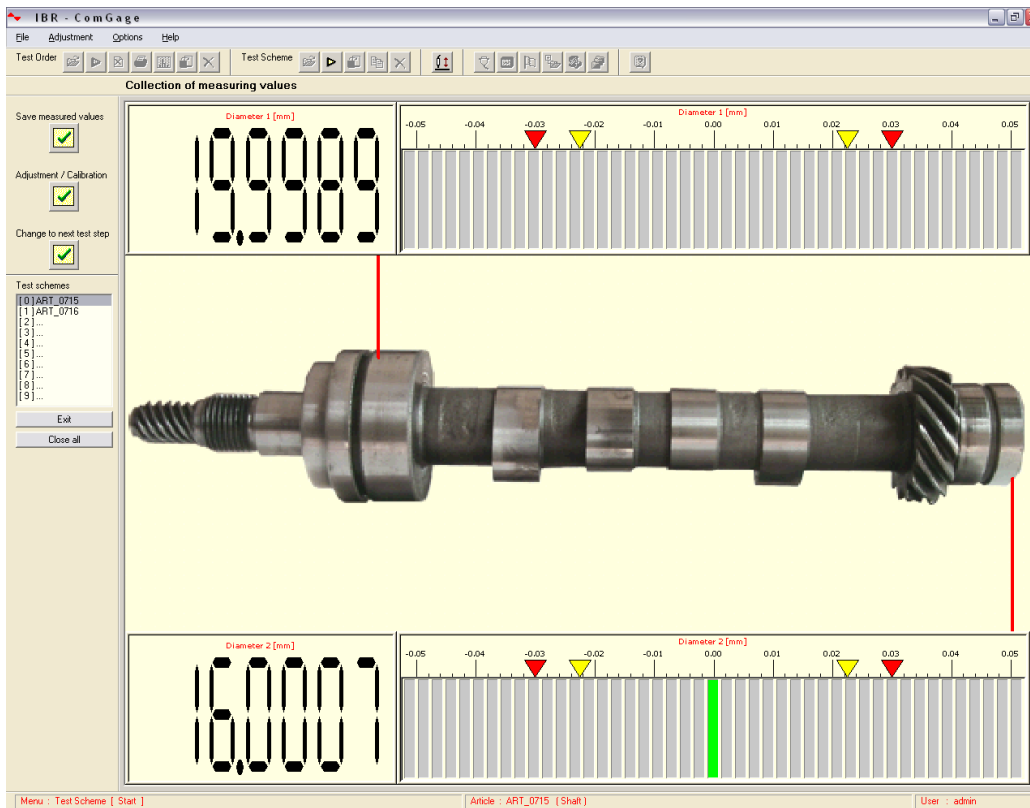
**1.) Starting an additional test scheme**

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 :

```
Test schemes
[ 0 ] ART_0715
[ 1 ] ART_0716
[ 2 ]...
[ 3 ]...
[ 4 ]...
[ 5 ]...
[ 6 ]...
[ 7 ]...
[ 8 ]...
[ 9 ]...
```
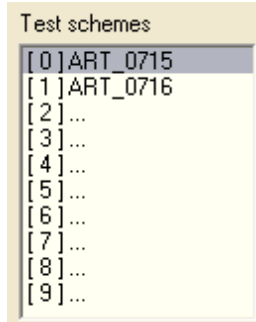
The number left of the article number ( e.g. [0] ) informs you which key you must press to start measuring with the particular test scheme. By clicking on the test scheme it is automatically started.

**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.

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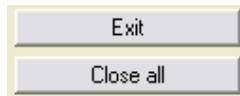
When all test schemes are closed the menu is left automatically.

**4.) Buttons**

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

```
Save measured values
      [✓]

Adjustment / Calibration
      [✓]

Change to next test step
      [✓]
```

**5.) Adjustment Button**

By clicking the following button in the menu bar you can open the window *mechanical adjustment of inductive probes.* ( See chapter 14.1 for menu description )

[↕]
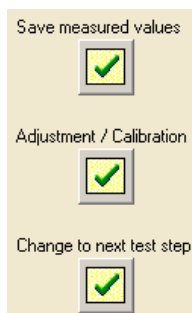
### 6.) Saving values

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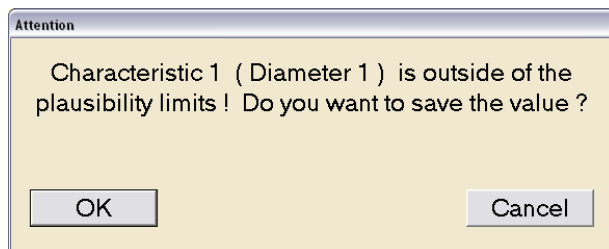


By clicking the **Cancel** - button the measurement value is rejected, i.e. it is not saved.

*!!! 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".
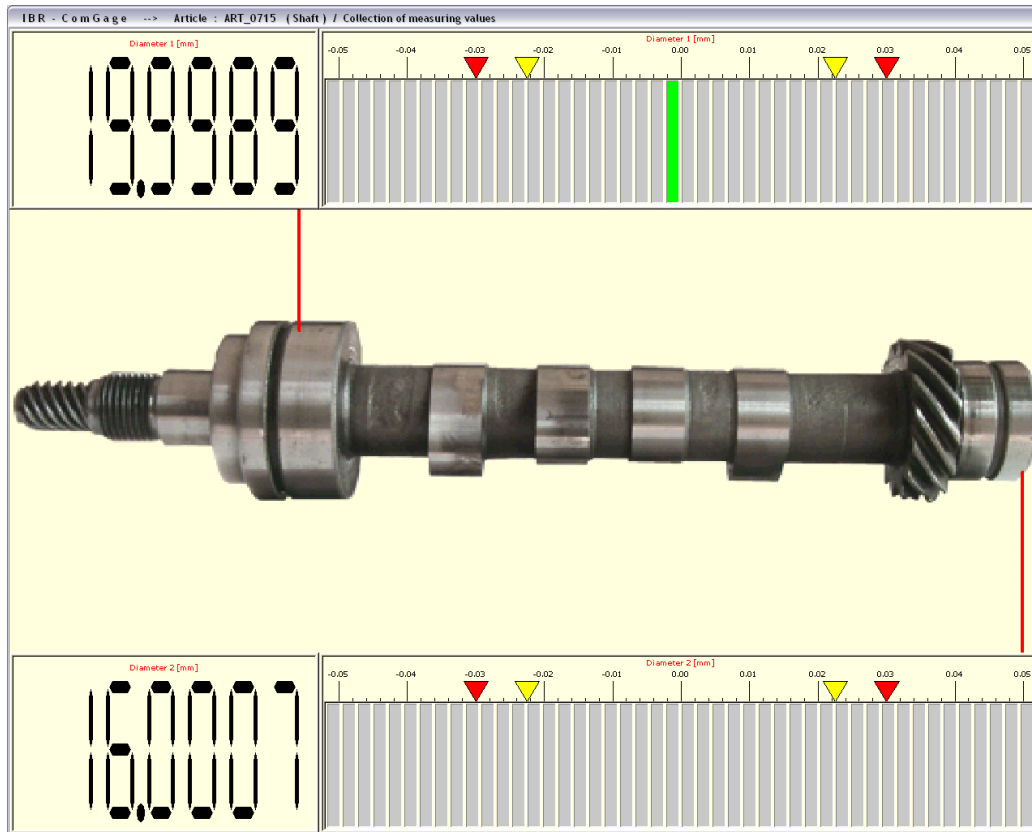


### 9.) Keys

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 |

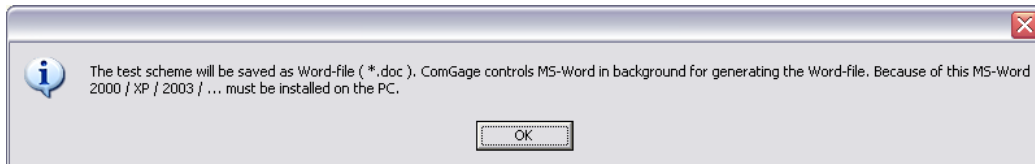# Manual    ComGage

**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.



The test scheme will be saved as Word-file ( *.doc ). ComGage controls MS-Word in background for generating the Word-file. Because of this MS-Word 2000 / XP / 2003 / ... must be installed on the PC.

OK

### 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 ).

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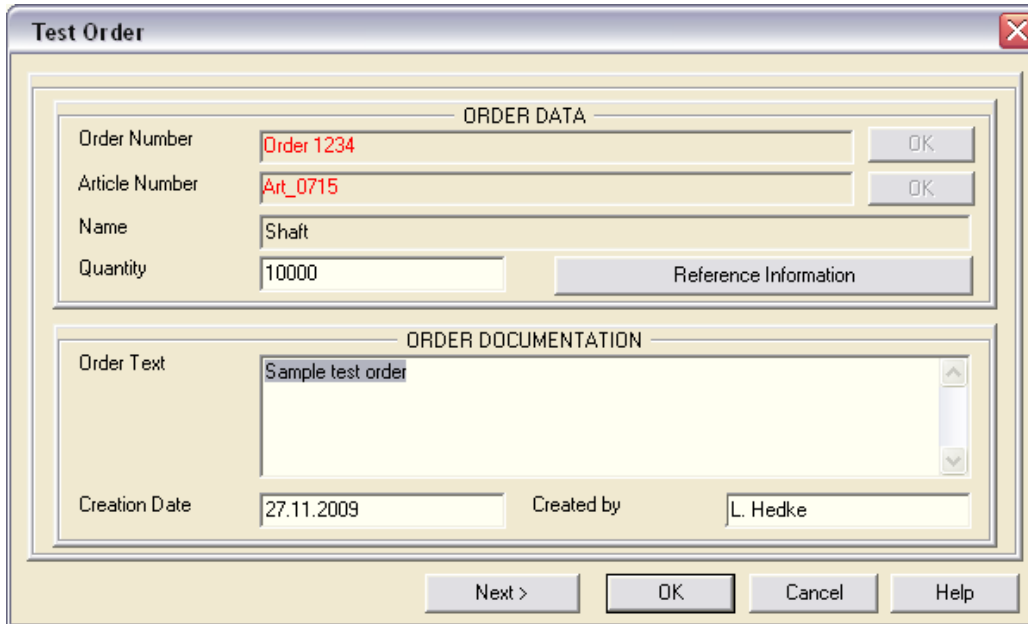
By clicking the **File / Test Scheme / Delete** menu ( Button :  ) you can delete one or more test schemes. You can easily find a specific test scheme among lots of existing test schemes by using the search function. After selecting the test schemes which are to be deleted, you can delete them by clicking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

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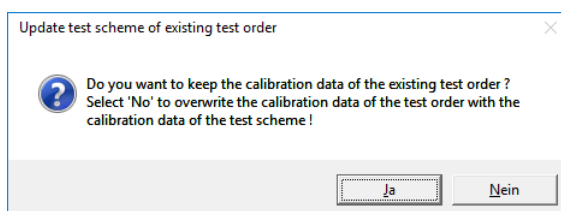
A data path can be entered preceding the order number. This entered data path is relative to the data directory ( see chapter 6.4 ) and must already exist. ComGage does not create any new subdirectories.
( Example :  **Machine 1\Art-1234**  ➔ *The test order* **Art-1234** *is created in the subdirectory*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

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 ).*

## 12. Starting the test order ( measuring )

This menu contains the measurement mode of ComGage.

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 :
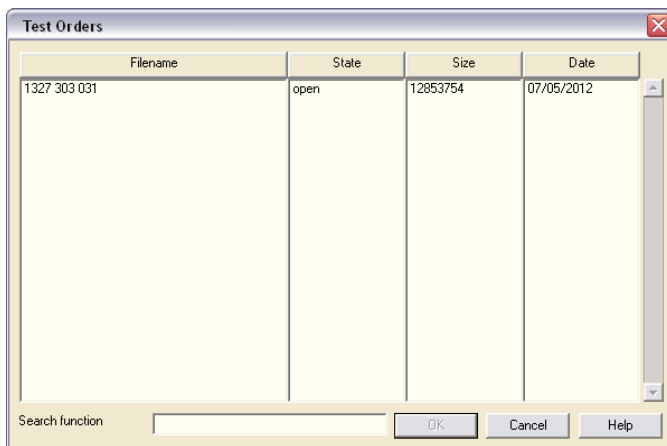
On the start of a test order, the reference information which has the mode *'on starting the measurement'* assigned to it, is requested :
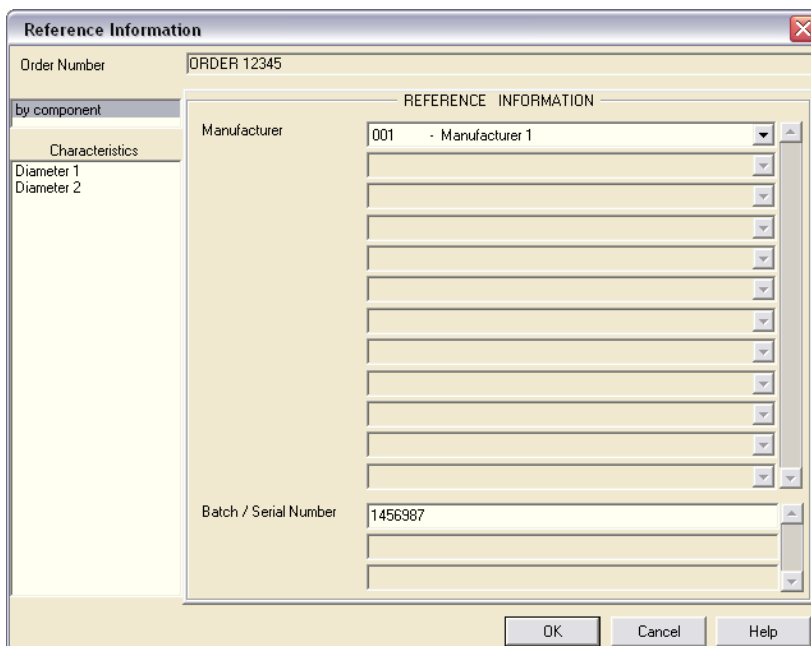
For documentation of the window :   See previous page.

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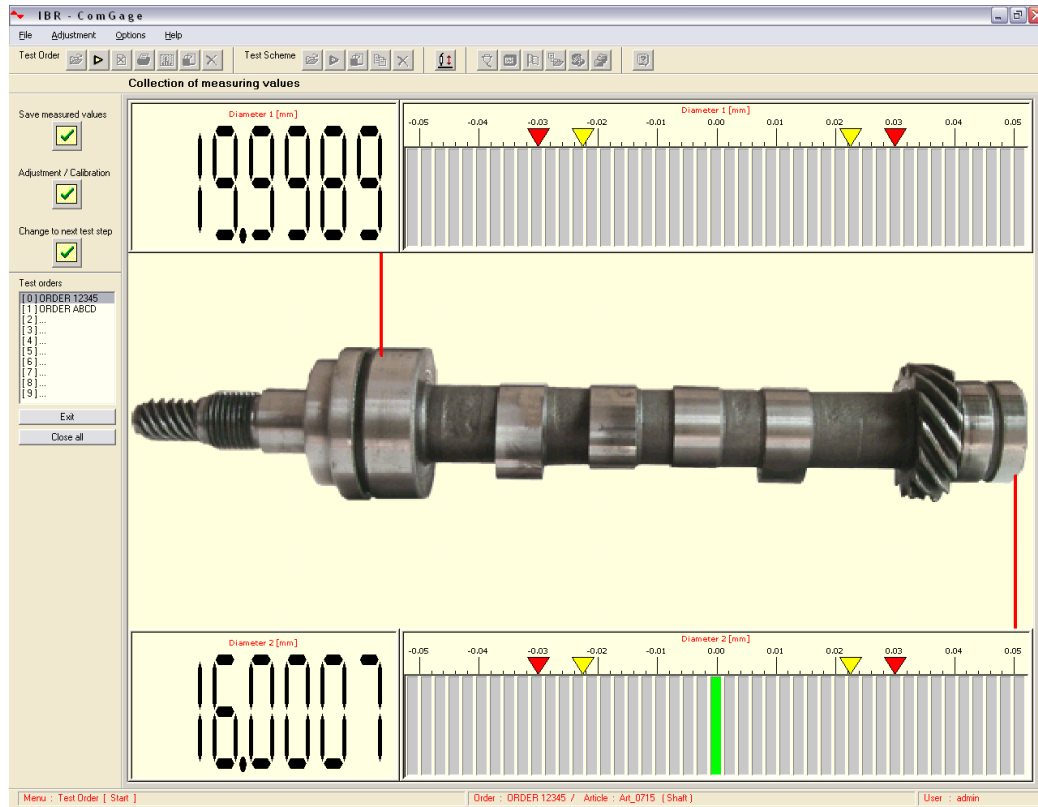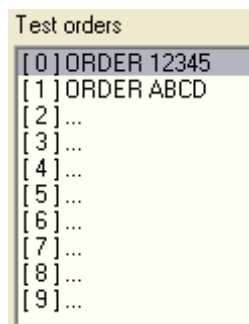


**1.)   Starting an additional test order**

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.

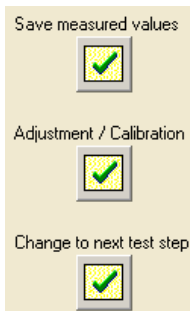**3.)   Closing of one test order or all test orders**

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.

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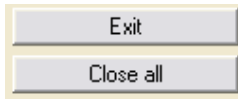
When all test orders are closed the menu is left automatically.

**4.)   Buttons**

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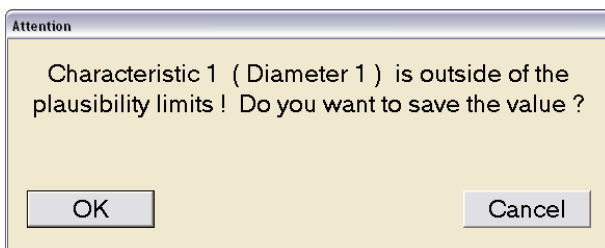
Save measured values

Adjustment / Calibration

Change to next test step

**5.)   Adjustment Button**

By clicking the following button in the menu bar you can open the window
*mechanical adjustment of inductive probes.* ( See chapter 14.1 for menu description )

**6.)   Saving values**

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

Attention

Characteristic 1  ( Diameter 1 )  is outside of the
plausibility limits !  Do you want to save the value ?
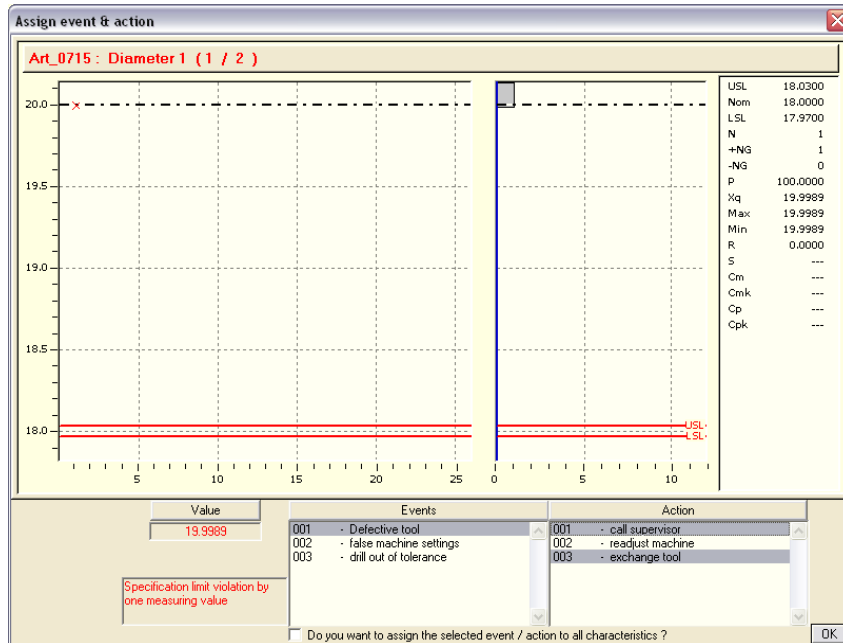
OK          Cancel

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.
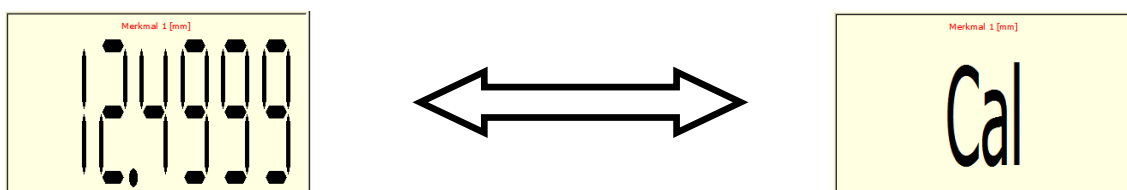
### 8.)  Zero adjustment and gauge calibration

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 :
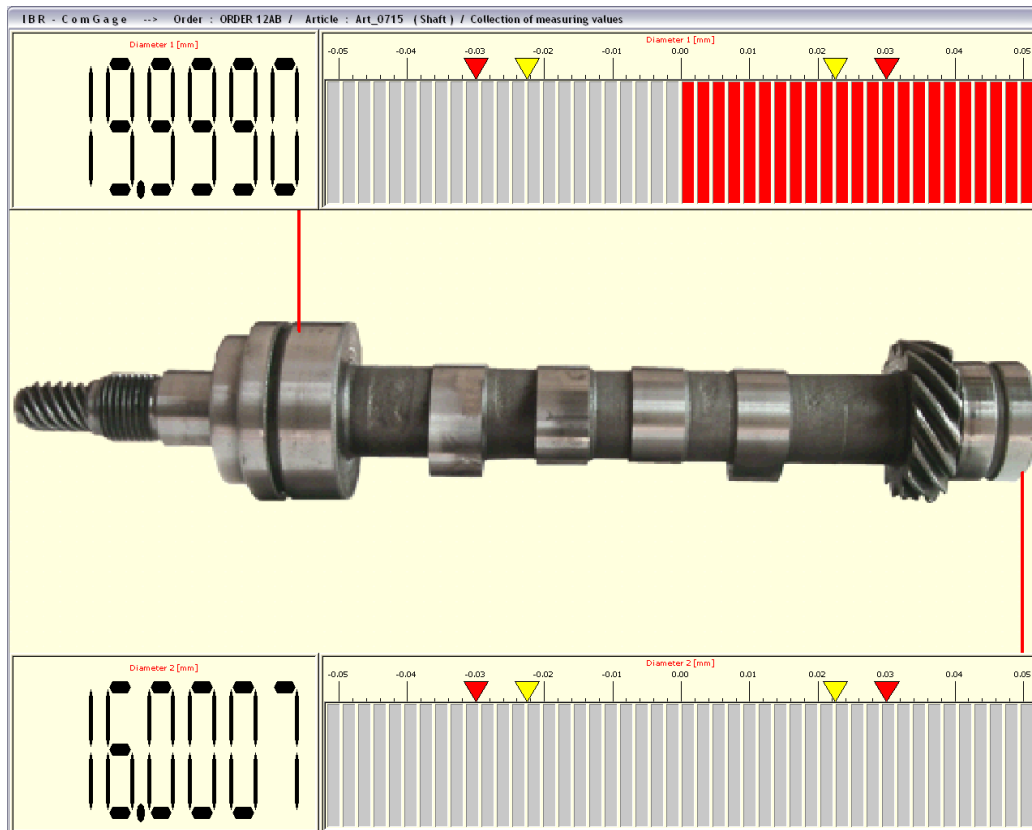
### 11.) Look at, change and delete measuring values

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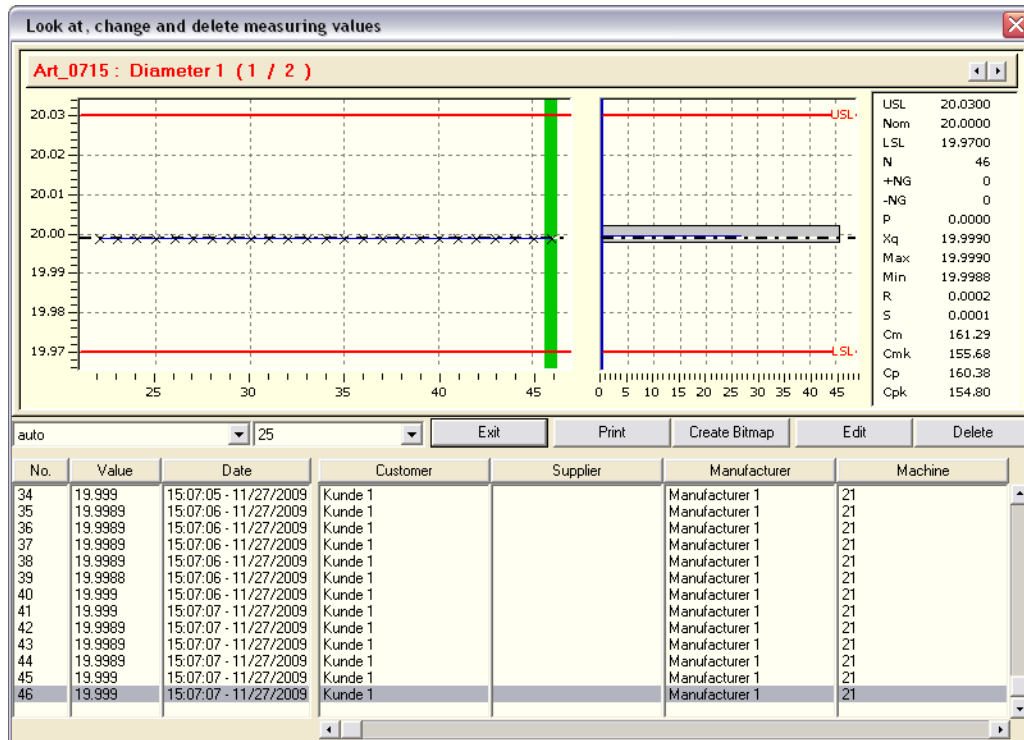


You can select the characteristic by clicking the **arrow** - buttons in the upper right window corner.

By pressing the **cursor** keys **left** and **right** you can scroll in the run chart / control chart of the current characteristic and have the reference information of the currently selected measurement value displayed. The **cursor** keys **up** and **down** can be used to scroll in the measuring value / reference information table.

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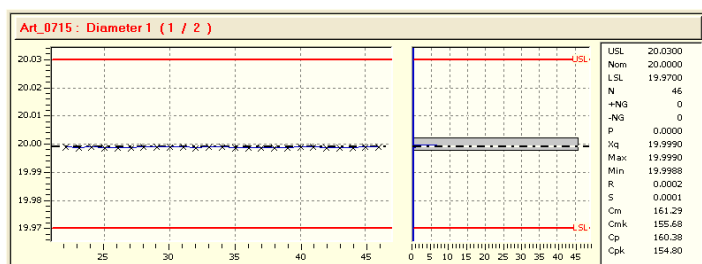
By clicking the **Edit** - button the current measurement value can be modified.
Before, the entry of a password is requested.

*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".*

## 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
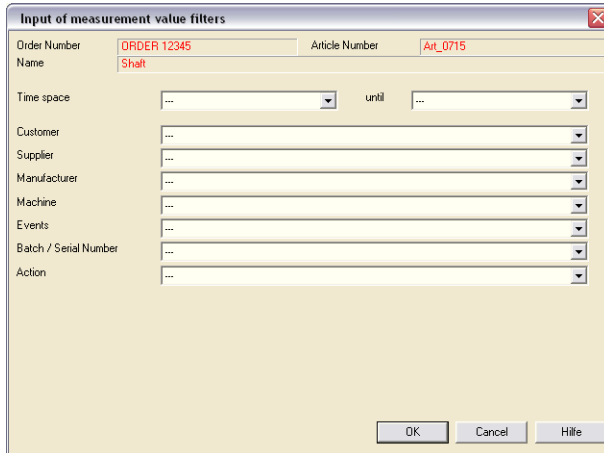measurements anymore, but they can be analysed or converted to different formats.

*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 val-
ues 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.
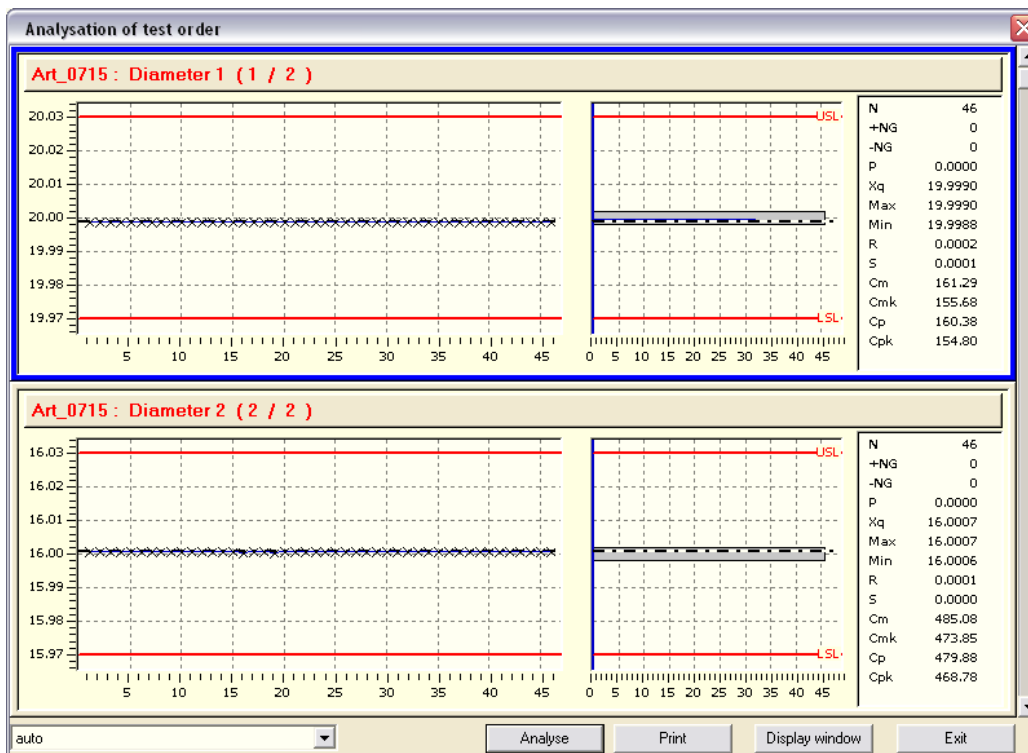


You can scroll through the individual characteristics by using the scrollbar at the right window side.

By the **left hand dropdown field** ( standard entry : auto ) 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 12.11 ).

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.
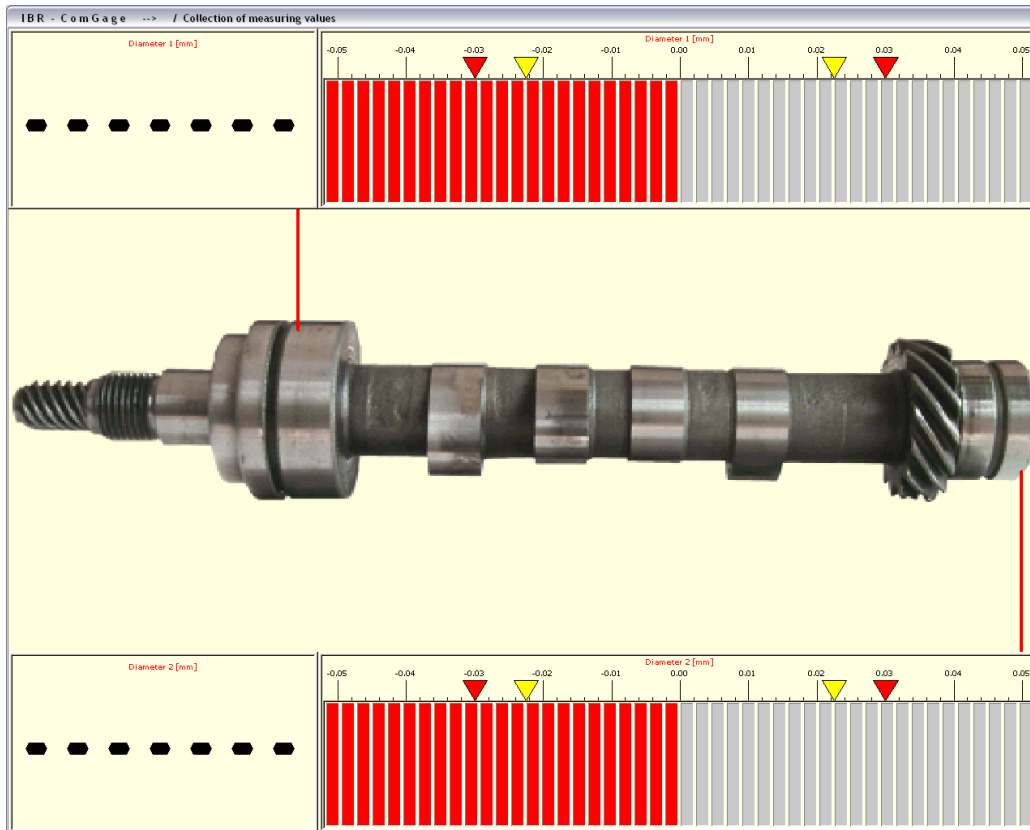


By pressing the **P** key you can print the window contents. You can exit the full screen mode by pressing the **ESC** key. ComGage then returns to the previous window.

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 :
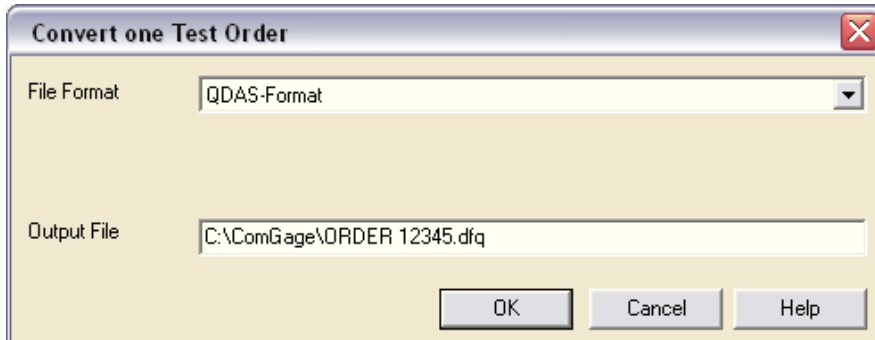


Now you can select the desired file format. On selecting the Excel format you can activate an additional filter for the measurement values. Then the output file is displayed including the path information. This automatically suggested path and file name can be edited by the user. By clicking the **OK**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

# 14. Additional software tools for initial operation of measuring systems

## 14.1 Mechanical adjustment of inductive probes

By clicking on the **Adjustment / Mechanical Adjustment** menu ( Button : [icon] ) 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. )
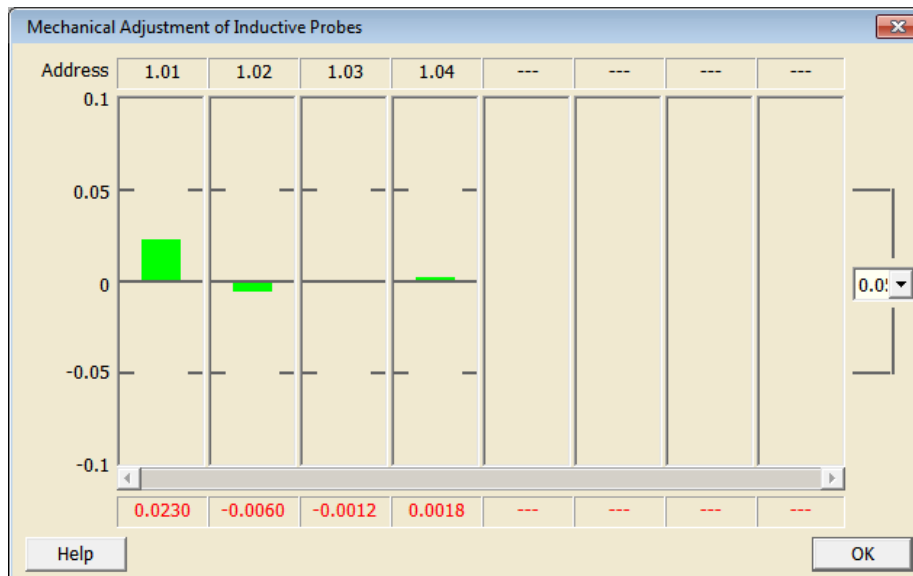


**Adjustment process :**

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.

## 14.2 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. You can change back to the timing diagram view by pressing the **Esc** - key. The timing diagram can be printed out by clicking on the **Print** - button.
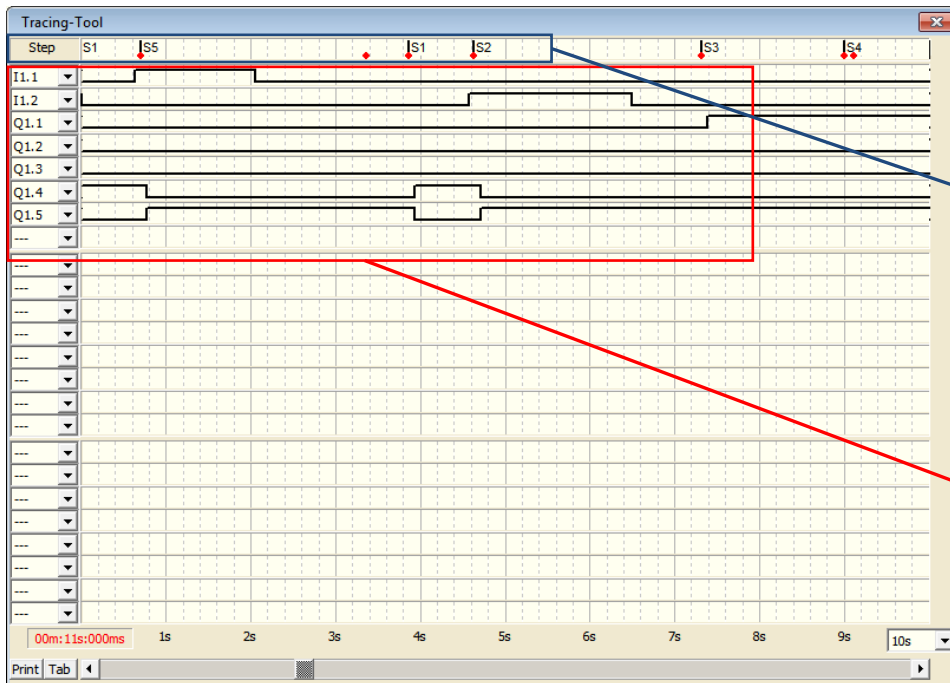


Illustration 1 :
Timing diagram

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.



Illustration 2 :
Display in tabular form

# Appendix A

**Registry keys of the workplace settings ( according to chapter 6.9 )**

**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

| "WINPARAM **14**" | = 0 | : | The ComGage window for keyboard input of characteristics values is not movable |
| | = 1 | : | The ComGage window for keyboard input of characteristics values is movable<br>( see WINPARAM 15 and 16 ) |
| "WINPARAM **15**" | = X | : | Determines the X-position of the upper left corner of the ComGage window for keyboard input<br>of characteristics values referring to the upper left corner of the monitor, as pixel value<br>( 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<br>of characteristics values referring to the upper left corner of the monitor, as pixel value<br>( 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<br>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 |

**\* :**    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 B

## 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" :

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

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

Method "Sigma = Rq / Dn" :

$$r_j = \max \; j - \min \; j \; ; range \, of \, sample \, j$$

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

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

Method "Sigma = Sq / An" :

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

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

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

Method "Sigma = sqr( … )" :

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

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

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

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

$x_{i,j}$ :     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 :

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

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 :

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

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.*