HYDAC ELECTRONIC

PC Software
CMWIN

User manual
(Translation of original manual)

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1 General Information

This manual provides you with key information on the HYDAC CMWIN. It will show you the most important screen dialogs and procedures. These are designed in such a way that it is possible to start at almost any chapter.

Our "**General Conditions of Sale and Delivery**" and the "**Special Conditions of Sale and Delivery for Software Products / Freeware**" apply to the use of the CMWIN. These Terms and Conditions can be viewed on our website (click Company/Legal information) or are available on request as a PDF file.

1.1 Previous Knowledge

No special previous knowledge is required for operating the CMWIN software. General PC experience using Windows operating systems and Windows-based applications is advantageous and will speed up the familiarization period.

1.2 Structure of the Manual

We have integrated a variety of different Help functions to make it easier to use this manual. Please consult the Table of Contents to find a specific topic. A brief overview is provided at the beginning of each Chapter listing the contents of that particular Chapter.

Selective Reading

You will find notes in the side margins that make it easier to find particular sections. Pictograms and markings also appear, the significance of which will be explained below.

Furthermore, this manual also contains instructions regarding personal safety and the avoidance of property damage that must be observed. The instructions are highlighted by a Warning symbol and displayed as follows, depending on the seriousness of the hazard:

Caution
means that an unwanted event or condition could occur if the particular instruction is not followed.

Note
means an important piece of information about the product, its handling or a part of the documentation to which particular attention should be paid.

1.3 Copyright Protection

The dissemination and/or reproduction of this document, as well as the exploitation and communication of its content, is not permitted unless specifically authorized. Contraventions are liable to compensation. All rights reserved.

1.4 Note on Warranty

This manual was compiled with the greatest possible care. Nevertheless, errors or deviations cannot be excluded, for which reason we assume no responsibility for the complete accuracy of the content.
In view of the fact that, despite intensive endeavors, errors can never be completely avoided, we welcome tips and suggestions for improvement at any time.

2 Safety

2.1 General Safety Precautions

Follow the specifications contained in this description. Non-observance of the instructions, operation in applications other than those outlined below, or incorrect handling of the product can be severely detrimental to the safety of personnel and systems/machines and will invalidate warranty and liability claims.
In the event of malfunction or uncertainty, please contact your HYDAC representative.

2.2 Proper/Designated Use

The PC software CMWIN can be used in conjunction with the following HYDAC devices:

- Portable data recorder HMG 3000
- Portable data recorder HMG 510
- Condition Monitoring Unit CMU 1000
- Condition Sensor Interface CSI-F-10
- Condition Sensor Interface CSI-B-2
- Oil Condition Sensor HYDACLab®
- AquaSensor AS 1000
- Contamination Sensor CS 1000

The software has been developed for processing and evaluating measured data which has been recorded using the above-mentioned HYDAC devices. We cannot accept any liability or provide warranty outside this field of application.

3 Installation

3.1 Hardware and Software Requirements

Minimum requirements:	Recommended:
PC, Pentium 400 MHz	PC, Pentium 1.8 GHz
256 MB RAM	256 MB RAM
Windows XP / 2000	Windows XP / 2000
CD-ROM drive	CD-ROM drive
3 MB free hard disk space	3 MB free hard disk space
RS 232 port	USB 1.1
RS 232 connector cable	Graphics resolution: 1024x768,
Graphics resolution: 640x480,	65536 colors
256 colors	

3.2 Installing the USB-Driver

If a HYDAC Measuring instrument (e.g. HMG 3000, HMG 510, CMU 1000) is being connected for the first time with the PC via USB, then you must first install the HYDAC USB driver „HE-Virtual-Comport-Driver".
The driver are included on the CD-ROM contained in the scope of delivery.

- Call up the file "*HE-VIRTUAL-COMPORT-INSTALLER.EXE*" in the "*HE-VIRTUAL-COMPORT-DRIVER*" folder and follow the instructions of the "*Setup Wizard*".

3.3 Installing CMWIN

- Call up the file "*CMWIN_Vxx_Rxx-Setup.Exe*" in the "*Installation*" directory and follow the instructions of the "*Setup Wizard*".

3.4 Starting CMWIN

- If you have installed the program in the default path suggested by the Setup Wizard it is located in the Start Menu under "*Programs*" "*HYDAC-ELECTRONIC CMWIN*". To launch the program, click on "*CMWIN*".
- When launching the program for the first time a window appears enabling you to select the user interface language: German, English or French. Simply click on the language of your choice with your mouse. Confirm by clicking on "*OK*".

4 Definition of terms

For a better understanding of the following chapters, the following terms must be differentiated.

4.1 CM devices

The term "CM devices" = "Condition Monitoring devices" includes all HYDAC components which are capable of recording data and interpreting condition information on machines, systems and their components (= Condition Monitoring).
The product range covers both the interpretation level and also the interface and sensor levels.

The following HYDAC products, amongst others, belong to this group:
- Portable data recorder HMG 3000
- Portable data recorder HMG 510
- Condition Monitoring Unit CMU 1000
- Condition Sensor Interface CSI-F-10
- Condition Sensor Interface CSI-B-2
- Oil Condition Sensor HYDACLab®
- AquaSensor AS 1000
- Contamination Sensor CS 1000

4.2 SMART Sensors

The sensor levels of the above-mentioned CM devices constitute the so-called "SMART sensors". They represent a new generation of sensors from HYDAC which can output several different measured values.
SMART sensors have the HSI interface (HYDAC Sensor Interface) and are therefore detected by higher-ranking modules (HMG, CMU, ...). The measured values of these sensors, including the unit of measurement, are also transferred via the HSI signal.
Depending on the type of sensor, there is an internal memory in the sensor. The measured values recorded over a longer period are stored in this memory. In addition, depending on the type of sensor, pre-set parameters can be changed and stored in the internal memory as a sensor configuration.

The following HYDAC products belong to this group:
- Oil Condition Sensor HYDACLab®
- AquaSensor AS 1000
- Contamination Sensor CS 1000

5 Using CMWIN

5.1 "File" Menu

5.1.1 Open

- To open a file which has already been saved on the PC, click on the "***File***" dialogue box and select "***Open***" in the dropdown menu. You also have the option of clicking directly on "***Open***" at the bottom left of the screen.
- Select the required recording in the relevant folder (file extension: ****.herf***").
- To open recordings made with a previous version of the device (e.g. HMG 2020), select "***Legacy formats***" as the file type in the dropdown menu (file extension: *.***hmg***, *.***cur***, ****pro***).
- Click on the "***File***" dialogue box. In the dropdown menu above the "***Quit***" menu item you will find a list of the most recently opened recordings (max. 8).

5.1.2 Import

- To import a text file exported from CMWIN, click on the "***File***" dialogue box and select "***Import***" from the drop-down menu.
- Select the required file in the appropriate folder for this purpose.
- Click on "***Open***" to import the file.
- Click on ***"Cancel"*** to cancel the action.

5.1.3 Save

- To save a recording, click on the ***"File"*** dialogue box and select ***"Save"*** in the dropdown menu, or click on ***"Save"*** at the bottom left of the window.
- If the recording has not yet been saved, the ***"Save recording as…"*** window opens.

5.1.4 Save As

- To save a file which hasn't been saved or to save a file under another name, click on the ***"File"*** dialogue box and select ***"Save as…"*** in the dropdown menu, or click on ***"Save as…"*** at the bottom left of the window.
- The ***"Save as…"*** window opens.

5.1.5 Save All

- To all changes in all files, click on the ***"File"*** dialogue box and select ***"Save all"*** in the dropdown menu, or click on ***"Save all"*** at the bottom left of the window.
- If all recordings have been previously saved, saving occurs without any new window opening.
- If one or more of the recordings have not yet been saved, the ***"Save recording as…"*** window opens.

5.1.6 Export

The "Export" function enables you to save measured data in a format that can be exported to a spreadsheet program (e.g. Excel), for example.

- To export a file, click on the "File" dialogue box and select "Export…" in the dropdown menu, or click on "Export…" at the bottom left of the window.
- Now the "Export data" window opens.
- Select the time range to be exported:
  - ■ *"Whole time range"*
  - ■ *"Displayed time range"*
- Select the channels to be exported:
  - ■ *"All channels"*
  - ■ *"Displayed channels"*
- Decide how unit of measurement should be displayed:
  - ■ *"Without unit"* or
  - ■ "*Separate row*"
- Select the data format in which the recording is to be saved:
  - ■ *"Text (separated by tabs)"*
  - ■ *"CSV (separated by commas)"*
  - ■ *"Formatted text (separated by spaces)"*
  - ■ *"User-defined ASCII/ANSI Format"*
- Select the delimiter characters (for *"User-defined ASCII/ANSI Format"* only):
  - ■ *"No quotation marks"*
  - ■ *"Single quotation marks (')"*
  - ■ *"Double quotation marks (")"*
- Select the separators (for *"User-defined ASCII/ANSI Format"* only):
  - ■ *"Space"*
  - ■ *"Tab"*
  - ■ *"List separator"*
  - ■ *"Other"*
- Select the column width (for *"User-defined ASCII/ANSI format"* only):
  - ■ *"Without fixed width"*
  - ■ *"Automatic optimum width"*
  - ■ *"Fixed column width"*
- Export folder:
  - ■ Click on button next to input box.
  - ■ A window opens enabling you to browse for the folder.
- File name:
  - ■ *"Keep name of recording"*
  - ■ *"Ask for new name"*
- File extension (for User-defined ASCII/ANSI format only):
  - ■ You can manually enter the file extension here.
- Click on "Ok" to export the file.
- Click on *"Cancel"* to cancel the action.

5.1.7 Export Folder

The "Export Folder" function enables you to save measured data in a format that can be exported to and read by a spreadsheet program (e.g. Excel), for example.

- To export a folder, please click the dialogue box "File" and select "Export folder" from the drop-down menu.
- Now the *"Export of measured values"* window opens. (as in section 5.1.2).
- Select the time range to be exported:
  - *"All values"*
  - *"Displayed time range"*
- Select the channels to be exported:
  - *"All channels"*
  - *"Displayed channels"*
- Decide how unit of measurement should be displayed:
  - *"Without unit"* or
  - *"Separate row"*
- Select the data format in which the recording is to be saved:
  - *"Text (separated by tabs)"*
  - *"CSV (separated by commas)"*
  - *"Formatted text (separated by spaces)"*
  - *"User-defined ASCII/ANSI Format"*
- Select the delimiter characters (for *"User-defined ASCII/ANSI Format"* only):
  - *"No quotation marks"*
  - *"Single quotation marks (')"*
  - *"Double quotation marks (")"*
- Select the column delimiter (for *"User-defined ASCII/ANSI Format"* only):
  - *"Space"*
  - *"Tab"*
  - *"List separator"*
  - *"Other"*
- Select the column width (for *"User-defined ASCII/ANSI format"* only):
  - *"Without fixed width"*
  - *"Automatic optimum width"*
  - *"Fixed column width"*
- Selected directory (directory containing all data to be exported):
  - Click on button next to input box.
  - A window opens enabling you to browse for the folder.
- Export folder:
  - Click on button next to input box.
  - A window opens enabling you to browse for the folder.
- Click on "*Ok*" to export the file.
- Click on *"Cancel"* to cancel the action.

5.1.8 Merge recordings

- In Order to merge individual recordings to obtain one compiled single file, please klick the dialogue box "*File*" and select "*Merge recordings*" from the drop down menu.
- First select the relevant directory path in the opening window.
- Then select the files to be merged into one single file and click "*Merge*".
- The procedure may take a few minutes.
- The size of the file compilation must not exceed 15 Mbytes.

5.1.9 Print

- To print a recording, click on the *"File"* dialogue box and select *"Print"* in the dropdown menu, or click on *"Print"* at the bottom left of the window.
- The *"Print"* window opens.
- In the upper part you can choose whether you want to print the recording in black & white only ("Monochrome").
- In the lower section you can decide which portions of the recording are to be contained in the printout by clicking on the checkbox before the particular portion.
- Click on *"Print"* at the bottom of the window.
- Click on *"Cancel"* to cancel the action.

5.1.10 Close

- To close the measurement curve you are currently editing, click on the "*File*" dialogue box and select *"Close"* in the dropdown menu, or click on "*Close*" at the bottom left of the window*.*

5.1.11 Close All

- To close all open measurement curves, click on the *"File"* dialogue box and select *"Close all"* in the dropdown menu, or click on *"Close all"* at the bottom left of the window.
- If you have not saved your recordings, you are prompted to do so.

5.2 "View" Menu

There are four view options for a measurement curve: **Graph, Table, Recorded data, Description**. All four views can be selected either in the dropdown menu of the *"View"* dialogue box or at the top of the screen, directly underneath the *"Tool bar"*.

5.2.1 Graph

- Graph: displays the measurement curve as a function (for edit options, see "***Working on a Measurement Curve***"and "***Editing a Measurement Curve***"). The time is shown first in the X axis, the measured values of the curves are shown in the Y axis, the curves being shown in the relevant color (for hiding or showing, see "***Settings***").

5.2.2 Table

- Table: table showing the measured values of the individual sensors recorded at a particular point in time.

5.2.3 Recorded data

- General: type of measurement curve, number of sensors, number of data records, start and end date of the measurement, etc.
- Channels with their measurement ranges

5.2.4 Description

- Description: Designation and comments entered for the curve. The designation and comment can be changed or added here.

5.3 "Graph" Menu

5.3.1 View

- **Full size**
  - ■ Click on the "*Graph*" dialog and select "*Full view*" in the dropdown menu, or select "*Full view*" at the bottom of the screen.
  - ■ The graph now shows the entire time and amplitude range of the measurement.

- **Apply scale settings**
  - ■ Click on the "*Graph*" dialog and select *"View / Apply scale settings"* in the dropdown menu, or select "*Apply scale settings*" at the bottom of the screen.
  - ■ The scale settings selected (see "Scaling" below) are applied to the current recording.

- **Scaling**
  - ■ Click on the "*Graph*" dialog and select *"View / Scaling"* in the dropdown menu, or select "*Scaling*" at the bottom of the screen.

  Selecting the resolution type and scaling type (refers to the default scale settings):

  - ■ **Resolution settings**: Click on the upper arrow button. A dropdown menu opens in which you can choose between the various resolution settings.
    - ▸ *best fit resolution* ⎱
    - ▸ *fine resolution*   ⎰ The coarser the resolution, the "rounder" the scaling in the
    - ▸ *medium resolution*   Y axis, meaning the measured values along the Y axis can
    - ▸ *large resolution*   be more easily read at first glance.
    - ▸ *1-2-5 resolution:* This resolution corresponds to the difference between the largest and smallest value of the current display range. Scaling is in increments of 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, etc. If a value is exceeded, the next larger value is used as the scaled range. (Example: if the difference between the smallest and largest value is 49 bar, scaling is from the *smallest* value to the *largest* value + 50, if the difference were 51 bar, scaling would be from the *smallest* value to the *largest* value +100)
  - ■ **Scaling type of channels:**
    - ▸ **scale all channels separately**
      When default scaling is applied, each channel is rendered optimally in a separate window with its maximum and minimum value.
    - ▸ **common scaling of channels using the same unit**
      When default scaling is applied, the smallest and largest measured value overall is used for scaling between these two values. The same scaling is applied to all channels with the same unit.
  - ■ Click on "*OK*" to apply the modified scale settings or *"Cancel"* to discard your changes*.*

- **Settings**
  - ■ Click on the "*Graph*" dialogue box and select "*View / Settings*" in the dropdown menu, or select "*Settings*" at the bottom of the screen, or click on one of the scales of the Y axis.
  - ■ A window with the settings is opened containing a number of tabs (each tab can be selected by clicking on the tab name):
  - ■ **"General"** tab (appears first when opening the window):
    - ‣ The recording time and the actual output range are indicated. The actual output range can be changed manually by entering other time values.
    - ‣ You can also choose whether the time or the measurement range of a sensor is to be scaled along the X axis (e.g. for a P/Q diagram).
    - ‣ By clicking the checkbox for *"Left Y axis"* and *"Right Y axis"* you can determine which channels are to be displayed and scaled on the Y axis (right- or left-hand side of the graph).
  - ■ **Individual measurement channel tabs:**
    - ‣ Under Designation you can give the measurement channel a name, e.g. "system pressure" if the system pressure of an equipment item was measured in this measurement channel using a pressure transducer.
    - ‣ The following can be entered manually in the second section: the full indication range (the range shown when selecting *"Full indication range"*) and the actual indication range (range currently shown).
    - ‣ Third section: the type of display can be set and whether or not the associated measurement series is to be displayed. The measurement series is hidden when you deactivate the checkbox after "*Show measurement series*" (i.e. click on the checkbox so that the checkmark disappears). You can also select the color for the measurement series from a list. You can access the list by clicking on the arrow button next to the color. You can select the line type by clicking on the arrow button. Options: "Solid line", "Dotted line" and "Dash dotted line".
    - ‣ Last section: you can enter a remark for the measurement series.
  - ■ Click on *"OK"* to save your changes or *"Cancel"* to discard them.

  Tip:
  If you only want to change the settings of one channel, e.g. hide it, click on this channel in the right-hand column next to the graph view. The Settings window opens in which the tab of this measurement channel is preselected.

- **Zoom In**
  - ■ Click on the "Graph" dialogue box and select "View" in the dropdown menu and "Zoom in" in the submenu, or select "Zoom in" at the bottom of the screen.
  - ■ When you move the mouse over the graph the mouse pointer turns into a magnifying glass with a plus sign.
  - ■ Only whole grid squares can be magnified.
  - ■ To zoom in on one of the grid squares, click on it and hold the left mouse button down. You can select one or more grid squares by dragging the mouse and drawing a rectangle around them.
  - ■ Release the left mouse button to zoom in on the selected portion, i.e. the selected portion is displayed larger within the overall graph.

- **Zoom Out**
  - ■ Click on the "***Graph***" dialogue box and select "***View***" in the dropdown menu and "***Zoom out***" in the submenu, or select "***Zoom out***" at the bottom of the screen.
  - ■ When you move the mouse over the graph, the mouse pointer turns into a magnifying glass with a minus sign.
  - ■ Zooming out functions in a similar manner to zooming in. Select one or more grid squares by dragging the mouse and drawing a rectangle around them.
  - ■ Release the left mouse button to display the view last shown in the overall graph in the framed area.

- **Panning**
  - ■ Click on the "***Graph***" dialogue and select "***View***" in the dropdown menu and "***Pan***" in the submenu, or select "***Pan***" at the bottom of the screen.
  - ■ When you move the mouse over the graph, the mouse pointer turns into a hand.
  - ■ Click on the graph and hold down the left mouse button.
  - ■ Using the mouse now shift the image in the required direction.
  - ■ Release the mouse button.
  - ■ Panning is only done in whole grid units.

- **Keyboard navigation**
  - ■ Click on the "***Graph***" dialogue and select "***View***" in the dropdown menu and "***Keyboard Navigation***" in the submenu, or select "***Keyboard Navigation***" at the bottom of the screen.
  - ■ Using the keyboard arrow keys you can shift the viewing area to the right, left, up and down. Every time you press an arrow key the viewing area is shifted by one grid unit in the relevant direction.
  - ■ If you hold down the Shift key at the same time, every time you hit the or ← key the time axis of the graph is enlarged or reduced respectively. This corresponds to a zoom function, but for the time axis only.
  - ■ If you press the Shift key while hitting the ↑ or ↓ key, you can change the scaling of the Y axis. This corresponds to a zoom function, but for the Y axis only.

- **Back**
  - ■ To undo changes in the graph view, click on the "***Graph***" dialogue box and select "***Back***" in the dropdown menu, or select "***Back***" at the bottom of the screen. You can do this as many times as there are changes.

- **Forwards**
  - ■ To redo changes which have been "undone" in the graph view, click on the "***Graph***" dialogue box and select "***View / Forwards***" in the dropdown menu, or select "***Forwards***" at the bottom of the screen. You can do this as many times as there are changes to redo.

- **Note**
    - ■ To save a zoomed view, for example, click on the "*Graph*" dialogue box and select "*View / Save*" in the dropdown menu, or select "*Save view*" at the bottom of the screen.
    - ■ A window opens where you can enter a name and a description for the saved view.
    - ■ Click on *"OK"* to save the view or *"Cancel"* to discard it and return to the graph.

- **List**
    - ■ "List views" is used to jump back and forth between various saved views.
    - ■ To view a saved view or select or rename it, click on the "*Graph*" dialogue box and select "*List views*" in the dropdown menu, or select "*List views*" at the bottom of the screen*.*
    - ■ A window with the saved views opens.
    - ■ This window is divided in two: the upper part contains a listing of all views with their names, the bottom part a description of the view currently selected.
    - ■ You can select any view by clicking on it with your mouse. When selecting a view, the view is shown in the background and its description appears in the lower section.
    - ■ Select "*OK*", "*Delete*" and "*Rename*" from the bar at the bottom of this window.
    - ■ *OK   = closes the window*
    - ■ *Delete   = deletes the selected view*
    - ■ *Rename   = to rename the selected view.*

5.3.2 Evaluation

- **Measure**
  - ■ Click on the "***Graph***" dialogue box and select "***Evaluation***" in the dropdown menu and "***Measure***" in the submenu, or select "***Measure***" at the bottom of the screen.
  - ■ When you move the mouse over the graph, the mouse pointer turns into a ruler.
  - ■ Move the ruler to a point in the graph and press the left mouse button.
  - ■ Crosshairs and the corresponding values of the intersection of these crosshairs are shown on the X and Y axis. If you hold down the left mouse button you can move the crosshairs in the graph.
  - ■ The intersection can be shifted as follows:
    - ‣ By moving the mouse over the crosshair you want to change (parallel to the time axis or value axis of the sensors). When the mouse pointer changes to a double arrow (o), click the left mouse button and shift the relevant axis to the point from which you need the measured value.
    - ‣ By clicking on another point in the graph with the ruler.

- **Measure difference**
  - ■ Click on the "***Graph***" dialogue box and select "***Evaluation***" in the dropdown menu and "***Measure difference***" in the submenu, or select "***Measure diff.***" at the bottom of the screen.
  - ■ When you move the mouse over the graph, the mouse pointer turns into a vernier caliper.
  - ■ Using the vernier caliper, select one of the two points between which you would like to measure the distance and press the left mouse button.
  - ■ A crosshair in bold (each of the hairs consisting of two thin parallel lines) appears along with a color-highlighted numerical value on each of the axes showing the distance.
  - ■ If you move the mouse over one of the axes a double arrow (↕) appears. If you hold the left mouse button, down you can pull the thick line "apart" and drag one of the lines to the level of the second point. The color-highlighted numerical value changes, indicating the distance. You can repeat this with all four lines as often as you like.
  - ■ After selecting the first point you can also hold down the left mouse button and immediately select the second point.
  - ■ Here, too, a new starting point can be selected repeatedly by clicking on another point in the graph.

- **Tracker**
  - ■ Click on the "***Graph***" dialogue box and select "***Evaluation***" in the dropdown menu and "***Track***" in the submenu, or select "***Track***" at the bottom of the screen.
  - ■ When you move the mouse over the graph the mouse pointer turns into a vertical broken line.
  - ■ Click (left mouse button) on the approximate point in time for which you would like to know the measured values.
  - ■ An indicator line appears vertically on the time axis on which the values of the individual curves are marked by squares. The time and the individual measured values are appropriately color-highlighted on the axes.
  - ■ If you hold the left mouse button down you can drag the line along the time axis whereby the values are displayed. During tracking, you jump from one measured value to another.
  - ■ The indicator line can also be moved along the time axis by clicking on the Up/Down Arrow buttons (lower right of screen underneath ***"Measured Value***

No.") or by pressing the Up Arrow or Down Arrow keys on the keyboard. By doing this, you track each measured value.
■ Clicking on another position in the graph will move the indicating line to that point.

- **Track the difference**
   ■ Click on the "*Graph*" dialogue box and select "*Evaluation*" in the dropdown menu and "*Track Difference*" in the submenu, or select "*Track Difference*" at the bottom of the screen.
   ■ When you move the mouse over the graph the mouse pointer turns into a dual vertical line.
   ■ Click (left mouse button) on the first approximate point in time for which you would like to know the measured values.
   ■ Pull the double line apart as far as the second time point for which you wish to know the measured values.
   ■ Vertical to the time axis, two indicator lines will appear and in between these the measuring point distance is displayed. The time and the individual differential values are color-highlighted as appropriate on the axes.

5.3.3 Other

- **Comments**
    - ■ Click on the "*Graph*" dialogue box and select "*Other*" in the dropdown menu and "*Comments*" in the submenu, or select "*Comments*" at the bottom of the screen.
    - ■ When you move the mouse over the graph the mouse pointer turns into a square connected with the "handle" (cf. dot) by a line.
    - ■ Using the "handle", click on the approximate position you would like to insert a remark.
    - ■ A Comment window opens. It is subdivided into three parts: text, font and anchor.

    - ■ **Comment text**
        - ▸ The comment text "%T: %V" automatically appears, which serves as a placeholder, *"Anchor to measured value"* is activated by a checkmark in the white checkbox.
        - ▸ Entering placeholders using %T for the actual time and %V for the actual measured value is not possible unless *"Anchor to measured value"* is activated.
        - ▸ If you leave the placeholders %T, %V and click on *"OK"*, you automatically get a measured value for a specific time (= quick and easy method for entering measured values in the graph).
        - ▸ Additional text can be entered, or the placeholders can be deleted.

    - ■ **Font**
        - ▸ Here you can change the font size and color and put the text in *"Bold"*, *"Italic"* or *"Underline"* by clicking the respective checkbox.
        - ▸ A blue-highlighted box with "*Set style as default*" appears. To use these settings as the default font settings, left-click on this box. A window pops up containing the message "*The current style has been set as default*". Confirm with "*OK*". The message window closes.

    - ■ **Anchor**
        - ▸ The checkbox in front of *"Anchor to measured value"* is initially activated (i.e. checked). To enter text without anchoring it to a measured value, deactivate this function by clicking on the checkbox.
        - ▸ If the checkbox is activated you can select the sensor (measurement channel) to which the comment is to be anchored (checkmark in the checkbox of the respective sensor).
        - ▸ You can also indicate the time at which the comment is to be anchored to the measurement curve. You can either enter the time in ms or change it by clicking the arrow keys next to the time box with your mouse. One click on one of the arrows ▲▼ corresponds to a change by the preset measurement rate.

    - ■ When you are finished entering your settings, confirm by clicking on *"OK"*.
    - ■ If you click on *"Cancel"* your comments will be discarded.
    - ■ After clicking on *"OK"* the Comment window closes and the Comment box can now be seen.
    - ■ If anchoring has been activated, the comment box is linked to the selected curve by a line. The circle at the end of the line shows which measured value the comment refers to.
    - ■ If anchoring has been deactivated, only the comment is visible.

    - ■ The comment can be edited and shifted later providing the comment function has been enabled.

■ The position at which the comment is anchored to the measurement curve can be shifted by moving the mouse pointer over the anchor position. If you hold the left mouse button down you can drag the anchor to the required position. If you have entered the placeholder it is adjusted accordingly when you release the mouse button. The anchor point is always a measured value since the comment is anchored to the measurement curve.

■ The comment box itself can be shifted by moving the mouse pointer over the comment box (it is now blue-highlighted; the square turns into a hand pointer, 3 handles appear in the lower right corner). Click and hold down the left mouse button and move the comment box to the required position.

■ To edit the comment text or manually enter another "anchor time", click on the 3 handles in the lower right corner.

■ The comment box opens again.

■ *"OK"*, *"Cancel"* and *"Delete"* appear in the bar at the bottom of this window.
   ▸ *"OK"*   = apply changes
   ▸ *"Cancel"*   = close window and discard changes
   ▸ *"Delete"*   = delete the entire comment

- **Comments List**
  ■ Click on the "*Graph*" dialogue box and select "*Other*" in the dropdown menu and "*Comments list*" in the submenu, or select "*Comments list*" at the bottom of the screen.
  ■ A window with the comments list opens.
  ■ All comments are listed along with the particular X axis allocated, their anchor, their position on the X axis (time), and the relevant comment text.
  ■ The entire text of the blue-highlighted comment appears in the lower box.
  ■ Click on *"Delete"* in the bar beneath this window to delete the blue-highlighted comment.
  ■ Click on *"OK"* to close the window with the comment list.

- **Create Picture**
  ■ Click on the "*Graph*" dialogue box and select "*Other*" in the dropdown menu and "*Create picture*" in the submenu, or select "*Create picture*" at the bottom of the screen.
  ■ A new window opens in which the actual graph view is shown as a picture.
  ■ In the left part of the window you have the following options.
  ■ Transparent = the created picture is transparent so that the underlying picture is visible, thus enabling two curves to be compared visually.
  ■ Copy = the picture is copied to the Windows Clipboard for use in other documents.
  ■ Save = opens a window for saving the picture in JPG format.

- **Reference recording**
  - ■ Click on the "*Graph*" dialogue box and select "*Other*" in the dropdown menu and "*Reference recording*" in the submenu, or select "*Reference recording*" at the bottom of the screen.
  - ■ A new window opens where you can make different settings and selections.
  - ■ You can save the settings made at this point in a file as a **Reference record**.
  - ■ This reference record then acts as a display/indication default for other recordings when opening other records relating to type of curve, type of line, colours, etc.

5.4 "Edit" Menu

You have various options for editing and processing a curve. All of the functions for this are located in the dropdown menu of the "**Edit**" dialogue box. "**Extract Recording...** " and "**Curve Overlay...** " create a new measurement which is filed in the left-hand box when files are open, the files being named "**Recording X**" (x = sequential number). They are not saved automatically however.

5.4.1 Extract Recording

- To create a copy of the measurement currently open or extract a zoomed portion of the measurement, click on the "**Edit**" dialogue box and select "**Extract Recording**" in the dropdown menu.
- The measurement is filed in the left box of the open files and can now be edited without any changes being made to the original file.
- You can save this file under a different name of your own choosing.

5.4.2 Curve Overlay

- Overlaying two measurement curves is useful for comparing measurements, e.g. the measurement of a machine cycle taken three months ago compared to its current condition.
- To superimpose two measurement curves, click on the "**Edit**" dialogue box and select "**Curve overlay**" in the dropdown menu
  (Note: possible only for curves with the same sampling interval.
- The *"Wizard for Overlay"* opens in a new window.
- You are now asked to select a 2nd recording, i.e. the curve to be superimposed on the curve currently open.
- Click on the arrow button to get a list of all open curves recorded using the same sampling rate.
- To see all the curves possible, click on the arrow button next to the name.
  (The list is empty if no curves with the same sampling rate are open.)
- Click on the curve you would like to superimpose, then click on *"Next"* in the bar at the bottom of the window.
- The second recording is opened in the same window as the original recording and a prompt for coordinating the time of the second recording appears in the wizard. (Shifting can only be done along the time axis.)
- The recording can be adjusted roughly using the mouse and clicking on the scrollbar, keeping the left mouse button pressed, and shifting the recording to the approximate position desired.
- To position the recording precisely, click on the arrow buttons to the right (▸) and left (◂) of the scrollbar until the second recording is positioned as desired.
- To overlay the curves click on *"Complete"* in the bar at the bottom of the window.
- Click on *"Cancel"* to cancel the overlay.

5.4.3 Time-Shift Channels

- To time-shift one or more channels in a measurement, click on the *"Edit"* dialogue box and select *"Time-shift channels"* in the dropdown menu.
- The *"Wizard for Time-shifting of channels"* opens.
- Select the channel you wish to time-shift in the dropdown menu.
- The measurement channel can be adjusted roughly by clicking on the scrollbar, keeping the left mouse button pressed and dragging to the right or the left.

- To position the recording precisely, click on the arrow buttons to the right (▸) and left (◂) of the scrollbar or press the right (→) and left (←) arrow keys on the keyboard until the measurement channel is positioned as desired.
- Click on *"Close"* to return to the main window.
- The time axis is now marked with an asterisk (*time [ms]). This means that at least one of the curves has been time-shifted.
- To undo the shifts, return to the *"Wizard for Time-shifting of channels"* (see above).
- Click on *"Delete"* to undo the shift of the active channel (see name in upper box). Click on *"Delete All"* to remove the time shift on all channels.
- Click on *"Close"* to return to the main window.

5.4.4 Add a Calculated Channel

- To calculate a channel from one or more measurement channels, click on the "*Edit*" dialogue box and select "*Add calculated channel*" in the dropdown menu.
- A new window opens for calculating the channel.
- Enter the mathematical formula for the virtual channel in the formula input box at the top. The formula can be comprised of numbers, measured values, arithmetical operators and functions. For measured values, use "S1...Sn" in the formula. Example: 5 * ((S1 + S2) / 2)
- For detailed information on the formula contents and symbols, click on *"Help"* located in the line below on the right. Click on *"Help"* again to close the window.
- The unit of the channel being calculated can be entered manually in the "*unit*" input box.
- Select the number of decimal places for the measured values displayed (0 .. 8 decimal places) from the "*Decimal places*" box.
- After entering a formula to be calculated, click on *"Calculate"* in the line at the bottom of the window. The computed curve is now inserted.
- This process can be repeated as often as desired.
- After entering all the channels to be calculated and computing them, click on *"OK"* to close the window.
- Clicking on *"Cancel"* also closes the window but the calculated channels are removed again.
- On the right of the screen you will now find the calculated channels. The settings can be changed here as for any other channel. Calculated channels are always marked with an *asterisk (*)*.

5.4.5 Add a filtered channel

- To remove noise from a measurement, for example, click on the *"Edit"* dialogue box and select *"Adding calculated channels"* in the dropdown menu.
- A window for filtering the channel opens.
- Clicking on the button next to the channel input box causes a dropdown menu to appear in which all channels are listed. Select the channel to be filtered.
- Clicking on *"Settings"* to open the channel settings window. Click on *"OK"* to save any changes you might have made, or *"Cancel "* to discard them.
- By moving the arrow on the bar "*Filter strength*" with your mouse the degree of filtering is changed. Changes can be monitored in the display pane of the graph.

- When the filter setting desired is located, click on "OK" and the channel is inserted permanently and can be edited like any other channel. Filtered channels are also always marked with an asterisk (*).
- Click on *"Cancel"* to cancel the action, without saving the changes.

5.4.6 Remove channels

CAUTION: *This action cannot be undone!*

- To remove, i.e. not just hide, individual measurement channels, click on the *"Edit"* dialogue box and select *"Remove channels"* in the dropdown menu.
- A new window opens in which all the channels of the recording are listed.
- Select the channels to be removed by clicking on the checkbox next to their name. A checkmark appears in the checkbox.
- When you have selected all of the channels to be removed, click on *"OK"* at the lower edge of the window.
- Click on *"Cancel"* to cancel the action.

5.5 "Units" Menu

5.5.1 Connection

- To establish a connection with a CM device connected to the PC, click on the"***Devices***" dialogue box and select "***Connection***" from the drop-down menu.

- In the window that opens, click on the appropriate button for the option you wish to use to establish a connection to a CM device:
    - **Direct Connection**
    - **Modem connection**
    - **TCP connection**

5.5.1.1 Direct Connection

- Click on "**Change**" to open the window for the interface settings.
- Make the corresponding preselection for the port settings in the window that opens under ***Interface selection***.
- Select the relevant port address and Baud rate under ***Interface settings***.
- As an alternative, you can also search automatically under ***CM devices search*** for CM devices connected to the PC by pressing "**Start**".
- Press "**Refresh**" to update the interfaces marked under ***Interface selection*** in terms of availability.
- Click on "**OK**" to apply the modified settings or "**Cancel**" to discard these changes. In either case you will then return to the ***Connection*** window.
- In the **Interface** field, select the option "**Open**" in order to open the selected interface (COM port).
- The opened interface will be indicated by a green dot on the right-hand edge of the window.
- Afterwards click on "**Connect**" in the ***Device*** box to connect the CM device to the PC.
- The successful connection will be symbolized by a green dot on the right-hand edge of the window.

- Press "**Disconnect**" in the ***Device*** box to disconnect the CM device from the PC.
- The interface (COM port) used can be closed again on the PC by pressing "**Close**" in the ***Interface*** box.
- At the end you also have the option of selecting an automatic connection setup. By placing a checkmark in the box for "**Set up connection next time automatically**" a connection is established automatically with the CM device that is linked via USB when the CMWIN software starts up. To ensure that this happens, no changes should be made to the interface parameter settings after the present connection is disconnected.
- Click on "**OK**" to complete the connection setup and to return to the CM Manager.

You can also connect several HYDAC CM devices with one another via the so-called "HSI Bus". Each CM device must be assigned an HSI Bus address for this purpose.

- First establish which CM device is the "Master" for the HSI Bus, i.e. which CM device the PC will be connected to.
- The other CM devices are connected to this device as "Slaves". The "Master" treats all of the other devices on the HSI Bus as SMART sensors.
- All "Slave devices" are connected via the "HSI" connection to the HSI Bus and linked with one another.

- In the "*Devices*" Menu, select the "*Connection*" option.
- Highlight the option "**Direct Connection**" option in the window that opens.
- Click on "**Change**" to open the window for the interface settings.
- Make the corresponding preselection for the port settings in the window that opens under *Interface selection*.
- Select the relevant port address and Baud rate under *Interface settings*.
- Press "**Refresh**" to update the interfaces marked under *Interface selection* in terms of availability.
- Click on "**OK**" to apply the modified settings or "**Cancel**" to discard these changes. In either case you will then return to the *Connection* window.
- Click on *Open* to open the selected interface. The open interface is indicated by a green dot at the top right.
- To set up a connection with the "Master" device, simply click on *Connect* and then *OK*.

To set up a connection with one "Slave" CM device (e.g. Address d), proceed as follows:

- Select *Change* in the *Pass-through mode* line. The window for setting the Pass-through mode opens.
- In the selection window, select the HSI channel to which the slave device is connected (in our example, Port H on the "Master" CMU).
- Afterwards, click on *Switch on* in order to switch on the pass-through mode for the selected channel.
- Confirm this with *OK*.

- Select *Change* in the *Bus address* line. The window for setting the bus address opens:
- Select the relevant slave device address in the selection window (Address d in our example).
- Confirm this with *OK*.
- Afterwards click on *Connect* to connect the PC to the Slave CM device (Address d).
- End the connection setup by confirming with *OK*.

5.5.1.2 Modem connection

With the *Modem connection* option, you have the facility for setting up a GSM mobile connection from the PC to a HYDAC GSM module, CSI-F-10, or CM devices connected to it, e.g. CMU 1000 or SMART sensors.

For detailed instructions on setting up this connection, please see the Manual for the HYDAC GSM module CSI-F-10.

5.5.1.3 TCP connection

With the *TCP connection* you have the facility for setting up a network connection from the PC to a HYDAC CM device via an Ethernet interface.

For detailed instructions on setting up the connection, please see the relevant manual for the HYDAC CM device with Ethernet interface.

5.5.2 CM Manager

5.5.2.1 Connection

Identical to Chapter 5.5.1

5.5.2.2 Actions

All the options and display values under the **Actions** menu are dependent on the CM device. In other words, different values, texts and messages will be displayed for a SMART sensor than for a CMU 1000.
For the definitions of the displayed values, texts and messages, please see the relevant manual for the CM device which is connected.

- **Display Device Status**
  - *Status*
  - *Status code*
  - *Status text*

- **Display device information**
  - *Part number*
  - *Registration key*
  - *Channel information*

- **Display Measured Values**

- **Managing Recordings**

- **Setup**
  - *Basic settings*
  - *Recording settings*
  - *HLB reset*
  - *Time settings*
  - *Network settings*
  - *Peripherals - Channel Settings*
  - *Peripherals - Analog outputs*
    The parameterization of the analog outputs is carried out in the CM Program.

- **Managing configurations**
  - *Settings configuration*
  - *Sensor configuration*
  - *Input configuration*

- **Set bus address**
  The standard setting is "Address a".

- **Managing sensor constellations**

- **Display input values**

5.5.2.3 Extras

Depending on the device, you have the following facilities under the Extras menu in the CM manager:

- **Update Firmware**
  - ■ Follow the installation wizard specific to the device.

- **Set password protection**
  - ■ To prevent unauthorized access to the CM device, you can equip the device with password protection. To do this, select the function **Set password protection**.
  - ■ You are prompted at this point to enter a password. If the CM device is still in the condition as supplied or if no password protection has been set, then enter the standard password for this function.
  - ■ Afterwards, disconnect the CM device and then reconnect it.
  - ■ Enter the Password and then click on OK in order to have unlimited access to the CM device.
  - ■ If you click on Cancel without entering a password, then you will obtain only "Reading Rights". You only have access to the following information: Sensor status, Sensor information, Measured values, Input values.
    It will not be possible to carry out any settings.

- **Change password**
  - ■ Here you have the opportunity of changing the password. After the *Change passwort* function has been selected, the following window opens:
  - ■ Enter the previous password in the top line.
  - ■ Enter the new password in the middle line.
  - ■ Repeat the new password in the bottom line.
  - ■ Confirm the action with *OK* (the new password is immediately activated) or end the action by clicking on *Cancel* without changing the password.

- **Removing Password Protection**
  - ■ To remove the password protection in the device again, select the function *Remove password protection*. The following window opens:
  - ■ Enter the current password.
  - ■ Confirm the action with *OK* (password protection is immediately deactivated) or end the action by clicking on *Cancel* without deactivating the password protection.

5.6 "Extras" Menu

5.6.1 CM Editor

HYDAC CM devices, such as the CMU 1000 and the GSM mobile module, CSI-F-10, require an application program and process this continuously and cyclically.
You generate this application program with the *CM Editor* and load it afterwards into the CM device. The CM Editor provides you with various tools and functions for designing, integrating and testing your CM program.

To open the Editor, proceed as follows:
- Start the HYDAC PC software **CMWIN**
- In the *Extras* Menu, select the "**CM Editor**" option.
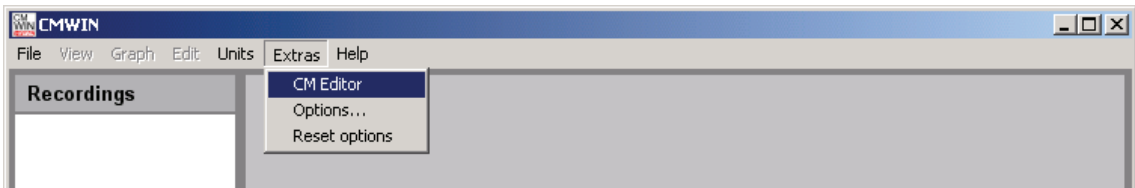
- The following screen opens:
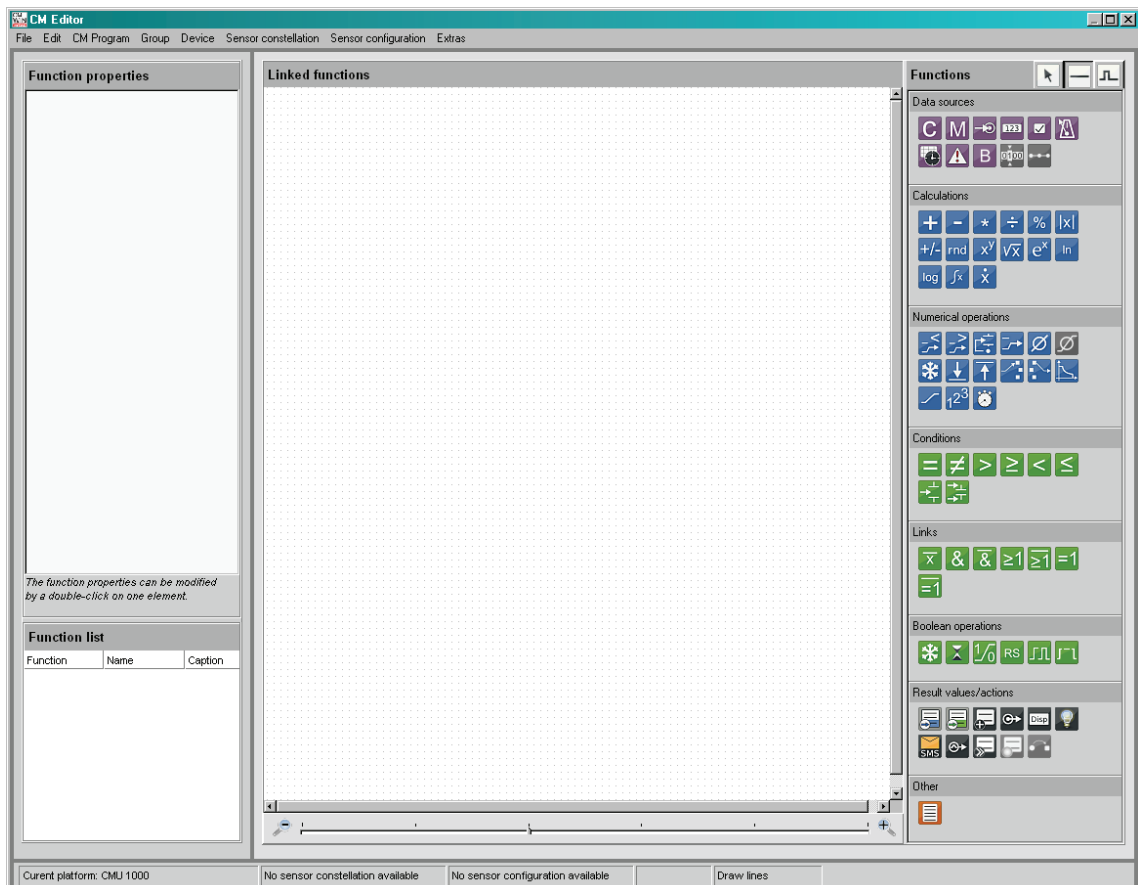
The menu structure and window properties of the Editor are explained below in greater detail:

5.6.1.1 File

- With "**New**", you can establish which platform (CM device) the CM program is to be created for before starting to create the CM program. The program functions which are not available for the selected platform will be grayed out in the *Functions* window and cannot be used during program generation.

- With "**Platform**", you can establish which platform (CM device) the CM program is to be created for during the creation of a CM program. The program functions which are not available for the selected platform will be grayed out in the *Functions* window and cannot be used during program generation.

- Pressing "**Open**" allows you to open an already generated and stored CM program. CM programs have the file extension *.hecmp*. Select the required file in the corresponding path.

- Select "*Save*" to save a CM program. If the recording has not yet been saved, the
"**Save as**…" window will open. Enter the required file name in the corresponding path.

- To save a file that has not yet been saved or to save a file that has already been saved under a different name, select "**Save as ...**" . Enter the required file name in the corresponding path.

- To integrate an existing program that has already been saved into the current program generation process, select "**paste from file**". Select the required file in the corresponding path.

- Press "**Print**" to print out the content of the *Linked functions* window (= program printout).

- Press "**Exit**" to close the CM Editor.

5.6.1.2 CM Program

- After "**Display**" is selected, a window opens listing all the functions used in the CM program which is currently open, together with inscriptions and parameters. The list can be printed out by selecting "**Print**".
  Pressing "**Close**" takes you back to the CM Editor.
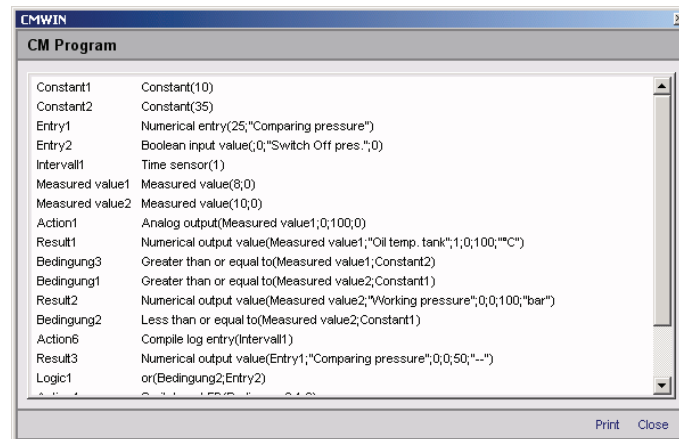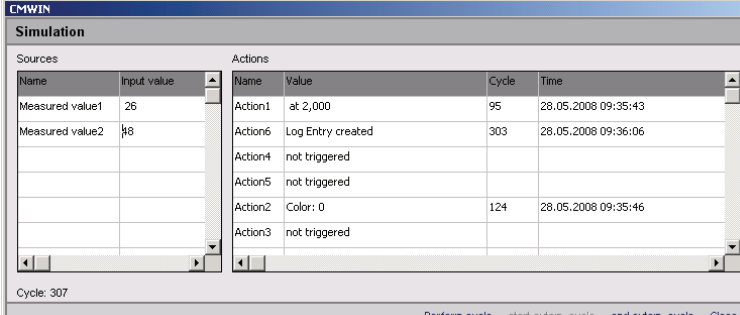
- With "**Simulate**", you can simulate and/or test the CM program that is currently open. The **Simulation** window opens for this purpose. It is not necessary for the CM device to be connected for the simulation.
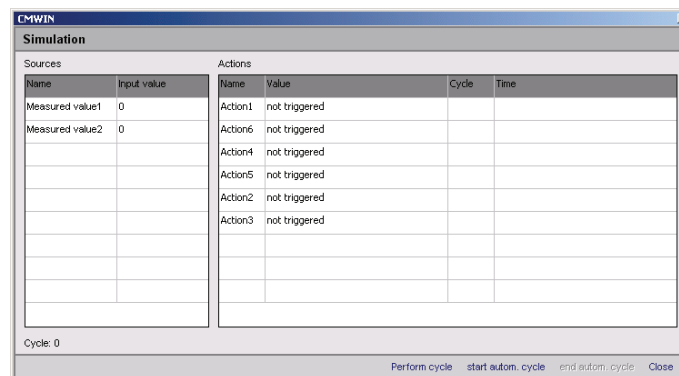
  - All of the input signals used in the CM program are listed one above the other in the *Name* column in the left-hand part of the Simulation window.

  - You can assign a specific value to each input in the *Input value* column.

  - All of the actions used in the CM program are listed one above the other in the *Name* column in the right-hand part of the Simulation window.

  - The current status of each action is displayed in the Value column.

  - The cycle number of the last status modification is displayed in the Cycle column.

  - The date and time of the last status modification is displayed in the Time column.

- With „**Perform cycle**", you can start the simulation for a single processing cycle and view the resulting status modifications of the actions afterwards.

- With "**Start autom. cycle**", you start a permanent, continuous program simulation. You can change the input values during the simulation however you like and observe the status modifications of the actions.

- With "**End autom. cycle**", you stop the permanent, continuous program simulation.

- Click "**Close**" to take you back to the CM Editor.

- During the simulation, the assigned input values and action statuses are also displayed in the *Linked Functions* window by means of corresponding symbols.
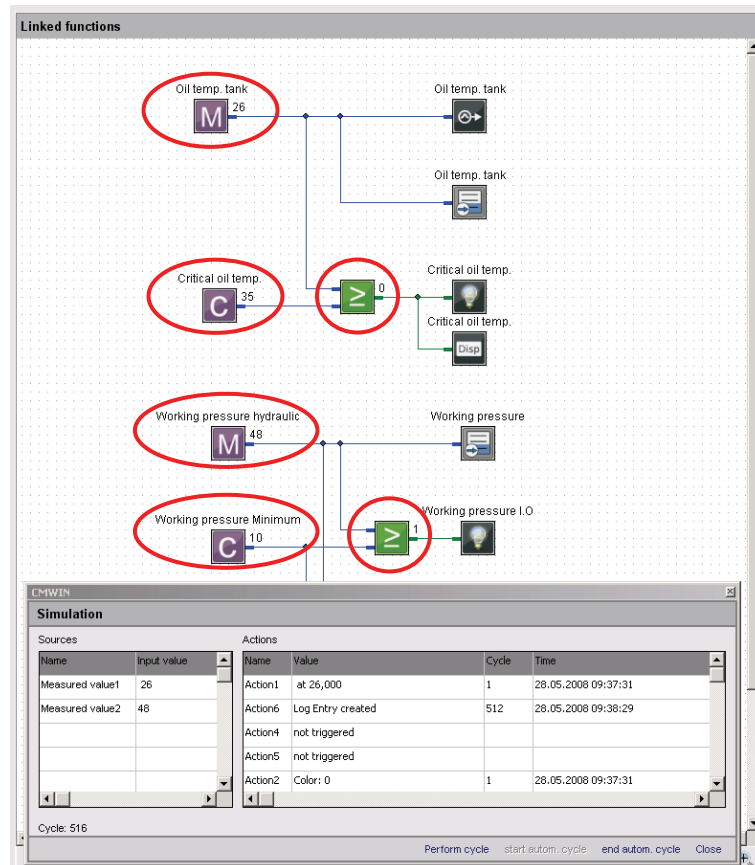
- You can transfer the CM program which is currently open to the CM device (e.g. CMU 1000) using "**Transfer into device**".

Note!
Only error-free programs can be transferred into the CM device.

▪ The following message appears after the program has been successfully applied:
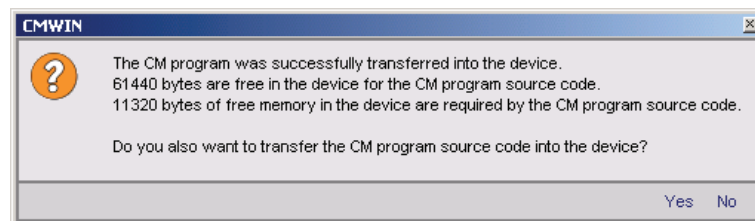
▪ Here you can select whether you also wish to transfer the source code of the program into the CM device.

Note!
If you also transfer the source code into the CM device, then it is available to be read again by every other connected PC and modified! If the source code is not transferred into the CM device, then the program cannot be read by another PC.

▪ The following message will appear if the CM program contains errors when attempting transfer:
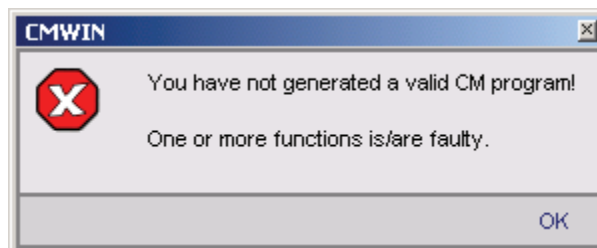
▪ Eliminate the error(s) found in the CM program and transfer the program again.

Note!
If you transfer a program and a power failure occurs during the transfer, then the program will not be saved in the CM device after power is restored. For that reason, first save your program on the PC on which it was originally generated or modified before making the transfer.

- You can transfer and then edit the CM program currently available in the CM device to your PC with "**Receive from device**". This will however only work if the CM program source code from the original creator has also been transferred into the CM device.
  If no source code is available in the CM device, then the following message will appear:
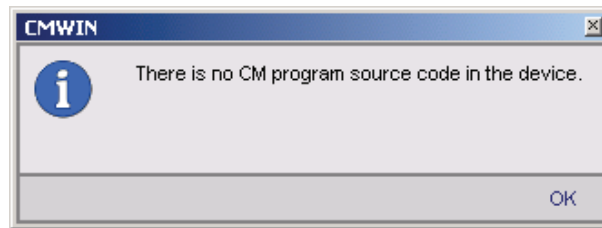
- The "**Online Debugging**" function is a tool for observing the CM program as well as for finding, diagnosing and eliminating possible errors in the CM program and/or in the connected peripherals.

  ▪ The following prerequisites must be fulfilled for this purpose:
    - The CM device must be connected with the PC and the CMWIN software.
    - The CM program opened in CMWIN and the one active in the CM device must be identical.

  ▪ If the "Online Debugging" mode is active, then the following values will be displayed for the relevant functions:
    - Measured values
    - Constants
    - Switching status of logical links
    - Date and time when the corresponding event is triggered

  ▪ The display in "Online Debugging" mode is shown in the following illustration, as an example:
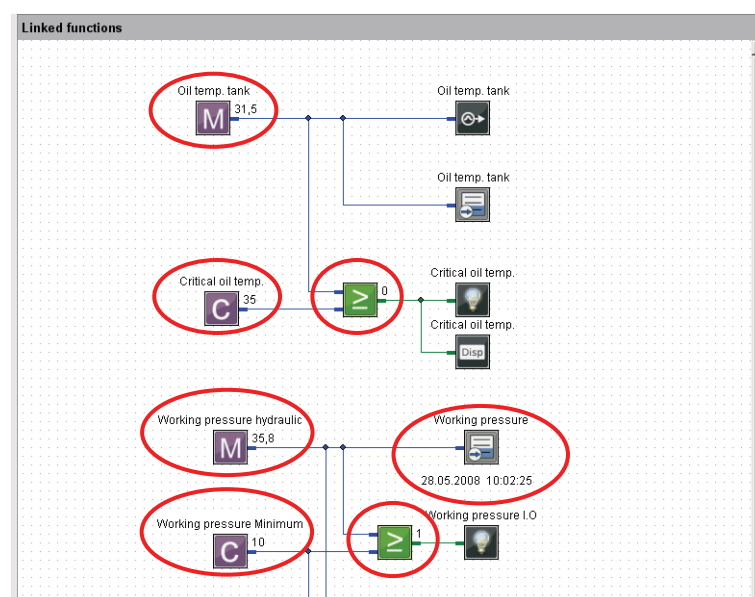
5.6.1.3 Grouping

- With **Create grouping** you can join several functions to make an cohesive unit and move and copy these as a block.

  - First mark the functions to be grouped by enclosing them in a frame created with the help of the cursor.
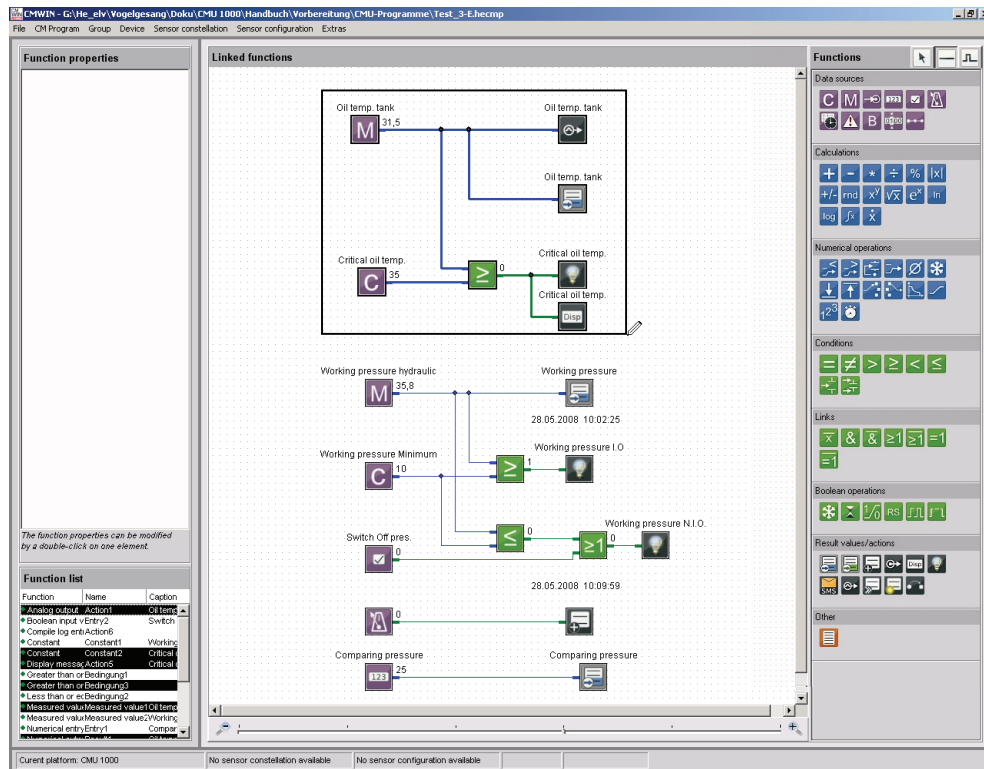
  - Afterwards, select "*Group*" in the menu bar and then "*Create grouping*" in the drop-down menu that appears.

- Press **Cancel grouping** to ungroup the functions which were linked together in the group.
  - To do this, highlight the group concerned by clicking on any one of the functions within the group.
  - Afterwards, select "*Group*" in the menu bar and then "*Cancel grouping*" in the drop-down menu that appears.

5.6.1.4 Device

The "**Connection**" function can be used to set up a connection between the PC and a CM device from the CM Editor.

The function is identical with the connection setup in the CM Manager. (See Chap. 5.5.1)

5.6.1.5 Sensor constellation

Reliable system monitoring means ensuring that exactly the same sensors that were connected at the time the CM device was configured are connected during operation.
The **Sensor constellation** is used for this purpose. The sensor constellation is a monitoring instrument for the connected sensor system, i.e. it performs a continuous comparison between the connected "Actual" sensor system and the specified "Reference" sensor system.

The sensor constellation is optional in the CM device and not mandatory. If however a sensor constellation has been saved, then the connected sensor system must match it. When there is an activated sensor constellation, then an "incorrect" sensor connected by mistake will be recognized, thus preventing a situation in which the CM program is working with incorrect information.
A sensor constellation can be saved in files and loaded from files, and can be both received and transferred by the CM device.
The constellation files all have the extension ***.hescf**.

The sensor constellation contains the following data:
 - Quantity of connected sensors
 - Quantity of subchannels for each connected sensor
 - Status of each individual subchannel (active/inactive)
 - Sensor class (Analog / HSI / SMART)
 - Units of the individual measured values
 - Name of each sensor
 - Device designation of each sensor

If a sensor constellation is available in the CM Editor, then you can use the correct names in connection with the measurements during program generation. It will then be the case that only those sensors and subchannels that are actually present will be available and accessible for adjustment.
A status message at the lower edge of the window of the CM Editor indicates whether or not a sensor constellation is available.
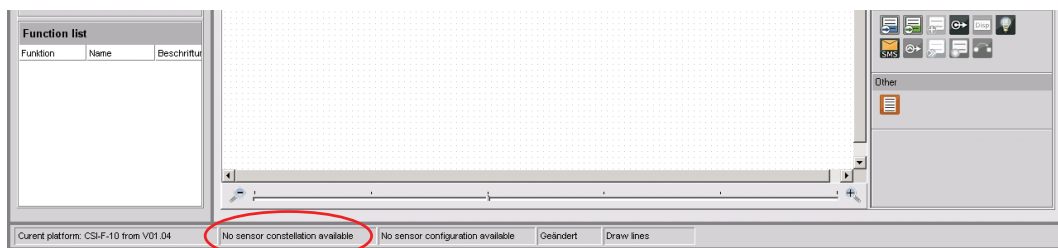
- With the function **Apply from file,** you can open a saved sensor constellation file and use it in the CM Editor.
  To do this, enter the corresponding path and file name in the window that opens and then click on **Open**.

- With the function **Apply from device**, you transfer one of the sensor constellations stored in the CM device to your PC, after which you can use it in the CM Editor.

- With ***Delete*** you delete the currently available sensor constellation in the CM Editor, after which it is no longer available for further use when generating programs.
  No saved constellation files are deleted!

- To save a constellation file, select ***Save to file***. Enter the appropriate path and required file name for this purpose in the window that opens.

- When the ***Display*** function is selected, a window opens in which the complete sensor constellation is displayed.
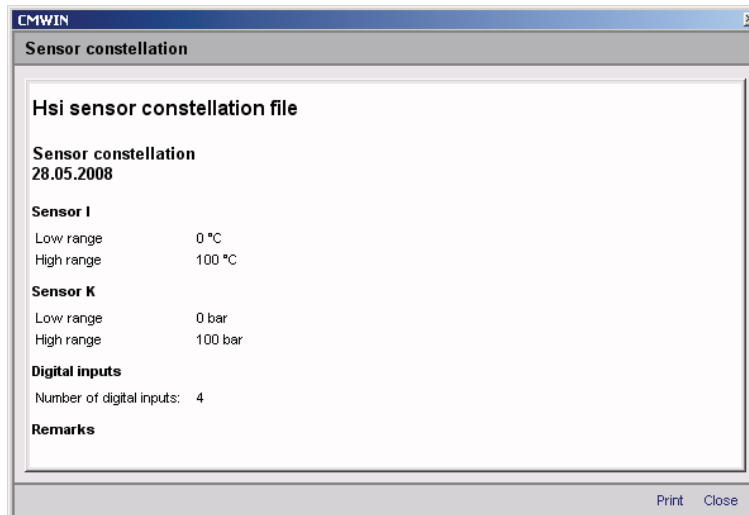
5.6.1.6 Sensor configuration

Sensor configuration is understood to mean all of the input-relevant settings in the CM device (Peripherals settings). The sensor configuration can only be generated with the CM device itself (offline generation in CMWIN is not possible). All necessary sensors must be connected in order for this to be possible.

A sensor configuration can be saved in files and loaded from files, and can be both received and transferred by the CM device.
The configuration files have the extension *.hedcf*.

The sensor configuration contains the following data:
- Sensor name
- Mode
- Measurement range
- Decimals
- Units of the individual measured values

A status message at the lower edge of the window of the CM Editor indicates whether or not a sensor configuration is available.
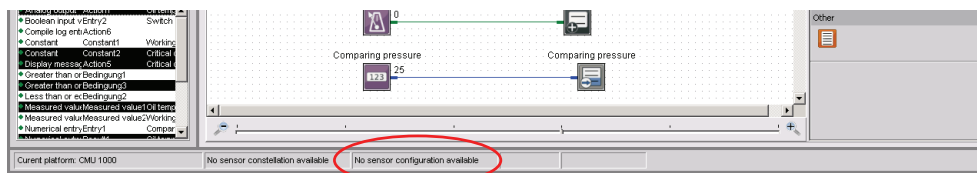
- With the function **Apply from file,** you can open a saved sensor configuration file and use it in the CM Editor.
  To do this, enter the corresponding path and file name in the window that opens and then click on **Open**.

- With the function **Apply from device**, you transfer a sensor configuration stored in the CM device to your PC, after which you can use it in the CM Editor.

- With **Delete** you delete the currently available sensor constellation in the CM Editor, after which it is no longer available for further use when generating programs.
  No saved constellation files are deleted!

- To save a configuration file, select **Save to file**. Enter the relevant path and required file name for this purpose in the window that opens.

- When the *Display* function is selected, a window opens in which the complete sensor configuration file is displayed.
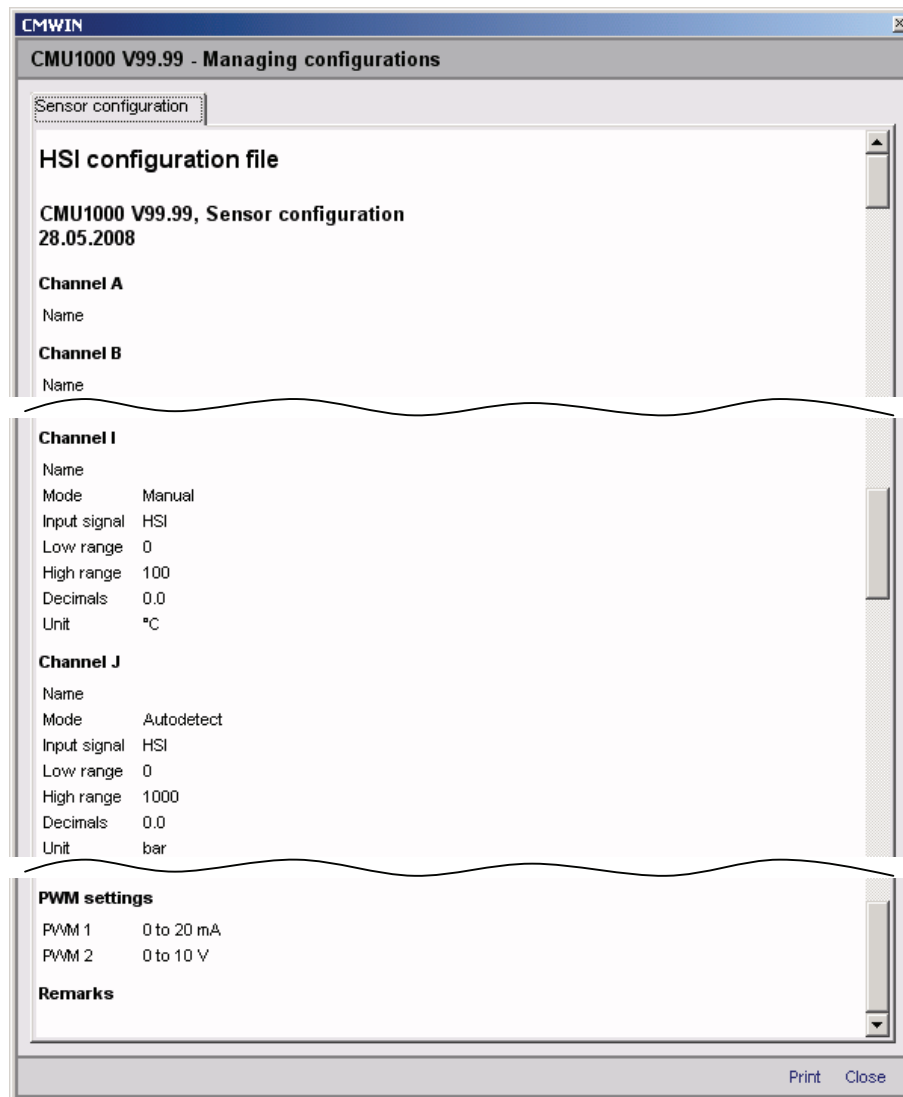
Note!

With a CM program, one has the opportunity of integrating not only a configuration file but also a constellation file, so that one can define the configuration and the constellation at the same time the CM program is transferred into the CM device. Both parts are however optional and need not be present in the CM program.

5.6.1.7 Extras

- The following window opens when the function **Options** is selected:
  The selection buttons at the right-hand edge of the window appear after clicking in the respective selection field.

CMWIN	
Options	
General	
Language	English
Working folder	
CM Editor	
Name as inscription	No
Frame group	No

OK   Cancel

- In the **Language** field, you can select either German, English or French as the CMWIN system language.

- In the field **Working folder** you define the path for saving the CMWIN files (CM programs, recordings, constellation and configuration files, ...).

- In the field **Name as inscription** you define whether or not the particular function name (e.g. Measured value 2, Action 4) is to be displayed as the function inscription in the "Linked functions" window.
  If "No" is selected, then you have the option of entering an inscription text manually into the function parameters.

- In the field **Frame group** you define whether or not a frame is to appear around generated groups in the CM program.

Clicking on **OK** applies the settings and returns you to the main CMWIN window.
Pressing **Cancel** takes you back without applying any changes.

- Select the **Display cycle time** function to open the following window and to display the current cycle time of the CM program.

Example:

CMWIN	
ℹ	Current cycle time: 10,0 ms
	OK
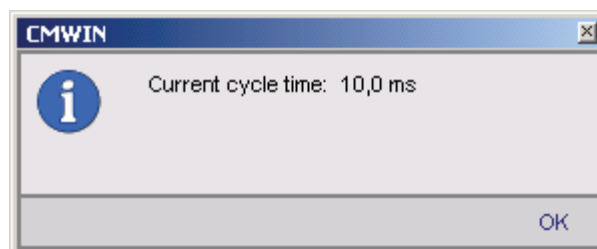
5.6.1.8 Window Divisions

The graphics interface of the CM Editor is divided into the following function windows:

"Function Properties" Window

The properties of the functions currently selected in the "Linked Functions" window are displayed in this window. These include:
- Function name (e.g. Action 2; Constant 5; Measured value 12)
- Function type (e.g. Constant, Measured value, Timer)
- Specific properties (parameter settings)
- Comment

"Function List" Window

This window lists all the functions used in the CM program with the following specifications:
- Function type (e.g. Constant, Measured value, Timer)
- Function name (e.g. Action 2; Constant 5; Measured value 12)
- Inscription (e.g. Working pressure N.I.O.)

"Linked Functions" Window

This window contains the actual CM program. The display can be zoomed in or out with the scroll bar on the lower edge of the window.

"Functions" Window

This window contains all the functions available for program generation, sorted according to:
- Data sources
- Calculations
- Numerical operations
- Conditions
- Links
- Boolean operations
- Result values/actions
- Other

5.6.2 Options

- The following window opens when the function **Options** is selected:
  The selection buttons at the right-hand edge of the window appear after clicking in the respective selection field.

CMWIN	
Options	
General	
Language	English
Working folder	
CM Editor	
Name as inscription	No
Frame group	No

OK   Cancel

- In the **Language** field, you can select either German, English or French as the CMWIN system language.

- In the field **Working folder** you define the path for saving the CMWIN files (CM programs, recordings, constellation and configuration files, ...).

- In the field **Name as inscription** you define whether or not the particular function name (e.g. Measured value 2, Action 4) is to be displayed as the function inscription in the "Linked functions" window.
  If "No" is selected, then you have the option of entering an inscription text manually into the function parameters.

- In the field **Frame group** you define whether or not a frame is to appear around generated groups in the CM program.

  Clicking on **OK** applies the settings and returns you to the main CMWIN window.
  Pressing **Cancel** takes you back without applying any changes.

5.6.3 Reset options

- Using the **Reset options** function, you can reset all manually set options to the factory default setting.
- Confirm that all options are to be reset to the factory default setting by clicking **OK** or press **Cancel** to go back without applying any changes.

5.7 Help

- Select the **Info** function, to find out the present software version and to obtain the link to the HYDAC website.

APPENDIX A: CM Program Functions

A CM program consists of many individual functions that are linked with one another and that are processed and evaluated cyclically.

A.1 General Information on Functions

A function has *Inputs*, *Outputs* and *Parameters*. This means, for example, the function "Median value" reads a numerical value at the input, forms a median value above it and then displays this at the output. A parameter is used to define the amount of time for which the calculation is rendered.

A.1.1 Inputs / Outputs

For most functions, the outputs change during the running time, depending on the input. Functions are linked with one another in the Editor. This means, for example, that the output of a function can be linked with the input of a different function. It is possible to make one output dependent on several inputs, but not several outputs on one input.

There are two types of inputs/outputs, depending on the value type: *Numerical* and *Boolean*. A "Boolean output" can only be linked with a "Boolean input" and a numerical output can only be linked with a "numerical input".

A.1.2 Numerical Values

A numerical value is a decimal number, i.e. a numerical value with an optional plus/minus sign and any number of digits after the decimal point. It is accurate to 7-8 significant places. That means that with a value of 2 million (7 places in front of the decimal point), the addition of a value of 0.001 (3 places after the decimal point) will not alter the numerical value. One would need accuracy to at least 10 significant places for it to be altered.

Numerical inputs/outputs and the corresponding connection lines are shown in **blue**.

Boolean Values

A Boolean value is a logical status. There are only 2 statuses: "true" or "1" and false or "0".

Boolean inputs/outputs and the corresponding connection lines are shown in **green**.

A.1.3 Parameters

Parameters are defined in the Editor and do not change during the running time. One exception to this are the input parameters, which can be modified during the running time in a menu on the CM device or using a PC which is connected.

Parameters have one of the following types:

Numerical Parameters
A numerical parameter is a decimal number in accordance with the inputs/outputs.

Whole Number
A whole number is a natural number, i.e. it has no digits after the decimal point. As a rule, no negative numbers are permitted either. Whole numbers are used for example for numbering purposes.

Input List
An entry from a list is selected for the input list type. The quantity and the type of list entries is dependent on the particular parameter.

Boolean Parameters
A Boolean parameter has, as already described in connection with the inputs/outputs, only two logical statuses: "0" and "1". Nevertheless, it is not "0" and "1" that are set in the Editor, but rather such terms as "No" or "Yes", "Inactive" or "Active", "Off" or "On", depending on the context.

Character String
A character string is an arbitrary text, the length of which is usually limited. In addition, any leading and subsequent empty spaces are usually removed automatically.

Values Table
A values table is a table with several values, whereby each value is positioned in a line of its own.
Furthermore, it is also possible to enter value pairs. The individual values of a value pair are then separated from one another with a colon ":".

Time
The time of the day is specified in the country-specific format that is set in Windows.

A.2 Data Sources

A.2.1 Numerical Constants

The *Numerical Constants* function supplies a numerical value which is defined in the Editor and which does not change during the running time.
That means that the *Value* parameter entered in the Editor is output during the running time at the output.

Inputs:	-	
Outputs:	y:	(Numerical)
Parameters:	p_1:	Value (Numerical)

A.2.2 Measured Value

The *Measured Value* function provides the current measured value of a connected sensor.

The *Sensor connection* parameter is used to define the sensor; the channel of the sensor with *Subchannel*. If a connected sensor has no subchannel, then no selection is possible at this point.

If a sensor constellation has been saved, then only the active connections are displayed in the input lists for the *Sensor connection*, each of them with the respective sensor name. The subchannels available for this sensor are then displayed at *Subchannel*, each of them with name and unit.

If no sensor constellation is saved, then Ports "A" to "P" are offered for selection at *Sensor connection* and Channels "1" to "32" at *Subchannel*.

Inputs:	-	
Outputs:	y:	(Numerical)
Parameters:	p_1:	*Sensor connection* (input list)
	p_2:	*Subchannel* (input list)

A.2.3 Digital Input

The *Digital input* function supplies the status of a digital input.

The *Input terminal* parameter is used to define which digital input port is used.

Inputs:	-	
Outputs:	y:	(Boolean)
Parameters:	p_1:	*Input terminal* (input list)

A.2.4 Numerical Entry

The function *Numerical input* supplies a numerical value which can be adjusted in the Parameters menu of the CM device. As an alternative, it can also be set via a connected PC.

The *Inscription* parameter is used as a menu option in the input menu for this purpose. The permissible input range runs from -2,000,000.00 to +2,000,000.00.

Modifications made in the CM device during the running time also remain in effect after switch-off. The value that is set under Start value will used after the first-time transfer of the CM program to the CM device until the first change is made.

Inputs:	-	
Outputs:	y:	(Numerical)
Parameters:	p_1:	*Starting value* (Numerical)
	p_2:	*Inscription* (character string)

A.2.5 Boolean Entry

The *Boolean input* function supplies a Boolean value, which can be set in the Parameters menu of the CM device. As an alternative, it can also be set via a connected PC.

The *Inscription* parameter is used as a menu option in the input menu for this purpose. On the CM device input is by selecting "Yes" or "No", on the PC, a checkbox appears.

Modifications made in the CM device during the running time also remain in effect after switch-off. The value that is set under Start value will used after the first-time downloading of the CM program into the CM device until the first change is made.
The *Functionality* parameter defines how the input is interpreted. The following settings are possible:

Switch
A menu option is generated on the CM device with which the input value can be switched on or off. This functionality is used to activate certain paths in the evaluation logic.
Key
When the value on the CM device is switched on, then only one impulse is generated in the evaluation logic and the option switches itself off in the menu again immediately. A key function is simulated, so to speak. This functionality can be used to trigger events in the evaluation logic.

Inputs:	-	
Outputs:	y:	(Boolean)
Parameters:	p_1:	*Starting value* (Boolean)
	p_2:	*Inscription* (character string)
	p_3:	*Functionality* (entry list)

A.2.6 Timer

The *Timer* is a function which generates an impulse at an adjustable interval (e.g. every minute, every 5 minutes), i.e. setting its Boolean output to "1" for a cycle and then back to "0".

The following settings are possible for the *Interval* parameter:

- *1; 2; 5; 10; 15; 30 Seconds*,
- *1; 2; 5; 10; 15; 30 Minutes*,
- *1; 2; 6; 12; 24 Hours*.

The output impulse is thereby always synchronized with the time of day. If, for example, "6 hours" is set, then an impulse will be generated at 6 AM, 12 AM, 18 PM and 0 PM.

If an impulse is required at particular times of the day, then you should use a clock timer with a downstream impulse generator instead of a timer (see Chap. A.8.5).

Inputs:	-	
Outputs:	y:	(Boolean)
Parameters:	p_1:	*Interval* (input list)

A.2.7 Clock Timer

The *Clock timer* is a function which switches on its Boolean output at a certain time during a month and then switches it off again at a different point in time.

The switch-on time is set using the parameters *Switch-on day* and *Switch-on time*, while the switch-off time is set using the parameters *Switch-off day* and *Switch-off time.*

A day of the week "Monday" to "Sunday" can be set. The setting "Daily" is also possible. The "Daily" setting is only possible if both days are set to "Daily". The Editor prevents incorrect inputs: If, for example, the switch-on day is changed from "Monday" to "Daily", then the switch-off day is automatically set to "Daily".

If switch-on time and switch-off time are identical, then the output will be switched on for precisely this specified second.
If only one impulse is required, i.e. if the output is to be set for exactly one cycle to "1" at the switch-on point and then back to "0", then use a downstream impulse generator (see Chap. A.8.5).

Inputs:	-	
Outputs:	y:	(Boolean);
Parameters:	p_1:	*Switch-off day* (input list)
	p_2:	*Switch-off time* (time of day)
	p_3:	*Switch-on day* (input list)
	p_4:	*Switch-on time* (time of day)

A.2.8 Error Event

Error handling can be implemented with the function *Error event*. The Boolean output is switched to "1" when an error condition is present. The output is switched back to "0" if the error disappears.

The type of error event can be set with the *Event* parameter.

The following events are possible:

Below signal range
A sensor has a cable break, for example

Above signal range
The signal of one sensor is above the signal range

Incorrect sensor constellation
There is either no sensor, or an incorrect sensor connected to one sensor connection port.

Numerical error
An error occured during a calculation, e.g. division by 0 or square root of a negative number, logarithm from 0, etc.

Cycle time exceeded
The set cycle time was exceeded.

Inputs:	-	
Outputs:	y:	(Boolean)
Parameters:	p_1:	*Event* (input list)

A.2.9 Boolean Constants

The Boolean Constant function supplies a Boolean value which is defined in the Editor and which does not change during the running time. That means that the parameter entered in the Editor is output during the running time at the output.

Inputs:	-	
Outputs:	y:	(Boolean)
Parameters:	p_1:	Value (Boolean)

A.2.10 State-bit
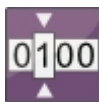
The function *Show Stat-bit* provides the status of the bit defined by the "Sensor port" and "Bit location" parameters in the status code of the selected SMART sensor (status code is sensor-specific) at the Boolean output.

Inputs	-	
Outputs:	y:	(Boolean)
Parameters:	p_1:	*Sensorport* (Channel A .. Channel H)
	p_2:	*Bit location* (0 .. n -sensorabhängig-)

Additional points for Sequence controls in the CMU

The two interrelated function components *Sequence* and *Transition* can be used to implement the functionality of Sequence controls or finite state machines.

A.2.11 Sequence

The *Sequence* component has a numerical output. This represents the current state of the Sequence. At the same time, a number is allocated to all states. The term 'Sequence' has been taken from control engineering. Typically several steps are completed one after the other in a Sequence. Branches and backward jumps are however possible. A sequence can adopt several states which are numbered in ascending order starting at "0". "0" is always the state following switch-on. A change in state is always triggered by a *transition*.

Inputs: -
Outputs: y: (Numerical)
Parameters: -
                 -

A.2.12 Transition (in the field "Result values / Actions")

The *Transition* component serves to bring about a change from one state to another in a Sequence. A transition has a Boolean input and has 4 parameters.

Inputs: x: (Boolean)
Outputs: -
Parameters: p_1:   *Sequence*
                             Name of the related Sequence in the application program
                 p_2:   *Current state*
                             Number of the state while the input condition is scrutinized.
                             With the "ignore" setting, the current Sequence state is ignored, i.e. the input condition is continually scrutinized, irrespective of the current state of the sequence.
                 p_3:   *Successor state*
•   State which is adopted once the input condition occurs.
                 p_4:   *Dwell time [s]*
                             Indicates how many seconds the Sequence must be in the current state before the input condition is scrutinized for the successor state.

For one Sequence, several transitions with identical current and successor states but with differing input conditions can be used in the application program. This enables branching into different Sequence cascades within a Sequence.

A.3 Numerical Calculations

A.3.1 Addition

The *Addition* function returns the sum of the two input values at the output:

$$y = x_1 + x_2$$

Inputs:	x_1:	(Numerical)
	x_2:	(Numerical)
Outputs:	y:	(Numerical)
Parameters:	-	

A.3.2 Subtraction

The *Subtraction* function returns the difference between the two input values at the output:

$$y = x_1 - x_2$$

Inputs:	x_1:	(Numerical)
	x_2:	(Numerical)
Outputs:	y:	(Numerical)
Parameters:	-	

A.3.3 Multiplication

The *Multiplication* function returns the product of the two input values at the output:

$$y = x_1 * x_2$$

Inputs:	x_1:	(Numerical)
	x_2:	(Numerical)
Outputs:	y:	(Numerical)
Parameters:	-	

A.3.4 Division

The *Division* function returns the quotient of the two input values at the output:

$$y = x_1 / x_2$$

Inputs:	x_1:	(Numerical)
	x_2:	(Numerical)
Outputs:	y:	(Numerical)
Parameters:	-	

A.3.5 Division Remainder

The *Division remainder* function returns the division remainder (the modulo) of the two input values at the output . The division remainder is determined by performing a whole number division x_1 / x_2 and outputting the remainder of this division as output value.

If the input x_1 counts upward, e.g. sequentially by 1, and the input x_2 amounts to 5, the the output will count around from 0 to 4.

Inputs: x_1:   (Numerical)
                x_2:   (Numerical)
Outputs: y: (Numerical)
Parameters: -

A.3.6 Absolute Value

The *Absolute value* function returns the input value without a plus/minus sign at the output:

$$y = |x|$$

Inputs: x: (Numerical)
Outputs: y: (Numerical)
Parameters: -

A.3.7 Change of Sign

The *Change of sign* function returns the inverse input value at the output:

$$y = -x$$

Inputs: x: (Numerical)
Outputs: y: (Numerical)
Parameters: -

A.3.8 Rounding

The *Rounding* function returns the rounded input value at the output. With this function, it is possible not only to round to whole decimal places, but also to whole-number multiples of a step.

The size of the step is specified in the *Step* parameter.

If the step size is 20, for example, then all values between -10 and 10 will be rounded off to 0, all values between 10 and 30 to 20, and so on.

Inputs: x: (Numerical)
Outputs: y: (Numerical)
Parameters: p_1:   *Step* (Numerical)

A.3.9 Raising to a Higher Power

The *Raising to a higher power* function supplies the power of the input value at the output.
The exponent is set using the *Exponent* parameter.

Inputs: x: (Numerical)
Outputs: y: (Numerical)
Parameters: p_1: *Exponent* (Numerical)

A.3.10 Square Root

The *Square root* function supplies the square root of the input value at the output.

If the input value is negative, then the value 0 will be supplied at the output and an error flag will be set. One can react to this situation with the Error event function (see Chap. A.2.8).

If a negative input can occur in everyday practice, then you should structure the corresponding behavior in accordance with your preferences with the functions *Absolute value*, *If-then-else* and *Less than* (see Chap. A.3.6, A.4.4 and A.6.5).

Inputs: x: (Numerical)
Outputs: y: (Numerical)
Parameters: -

A.3.11 Power at Base e

The *Power at base e* function supples the power at base e at the output.
The input value is used as the exponent.

Inputs: x: (Numerical)
Outputs: y: (Numerical)
Parameters: -

A.3.12 Natural Logarithm

The *Natural logarithm* function supplies the logarithm of the input value at base e at the output.

If the input value is negative or 0, then the value 0 will be supplied at the output and an error flag will be set. One can react to this situation with the Error event function (see Chap. A.2.8).

If a negative input can occur in everyday practice, then you should structure the corresponding behavior in accordance with your preferences with the functions *Absolute value*, *If-then-else* and *Less than* (see Chap. A.3.6, A.4.4 and A.6.5).

Inputs: x: (Numerical)
Outputs: y: (Numerical)
Parameters: -

A.3.13 Decade Logarithm

The *Decade logarithm* function supplies the logarithm of the input value at base 10 at the output.

If the input value is negative or 0, then the value 0 will be supplied at the output and an error flag will be set. One can react to this situation with the Error event function (see Chap. A.2.8).

If a negative input can occur in everyday practice, then you should structure the corresponding behavior in accordance with your preferences with the functions *Absolute value*, *If-then-else* and *Less than* (see Chap. A.3.6, A.4.4 and A.6.5).

Inputs:	x:	(Numerical)
Outputs:	y:	(Numerical)
Parameters:	-	

A.3.14 Integral

The *Integral* function supplies the integral of the input value over time at the output. The output is always calculated with the unit of seconds. This means that the input value 6 causes the output to increase every second by 6. The trapezoidal rule is applied to make the calculation.

The function still has a Boolean reset input. If the value "1" is pending there, then the value "0" will be set up at the output.

Furthermore, the integral function also has an automatic anti-wind-up mechanism. It is with this that a parameterizable *Lower limit* and *Upper limit* are set for the output.

This function adopted from control engineering has the following background:
If a control variable is not achieved, then the I ratio continues to integrate further. The controller then may require under certain circumstances a very long time to exit this range again if the actuating variable reverses its sign. This can lead to very unstable behavior.

Inputs:	x_1:	*Input value* (Numerical)
	x_2:	*Reset input* (Boolean)
Outputs:	y:	(Numerical)
Parameters:	p_1:	*Lower limit* (Numerical)
	p_2:	*Upper limit* (Numerical)

A.3.15 Differential Quotient

The *Differential quotient* function supplies the derivation of the input value over time at the output. The output is always calculated with the unit of seconds. This means that an increase of the input value from 5 to 6 in one second will yield an output value of 1.

The differential quotient is formed and filtered numerically by the difference quotient. This filtering is necessary for the following reasons:

In view of the fact that the input values usually arise from a quantized measured value, e.g. in connection with the digitization of an analog quantity, these values will have what is called a quantizing distortion. This means that the digitization causes the value to fluctuate by the amount of the resolution. For example, with a 12-bit resolution, a value of 600 bar that was resolved with 12 bit will fluctuate back and forth by 0.15 bar. If the difference quotient is formed now every millisecond, then this quantizing distortion will be amplified by a factor of 1000. That means that, without filtering, the output would jump back and forth between + and - 150 bar/s.

The filter can be set with the *Filtering* parameter. The setting corresponds thereby to the time range during which the filtering takes place. Nonetheless, no pure median value formation will be used as a filter, but rather a special algorithm instead.

The following settings are possible:
- *switched off*,   • *200 ms*,   • *1 second*   • *5 seconds.*

Inputs:	x_1:	(Numerical)
Outputs:	y:	(Numerical)
Parameters:	p_1:	*Filtering* (entry list)

A.4 Numerical Operations

A.4.1 Minimum

The *Minimum* function supplies the smaller of the two input values at the output.

Inputs:	x_1:	(Numerical)
	x_2:	(Numerical)
Outputs:	y:	(Numerical)
Parameters:	-	

A.4.2 Maximum

The *Maximum* function supplies the larger of the two input values at the output.

Inputs:	x_1:	(Numerical)
	x_2:	(Numerical)
Outputs:	y:	(Numerical)
Parameters:	-	

A.4.3 Limit

The *Limit* function limits the input value x_1, and makes it available at the output.

The two limits are set by the input values x_2 and x_3. If x_1 is less than x_2, then x_2 will be output, if x_1 is greater than x_3, then x_3 will be output, otherwise x_1.

Inputs:	x_1:	*Input value* (Numerical)
	x_2:	*Lower limit* (Numerical)
	x_3:	*Upper limit* (Numerical)
Outputs:	y:	(Numerical)
Parameters:	-	

A.4.4 If - Then - Else

The function *If-Then-Else* has two numerical inputs x_1 and x_2 as well as a Boolean input x_3.

If the Boolean input value is "1", then the input value of x_1 is output at the output, otherwise the value of x_2.

Inputs:	x_1:	(Numerical)
	x_2:	(Numerical)
	x_3:	(Boolean)
Outputs:	y:	(Numerical)
Parameters:	-	

A.4.5 Median Value

The *Median value* function supplies the arithmetical median value of the input values over an adjustable time range.

The time range is set in seconds using the *Time* parameter.

The median value is formed according to the "Repeating Average" procedure. This means that, when the time setting is "2 seconds", for example, the input values are compiled for 2 seconds, then averaged and output at the output. The next median value interval begins after that. The output value pauses on the last median value.

Inputs: x: *Input value* (Numerical)
Outputs: y: *Median value* (Numerical)
Parameters: p_1:   *Time* (Numerical)

A.4.6 Extended Average

The *Extended Average* function supplies the arithmetic average of the numerical input value at the output. The interval over which the average value is generated, is controlled using a boolean reset input.

If the reset input has the value "1", then the input value is passed directly to the output. If the signal on the reset input falls from "1" to "0", then from this point, the arithmetic average of the input value is given at the output.

Inputs: x_1:   *Input value* (Numerical)
            x_2:   *Reset* (Boolean)
Outputs: y: (Numerical)
Parameters: -

A.4.7 Note Value

The *Note value* function is used to hold on to certain values (to freeze them). It has one numerical and one Boolean input.

If the Boolean input value is "1", then the numerical input value is output at the output. If the Boolean input value is "0", then the last output value continues to be output.

If the value is only to be applied for one flank of the Boolean input, then you can put the function *Pulse generation* upstream from it (see Chap. A.8.5).

Inputs: x_1:   *Input value* (Numerical)
            x_2:   *Switch value through* (Boolean)
Outputs: y: (Numerical)
Parameters: -

A.4.8 Note Minimum

The *Note minimum* function supplies as the output value the smallest value that the input value has yet reached.

If the input value is greater than the output value, then the output value remains unchanged. If the input value is less, then the output value will be reset.

The minimum can be reset with the Boolean input x_2. The input value will be applied directly at the output for as long as this input is "1".

Inputs:	x_1:	*Input value* (Numerical)
	x_2:	*Reset* (Boolean)
Outputs:	y:	(Numerical)
Parameters:	-	

A.4.9 Note Maximum

The *Note maximum* function supplies as the output value the largest value that the input value has yet reached.

If the input value is less than the output value, then the output value remains unchanged. If the input value is greater, then the output value will be reset.

The maximum can be reset using the Boolean input x_2. The input value will be applied directly at the output for as long as this input is "1".

Inputs:	x_1:	*Input value* (Numerical).
	x_2:	*Reset* (Boolean)
Outputs:	y:	(Numerical)
Parameters:	-	

A.4.10 Tabular Value

With the function *Tabular value*, the output value is obtained from a parameterized number table. The input value functions thereby as number of the table entry.

If the whole number value of the input is 0 or less, then the first value of the table will be output; if it is 1, then the second value; and so on up to the last tabular value. If the input value is greater than the number of tabular entries, then the last table entry will be output.

As a basic rule, the input value will be rounded to a whole number. The table is defined using the *Table* parameter. Each value must have a line of its own at the time of entry. Empty lines are removed automatically. The number of values will also be defined automatically on the basis of the available lines. It must be between 2 and 20.

The *Tabular value* function can be used for example as a downstream element of a division remainder in order to specify various values one after the other (see Chap. A.3.5).

Inputs:	x:	*Index of the selected tabular value* (Numerical)
Outputs:	y:	*Selected value* (Numerical)
Parameters:	p_1:	*Table* (values table)

A.4.11 Tabular Index

The *Tabular index* function is the counterpart to the *Tabular value* function. The input value is sorted into a parameterizable numerical table, which must be organized in order of increasing values, and the number of the tabular entry is output.

If, for example, the first tabular entry is 4 and the second is 7.8, then a 0 will be output for all input values less than 4, the value 1 will be output for all values between 4 and 7.8, and the value 2 for all values greater than 7.8.

The table is defined using the *Table* parameter. Each value must have a line of its own at the time of entry. Empty lines are removed automatically. The number of values will also be defined automatically on the basis of the available lines. It must be between 2 and 20.

This function can be used for flexible range definition. Thus, for example, limit values can be defined in the table when a value is normal, suspicious, critical and very critical.

Inputs:	x:	*Value in the table* (Numerical).
Outputs:	y:	*Index of the value / Value range* (Numerical).
Parameters:	p_1:	*Table* (values table)

A.4.12 Characteristic curve

The *Characteristic curve* function is used to convert input values from one range into another. The conversion can be subdivided into various segments through the specification of up to 20 nodes.

The *Table* parameter is used to specify the nodes. Each value pair is in a different line in the table. The values for x and y are separated by a colon. The x values must be listed in ascending order. No x value may appear more than once. Empty lines are removed automatically. The number of values will also be defined automatically on the basis of the available lines. It must be between 2 and 20.

The ranges between the nodes are interpolated linearly; the values outside the nodes are extrapolated from the last segment. A limitation is easy to set up by simply setting another node nearby that has the same y value. If for example the range of 0 to 450 is to be converted to percent and at the same time limited to 0 and 100, then this is accomplished with the following value pairs:

-1:	0
0:	0
450:	100
451:	100

Inputs:	x:	*X value of the characteristic curve* (Numerical).
Outputs:	y:	*Function value from the characteristic curve* (Numerical)
Parameters:	p_1:	*Table* (values table)

A.4.13 Slope

The *Slope* function is used to prevent rapid value changes. Under stable conditions, the input value is shown at the output. Changes of the input value are however not passed along directly to the output, but rather only in small steps. Like a slope, so to speak. Different slopes can be defined thereby for positive and negative value modifications.

The parameters *Descending slope* and *Ascending slope* are used to specify the maximum permissible value changes per second.

If for example the value 5 is set for *Ascending ramp* and the input value jumps from 0 to 100, then the output will be only slowly increased, and it will take 20 seconds for the output value to reach 100.

Inputs:	x:	(Numerical)
Outputs:	y:	(Numerical)
Parameters:	p_1:	*Descending slope* (Numerical)
	p_2:	*Ascending slope* (Numerical)

A.5 Counting Functions

A.5.1 Count Pulses

The *Count pulses* function has three Boolean inputs and one numerical output. If the *Counting* input has the value "1", then the changes from "0" to "1" at the *Pulses* input will be counted and the count value will be set at the output. If the *Reset* input is at "1", then the count value, and thus the output as well, will be "0".

Flexible counting structures can thus be obtained by placing the *Pulse generation* function upstream (see Chap. A.8.5). The placement of a downstream *Note value* function (see Chap. A.4.6) also makes it possible to implement a counter with an interim status.

Inputs:	x_1:	*Pulses* (Boolean)
	x_2:	*Counting* (Boolesch)
	x_3:	*Reset* (Boolean)
Outputs:	y:	*Count value* (Numerical)
Parameters:	-	

A.5.2 Stop watch

The *Stop watch* function has two Boolean inputs and one numerical output. If the *Start/Stop* input has the value "1", then the seconds will be counted and the time will be applied at the output. If the *Reset* input is at "1", then the time, and thus the output as well, will be "0". The behavior at the output can be controlled with the *Output* parameter.

Two settings are possible:

Current time
The output value is the current number of seconds counted.

Stopped time
The output value is not the current quantity, but rather the most recently measured quantity. This means that the current count is set to the output whenever the time is stopped with the *Start/Stop* input.

Flexible time measurement structures can thus be obtained by placing the *Pulse generation* function upstream (see Chap. A.8.5).

Inputs:	x_1:	*Start/Stop* (Boolean)
	x_2:	*Reset* (Boolean)
Outputs:	y:	(Numerical)
Parameters:	p_1:	*Output* (entry list)

Numerical Conditions

A.6.1 Equals

The *Equals* function compares two numerical input values for equivalence and outputs a "1" at its Boolean output if the values are equivalent, otherwise a "0".

With the Precision parameter, you can adjust how precise the comparison is. For this the following explanation:

In view of the fact that numerical values are presented on computers as floating point numbers with finite precision, normal comparisons usually fail. Thus, for example, the finite precision of 2/6 is not necessarily the same as the result of 1/3. The difference is not to be found before the 8th decimal place, but nonetheless the two values are not recognized as being equivalent.

The point at which one needs to break off the comparison of numbers varies from case to case. It is for that reason that you have the option of controlling the precision of the comparison.

If you specify 0.01 for precision, for example, then the numbers 12.453 and 12.458 will still be recognized as equivalents to one another, because the difference is less than 0.01.

Inputs:	x_1:	(Numerical)
	x_2:	(Numerical)
Outputs:	y:	(Boolean)
Parameters:	p_1:	*Precision* (Numerical)

A.6.2 Does not Equal

The *Does not equal* function compares two numerical input values for equivalence and outputs a "1" at its Boolean output if the values are not equal, otherwise a "0".

For the *Precision* parameter, see the explanation in the Equals function (Chapter A.6.1).

Inputs:	x_1:	(Numerical)
	x_2:	(Numerical)
Outputs:	y:	(Boolean)
Parameters:	p_1:	*Precision* (Numerical)

A.6.3 Greater than

The *Greater than* function compares two numerical input values for equivalence and outputs a "1" at its Boolean output if value x_1 is greater than x_2, otherwise a "0".

In view of the fact that numerical values are presented on computers as floating point numbers with finite precision, it is difficult to make decisions in border ranges. (See the explanation in Chapter A.6.1, *Equals* function). This is however usually irrelevant in everyday usage, because the imprecision is not to be found before the 8th significant decimal place.

When however it is important that a precise decision be made for a border range, then you can install the *Rounding* function upstream (see Chap. A.3.8).

Inputs:	x_1:	(Numerical)
	x_2:	(Numerical)
Outputs:	y:	(Boolean)
Parameters:	-	

A.6.4 Greater than or Equal to

The *Greater than or equal to* function compares two numerical input values for equivalence and outputs a "1" at its Boolean output if value x_1 is greater than or equal to x_2, otherwise a "0".

For more on the subject of precision, please note the explanations in the *Greater than* function (see Chapter A.6.3).

Inputs:	x_1:	(Numerical)
	x_2:	(Numerical)
Outputs:	y:	(Boolean)
Parameters:	-	

A.6.5 Less than

The *Less than* function compares two numerical input values for equivalence and outputs a "1" at its Boolean output if value x_1 is less than x_2, otherwise a "0".

For more on the subject of precision, please note the explanations in the *Greater than* function (see Chapter A.6.3).

Inputs:	x_1:	(Numerical)
	x_2:	(Numerical)
Outputs:	y:	(Boolean)
Parameters:	-	

A.6.6 Less than or Equal to

The *Less than or equal to* function compares two numerical input values for equivalence and outputs a "1" at its Boolean output if value x_1 is less than or equal to x_2, otherwise a "0".

For more on the subject of precision, please note the explanations in the *Greater than* function (see Chapter A.6.3).

Inputs:	x_1:	(Numerical)
	x_2:	(Numerical)
Outputs:	y:	(Boolean)
Parameters:	-	

A.6.7 Within

The *Within* function compares three numerical input values for equivalence and outputs a "1" at its Boolean output if value x_1 is greater than or equal to x_2, and smaller than or equal to x_3, otherwise a "0".

For more on the subject of precision, please note the explanations in the *Greater than* function (see Chapter A.6.3).

Inputs:	x_1:	(Numerical)
	x_2:	(Numerical)
	x_3:	(Numerical)
Outputs:	y:	(Boolean)
Parameters:	-	

A.6.8 Outside

The *Outside* function compares three numerical input values for equivalence and outputs a "1" at its Boolean output if value x_1 is smaller than x_2 or greater than x_3, otherwise a "0".

For more on the subject of precision, please note the explanations in the *Greater than* function (see Chapter A.6.3).

Inputs:	x_1:	(Numerical)
	x_2:	(Numerical)
	x_3:	(Numerical)
Outputs:	y:	(Boolean)
Parameters:	-	

A.7 Boolean Links

A.7.1 Not

The *Not* function supplies the negated Boolean input value at its Boolean output.

If x = "0", then a "1" is output, otherwise a "0".

Inputs:	x:	(Boolean)
Outputs:	y:	(Boolean)
Parameters:	-	

A.7.2 And

The *And* function links the two Boolean inputs with the "and" operation and supplies the result to its Boolean output.

The output is then "1" only if both inputs are "1", otherwise it is "0".

The following log table makes this function clear.

x_1	x_2	y
0	0	0
0	1	0
1	0	0
1	1	1

Inputs:	x_1:	(Boolean)
	x_2:	(Boolean)
Outputs:	y:	(Boolean)
Parameters:	-	

A.7.3 Not - And

The *Not - And* function links the two Boolean inputs with the "nand" operation and supplies the result to its Boolean output.

The output is then "0" only if both inputs are "1", otherwise it is "1".

The following log table makes this function clear.

x_1	x_2	y
0	0	1
0	1	1
1	0	1
1	1	0

Inputs:	x_1:	(Boolean)
	x_2:	(Boolean)
Outputs:	y:	(Boolean)
Parameters:	-	

A.7.4 Or

The *Or* function links the two Boolean inputs with the "or" operation and supplies the result to its Boolean output.

The output is "1" if one of the two inputs is "1". If both are "0", then the output will also be "0".

The following log table makes this function clear.

x_1	x_2	y
0	0	0
0	1	1
1	0	1
1	1	1

Inputs:	x_1:	(Boolean)
	x_2:	(Boolean)
Outputs:	y:	(Boolean)
Parameters:	-	

A.7.5 Not - Or

The *Not - Or* function links the two Boolean inputs with the "nor" operation and supplies the result to its Boolean output.

The output is "0" if one of the two inputs is "1". If both of the inputs are "0", then the output will be "1".

The following log table makes this function clear.

x_1	x_2	y
0	0	1
0	1	0
1	0	0
1	1	0

Inputs:	x_1:	(Boolean)
	x_2:	(Boolean)
Outputs:	y:	(Boolean)
Parameters:	-	

A.7.6 Exclusive Or

The *Exclusive Or* function links the two Boolean inputs with the "xor" operation and supplies the result to its Boolean output.

The output is "1" if precisely one of the two inputs is "1". If both of the inputs are "0" or if both of the inputs are "1", then the output will be "0". One can also say that the output is then precisely "1" if the two inputs are not equivalent.

The following log table makes this function clear.

x_1	x_2	y
0	0	0
0	1	1
1	0	1
1	1	0

Inputs:	x_1:	(Boolean)
	x_2:	(Boolean)
Outputs:	y:	(Boolean)
Parameters:	-	

A.7.7 Not Exclusive Or

The *Not Exclusive Or* function links the two Boolean inputs with the "nxor" operation and supplies the result to its Boolean output.

The output is "0" if precisely one of the two inputs is "1". If both of the inputs are "0" or if both of the inputs are "1", then the output will be "1". One can also say that the output is then precisely "1" if the two inputs are equivalent.

The following log table makes this function clear.

x_1	x_2	y
0	0	1
0	1	0
1	0	0
1	1	1

Inputs:	x_1:	(Boolean)
	x_2:	(Boolean)
Outputs:	y:	(Boolean)
Parameters:	-	

A.8 Other Boolean Operations

A.8.1 Note Switching Status

The *Note switching status* function is used to hold on to a Boolean value (to freeze it). It has two Boolean inputs.

If the input value x_2 is "1", then the input value x_1 is output at the output. If the input value x_2 is "0", then the last output value remains in effect.

If the value is only to be applied for one flank, then you can put the function Pulse generation upstream at x_2 (see Chap. A.8.5).

Inputs:	x_1:	*Value* (Boolean)
	x_2:	*Note* (Boolean)
Outputs:	y:	(Boolean)
Parameters:	-	

A.8.2 Switching Delay

The *Switching delay* function is used to delay Boolean signals. The function has one Boolean input and one Boolean output. A change at the input will not be recognizable at the output until after a parameterizable delay time has elapsed.

The delay times can be set separately for switching on and switching off. . They are adjusted with the parameters *Switch-on delay* and *Switch-off de*lay. This makes it possible to hide short-term signal changes.

Example:
Input and output are "0", the switch-on delay is set to 5 seconds. If the input switches now to "1", then the output waits 5 seconds before switching to "1". If the input switches back to "0" before the 5 seconds have elapsed, then the input remains set to "0" and the change at the input is not visible at all at the output.

Inputs:	x:	(Boolean)
Outputs:	y:	(Boolean)
Parameters:	p_1:	Switch-on delay (Numerical)
	p_2:	Switch-off delay (Numerical)

A.8.3 T - Flipflop

The *T-FlipFlop* function is the representation of a surge relay. The output switches over every time the Boolean input value changes from "0" to "1". (Toggle function, hence the name T-Flipflop).

A side effect of the T-FlipFlop is that it halves the frequency of a counting signal.
The output is set to 0 after initialization at the time of program start.

Inputs:	x:	(Boolean)
Outputs:	y:	(Boolean)
Parameters:	-	

A.8.3 Mono Flop

The output switches on when the Boolean input value switches from "0" to "1". The function is comparable to the automatic switching of a light in a stairwell.
The output is set to 0 after initialization at the time of program start.
When the Reset input is set to "1", then the output is definitely set to "0".

- *Not retriggerable*
  When the flank switches from "0" to "1", the output for the specified time is switched to "1". After the time elapses, the output is set back to "0". It doesn't matter whether or not this flank occurs again during this time.

- *Retriggerable*
  When the flank switches from "0" to "1", the output for the specified time is switched to "1". After the time elapses, the output is set back to "0". If the flank switches from "0" to "1" once again during this time, then the output will be switched again to "1" for the time specified.

- *Prolongable*
  When the flank switches from "0" to "1", the output for the specified time is switched to "1". If no change of flanks occurred during this time, then the output remains switched to "1" until the flank switches from "1" to "0".

Inputs:	x_0:	S (Boolean)
	x^1:	R (Boolean)
Outputs:	y:	(Boolean)
Parameters:	p1:	Mode
	p2:	Time in seconds
	I1:	Flank recognition
	I2:	Time counter

A.8.4 RS - Flipflop

RS

The *RS-FlipFlop* function has a Boolean input *Set* for the purpose of setting the output to "1" and a Boolean input *Reset* for setting the output back to "0".

The *Priority* parameter can be used to define how the output will react when a "1" is present at both inputs simultaneously. The following priorities are possible:

First
If the Set input is the first to switch to "1", then the output is "1"; if the Reset input is the first to switch to "1", then the output is "0". If both switch to "1" simultaneously, then the output remains in the status it was in.

Last
If the Set input is the last to switch to "1", then the output is "1"; if the Reset input is the last to switch to "1", then the output is "0". If both switch to "1" simultaneously, then the output remains in the status it was in.

Off
The output value is "0"

On
The output value is "1"
The output is set to 0 after initialization at the time of program start.

Inputs:	x_0:	*S* (Boolean)
	x_1:	*R* (Boolean)
Outputs:	y:	(Boolean)
Parameters:	p_1:	*Priority* (entry list)

A.8.5 Pulse Generation

⊓⊔

The *Pulse generation* function is used for generating a Boolean pulse. Every time the input changes from "0" to "1", the output is set to "1" for a cycle.

This function is useful with the Note functions (Note value, Note minimum, etc.), among others.

Inputs:	x:	(Boolean)
Outputs:	y:	(Boolean)
Parameters:	-	

A.9 Result Values

A.9.1 Numerical Output Value

The *Numerical output value* function makes a numerical input value available to the outside. It publishes the value.
Output values are displayed on the CM device as well as in the measured value display on a connected PC. Furthermore, the output values are also recorded in the log recording (see Chap. A.10.3). A maximum of 32 values can be published.

The publication of values is accomplished in a fixed decimal point representation. The number of decimal places must be entered using the *Decimal format* parameter. The current format permits only 5 significant places, whereby the first one only goes up to 3. This results in the following maximum numerical ranges:

Decimal format	maximum value range
0	-30000 ..+30000
0.0	-3000.0 ..+3000.0
0.00	-300.00 ..+300.00
0.000	-30.000 ..+30.000

The output value is always limited to the above-mentioned maximum value range. The decimal format is to be adjusted in such a way that all of the values relevant to practical requirement can be presented. If needed, one can for example publish a "bar" value in "millibars" by multiplying the value by 1000.

The *Designation* parameter defines the name under which the value is displayed. The *Unit* parameter defines the physical unit. No two output values are permitted to have the same name.

The *Low range* and *High range* parameters are used solely for defining the typical value range for post-processing work. If, for example, the value progression is output as a graphic, then the graphics program will first scale the values to the value range specified here. The specification of the measurement range has no effect on the limitation of the output value.

Example: "0.00" is set as the decimal format, "250.00" as the upper measuring range. If the input value is now at 450.00, then the value 300.00 will be published, because the limiting comes from the maximum value range and not from the upper measuring range.
If this behavior is not wanted, limit the value using the *Limit* function (see Chap. A.4.3).

Inputs:	x:	(Numerical)
Outputs:	-	
Parameters:	p_1:	*Designation* (character string)
	p_2:	*Lower range* (Numerical)
	p_3:	*Upper range* (Numerical)
	p_4:	*Unit* : (character string)
	p_5:	*Decimal format* : (input list)

A.9.2 Boolean Output Value

The *Boolean output value* function makes a Boolean input value available to the outside. It publishes this value.

The status values are displayed on the CM device. A connected PC indicates the status values in the status line. Furthermore, the status values are also recorded in the log recording (see Chap. A.10.3). A maximum of 15 status values can be publicized.

All status values are combined in a common status in the results log. Each individual status value is represented by one Bit.
The question of which Bit will be used is defined in the *Bit number* parameter.

No two status values are permitted to have the same Bit number.

Inputs: x: (Boolean)
Outputs: -
Parameters: p_1:   *Bit number* (whole number)

A.10 Actions

A.10.1 Setting Switching Output

The *Set switch output* function transmits the Boolean input to a digital switching output on the CM device.

The *Output terminal* parameter is used to define which digital output port is used.

Inputs: x: (Boolean)
Outputs: -
Parameters: p_1:   *Output terminal* (input list)

A.10.2 Setting Analog Outputs

The *Set analog output* function outputs the numerical input to an analog output of the CM device.

The *Output* parameter is used to define which analog output will be used. The scaling is defined by the parameters *Lower value* and *Upper value*.

If for example -25 is set for the lower value and 150 for the upper value, then all input values less than or equal to -25 will cause the lower signal range to be output at the output (typically 0 V or 4 mA) and all input values greater than or equal to 150 will lead to an output signal that corresponds to the upper signal range. (typically 10 V or 20 mA)

Inputs: x: (Numerical)
Outputs: -
Parameters: p_1:   *Output* (input list)
               p_2:   *Lower range* (Numerical)
               p_3:   *Upper range* (Numerical)

A.10.3 Display Message
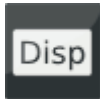
The *Display message* function has one Boolean input. A message will be displayed on the CM device monitor for as long as the input value is "1". The upper line includes the date and time of day that the message appeared.

The text of the message is defined with the *Message* parameter. This is to be found in the lower line of the display.

The *Acknowledgement* parameter can be used to specify that the message will not automatically disappear with the display when the input returns to "0", but rather that it must be acknowledged by pressing a key. If this occurs, then the top line will flash.

Irrespective of what is set under Acknowledgement, a message can be acknowledged at any time in order that the CM device can be operated. If the input remains at "1" however, then the message will be displayed again after a time.

If several messages are active simultaneously, then the keys can be used to scroll through the list of messages.

Inputs:	x:	(Boolean)
Outputs:	-	
Parameters:	p_1:	*Message* (character string)
	p_2:	*Acknowledgement* (Boolean)

A.10.4 Switch on LED

The *Switch on LED* function has one Boolean input. The relevant LED will remain on for as long as the input value is "1".

The *Acknowledgement* parameter can be used to specify that the LED will not automatically go out when the input returns to "0", but that the LED must be acknowledged by pressing a key instead. The appropriate LED will start to flash in such cases.

The *Color* parameter is used to set which LED will be switched on. 3 traffic light colors are present: • red, • yellow • green.

Each color may only be used once in the CM program.

Depending on the specific CM device, the LEDs can also have designations other than the names of their colors, e.g.: LED1, LED2, etc.

Inputs:	x:	(Boolean)
Outputs:	-	
Parameters:	p_1:	*Color* (entry list)
	p_2:	*Acknowledgement* (Boolean)

A.10.5 Compiling a Log Entry

The *Compile log entry* function is used for saving the currently publicized values in the ongoing log recording (see Chap. A.9.1. Numerical output value and A.9.2 Boolean output value).

The log entry is generated every time the input value changes from "0" to "1".

Inputs:	x:	(Boolean)
Outputs:	-	
Parameters:	-	

A.10.6 Compiling Quick Log Entries

The *Quick log entries* function is used for rapidly saving the currently publicized values in the ongoing log recording (see Chap. 7.9.1. Numerical output value and 7.9.2 Boolean output value).
Log entries will be generated at the specified time interval (p2) for as long as the input is set to "1".
The *Interim period* parameter specifies that for every time stamp of a log entry, the precise time value of the log entry will also be saved in ms.

The log entry is generated every time the input value changes from "0" to "1".

Inputs:	x:	(Boolean)
Outputs:	-	
Parameters:	p1:	Interim period (Boolean)
	p2:	Time in seconds

A.10.7 Start new log

Using the *Start new log* function, a new time-dependent or cycle-dependent log file can be generated. The numbering in the file name is increased by 1.
The previous log file is stored in the internal memory.

Eingänge:	x:	(Boolesch)
Ausgänge:	-	
Parameter:	-	

A.10.8 Transition (see Chap. A.2.12)

A.10.9 Send SMS

The *Send SMS* function is used to send an SMS when an event occurs. This occurs with every switchover of the input value changes from "0" to "1".

The text of the SMS is defined with the *Message* parameter and the *Telephone number* parameter defines the number to which the SMS is sent.

Inputs:	x:	(Boolean)
Outputs:	-	
Parameters:	p_1:	*Telephone number* (character string)
	p_2:	*Message* (character string)

Caution

The "**Send SMS**" function requires that the following conditions be met:
- The GSM module CSI-F-10 is supplied with voltage and ready for operation.
- A valid, functioning SIM card has been inserted in the GSM module CSI-F-10.
- The GSM module has sufficient network reception strength.

A.11 Other

A.11.1 Comment

With the *Comment* function, it is possible to insert a comment at any given point in the CM program.

The heading of the Comment box is defined with the *Inscription* parameter.

The actual comment text is entered with the *Comment* parameter.

Inputs:	-	
Outputs:	-	
Parameters:	p_1:	*Inscription* (character string)
	p_2:	*Comment* (character string)

APPENDIX B: Error Messages CM Program Compilation

In order to ensure as high a degree of operational safety as possible, the CM program generated will be checked for possible programming errors before it is transferred into the device. If the system recognizes one or more such programming errors, then the following message will appear and the CM program will not be transferred into the CM device.
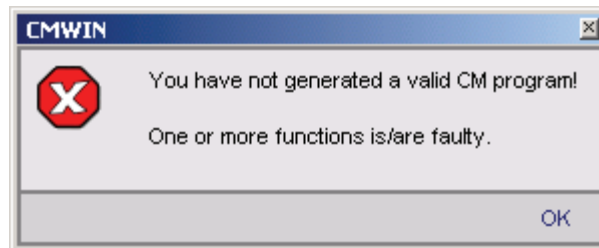
The menu function [*CM Program / Display*] (see Chap. 6.1.2) can be used in such cases to have a more detailed program evaluation displayed, together with error messages, and to have this printed out as needed.
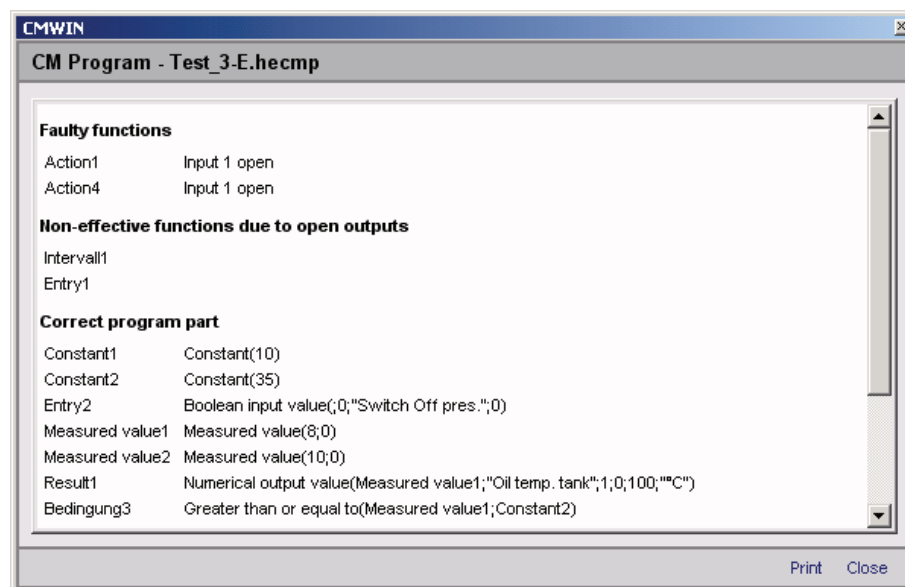
Work through all of the error messages in your CM program and then transfer the program once again into your CMU 1000.

The following list shows all of the error messages that could occur during programming, together with the associated function groups present in CMWIN, and their causes.

B.1 Overriding Error Messages

B.1.1 Function not Available in this Mode

The CM program was compiled for a platform in which the marked function does not exist.
► Check the platform setting and correct it or modify the CM program accordingly.

B.2 Error Messages with Data Sources

B.2.1 Invalid Channel Setting

A channel/subchannel was selected that is not valid.
► Check the channel setting and correct it.

B.2.2 Duplicate Channel Name

The name of a channel may only be used once in a CM program.
► Check the channel name and correct it.

B.2.3 Invalid Digital Input

A port must be set for the Digital input function.
► Check the port setting and correct it.

B.2.4 Duplicate Digital Input

A port must be set for the Digital input function. This port that is set may only be used once in a CM program.
► Check the port setting and correct it.

B.2.5 Too many Boolean Input Values

A maximum of 50 Boolean input values are permitted to be present in a single CM program.
► Reduce the Boolean input values to a maximum of 50.

B.2.6 No Inscription with Boolean Input

The Boolean input value must have an inscription.
► Enter an inscription in the function properties.

B.2.7 Duplicate Inscription with Boolean Inputs

The inscription of a Boolean input value must be unambiguous within a CM program and is only permitted to occur once for that reason.
► Check the inscription and correct it.

B.2.8 Too Many Numerical Input Values

A maximum of 50 numerical input values are permitted to be present in a single CM program.
► Reduce the numerical input values to a maximum of 50.

B.2.9 No Inscription with Numerical Input

The numerical input value must have an inscription.
► Enter an inscription in the function properties.

B.2.10 Duplicate Inscription with Numerical Input

The inscription of a numerical input value must be unambiguous within a CM program and is only permitted to occur once for that reason.
► Check the inscription and correct it.

B.2.11 Duplicate Error Source

A setting is made for an error source to indicate which error will be the output of the error source. No error source may be present more than once in a CM program.
► Check the setting under "Error messages" and correct it.

B.3 Error Messages with Operations/Conditions

B.3.1 Upper and Lower Measured Value Limits too Close to one another

For functions with upper and lower value limits, the two values must be at least 10 steps apart.
► Check the values that were entered and correct them.

B.3.2 Measured Value Limits Outside the Range of -30000 to 30000

For functions with upper and lower value limits, the entered values must be between -30,000 and +30,000.
► Check the values that were entered and correct them.

B.3.3 Lower Measured Value Limit Greater than Upper Measurement Value Limit

For functions with upper and lower measured value limits, the lower measured value must be less than the upper measured value.
► Check the values that were entered and correct them.

B.4 Error Messages with Result Values/Actions

B.4.1 Invalid Output LED Selected

The selected LED does not exist in this device and must be set correctly.
► Check the LED setting and correct it.

5.7.1 B.4.2 Duplicate Usage of Output LED

The selected LED is already being used in the current CM program and may not appear twice.
► Check the LED selection and correct it.

B.4.3 Invalid Digital Output

The quantity of digital outputs is device-dependent. This error is set when an output terminal is selected that a device doesn't have.
► Check the selection and correct it.

B.4.4 Duplicate Digital Ouput

The output terminal of the digital output may only appear once in a CM program.
► Check the output terminal which has been set and correct it.

B.4.5 Invalid Analog Output

The quantity of analog outputs is device-dependent. This error is set when an output is selected that a device doesn't have.
► Check the selection and correct it.

B.4.6 Duplicate Analog Output

The set output of the analog output may only appear once in a CM program.
► Check the output settings and correct them.

B.4.7 Too Many Boolean Output Fields

The quantity of Boolean output fields in one CM program is device-dependent.
► Reduce the Boolean output fields to the device-specific maximum.

B.4.8 Duplicate Boolean Output Field

The inscription of a Boolean output field may only appear once in a CM program.
► Check the inscription and correct it.

B.4.9 The Bit Number Must Be a Figure between 0 and 14

The "Bit number" attribute must not be outside the range of 0 ... 14 for the Boolean output field function.
► Check the value that was entered and correct it.

B.4.10 Too Many Numerical Output Fields

The quantity of numerical output fields in one CM program is device-dependent.
► Reduce the numerical output fields to the device-specific maximum.

B.4.11 Duplicate Numerical Output Field

The inscription of a numerical output field may only appear once in a CM program.
► Check the inscription and correct it.

B.4.12 Message and Telephone Number too Long

The length of the message + telephone number together is limited to 230 characters.
► Check the relevant entries and correct them.

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Notice

The information in this manual relates to the operating conditions and applications
described. For applications and operating conditions not described, please contact the
relevant technical department concerned.

If you have any questions, suggestions, or encounter any problems of a technical
nature, please contact your HYDAC representative.

Subject to technical modifications.