OPERATING INSTRUCTIONS

QAL3 Master

PC Software for standard-compliant monitoring of emission measuring instruments

 $\textbf{Description} \cdot \textbf{Configuration} \cdot \textbf{Application}$





Described Product

Product name: QAL3 Master

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Original document

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Quick start 1

For experienced users

1.1 **Starting operation**

- 1 Start QAL3Client.exe.^[1]
- 2 Enter user and password.
- 3 Select menu language.
- »» The program interface appears (see Fig. 1).

1.2 **Principle of operation**

Fig. 1: Principle of operation

| QAL3-Client | - • • |
|---|---|
| User Admin | SICK |
| Component Unit NO Jame Z0.07.20:2017123248 Warring T Construction Line1 5.0080 10.3000 00 4 6.5900 4 Struction 10.0160 0.0000 0 6.5900 4 6.5900 4 | 11.07.2017 09:31:49 402.5613 410.7100 |
| Dritter 0 </td <td>2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2</td> | 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 |
| State State Shewhart History Zeropo Alory Ref Point Readings | |
| 1 ► Select a QAL3 component. 2 ► Select the display function. | |
| 3 Selected QAL3 component ^[1] 4 QAL3 after last reference measurement ^[2] 5 Readings as graph ^[2] 6 Readings Table ^[2] 7 Menu functions | |
| 8 Status display for QAL3 Server | |

[1] Additional information "Standard reference material", see Fig. 31, page 44. [2] For the selected QAL3 component in the active campaign.

^[1] The storage location (path) is selected during software installation (see page 14).

1.3 Warning signals

| and a subserved to the second se | line1 | | | Warning | | | | |
|--|--|-------------------------|--|--|---------------------------------------|--|----------------------|---------------------|
| Juar Ada | | | | Alarm | (2) | | | SICK |
| Component | (1) | | Zaman | Alaini | | Pa | d point | JICI |
| Unit / C | 002 | Alaun | | 2010/2017/12/2040 | | Maning | | 11 07 2017 09 21 49 |
| location C | Dava and | Alarm | and only | | Diff exceedance | warning | nex and d | |
| | FIOW PU | | ActValue | | Same + | 1.300 | Activatae | 4025613 |
| | Line2 | | Non-Value | | Algorited | 1.900 | Non-Value | percenta |
| | 🗅 NO " | | | | warangen | | | |
| CO CO2 | Teedarp | Status | Non Value | Diff | Tmestarp | Status | Non Value | Diff |
| Flow | 27.06.2017 10:59:27 28.06.2017 10:59:28 | Uk Ok | 0,0097 | 0,0097 | 26.06.2017 10:0 | 6:53 Uk 5:17 Ok | 404,1310 404,1310 | -6,5790 -6,5790 |
| | 29.06.2017 09:59:07 | Ok | 0,0097 | 0,0097 | 11.07.2017 09:3 | 1:49 Warning | 402,5613 | -8,1487 |
| - TOC | 30.06.2017 10:59.21 01.07.2017 10:02:25 | Alarm | 14,4473 | 14,4473 | | | | |
| Elow | 02.07.2017 10:03:35 | Ok | 2,1144 | 2,1144 | | | | |
| - | 03.07.2017 10:06:08 | Ok | 0,0175 | 0,0175 | | | | |
| | 04.07.2017 10:03:28 | Ok | -0,6165 | -0,6165 | | | | |
| | 05.07.2017 09:59:04 | Ok | -0,1944 | -0,1944 | | | | |
| | 05.07.2017 09:59:12 | UK Ok | 0,0343 | 0,0343 | | | | |
| | 08.07.2017 09:59:03 | Ok | 0.5840 | 0.5840 | | | | |
| | 09.07.2017 09:59:19 | Warning | 6.0756 | 6.0756 | | | | |
| | 10.07.2017 09:59:10 | Ok | -0,5202 | -0,5202 | | | | |
| | 10.07.2017 12:11:54 | Ok | -0,7322 | -0,7322 | | | | |
| | 11.07.2017 10:02:37 | Warning | 5,6803 | 5,6803 | | | | |
| | | | | | | | | |
| Server Stat | e 3 | niet History I | fed Posts] Freedings |] | | | | |
| Server Stat | e ③ | st | for Print Reading | J | | | | |
| Server Stat Notes in the QAI Notes in the Cor | e 3 L3 components list htrol Card (examp | st le for " | Shewhart | " evaluation n | nethod) | | | |
| Server Stat Notes in the QAI Notes in the Cor Signal color | e 3 -3 components lia htrol Card (examp Significance [1] | st le for " | Shewhart | " evaluation n | nethod) | | | |
| Server Stat Notes in the QAI Notes in the Cor Signal color Yellow | e 3 -3 components lis htrol Card (examp Significance ^[1] Warning: | st le for " | Shewhart | <i>" evaluation n</i> nominal value | nethod) ∋ ≥ warnin | g limit ^[2] | | |
| Server Stat Notes in the QAI Notes in the Cor Signal color Yellow Red | e 3 L3 components list htrol Card (examp Significance [1] Warning: Alarm: | st le for " Actu | Shewhart nal value - nal value - | " evaluation n nominal value nominal value | nethod) e ≥ warnin e ≥ warnin | g limit ^[2] g limit ^[2] | | |

Fig. 2: Signals in QAL3 Client (with example data)

In the QAL3 Components list: Applicable for at least one reading during the current campaign.
 After the last reading. - Values of warning and alarm limits, see "Managing active campaigns", page 28.

3 Status display for program module QAL3 Server" (evaluation of readings)

Mandatory user actions (short instructions) 1.4

| Task | Steps |
|--|---|
| Start/end session: | Components → Campaign Management |
| Evaluate semi-automatic readings: [1] | Reading \rightarrow Semi-automatic reading. |
| Manual entry of readings: ^[2] | Reading → Manual reading |
| Terminate session: | Components \rightarrow Campaign Management \rightarrow select campaign involved \rightarrow [Close] |

Only in a scenario with semi-automatic readings.
 Only in a scenario without automatic readings.

User actions as required (short instructions) 1.5

| Task | Steps |
|---|--|
| Enter a comment for a stored reading: | Readings \rightarrow Context menu: Comment \rightarrow Enter text. |
| Exclude a stored reading from the QAL3 evalu- ation: | Readings → Context menu: Block a reading. |
| Change the value in a stored reading: | Readings → Context menu: Change a reading → enter new actual value. |
| Change the nominal value in a stored reading: | Readings → Context menu: Refmaterial → enter new nominal value. |
| Change a warning/alarm limit: | Components \rightarrow Campaign Management \rightarrow Change value. |
| Print the Control Card for the current cam- paign: | File → Print. |
| Cancel an active campaign and start a new campaign: | Components \rightarrow Campaign Management \rightarrow [+ New] \rightarrow Enter new values for standard deviation \rightarrow [Save]. |
| View previous campaigns: | Extras \rightarrow Offline mode. |

2 Product description

2.1 Intended use

2.1.1 Purpose

QAL3 Master is a PC software to assist operators of automatic measuring instruments (AMS) to measure drift and precision of measuring instruments in accordance with EN 14181. Several measuring instruments can be monitored together.

Control ranges are automatically monitored. Discrepancies are automatically signaled. Control Cards are automatically updated.

2.1.2 Target group

- QAL3 Master should be used by skilled persons that know and implement the EN 14181 standard.
- These Operating Instructions are basically intended for skilled persons using QAL3 Master in operation. However, Sections "Installation", "Initial start-up" and "Program configuration" are only intended for trained skilled persons preparing the QAL3 Master for operation and adapting it to the individual application.

2.2 Functional principle

Readings

In compliance with EN 14181, automatic measuring instruments must perform regular measurements with check media (QAL3). The results from these reference measurements are referred to as "readings" when transferred. The check media are referred to as "reference material".

QAL3 Master stores all readings in a database. The actual values of readings are compared automatically against the nominal value. Deviations from the nominal value exceeding a set limit value are signaled in the operating program. An automatic e-mail can be generated at the same time (option).

Campaigns

All evaluations refer to a certain monitoring time (normally a calender time period). These monitoring times are referred to as "campaigns". Campaigns are started and stopped in QAL3 Master using menu functions. The QAL3 monitoring functions are only in operation when a campaign is active.



QAL3 Client

All operation and configuration functions are in program module "QAL3 Client". "QAL3 Client" can be installed on several PCs depending on licencing. Simultaneous operation of several variants is possible.

2.3 **Evaluation methods supported**

The following evaluation methods can be selected during program installation:

- CUSUM Control Card (drift and precision evaluation)
- Shewhart Control Card (drift evaluation)
 - Evaluation method "CUSUM" (cumulative sum): +i

Drift and precision (development of drifts) of the measuring instruments are monitored separately. Advantage: Better support of proactive planning of check and maintenance tasks.

Program modules 2.4

| Program module | Function |
|----------------------------|---|
| QAL3 Server ^[1] | Processing data in the QAL3 database.Connecting program module. |
| QAL3 Database | Storing data of connected automatic measuring instruments. [2] |
| QAL3 Driver [1] | • Importing data of individual measuring instruments via a PC interface and storing in a QAL3 database. |
| QAL3 Client | Creating displays and operating functions.Providing functions for program configuration. |

Table 1: Program modules

Permanent background process.
 Database management system: MariaDB Server.

QAL3 monitoring with QAL3 Master (example) Fig. 3:



2.5 System requirements

2.5.1 Computer system

| Computer component | Minimum requirements |
|-----------------------|---|
| Basis hardware: | Windows compatible PC (type optional) |
| Operating system: | Microsoft Windows 7 or Windows 10 32 bit or 64 bit |
| Working memory (RAM): | For 32 bit operating system: ≥ 1 GB For 64 bit operating system: ≥ 2 GB |
| Data medium (HD/SSD): | ≥ 500 MB (available) |
| Connections: | For Modbus-TCP: Ethernet interface (LAN) For Modbus-RTU: Serial interfaces (RS232/RS485) ^[1] |
| Monitor: | Color depth: 8 bit Resolution: ≥ 1280 x 768 pixels (16:9 WXGA) |

[1] One each serial interface for each analyzer of the measuring instrument.

2.5.2 Requirements for connected analyzers

| Modbus type for analyzer | Mandatory prerequisites |
|--|--|
| Analyzer has no Modbus interface. | Analyzer data evaluated by a MEAC system. |
| Analyzer does not support automatic readings via Modbus. | MEAC system stores analyzer readings (QAL3 function). QAL3 Master driver for MEAC installed on the MEAC system. MEAC driver stores the readings in the QAL3 database. The measured values to serve as reference values during reference measurements (zero point, reference point) must be selected manually using QAL3 Client. |
| Analyzer supports automatic readings via Modbus. | Without MEAC system: Modbus interface of analyzer connected to the PC on which the driver suitable for QAL3 Master is installed. With MEAC300: At least one Modbus compatible interface or at least one IP port available on the analyzer. With a different MEAC system: At least two Modbus compatible interfaces on the analyzer. ^[1] |

[1] If this is not possible: The analyzer could be connected via an analog output (mA signal) on the MEAC system.

2.5.3 Compatible MEAC systems

- MEAC300 with Add-on "UniversalModbus"
- All other MEAC systems apart from MEAC2000 V2.0

2.5.4 Requirements for automatic readings

| Alternative | Maximum function |
|--|--------------------------|
| Without MEAC system: PC with Modbus interface, QAL3 Master, Software "UniversalModbus" | Fully automatic readings |
| With MEAC300: MAC Add-on "UniversalModbus" | |
| With a different MEAC system:^[1] MEAC option "QAL3" | Semi-automatic readings |

[1] MEAC2000 V2.0 is not compatible.

2.5.5 Requirements for automatic e-mail alarms (option)

- Direct access to an e-mail server (SMTP)
- An e-mail account available on this e-mail server

2.6 Scope of delivery

2.6.1 Standard scope of delivery

1 installation CD

| Standard in | Istallation CD |
|-------------|--|
| QAL3 Se | prver |
| QAL3 CI | ient |
| QAL3 M | odbus driver |
| Universa | al Modbus |
| Operatir | ng Instructions as PDF (installed automatically) |
| Serial nu | umber |
| +i | Licences, see "Entering the licence number", page 15. Operating QAL3 Master requires the database management system "MariaDB Server" "MariaDB Server" is Open-Source software. This software cannot be delivered with the CD due to licence conditions (further information, see "Installing the database management system", page 14). |

2.6.2 Options

• *E-mail alarm:* When the actual value of a new reading exceeds the alarm limit, an e-mail is sent to all e-mail addresses stored in QAL3 Master.

3 Installation

3.1 Creating hardware connections

- Connect all PCs on which program modules from QAL3 Master are to run to a common Ethernet network (LAN).
- Connect analyzers for which readings are to be processed directly in QAL3 Master (via Modbus interface) to this network.
- To pass QAL3 Data from a MEAC system to QAL3 Master: Connect the MEAC system emission PC to this network.

+1-3 Options for connecting analyzers, see "Guideline: Connecting the analyzers", page 16.

3.2 Installing the software

3.2.1 Installing the database management system

- ▶ Download MariaDB Server from the internet (→ https://mariadb.org).
- Install MariaDB Server on the PC on which QAL3 Master will be installed. Note during installation:
 - IP address of the PC on which the database will be installed
 - IP port or network name of this PC

+1 These data are required during QAL3 Master installation.

3.2.2 Installing the QAL3 Master

On each PC used:

- Start the QAL3 Master installation program (Setup) with administrator rights.
- Select the program components to be installed (see Fig. 4).
- ► Follow the instructions of the installation program.

Fig. 4: Selecting program components during installation

| Select the components you | want to insta | II; clear the components you | do not want t | 0 |
|--|----------------------------|------------------------------|--|---|
| basic package | (1) | | | , |
| OAL3 Database | | basic package | 0.1 MB | |
| o new create | | user defined | 0,1 MB | |
| CUSUM import QAL3 Server QAL3 Client QAL3 Driver QAL3 MEAC-Driver MEAC300 FED MEAC300 IED MEAC 2012 MEAC 2012 MEAC EU ALARM (Mail) Modbus Export | -2 -3 -4 -5 -6 | | 0,1 MB 1,7 MB 0,1 MB 0,1 MB 0,1 MB 0,1 MB 0,1 MB 0,6 MB 0,1 MB | |

| | 1 | If required: Select a standard installation. | | |
|----|---|--|--|--|
| Γ | 2 | • <i>Either:</i> Create a new QAL3 Database. Specify the evaluation method in this case (Shewhart or CUSUM). | | |
| | | Or: Import and use an existing QAL3 Database. [1] | | |
| | 3 | QAL3 Server, QAL3 Client: Mandatory program modules for the basic functions | | |
| | 4 | If required: Select the suitable MEAC Driver. | | |
| | 5 | Only with option "E-mail alarm": Select the Alarm driver. | | |
| | 6 | Modbus driver: Mandatory program module for Modbus connections ^[2] | | |
| [] | Notes see "Using Backup functions", page 47. The installation program for "UniversalModbus" software starts automatically after the Modbus driver has been installed. Information on configuration measures required is displayed instead when MEAC300 is installed on a PC. | | | |

 Every PC on which QAL3 Client runs must have a network connection to QAL3 Database.

14

+i

3.2.3 Entering the licence number

3.2.3.1 Licencing principle

- The Licence key is generated during an e-mail dialog with the manufacturer.
- Each QAL3 Master licence is valid for the hardware on which QAL3 Server and QAL3 Driver run. The data storage used (HD, SSD) is part of this hardware.
- The Licence key is saved in the RegQAL3Svr.dat file.
- When required, the Licence key can be renewed when, for example, a hardware component is changed.

3.2.3.2 Licencing

- 1 Start QAL3 Client on a PC.
- 2 Call up the Driver display (see "Checking drivers", page 23).
- 3 Call up the Licencing menu (see "Checking drivers", page 23).
- 4 Follow the instructions in the menu. Carry out the work steps described.
- 5 Terminate and restart QAL3 Client.

3.2.3.3 Test operation without licence

QAL3 Master functions completely when a Licence number has not been entered but only processes a maximum of 10 readings.

+1 "Demo operation" is displayed in QAL3 Client during test operation.

3.2.4 Configuring Modbus connections

see "Guideline: Configuring the Modbus connection of analyzers", page 18.

4 Initial start-up

4.1 Guideline: Connecting the analyzers

| Scenario 1 Analyzers + QAL3 Master (→ fully automatic readings without MEAC system) | | |
|---|--|--|
| Characteristics | Measures | |
| Each analyzer has at least one Modbus interface available and supports automatic readings. Readings to be stored and monitored | Connections: Connect the analyzers to QAL3 Master via Modbus. Install and configure one independent variant of the "Universal Modbus" program for each analyzer. | |
| directly in QAL3 Master. | In Universal Modbus configuration program: Configure one numeric input for each QAL3 relevant measuring component of the analyzer (see "Guideline: Configuring the Modbus connection of analyzers", page 18). | |
| | In QAL3 Master: Set up a QAL3 Component for each QAL3 relevant measuring component of the analyzer (see "Setting up QAL3 Components", page 21). Make sure the Modbus Export Driver is running (Service "QAL3_Trb_ModbusExport"). | |

Scenario 2 Analyzers + MEAC300 + QAL3 Master $(\rightarrow fully automatic readings with MEAC300)$

| (| (Tully automatic readings with MEA0500) | | |
|-----------------|--|--|--|
| Characteristics | | Measures | |
| • | Each analyzer has at least one Modbus TCP interface available and supports automatic readings. Emission measured values to be pro- cessed in MEAC300. QAL3 data of analyzers to be monitored with QAL3 Master. | Connections: Connect analyzers to the MEAC system via Modbus. Install the QAL3 Master MEAC driver on the MEAC system. | |
| • | | In "MEAC-UniversalModbus" (Add-on): Configure one numeric input for each QAL3 relevant measuring component of an analyzer (see "Guideline: Configuring the Modbus connection of analyzers", page 18). | |
| | | In QAL3 Master: ► As for scenario 1. | |

Scenario 3 Analyzers + MEAC system (apart from MEAC300) + QAL3 Master (\rightarrow fully automatic readings with MEAC [1])

| Characteristics | Measures |
|--|---|
| Each analyzer has at least two Modbus interfaces available and supports automatic readings. Analyzers readings to be transferred to a MEAC system and stored there. | Connections: Connect analyzers to QAL3 Master via Modbus. Install and configure one independent variant of the "Universal Modbus" program for each analyzer. Also connect analyzers to the MEAC system via Modbus. |
| QAL3 Data to be monitored with QAL3 Master. | For Universal Modbus: ► As for scenario 1. |
| | In QAL3 Master: ► As for scenario 1. |

[1] Requirements, see "Compatible MEAC systems", page 11.

| Scenario 4 Analyzers without QAL3 Modbus function + MEAC System + QAL3 Master (→ semi-automatic readings) | | | |
|---|--|--|--|
| Characteristics | Measures | | |
| Analyzers have no Modbus interface. Or: Analyzers have a Modbus interface but do not support automatic readings. Analyzers have an electronic output which signals status "Reference measurement running". QAL3 data of analyzers to be monitored with QAL3 Master. | Connect analyzers to a MEAC system (via data acquisition unit or Field module) either via Modbus (when available) or via analog signal (mA) and record analyzer emission measured values with the MEAC system. | | |
| | In the MEAC system: Install MEAC driver for QAL3 Master. Set up a MEAC component for each analyzer measuring component delivering QAL3 relevant emission measured values. For each of these MEAC components: MEAC Universal Modbus: Set up a digital Modbus input for analyzer status signal "Reference measurement running". Status signals to be considered during calibration: Select the digital Modbus input "Reference measurement running" of this analyzer for the "Calibration" status signal. QAL3 component evaluation: Activate. | | |
| | In QAL3 Master: Set up a QAL3 component for each of these MEAC components (see "Setting up QAL3 Components", page 21). During operation:[1] Use the functions for semi-automatic readings to determine the reading values (see "Using semi-automatic read- ings", page 42). | | |

 $\ensuremath{\left[1\right]}$ In a QAL3 Client. Time point and frequency at user's discretion.

| Scenario 5 Analyzers without electronic connection + QAL3 Master (→ manual readings) | | |
|---|---|--|
| Characteristics | Measures | |
| Analyzers have no interface. Analyzers cannot signal status "Reference measurement running" automatically. | Install QAL3 Master on a PC. Read off reference measurements readings on the analyzers visually. Enter readings manually (see "Manual entry of readings", page 45). | |

П

4.2 Guideline: Configuring the Modbus connection of analyzers

Configure a Modbus input for the following data for each QAL3 Component to be monitored with QAL3 Master:

| Reading data | Set up one numeric Modbus input for each ^[1] |
|--|--|
| Actual values | Actual value for zero pointActual value for reference point |
| When included in readings: Nominal values | Nominal value for zero pointNominal value for reference point |
| When included in readings: Timestamp | Timestamp for actual value at zero pointTimestamp for actual value at reference point |

[1] Set up export parameters suitable for QAL3 Master.



Instructions on "UniversalModbus" software, see "Technical Information MEAC300 Add-ons".

4.3 Guideline: Configuring program functions

| Measure | Information | |
|--|---|--|
| Start a QAL3 Client. | see "Starting the program (QAL3 Client)", page 19 | |
| Set up QAL3 Components. | see "Setting up QAL3 Components", page 21 | |
| Carry out mapping. | see "Configuring Mapping (assigning data sources)", page 24 | |
| Set up campaigns. | see "Using campaigns", page 28 | |
| If nominal values are not included in readings: Determine nominal values. | see "Managing reference material/determining nominal values (as required)", page 44 | |
| Activate automatic backups. | see "Configuring automatic backups", page 47 | |

4.4 Putting QAL3 Master into operation

| Measure | Information |
|--|--|
| Start a campaign for each single QAL3 component. | see "Using campaigns", page 28 |
| | Enter standard deviations. |
| Make the following settings: | With evaluation method "Shewhart": Set warning limits. ^[1] Set alarm limits. ^[1] |
| | With evaluation method "CUSUM": ► Have alarm limits calculated. |

[1] Standard value is displayed.

5 Starting the program (QAL3 Client)

| Step | | Measure |
|------|--|--|
| 1 | Start QAL3 Client. | With MEAC System: ► Call up menu function "QAL3 Monitoring" of the MEAC program. |
| | | Without MEAC system: ► Double-click link symbol "QAL3 Client" (start QAL3Client.exe). [1] |
| 2 | Select user (Login). | Enter user and password. Select desired language. |
| 3 | If required: | Check connection to QAL3 Database (see Fig. 5). |

[1] Some program functions are only usable when QAL3 Client runs with Administrator rights (see information in text).





| 1 | Enter user name. [1] | |
|---|----------------------|--|
| | 1 | |

- 2 ► Enter user password.
- 3 ► Select language.
- 4 IP address of PC on which QAL3 Database is installed
- 5 IP Port of this PC [2]
- 6 Internal name of QAL3 Database [2]
- 7 Fest connection to QAL3 Database.

8 Message after test.

[1] Selection, see "Setting up/managing users", page 20.

[2] Defined during database management system installation.

Fig. 6: QAL3 Client after program start (example)

| User / | Admin | | | | | | | 5 C I |
|---|-----------|---|--|--|---|--|--|-------|
| Componen Unit Location + Component | t witz | Zaropoint Diff exceedurce Series Series Activate Non-Value Varinglist | | Drift exceedance Sams = Alamilimit Warningfimit | Ref. point latest reading Act.Value Non.Value | | | |
| | | | | | | | | |
| | | | | | | | | |



Principle of operation, see "Principle of operation", page 6.

6 Program configuration



Only for trained Service technicians and administrators.

6.1 Setting up/managing users

Internal user functions

- The user selected during QAL3 Client start is named in the Maintenance Manual entries.
- With option "E-mail alarm": An individual e-mail address can be entered for each user to which the automatic alarm messages are to be sent.

Recommend minimum measures for initial start-up

- Change standard setting for user.
- ▶ With option "E-mail alarm": Enter e-mail addresses for users.





| 🕒 QAL3-Client | | | |
|------------------------|------------------------|-------------|-------------------|
| File Components Readin | ig Extra ? | | |
| User Admin | Settings | | |
| | Language 🕨 | <u>ا</u> | |
| Component | Settings > | Users | |
| Unit | Maintenance manual | RefMaterial | |
| C. O.C. Martin | Defeet | Drivers | |
| Contract of the | Keiresn | ActValue | |
| · Camporanti | offline mode | Nors Vide e | |
| In C Leel | i margara di | | |
| | User management | | |
| | Nr Name | Mail | |
| | 1 Admin 2 J. Doe | | + New 2 |
| | | | Change Passw 3 |
| | | | |
| | | (1) | 👔 Change name 🛛 4 |
| | | - | Change mail |
| | | | |
| | | | |
| | | | |
| | 1 | | |
| | | OK Cancel | |
| | | | |
| 1 List of users in | QAL3 Master | | |
| 2 ► Add a user. | | | |
| 3 🕨 Change pas | sword for marked user. | | |
| 4 🕨 Change nan | ne of marked user. | | |
| | | | |

[1] Only available with option "E-mail alarm".

6.2 Setting up QAL3 Components

6.2.1 Functional principle of QAL3 Components in QAL3 Master

"QAL3 Components" are the measuring components to be monitored with QAL3 Master. QAL3 Master only functions when at least one QAL3 Component has been set up. The QAL3 Components must be set up using QAL3 Client during initial start-up.

Each QAL3 Component is assigned a "location". Several locations can be set up and given suitable names.

- Which measuring components are to be monitored normally depends on official ٠ +1 requirements on the respective measuring instrument.
 - An own QAL3 Component must be set up for each measuring range when a measur-• ing component has several measuring ranges.

Fig. 8: QAL3 Components in QAL3 Master (example)

| 🕒 QAL3-Client | |
|--|---|
| File Components Reading Extra ? | |
| User Admin | |
| | Zeropoint Diff exceedarce Nore Intert mading [10:07:2017:00:00:13] Diff exceedarce Sams + [1:090] Aut Value [0:0174] Sams + Sams + Attended [2:1400] Nam Value [0:000] Attended Vianight Vianight [1:070] Non Value [0:000] Attended Vianight |
| CO2 Flow Control C | aign (4) laterial management (5) |
| 1 Location | |
| 2 QAL3 Components for this loc | cation |
| 3 Further locations with their Q | AL3 Components |
| 4 ► Call up a campaign (see " | Managing active campaigns", page 28). |
| 5 Call up reference material page 44). | (see "Managing reference material/determining nominal values (as required)", |
| Symbol ^[1] | Significance |
| BLUE ? | Configuration not complete. |
| YELLOW ! | Warning: Actual value – nominal value \geq warning limit ^[2] |
| RED ! | Alarm: Actual value - nominal value ≥ alarm limit [2] |

[1] Also displayed for the group.[2] After the last reading.

6.2.2 **Configuring QAL3 Components**

One QAL3 Component must be configured for each component of an analyzer for which the readings are to be monitored in QAL3 Master.

• Carry out for each desired QAL3 Component:

Fig. 9: QAL3 Component Management (with example data)

| 🕒 QAL3-Client | | | | | | |
|---|--|----------|--|--|--|--|
| File Components Reading Extra ? | | | | | | |
| New | | | | | | |
| Mapping | Name (1) | New | | | | |
| Campaign | | 🙀 Modify | | | | |
| Location | Start End 3 | | | | | |
| | | | | | | |
| + Components | Analyzer | | | | | |
| In to Leaf | | | | | | |
| IE- I Co Line2 | | U Save | | | | |
| | Nr Name Unit Alarm Rang Rang Analyzer | Location | | | | |
| | 1 NU mg/m² 0 500 MCS100F1 2 TOC mg/m² 0 30 MCS100FT | Line1 | | | | |
| | 3 CO2 mg/m ³ 0 30 MCS100FT | Line1 | | | | |
| | 4 Flow Nm ² /h 0 100000 FlowSick100 | Line1 | | | | |
| | 6 TDC mg/m² ··· 0 30 MCS100FT | Line2 | | | | |
| | 7 CD2 mg/m ² 0 30 MCS100FT | Line2 | | | | |
| | 8 Flow Nm²/h 7 100000 FlowSick100 | Line2 | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | • | | | | | |
| | Close | | | | | |
| | 5000 | | | | | |
| | | | | | | |
| 1 ► Enter desired QAL3 Con | nponent name. | | | | | |
| 2 Enter physical unit of m | 2 ► Enter physical unit of measured values. | | | | | |
| 3 Enter start and end value | Enter start and end values of measuring range. | | | | | |
| | Enter (desired) analyzer name from which measured values originate. | | | | | |
| 4 ► Enter (desired) analyzer | name from which measured values originate. | | | | | |
| 4 ► Enter (desired) analyzer 5 ► Either: Select an existing | name from which measured values originate. | | | | | |
| 4 ► Enter (desired) analyzer 5 ► Either: Select an existin ► Or: Enter new location n | name from which measured values originate. g location. ame. | | | | | |
| 4 Enter (desired) analyzer 5 Either: Select an existin Or: Enter new location n 6 Activate automatic alarr | name from which measured values originate. g location. ame. n messages via e-mail for this OAL3 Component. | | | | | |
| 4 Enter (desired) analyzer 5 Either: Select an existin • Or: Enter new location n 6 Activate automatic alarr | name from which measured values originate. g location. aame. n messages via e-mail for this QAL3 Component. | | | | | |



Also necessary:

Carry out Mapping (see "Configuring Mapping (assigning data sources)", page 24).

6.3 **Checking drivers**

Drivers in QAL3 Master serve to import readings automatically and store these in the QAL3 Database. The Alarm driver is required for automatic alarm messages via e-mail (option).



[1] Licencing explanation, see "Entering the licence number", page 15.

6.4 Configuring Mapping (assigning data sources)

"Mapping" serves to assign measuring components for which readings are imported via the QAL3 Driver to the QAL3 Components.

| New Mapping Campaign | Diff accordance | Zeropoint Ident maling | | | | | |
|----------------------------|--|---------------------------|--|--------|----------------|----------|-------|
| Mapping Driver 1 | Filter × (4) | Refresh 5 | Q/ | AL3 Co | mponents | | |
| | Filter T | | _ | | | | |
| NEXUS1 (2) | KompID Name | | Nr | Name | Identification | DriverID | Kompl |
| Modbus Import V1. | 14 HCL.Kanal0.MB0 | | <u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u> | NO | Line1 | 1 | 18 |
| (3) | HF.Kanal0.MB0 | | | TOC | Line1 | -1 | -1 |
| Ϋ́ | 15 NH3.KanalU.MBU | | - H3 | CU2 | Linel | 1 | 23 |
| | LI 17 CU.Kanalu.MBU | | [] [] 4 | FIOW | Linei | | - 1 |
| | 18 NU.Kanalu.MBU | | - 남음 | NU | Line2 | • | - 1 |
| | D 20 CD2 Kanalu.MB0 | | - 남 | 100 | Line2 | | - 1 |
| 1 | □ 1 N02.Kanal0.M80 6 □ 22 N20.Kanal0.M80 6 □ 23 CO2.Kanal0.M80 1 □ 24 H20.Kanal0.M80 1 □ 25 C3H8.Kanal0.M80 1 □ 26 C2H6.Kanal0.M80 1 | | | Flow | | 1 | |

Fig. 11: Mapping (example)

- 1 List of connected PCs and installed drivers
- 2 PC name in network
- 3 Driver for QAL3 Master installed on this PC
- 4 ► Enter filter text for list [6]. [1]
- 5 ► Activate entered filter text.

6 List of measuring components for which the marked driver delivers readings to QAL3 Master [2]

7 List of configured QAL3 Components (see "Configuring QAL3 Components", page 22) [2]

[1] Joker character: "%"

[2] With name: Assigned (configured). Without name: Not assigned.

To assign a certain measuring component to a QAL3 component:

- 1 Mark driver which delivers readings for this measuring component.
- 2 Mark name of the measuring component (mouse-click).
- 3 Drag measuring component name to name of associated QAL3 component (Drag & Drop).
- During initial start-up: Repeat these work steps until every QAL3 component is assigned a measuring component.

6.5 Activating e-mail alarms

Only valid when option "E-mail alarm" is installed.

When e-mail alarm is activated, an e-mail is generated automatically when the evaluation of the last reading of an analyzer shows that the analyzer no longer works within the permissible range. This e-mail is sent automatically to all users for which an e-mail address is specified (see "Setting up/managing users", page 20).

QAL3 Master requires direct access to an e-mail account to be able to send automatic emails. Configure this access here.

Requirements for automatic e-mail alarms:
QAL3 Server running.
Alarm driver running.

Fig. 12: Configuring automatic e-mails

| 🕒 QAL3-Client | | | |
|-----------------------------------|----------------------|--------------------------|-------------------|
| File Components Reading | Extra ? | | Settings |
| User Admin | Settings | | Alarm |
| Component | Language Settings | Zeropoint | Host |
| Unit Location | Maintenance manual | latest mading | Port |
| | Refresh | ActValue | 3 |
| Components | offline mode | Non-Value | Account User |
| 10 Leni 10 Leni | Twenty 5 | tatar Nom Value | Security SSL 6 |
| 1 Activate autor Enter IP addre | matic e-mail alarms. | nail server belonging to | DK Cancel |

- 3 ► Enter port number of e-mail server.
 - 4 Enter user name of mail account to send the e-mail alarms. [1]
 - 5 Enter password of this user.
 - 6 ► If desired: Activate SSL encryption for sent e-mails.

[1] The account e-mail address is often used here in internet.



These settings are valid for all QAL3 Master users.

6.6 Selecting the logo for Control Cards

r

The graphic chosen is automatically shown in the printed Control Cards.

- Application options (example): Operating company logo, plant symbol.
- Allowable graphic formats: PNG, JPG, BMP.

Fig. 13: Selecting the logo for Control Cards

| 🕒 QAL3-Client | | | Culture | |
|-------------------------|--------------------|---------------|-----------|---|
| File Components Reading | Extra ? | | Settings | |
| User Admin | Settings | | | |
| | Language 🕨 | | Logo | |
| Component | Settings + | Zeropoint | | |
| Location | Maintenance manual | latest mading | | |
| | Refresh | ActValue | | |
| Components | offline mode | NonValue | | |
| III C Leel | Waningfed | | | |
| a-10 rest | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | _ |
| | | | OK Cancel | |
| | | | | |
| | | | | |

Additional functions 6.7

Fig. 14: Additional functions

| ΘQ | AL3-Client | | | | | |
|------|--|-----------|---|----------------------|---|---|
| File | Components Reading | Extr | ra] ? | | | Settings |
| Use | r Admin | C | Settings | } | | Display |
| _ | | | Language + | · · · · · · | Terror of the | Semiautom, readings |
| Con | nponent | | Settings + | | zeropoint | Assume separate cycles when pause greater than |
| Loc | ation | | Maintenance manual | | latest mading | |
| | | | Refresh | | ActValue | Display |
| | Components | | offline mode | | NonValue | Comp.Name 🗖 incl. (2) |
| - | C Livel | _ | Varages 1 | - | | Various |
| | | | Tenestamp | Status | Non, Value | Command |
| | | | | | | |
| | | | | | | OK Cancel |
| | | | | | | |
| 1 | For semi-auto reference mea ter. [2] | ma asu | atic readings:[1] Set irements so that the | the mini se refer | mum time interval (s ence measurements | seconds) that must elapse between two can be shown separately in QAL3 Mas- |
| 2 | For the list of | QĀ | L3 Components:[3] | Display 1 | the measuring range | S |
| 3 | Only for trained | ed : | skilled persons: Ente | er a syst | em command. | |

see "Using semi-automatic readings", page 42. A larger value serves to show several reference measurements that were made in a short time gap together.
 Standard value: 300 seconds.
 see "Functional principle of QAL3 Components in QAL3 Master", page 21.

7 Handling during operation

7.1 Using campaigns

7.1.1 Managing active campaigns

| | [] | QAL3 monitoring only functions when a campaign is running. A campaign is only valid for one single QAL3 component. |
|---|----|--|
| _ | | To activate QAL3 monitoring: Start a campaign for each QAL3 component. Important when using evaluation method "Shewhart": Always start a new campaign when an alarm limit has been changed. |
| | +1 | Always start a new campaign after defining a new standard deviation – e.g., after an annual function test (AST). Campaign run times are normally coordinated to local requirements. |

Fig. 15: Campaign management for a QAL3 Component (with example data)

| 🕒 QAL3-Client | | | |
|--|---|--|---|
| File Components Reading Extra | ? | | |
| New | Campaign Management | | |
| Mapping | Component NO | Analyzer MCS100FT | |
| Campaign | Range [0,00 - 500,00] | Location Line1 | |
| Location | Device characteristic curve | Contracting the second se | + New (5) |
| | | Zerapiet | |
| A Comment of | a+b++cx ; ; = ; | Jimm | X Finalize 6 |
| La contra da la co | Start timestamp | ור | i i i |
| | | I narmar | G Save (7) |
| | | | |
| | | (10) | Explanation |
| | | | Zeropoint |
| | 1 | | RefPoint |
| | Nr Start Stop Std.Dev | Alarmlimit Warninglimit Std.Dev | Alarmlimit Warninglimit |
| | 1 01.05.2017 11:37:52 5,0080 | 10,0160 5,0080 <mark>6,9800</mark> | 13,9600 6,9800 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | 1 | (9) | |
| | | Close | |
| | | | |
| 1 🕨 S | Select a QAL3 Component. | | |
| 2 Info | rmation on selected QAL3 Component | | |
| 3 ► /1 | f required: Activate regression formula for actua | I value conversion and enter re | egression formula factors. ^[1] |
| 4 1 | f required: Enter/set start time for new campai | 2n. [2] | <u> </u> |
| 5 • 9 | Set un a new campaign | D | |
| | Forminato activo compaign | | |
| | | | |
| / ► S | start the new campaign. | | |
| 8 List | of campaigns for selected QAL3 Component (ir | cluding data). | |
| Grey | y text = previous campaigns. [3] | | |
| 9 ► T | Ferminate campaign management. | | |
| 10 Star | ndard deviations, warning limits/alarm limits | | |
| – F | For evaluation method "Shewhart", see Fig. 16. | page 29 | |
| – F | For evoluction method "CUCUM" and Fig 17 no | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | |
| | | ige 29 | |

[2] Otherwise the time used when selecting [5] is used. [3] see "View previous campaigns (Offline mode)", page 30.

| (| | | |
|------------------|--|---|--|
| Cam | paign Management | | |
| | amporent NO | Analyzes | MCS100FT |
| | langes [0.00 - 500.00] | Location | Line Contraction of the second s |
| De | vice characteristic curve | Operating | parameters |
| 1 | | | Zeropoint |
| | a - be - of 1 | Alarmlimit | (2) Manual |
| - 54 | d line lang | Warninglim | mi 3 |
| 1 | | | |
| | an [amann 2] the [mann 22] | Alamalimit | 2 Ref.Point |
| Sa | ms | Warninglin | |
| Ze | ropoint 1 | waningiin | |
| Re | f.Point | | Language State |
| | | | |
| | Read Read Read Read Read Read | · | |
| 1 | Stat Stap StdDev (0.85.2017.01.37.52 6.0000 | Afaerdine 10.0140 | Warringhot End Den: Allenihrik Warringhot End Press 6,0000 6,0000 13,9000 6,0000 2,9000 |
| 1 | Stat Stap StatDev 0:05.201711.3752 5.0000 | Alarchine 10.0160 | Waringhot Eddber Alambet Waringhot 6.000 6.000 13.000 6.000 |
| 1 | Stat Stage StatDev 01.05.201711.3752 5.0000 | Alamint | Waringhot Std.Dev. Alambet Waringhot 5.0000 6.5000 13.5000 6.3000 |
| 1 | Enter standard deviations from last Test | Report (| (physical values). |
| 1 | Enter standard deviations from last Test Standard values for alarm limit and warnin | Report (| (physical values). |
| 1 | Enter standard deviations from last Test Standard values for alarm limit and warnin, 200 % · standard deviation; warning limit = | : Report (g limit ar standard | (physical values). re generated automatically from the values entered (alarm limit = d deviation) |
| 1 | Enter standard deviations from last Test Standard values for alarm limit and warnin 200 % · standard deviation; warning limit = Alarm limit for this OAL3 component in this | Report (g limit ar standard s campaig | (physical values). re generated automatically from the values entered (alarm limit = d deviation) |
| 1 | Enter standard deviations from last Test Standard values for alarm limit and warnin 200 % · standard deviation; warning limit = Alarm limit for this QAL3 component in this Warning limit for this OAL3 component in t | : Report (g limit ar standard campaig his camp | (physical values). re generated automatically from the values entered (alarm limit = d deviation) ign paign |
| 1 2 3 4 | Enter standard deviations from last Test Standard values for alarm limit and warnin 200 % · standard deviation; warning limit = Alarm limit for this QAL3 component in this Warning limit for this QAL3 component in t If required: Activate manual entry. [1] | : Report (g limit ar standard campaig his camp | (physical values). re generated automatically from the values entered (alarm limit = d deviation) ign paign |
| 1 2 3 4 | Enter standard deviations from last Test Standard values for alarm limit and warnin 200 % · standard deviation; warning limit = Alarm limit for this QAL3 component in this Warning limit for this QAL3 component in t If required: Activate manual entry. [1] Then enter desired value (replaces stan | : Report (g limit ar standard campaig his camp | (physical values). re generated automatically from the values entered (alarm limit = d deviation) ign paign |

Fig. 16: Standard deviation and alarm limits/warning limits for "Shewhart"

[1] Only possible for alarm limit before this campaign is started. Also possible for warning limit when this campaign is active. These values can no longer be changed after the campaign has been terminated.

| Fig. 17: | Standard deviation | and alarm limits | /warning limits | for "CUSUM" (wi | th example data) |
|----------|--------------------|------------------|-----------------|-----------------|------------------|
|----------|--------------------|------------------|-----------------|-----------------|------------------|

| Campaign Management | | × |
|---|--|-------------------------------|
| Component ND Ronge [0,00 - 500,00] | Analyzes MCS100FT Location Line1 | |
| Trippener a b s | Derating parameters 3 Drift calculation 2eropoint Ins [21,3750 hs 388,1250 h | + New Constant |
| Standard deviation Zero 7,5000 Span 7,5000 Calculate | ks 3/70'5 ks 104,0625 RefPoint RefPoint ha 21,3750 hs 388,1250 kx 3.7575 ks 104,0625 | C Low Expension Despect |
| Image: Transmission Transmission Transmission Image: Transmission Image: Transmission Image: Transmission Image: Transmission Image: Transmission Image: Transmission Image: Transmission Image: Transmission Image: Transmission Image: Transmission | Alamina Vianingkot StdDev Alamina Vi NLIMAR SLIMAR SLIMAR SLIMAR SLIMAR SLIMAR SLIMAR SLIMAR SLIMAR SLIMAR | nd: Part |
| 1 ► Enter standard deviations from last Test | Report (physical values). | |
| 2 ► Calculate current CUSUM operating para | meters automatically using the standard deviation | ons. |
| 13 Current CUSUM operating parameters | | |

7.1.2 View previous campaigns (Offline mode)

| User Admin Component TOC Unit mg/m ² Location Line1 + Corporation - 10 N0 - 1 | Settings Settings Maintenance manual Refresh offline mode 1 | | Zuropoint Untel madig ActValue NamValue | [18.07.201 [4.0174 [0.0000 |
|--|---|---------------|---|----------------------------------|
| Component TOC Unit engine" Location Line1 + Conjunction - TOC 100 - TOC 10 | Language , Settings , Maintenance manual Refresh offline mode (1) | | Zeropoint Unit madeg ActValue NonValue NonValue | 14.07.201 [4.0174 [0.0000 |
| Component 100- Unit engle* Location Line1 Component Comp | Settings Maintenance manual Refresh offline mode 1 | | a antigeometric latest mading ActiValue NoniValue | 14.07.205 4.0174 0.0000 |
| Conjunction Conjuncti | Maintenance manual Refresh offline mode 1 | | Intent mading ActiVation Non:Vation | [16.07.201 [4.0174 [0.0000 |
| + Carporen | Refresh offline mode 1 | | ActValue Non:Value Non:Value | 0.000 |
| Corporation Tal Low Tal Low Tal Low Tal Tal Low Tal T | offline mode (1) |) Dana | Non-Value | |
| 0 2 Lord 0 10 0 10 0 202 0 Ros | Variegies 71 Streetwa 20.06.2017 V 00.2 20.06.2017 0 00.1 | Status Dh | Non. Value | |
| 0 10C 0 002 0 Fbm | Teentarg 26.06.2017 M 50.2 26.06.2017 Ø 50.1 | Status Ok | Non, Value | |
| - Fitter | 28-06-2017-10 53-2 29-06-2017-00 53-1 | I Dk | | |
| | 29.06.2017 01:53:14 | | -0.0019 | -0.1 |
| the second second | | i Di | 0.0254 | -0.1 |
| 10.10 | 30.06.2017 10 53 11 | 5 (Dk | 0.0363 | -0.1 |
| | 01.07.2017.00157.3 | i (). | 4.0199 | |
| | 02:07.2017.10:00:5 | E (D). | 0.0074 | |
| - Fine | 03-07 2017 01/59-50 | I Dk | -0.0053 | -0. |
| | 03-07-2017-10-110-11 | 1 Di. | -0.0203 | -0.1 |
| | 03-07-2017-10-49-2 | 5 Dk | 0.0940 | |
| | 04.07.2017.00457.26 | 5 (Dk | 0.0365 | |
| | 05.07.2017.01453-11 | 5 Dk | -0.0022 | -0. |
| | 06-07-2017-09-52-11 | 5 (Dk | -0.0004 | |
| | 07 07 2017 01 153 10 | I Dk | 0.0164 | |
| | 08-07 2017 09 53-2 | 1 Dk | -0.0223 | - |
| | 05-07 2017 01 53-11 | E Ch | 0.0343 | |
| | 10.07.2017 09:53.2 | Dk. | 0.0012 | |
| | 10.07.2017.10.03.2 | Dk. | -0.0298 | -0. |
| x offline mode 1 : 18.05.2017 13:33 | | | | |
| 2 | | | | |
| | | | | |
| Server DB | | | | |
| Paddens 1271 | 10.1 Shewhart History Zwo | point History | RetPort Readings | |
| 2017-05-10 11:02:17 | | | | |
| 2011-03-13 11:00:11 | | | | |
| de to view and print prev | vious campaigns. | | | |
| ins for selected QAL3 Co | omponent (including a | active ca | ampaign). | |

Fig. 18: Mode for previous campaigns

► To use this mode: Call up Campaign Management (see Fig. 15, page 28).

► To terminate this mode: Close the mode display.

► Use the print function when desired (see "Printing Control Cards/readings").



E(W

Data from previous campaigns cannot be modified.

7.1.3 Printing Control Cards/readings

Fig. 19: Print functions

| G Q File | AL3-Client Components Reading Extra ? Print All components | | | | | 🕞 Printer menu 💷 📧 |
|-------------------------|--|--|-----------------------|--------------------|-------------|---------------------------|
| - | Close Focussed compo | nent (2) | | Zeropoint | | Report focussed component |
| Loc | ation | Diff exceedance | | latest mading | | Beadings (4) |
| • | Corporati | Sam - Alamint Varingint | | ActValue Non/Value | | Chart 5 |
| | 10 mil | Tmestamp | Status | Non. Value | | |
| 1 | Print summary for all | QAL3 Compo | nents for w | hich a campaig | gn is activ | /e. ^[1] |
| 2 | Print functions for select | ed QAL3 Com | ponent ^[2] | | | |
| 3 | Print Control Card for | active campa | iign. | | | |
| 4 | 4 ► Print readings for active campaign as Table. ^[1] | | | | | |
| 5 | Print readings for activity | ve campaign | as graph. | | | |
| 6 | Start print preview. [3] | | | | | |
| [1] 0 [2] 0 [3] U | INIY for evaluation method INIY functions when a can se the print function the | d "Shewhart". npaign is runr e to print. | ning. | | | |

| +1-> | Examples, | see | "Printed | data | examples", | page | 53. |
|------|-----------|-----|----------|------|------------|------|-----|
|------|-----------|-----|----------|------|------------|------|-----|

7.2 Using Shewhart functions

Only valid when evaluation method "Shewhart" has been installed.

The functions are valid for the respective active campaign of selected QAL3 Component.

7.2.1 Shewhart: Viewing current Control Cards and readings – tabular

Fig. 20: Shewhart: Control Cards and readings - tabular (with example data)

| O QAL3-Client | | | | |
|---|---|---|---|--|
| File Components Reading Extra 7 User Admin | | | | SICK |
| Component NO | | Zeropoint | Ref. point | t |
| Unit mg/m* Location Line1 | Drift exceedance Alarm Sams = 5,0080 Alarmlimit 10,0160 Warninglimit 5,0080 | latest reading 20.07.2017 12:32:48 Qratue 10.3000 Nom.Value 0.0000 | Drift exceedance Warning latest r Sams = 6.9900 3.a Alarmlimit 13.9600 Nom V Warninglimit 6.9800 10.000 | reading 11.07.2017 09:31:49 alue 402,5613 /alue 410,7100 |
| | Timestamp Status 05.07.2017.09.59.04 0k 06.07.2017.09.59.12 0k 07.07.2017.09.59.12 0k 08.07.2017.09.59.30 0k 09.07.2017.09.59.31 Warning 10.07.2017.01.95.91.00 0k 10.07.2017.01.95.92 0k 11.07.2017.11.11.54 0k 11.07.2017.10.03.32 Warning 12.07.2017.10.03.32 0k 13.07.2017.10.03.32 0k 14.07.2017.09.17.20 0k 15.07.2017.09.17.20 0k 15.07.2017.09.17.20 0k 19.07.2017.09.17.20 0k 19.07.2017.09.17.20 0k 19.07.2017.09.17.20 0k 19.07.2017.09.17.23 0k 19.07.2017.12.31.52 Warning 20.07.2017.12.32.48 Alarm | Nom. Value Drit 0.1944 -0.1944 0.0343 0.0343 0.7468 0.7468 0.5840 0.5840 6.0756 6.0756 -0.5202 -0.5202 -0.722 -0.7322 -0.1019 0.1019 0.1019 0.1019 0.1019 0.1019 0.1019 0.1019 0.5005 2.6306 2.6306 2.6306 2.6306 2.6306 0.3000 10.3000 | Timestamp Status N 26.06.2017 10.06.53 0k 03.07.2017 10.25.17 0k 11.07.2017 09:31:43 Warning 5 | Om. Value Drift 404,1310 -6,5730 404,1310 -6,5730 402,5513 -8,1487 |
| 2017-08-04 13:19-25 | | | | |
| | | | | |
| 1 | Select a QAL3 Compone | ent. | | |
| 2 Co | ntrol Cards: Current zero | point data | | |

| 1 | ► Select a QAL3 Component. |
|---|--|
| 2 | Control Cards: Current zero point data |
| 3 | Control Cards: Current reference point data |
| 4 | Readings and calculated drifts: Zero point data |
| 5 | Readings and calculated drifts: Reference point data |
| | |
| | |

Printing these values, see "Printing Control Cards/readings", page 31.

+1>

7.2.2 Shewhart: Viewing readings and drift - as graph





| 1 | • | Select a QAL3 Component. |
|---|----|-----------------------------------|
| 2 | ► | Select Zero or Ref. point. |
| 3 | Re | eadings course in active campaign |
| Λ | Ec | armat explanation |

4 Format explanation



Printing these values, see "Printing Control Cards/readings", page 31.

7.2.3 Shewhart: Readings, viewing/changing (tabular)

Fig. 22: Shewhart: Viewing readings (with example data)

| 🕞 QAL3-Client | | | | | | | |
|------------------------------------|------------------------------------|----------------|--------------|-----------------|--------------|----------------|----------|
| User Admin | | | | | | | SICK |
| Component NO | | Zeropoint | | | Flat | t. point | |
| Unit mg/m* | | | | | | | |
| Location Line1 | Diff exceedance Alarn | latest reading | | Diff exceedance | warang | latest reading | |
| | | Art Value | | | 1.9000 | dest Victory | 402.9813 |
| + Components | | No. 1 Aug | | | | Non-Make | |
| | Norman In common | Non-Yang 1 | | | | NUM VALUE | |
| | to analyzed process | | | Security game | | | |
| | Table | | | | | | |
| O Flow | Nr Timestamp | Value | Ref.Mat | Nr Timesta | mp | Value | Ref.Mat |
| III I D LINE | 1 28.06.2017 10:53:21 | -0,0019 | 0,0000 | 1 26.06.2 | 017 10:33:16 | 13,7857 | 13,6000 |
| -0 100 | 2 29.06.2017 09:53:14 | -0,0354 | 0,0000 | 2 03.07.2 | 017 10:52:27 | 13,5153 | 13,6000 |
| | 3 30.06.2017 10:53:15 | -0,0363 - | 0,0000 | 3 10.07.2 | 017 10:37:56 | 13,9422 | 13,6000 |
| - C Flow | 4 01.07.2017 09:57:36 | -0,0199 | 0,0000 | 4 11.0/2 | 01710:18:01 | 13,4243 | 13,6000 |
| | 6 03.07.2017 09:59:58 | -0.0053 | | | | | |
| | 7 03.07.2017 10:10:19 | -0,0203 | RefMateria | (2) | | | |
| | 8 03.07.2017 10:49:25 | 0,0940 | | | | | |
| | 9 04.07.2017 09:57:35 | 0,0365 | Write a com | ment | | | |
| | 10 05.07.2017 09:53:15 | -0,0022 | Block readin | . (3) | | | |
| | 11 06.07.2017 09:53:15 | -0,0004 | Maninulator | | | | |
| | 12 07.07.2017 09:53:18 | 0,0164 | | eauing | | | |
| | 14 09.07 2017 09:53:19 | 0,0221 | 0,0000 | | | | |
| | 15 10.07.2017 09:53:21 | 0.0012 | 0.0000 | | | | |
| | 16 10.07.2017 10:03:21 | -0,0398 | 0,0000 | | | | |
| | 17 10.07.2017 12:03:11 | 0,0382 | 0,0000 | | | | |
| | 18 11.07.2017 09:17:35 | -0,0088 | 0,0000 | | | | |
| | 19 11.07.2017 09:56:42 | -0,0243 | 0,0000 | | | | |
| | 20 11.07.2017 10:15:00 | -0,0228 | 0,0000 | | | | |
| | 21 12.07.2017 09:57:35 | -0,0242 | 0,0000 | | | | |
| | 23 14 07 2017 09:11:19 | 0,0304 | 0,0000 | | | | |
| | 24 15.07.2017 09:11:22 | -0,0720 | 0,0000 | | | | |
| | 25 17.07.2017 07:03:53 | -0,0614 | 0,0000 | | | | |
| | 26 18.07.2017 08:08:13 | -0.0174 | 0.0000 | | | | |
| State Pathers 127001 | Shewhart History Zeropoint History | Readings | | | | | |
| 1017 OF 04 12 10 10 | | | | | | | |
| THE R. P. LEWIS CO., LANSING MICH. | | | | | | | |

| 1 | | Select a | OAL3 | Com | oonent. |
|---|-----|----------|--------|-------|-----------|
| - | 1 ° | OCICUL U | Q/ YEO | 00111 | ponicine. |

2 Change reference material/nominal value (see "Managing reference material/determining nominal values (as required)", page 44). [1]

3 ► Edit marked readings (see "Editing stored readings", page 41).

[1] When several readings are marked: Valid for all marked readings.

+1- Printing displayed values, see "Printing Control Cards/readings", page 31.

7.3 Using CUSUM functions

Only valid when evaluation method "CUSUM" has been installed.

The functions are valid for the respective active campaign of selected QAL3 Component.

7.3.1 CUSUM: View current drift Control Card

Fig. 23: CUSUM: Control Card for drift (with example data)

| 🕞 QAL3-Client | | | | - • • |
|--|--|--|--|--------------------|
| File Components Reading Edua I | | | | SICK |
| Over Admin | | Terrented | | SICK |
| Component NO Unit mg/m ² | Loss of precision | 2 aropoint | Loss of precision No. | Fuel point |
| Location Line? | Dati Negative | Later eading income and a set | Date Ten Mercel reads | E parte series and |
| + Corporants | Sams = 7,5000 cact,zero | = 3,0000 | Sams = 7,5000 | |
| III Č Litel | hx = 21,3750 cref,zero | = 0,0000 | hx = 21,3750 cref,span = 200,0000 | |
| | kx = ^{3,7575} IDzero previous CUSUM values | = Auto HetZeo | kx = 3,7575 IDspan= NU Span previous CUSUM values | |
| | | | | |
| TO First | Sum[pos]t-1 N[pos]t-1 0,0000 0,0000 | 22,4975 0,0000 | Sum[pos]t-1 N[pos]t-1 Sum[neg]t-1 16,4550 0,0000 0,0000 | N(neg)t-1 |
| | dt=cref zero - c. | act zero = -3,0000 | dt=cref span - cact span = 10,0000 | _ |
| | Sum(pos)p=Sum(pos)t-1 | + dt ·kx = -6.7575 | Sum(pos)p=Sum(pos)t-1 + dt -kx = 22,6975 | |
| | Sum(neg)p=Sum(neg)t-1 New CUSUM values | - dt - kx = 21,7400 | Sum(neg)p=Sum(neg)t-1 - dt - kx = -13,7975 New CUSUM values | _ |
| | Sum(pos)t N(pos)t | Sumfnenit Ninenit | Sum(nos)t N(nos)t Sum(neg)t | Nínegít |
| | 0,0000 | 21,7400 0,0000 | 22,6975 0,0000 0,0000 | 0,0000 |
| | Drift | Dadiust | Drift Dadi | ust |
| | Negative | -4,5325 | Yes 4,9000 | |
| | | | | |
| | | OAL3 operating parameters | | |
| | | Dadjust Value to be used for adjustment | t of an AMS when a drift is detected | |
| | | dt Difference between the actual dt-1 Difference between the previou | instrument reading of the AMS and the reference value us instrument reading of the AMS and the reference value | |
| | | hx Operating parameter for detecti hx Constant for calculation of the s | ion of a drift sum of standard deviations | |
| | | kx Constant for calculation of the s necessary adjustment value of | sum of positive and negative differences and for calculation of t the AMS | he |
| Server DB In State IP address 127.0.0.1 | CUSUM Drift | N(pos) Number or samples since detec N(neg) sp provisional normalised sum of th | erron or a positive difference | |
| 2017-08-11 10-05 26 | | st provisional normalised sum of th st-1 provisional normalised sum of th | ne standard deviations of the AMS at timepoint t ne standard deviations of the AMS at timepoint t-1 | |
| | | unst uncertainty from instability (drift- utemp uncertainty relating from variatio uncertainty relating from variatio | and dispersion) expressed as standard deviation ons in ambient temperature expressed as standard deviation ons in ambient pressure expressed as standard deviation | |
| | | uvolt uncertainty relating from variatio uothers uncertainty relating from other s | ons in voltage expressed as standard deviation | |
| | | can affect(Expressed as a stan Sum(pos)p provisional normalized sum for p Sum(pos)thermalized sum for positive difference at t | idard deviation) | |
| | | Sum(pos)t-1 provisional normalized sum for p Sum(neg)p provisional normalized sum for r | negative difference of timepoint t-1 negative difference | |
| | | Sum(neg)t normalized sum for negative diff Sum(neg)t-1 provisional normalized sum for n | ference at timepoint t negative difference at timepoint t-1 | |
| | | | | |
| | | | OK | |
| | L | | | |
| 1 | Select a QAL3 Compor | nent. | | |
| 2 ► | Show character legend | 1. | | |
| +1 | Printing these | values, see "Printing Contro | ol Cards/readings", page 31. | |

7.3.2 CUSUM: View current precision Control Card

Fig. 24: CUSUM: Control Card for precision (with example data)

| 🕒 QAL3-Client | | |
|--|---|--|
| File Components Reading Extra ? | 7 (2) | |
| User Admin | | SICK |
| Component NO | Loss of precision Terropoint | Loss of precision Not Part. point |
| Location Line2 | Duit Negative Intert washing [10.07.2017.07.91.97 | Dalt Interf madeg 08.07 2017 00:08.11 |
| * Corporants | Sams = 7.5000 cact.zero = 3.0000 | Sams = 7.5000 |
| E C Litel | hs = 388,1250 cref,zero = 0,0000 | hs = 1388,1250 cref,span = 1200,0000 |
| . 🕒 NO (1) | ks = 104,0020 IDzero= 104,0000 E00 | ks = j100 span = j100 span |
| | | |
| - ? C Flow | dt-1 st-1 N(s)t-1 -15,0000 893,5999 8 | dt-1 st-1 N(s)t-1 9,0000 0 |
| | | |
| | dt=cref,zero - cact,zero = -3,0000 | dt=cref,span - cact,span = 10,0000 |
| | sp=st-1 + (dt-dt-1)^2/2-ks= 001,0014 | sp=st-1 + (dt-dt-1)*2/2-ks=)*100,0020 |
| | Neue CUSUM-Werte | Neue CUSUM-Werte |
| | dt st N(s)t -3,0000 861,5374 9 | dt st N(s)t |
| | Abnahme der Präzision | Abnahme der Präzision |
| | Yes | No |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| Server DB State P address 127.0.0.1 | CUSUM Precision | M olas Reading |
| 2017-08-11 10:05:35 | | |
| | | |
| 1 > 5 | Select a QAL3 Component. | |
| 2 > 5 | bnow character legend. | |

+1-> Printing these values, see "Printing Control Cards/readings", page 31.

7.3.3 CUSUM: Viewing drift/precision course (as graph)

Fig. 25: CUSUM: Course of drift/precision (with example data)



| 1 | Select a QAL3 Component. |
|---|--|
| 2 | Select Zero or Ref. point. |
| 3 | Select drift or precision. |
| 4 | Format explanation |



Printing these values, see "Printing Control Cards/readings", page 31.

7.3.4 CUSUM: Viewing Control Card values

Fig. 26: CUSUM: Control Card values (with example data)

| C QAL3-Client | 7 (5) | | | | |
|---|---|--|--|---|--|
| User Admin | | | | | SICK |
| Component NO Unit anginet Location Line? | (2) | Z latest moding ^[10,07,2017,0] | 51.52 Loss of precision Dolt | - | Teach parameters |
| + Components | Zeropoint Ref.Point | | | | Order desc. |
| I COND | Nr Timestamp 1 26.06.2017 12:22:48 2 27.06.2017 13:43:23 3 29.06.2017 07:45:51 4 30.06.2017 07:45:51 4 30.06.2017 07:46:04 5 01.07.2017 07:48:11 6 02.07.2017 07:49:59 7 03.07.2017 07:50:16 8 04.07.2017 07:50:26 9 05.07.2017 07:50:51 11 07.07.2017 07:50:51 12 12.08.07.2017 07:51:11 13 09.07.2017 07:51:38 14 10.07.2017 07:51:57 | Value dt 0.0000 0.0000 0.0000 -2,5000 10.0000 -10,0000 -3,8000 -8,8000 -7,5000 7,5000 11,3000 -11,3000 12,5000 -12,5000 -10,0000 12,5000 -22,5000 -22,5000 -3,8000 3,8000 3,0000 -15,0000 3,0000 -3,0000 | Sum(pos) Sum(pos) Sum(pos) -3,7575 0.0000 -6,2575 0.0000 -13,7575 0.0000 0.0425 0.0425 -12,5150 0.0000 3,7425 -3,7425 -11,3150 0.0000 -3,6275 0.0000 -6,2575 0.0000 -6,2425 -6,2425 -20,0150 0.0000 0.0425 0.0425 -18,7150 0.0000 -6,7575 0.0000 | Sum(neg)[b] Sum(neg)[b] -3,7575 0,0000 -1,2575 0,0000 6,2425 6,2425 -1,3150 0,0000 5,0425 5,0425 -5,2150 0,0000 7,5425 7,5425 5,0850 5,0850 13,82275 13,82275 10,0700 0,0700 18,8125 18,8125 11,2550 12,24975 21,7400 21,7400 | sp et -104,0625 0.0000 -100,9375 0.0000 -8,8425 0.0000 -8,8425 0.0000 -24,6825 0.0000 28,7825 28,7825 101,4400 101,4400 47,3775 6,0350 155,0975 155,0975 579,1600 579,1600 820,9424 820,9424 833,5999 983,5999 861,5374 861,5374 |
| Server DB State P address 127.0.0.1 2017-08-11 10-05.35 | COSOM Self COSOM Placinan Horag | His | torical CUSUM values | ig | |
| 1 > 5 | Select a QAL3 Component | | | | |

| 1 | Select a QAL3 Component. |
|---|---|
| 2 | Select Zero or Ref. point. |
| 3 | Control Card values (sorted in chronological sequence) |
| 4 | Reverse sort sequence. |
| 5 | Show character legend (see Fig. 24, page 36). |

7.3.5 CUSUM: Viewing/changing readings - tabular

Fig. 27: CUSUM: Readings - tabular (with example data)

| G QAL3-Client | | | | | |
|--|--|---------------------------------|----------------------------|---|---|
| User Admin | | | | | SICK |
| Component NO Unit mg/m ⁶ Location Line2 | Loss of precision Tom Dolt Topption | latest mading [10.07. | Zeropoint 2017 07 51 52 | Loss of paraisian No. | Flat, point latest mading 06.07 2017 08-06.11 |
| + Components | Table graphical | | | | |
| in O Loui | Nr Timestamp 1 26.06.2017 12:22:48 | Value 0,0000 | Ref.Mat 0,0000 | Nr Timestamp 1 26.06.2017 06:06:21 | Value Ref.Mat 200,0000 200,0000 |
| ! 👄 NO (1) | 2 27.06.2017 13:43:23 3 29.06.2017 07:45:51 4 20.05 2017 07:45:04 | 2,5000 10,0000 2,9000 | 0,0000 0,0000 | 2 27.06.2017 07:56:29 3 28.06.2017 07:56:42 4 29.05 2017 07:56:50 | 199,0000 200,0000 198,0000 200,0000 197,0000 200,0000 |
| 10 Res | 5 01.07.2017 07:48:59 6 02.07.2017 07:49:59 | -3,8000 8,8000 -7,5000 | 0,0000 0,0000 | 5 30.06.2017 07:58:30 6 01.07.2017 07:58:31 | 196,0000 200,0000 195,0000 200,0000 |
| | 7 03.07.2017 07:50:16 8 04.07.2017 07:50:26 | 11,3000 | 0,0000 0,0000 | 7 02.07.2017 07:58:45 8 03.07.2017 07:59:04 | 194,0000 200,0000 193,0000 200,0000 |
| | 9 05.07.2017 07:50:39 10 06.07.2017 07:50:51 11 07.07.2017 07:51:11 | 12,5000 -10,0000 -22,5000 | 0,0000 | 9 04.07.2017 08:04:51 10 05 07.2017 08:05:12 | 192,0000 200,0000 191,0000 200,0000 |
| | 12 08.07.2017 07:51:11 12 08.07.2017 17:51:21 13 09.07 2017 07:51:38 | -3,8000 | RefMaterial | 2 017 08:08:11 | 130,0000 200,0000 |
| | 14 10.07.2017 07:51:57 15 11.07.2017 07:52:04 | 3,0000 | Write a comm | nent | |
| | | | Manipulate re | eading | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Server DB B State IP address 127.0.0.1 | CUSUM Dell CUSUM Precision History | Geopoiet History Rel Po | Hatakal CUSU | Readings | |
| 2017-08-11 10-05-36 | | | | | |

1 ► Select a QAL3 Component.

2 Change reference material/nominal value (see "Managing reference material/determining nominal values (as required)", page 44). [1]

3 Edit marked readings (see "Editing stored readings", page 41).

[1] When several readings are marked: Valid for all marked readings.



Printing displayed values, see "Printing Control Cards/readings", page 31.

7.3.6 CUSUM: Viewing readings - as graph

Fig. 28: CUSUM: Viewing readings - as graph (with example data)



| - | |
|---|---|
| 2 | Course in current campaign |
| | To mark a timepoint: Drag the time cursor with the mouse. |
| 3 | Data at marked timepoint |
| 4 | Data for zero point |

5 Reference point data

7.4 Editing stored readings

Ref. point Taxa . 1.900 Same -Act Value 410,7100 11.9600 Reading comment... × (3) readings -Filter Value Ref.Mat Nr Value Ref.Mat Timestamp Comment -0,0019 -0,0354 0,0000 0,0000 26.06.2017 10:33:16 03.07.2017 10:52:27 13,7857 13,5153 13,6000 13,6000 itch-over failure 2 10.07.2017 10:37:56 -0,0363 0.0000 3 13,9422 13,6000 (4)0,0199 0,0000 4 13,4243 13,6000 0.0074 0.0000 0,0053 0.0000 (1)-0.0203 Ref.-Material 0,0940 0,0365 OK Cancel Write a comment -0.0022 (2) Block reading -0,0004 0.0164 Manipulate reading. Manual reading × -0,0221 0.000 Component NO 0,0343 0,0000 mg/mª Line1 Unit 0,0012 0,0000 0,0000 Location 0,0382 0,0000 Туре -0,0088 0,0000 19.07.2017 💌 Date © No -0.0243 0,0000 12:31:52 Time -0,0228 0,0000 O Re Reading value 6,2000 (5) -0.0242 0.0000 0,0304 0.0000 0,0000 OK Cancel -0.0720 0.0000 -0,0614 0,0000 -0.0174 0.0000 Readings

Fig. 29: Changing/commenting a reading (with example data)

- To exclude or re-include readings in QAL3 processing:
- 1
 Mark at least one reading.
- Call up the Context menu (right mouse button).
- 2 Select block reading or manipulate reading. [1]
- All following readings in the current campaign are then re-evaluated. The action is effective for all marked readings when several readings are marked.

| To e | ent | er a comment for a reading: |
|------|-----|--|
| 1 | ► | Call up the Context menu for a reading (right mouse button). |

- 3 ► If desired: Select a keyword. [1]
- 4 ► Enter the new comment text.
- [1] Explanation see "Viewing/commenting the Maintenance Manual (protocol)", page 46.

To modify a reading value:

- 1 Call up the Context menu for the reading concerned (right mouse button).
- 5 Enter the new value.

7.5 Using semi-automatic readings

Only valid when QAL3 Master runs in a scenario with semi-automatic readings (see "Guideline: Connecting the analyzers", page 16).

7.5.1 How semi-automatic readings function

Semi-automatic readings are used when reference measurement results cannot be retrieved as digital values via Modbus. The reference measurement course is recorded instead.

An analyzer must signal status "Reference measurement running". The MEAC system records the course of the measured values as long as this status is active. These data are transferred into the QAL3 Database.

A user must then call up these data in QAL3 Client and mark the timepoint in the graph at which the measured value is to serve as an actual value. This must be normally done for each of the zero point and reference point.

This work is principally required (for each QAL3 Component) when a new reference measurement has been carried out. The user must decide how often readings should be determined using this method.

7.5.2 Evaluating semi-automatic readings

🕒 QAL3-Client File Components Reading Extra ? Manual reading Semiautom, reading Com Unit Locat × natic reading Flow Components 10.00 100000.00 Real Property 6 Nom.Value 62,50 2 (3) (7)26.06.2017 11:45:20 Checkcycles Timestamp 25.06.2017 11:37:45 - 25.06.2017 11:40:50 ✓ 25.06.2017 19:40:00 - 25.06.2017 19:43:10 ✓ 26.06.2017 03:42:15 - 26.06.2017 03:45:25 (1)😕 Flow 70.000 (8)60.000 26.06.2017 19:46:50 - 26.06.2017 19:49:55 27.06.2017 03:49:10 - 27.06.2017 03:52:15 50.000 (9) 40.000 30.000 Mark for deletion (4) Zerop Zeropoint 20.000 (5)Ref.-Point Ref.-Point Select all 10.000 c 11:44 11:45 11:45 11:45 11:45 11:46 11:46 11:46 11:46 11:47 11:47 11:47 Timestamp 26.06.2017 11:45:15 Value 56,2489 Ref.Mat Timestamp 26.06.2017 11:46:55 Value 70168,7500 Ref.Mat (13) Reference material (11) (12)(14) Delete Select all (15) Close

Fig. 30: Semi-automatic reading (with example data)

1 Select a QAL3 Component.

| 2 | List of stored reference measurements (calibration cycles) ^[1] |
|--------|---|
| | No marking: No value has been selected yet from this reference measurement. |
| | Green marking: A value has been selected from this reference measurement. |
| | Red marking: Marked for deletion. |
| 3 | Delete reference measurements marked for deletion. |
| 4 | Mark for deletion. |
| 5 | ► Mark all. |
| [1] \$ | Setting option, see "Additional functions", page 27. |
| | |

6 Measured value course of selected reference measurement

- 7 Data at marked timepoint
- 8
 To select reading timepoint: Drag the time cursor with the mouse.
- 9 To create a reading at marked timepoint:
 - Call up the Context menu (right mouse button).
 - Select Zero or Ref. point.
- 11 Selected actual value for zero point
- 12 Selected actual value for reference point
- 13 Select reference material/nominal for marked reference measurement.
- 14 Delete marked reference measurement.
- 15
 Mark all reference measurements in this list.

16 ► Save the status shown.



Stored evaluations cannot be modified. Evaluated reference measurements no longer appear in the list of reference measurements.

7.6 Managing reference material/determining nominal values (as required)

When readings for a QAL3 Component do not include nominal values:

Define the reference materials for zero point and reference point for this QAL3 Component (see Fig. 31).



| - | |
|------------------|--|
| QAL3-Client | nate Description (Friday) 2 |
| File Compon | nis reading Exita : |
| User A | |
| Component | Settings Vsers |
| C | Maintenance manual RefMaterial |
| Standard referen | e material activate |
| | Act.Value |
| • Compose | offline mode Nom.Value |
| | Warninglimit |
| | Timestamo Status Nom Value |
| | Reference material management |
| | Component NO |
| | Unit mg/m* Location Line1 |
| | New 2 |
| | Type 4 Auto Ref. Zeo 0,0000 Null |
| | C Null 3 C Ref 3 Auto RefSpan 410,7100 Span - aktiviet |
| | Nominal value 0.0000 (4) |
| | Identification Auto Re 5 |
| | use not as default |
| | Attention: RefMaterials marked as standard |
| | have priority! If nominal values are transferred, then |
| | do not select standard refmaterial! |
| | |
| | Explanation |
| | Zero |
| | Reference |
| | OK Cancel |
| | |
| 1 🕨 Sel | ect a QAL3 Component. |
| 2 ► If re | guired: Set up a new reference material. |
| 3 ► She | cify if the new reference material is valid for the zero or reference point |
| A Ent | ar pominal value for new reference material |
| | |
| 5 F Ent | er desired name for new reference material. |
| 6 List of | reference materials stored for this QAL3 Component [1] |
| 7 ► If re | quired: Use this reference material as standard reference material for all readings of this QAL3 Com- |
| por | ent (nominal value for zero or reference point). [2] |
| 8 Status | display for QAL3 Component when a standard reference material is activated |
| [1] Stored r | eference material cannot be modified. |
| [2] Status d | isplay in this list: "Activated". |
| | |
| | NOTE: Consequences of a standard reference material |
| | When a standard reference material is activated, this reference material is used for |
| | all new OAL3 evaluations in the active campaign of the associated OAL3 Component |
| | This is also valid when a different reference material or nominal value is specified in |
| | the original readinge |
| | ute original readings. |
| | The standard reference material is also used retroactively when all readings of the |
| | anthe an experience of a second value of This action of the second second second second second second second se |
| | active campaign are re-evaluated. This can occur, for example, when readings of the |
| | active campaign are re-evaluated. This can occur, for example, when readings of the active campaign are blocked or released. |

7.7 Manual entry of readings

Manual entry of readings is also possible. This is also valid when readings are imported fully automatic or semi-automatic.

Fig. 32: Manual reading (with example data)

| 0 | QAL3-Client | | | | | |
|------|---|--|--|--|--|--|
| File | Components Reading E | xtra ? | | | | |
| Us | Manual reading | | | | | |
| Car | Semiau | utom. reading | | | | |
| Uni | 8 | | | | | |
| Loc | ution | De acastera des astro | | | | |
| - | | Manual reading | | | | |
| | Components | Unit mg/m ^a | | | | |
| | | Location Line1 | | | | |
| | | Date 04 217 Type Time 133553 - C Null 4 Reading value 3 C Ref 14 | | | | |
| | | RefMaterials | | | | |
| | | ID Name Nominal va Type Defau | | | | |
| | | C Null C Ref Add Ner.280 0,0000 Null | | | | |
| | | Nominal value Save 6 use as default | | | | |
| | | Attention: RefMaterials marked as standard have priority! If nominal values are transferred, then do not select standard refmaterial! | | | | |
| | | Explanation | | | | |
| | | Zero | | | | |
| | | Cancel | | | | |
| | | | | | | |
| 1 | Select a QAL3 C | Component. | | | | |
| 2 | Enter timepoint | at which this reading is valid. (Standard value: Current time.) | | | | |
| 3 | Enter the actual value. | | | | | |
| 4 | 4 ► Specify if reading valid for zero or reference point. | | | | | |
| 5 | Select reference | e material for reading. | | | | |
| 6 | If required: Def | ine standard reference material. | | | | |
| 7 | ▶ If required: Set | up a new reference material. | | | | |



Consequences of a standard reference material, see "Managing reference material/ determining nominal values (as required)", page 44.

8 Maintenance functions

8.1 Viewing/commenting the Maintenance Manual (protocol)

QAL3 Master records all user actions automatically - without time limit and separately for each QAL3 Component.

- A comment can be entered for each protocol entry. Comments can have a keyword ("Category"). Keywords can be used as filter criteria.
- Comments can also be added as independent protocol entries.

Fig. 33: Function "Maintenance Manual" (with example data)

| 🕒 QAI | .3-Client | | | | | |
|-------------------|--------------------------|--------------------------------------|--|---------|----------------------------------|----------|
| File (| Components Read | ng Extra ? | | | | |
| User | Admin | Settings | | | | |
| Comr | onent | Language | Zeropoint | _ | | |
| Unit | | Settings | | _ | | |
| Locat | ion | Maintenance manual | latest reading | | | |
| | | | | | | |
| Mainten | ance manual | | | _ | | |
| Rang | onent NU e [0,00 - 50 |),00] | Analyzer MLS1UUFI Location Line1 | | <u> </u> | |
| - - <u>- </u> 0 | unei ∋NO / | 30.06.2017 10:59:21 | Admin | — I I | Filter | |
| | 5 TOC 5 CO2 | Entry | 6 | | Ireadings | 4) |
| | Flow | Ables.man.Komment | | ; | Period Start 05.0 | 5) 🗖 🖥 |
| | (1) | Author Admin (7) | Category readings (8) | | Campagin | |
| | Ĭ | Comment | | | ID Start 1 01.05.2017.11-27-5 | Stop |
| | | switch-over failure | | \sim | 01.03.2017 11.37.5 | 6 |
| | | | 10 | | | 9 |
| | | | 10 | | | |
| | | | | | | |
| | | | | | | 1 |
| | | New(2) - Disca | | **(12) | | <u> </u> |
| | | Nr Date Ti | me Entry | | Comment | |
| | | 32 30.06.2017 10 31 04.08.2017 12 | 0:59:21 Ables.man.Komment 3:15:09 Ablesung gesperrt Reading ID: 10 | | switch-over failure |] |
| | | 29 04.08.2017 12 28 04.08.2017 12 | 2:33:02 manual reading added. Actual value 1 | 13 | | |
| | | 27 04 00 2017 1 | 24:40 Ablesung freigegeben Reading ID: 10 50:40 Ablesung freigegeben Reading ID: 10 | | | |
| | | 9 25.07.2017 1 | 3:27:46 Campaign started | | | |
| | | 1 25.07.2017 13 | st21:09 new component: NU [0,00-500,00] mg | NY | | |
| Explanati | ion . | | | | | |
| N | io active campaign | | | 1 | | |
| | | | OK Cance | | | |
| 1 | Select a QA | L3 Component. | | | | |
| 2 ► | To write a i | ew comment as addi | tional protocol entry: Click h | ere. | | |
| 3 🕨 | To add or d | hange a comment for | an existing protocol entry: | Aark th | e protocol entry invol | ved (m |
| 4 ► | Restrict lis | [3] to entries contain | ing the selected keyword (ca | tegory) | | ` |
| 5 ► | Restrict lis | [3] to the time period | entered. | | | |
| 6 • | Restrict lis | [3] to the selected ca | mpaign. | | | |
| 6 [| ate of marke | d protocol entry | r0 | | | |
| 7 0 | urrent user (| automatically author c | f new/changed comment) | | | |
| 8 | Select kev | ord for marked protor | col entry. | | | |
| 9 | Create new | keyword. | | | | |
| 10 0 | comment text | for marked protocol e | ntrv | | | |
| | Enter the n | ew comment text here | or change the existing com | ment te | ext. | |
| 11 | Discard ch | inges. | | | | |
| 12 | Save chan | <u>es</u> | | | | |
| - <u>~</u> ^ | Sure onang | | | | | |

8.2 Backing up data

8.2.1 Using Backup functions

The QAL3 Master Backup functions access the QAL3 Database. All QAL3 data and all program configuration settings are contained therein. The program modules are not saved during a backup.

The QAL3 Master Installation program can be used to replace a damaged QAL3 Database by a backup or to use a saved QAL3 database during a new installation.



Perform regular QAL3 Database backups.
 Configure automatic backups.



8.2.2 Starting a manual backup

- 1 Start a manual Backup (see Fig. 34).
- 2 Enter the folder path in which the backup is to be stored.

8.2.3 Configuring automatic backups



To be able to configure automatic backups: Start a QAL3 Client with Administrator rights on the PC on which QAL3 Database is installed.

- 1 Call up Backup function "Task create" (see Fig. 34).
- 2 To create a backup control task in the Windows Task Scheduler:
 - Enter the folder path in which the backup is to be stored.
 - Set the desired task time settings.

Fig. 34: Backup functions

| File Components Reading | Extra ? | | Settings Database | ene l |
|-------------------------|---------------------------|------------------------|----------------------|-------------|
| User Admin | Settings Language | | Backup (1 |) |
| Component | Settings + | Zeropoint | Manual ba | ckup |
| Location | Maintenance manual | Meet mading | D:\QAL3 Master_OI | |
| | Refresh | ActValue | 2 | 3 |
| Components | offline mode | NonValue | Task create | Task delete |
| III C Line1 | Wanaged | | | |
| | Texestanp | Status Non. Value | | |
| 1 🕨 Start a manu | al backup. | | | |
| 2 ► Call up the W | indows Task Scheduler to | configure automatic ba | ckups. | |
| 3 Delete the ta | sk configured for automat | ic backups | | |

8.2.4 Restoring a backup

- 1 Start the QAL3 Master Installation program on the PC on which QAL3 Database is installed (see "Installing the QAL3 Master", page 14).
- 2 Select "Import QAL Database".



9 Troubleshooting

9.1 Errors during QAL3 evaluation

9.1.1 A warning/alarm display is not correct

| Possible cause | Corrective measures | Notes for Service |
|--|---|---|
| Warning and alarm limits are not cor- rect for active campaign. | Shewhart: Incorrect warning limit: Correct while active campaign is running. Incorrect alarm limit: Terminate active campaign. Start a new campaign with corrected alarm limit. | Check stored read- ings: Exceptions? Discrepancies? |
| | CUSUM: Terminate active campaign. Start a new campaign. Recalculate CUSUM parameters when starting. | |

9.1.2 Some QAL3 values are clearly wrong

| Possible cause | Corrective measures | Notes for service |
|--|---|--|
| Mapping not correct. | Check/correct mapping (see "Configuring Mapping (assigning data sources)", page 24). | |
| Incorrect Modbus register specified. | Check/correct (in "Universal Modbus" Con- figuration program). | Analyze Modbus reg- isters and data types. |
| Incorrect reference material specified. | Check/correct reference material (for QAL3 Component involved) (see "Managing refer- ence material/determining nominal values (as required)", page 44). | View actual and nominal values in previous readings. |
| <i>If readings entered manually:</i> Entries were (partially) incorrect. | If correct values are known: Correct the reading. Otherwise: Block the reading involved. → see "Editing stored readings", page 41. | |
| For semi-automatic readings: Zero point and reference point swapped for some readings. | Block incorrect readings. Replace these readings with manual entries. | |

9.1.3 Connection to QAL3 Database not present

| Possible cause | Corrective measures | Notes for service |
|--|---|---|
| Incorrect IP address of the PC on which QAL3 Database is running spec- ified in QAL3 Master. | Check and correct the IP address (see "Starting the program (QAL3 Client)", page 19). | Use static IP address or host name. |
| For dynamic IP addresses: IP address changed. | | |
| Incorrect internal name of QAL3 Data- base used specified in QAL3 Master. | Check and correct name of QAL3 Database used (see "Starting the program (QAL3 Cli- ent)", page 19). | |
| There is a general problem in the net- work. | Check all devices belonging to the QAL3 Network are in operation. Check hardware connections (plug connections, cables, switches). Check if other network malfunctions exist. | Check that the PC on which QAL3 Data- base is running is generally accessible in the network. |
| Incorrect port specified in QAL3 Mas- ter. | Check and correct the IP port (see "Starting the program (QAL3 Client)", page 19). | |
| Specified IP port not released. | Check IP port/arrange IP port release. | Check ports, e.g., |
| Network connection blocked in a fire- wall. | Release all QAL3 Master program modules in the firewall. | with "Telnet". |

9.2 Malfunctions in program functions

9.2.1 Printing not functioning

| Possible cause | Corrective measures | Notes for service |
|--|--|---|
| Printer used not ready. | Visually check current operating state of printer used. | Check current/tem- porary blocks/autho- rizations. |
| Connection to printer interrupted. | Check hardware connections (plug connections, cables, switches). | |
| If printer is connected via network: Printer not accessible or blocked. | Check if other network malfunctions cur- rently exist. | Check printer is gen- erally accessible in the network. |

9.2.2 E-mail alarm not functioning

| Possible cause | Corrective measures | Notes for service |
|---|---|-------------------|
| Incorrect E-mail Server connection configuration. | Check/correct (see "Activating e-mail alarms", page 25). | |
| Incorrect e-mail address (receiver address). | Check/correct (see "Setting up/managing users", page 20). | |
| QAL3 Server not running. | | |
| Alarm driver not running. | | |
| E-mail Server not in operation. | Check for temporary Server restrictions. | |

9.2.3 Backup not functioning

| Possible cause | Corrective measures | Notes for service |
|---|--|-------------------|
| Connection to storage medium on which backups are to be stored is interrupted. | Check electrical connection. Check storage medium is recognized by Windows. | |
| Insufficient free storage capacity on storage medium on which backups are to be stored. | Check storage medium status. Check if older backups can be deleted. | |
| Program "MySQLDump.exe" missing in the folder in which QAL3 Database is installed. | Reinstall MariaDB Server. | |
| Automatic backups: Task deleted by mistake. | Reconfigure automatic backups. | |
| The PC on which QAL3 Database is installed is/was not in operation. | ► Check. | |

10 Shutting down/interrupting operation

10.1 Information on interrupting program operation

- Automatic E-mail alarm (option) only functions when at least one -"QAL3 Client" is running.
- Automatic processing of QAL3 Data (store new data in QAL3 Database and calculate QAL3 Values) only functions when program module "QAL3 Server" and the QAL3 Drivers which transfer automatic readings to QAL3 Database are running.
- After program operation has been interrupted, readings not transferred during the interruption are subsequently automatically retrieved by QAL3 Master. This only functions for readings that remain stored in the analyzers or MEAC system during the interruption.



Some current readings could be lost when the interruption in program operation exists for a long time.

This is not the case when all readings are stored in a MEAC system.



QAL3 Data continue to be stored in a running MEAC system when the MEAC driver does not run temporarily. The QAL3 Data are then transferred to QAL3 Database when the MEAC driver is running again.

10.2 Preparing to interrupt program operation

Make a backup (see "Starting a manual backup", page 47).

10.3 Checking/clearing data gaps

After an interruption in program operation:

Call up the list of readings and check if any are missing based on the timestamp.

If readings are missing:

Check whether data for missing readings can be determined (e.g., visually on the analyzers). If this is the case: Enter missing readings (see "Manual entry of readings", page 45).



All user actions are automatically recorded (see "Viewing/commenting the Maintenance Manual (protocol)", page 46).

11 Using the "UniversalModbus" software

11.1 Modbus program window: Operating functions

- The Modbus program window is displayed permanently when the -"Universal Mod-+i
 - bus" software or MEAC Add-on "MEAC Universal Modbus" is running.
 - The Modbus program window is applicable for just one Modbus variant. Several Mod-. bus program windows exist when several Modbus variants run at the same time.

Fig. 35: Modbus program window: Operating functions

| SICK Sensor Intelligence | PF Thro 8 9 10 11 12 13 Config Port Modbus Data Clear log 3 V.1.0 21.03.2016 23:12:56 No response received (request (FC 4, Addr 5000, Count 20) 21.03.2016 23:12:57 Failed to send request (FC 4) Count 20, Timeout during operation |
|--|--|
| Path Sleve 1. BCU Hamerical Ing Disortie spon Disortie | Konfiguration 2 Log 1/0 traffic 3 Restart 4 Terminate 5 |
| (15) Current data VDI42 | 01 Simulation VDI4201 Reference materials VDI4201 Etikett |

| 1 | Modbus variant identification |
|----|---|
| 2 | Call up configuration functions for this Universal Modbus variant. ^[1] |
| 3 | Record data transfers of this Modbus variant. ^{[2][3]} |
| 4 | Terminate and restart data transfer of this Universal Modbus variant. |
| 5 | Terminate this Modbus variant. |
| 6 | Call up information on Universal Modbus. |
| 7 | Status display for Modbus configuration ^[4] |
| 8 | Status display for hardware interfaces used [4] |
| 9 | Status display for Modbus data transfer ^[4] |
| 10 | Status display for values transferred [4] |
| 11 | Activate/deactivate display of Log messages (14). ^[5] |
| 12 | ► Clear the Log. ^[5] |
| 13 | Symbol for current user access rights ^[6] |
| 14 | Log messages |
| 15 | Standard function |
| 16 | Special functions for Guideline VDI 4201 [7] |
| 17 | Lists and display depending on function selected |

Not present on a PC with MEAC300. In this case, call up the corresponding configuration function in MEAC300 (description, see "Technical Information MEAC300 Add-ons").
 In text file <Installationsordner>\log\MBxx.log (xx = Modbus variant number in Interface list).
 Only available with extended access rights (see [13]).
 BLUE = operating state. RED = Modbus operation is possibly interrupted.

[5] Only available with the highest access rights (Supervisor).
[6] "Open padlock"" = the logged in user has the extended access rights for the Modbus operating functions.
[7] Only when corresponding program configuration present.

11.2 Modbus program window: Modbus Status

Select the tab for current data in the Modbus window.



| | Universal Mod 1 evice 2, Location: E | 3CU_V4, RTU master COM11 (9600,8,N,1 | .) | | |
|-------|---|--|---|--------------|--|
| | SICK Sensor Intelligence | Me Ref Medice Data | | B *** | |
| | Path 2 Numerical mutus Discrete inputs Numerical outputs 1: VDI Comp 1 -2: DVI Comp 1 -3: VDI comp 2 -3: VDI comp 2 -1: Failure -2: Maintenance -3: Check -3: Check -4: VOI control -5: Simulation -5: Simulation | Current Data 3 1500,0000 0,0000 15,0000 0,0000 False False False False | Timestamp 4 21.3.2016 22:47:27 21.3.2016 22:47:27 21.3.2016 22:47:27 21.3.2016 22:47:27 21.3.2016 22:47:27 21.3.2016 22:47:27 21.3.2016 22:47:27 21.3.2016 22:47:27 21.3.2016 22:47:27 21.3.2016 22:47:27 21.3.2016 22:47:27 21.3.2016 22:47:27 | | |
| | | | | | |
| 1 M | odbus variant identification | | | | |
| 2 Cc | nfigured Modbus inputs and o | outputs of this Modbus va | ariant | | |
| 3 La | st values transferred | | | | |
| 4 Tir | nestamp of last values transfe | rred | | | |

12 Printed data examples

12.1 Printed Control Cards

Fig. 37: Printed Shewhart Control Card (example)

| | Shewhart - Con | trol card (EN14181) | SICI |
|-----------------|------------------------|---------------------|------------------------|
| AMS-Type | MCS100FT | | |
| Manufacturer: | SICK | | |
| Component | NO | | |
| Location | Line1 | | |
| Unit | mg/m³ | | |
| Range: | 0 - 500 | | |
| Campaign Start: | 01.05.2017 11:37:52 | | |
| Z | eropoint | R | ef.point |
| Sams | 5,0080 | Sams | 6,9800 |
| Nom.value | 0,0000 | Nom.value | 410,7100 |
| Act.value | 10,3000 | Act.value | 402,5613 |
| Drift | 10,3000 | Drift | -8,1487 |
| | Test: Warni | ng limit | |
| Drift > | 5,0080 ? | Drift > | 6,9800 ? |
| Test results: | Warn. limit exceedance | Test results: | Warn. limit exceedance |
| | Test: Alarr | n limit | |
| Drift > | 10,0160 ? | Drift > | 13,9600 ? |
| Test results: | Alarm limit exceedance | Test results: | No exceedance |
| Date | | | |
| | | | |
| Τe | echnician | | Signature |
| | | | - |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Fig. 38: Printed CUSUM Control Card (example)

| Timestamp .06.2017 07:56:29 .06.2017 07:56:42 .06.2017 07:56:50 .06.2017 07:58:18 .07.2017 07:58:45 .07.2017 07:59:04 .07.2017 08:04:51 .07.2017 08:05:12 .07.2017 08:06:11 | Value 9 199,0000 2 198,0000 2 198,0000 3 196,0000 4 195,0000 5 194,0000 1 192,0000 1 192,0000 1 192,0000 1 190,0000 | Drift 1,0000 2,0000 3,0000 4,0000 5,0000 6,0000 7,0000 8,0000 9,0000 10,0000 | Sum(pos)p -2,7575 -1,7575 0,2425 1,4850 3,7275 6,9700 11,2125 16,4550 22,6975 | Sum(pos) 0,0000 0,0000 0,2425 1,4850 3,7275 6,9700 11,2125 16,4550 22,6975 | Sum(neg)p -4,7575 -5,7575 -6,7575 -7,7575 -8,7575 -9,7575 -10,7575 -11,7575 -12,7575 -13,7575 | Sum(neg) 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 | SP -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 | ST 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 |
|--|---|---|--|---|---|--|--|--|
| 06.2017 07:56:29 06.2017 07:56:42 06.2017 07:56:50 06.2017 07:58:18 07.2017 07:58:31 07.2017 07:58:45 07.2017 07:59:04 07.2017 08:04:51 07.2017 08:05:12 07.2017 08:06:11 | 199,0000 198,0000 198,0000 197,0000 197,0000 195,0000 195,0000 194,0000 192,0000 191,0000 190,0000 | 1,0000 2,0000 3,0000 4,0000 5,0000 7,0000 8,0000 9,0000 10,0000 | -2,7575 -1,7575 -0,7575 0,2425 1,4850 3,7275 6,9700 11,2125 16,4550 22,6975 | 0,0000 0,0000 0,2425 1,4850 3,7275 6,9700 11,2125 16,4550 22,6975 | -4,7575 -5,7575 -6,7575 -7,7575 -8,7575 -9,7575 -10,7575 -11,7575 -12,7575 -13,7575 | 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 | -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 | 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 |
| 06.2017 07:56:42 06.2017 07:56:50 06.2017 07:58:18 07.2017 07:58:31 07.2017 07:58:45 07.2017 07:59:04 07.2017 08:04:51 07.2017 08:05:12 07.2017 08:06:11 | 2 198,0000 3 197,0000 4 195,0000 5 194,0000 4 193,0000 1 192,0000 1 192,0000 1 190,0000 | 2,0000 3,0000 4,0000 5,0000 7,0000 8,0000 9,0000 10,0000 | -1,7575 -0,7575 0,2425 1,4850 3,7275 6,9700 11,2125 16,4550 22,6975 | 0,0000 0,0000 0,2425 1,4850 3,7275 6,9700 11,2125 16,4550 22,6975 | -5,7575 -6,7575 -7,7575 -8,7575 -9,7575 -10,7575 -11,7575 -12,7575 -13,7575 | 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 | -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 | 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 |
| .06.2017 07:56:50 .06.2017 07:58:18 .07.2017 07:58:31 .07.2017 07:58:45 .07.2017 07:59:04 .07.2017 08:04:51 .07.2017 08:05:12 .07.2017 08:06:11 | 0 197,0000 3 196,0000 1 195,0000 5 194,0000 4 193,0000 1 192,0000 2 191,0000 1 190,0000 | 3,0000 4,0000 5,0000 7,0000 8,0000 9,0000 10,0000 | -0,7575 0,2425 1,4850 3,7275 6,9700 11,2125 16,4550 22,6975 | 0,0000 0,2425 1,4850 3,7275 6,9700 11,2125 16,4550 22,6975 | -6,7575 -7,7575 -8,7575 -9,7575 -10,7575 -11,7575 -12,7575 -13,7575 | 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 | -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 | 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 |
| .06.2017 07:58:18 .07.2017 07:58:31 .07.2017 07:58:45 .07.2017 07:59:04 .07.2017 08:04:51 .07.2017 08:05:12 .07.2017 08:06:11 | B 196,0000 I 195,0000 I 194,0000 I 193,0000 I 192,0000 I 192,0000 I 190,0000 | 4,0000 5,0000 6,0000 7,0000 8,0000 9,0000 10,0000 | 0,2425 1,4850 3,7275 6,9700 11,2125 16,4550 22,6975 | 0,2425 1,4850 3,7275 6,9700 11,2125 16,4550 22,6975 | -7,7575 -8,7575 -9,7575 -10,7575 -11,7575 -12,7575 -13,7575 | 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 | -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 | 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 |
| .07.2017 07:58:31 .07.2017 07:58:45 .07.2017 07:59:04 .07.2017 08:04:51 .07.2017 08:05:12 .07.2017 08:06:11 | 1 195,0000 5 194,0000 4 193,0000 1 192,0000 2 191,0000 1 190,0000 | 5,0000 6,0000 7,0000 8,0000 9,0000 10,0000 | 1,4850 3,7275 6,9700 11,2125 16,4550 22,6975 | 1,4850 3,7275 6,9700 11,2125 16,4550 22,6975 | -8,7575 -9,7575 -10,7575 -11,7575 -12,7575 -13,7575 | 0,0000 0,0000 0,0000 0,0000 0,0000 | -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 | 0,0000 0,0000 0,0000 0,0000 0,0000 |
| .07.2017 07:58:45 .07.2017 07:59:04 .07.2017 08:04:51 .07.2017 08:05:12 .07.2017 08:06:11 | 5 194,0000 4 193,0000 1 192,0000 2 191,0000 1 190,0000 | 6,0000 7,0000 8,0000 9,0000 10,0000 | 3,7275 6,9700 11,2125 16,4550 22,6975 | 3,7275 6,9700 11,2125 16,4550 22,6975 | -9,7575 -10,7575 -11,7575 -12,7575 -13,7575 | 0,0000 0,0000 0,0000 0,0000 0,0000 | -103,5625 -103,5625 -103,5625 -103,5625 -103,5625 | 0,0000 0,0000 0,0000 0,0000 0,0000 |
| .07.2017 07:59:04 .07.2017 08:04:51 .07.2017 08:05:12 .07.2017 08:06:11 | 4 193,0000 1 192,0000 2 191,0000 1 190,0000 | 7,0000 8,0000 9,0000 10,0000 | 6,9700 11,2125 16,4550 22,6975 | 6,9700 11,2125 16,4550 22,6975 | -10,7575 -11,7575 -12,7575 -13,7575 | 0,0000 0,0000 0,0000 0,0000 | -103,5625 -103,5625 -103,5625 -103,5625 | 0,0000 0,0000 0,0000 0,0000 |
| .07.2017 08:04:51 .07.2017 08:05:12 .07.2017 08:06:11 | 1 192,0000 2 191,0000 1 190,0000 | 8,0000 9,0000 10,0000 | 11,2125 16,4550 22,6975 | 11,2125 16,4550 22,6975 | -11,7575 -12,7575 -13,7575 | 0,0000 0,0000 0,0000 | -103,5625 -103,5625 -103,5625 | 0,0000 0,0000 0,0000 |
| .07.2017 08:05:12 .07.2017 08:06:11 | 2 191,0000 1 190,0000 | 9,0000 10,0000 | 16,4550 22,6975 | 16,4550 22,6975 | -12,7575 -13,7575 | 0,0000 | -103,5625 -103,5625 | 0,0000 |
| .07.2017 08:06:11 | 1 190,0000 | 10,0000 | 22,6975 | 22,6975 | -13,7575 | 0,0000 | -103,5625 | 0,000(|
| | | | | | | | | |
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12.2 Printed course of readings as graph



Fig. 39: Readings of a Shewhart campaign as printed graph (example)



Fig. 40: Readings of a CUSUM campaign as printed graph (example)

12.3 Printed Readings Table

Fig. 41: Readings of a Shewhart campaign as Table (example)

| | e1 | on | NO Locatio | Component |
|-----------------|------------|---------------|---------------------|-----------|
| | | 52 | 01.05.2017 11:37 | Campaign |
| | 1 | Zeropoi | | |
| Drift | Act.Value | Status | iding date | Rea |
| 0,0097 | 0,0097 | ok | 27.06.2017 10:59:27 | |
| 0,0097 | 0,0097 | ok | 28.06.2017 10:59:28 | |
| 0,0097 | 0,0097 | ok | 29.06.2017 09:59:07 | |
| 0,1683 | 0,1683 | ok | 01.07.2017 10:03:35 | |
| 2,1144 | 2,1144 | ok | 02.07.2017 10:07:04 | |
| 0,0175 | 0,0175 | ok | 03.07.2017 10:06:08 | |
| -0,6165 | -0,6165 | ok | 04.07.2017 10:03:28 | |
| -0,1944 | -0,1944 | ok | 05.07.2017 09:59:04 | |
| 0,0343 | 0,0343 | ok | 06.07.2017 09:59:12 | |
| 0,7468 | 0,7468 | ok | 07.07.2017 09:58:58 | |
| 0,5840 | 0,5840 | ok | 08.07.2017 09:59:03 | |
| 6,0756 | 6,0756 | Warning | 09.07.2017 09:59:19 | |
| -0,5202 | -0,5202 | ok | 10.07.2017 09:59:10 | |
| -0,7322 | -0,7322 | ok | 10.07.2017 12:11:54 | |
| 5,6803 | 5,6803 | Warning | 11.07.2017 10:02:37 | |
| 5,6803 | 5,6803 | Warning | 12.07.2017 10:03:39 | |
| 0,1019 | 0,1019 | ok | 13.07.2017 10:06:32 | |
| 0,1019 | 0,1019 | ok | 14.07.2017 09:17:20 | |
| -0,6089 | -0,6089 | ok | 15.07.2017 09:17:31 | |
| 2,6306 | 2,6306 | ok | 17.07.2017 07:10:25 | |
| 2,6306 | 2,6306 | ok | 18.07.2017 08:14:39 | |
| 6,2000 | 6,2000 | Warning | 19.07.2017 12:31:52 | |
| 10,3000 | 10,3000 | Alarm | 20.07.2017 12:32:48 | |
| | | | | |
| D.:!# | A st Malus | Ref.poi | | |
| Drift 6.5700 | Act. value | Status | 26 06 2017 10:06:52 | Rea |
| -0,5790 | 404,1310 | UK | 20.00.2017 10.00.55 | |
| -0,5790 | 404,1310 | OK Marning | 11 07 2017 10:25:17 | |
| -0,1407 | 402,5013 | warning | 11.07.2017 09.31.49 | |

Date 04.08.2017

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