bürkert
FLUID CONTROL SYSTEMS

# Type 8620
# mxCONTROL

## Multifunction
## Water Treatment
## Controller

# Operating Instructions

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We reserve the right to make changes without notice!



Operating instructions 1007/03_EU_EN_00805853

# Contents



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# 1 The operating instructions

**WARNING!**

**The operating instructions must be read and understood.**

**Read the operating instructions carefully.**

**Note the chapters Intended Use and General Safety Instructions!**

## Presentation elements

**DANGER!**

**Mains voltage! Immediate danger!**
**Death or serious injuries are the result of non-compliance with the safety instructions.**

**DANGER!**

**Immediate danger!**
**Death or serious injuries are the result of non-compliance with the safety instructions.**

**WARNING!**

**Potentially dangerous situation!**
**Serious injuries or death may result from non-compliance with the safety instructions.**

**CAUTION!**

**Potentially dangerous situation!**
**Medium or light injuries may result from non-compliance with the safety instructions.**

**CAUTION!**

**Potentially dangerous situation!**
**Likely property damages in case of non-compliance.**

Designates important additional information, tips and recommendations important for your safety and the flawless function of the device.

Refers to information in these operating instructions or other documentation.

→ Marks a section you have to carry out.

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# 2 Intended Use

**WARNING!**

**Hazards to persons, equipment in the vicinity and the environment may result when not using the „Type 8620 mxCONTROL“ as intended.**

**The „Type 8620 mxCONTROL“ may not be used in explosion-hazard rooms.**

**The „Type 8620 mxCONTROL“ may only be used at temperatures from 0 °C.**

**The permissible data and operating conditions specified in the operating instructions as well as the application areas described in chapter 6.1 must be followed. The customer is responsible for choosing the device suitable for his application.**

**Proper transport, proper storage and installation as well as careful operation and service are the prerequisites for safe and flawless operation.**

**Use the „Type 8620 mxCONTROL“ only as intended.**

The „Type 8620 mxCONTROL“ is a multifunction controller. This multifunction controller was developed to **automate the control and process variables in a water treatment system** (e.g. boiler, cooling tower or Reverse Osmosis system).

Sophisticated electronics and state of the art control algorithms ensure that optimum process control is maintained at all times, with minimal operator intervention.
Depending on the hardware version, the „Type 8620 mxCONTROL“ is capable of processing several analog and digital inputs as well as several relay, transistor and analog outputs at the same time. Combined with an easy to read display in three languages: English, German and French (other languages on request), the device offers nearly unlimited options for process automation systems.

The „Type 8620 mxCONTROL“ functions are highly software-based. All **configuration and parameter files** can be created in a quick and unsophisticated manner **with the help of a PC Tool** and downloaded in the „Type 8620 mxCONTROL“ via SD card or USB. Alternatively, the optional Ethernet interface can be used to configure and parameterize the device. The operator can then enter and display all important variables and parameters using five soft-touch keys.

The „Type 8620 mxCONTROL“ is **supplied with an SD card** containing not only the configuration and parameter files but also the **operating instructions.**

Three authorization levels (code level) allow for the safe operation of the „Type 8620 mxCONTROL“: Open access, access only for instructed operators, access for specialists.

## 2.1 Restrictions

Note possibly existing restrictions when exporting the device.

## 2.2 Anticipated misuse

- The „Type 8620 mxCONTROL“ may not be used in explosion-hazard areas!
- Do not put mechanical stress on the unit (e.g. by storing heavy objects on it or using it as a step).

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# 3 General Safety Instructions

These safety instructions do not take any

- Incidents and occurrences into account which may occur during assembly, operation and maintenance of the devices.
- Local safety regulations where the operating party is responsible for its compliance, also in regard to the installation staff.

**DANGER!**

**Danger from electrical voltage**

Reaching into the system presents an acute risk of injury.

Always switch off the power before beginning with the work activities and secure it against being switched back on inadvertently! Obey the applicable accident prevention and safety regulations for electrical devices!

**WARNING!**

**Inadvertent operation or impermissible restrictions may cause general danger situations through the downstream actuators, including physical injuries.**

Take proper precautions to prevent accidental actuation or inadmissible impeding.

Dangerous situations may develop during installation and repair activities. This type of work may only be carried out by authorized technical personnel and with suitable tools!

After an interruption of the electric supply, ensure a defined and controlled restart of the processes!

**WARNING!**

**Personal injuries and damage to the system may occur following a system interruption or after manual operation through unwanted operation of output devices.**

Before **changing the mode of operation** (Manual or Automatic), appropriate measures must be taken to prevent harm to personnel and the system due to unwanted actuation of an output device (e.g. biocide pump).

**CAUTION!**

**The general engineering rules apply to the deployment planning and operation of the device!**

Disregarding these rules may result in injuries and/or damages to the device and possibly its environment.

Follow the general rules of engineering!

**CAUTION!**

**Electrostatically endangered components/modules**

The device contains electronic components which may react sensitively against electrostatic discharges (ESD). Touching electrostatically charged persons or objects puts these components at risk. In the worst case, they will be destroyed or fail after startup.

Follow the requirements according to DIN EN 61340-5 to minimize or prevent the possibility of damage due to sudden electrostatic discharge!

Make also sure not to touch the electronic components if supply voltage is supplied!

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## CAUTION!

**Hardware and Software modifications and changes**

For safety reasons unauthorised modifications and changes of hardware and software are not allowed.

Make sure to comply with the notes, thresholds, operating modes and safety instructions given in this manual.

Non-compliance with this manual and operating sequence will void any liability claims.

## CAUTION!

**Temporary protection against overload and short circuit**

**Instrumentation Supply part (24 V DC):** the device is protected against destruction by overload and short circuit**.** No safe function is ensured for the duration of such disturbance. After such a disturbance, the „Type 8620 mxCONTROL“ automatically continues its normal operation.

The plant must be dimensioned so that the **sum of extracted current** of all actuators/sen¬sors connected at the Instrumentation Supply side **never exceeds the value of 1.04 A.**

The „Type 8620 mxCONTROL“ was developed on the basis of recognized technical safety rules and corresponds to the state of technology. Hazards may nonetheless develop. Operate the „Type 8620 mxCONTROL“ only in flawless condition and in compliance with the operating instructions. Also make sure to **comply with the conditions of use according to the specifications** in chapter 6.1 „Technical Specifications“ and on the type plate of the device.

Non-compliance with these instructions and unauthorized tampering with „Type 8620 mxCONTROL“ voids any liability by us; the warranty for the device and accessories also becomes void!

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# 4 General Information

## 4.1 Scope of Delivery

Verify immediately after receiving the shipment that the contents are not damaged and agrees with the specified scope of delivery as stated on the enclosed "Delivery instructions"; also make sure that the details on the type plate match the conditions of use.

Please contact our sales centre immediately in case of disagreements:

**Bürkert Fluid Control Systems**
**Sales Center**
Christian-Bürkert-Str. 13-17
D-74653 Ingelfingen
Germany

Phone: +49 (0)7940 - 10 111
Fax: +49 (0)7940 - 10 448
Email: info@de.buerkert.com

or your Bürkert distribution centre.

## 4.2 Warranty Regulations

This document contains no promise of guarantee. Please refer to our terms of sales and delivery. The warranty is only valid if the device is used as authorized in accordance with the specified application conditions.

The warranty extends only to defects of the „Type 8620 mxCONTROL“ and its components. We accept no liability for any kind of collateral damage which can occur due to failure or malfunction of the device.

## 4.3 Certifications

The certification designation on the Bürkert type plates refers to the Bürkert products.

More information on the certifications can be found in the chapter 6.1 “Technical Specifications“.

## 4.4 Information in the Internet

You can find operating instructions and data sheets on type 8620 in the Internet at:

www.buerkert.de → Technical Data → Operating instructions → Data sheets → Type 8620.

The complete documentation is supplied on the SD card.

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# 5 Abbreviations

## 5.1 Abbreviations in Software and Documentation

Further abbreviations (Error messages) can be found in chapter 15.3.

| Abbreviation | Explanation |
|---|---|
| +Tm | Maximum output time |
| +TmPB | Maximum pre-bleed duration |
| AH | Higher Alarm Process Value |
| AL | Lower Alarm Process Value |
| Alarm- | Lower alarm limit |
| Alarm+ | Upper alarm limit |
| AlarmHys | Alarm hysteresis in % of process value range |
| Alarm H | Upper Process Value Alarm |
| Alarm L | Lower Process Value Alarm |
| AnalogIn 1 to 4 | Analog input 1 … 4 |
| ASL | Acid (pump) stop limit (Acid Stop Limit) |
| ASL PumpStop | Pump Stop due to the ASL alarm |
| Au | Automatic Mode |
| BATCH (or Batch Dosing) | Batch Module (dosing by batches) |
| Binary | Binary input (digital: 0 / 24 VDC) |
| BIOCIDE_DOSING | Biocide dosing module |
| BioDos | Biocide dosing module (abbrev.) |
| Cd | Conductivity module (On/Off control) - abbrev. |
| Cd-PI | Conductivity module (PI control) - abbrev.<br>(in part with 3-point step output) |
| Cd-PIr | Conductivity module (PI-Ratio-Control) - abbrev., set point depending on Make-Up-Channel ratio |
| Cd r | Conductivity module (On/Off Ratio-Control) - abbrev., set point depending on Make-Up-Channel ratio |
| CL | Chlorine |
| CL/ORP | Chlorine/Oxidising Redox Potential PI-Control Module - abbrev. |
| CL_ORP | Chlorine/Oxidising Redox Potential-PI-Control Module |
| CM | Calibration mode: 4-20mA input or output is currently calibrated |
| CMD | Module output (command) to actuator (%) - proportional/integral |
| CMD A | Module output (Acid) - acid pump |
| CMD C | Module output (Caustic) - caustic pump |
| CMD on | Output value at module output e.g. during dosing |
| CMDsafe | Safety output value, it is active if<br>- on the 4…20 mA input less than 3.5 mA or more than 20.5 mA are applied,<br>- on the Pt100 input, a temperature outside of the measuring range is applied |
| CMD 1, CMD 2 | Module output for channel 1, module output for channel 2 (at BIOCIDE_DOSING) |
| Cond | Conductivity |
| COND_CONTROL | Conductivity module (On/Off control) |
| COND_CONTROL_RATIO | Conductivity module (On/Off Ratio-Control), set point depending on Make-Up-Channel ratio |
| COND_PI | Conductivity module (PI control)<br>(in part with 3-point step output) |
| COND_PI_RATIO | Conductivity module (PI-Ratio-Control), set point depending on Make-Up-Channel ratio |
| Cor | Corrosion |
| CorroD | Corrosion Display Module (short name) |

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| Abbreviation | Explanation |
|---|---|
| CORROSION_DISPLAY | Corrosion Display Module |
| Cut- | Lower CutOff threshold (Module "COMMON_PID") |
| Cut+ | Upper CutOff threshold (Module "COMMON_PID") |
| D- | Max. negative set point change per minute, falling (Delta-) |
| D+ | Max. positive set point change per minute, rising (Delta+) |
| Dbnd | Deadband - to prevent vibration of the actuator |
| DigIn 1 … 4 | Digital input 1 … 4 |
| Dos1 … Dos8 | Biocide timer settings (8 per day per channel) |
| FA | AD-Fault |
| Fc | Calibration Data Fault |
| FC | Configuration Fault |
| fF | Flow switch: “No Flow” |
| FI | Input Fault |
| Filter | Filter stage (for Low Pass Filter) |
| Fmax | Maximum actuator output pulse rate per minute or per hour |
| fo | forced by other modules |
| Freq- | Lower frequency value of a frequency range |
| Freq+ | Upper frequency value of a frequency range |
| Fr | Friday |
| fS | System switch: “Stand-by” |
| FS | Sensor Fault; Full scale (in connection with Technical Specification) |
| FSOR | Flow switch override |
| Hyst | Switching hysteresis set in engineering units |
| HO | Process Value state, Value Hold during User Calibration of 4-20mA inputs |
| Inv | Inversion of the sense of action of a module/signal |
| IS | Instrumentation Supply |
| Kp | Gain/amplification factor (in [% control output/PV unit]) |
| Kx | Ratio factor for internal set point calculation |
| Lim- | Lower output limit in % |
| Lim+ | Upper output limit in % |
| Ma | Manual (operation) mode |
| Mo | Monday |
| MONITOR_PV | Module - monitoring only a Process Value PV (data logging) |
| Mon PV | Module - monitoring only a Process Value (data logging) - short name |
| MOT | Maximum Output Timer |
| MPY | Mils Per Year |
| MTPB | Maximum pre-bleed timer |
| µMPY | Micro Mils Per Year |
| nA | Input not active |
| O2_SCAV_CTRL_RATIO | Dosing of O2-absorption media based on flow and temperature |
| O2SCR | Dosing of O2-absorption media based on flow and temperature - abbrev. |
| OF | Output fault of the 4…20 mA outputs |
| OPEN_PROP | Dosing proportionally to process value |
| OpProp | Dosing proportionally to process value - abbrev. |
| ORP | Oxidising Redox Potential (Redox) |
| PB | Pre-Bleed Limit of biocide dosing module in connection with the COND_CONTROL and COND_PI modules |
| PB ratio | Pre-Bleed Ratio Limit of biocide dosing module - only in connection with the modules COND_CONTROL_RATIO and COND_PI_RATIO |
| PFM | Pulse Frequency Modulation |
| pH-AC | pH PI Module with selection of acid **and** caustic pump (abbrev.) |
| pH-A/C | pH PI Module with selection of acid **or** caustic pump (abbrev.) |

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| Abbreviation | Explanation |
|---|---|
| PH_ACID_CAUS | pH PI Module with selection of acid **and** caustic pump |
| PH_ACID_OR_CAUS | pH PI Module with selection of acid **or** caustic pump |
| ptf.binary | Binary input (digital, potential-free) |
| PS | Power Supply |
| Psd | Process switching difference |
| PumpStop | Pump stopped because corrosion limit exceeded |
| PV | Process value |
| PV BSi | Process value of Batch size |
| PV cal | Conductivity value (for TDS-calibration) |
| PWM | Pulse Width Modulation |
| r | read (access via configuration menu or via XML-configuration or parameter file) |
| Ref.Date Week1 | Reference Date for week 1 |
| rw | read and write (access via configuration menu or via XML-config. / parameter file) |
| Sa | Saturday |
| Scal- | Minimum value of sensor range (in engineering units) |
| Scal+ | Maximum value of sensor range (in engineering units) |
| SP | Set point |
| SP BSi | Set point of Batch size |
| SpecFunc | Special input function for 4…20 mA inputs |
| SPLim | Set point minimum (internal calculation for conductivity) |
| SPLim- | Lower set point limit for pH measurement |
| SPLim+ | Upper set point limit for pH measurement |
| SP Limit | Set point Limiter |
| SP Ramp | Set point ramp |
| SSOR | System switch override |
| State | Current state of dosing process in batch module |
| Su | Sunday |
| Tco cl | Time for complete closing: 100% → 0%) |
| Tco op | Time for complete opening: 0% → 100%) |
| Tdose | (Total) Biocide dosing time; Batch dosing time |
| TDS | Total Dissolved Solids |
| TDS cal | TDS-value (Total Dissolved Solids value) |
| Th | Thursday |
| +Tm | Maximum output time |
| +TmPB | Maximum pre-bleed duration |
| Tm1 | Interval between main biocide dosing & post dosing |
| Tm2 | Delay after post-dosing before conductivity control resumes |
| Tn | Reset time in seconds |
| Tperiod | period duration |
| Tpuls | Pulse duration of the actuator output in milliseconds or seconds |
| Tsample | Sample time of the respective control loop; sample time with data logging |
| Tu | Tuesday |
| Tv | Rate time |
| w | write (access via configuration menu or via XML-configuration or parameter file) |
| Warn- | Lower warning limit |
| Warn+ | Upper warning limit |
| WarnHys | Warning hysteresis in % of process value range (AwHyst) |
| WH | Upper warning process value |
| We | Wednesday |
| WL | Lower warning process value |
| YA | Abbreviation in the alarm display for ASL-pump-stop |

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| Abbreviation | Explanation |
|---|---|
| YF | Out fails (MOT is expired) |
| YS | Safety output value is active (due to input/sensor fault) |

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## 5.2 Display of the units

Because of the limited display, there is not always sufficient room available for the detailed display of the unit. Depending on the available positions, 3 or 6 positions are shown in the display; the equivalents as well as the output during data logging are listed in the following table, arranged by groups.

| Display max. 3 characters | Display max. 6 characters | Display of the unit selection as well as data logging | unit |
|---|---|---|---|
| **Volume units** | | | |
| L | L | L | Litre |
| hL | hL | hL | Hectolitre |
| m3 | m3 | m3 | Cubic metre |
| Gal | Gal US | Gal US | U.S. liq. Gallon |
| bbl | bbl US | bbl US | U.S. Barrel |
| gal | gal Im | gal Imp | Imperial Gallon |
| ft3 | ft3 | ft3 | Cubic Foot |
| yd3 | yd3 | yd3 | Cubic Yard |
| **Flow units** | | | |
| L/s | L/s | L/s | Litre per second |
| L/m | L/min | L/min | Litres per minute |
| L/h | L/h | L/h | Litre per hour |
| m3M | m3/min | m3/min | Cubic metre per minute |
| m3H | m3/h | m3/h | Cubic metres per hour |
| G/s | Gal/s | Gal/s US | U.S. liq. Gallons per second |
| G/m | Gal/m | Gal/m US | U.S. liq. Gallons per minute |
| G/h | Gal/h | Gal/h US | U.S. liq. Gallons per hour |
| g/s | gal/s | gal/s Imp | Imperial gallons per second |
| g/m | gal/m | gal/m Imp | Imperial gallons per minute |
| g/h | gal/h | gal/h Imp | Imperial gallons per hour |
| bbS | bbl/s | bbl/s US | U.S. Barrel per second |
| bbM | bbl/m | bbl/m US | U.S. Barrel per minute |
| bbH | bbl/h | bbl/h US | U.S. Barrel per hour |
| f3S | ft3/s | ft3/s | Cubic Feet per second |
| f3M | ft3 /m | ft3 /min | Cubic Feet per minute |
| f3H | ft3/h | ft3/h | Cubic Feet per hour |
| P/s | Pul/s | Pul/s | Pulses per second |
| P/m | Pul/m | Pul/m | Pulses per minute |
| **Units for chemical analysis** | | | |
| µS | µS/cm | µS/cm | Microsiemens per centimetre |
| mS | mS/cm | mS/cm | Millisiemens per centimetre |
| MPY | MPY | MPY | Mils per year |
| µMY | µMPY | µMPY | Micromils per year |
| mV | mV | mV | Millivolt |
| mgL | mg/L | mg/L | Milligrams per litre |
| %Sa | %Sat | %Sat | Percent of saturation |
| pH | pH | pH | pH |
| **Temperature units** | | | |
| °C | °C | °C | Degree Centigrade |
| °F | °F | °F | Degree Fahrenheit |
| °Ra | °Rank | °Rank | Degree Rankine |
| K | K | K | Kelvin |

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| Display max. 3 characters | Display max. 6 characters | Display of the unit selection as well as data logging | unit |
|---|---|---|---|
| **Pressure units** | | | |
| bar | bar | bar | Bar |
| mba | mbar | mbar | Millibar |
| psi | psi | psi | psi |
| **Various units** | | | |
| ppm | ppm | ppm | Parts per million |
| V | V | V | Volt |
| mA | mA | mA | Milliamps |
| Pul | Pulse | Pulse | Pulse |
| Hz | Hz | Hz | Hertz |
| % | % | % | Percent |
| **Other parameter units** | | | |
| ms | ms | ms | Milliseconds |
| s | s | s | Seconds |
| min | min | min | Minutes |
| h | h | h | Hours |
| /m | /min | /min | Per minute |
| /h | /h | /h | Per hour |

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# 6 Technical Data

## 6.1 Technical Specifications

These operating instructions are valid from **Firmware revision:** C.00.00.00

| | |
|---|---|
| **General Details of the Device** | |
| Enclosure | with sealed keypad and display |
| Enclosure outer dimensions L x W x H | 230 x 204 x 119 mm (without cable glands) |
| Enclosure material | PC (UL94) with transparent door and key |
| Weight | 1.8 kg |
| Degree of protection | IP 65 and NEMA/UL 50, Type No. 4X, with door closed and properly sealed cable glands,<br>additional cover of USB port and SD card slot |
| Graphic display, large and backlighted | 128 x 64 dots, two colored (blue and white) |
| Keypads for manual operation | 5 keys for user inputs |
| Operating temperature | 0 … +50 °C |
| Storage temperature | -20 … +60 °C |
| **Electrical Details** | |
| Mains voltage (power supply) | 100 … 240 V AC, 50/60 Hz, no adjustment necessary |
| Power consumption (of mxCONTROL device) | max. 35 W (incl. sensor supply at Instrumentation Supply part) |
| Total power consumption<br>(using the internal power distribution) | max. 2400 W (at 240 V AC) or max. 1100 W (at 110 V AC)<br>incl. connected actuators at Power Supply part |
| Total input current $I_{in}$ (using internal power distr.) | max. 10 A |
| Total output current $I_{out}$<br>(using the internal power distribution) | <10 A (incl. device power consumption of 35 W) |
| Instrumentation supply for sensors / transistor outputs | 24 V DC (±5 %), max. 1.04 A (25 W),<br>short circuit and overload protected |
| Fuse for device protection<br>(Instrumentation) | internal: electronic fuse, recovers automatically after fault condition is removed |
| Fuse for Relays outputs | Relay outputs to be fused in external installation according to actuators |
| Inrush current (typ.) | Cold start: 30 A / 230 V AC |
| **Electrical Connections** | |
| Electrical connection Power Supply | **Hardware version 1:** Screw terminals, grid 5.08 mm,<br>for wire gauges 0.14 … 1.5/2.5 mm² (AWG 26…14)<br>**Hardware version 2:** Spring type terminal, grid 5.0 mm,<br>for wire gauges 0.2 … 2.5/4.0 mm² (AWG 24…12) |
| Electrical connection Instrumentation Supply | **Hardware version 1:** Screw terminals, grid 3.81 mm,<br>for wire gauges 0.14 … 1.0/1.5 mm² (AWG 26…16)<br>**Hardware version 2:** Spring type terminal, grid 3.5 mm,<br>for wire gauges 0.2 … 1.5 mm² (AWG 24…16) |
| Cable glands and cables | **Hardware version 1:**<br>9 x M16 (PG9) 5 ... 6.5 mm cable<br>1 x M32 (PG21) 5 mm cable (5x)<br>**Hardware version 2:**<br>4 x M16 (PG9) 5 ... 6.5 mm cable<br>2 x M16 (PG9) 6 ... 9.5 mm cable<br>3 x M20 (PG13) 9 ... 13.5 mm cable<br>1 x M32 (PG21) 5 mm cable (5x)<br>(cable = outer diameter of cable)<br>Not used cable glands have to be sealed with appropriate sealing bolts to guarantee the Degree of protection IP65. |
| | **Thermal stability** (cable material):<br>105 °C for cables at Power Supply part<br>80 °C for cables at Instrumentation Supply part |

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| **Internal Equipment – Inputs** | |
|---|---|
| Inputs | **Hardware version 1:**<br>4 Analog inputs (4 … 20 mA or Pt100; software-configurable) +<br>4 digital (On/Off or Freq) inputs<br>**Hardware version 2:**<br>4 Analog inputs 4 … 20 mA +<br>2 Pt100 +<br>4 Digital (On/Off or Freq) inputs +<br>4 digital (On/Off) inputs |
| **Analog inputs –** Characteristics | |
| Input resistance of 4…20 mA inputs | max. 300 Ω |
| Measuring error of 4…20 mA inputs | < 0.2 % FS |
| Range of Pt100 inputs | -20 … +150 °C |
| Measuring error Pt100 inputs | max. ±0.25 K<br>3 wire connection; software compensated wire resistance required |
| **Digital Inputs** - Characteristics | |
| Logical values binary inputs | 1 or HIGH: 13 ... 35 V; 0 or LOW: 0 … 4.5 V |
| Input resistance of binary inputs | ≥ 20 kΩ |
| Max. frequency | 2 kHz |
| Duty factor frequency | 1 : 1 |
| Measuring error frequency | max. 0.2 % FS |
| Input accepts signals from | open collector; open emitter; push-pull output; hall effect; reed switch; micro switch |
| **Internal Equipment - Outputs** | |
| Outputs | **Hardware version 1:**<br>5 Relay outputs +<br>4 Analog outputs 4 … 20 mA (optional) +<br>4 Transistor outputs (optional)<br>**Hardware version 2:**<br>5 Relay outputs +<br>2 Analog outputs 4 … 20 mA +<br>2 Transistor outputs |
| **4…20 mA Analog outputs** - Characteristics | max. 500 Ohmic load, output resolution 10 bit (effective >9 bit) |
| **Relay outputs -** Characteristics | max. 250 V AC/DC, max. 10 A, potential-free, two-way contacts,<br>max. 2500 VA (AC), max. 40 W Ohmic load (DC),<br>3 million switching cycles at 1 A, 10 million switching cycles at 0 A |
| **Transistor outputs** - Characteristics | 24 V DC, switching capacity each max. 16 W, pnp, max. 2200 Hz |
| **Further internal Equipment** | |
| Micro-controller core | 32 bit with integrated flash memory |
| Slot for SD card (memory card) | Can be used for data logging, up- and download of configuration and parameter files |
| Clock | real-time clock with calendar |
| Battery back-up for real-time clock | Lithium battery CR2032, exchangeable, approx. 10 years service life |

Continuation next page

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| | |
|---|---|
| **Communication** | |
| SD card | SD card capacity: minimum 64 MB, maximum 2 GB, formatted with FAT16 file system |
| Up-/download of configuration data and parameters | via USB or SD card |
| Data-logging | on SD card |
| Firmware update | via USB |
| USB slave interface | standard USB interface for PC communication |
| Ethernet interface | optional: Ethernet interface for easy diagnosis including Web Server and email option |
| Extension bus interface | CAN-based bus for connection of extension units (e.g. I/O extensions) |
| **Controller structure** | |
| Number of control loops | max. 8 active control loops |
| Controller outputs/Module outputs | 1) On/Off<br>2) Pulse frequency modulated (PFM)<br>3) Pulse width modulated (PWM)<br>4) Analog |
| Sample period | approx. 50 ms (with 1…4 active control loops);<br>approx. 100 ms (with more than 4 active control loops) |
| User configuration | Cascade control possible; inputs, outputs and control function designations can be changed via configuration file |
| **Characteristics of modules** | |
| General PID control | PID process controller for fixed value, subsequent value or cascade control |
| Conductivity control | On/Off or PI control - continuous dosing through PFM, PWM or 4…20 mA analog output,<br>automatic or manual drain |
| Corrosion display | No controller function, only display of measuring values; impact on general alarm output |
| pH control | PI control - continuous dosing through PFM, PWM or 4…20 mA analog output |
| Module for dosing of oxygen scavenger media | Proportional dosing for flow and oxygen content depending on flow with or without temperature input |
| Chlorine / Redox Control | PI control - continuous dosing through PFM, PWM or 4…20 mA analog output |
| Batch-Dosing | Allows batching of a chemical based on volume of water added |
| Biocide dosing | 14-day program, 8 dosing events per channel/per day; Pre-bleed function to optimize biocide kill time |
| Monitor module | Display of process values |
| Totalizer function | Single or dual channel flow totalizer (each having two manually resetable totalizers) |
| Further functionalities | Password protection, filter; selection of engineering units, alarm; inverse function |
| **Norms and standards** | |
| Environment standards | IEC/ DIN IEC 60068 |
| EMC standards | EN 61000, EN 55011 |

Continuation next page

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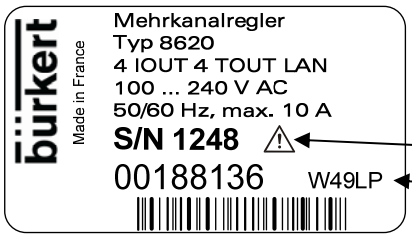
| | |
|---|---|
| CE mark | applicable tests resulting in CE mark |
| UL/CSA (for UL/CSA approved versions) | conform to Std. UL61010-1 Second Edition “Process Control Equipment” and to the appropriate<br>CSA standard C22.2 No. 61010-1 Second Edition |

*Table 1: Technical Specifications*

## 6.2 Type Plate – Example




Device designation (multi function controller)
Type
Specifical Configuration of the device
Voltage and Frequency range, admissible Current
Serial Number and ⚠ Attention! Consider the manual!
Order Number and Production Code


The UL Mark is necessary for marketing at the US and Canadian market.

This UL Mark certifies that the appropriate safety requirements are observed (for UL approved versions only.)

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# 6.3 Hardware Structure

This simplified block diagram shows the main hardware components of „Type 8620 mxCONTROL“.

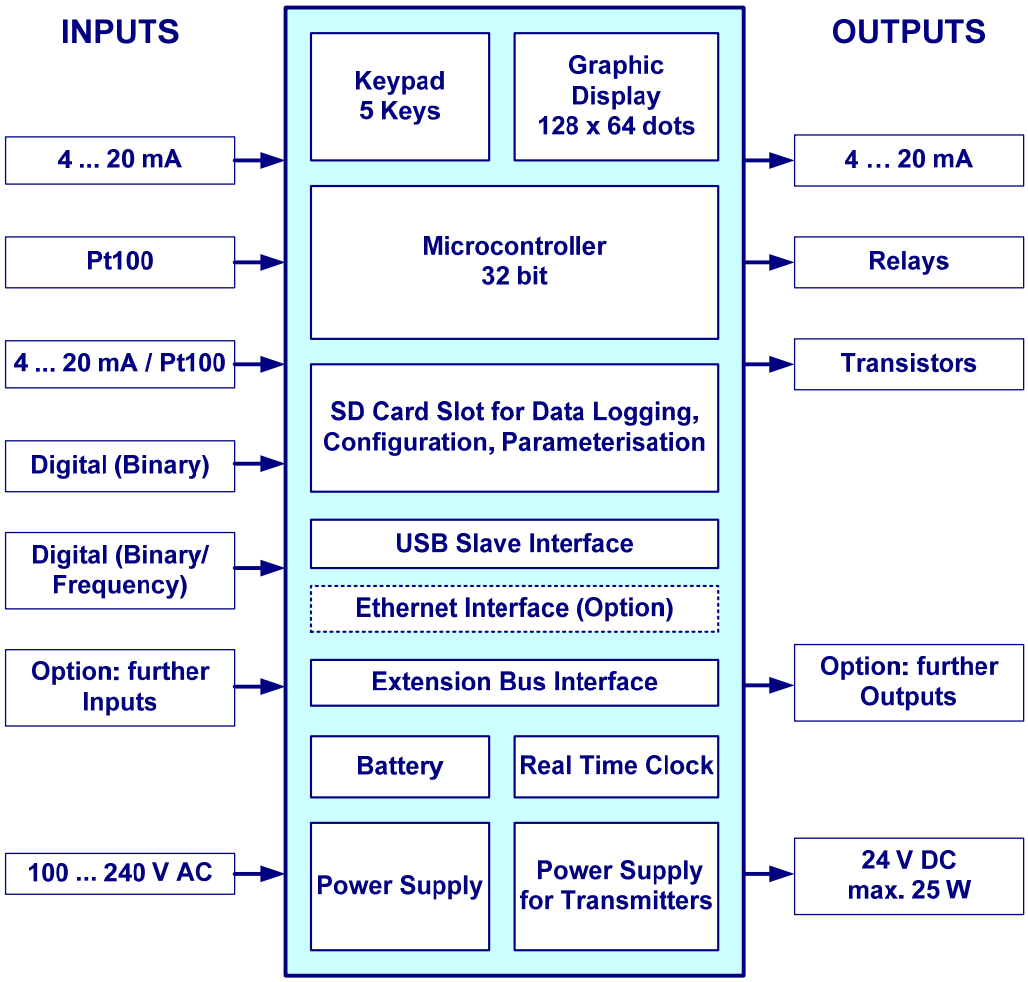


*Figure 1: Block diagram - Hardware structure*

The number of the in- and outputs of the several hardware versions is listed in the following Table 2:

| | | Hardware version 1 | Hardware version 2 |
|---|---|---|---|
| **Inputs** | Analog 4 … 20 mA | - | 4 |
| | Analog Pt100 | - | 2 |
| | Analog 4 … 20 mA or Pt100 | 4 | - |
| | Digital (Binary) | - | 4 |
| | Digital (Binary or Frequency) | 4 | 4 |
| **Outputs** | Analog 4 … 20 mA | 4 (optional) | 2 |
| | Relay | 5 | 5 |
| | Transistor | 4 (optional) | 2 |

*Table 2: Number of inputs and outputs of the hardware versions*

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# 6.4 Module Overview

This table shows the available standard modules which can be combined specifically for the application. They can function either as process or control or merely as display module.

The module names as used in the configuration files and the short designations for the menu are listed as well as a short explanation of the module type.

| Module-name for XML-configuration-file | Short name in menu | Module type |
|---|---|---|
| NONE | -- | -- |
| BATCH | Batch | Batch-Dosing |
| BIOCIDE_DOSING | BioDos | Biocide-Dosing |
| CL_ORP | CL/ORP | Chlorine/Redox-PI-Control |
| COMMON_PID | PID | General PID controller |
| COND_CONTROL | Cd | Conductivity On/Off control |
| COND_CONTROL_RATIO | Cd r | Conductivity On/Off control, set point via ratio from Make-Up Channel |
| COND_PI | Cd-PI | Conductivity PI-Control |
| COND_PI_RATIO | Cd-PIr | Conductivity PI-Control,<br>set point via ratio from Make-Up-Channel |
| CORROSION_DISPLAY | CorroD | Corrosion-Display |
| MONITOR_PV | Mon PV | Monitoring only up to two process values (data logging) and optionally output |
| O2_SCAV_CTRL_RATIO | O2SCR | Dosing of oxygen absorption media based on flow rate and temperature of the feed water |
| OPEN_PROP | OpProp | Dosing (proportionally to process value) |
| PH_ACID_CAUS | pH-AC | pH PI-Control with outputs for acid and caustic pumps |
| PH_ ACID_OR_CAUS | pH-A/C | pH PI-Control with output for acid (or caustic) pump |
| TOTALIZER | Total | 2-channel totalizer |

*Table 3: Module designations and types*

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# 7 Installation

## 7.1 Safety Notes

**DANGER!**

**Danger from electrical voltage!**

Reaching into the system presents an acute risk of injury.

Always switch off the power before beginning with the work activities and secure it against being switched back on inadvertently!

Obey the applicable accident prevention and safety regulations for electrical devices! Please, compare the DANGER and UL indications in chapter 7.4 “Electrical Connections”!

**WARNING!**

**Danger from improper installation!**

Improper installations may result in injuries as well as damages on the device and its environment.

This type of work may only be carried out by authorized technical personnel and with suitable tools!

**Danger from unintentional operation!**

Dangerous situations may develop from unintentional operation of the plant.

Prevent the possibility of unintentional operation of the plant through suitable measures.

## 7.2 Quick Start Guide

Install the „Type 8620 mxCONTROL“ in a plant or mounted on a backboard as shown in figure 2

*Figure 2:*
*„Type 8620 mxCONTROL“ - Installation example*

→ Install the required sensors and other equipment, according to the separate operating instructions.

→ Make the wiring connections according to the specifications in chapter 7.4.

→ Switch on the operating voltage.

→ **Load the configuration file** and the parameter file **from an SD card** (see chapter 11.2).

→ **Check/edit parameters and values** in the operating menu according to the menu description (see Chapter 9) and module description (chapter 14).

→ Set the **date and time** in the corresponding menu (refer to chapter 21.5.8).

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# 7.3 Mechanical Installation

**Direct sunlight** will reduce the **viewing contrast** at the display – although it is harmless to the display. Therefore find a **suitable, protected location** for the installation.

The „Type 8620 mxCONTROL“ is **not designed for ambient temperatures below.0 °C**.
If this cannot be avoided, the „Type 8620 mxCONTROL“ must be installed in a **thermostatically controlled cabinet** to maintain a normal ambient temperature.

**In North America,** the device must not be installed directly at building walls! In this case use always appropriate backboards or switchboards/switching cabinets for mounting the device.

→ **Open the cover** (unlock it if a key is supplied) by pressing the snap lock with both thums.
**For closing the cover** press it down until a “click” is to be heard (and lock it with the key).

→ The „Type 8620 mxCONTROL“ is designed for **wall mounting** (exception: North America – see information frame above). Figure 2 shows the preferred mounting position.

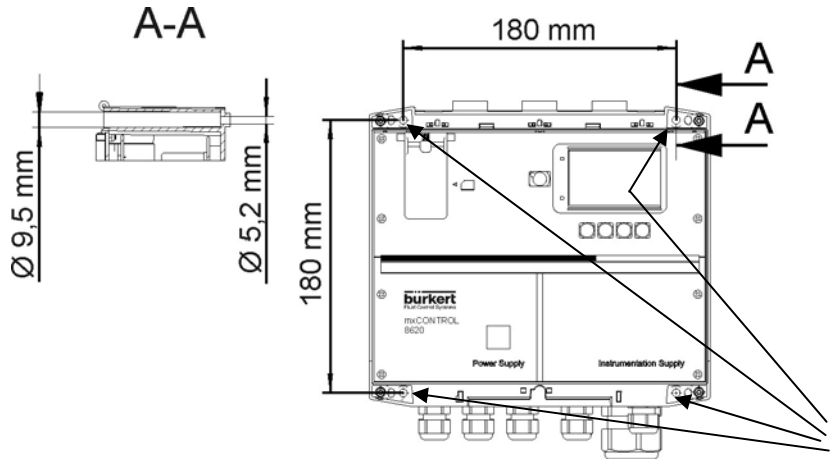


*Figure 3: Dimensions for mounting*

→ Wall mounting with screws is made possible by 4 openings located in each corner of the enclosure (see Figure 3). Access to these openings is obtained by opening the cover.

# 7.4 Electrical Connections

**DANGER!**

**Danger from electrical voltage**

Reaching into the system presents an acute risk of injury.

Make sure that no supply voltage is present on the device when working on it! Obey the applicable accident prevention and ensure that all electrical connections comply with local and plant regulations!

Pay attention to **correct design of the fuse and/or the line safety switch** in the power supply line.
For dimensioning and installation of disconnecting switch, fuses etc. necessarily refer to further information below!

**In North America**, devices with UL certification have to be used for these purposes.

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## *Dimensioning of fuses, line safety switches, overcurrent protection devices*

Pay attention to correct design of the fuse and/or the line safety switch in the power supply line. The L- and N-conductors have to be protected with overcurrent protection devices (max. 10 A) as e.g. fuses, line safety switch etc.

Also install an **equipment for the disconnection of L- and N-conductors** from the power supply **near the „Type 8620 mxCONTROL“.** Therefor e.g. the above-mentioned overcurrent protection device or an appropriate disconnecting switch (110/240 V and with at least the size of current of the overcurrent protection device) can be used.

**If the sum of extracted current** of all connected actuators at the Power Supply part **exceeds the value of 10 A,** the actuators can be connected with a separate voltage supply for those actuators - please refer to the schemata in appendix 21.2 **„**Power Supply of Actuators/Sensors**“**.

## *Electrical Connections*

The preferred mounting position for the „Type 8620 mxCONTROL“ is with the cable glands facing downward, i.e. all cable glands are located at the bottom of the device.

→ The electrical connections can be accessed by loosening the screws that hold the lower cover plate in place. You can then lift the cover plate by the black handle.

→ The terminal strips for the mains voltage level (power supply) and the low-voltage level (instrumentation supply) are separated by an isolating plate (see Figure 4).

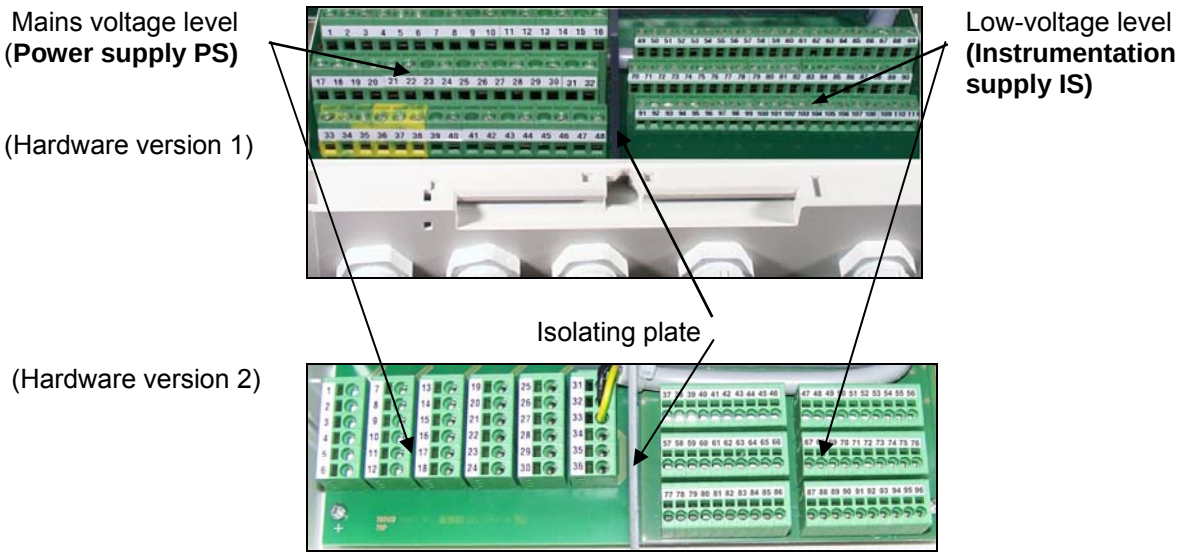


*Figure 4: Viewing the inside of the terminal strip compartment (with the cover plate removed) of the „Type 8620 mxCONTROL“:*
*top: Hardware version 1: Screw terminals*
*bottom: Hardware version 2: Spring type terminals*

→ Use suitable cables (for wire gauges/cross sections see chapter 7.5) for the passage through the cable glands (for outside cable diameters and thermal stability of cable material refer to chapter 6.1, paragraph “Electrical connections”).

→ Unscrew the nut of cable gland and remove the seal.

→ First push the cable through the nut of the cable gland and the seal insert and then prepare each wire of the cable with a cable end sleeve (see Figure 5) of the recommended length:
(cable for Power Supply: sleeve length: 7 mm,
cable for Instrumentation Supply: sleeve length: 5 mm).

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*Figure 5:*
*Cable with cable end sleeves*

→ Then guide the prepared cable through the cable gland opening into the device and attach the wires to the terminal strip.

→ Now screw the cable gland nut tight until the cable is securely attached
(tightening torque for cable gland M16: max. 6 Nm
(tightening torque for M20 cable gland: max. 8 Nm
(tightening torque for M20 cable gland: max. 10 Nm)

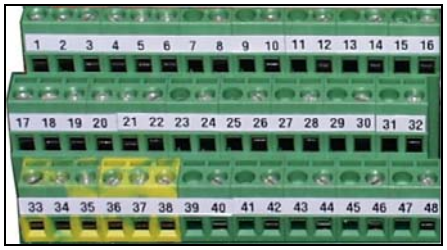
→ After clamping all required connections re-attach the plate and tighten the screws.

**Important!** Seal unused cable glands with sealing bolts – **protection class IP65** is otherwise not guaranteed.

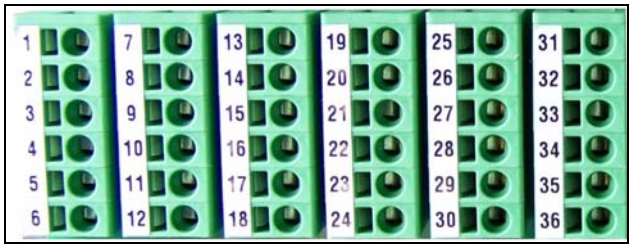
# 7.5 Terminal Strip Pin Assignment

## 7.5.1 Power Supply (PS)

Connect the cables as shown in the PIN tables in the appendix (21.3.1 and 21.4.1).
The respective terminal assignment plans are created with the PC Tool according to the “project”.
They serve as basis for wiring diagrams and the input/output assignment as shown in the example in the appendix 21.1




*Hardware version 1*




*Hardware version 2*

*Figure 6: Terminal strips for the mains voltage level, with PIN numbers*

| | **Hardware version 1** | **Hardware version 2** |
|---|---|---|
| PIN numbering | 1 to 48 | 1 to 36 |
| Terminal strips | Screw terminals | Spring type terminals |
| Terminal grid | 5.08 mm, AWG 26 … 14 | 5.0 mm, AWG 24 … 12 |
| Wire gauges - rigid wires | 0.14 … 2.5 mm² | 0.2 … 4.0 mm² |
| Wire gauges - flexible wires | 0.14 … 1.5 mm² | 0.2 … 2.5 mm² |
| Tightening torque for screws | 0.5 … 0.6 Nm (4.5 … 5.3 lb in) | -- |
| PIN table | Table in appendix 21.3.1 | Table in appendix 21.4.1 |

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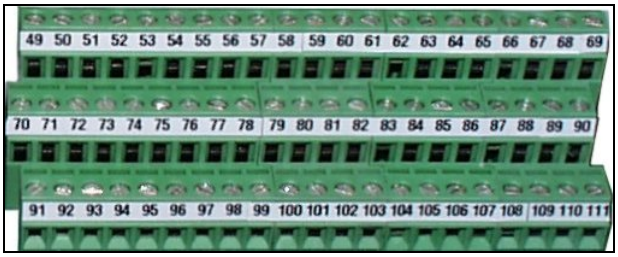
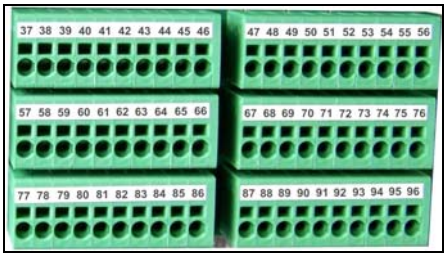
## 7.5.2 Instrumentation Supply (IS)

Connect the cables as shown in the PIN tables in the appendix (21.3.2 and 21.4.2).
The respective terminal assignment plans are created with the PC Tool according to the “project”.
They serve as basis for wiring diagrams and the input/output assignment as shown in the example in the appendix 21.1

For sensor inputs and analog 4…20 mA outputs **shielded cables** are recommended for best EMC. Connect the cable shields with the respective Pin “**GND**” for EMC.




*Hardware version 1*




*Hardware version 2*

*Figure 7: Terminal strips for the low voltage level, with PIN numbers*

| | **Hardware version 1** | **Hardware version 2** |
|---|---|---|
| PIN numbering | 49 to 111 | 37 to 96 |
| Terminal strips | Screw terminals | Spring type terminals |
| Terminal grid | 3.81 mm, AWG 26 … 16 | 3.5 mm, AWG 24 … 16 |
| Wire gauges - rigid wires | 0.14 … 1.5 mm² | 0.2 … 1.5 mm² |
| Wire gauges - flexible wires | 0.14 … 1.0 mm² | 0.2 … 1.5 mm² |
| Tightening torque for screws | 0.22 … 0.25 Nm (2 … 2.2 lb in) | -- |
| PIN table | Table in appendix 21.3.2 | Table in appendix 21.4.2 |

# 7.6 Download of a Configuration and Parameter File

A configuration file must be downloaded to the „Type 8620 mxCONTROL“ before it can be effectively used in an automation system. Downloading of configuration files is for the **Specialist Level only!**

After successful download of the configuration file the parameters will be set back to the default values. With the download of the corresponding parameter file the default values will be overwritten with these values.

Read chapter 8 and especially chapter 11.2 before.

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# 8 Description of Human-Machine Interface

## 8.1 Safety Notes

**WARNING!**

**Danger from improper operation!**

Improper operation may result in injuries as well as damages on the device and its environment.

The device may only be operated by authorized technical personnel!

The persons operating the device must be familiar with the content of the operating instructions and have understood the same. The safety instructions and intended use require special consideration.

## 8.2 Operating and Display Elements

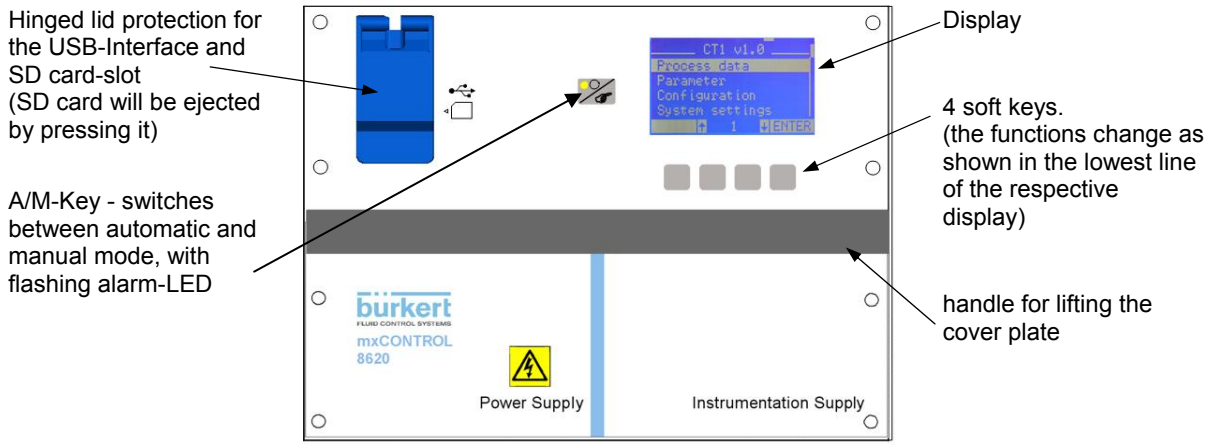


*Figure 8: View on the panel of „Type 8620 mxCONTROL“*

The „Type 8620 mxCONTROL“ is operated with 4 soft keys below the display (with alternating functions) and an A/M key to switch between automatic and manual mode.

The **brightness of the display** can be changed. The brightness can be adjusted in 10 brightness levels under the main menu item "System settings"; refer to Table 4 in chapter 9.1.
The default setting is brightness level 5 to ensure a long service life of the display.

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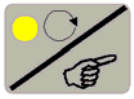
# 8.3 Operation Mode

## 8.3.1 Automatic & Manual Mode Key

| | |
|---|---|
| A/M key with yellow LED  | The A/M key switches between the Automatic and Manual Mode; the A/M key includes a yellow LED:<br>LED on → Automatic Mode<br>LED off → Manual Mode<br>LED flashing → ALARM (at least one alarm) both in automatic and manual mode |

In **case of alarm,** follow the descriptions in chapter 15 “Alarm and Error Messages”.

## 8.3.2 Automatic Mode (LED on)

The „Type 8620 mxCONTROL“ starts in automatic mode after powering up. The LED is on; a "running bar" in the top line of the display also indicates the Automatic Mode.

## 8.3.3 Manual Mode (LED off)

The operating mode for **all modules** can be changed directly by pressing the separate A/M-Key.

**Attention: All dosing processes** of the Batch- and Biocide-Dosing-Modules **are cancelled in Manual Mode!**
(The next dosing process will start at its programmed time when returning to Automatic Mode.)

In **manual operation,** the control of the process values is transferred from the device to the user. The user now controls the process values manually with the soft keys of the „Type 8620 mxCONTROL“ whereby the connected actuators are operated. For this purpose, the values in the main menu "Process data" need to be changed under the corresponding module.

**Switching from Automatic to Manual Mode** is “changeless”, except for the "Biocide-Dosing" and "Batch" modules. “Changeless switching” means that the last output value in Automatic Mode is the current output value in Manual Mode as long as the operator does not change the output value manually.

If the **system switch override function** or the **flow switch override function** or the **safety output value** is activated the **manual output value will be reset to “0”!**

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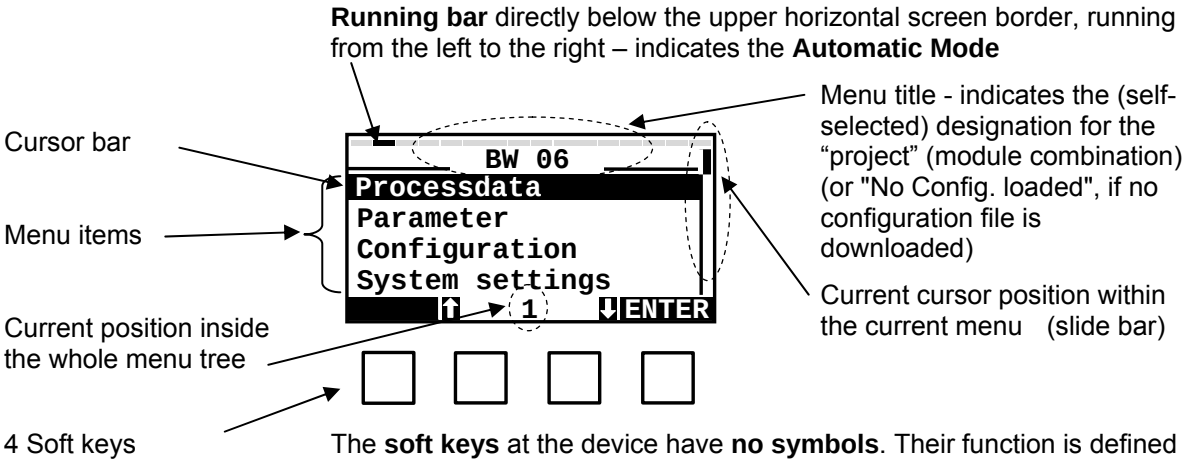
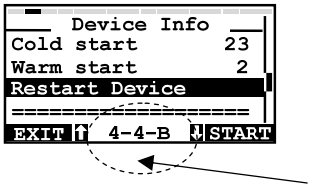
# 8.4 Layout of Menu Screens




The **soft keys** at the device have **no symbols**. Their function is defined in the bottom screen line, where the **current function of each key is displayed** as a text string or as a symbol.

The keys have symbols to explain the possible actions, in the above example:
***no function, up-arrow, down-arrow, Enter***

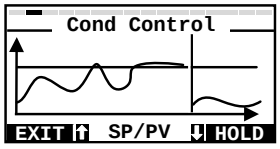



The **current position** inside the menu tree is shown in the middle of the bottom screen line.

You can scroll through the menu with the "up-arrow" and "down-arrow" soft keys.

The menu position/numbering is indicated by the **main menu and max. 4 submenus**, i.e. it is a max. 5-character alphanumeric combination and is shown in the following format: "4-A-3-1-2".
(the numbering of the menu items within the menu goes from 1 to 9, higher positions are continued with capital letters because of the limited space in the display:
from "A" (=10), "B" (=11) to "Z" (=35).

The font size of the current position string depends on the number of submenus to be displayed.




The **trend of the process value PV** from standard (4...20 mA) and frequency signal inputs is shown as chart and regularly updated.

The example shows a trend chart of set point SP and process value PV - the inscription ("SP/PV") only names the trend chart without identifying any soft key.
"HOLD" freezes the display ("CONT" continues displaying the trend.)

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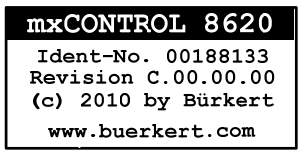
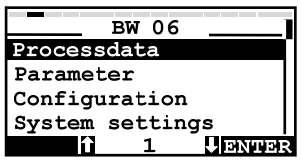
# 9 Menu Structure

## 9.1 Principle of Menu Tree Structure




A welcome message appears in the display after switching on the „Type 8620 mxCONTROL“. This display content is then shown with the **current software version number** for approx. 4 seconds.

When starting the „Type 8620 mxCONTROL“ for the first time, the next display text shows "No Config. loaded", i.e., no (configuration/parameter) files have been downloaded yet. In this case, refer to chapter 11.2 about downloading configuration and parameter files.




The menu of „Type 8620 mxCONTROL“ contains 8 main menu items; its submenus are used to display and set variables and parameters.

The first number in the bottom line of display is the number of the active main menu item (items 1 to 8).

Depending on the hardware version, the „Type 8620 mxCONTROL“ has digital and analog inputs which can be configured according to the user requirements.

The configuration via the configuration file is needed for enabling and labelling the desired inputs and outputs and for activation of special input functions. The scaling, filter and alarm settings can be done with the configuration file, too, but also directly at the „Type 8620 mxCONTROL“ device.

The main menu and submenu items for a “project” (module combination) with freely selectable name (in this case "BW 06") are listed in the appendix (21.4.3 ff). The following figure shows exemplified part of the menu tree and illustrates the structure of the menu.

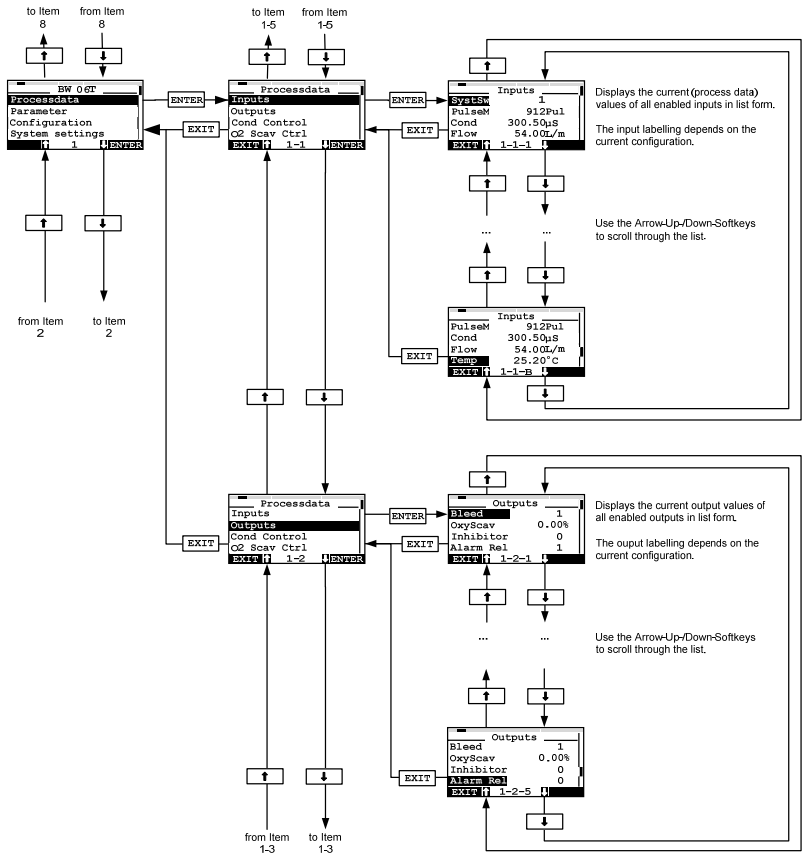



*Figure 9: Structure principle of the menu tree*



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**A similar structure is given for all “projects”.**

The main menu items contain submenus as exemplary listed below:

| Main Menu | | Submenus |
|---|---|---|
| 1 | Processdata | Display of the process values depending on the current configuration:<br>Inputs and outputs, module-specific process data displays:<br>1-1 Inputs<br>1-2 Outputs<br>1-3 Cond Control (module in *function* (*) 1)<br>1-4 O2 Scav Ctrl (module in *function* (*) 2)<br>…<br>1-A (module in *function* (*) 8) |
| 2 | Parameter<br>(CodeLevel:<br>Operator) | Access to the parameters of the configured modules:<br>2-1 Cond Control<br>2-2 O2 Scav Ctrl<br>2-3 Batch-Dosing<br>… |
| 3 | Configuration<br>(CodeLevel:<br>Specialist) | Access to the configuration data of the configured inputs, outputs and modules. Also access to Alarm Output, System Switch and Flow Switch configuration and to Codes:<br>3-1 Inputs<br>3-2 Outputs<br>3-3 Modules<br>3-3-1 Cond Control (module in *function* (*) 1)<br>3-3-2 O2 Scav Ctrl (module in *function* (*) 2)<br>…<br>3-3-8 (module in *function* (*) 8)<br>3-3-9 System Switch<br>3-3-A Flow Switch<br>3-3-B Alarm<br>3-4 Codes |
| 4 | System settings | Language selection, display inversion, factory reset (CodeLevel: Specialist), Device information (with Firmware revision, Number of restarts, Restart function (CodeLevel: Specialist)):<br>4-1 Language<br>4-1-1 German<br>4-1-2 English<br>4-1-3 French<br>4-2 Display<br>4-2-1 normal<br>4-2-2 inverse<br>4-2-3 brightness<br>4-3 Factory Reset (CodeLevel: Specialist)<br>4-4 Device info<br>4-5 Network info (CodeLevel: Operator, available only for devices with Ethernet Option) |
| 5 | Upload/Download<br>(CodeLevel:<br>Operator/Specialist) | Upload / Download of<br>- Configuration file (Specialist level)<br>- Parameter file (Operator level)<br>from / into „Type 8620 mxCONTROL“ via SD card:<br>5-2 Download<br>5-3 Upload |
| 6 | Data logging<br>(CodeLevel: Operator) | Start / Stop of data logging on SD card, Setting of data logging sample time (Tsample), log file options and event log settings (CodeLevel: Specialist). |
| 7 | Calibration<br>(CodeLevel:Specialist) | User calibration of 4-20mA inputs and 4-20mA outputs |
| 8 | Clock<br>(CodeLevel: Operator) | Setting time and date. |

(*) *function* – refer to chapter 11.1 „Functional Overview“

*Table 4: Main menu and submenu items (in the example for "BW 06")*



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# 9.2 Setting Numeric Values

Parameters, i.e. their numeric values can be changed within predefined ranges. They are described in the following chapters. Not all numeric values allow to move the decimal point.

The operator has to select the variable or parameter he wants to change with the soft key “ENTER”.

Before the operator can change the value of a parameter, he has to enter the **correct password**. To change values from the main menu items "Parameter" or "Configuration", the password needs to be entered only once**.** For changing parameters from process data level, the operator has to enter the correct password every time he wants to change a variable.
(Compare also chapter 10.)

→ If the password protection is passed, a special input screen is displayed. In this screen either the decimal point (if available) or the lowest numeral or character will be automatically selected as the first cursor position.

→ The **current cursor position** is always displayed in **inverse colour**. It can be changed step-by-step by pressing the key **“<-“**.

→ If the decimal point is selected by the current cursor position, it can be moved step-by-step to the left by pressing the soft key **“+”**.

→ **Change the value** of a selected numeral/character by pressing the key **“+”**.

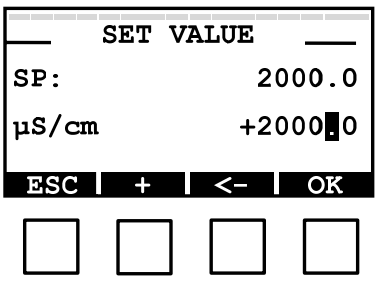
→ **Cancel** the whole setting process by pressing the key **“ESC”** (Escape).

→ **Confirm** the whole setting process by pressing the key **“ENTER”**.

→ After **leaving** the setting process by pressing the key **“ESC”** or **“ENTER”** the original menu screen is shown again.

**Important!**
The **new parameter/configuration data** will be saved only **after returning to the main menu** – a short message thereby shows **“Save in EEPROM”.**
**The password protection only becomes active again after returning to the main menu**!
Return therefore to the main menu after completing the changes!

In the following example soft key 1 is **“ESC”**, key 2 is **“+“**, key 3 is **“<-”** and key 4 is **“OK”**.




Soft key 1 2 3 4

Soft key 1: **ESC**
Soft key 2: **+**
Soft key 3: ←
Soft key 4: **OK**

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# 10 Password Protection

Three **authorization levels** (CodeLevel) are provided for the operation of „Type 8620 mxCONTROL“: **General** access, access for **operators**, access for **specialists**.

A password is a 4 digit number. The operator has to enter the password of the **required protection level** in order to enter protected menus or menu items.
The specialist password also overrides the operator password.

A separate description on **how to change the password** is provided below.

Following user operations are **password protected –** see also table below:

- Editing parameters / configuration data
- Download/upload of parameter/configuration files
- User calibration of 4-20mA outputs
- Changing passwords
- Factory Reset
- Software Reset
- Data Logging
- Clock setting

**Note!** The **"Master" password** cannot be changed. The user of this password is granted **access to all protected code levels**. This Master Password is available at Bürkert Service.

| Protection Level | User | Notes |
|---|---|---|
| **0** | **General access** | **Generell/normal process level:**<br>Current process and control outputs are displayed.<br>Following actions are allowed:<br>• Changing the operating mode of the „Type 8620 mxCONTROL“ between automatic and manual mode.<br>• Changing values in manual mode<br>• Acknowledgement of Alarms (e.g. Maximum Output Timer) and messages.<br>• Operating Language<br>• Display-Mode |
| **1** | **Operator** (Factory set: **Code: 0001**) | **In addition to protection level 0** the following actions are allowed:<br>• Parameter access<br>• Up- and Download of parameter files<br>• Data Logging<br>• Setting Up Real Time Clock |
| **2** | **Specialist** (Factory set: **Code: 0002**) | **In addition to protection levels 0 and 1** the following actions are allowed:<br>• Configuration access<br>• Up- and Download of configuration files<br>• User calibration of 4-20mA outputs<br>• Changing Passwords<br>• Factory Reset<br>• Software Reset |

*Table 5: Password protection – different levels*

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## Changing Passwords

→ Choose the main menu item “Configuration”, enter with “ENTER”

→ Enter the specialist password (by possibly pressing the "+" key several times; you can also use the "<-" for multi-digit numbers), then press "OK".

→ Scroll for Menu item “Codes” with the “Arrow”-keys, enter with “ENTER”

→ Choose the Operator or Specialist Level which shall be changed, then press key “INPUT”

→ Input the specialist code by pressing the key “+” the required number of times, then press “OK”

→ Set a new value for the code by pressing the key “+” (for multi-digit codes use also the key “<-“), then press “OK”.
If the menu item was left by pressing key “ESC” the new value is not accepted!

→ Leave the Menu item “Codes” by pressing “EXIT”

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# 11 General Software Concept and Functions

## 11.1 Functional Overview

The „Type 8620 mxCONTROL“ is a configurable multifunction controller. Its principal of function can be divided into three main process areas:
Input process, control process and output process (see Figure 10).

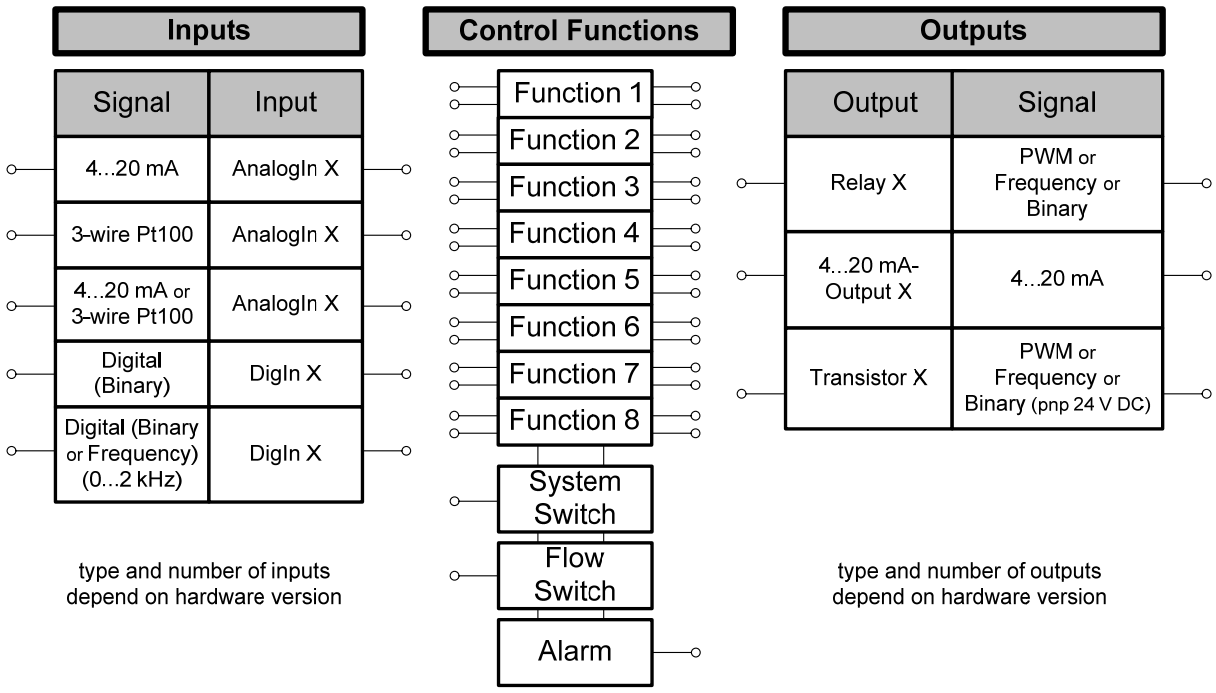


*Figure 10: Process diagram*

**Input Process**:

- Reading of the enabled inputs and the processing of scaled process values from raw values.
- alarm functionality for each of the inputs - except binary and pulse counter inputs

**Control Process:**

- Simultaneous activity of up to 8 Control Functions (further on named *Function*)
- Available modules in the device (see chapter 14 „Controller Modules“) can be used also several times as *function* with its own configuration and parameter data – considering the required resources. The very data-intensive module „BIOCIDE_DOSING" can be used only 1 times, for example
- Each *function* can be configured to work as one of the available modules (see chapter 14) – if the structure of the *function* allows
- Each *function* can contain modules with few module inputs and outputs. But only spezial *functions* can work as modules with many in- and outputs
- The in- and outputs of the *functions* will be linked by means of the PC Tool

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Most modules have a spezial **"Output Override"-Function** (override the original output value) in order to react to situations as:

- Input or Sensor Faults,
- Activation of the System or Flow Switch or
- special states or alarms of other activ modules.

**Output Prozess:**

- Converting and transferring of the virtual module outputs to the configured real outputs (that means the real outputs are controlled to output the configured form of output signal)

## 11.2 Up- and Downloading of Configuration/Parameter Files

### 11.2.1 Download

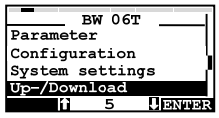
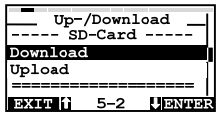
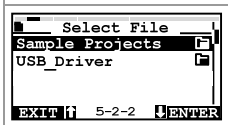
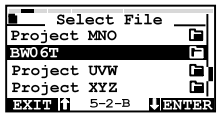
Before the „Type 8620 mxCONTROL" can act in an automation system, a configuration file must be downloaded to the device (e.g. from the SD card).

(The last downloaded configuration and parameter file defines the function of the „Type 8620 mxCONTROL"!)

This is **for the Specialist Level only!**

Up-/Download processes on SD-Card are only possible if Data Logging is disabled.

For the Download process proceed as stated below
(see also the sample menu tree in the appendix 21.5.6):

| | | |
|---|---|---|
| | → | **Supply** the „Type 8620 mxCONTROL" with power |
| | → | Insert an **SD card (formatted with FAT16)** into the interface (SD card slot) under the hinged lid |
|  | → | Scroll in the main menu to the menu item **"Up-/Download"** (via "arrow" keys), press key "ENTER". |
| | → | Enter the **correct password** (via keys **„+"** and **„<-"**)<br>**(**specialist password for configuration files,<br>operator or specialist password for parameter files). |
|  | → | Select **"Download"**, press key "ENTER" |
|  | → | Navigate via arrow keys to file folder containing the desired configuration or parameter file.<br>Return to parent folder by scrolling to **".." or**<br>open a folder by pressing the key "ENTER". |
|  | | To furnish the „Type 8620 mxCONTROL" with a new configuration, **first the configuration file** must be downloaded to the device, followed by the corresponding parameter file. |



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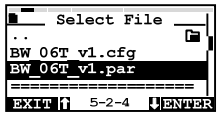
| | |
|---|---|
|  | → Select the desired configuration file **"XXX.cfg"** for download into the „Type 8620 mxCONTROL“, press key "ENTER".<br>Download of the configuration file is running. If the download was successful, the message "Successful" appears in the display.<br>→ Return to submenu by pressing key "EXIT". |
|  | → Select associated parameter file **“XXX.par”,** press key "ENTER".<br>Download of the configuration file is running. If the download was successful, the message "Successful" appears in the display.<br>→ Return to submenu by pressing key "EXIT". |
| | → **Leave the submenu** by pressing key “EXIT” (several times).<br>Remove the SD card by pressing against it. |

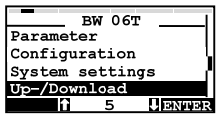
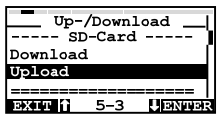
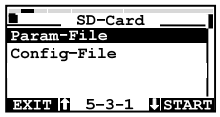
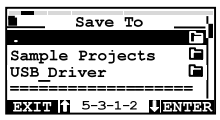
## 11.2.2 Upload

For saving parameter/configuration files use the function “Upload”.

Comments in a downloaded xml-file will not be stored in „Type 8620 mxCONTROL“ – when uploading a file **no comments are included!**

Up-/Download processes on SD-Card are only possible if Data Logging is disabled.

For the Upload process proceed as stated below
(see also the sample menu tree in the appendix 21.5.7)

| | |
|---|---|
| | → **Supply** the „Type 8620 mxCONTROL“ with power |
| | → Insert an **SD card (formatted with FAT16)** into the interface (SD card slot) under the hinged lid |
|  | → Scroll in the main menu to the menu item **“Up-/Download”** (via “arrow” keys), press key “ENTER”<br>→ Enter the **correct password** (via keys **„+“** and **„<-“**)<br>**(**specialist password for configuration files,<br>operator or specialist password for parameter files) |
|  | → Select **“Upload”**, press key “ENTER” |
|  <br>  | → Select **“Param-File”** (operator or specialist level)<br>**or „Config-File“** (for specialist level only) by pressing key “START”.<br>The **device saves the file** to the current folder (marked by a single dot **"."**) after pressing the key "ENTER" or<br>scroll to another folder and press key "ENTER".<br>The device either **uses the name of the last file loaded or creates a new internal name** for the file by extending with “vXX”. (XX is running from 01 to 99).<br>To overwrite an **existing file** with new data, select the desired existing file, press key “ENTER”. It appears a **request for overwriting:**<br>→ Press **“YES”** for overwriting the selected file,<br>→ press **“NO”** for creation of a new file name (with extension vXX) or<br>→ press **“EXIT”** to stop/cancel the upload process |

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| | |
|---|---|
| | **Stopping/cancelling of the upload process** – by pressing key „EXIT“ - makes the uploaded file incomplete and it cannot be used for a download process.<br>But **only at next download process** appears the **error message!**<br>And if upload process was successful the display shows the notification **“Successful”.** |
| | → **Leave the submenu** by pressing key “EXIT” (several times). Remove the SD card by pressing against it. |

# 11.3 Data Logging

The "Data Logging" function

- stores all important process values for **reading, checking and archiving**
- has to be **activated/enabled** for that functionality
- logs the data cyclically according to the set data logging sampling time **"Tsample"**
- logs the data event-triggered (for details refer to “Event Triggered Data Logging Function”)

Each time the internal (volatile) 512-Byte-memory is filled, its content will be attached at the end of the datalog file on the SD card (formatted with FAT16) and will be saved then.

The **Data Logging continues**

- as long as the data logging function is activated
- as long as the SD card is filled - which causes an error message on the display
- as long data can be saved on the SD card - if the logged data cannot be written (anymore) to the SD card, data logging will be stopped and a corresponding error message is shown on the display.

The "**Tsample" sample time** has a factory setting **of 3600 seconds**.

If the selected **sample time is too short**, an excessive data volume will be produced and may fill the memory capacity of the SD card very fast.

Therefore **select a sample time** that enables the SD card to be written with the data until the next change of the SD card or use an SD card with higher capacity (described in next section).

A **new set sample time gets active** when returning to the main menu.

**No Up-/Download** processes on SD-Card are possible if Data Logging was active.

The data is stored into the current log file “**8620-DEV_ID-DEV_SERIAL-INDEX.log**”:

| | | | |
|---|---|---|---|
| with: | DEV_ID | device ID number | (8 digits with leading zeros) |
| | DEV_SERIAL | device serial number | (7 digits with leading zeros) |
| | INDEX | log file index (00001...65535) | (5 digits with leading zeros) |

The current log file name is displayed in the menu “Data logging\Logfile\” under the item “Current”.
The log file index “INDEX” can be increased manually by the operator in the same menu with the item “New logfile” (CodeLevel Operator) – in this case a new log file is started.
If data logging was disabled the log file index can be adjusted (CodeLevel: Specialist); e.g. in order to restore manually the old log file index after a firmware update or a factory reset.

The data can be selected, indicated, edited with PC and also archived externally if necessary.

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Log files are stored in the root directory of the SD card. The root directory can contain approximately max. 100 entries (files and folders; each file / folder name has max. 31 characters).

The **layout of the data logging file**, the abbreviations and the coding used in the header are shown in an **example in appendix 21.6.**

### *Automatic log file size limitation (FSizeLimit = Yes)*

A new log file is started automatically by increasing the log file index,
if data logging was active **and** the current log file size exceeded the maximum log file size FSizeMax.

Back up older log files in time from SD card on PC. If permitted, delete them afterwards on SD card.

### *Event Triggered Data Logging Function*

An integrated **Event Triggered Data Logging Function** logs a complete set of process data with max. 10 s delay, after a specific event was triggered.

Such specific events are:

- Occurrence / Disappearance of an alarm.
- Occurrence of important error messages
  - Battery Failed / RTC Failed / Check Clock!
  - Eeprom Fault XXY
  - Error ISR timing!
  - Calibdata Fault 4-20mA In / Pt100 in / 4-20 mA Out
  - 4-20mA Out X failed
- Changing operational mode (Automatic / Manual)
- Switching on/off of an output, which is configured as an On/Off output
- Communication events and errors (devices with Ethernet Option only)
  - Start / end of incoming / outgoing connection
  - Changes of net link status
  - Important communication error messages
- Miscellaneous events
  - Totalizer reset
  - Start / end of user calibration of 4-20mA inputs / outputs

The event triggered data logging function can be enabled / disabled and configured by means of configuration. For details refer to section “Configuration”.

### *Datalog failed alarm*

If data logging failed (e.g. in case of writing error or full/missing SD Card), a **special datalog alarm** is raised and the common alarm is actuated, too.

This special datalog alarm needs to be reset in the data logging menu by the operator.

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## Parameter (CodeLevel: Operator)

| Parameter | Access via Datalog-menu | Access via XML-Param.-File | Abbre-viation (menu) | Range | Default values (after factory reset or at start of Param-File-Download) |
|---|---|---|---|---|---|
| Datalog Logging SD-Card | rw | -- | -- | enable/disable | Disable (only after factory reset) |
| Sample Time | rw | rw | Tsample | 10 ... 99999sec | 3600sec (*) |
| ***Logfile*** | | | | | |
| Current log file name | r | -- | Current | -- | -- |
| Increase log file index by one (Creates new log file) | w | -- | New Logfile | -- | -- |
| Automatic log file size limitation | rw | rw | FSizeLimit | Yes / No | No |
| Max. log file size | rw | rw | FSizeMax | 0.1 … 100.0 MB | 1.0 MB |

(*) Default value also after successful download of Cfg-File

## Configuration (CodeLevel: Specialist)

| Configuration | Access via Datalog-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| ***Log File*** | | | | | |
| Log file index (**) | rw | -- | LFI | 1 … 65535 | 1 (only after factory reset) |
| ***EventLog*** | | | | | |
| Event Log function | rw | rw | EventLog | On, Off | On |
| ***Log Events (*)*** | | | | | |
| Alarms | rw | rw | Alarms | On, Off | On |
| Important error messages | rw | rw | ErrorMsg | On, Off | On |
| Switching Operational Mode | rw | rw | OpMode | On, Off | On |
| Switching of On/Off outputs | rw | rw | O/O outputs | On, Off | On |
| Communication events / errors | rw | rw | Comm | On, Off | On |
| Miscellaneous | rw | rw | Misc | On, Off | On |

(*) Only displayed, if Event Log function was set to On.
(**) Only displayed, if Datalogging was disabled

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### 11.3.1 Selection of SD card size for Data Logging purposes

The size required for one process data sample depends on the current configuration and the sample time. Every Tsample seconds a new sample of process data is written into the internal volatile Data Logging memory.

**Required free memory** in **[kByte]** $= (\text{LogsPerDay} * \text{Days} * \text{SampleData}) + (\text{NOC} * \text{HeaderData}) + 1024\ \text{kByte}$

with

| | |
|---|---|
| **LogsPerDay** | $= \frac{86400\,\mathbf{s}}{\mathbf{Tsample}} + \mathbf{NOE}$ |
| **NOE** | "**N**umber **O**f trigger **E**vents per day" which forces a new process data sample to be written.<br>For trigger events refer to above section "Event Triggered Data Logging Function". |
| **Tsample** | Data Logging Sample Time in seconds |
| **Days** | Number of Days to be logged |
| **SampleData** | See below |
| **NOC** | "**N**umber **O**f **C**hanges": Number of events requiring a new "header" in the data log file |
| **HeaderData** | See below |
| **86400 s** | = 24 h = 1 day |

**Required free memory** in **[MByte]** **= Required free memory** in **[kByte]** $* \frac{1\text{MByte}}{1024\ \text{kByte}}$

It is:

**SampleData** - storage capacity required on the SD card to log 1 process data sample after Tsample has run down and

**HeaderData** - storage capacity required on the SD card to log 1 header + 1 process data sample.

That means, a **new header and a current process data sample** is written each time, when:

- enabling the Data Logging

or if Data Logging already is enabled:

- returning to the Main Menu after configuration and/or parameter were changed
- the download is finished successfully / is cancelled / failed

**SampleData** in [kByte] = 0.05 kB * (2 + Number of modules)

**HeaderData** in [kByte] = 0.4 kB * (1.5 + Number of modules) + SampleData

with **Number of modules:** Number of active modules.



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**Estimation for a blank SD card**, formatted with FAT16 file system:

$$\text{Required SD card size [MByte]} \geq \frac{\text{Required free memory [MByte]}}{0{,}9}\text{, resulting in:}$$

$$\text{Free SD card memory [MByte]} = 0{,}9 * \text{SD card size [MByte]}$$

**Estimation, how many days the SD card will suffice:**

$$\textbf{Days} = \frac{\left(\text{Free SD card memory [MByte]} - 1\text{MByte}\right) * \frac{1024\text{ kByte}}{1\text{MByte}}\right) - \left(\text{NOC} * \text{HeaderData}\right)}{\text{LogsPerDay} * \text{SampleData}}$$

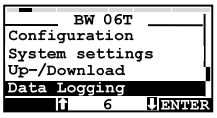
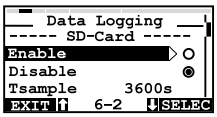
**Example:**

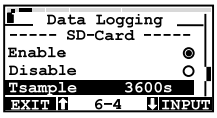
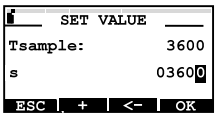
An **empty 64MByte SD card,** formatted with the FAT16 file system,
with a free SD card memory of 0.9 * 64 MByte can receive the logging of process data of 4 normal modules (SampleData = 0.3 kB, HeaderData = 2.5 kB) at an estimated number of 1000 NOC (Number Of Changes = special events):

- with disabled event triggered datalog function:
  - approx. 21 days with TSample = 10 sec or
  - approx. 3.5 years with TSample = 600 sec = 10 min
- with enabled event triggered datalog function and estimated number of 1000 NOE (Number Of trigger Events per day – corresponds approx. with switching on and off each of the 4 module outputs 5 times per hour):
  - approx. 19 days with TSample = 10 sec or
  - approx. 5 months with TSample = 600 sec = 10 min

## 11.3.2 Start of Data Logging (enabling)

To enable the Data Logging function proceed as stated below.
An example for the data logging layout can be seen in appendix 21.6.

| | |
|---|---|
| | → Insert an **SD card (formatted with FAT16)** with enough free memory into the SD card slot under the hinged lid |
|  | → Scroll in the main menu to the menu item **"Data Logging"** (via "arrow" keys), press key "ENTER".<br>→ Enter the operator or specialist **password** (via keys **„+"** and **„<-"**) |
|  | → Select **„Enable"** of Data Logging, press key "SELEC"<br>The Data Logging function is **activated immediately!**<br>The active function is indicated by a **symbol top left on the display.**<br>It is now possible to select another menu item (except Up-/Download) because the Data Logging function is running in the background until being disabled. |

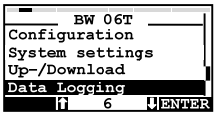
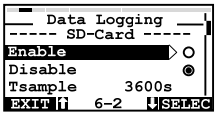
| | |
|---|---|
|  | Changing sample time:<br>→ Select **„Tsample“**, press key “INPUT” |
|  | → Input a new value for „Tsample“ (via keys „+“ und „<-“), press key „OK“<br>New settings of Tsample apply **when returning to the main menu!** |
| | → **„ESC“ cancels** the function of setting a new value for Tsample, the new value for Tsample will not be applied. |
| | → **Leave the submenu** by pressing key “EXIT”. |

**Do not remove the SD card** if the Data Logging function is active!
Otherwise the logged data could be lost and the directory structure of the SD card could be damaged up to a non-readability of the SD card.

When **changing the SD card** the Data Logging has to be enabled again (notice the symbol top left on display).

## 11.3.3 Stop of Data Logging (disabling)

To disable the Data Logging function proceed as stated below.

| | |
|---|---|
|  | → Scroll in the main menu to the menu item **“Data Logging”** (via “arrow” keys), press key “ENTER”.<br>→ Enter the operator or specialist **password** (via keys **„+“** and **„<-“**) |
|  | → Select **„Disable“** of Data Logging, press key "SELEC"<br>The Data Logging function is **deactivated immediately!**<br>The symbol top left on the display vanishes**.** |
| | → **Leave the submenu** by pressing key “EXIT”.<br>Remove the SD card for processing of the file on a PC. |

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# 11.4 Configuration and Parameterization

## 11.4.1 Preface about Configuration/Parameterisation

The configuration **(Code Level: Specialist)** can be done with a **special configuration file** (XML style), which can be downloaded into the „Type 8620 mxCONTROL“ from an SD card or via USB. This configuration file will be generated with a special PC Tool.

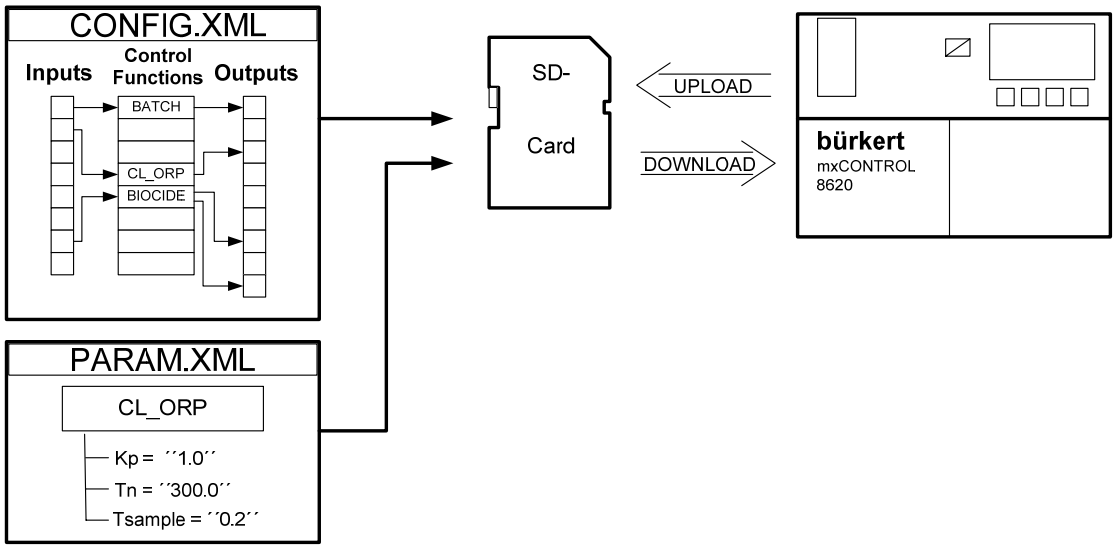


*Figure 11: Diagram of the upload and download of configuration and parameter files*

This procedure allows an identical **configuration** of many „Type 8620 mxCONTROL“ devices. It is also possible to upload a current configuration file from the „Type 8620 mxCONTROL“.

The **parameterization** can be done separately in the same way.
It is possible to change only the parameterization in the parameter file, e.g. for optimizations and download it into the device.
Furthermore, the „Type 8620 mxCONTROL“ can be parameterized by using the soft keys. It is also possible to upload the current parameters from the „Type 8620 mxCONTROL“.

**Firmware updates** are handled only via USB.

## 11.4.2 Operating Language

**Pre-selection of the operating language** is done in the configuration file. The language can also be changed by an operator in the **System settings menu** at the device. Available are the languages **English, German, French**.

## 11.4.3 Factory Setting of Parameters and Factory Reset

The command **“Factory Reset” deactivates (deletes) the current configuration and parameterization.**
Also the all the **parameters** and the **codes are reset** to **default values.**
Further operation of the „Type 8620 mxCONTROL“ is only possible after downloading a configuration and parameter file via SD card.

"Factory Reset" is a submenu of the main menu item "System Settings". It is password-protected (CodeLevel: Specialist).

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# 11.5 Communication

## 11.5.1 USB

Device access via USB allows putting the “Type 8620 mxCONTROL” easily into service.
This functionality is available from Firmware Rev.C.00.00.00.

### *Functionality*

Please refer to chapter 11.5.3 “(Remote) Device access via PC-Tool”.

### Configuration (CodeLevel: Specialist)

This configuration menu is located under the menu item “Configuration\Communication\USB“.

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset) |
|---|---|---|---|---|---|
| USB device access (via PC-Tool) | rw | -- | PCTool Access | On, Off | On |

## 11.5.2 Ethernet (only devices with Ethernet option)

„Type 8620 mxCONTROL“ devices with assembled Ethernet option offer remote access and email notification possibilities.

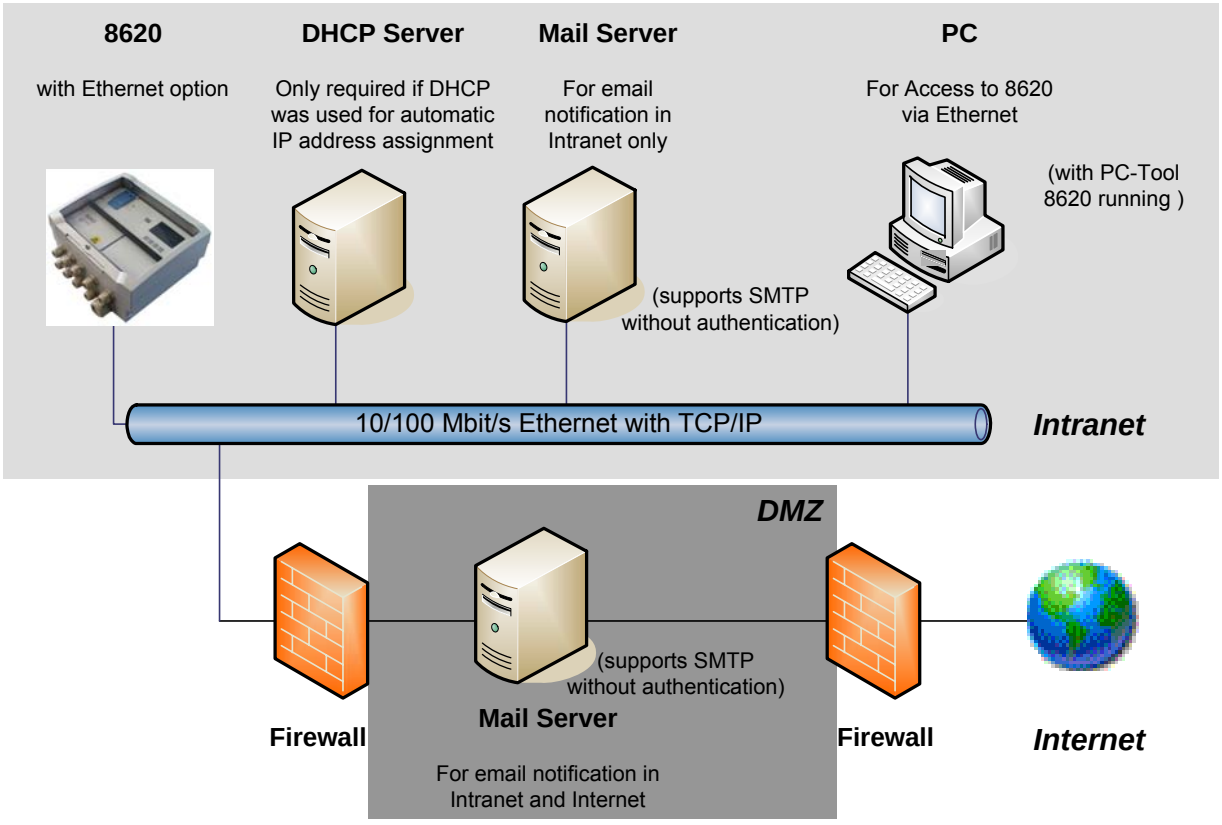


*Figure 12: Remote access and Email notification possibility (with Ethernet option)*



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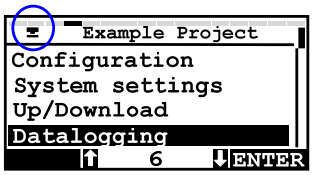
## Features

| Feature | |
|---|---|
| Operational Speed | 10 / 100 Mbps (auto negotiation) |
| IP address assignment | Static (recommended) or dynamic (DHCP).<br>A DHCP server is required for dynamic IP address. |
| Email notification | For alarm / warning / error and restart information.<br>Therefore a mail server with SMTP (without authentication) for sending emails to intranet and internet is required.<br>(For details refer to “Email notification”) |
| Device access | With Buerkert PC-Tool via Serial Tunnel and TCP/IP over Port 10001.<br>(For details refer to “Remote device access via PC-Tool”) |
| Security | - Code protected device login via PC-Tool : CodeLevel + Code<br>- Automatic logout after 5 minutes of no action (except if remote control was active)<br>- Automatic disconnection after 5 minutes without login<br>- No encryption of data transmitted over TCP/IP<br>- DMZ (Demilitarized Zone) or VPN (Virtual Private Network) are not supported – therefore an external gateway with the necessary functionality is required. |

## Display of Ethernet state

The following list shows the displayed **symbols for the current ethernet state.**

The symbol for the Ethernet remote state is located in the upper left corner of the display, right beside the datalog symbol.




| Symbol | Description |
|---|---|
| | Ethernet function disabled / not supported (devices without ethernet option) |
| | Ethernet function enabled, initializing / checking network status |
| | No network detected |
| | Ethernet ready |
| | Incoming connection (e.g. from PC-Tool) |
| | Outgoing connection (to SMTP mail server) |
| | Update mode active (e.g. for firmware update of ethernet component) |

Following additional information can be found in the menu “System settings \ Network info” (CodeLevel Operator or Specialist required):

| | |
|---|---|
| Device | - Current IP address and subnet mask<br>- MAC address (*)<br>- Firmware revision of ethernet module (*)<br>- Update Mode (*) |
| Connection | - IP address which the device is currently connected with (0.0.0.0 if there is no connection or IP of incoming connection could not be detected)<br>- Current Gateway IP address |
| Send test email | Initiates transmission of a test email (only visible, if email notification is enabled) |
| State (*) | of internal ethernet state machine |

(*) only visible with CodeLevel Spezialist

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## Email notification

### *Requirements*

A mail server is required, that

- supports SMTP (Simple Mail Transfer Protocol) without prior user authentication
- is reachable by the “Type 8620 mxCONTROL” from the Intranet

For transmission of emails outside the local network (e.g. to the Internet):

- Local network safety mechanism allows transmission of emails to the outside
- The SMTP mail server in the Intranet has to be configured to allow email messages at least for these certain external addresses and to forward them to the outside.

### *Functionality*

An email transmission is caused by a trigger event.

There are 3 kinds of email types which differ in the transmission trigger events - refer to the following table for details.

| Email type | Trigger events |
|---|---|
| Email 1 | Occurrence of a new alarm:<br>- Input alarm<br>- Control function alarm<br>- Output alarm<br>- Datalog failed alarm |
| Email 2 | Occurence of a new warning<br>- Input warning<br>- Control function warning<br>Displayed important error messages:<br>- Battery Failed / RTC Failed / Check Clock!<br>- Eeprom Fault XXY<br>- Error ISR timing!<br>- Calibdata Fault 4-20mA In / Pt100 in / 4-20 mA Out<br>- 4-20mA Out X failed<br>- Datalog IS NOT ACTIVE<br>SD errors during datalogging:<br>- SD: Disk is full / Error Writing! / Error Open File / Error Sync / No SD-Card detected |
| Email 3 | (Re)start of the device. |
| Test email | Initiated by operator from menu “System settings \ Network info \ Send test email”<br>(CodeLevel Operator required) |

Each email contains additional information on the device and the trigger event (for examples refer to “Email examples”). Emails are created in English only.

The emails are always transmitted to all configured recipients (max. 2 recipients possible).

The priority and the subject of emails 1 - 3 are user configurable.

The transmission of not required email types can be deactivated by setting the corresponding Trigger parameter to Off.

Emails will only be transmitted, if there is no remote device access via Ethernet (with the PC-Tool).

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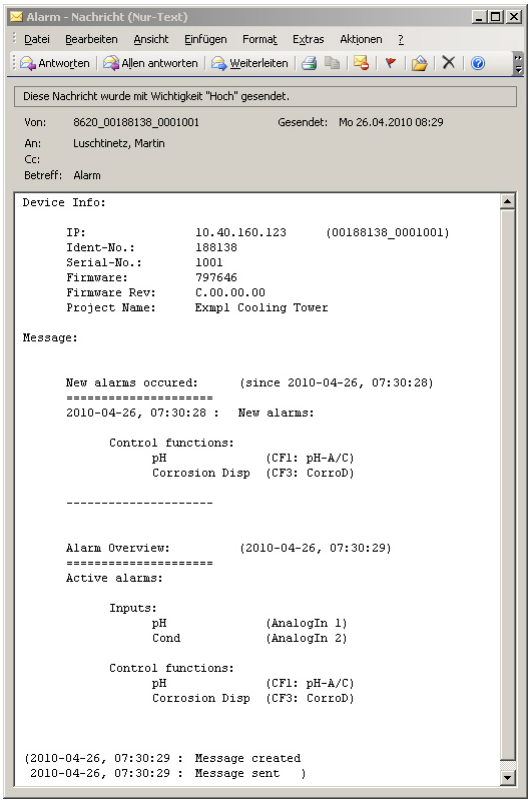
Up to 4 emails can be sent with one server connection. There is a 5 second mail server reconnection delay, in order to enable external device access in worse case of continuous new trigger events. The reconnection delay is set to 30 sec / 10 sec in case of failed mail server connection / communication.

If a connection to the mail server was delayed or failed the latest event information is kept and updated in a volatile memory – for a later reconnection. Refer to the following table for details.

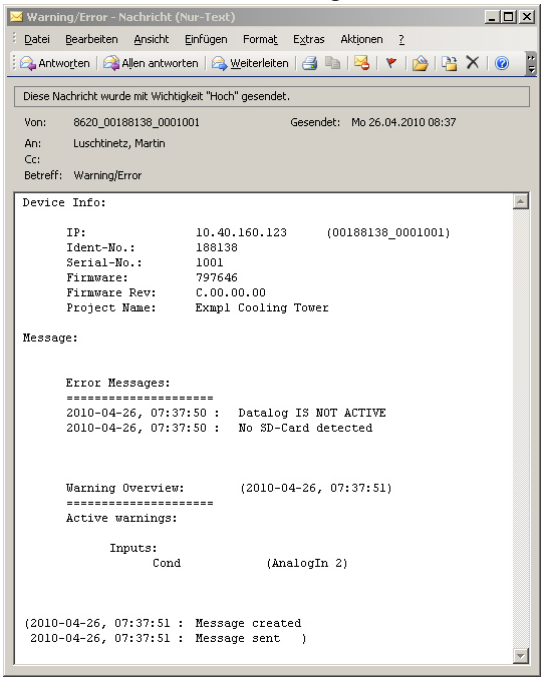
| Email type | In case of failed / delayed connect to the mail server - stored for a reconnect |
|---|---|
| Email 1 | - Last 5 alarms<br>- Information, which former alarms occured at least once since last transmitted email 1 |
| Email 2 | - Last 5 warnings<br>- Information, which former warnings occured at least once since last transmitted email 2<br>- Last 10 displayed important error messages |
| Email 3 | - Device (re)start timestamp |

## *Email examples*

**Email 1 – Alarm**




**Email 2 – Warning/Error**




## *Renotification*

A renotification interval can be configured for email 1 and email 2.

If at least one of the alarms (email 1) or warnings (email 2) is still active and the corresponding renotifcation timer expires, the corresponding email is re-sent. A new trigger event resets the corresponding renotification timer.

The email contains information on the device and an overview of current active alarms (email 1) or warnings (email 2).

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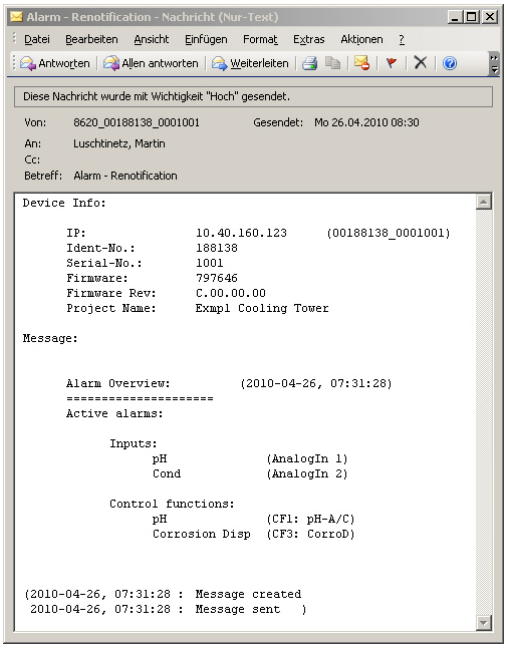
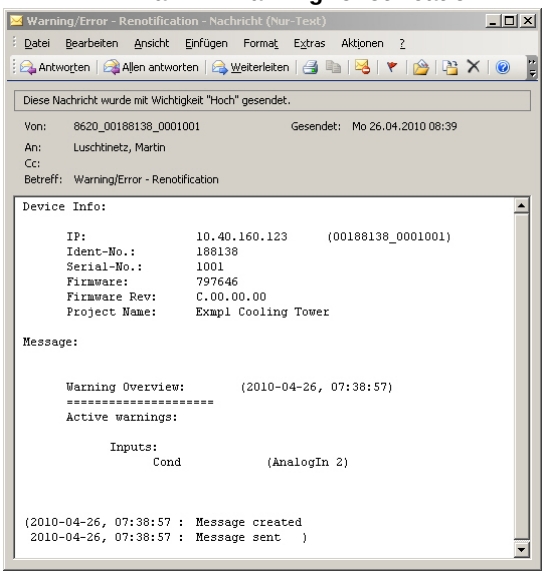
**Email 1 – Alarm renotification**




**Email 2 – Warning renotification**




## Remote device access via PC-Tool

### *Requirements*

- Access to the local Ethernet network, in which the device “Type 8620 mxCONTROL” is located
- Network safety regulations allow traffic on TCP/IP port 10001
- IP address of “Type 8620 mxCONTROL” is known
- Unique DHCP host name of “Type 8620 mxCONTROL” is known (if Static IP = No)

### *Functionality*

Please refer to chapter 11.5.3 (Remote) Device access via PC-Tool.

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## Datalogging

The datalog file of devices with Ethernet option contains 2 additional columns: “Ethernet state” and “Ethernet event”.

### *Ethernet state*

<table>
<tr><th>Ethernet state</th><th>Description</th></tr>
<tr><td>-1</td><td>Ethernet function disabled</td></tr>
<tr><td>0</td><td>Unknown state</td></tr>
<tr><td>1</td><td>Ethernet module is initializing / periodically checking network status</td></tr>
<tr><td>5</td><td>Ethernet function enabled, but no net link available</td></tr>
<tr><td>9</td><td>Disconnecting a connection</td></tr>
<tr><td>10 - 13</td><td>Ethernet ready
<table>
<tr><td></td><td>PC-Tool Access</td><td>Email notification</td></tr>
<tr><td>10</td><td>off</td><td>off</td></tr>
<tr><td>11</td><td>on</td><td>off</td></tr>
<tr><td>12</td><td>off</td><td>on</td></tr>
<tr><td>13</td><td>on</td><td>on</td></tr>
</table></td></tr>
<tr><td>20</td><td>Outgoing connection to mail server</td></tr>
<tr><td>30</td><td>Incoming connection (e.g. from PC-Tool)</td></tr>
<tr><td>50</td><td>Ethernet module in update mode</td></tr>
</table>

### *Ethernet event*

The column “Ethernet event” contains e.g.

- the last displayed ethernet messages (max. 5)
- the email recipients, if emails were successfully sent
- start / end of incoming connection (PC-Tool access)

## Configuration (CodeLevel: Specialist)

| **Configuration** | **Access via Cfg.-menu** | **Access via XML-Cfg.-File** | **Abbreviation (menu)** | **Value range** | **Default values** (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Ethernet functionality | rw | -- | Ethernet | On, Off | On |
| Remote device access (via PC-Tool) | rw | -- | PCTool Access | On, Off | On |
| ***Settings (#)*** | | | | | |
| Static IP address | rw | rw | Static IP | Yes, No | No |
| Device IP address (*) | rw | rw | IP | 0.0.0.0 … 255.255.255.255 | 0.0.0.0 |
| Subnet mask (*) | rW | rw | SNM | 255.0.0.0 … 255.255.255.254 | 255.255.255.0 |
| Gateway IP address (*) | rw | rw | Gateway IP | 0.0.0.0 … 255.255.255.255 | 0.0.0.0 |
| DHCP host name (**) | rw | rw | DHCP host name | max. 16 characters [a-zA-Z0-9_-] - for default value leave string empty | ID_SERIAL with (*****) |

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| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| ***Notification*** | | | | | |
| Notification via email | rw | rw | Via email | Yes, No | No |
| ***SMTP mail server (#) (***)*** | | | | | |
| IP address of mail server | rw | rw | IP | 0.0.0.0 … 255.255.255.255 | 0.0.0.0 |
| Port number for SMTP | rw | rw | Port | 0 … 65535 | 25 |
| ***Email (***)*** | | | | | |
| Device´s sender address (#) | rw | rw | From (sender) | max. 47 characters (***** *) [a-zA-Z0-9_@.-] | |
| Recipient 1 | rw | rw | To (recipient 1) | max. 39 characters [a-zA-Z0-9_@.-] | |
| Recipient 2 | rw | rw | To (recipient 2) | max. 39 characters [a-zA-Z0-9_@.-] | |
| ***Email 1, Email 2, Email 3 (***)*** | | | | | |
| Email Trigger | rw | rw | Trigger | On, Off | On |
| Email priority (for display in email program on PC) | rw | rw | Priority | 1 (highest) … 5 (lowest) | 1 |
| Renotification interval (****) | rw | rw | ReNotify | 0 (off) … 10800 min | 0 min |
| Email subject | rw | rw | Subject | max. 23 characters [a-zA-Z0-9 _.:/!+*-] | Email 1: Alarm 2: Warning/Error 3: Device Restarted |

(#) Ask your local network administrator for the right settings.
(*) Only visible, if Static IP = Yes
(**) Only visible, if Static IP = No
(***) Only visible, if Via email = Yes
(****) Only available for email 1 and email 2
(*****) ID = Device ident no. (8 digits with ledig zeros),
SERIAL = Device serial no. (7 digits with ledig zeros)
(***** *) Empty string activates default sender address: 8620_ID_SERIAL with (*****)

## 11.5.3 (Remote) Device access via PC-Tool

Remote device access allows operating the controller via Ethernet (devices with Ethernet option only) or via USB.

Remote device access can be disabled only directly at the device – in the configuration menu:

| | | |
|---|---|---|
| USB: | Configuration \ Communication \ USB \ PCToolAccess | On (default) / Off |
| Ethernet: | Configuration \ Communication \ Ethernet \ PCToolAccess | On (default) / Off |

Configuration of PCToolAccess is not stored in the configuration file.

The PCToolAccess has to be disabled manually again in case of factory reset.

The device can handle only one remote device access at one time.

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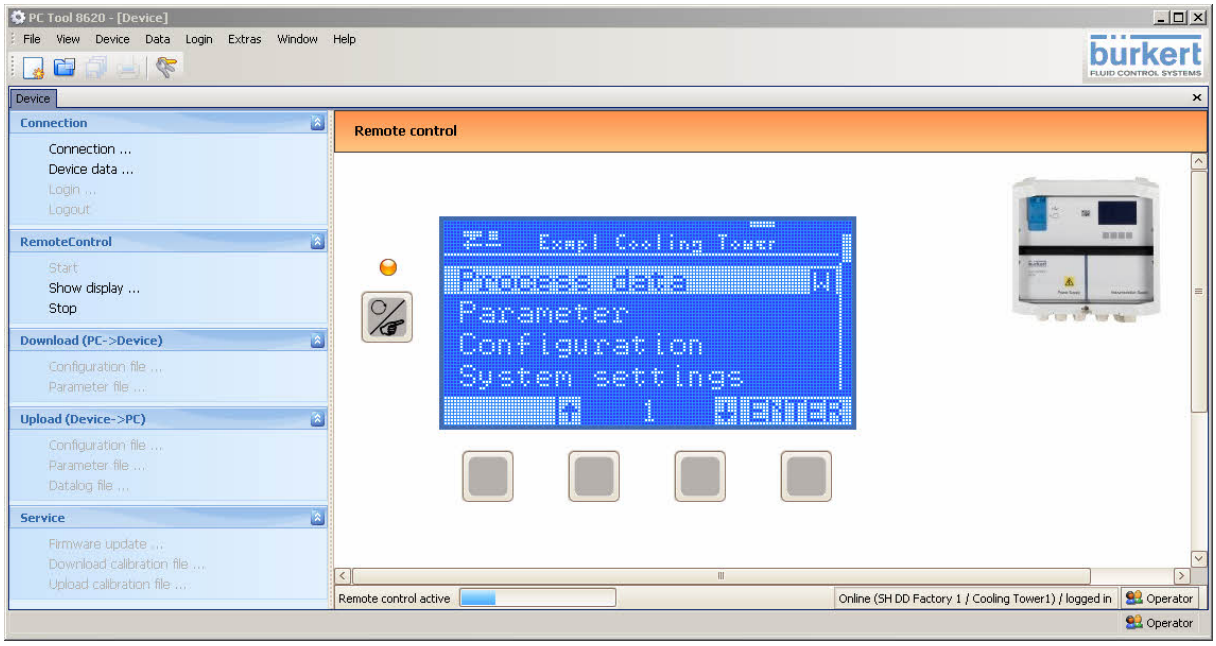
## Function overview




| PC Tool menu item | Explanation |
|---|---|
| **Connection** | One connection possible at one time. |
| Connection … | Establishing / closing a connection to a device.<br>Devices with Ethernet option: The user has to input IP address and the port number of the desired device.<br>An integrated address book function supports easy device access. |
| Device data … | Display of current device ID & serial number, Firmware ID & revision |
| Login | Device login window with selectable login level (Operator / Specialist / Master) and code input. |
| Logout | Device logout. |
| **Remote Control** | Current device display is shown in the PC-Tool, too. Navigation with keys like standing directly in front of the device, including code input for accessing code protected menus.<br>Device keys have priority. Yellow LED displays operation mode / alarm status. |
| **Download (PC-> Device)** | Download corresponding file from PC into device.<br>Corresponding device login level required: |
| Configuration file | Specialist or higher |
| Parameter file | Operator or higher |
| **Upload (Device->PC)** | Upload corresponding file from device to PC<br>Corresponding device login level required: |
| Configuration file | Specialist or higher |
| Parameter file | Operator or higher |
| (Data)Log file | Operator or higher<br>Upload of complete file or of a special time selection.<br>Remote deletion of (data)log file on SD Card possible (CodeLevel: Specialist).<br>For deletion of current datalog file, data logging needs to be disabled. |
| **Service** | Corresponding device login level required: |
| Download calibration file | Master |
| Upload calibration file | Master |

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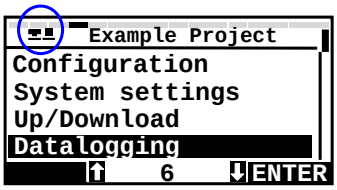
## Display of current state

Do not change parameters / values, when remote upload or download is active.

The following list shows the displayed **symbols for the current remote state.**

The symbol for the remote state is located in the upper left corner of the display, right beside the Ethernet status symbol.




| Symbol | Description |
|---|---|
| | Remote user is logged in |
| | Remote Download is active |
| | Remote Upload is active |
| | Remote Control is active |
| | Remote Access is active (reading log files on SD card) |

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# 12 Inputs

Depending on the hardware version, the „Type 8620 mxCONTROL“ has digital and analog inputs which can be configured according to the user requirements.

**Configuration via the configuration file:**

- Enabling and labelling the desired inputs
- Activation of special input functions

**Configuration via the configuration file but also directly on the „Type 8620 mxCONTROL“:**

- Scaling and filter settings
- alarm settings.

**Inputs** of a configuration **can be enabled or disabled directly at the device** by enabling or disabling them in the main menu item “Configuration”.

**Disabled inputs** can no longer be accessed via the "Process Data" menu after returning to the main menu.
**Reactivation** is possible via the "Configuration" menu or by loading the original configuration.
Disabling inputs may result in **configuration errors with their associated modules** which may then possibly no longer work correctly.

## 12.1 Digital Inputs

The digital inputs of the „Type 8620 mxCONTROL“ can be configured as follows:

- as binary input (for e.g. the Flow Switch and System Switch override functionality) **or**
- as pulse counter input (e.g. for the batch module) **or**
- as frequency input.

The **type configuration** has to be done with the configuration file.

The following table lists the accepted signals, depending on the input type.

| Digital input type | Configuration as | Accepts signals from |
|---|---|---|
| Binary input | Binary | push-pull-output |
| | potf.Binary | - open collector (npn, pnp)<br>- hall effect<br>- reed switch<br>- micro switch |
| Pulse counter input | PulseC | |
| Frequency input | Frequency | |

### Configuration (CodeLevel: Specialist)

| Confi-gura-tion | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbre-viation (menu) | Range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Type | r | rw | Type | Binary (0/24 V DC binary input),<br>potf.Binary (dry contact binary input),<br>PulseC (pulse counter input),<br>Frequency (frequency input),<br>(none) | (none) |



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## 12.1.1 Binary Inputs

Binary inputs are usually used to detect special outer conditions, which shall have an effect on the behaviour of the controller/module.

There are **two types of binary inputs**, which differ in the acceptance of the input signal: Normal binary inputs and potential-free binary inputs. Please refer to the following selection chart for the configuration of the right input type.

| Digital input type | Accepts signals from |
|---|---|
| Binary | push-pull-output |
| potf.Binary | - open collector (npn, pnp)<br>- hall effect<br>- reed switch<br>- micro switch |

The **binary input signal** can be inverted internally by means of configuration. Please refer to the following table for the logical assignment.

| **Binary** | | |
|---|---|---|
| input voltage | **logical value** | |
| | Input signal:<br>**Not inverted (Inv = No)** | Input signal:<br>**Inverted (Inv = Yes)** |
| 0 … 4.5 V | 0 (not active) | 1 (active) |
| 13 … 35 V | 1 (active) | 0 (not active) |

| **potf.Binary – Binary, potential-free** | | |
|---|---|---|
| input voltage | **logical value** | |
| | Input signal:<br>**Not inverted (Inv = No)** | Input signal:<br>**Inverted (Inv = Yes)** |
| open contact | 0 (not active) | 1 (active) |
| 0 … 4.5 V<br>or 13 … 35 V | 1 (active) | 0 (not active) |

The corresponding logical value is shown in the display.

### *(Process Value) Alarm*

A process value alarm function can be activated by configuration of the alarm mode.

| Alarm Mode | Description |
|---|---|
| Off | Alarm function not active |
| Alarm L | Low Alarm.<br>If the binary input signal (after inversion) was continuously<br>• 0 for more than alarm delay time **AlarmDel** [seconds], the alarm gets active.<br>• 1 for more than alarm delay time **AlarmDel** [seconds], the alarm gets inactive. |
| Alarm H | High Alarm.<br>If the binary input signal (after inversion) was continuously<br>• 1 for more than alarm delay time **AlarmDel** [seconds], the alarm gets active.<br>• 0 for more than alarm delay time **AlarmDel** [seconds], the alarm gets inactive. |

If a low or a high alarm occurred, the **common alarm output** (if enabled) is actuated, too.



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The alarm information is **displayed in the menu Processdata\Inputs** as an icon similar to the input alarms of frequency and analog inputs. As long as the alarm is timing (i.e. the binary input signal fits the alarm condition, but the alarm delay time is not reached yet) a warning icon is displayed.

### Configuration (CodeLevel: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbre-viation (menu) | Range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Enabling / disabling input | rw | rw | Input | On/Off | Off |
| Inversion of Input signal | rw | rw | Inv | Yes / No | No |
| ***Process value alarm*** | | | | | |
| Alarm Mode | rw | rw | Mode | Off, Alarm L, Alarm H | Off |
| Alarm delay time | rw | rw | AlarmDel | 0.0 … 1800.0 s | 1.0 s |

## 12.1.2 Frequency Inputs

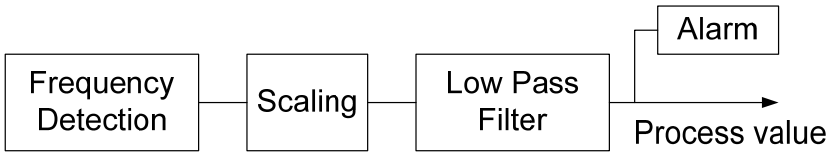


*Figure 13: Frequency input*

### *Frequency detection*

The current **frequency of the input signal** is detected by measuring the time between two rising edges of the input signal. Frequencies lower than 0.5 Hz are assumed as 0 Hz, frequencies higher than 2000 Hz are rejected as interferences.

Frequency inputs do **not support the safety output** function.

### *Scaling*

There are two ways of scaling the frequency input signal, either

- Determining the K-Factor as well as the low and high scaling value in the desired engineering unit or
- determining a low and high frequency value (Freq-, Freq+) with the corresponding low and high scaling values (Scal-, Scal+) in the desired engineering unit.

The scaling procedure is determined in the configuration file for each frequency input separately by **USE_KFACTOR**

| USE_KFACTOR | |
|---|---|
| 0 | Scaling with Freq- and Freq+ |
| 1 | Scaling with the K-Factor |

#### Scaling with K-Factor

The scaling with K-Factor is recommended for easy configuration of connected flow sensors.



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The K-Factor specifies the amount of pulses per volume unit. The K-Factor can specified in different units - please refer to the "Configuration" section (see below) for the available units.

The setting of the scaling unit determines the unit of the process value. This unit is used at the same time for the scaling values, the alarm and warning limits of this input and for certain parameters of associated modules.

| Unit Group | Measuring units (*) |
|---|---|
| Flow (flow rate) | L/s, L/min, L/h, m3/min, m3/h, Gal/s US, Gal/m US, Gal/h US, gal/s Imp, gal/m Imp, gal/h Imp, bbl/s US, bbl/m US, bbl/h US, ft3/s, ft3/min, ft3/h, P/s, P/m |

(*) If the display does not have sufficient spaces available, only 3 or 6 digits are shown; please refer to the table in chapter 5.2 for the specific unit abbreviations.

The reference span for the alarm and warning hysteresis of this input as well as for specific parameters of associated modules (e.g. deadband) are defined by the setting of the low and high scaling value. Furthermore, the value range of some input parameters and certain module parameters (e.g. set point) is determined by the low and high scaling value.

The process value is not limited by the low and high scaling value.

**Scaling with low and high frequency values**

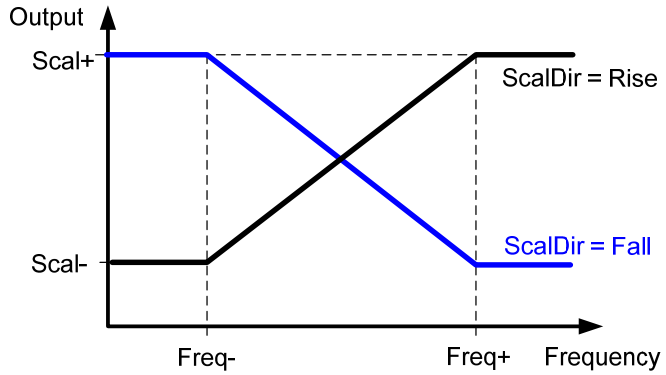


*Figure 14: Frequency scaling with low and high scaling value.*

| | |
|---|---|
| Freq- | Low frequency value |
| Freq+ | High frequency value |
| Scal- | ScalDir = Rise: Low scaling value, assigned to the lower frequency value (Freq-)<br>ScalDir =case: Low scaling value, assigned to upper frequency value (Freq+) |
| Scal+ | ScalDir = Rise: High scaling value, assigned to the upper frequency value (Freq+)<br>ScalDir =case: High scaling value, assigned to low frequency value (Freq-) |

The **scaling function** assigns a numeric value to the measured frequency that corresponds to the physical parameter transmitted to the controller by the sensor/transmitter.

For displaying purposes an engineering unit can be assigned to the input. The following table lists the available units to be selected separately for each frequency input:

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| Unit Group | Measuring units (*) |
|---|---|
| Miscellaneous | ppm, V, mA, Pulse, Hz, %, no unit? |
| Chemical Analysis | µS/cm, mS/cm, MPY, µMPY, mV, mg/L, %Sat, pH |
| Volume | L, hL, m3, Gal US; bbl US, gal Imp, ft3, yd3 |
| Flow (flow rate) | L/s, L/min, L/h, m3/min, m3/h, Gal/s US, Gal/m US, Gal/h US, gal/s Imp, gal/m Imp, gal/h Imp, bbl/s US, bbl/m US, bbl/h US, ft3/s, ft3/min, ft3/h, P/s, P/m |
| Temperature | °C, °F, °Rank, K |
| Pressure | bar, mbar, psi |

(*) If the display does not have sufficient spaces available, only 3 or 6 digits are shown; please refer to the table in chapter 5.2 for the specific unit abbreviations.

If the **scaling unit of a frequency input** was changed, the corresponding **alarm and warning limits and** the **set points** of the corresponding modules **have to be set manually** to the value corresponding with the new engineering unit of the input (no automatic conversion from one unit to a different one!).

When **changing the scaling values,** the corresponding **alarm and warning limit** as the set points of the corresponding modules should **be examined for** their **relevance!**

## *Low Pass Filter*

To **minimise the effect of spikes and fast transients** acting on the device's external cabling and possibly causing interferences, a low pass filter (PT1) is employed.

The setting is made via the selection of the filter stage (refer to the following Table 6).

| Filter stage | Corresponds to limit frequency [Hz] | Effect |
|---|---|---|
| 0 | 10 | Lowest filter effect |
| 1 | 5 | |
| 2 | 2 | |
| 3 | 1 | |
| 4 | 0.5 | |
| 5 | 0.2 | |
| 6 | 0.1 | |
| 7 | 0.07 | |
| 8 | 0.05 | |
| 9 | 0.03 | Greatest filter effect |

*Table 6: Filter stage and limit frequency*

## *(Process Value) Alarm*

This function activates the general alarm output if a controlled process value exceeds the (adjustable) upper and lower alarm limits.

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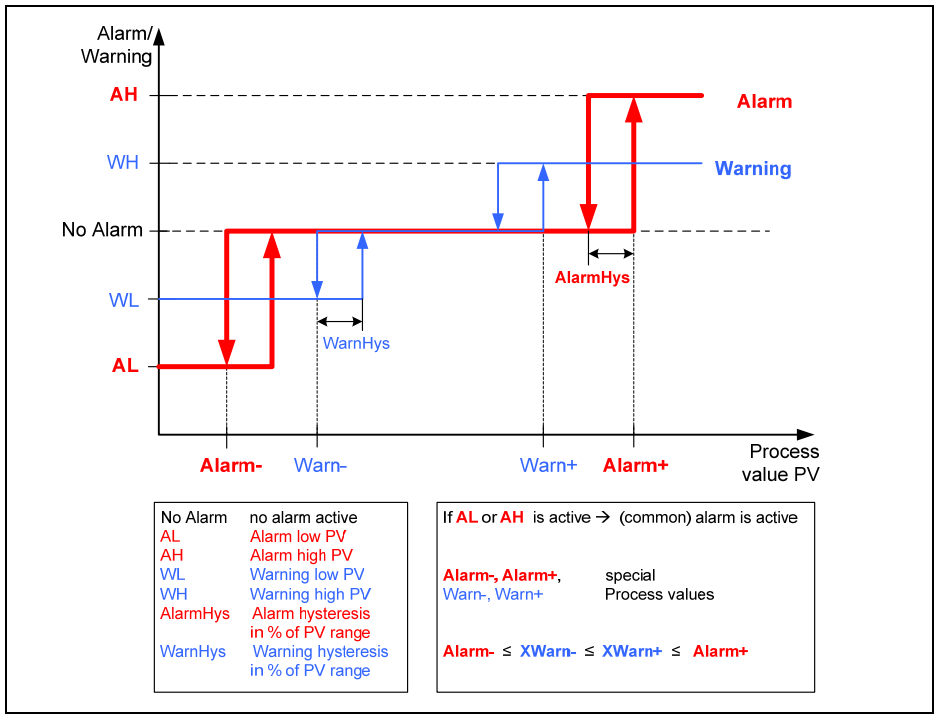


*Figure 15: Alarm/warning - switching hysteresis*

Alarm activation is equipped with a **switching hysteresis** (AlarmHys) to prevent excessive switching. The hysteresis has to be parameterized in percent of input range (i.e. the input range (Scal- … Scal+) corresponds to 100 %).

For displaying and data logging purposes there are adjustable upper and lower warning limits and a **separate warning hysteresis WarnHys.**

The alarm and warning limits are configured in the unit of the process value.

The function scope of the alarm and warning function can be configured as follows:

| Alarm mode | Description |
|---|---|
| Alarm & Warn | Alarm and warning function enabled. |
| Alarm | Only alarm function enabled. Parameters of the warning function are not indicated. |
| disable | Alarm and warning function not enabled. Parameters are not indicated. |

If one of the two alarm limits is not required while the alarm function is enabled, this alarm limit is to be set to a value outside of the accessible process value range.

| | |
|---|---|
| Example: | Flow measurement, process value range: 0 - 10 L/s, no alarm required at lower alarm limit → set lower alarm limit to -1L/s |

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## Configuration (CodeLevel: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbre-viation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Enabling / disabling input | rw | rw | Input | On/Off | Off |
| USE_KFACTOR | -- | rw | -- | 0; 1 | 0 |
| Unit K-Factor *) | rw | rw | K-Factor Unit | (Pulses per) … L, m³, Gal US, bbl US, gal Imp, ft3, Pulse | Pulses per L |
| K-Factor *) | rw | rw | K-Factor | 0.001 ... 9999.0 | 1.0 |
| Frequency range: Lower value**) | rw | rw | Freq- | 0 Hz … Freq+ | 0.0 |
| Frequency range: Upper value**) | rw | rw | Freq+ | Freq- … 2000 Hz | 2000.0 |
| Process value scaling: unit | rw | rw | Scal Unit | Units of Chem. Analysis, Volume, Flow, Temperature, Misc; if *) then only Flow***) | No Unit |
| Process value scaling: low scaling value | rw | rw | Scal- | -99999 … Scal+ | -99999 |
| Process value scaling: high scaling value | rw | rw | Scal+ | Scal- … 99999 | 99999 |
| Process value scaling**): Sense of action | rw | rw | ScalDir | Rise / Fall | Rise |
| Filter stage | rw | rw | Filter | 0 ... 9 | 0 |
| ***Process value alarm*** | | | | | |
| Alarm mode | rw | rw | Mode | Off, Alarm, Alarm & Warn | Alarm & Warn |
| Low alarm limit (****) | rw | rw | Alarm- | -99999 … Alarm+ | -99999 |
| High alarm limit (****) | rw | rw | Alarm+ | Alarm- … 99999 | 99999 |
| Alarm hysteresis (****) | rw | rw | AlarmHys | 0.1 … 10.0 % of range (Scal- … Scal+) | 1.0 % |
| Low warning limit (****) | rw | rw | Warn- | Alarm- … Warn+ | -99999 |
| High warning limit (****) | rw | rw | Warn+ | Warn- … Alarm+ | 99999 |
| Warning hysteresis (****) | rw | rw | WarnHys | 0.1 … 10.0 % of range (Scal- … Scal+) | 1.0 % |

*) only visible if "Use K-Factor for Scaling" = 1
**) only visible if "Use K-Factor for Scaling" = 0
***) the units “P/m”, “P/s” are only accepted, if the unit pulses per “Pulse” is selected at “Unit K-Factor”; other units are only accepted, if **not** the unit pulses per “Pulse” is selected at “Unit K-Factor”
(****) will be only displayed if the corresponding Alarm Mode is selected

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### 12.1.3 Pulse Counter Inputs

The pulse counter inputs, for example, can be used in combination with the Batch Dosing modules.

The incoming **pulses are counted and scaled for further processing per K-Factor.** The K-Factor specifies the amount of pulses per volume unit. The K-Factor can specified in different units - please refer to the "Configuration" section (see below) for the available units.

Only the number of incoming pulses is indicated at pulse counter inputs in the menu item "Process data" \ "Inputs". The display starts with 0 again if more than 99999 pulses are counted.

#### Configuration (Code Level: Specialists)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbre-viation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Enabling / disabling input | rw | rw | Input | On/Off | Off |
| Unit K-Factor | rw | rw | K-Factor Unit | (Pulses per) … L, m³, Gal US, bbl US, gal Imp, ft3, Pulse | Pulses per L |
| K-Factor | rw | rw | K-Factor | 0.001 … 9999.0 | 1.0 |

## 12.2 Analog Inputs

The analog inputs are configurable either as 4…20 mA inputs or as Pt100 inputs via the configuration file for defined hardware versions.

For details please refer to the following sections.

### 12.2.1 4…20 mA Inputs

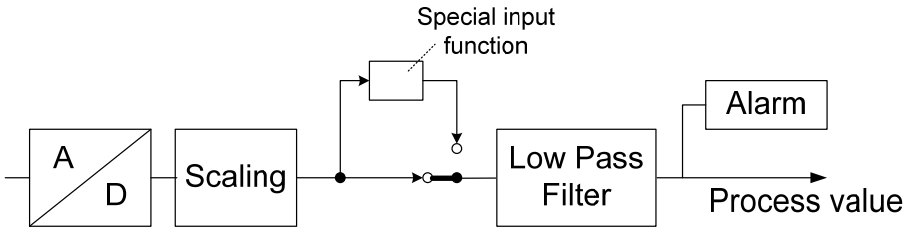


*Figure 16: 4…20 mA Input*

#### *A/D-Conversion*

The enabled analog 4...20 mA inputs are sampled every 50 ms with a resolution of 10 bit in order to convert the analog input signal to a digital value.

Additionally the enabled analog 4...20 mA inputs are checked after each sampling process on:

- input fault (current less than approx. 3.5 mA)
- sensor fault (current greater than approx. 20.5 mA)
- AD-fault (fault during sampling process).
- A calibration data fault is treated as an input fault.



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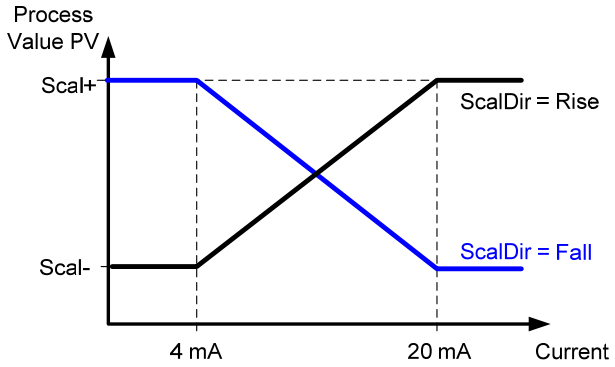
If such a fault occurs, the **common alarm output is activated**.
Additionally, the **safety output value** will be activated in the corresponding modules, which support the safety output function and which are linked with the faulty input.

If the **safety output value** is activated the **manual output value will be reset to "0"!**

## *Scaling*




**ScalDir = Rise:**

| | |
|---|---|
| Scal+ | High scaling value, assigned to the maximum current (20 mA) |
| Scal- | Low scaling value, assigned to the minimum current (4 mA) |

**ScalDir = Fall:**

| | |
|---|---|
| Scal+ | High scaling value, corresponds to the minimum current (4 mA) |
| Scal- | Low scaling value, corresponds to the maximum current (20 mA) |

*Figure 17: Scaling of a 4…20 mA input*

The scaling function assigns a numeric value to the measured analog value, that corresponds to the physical parameter transmitted to the device by the sensor/transmitter.

For displaying purposes an engineering unit can be assigned to the input. The following table lists the available units, selectable for each 4...20 mA input separately.

| Unit Group | Measuring units (*) |
|---|---|
| Miscellaneous | ppm, V, mA, Pulse, Hz, %, no unit? |
| Chemical Analysis | µS/cm, mS/cm, MPY, µMPY, mV, mg/L, %Sat, pH |
| Volume | L, hL, m3, Gal US; bbl US, gal Imp, ft3, yd3 |
| Flow (flow rate) | L/s, L/min, L/h, m3/min, m3/h, Gal/s US, Gal/m US, Gal/h US, gal/s Imp, gal/m Imp, gal/h Imp, bbl/s US, bbl/m US, bbl/h US, ft3/s, ft3/min, ft3/h, P/s, P/m |
| Temperature | °C, °F, °Rank, K |
| Pressure | bar, mbar, psi |

(*) If the display does not have sufficient spaces available, only 3 or 6 digits are shown; please refer to the table in chapter 5.2 for the specific unit abbreviations.

If the **scaling unit of a 4…20 mA** input was changed, the corresponding **alarm and warning limits and** the **set points** of the corresponding modules **have to be changed manually** to the value corresponding with the new engineering unit of the input (no automatic conversion from one unit to a different one!).

When **changing the scaling values,** the corresponding **alarm and warning limit** as the set points of the corresponding modules should be examined for their **relevance!**

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## *Special input function*

There is special root extraction function available, e.g. for adapting special flow sensors. Therefore the following function is applied to the scaled value.

$$\mathbf{PV,new} = \sqrt{(\mathbf{PV} - \mathbf{Scal^-})(\mathbf{Scal^+} - \mathbf{Scal^-})} + \mathbf{Scal^-}$$

with Scal- (low scaling value)
Scal (high scaling value)
PV (scaled process value)

Refer also to Figure 18: Root function.

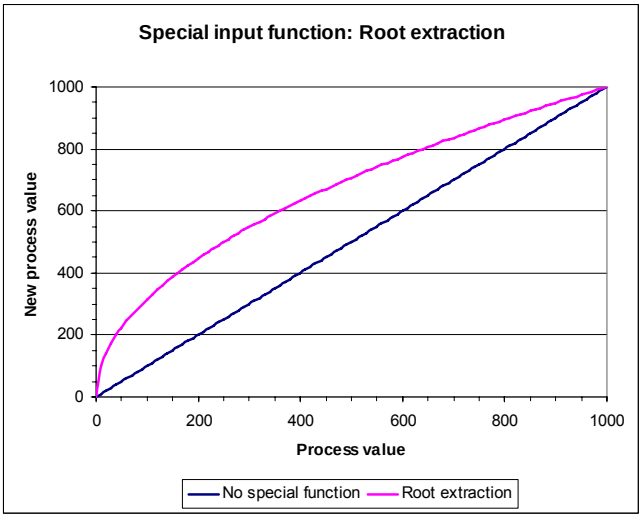


*Figure 18: Root function*

## *Low Pass Filter*

To **minimise the effect of spikes and fast transients** acting on the device's external cabling and possibly causing interferences, a low pass filter (PT1) is employed.

The setting is done via the selection of the filter stage.

| Filter stage | Corresponds to limit frequency [Hz] | Effect |
|---|---|---|
| 0 | 10 | Lowest filter effect |
| 1 | 5 | |
| 2 | 2 | |
| 3 | 1 | |
| 4 | 0,5 | |
| 5 | 0,2 | |
| 6 | 0,1 | |
| 7 | 0,07 | |
| 8 | 0,05 | |
| 9 | 0,03 | Greatest filter effect |

*Table 7: Filter stage and limit frequency*

## *(Process Value) Alarm*

Refer to Figure 15:

This function actuates the common alarm output whenever a controlled process value exceeds the adjustable upper and lower alarm limits.



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Alarm activation is equipped with a **switching hysteresis** (AlarmHys) to prevent excessive switching. The hysteresis has to be parameterized in percent of input range (i.e. the input range (Scal- … Scal+) corresponds to 100 %).

For displaying and data logging purposes there are adjustable upper and lower warning limits and a **separate warning hysteresis WarnHys**.

The alarm and warning limits are configured in the unit of the process value.

The function scope of the alarm and warning function can be configured as follows:

| Alarm mode | Description |
|---|---|
| Alarm & Warn | Alarm and warning function enabled. |
| Alarm | Only alarm function enabled. Parameters of the warning function are not indicated. |
| disable | Alarm and warning function not enabled. Parameters are not indicated. |

If one of the two alarm limits is not required while the alarm function is enabled, this alarm limit is to be set to a value outside of the accessible process value range.

| | |
|---|---|
| Example: | Conductivity measurement, process value range: 0 - 1000 µS/cm, no alarm necessary at lower alarm limit -> set lower alarm limit to -1 µS/cm |

## *User Calibration*

The user calibration function of the Type 8620 offers the possibility to adopt the input scaling of the 4-20mA sensor signal for **user calibration of sensors.**

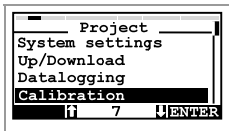
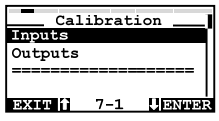
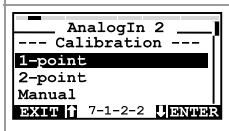
**Functional impairments due to incorrect calibration**

The calibration may only be carried out by qualified personnel.

When downloading a configuration file, the user calibration values are at first internally reset to the default values before they will be overwritten by the values contained in the configuration file.

After successful user calibration it is therefore recommended to:
- save the just changed configuration file and
- note the user calibration values for future manual input.

For the User Calibration procedure proceed as stated below:

| | |
|---|---|
|  | → Scroll in main menu to the menu item **"Calibration"** (via "arrow" keys), press key **"ENTER"**.<br>(the calibration is password protected: for specialist only) |
|  | → Enter **"Inputs"**, choose an input and press key **"ENTER"**<br>(menu entries are only displayed if the input was configured as enabled and calibration functionality was set to "YES"). |
|  | → Choose the **calibration mode**:<br>- 1-point or<br>- 2-point or<br>- Manual<br>and press key **"ENTER"** |



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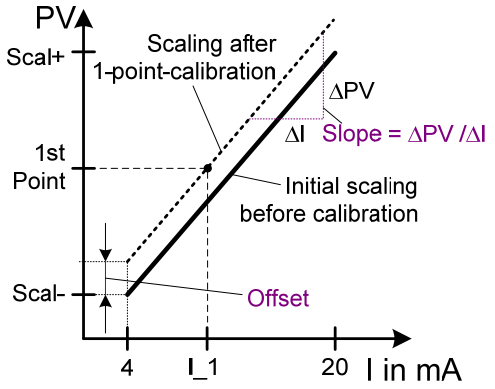
## Calibration Mode “1-point”

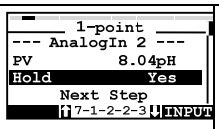
This calibration mode can be used for the calibration of 4-20mA input signals from e.g.

- Redox Transmitters
- pH-Transmitters

This mode of calibration needs one buffer solution to receive the new straight calibration line.

Take care for the dependence of temperature of the buffer solution/pH-measurement. Usually it is mentioned on the buffer bottles.



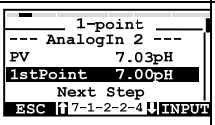




→ **Hold the current PV** during the calibration procedure: Yes or No (Default: Yes).

**Hold Function** – for calibration without interrupting the process: it holds the PV constant during the whole calibration procedure. Therefor the current PV is used when starting the calibration procedure with confirming “Next Step”.

→ Proceed with **“Next Step”,** press key **“OK”**

→ Then **rinse/clean** the electrode as requested, after that press key **“OK”**



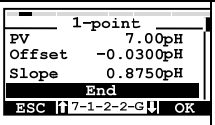

→ Scroll to “1stPoint”, press key **“INPUT”**.

→ Put the **electrode into buffer solution** and input the value of this buffer solution (care for temperature dependence), confirm with **“OK”**.

→ **Wait** until the measured PV has a steady value, then

→ Proceed with **“Next Step”,** press key **“OK”**

The controller measures the current PV of the buffer solution and the corresponding current I_1…




… and calculates Offset and Slope values.

→ **Rinse/clean** the electrode again before putting back into process fluid.

→ Finish calibration and the Hold Function of PV with **“End”,** press key **“OK”**

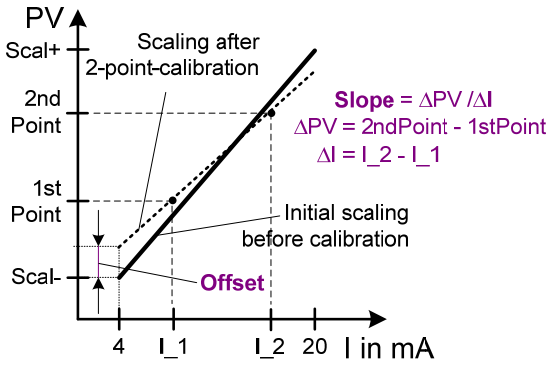
## Calibration Mode “2-point”

This calibration mode can be used for the calibration of 4-20mA input signals from e.g.

- pH-Transmitters

This mode of calibration needs two buffer solutions to receive the new straight calibration line.

Take care for the dependence of temperature of the buffer solution/ pH-measurement. Usually it is mentioned on the buffer bottles.



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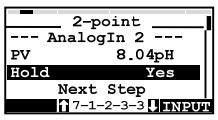
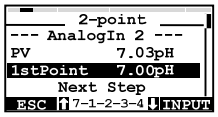
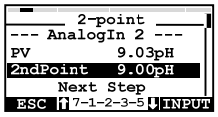
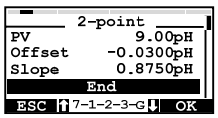
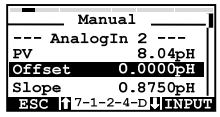
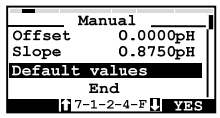
| | |
|---|---|
|  | → **Hold the current PV** during the calibration procedure: Yes or No (Default: Yes).<br><br>**Hold-Function** – for calibration without interrupting the process: it holds the PV constant during the whole calibration procedure. Therefor the current PV is used when starting the calibration procedure with confirming "Next Step".<br><br>→ Proceed with **"Next Step",** press key **"OK"**<br>→ Then **rinse/clean** the electrode as requested, after that press key **"OK"** |
|  | → Scroll to "1stPoint", press key **"INPUT"**.<br>→ Put the **electrode into 1st buffer solution** and input the value of this buffer solution (care for temperature dependence), confirm with **"OK"**.<br>→ **Wait** until the measured PV has a steady value, then<br>→ Proceed with **"Next Step",** press key **"OK"**<br>The controller measures the current PV of the 1st buffer solution and the corresponding current I_1. |
| | → Then **rinse/clean** the electrode again as requested, after that press key **"OK"** |
|  | → Scroll to "2ndPoint", press key **"INPUT"**.<br>→ Put the **electrode into 2nd buffer solution** and input the value of this buffer solution (care for temperature dependence), confirm with **"OK"**.<br>→ **Wait** until the measured PV has a steady value, then<br>→ Proceed with **"Next Step",** press key **"OK"**<br>The controller measures the current PV of the 2nd buffer solution and the corresponding current I_2 … |
|  | … and calculates Offset and Slope values.<br>(The item **"Calib failed"** is only displayed if calibration failed: Slope could not be calculated. In that case start the calibration procedure again.)<br>→ **Rinse/clean** the electrode again before putting back into process fluid.<br>→ Finish calibration and the Hold Function of PV with **"End",** press key **"OK"** |

### Calibration Mode "Manual"

This calibration mode can be used for the calibration of 4-20mA input signals in case of known Slope and Offset values.

| | |
|---|---|
|  <br>  | → Input the values of<br>**Offset** in [Scal Unit] at 4 mA, then press key **"INPUT"**and<br>**Slope** in [Scal Unit]/[mA], then press key **"INPUT"**.<br><br>→ For setting back the values to default values press key "YES" for a few seconds (password protected: for Specialist only)<br>→ Finish calibration with **"End",** press key **"OK"** |

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## Configuration (CodeLevel: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbre-viation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Enabling / disabling input | rw | rw | Input | On/Off | Off |
| Special input function | rw | rw | SpecFunc | 0: none<br>1: Square root of PV | 0 |
| Process value scaling: unit | rw | rw | Scal Unit | Units of Chem. Analysis, Volume, Flow, Temperature, Misc. | No Unit |
| Process value scaling: Low scaling value @ 4 mA | rw | rw | Scal- | -99999 … Scal+ | -99999 |
| Process value scaling: High scaling value @ 20 mA | rw | rw | Scal+ | Scal- … 99999 | 99999 |
| Process value scaling: Sense of action | rw | rw | ScalDir | Rise / Fall | Rise |
| Filter stage | rw | rw | Filter | 0 ... 9 | 0 |
| ***Process value alarm*** | | | | | |
| Alarm mode | rw | rw | Mode | Off, Alarm, Alarm & Warn | Alarm & Warn |
| Low alarm limit (*) | rw | rw | Alarm- | -99999 … Alarm+ | -99999 |
| High alarm limit (*) | rw | rw | Alarm+ | Alarm- … 99999 | 99999 |
| Alarm hysteresis (*) | rw | rw | AlarmHys | 0.1 … 10.0 % of range (Scal- … Scal+) | 1.0 % |
| Low warning limit (*) | rw | rw | Warn- | Alarm- … Warn+ | -99999 |
| High warning limit (*) | rw | rw | Warn+ | Warn- … Alarm+ | 99999 |
| Warning hysteresis (*) | rw | rw | WarnHys | 0.1 … 10.0 % of range (Scal-…Scal+) | 1.0 % |
| ***Calibration*** | | | | | |
| Calibration funtionality | rw | rw | CalibFct | No/Yes | No |
| Offset (@4mA) (**) | rw | rw | Offset | -99999 … +99999 in [Scal Unit] at 4 mA | 0.0 |
| Slope (**) | rw | rw | Slope | if ScalDir = Rise: 0 … +99999<br>if ScalDir = Fall: -99999 … 0<br>in [Scal Unit] / [mA] | 16 mA / [Scal+ - Scal-] |
| Apply Default values to Offset and Slope (**) | -- | w | Default values | | |

(*) will be only displayed if the corresponding Alarm Mode is selected
(**) only visible if CalibFct = Yes

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## 12.2.2 Pt100 Inputs

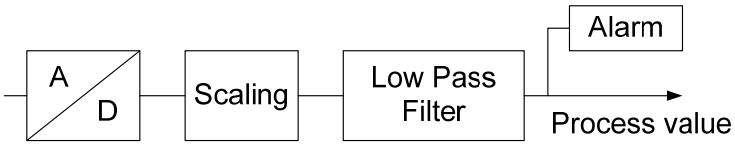


*Figure 19: Pt100 Input*

### *A/D-Conversion*

The enabled analog Pt100 inputs are sampled every 50ms with a resolution of 10 bit in order to convert the analog input signal to a digital value.

Additionally the enabled analog inputs are checked after each sampling process on

- input fault (detected temperature < approx. -22 °C)
- sensor fault (detected temperature > approx. +155 °C)
- AD-fault (fault during sampling process).
- A calibration data fault is treated as an input fault.

If such a fault occurs, the **common alarm output is activated**.
Additionally, the **safety output value** will be activated in the corresponding modules, which support the safety output function and which are linked with the faulty input.

If the **safety output value** is activated the **manual output value will be reset to "0"!**

### *Scaling*

The measuring range of the Pt100 inputs depends on the hardware:

-20 °C ... +150 °C or -4 °F ... 302 °F .

Each Pt100 input is configured separately, available engineering units are:
Degree Celsius (°C), degree Fahrenheit (°F), degree Rankin (°R) and Kelvin (K).

The unit is used at the same time for the scaling values, the alarm and warning limits of this input and for certain parameters of associated modules.

If the **scaling unit of a Pt100** input was changed, the corresponding **alarm and warning limits and** the **set points** of the corresponding modules **have to be changed manually** to the value corresponding with the new engineering unit of the input (no automatic conversion from one unit to a different one!).

The reference span for the alarm and warning hysteresis of this input as well as for specific parameters of associated modules (e.g. deadband) are defined by the setting of the low and high scaling value. Furthermore, the value range of some input parameters and certain module parameters (e.g. set point) is determined by the low and high scaling value.

The process value is not limited by the low and high scaling value.

When **changing the scaling values,** the corresponding **alarm and warning limit** as the set points of the corresponding modules should be examined for their **relevance!**

#### Correction Value

The temperature measurement with platinum resistors of type Pt100 is based on the changing resistance of platinum in dependence on the changing of the temperature. In the factory calibration data of the Pt100 Inputs the constant resistance of the cable used for calibration is included.

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A cable different than the calibration cable (with a different constant resistance) is normally used for **wiring the Pt100 sensor "in the field"** with the „Type 8620 mxCONTROL“.
This leads to a **falsification of the measurement**, which means the measured resistance with the used cable is lower or higher than the **value measured with the calibration cable**. This falsification has to be corrected by compensation of the measured resistance.

A **comparison measurement** with a calibrated temperature sensor is therefore required to determine the corresponding correction value. This correction value can be entered manually in the configuration file or in the "Configuration" menu item.

**Procedure of determining the Correction value**

1. Place the Pt100 sensor and another calibrated temperature sensor ready for the comparison measurement. Assure an uniform temperature in both sensors by applying a sufficient waiting time.
2. Set the correction value of the corresponding Pt100 Input to "0" (in the Configuration/Inputs/AnalogIn X menu, - password required - CodeLevel: Specialist)
3. Measure the temperature with both temperature sensors:
   - TPt100 with the Pt100 sensor, connected with the „Type 8620 mxCONTROL“ (in the menu: Process data/Inputs)
   - and TCompare with the other temperature sensor used for comparison measurement. (e.g. TPt100 = 25.1 °C and TCompare = 25.8 °C)
4. Determine the correction value due the following relation ship:

   Correction value = $T_{Pt100}$ - $T_{Compare}$

   (e.g. Correction value = 25,1 °C - 25,8 °C = -0,7 °C)

   Assure that both values have the same engineering unit!

   **Note:** This determined correction value is valid for sensors of the same type using the same cable.

5. Enter the parameter "KorValue", according to the correction value determined (in the menu: Configuration/Inputs/AnalogIn X).

   The correction value must be entered in the configured unit of the corresponding Pt100 input. Assure that the algebraic sign of the Correction value is set correctly. The new Correction value will be enabled, if the main menu is re-entered.

   When downloading a configuration file, the Correction value is at first internally reset to the default value before it will be overwritten by the Correction value contained in the configuration file.

   After the change/input of the Correction value it is therefore recommended to:
   - save the just changed configuration file and
   - note the Correction value for future manual input.

6. For assurance both temperatures (as in point 3) should be measured again. Both temperature values should have now nearly the same value. If yes, the correction of this Pt100 Input is completed; if not continue with point 1.

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### *Low Pass Filter*

Please refer to the description of the low pass filter in section 12.2.1.

### *(Process Value) Alarm*

Please refer to the description on the process value alarm in section 12.2.1.

## Configuration (CodeLevel: Specialist)

| **Configuration** | **Access via Cfg.-menu** | **Access via XML-Cfg.-File** | **Abbre-viation (menu)** | **Value range** | **Default values** (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Enabling / disabling input | rw | rw | Input | On/Off | Off |
| Process value scaling: unit | rw | rw | Scal Unit | °C, °F, °Rank, K | °C |
| Process value scaling: low scaling value | rw | rw | Scal- | -200 ... Scal+ (in selected unit) | -200 |
| Process value scaling: high scaling value | rw | rw | Scal+ | Scal- ... 800 (in selected unit) | +800 |
| Correction Value | rw | rw | CorVal | Depending on the selected unit: -20.0 ... + 20.0 °C or K - 36.0 ... + 36.0 °F or °R | 0.0 °C |
| Filter stage | rw | rw | Filter | 0 ... 9 | 0 |
| ***Process value alarm*** | | | | | |
| Alarm mode | rw | rw | Mode | Off, Alarm, Alarm & Warn | Alarm & Warn |
| Low alarm limit (*) | rw | rw | Alarm- | -99999 … Alarm+ | -99999 |
| High alarm limit (*) | rw | rw | Alarm+ | Alarm- … 99999 | 99999 |
| Alarm hysteresis (*) | rw | rw | AlarmHys | 0.1 … 10.0 % of range (Scal- … Scal+) | 1.0 % |
| Low warning limit (*) | rw | rw | Warn- | Alarm- … Warn+ | -99999 |
| High warning limit (*) | rw | rw | Warn+ | Warn- … Alarm+ | 99999 |
| Warning hysteresis (*) | rw | rw | WarnHys | 0.1 … 10.0 % of range (Scal- … Scal+) | 1.0 % |

(*) will be only displayed if the corresponding Alarm Mode is selected

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# 13 Outputs

The „Type 8620 mxCONTROL“ has 5 relay outputs by default.
Depending on the hardware version, the „Type 8620 mxCONTROL“ can have additional analog and transistor outputs.

**Configuration via the configuration file:**

- Enabling and labelling the desired outputs

**Configuration via the configuration file but also directly on the „Type 8620 mxCONTROL“:**

- Other settings

**Outputs** of a configuration **can be enabled or disabled directly at the device** by enabling or disabling them in the main menu item “Configuration”.

**Disabled outputs** can no longer be accessed via the "Process Data" menu after returning to the main menu.
**Reactivation** is possible via the "Configuration" menu or by loading the original configuration.
**By disabling outputs**, the control outputs of the modules connected to these outputs can no longer be provided to the process.

## 13.1 Relay Outputs

The relays can be used for activating of e.g.

- On/Off valves and pumps
- Dosing pumps (Pulse Frequency modulated (PFM-) outputs)
- Motor activated elements (3-point-outputs)

The relay outputs can be configured to work as

- Simple On/Off outputs
- Pulse Frequency modulated (PFM-) outputs outputs
- Pulse Width modulated (PWM) outputs.

**PFM:**
Pulse Frequency Modulation - modulation of a square wave signal with constant pulse duration (Tpuls). The parameter “Tpuls” can be changed.

**PWM:**
Pulse Width Modulation - modulation of a square wave signal with constant frequency (Tperiod). The parameter “Tperiod” can be changed.

The principle of PFM and PWM is shown in Figure 21 and Figure 22.

The configuration of all supported types of relay outputs is summarized in chapter 13.1.4.

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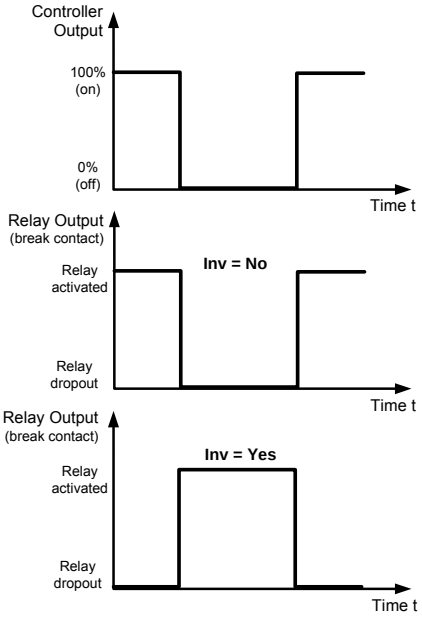
## 13.1.1 Relay as Binary Output (On/Off)



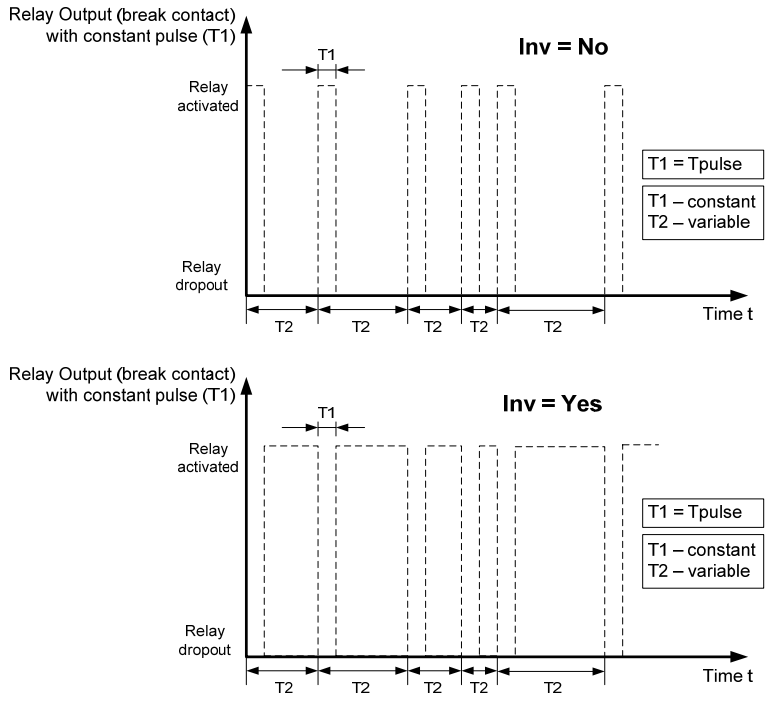

The simple On/Off outputs are used to switch on or off valves, pumps and the alarm output.

The figure shows the operational mode of the On/Off outputs.

*Figure 20:*
*Relay as binary output –*
*Operating mode: Normal or inverted*

If a relay is configured as simple binary output, the output value that is not inverted is always shown in the display!

## 13.1.2 Relay as PFM Output




Pulse Frequency modulated (PFM) outputs are used for controlling the dosing pumps.

The figure shows the operational mode of the pulse outputs.

*Figure 21:*
*Relay as PFM output –*
*Operating mode: Normal or inverted*



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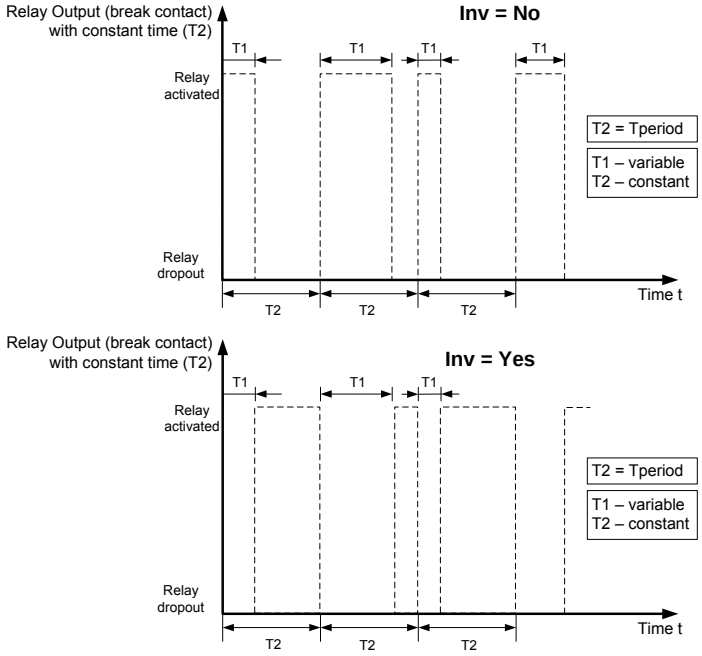
## 13.1.3 Relay as PWM Output




Pulse Width modulated (PWM) outputs are used for controlling the 2-point-valves which are necessary for PI-controlling of the conductivity.

The figure shows the operational mode of the PWM outputs.

*Figure 22:*
*Relay as PWM output – Operating mode: Normal or inverted*

## 13.1.4 Configuration (CodeLevel: Specialist)

| **Configuration** | **Access via Cfg.-menu** | **Access via XML-Cfg.-File** | **Abbre-viation (menu)** | **Value range** | **Default values** (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Enabling / disabling output | rw | rw | Output | On/Off | Off |
| Relay Output Type | rw | rw | Type | On/Off, PFM, PWM | enable/disable |
| Inversion of the output signal | rw | rw | Inv | Yes / No | No |
| ***Additional configuration, if Relay Output Type = PFM selected*** | | | | | |
| Unit pulse duration | rw | rw | Tpuls Unit | s, ms | ms |
| Pulse duration | rw | rw | Tpuls | 1 … 9999 | 100 ms |
| Unit Max. pulse frequency | rw | rw | Fmax Unit | /min, /h | /min |
| Max pulses per time | rw | rw | Fmax | 1 … MAX<br>MAX <= 9999 and MAX depend on the current unit and pulse duration:<br>MAX = 1/Tpuls with Tpuls in units of 1/(unit of Fmax) | 160/min |
| ***Additional configuration, if Relay Output Type = PWM selected*** | | | | | |
| Unit of period duration | rw | rw | Tperiod Unit | s, ms | s |
| period duration | rw | rw | Tperiod | 1 … 9999 s or<br>100 … 9999 ms | 10 s |

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# 13.2 Analog 4...20 mA Outputs (Option)

The control output of the connected module output is converted to a 4…20 mA output signal as shown in Figure 23.

The nominal resolution of the analog output circuit is 10 bit (1024 steps), but due to factory calibration the actual resolution is lower but at least 9 bit (512 steps). The maximum load is 500 Ω.

The process values can be monitored in combination with the MONITOR_PV module; the process value range (Scal- … Scal+) is hereby converted to a 4…20 mA output signal.

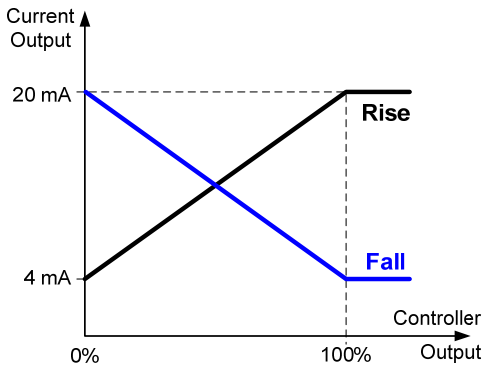


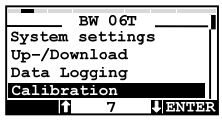
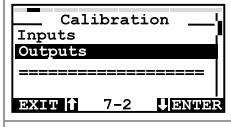
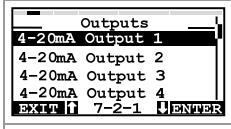
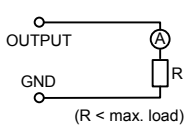

*Figure 23: 4...20 mA analog output*

If there is a calibration data fault on a configured analog output, the corresponding analog output will output 0 mA.

## Calibration of 4 ... 20 mA Outputs

**Functional impairments** due to incorrect calibration!
The calibration may only be carried out by qualified personnel.

The 4…20 mA outputs can be calibrated as specified in the following description:

| | |
|---|---|
|  | → Scroll to main menu item **“Calibration”** (via “arrow” keys), press key “ENTER”.<br>→ Enter the **specialist password** (via keys **„+“** and **„<-“**). |
|  | → Select **“Outputs”** |
|  | → Select a 4-20mA output X (via “arrow” keys), press key “ENTER |
|  | → **Prepare the calibration:**<br>connect a resistor R (< max. load (500 Ohm)) and an Ampere-meter between pin “OUTPUT” of the output to be calibrated and pin “GND”;<br>remove all other connections to that OUTPUT |

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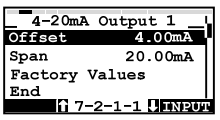
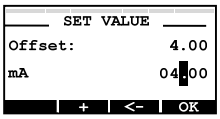
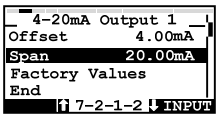
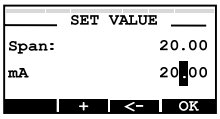
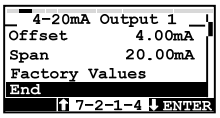
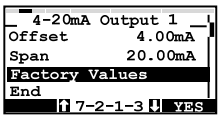
| | |
|---|---|
|  | → Select **„Offset“,** press key “INPUT” |
|  | (→ the device outputs now a current of 4 mA at the 4-20mA output X)<br>→ **Measure** the real current through the resistor R<br>→ **Input** the measured current value (via keys **„+“** and **„<-“**), press key "OK" |
|  | → Select **„Span“,** press key “INPUT” |
|  | (→ the device outputs now a current of 20 mA at the 4-20mA output X)<br>→ **Measure** the real current through the resistor R<br>→ **Input** the measured current value (via keys **„+“** and **„<-“**), press key "OK" |
|  | → Select **“End”;** press key “ENTER”.<br>Leaving this menu item the analog output will be calibrated based on the input values (Offset, Span) and will be re-initialized.<br>The user calibration data are stored in Eeprom when returning to the main menu. |
|  | If **„Factory Values“** is selected, the user calibration data will be overwritten with the factory calibration values.<br>If **„Factory Reset“** was activated, the user calibration data of all 4-20mA-outputs are overwritten with factory calibration values. |

## Configuration (Code Level: Specialist)

| **Configuration** | **Access via Cfg.-menu** | **Access via XML-Cfg.-File** | **Abbre-viation (menu)** | **Value range** | **Default values** (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Enabling / disabling output | rw | rw | Output | On/Off | Off |
| Sense of action of the current output | rw | rw | Dir | Rise / Fall | Rise |

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# 13.3 Transistor Outputs (Option)

Technical details of the transistor outputs are described in chapter 6.1 “Technical Specifications”. Transistor outputs can be used for controlling e.g.

- On/Off valves and pumps
- Dosing pumps (Pulse Frequency modulated (PFM-) outputs)
- Proportional valves (PWM / fast PWM output)

Each transistor output can be configured to work as

- Simple On/Off output
- Pulse Frequency modulated (PFM-) output
- Pulse Width modulated (PWM) output
- Fast PWM (pulse width modulated) output.

**PFM:**
Pulse Frequency Modulation - modulation of a square wave signal with constant pulse duration (Tpuls). The parameter “Tpuls” can be changed.

**PWM:**
Pulse Width Modulation - modulation of a square wave signal with constant frequency (Tperiod). The parameter “Tperiod” can be changed.

The principle of PFM and PWM is shown in Figure 21 and Figure 22.

The configuration of all supported transistor outputs is summarized in chapter 13.3.5.

## 13.3.1 Transistor output as On/Off-Output

The relation between controller output and transistor output as On/Off-output is similar to the relay output as On/Off-output. Compare chapter 13.1.1.

## 13.3.2 Transistor output as PFM Output

The relation between controller output and transistor output as PFM output is similar to the relay output as PFM output. Compare chapter 13.1.2.

## 13.3.3 Transistor output as PWM Output

The relation between controller output and transistor output as PWM output is similar to the relay output as PWM output. Compare chapter 13.1.3.

The **period duration** is configurable between **0.1 … 9999 seconds**.

### Limitation of the manipulating speed

In addition, the manipulating speed of the transistor output can be limited. For this purpose, the control output originating from any module is compared with the currently provided control output in regard to its change. If the change is greater than the parameterized maximum permitted value, the provided

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control output is changed only be this max. permitted value. The maximum manipulating speed can be configured separately for rising and falling control outputs.

The **opening time parameter Topen** is to be set to the time value required to change the control output from 0% to 100% with the max. permitted manipulating speed.
The **closing time parameter Tclose** is to be set to the time value required to change the control output from 100% to 0% with the max. permitted manipulating speed.

If no control output limitation is required, the parameters **Topen** and **Tclose** are to be set to **0 s**.

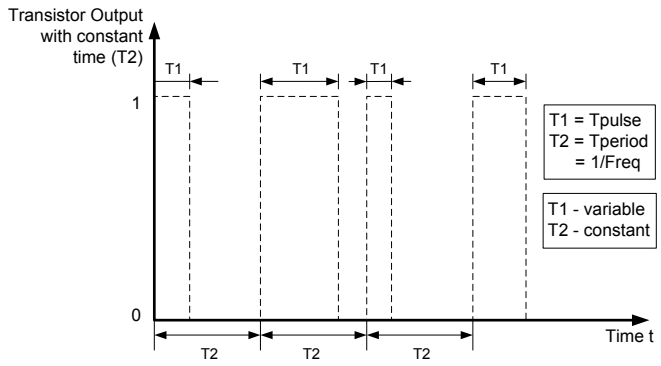
## 13.3.4 Transistor output as fast PWM Output

The range of the PWM-Frequency (f = 1/T2) can be set between 20 ... 2250 Hz are configured (corresponds to a **Period duration between 50 … 0.45 milliseconds**), but only certain frequency values of this range are supported - when entering a new frequency the firmware automatically selects the next supported frequency.

The output resolution of pulse length T1 is 8 bit (i.e. 256 steps).

### Limitation of the manipulating speed

Refer to chapter 13.3.3 „Limitation of the manipulating speed“.




Transistor outputs in fast PWM mode are used for e.g. controlling proportional valves.

The figure shows the transistor outputs in PWM / fast PWM output mode.

*Figure 24: Transistor output as "Fast PWM" output in normal mode.*

## 13.3.5 Configuration (Code Level: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbre-viation (menu) | Range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Enabling / disabling output | rw | rw | Output | On/Off | Off |
| Transistor Output Type | rw | rw | Type | On/Off, PFM, PWM, fast PWM | enable/disable |
| Inversion of the output signal | rw | rw | Inv | Yes / No | No |
| ***Additional configuration, if Transistor Output Type = PFM selected*** | | | | | |
| Unit pulse duration | rw | rw | Tpuls Unit | s, ms | ms |
| Pulse duration | rw | rw | Tpuls | 1 … 9999 | 100 ms |
| Unit<br>Max. pulse frequency | rw | rw | Fmax Unit | /min, /h | /min |
| Max pulses per time | rw | rw | Fmax | 1 … MAX<br>MAX <= 9999 and MAX depend on the current unit and pulse duration:<br>MAX = 1/Tpuls with Tpuls in units of 1/(unit of Fmax) | 160/min |
| ***Additional configuration, if Transistor Output Type = PWM selected*** | | | | | |
| Unit of period duration | rw | rw | Tperiod Unit | s, ms | s |
| period duration | rw | rw | Tperiod | 1 … 9999 s or<br>100 … 9999 ms | 10 s |
| ***Additional configuration, if Transistor Output Type = fast PWM selected*** | | | | | |
| PWM frequency | rw | rw | Freq | 20 … 2250 Hz | 30.1Hz |
| ***Limitiation of the manipulating speed, if transistor output type "Fast-PWM" or "PWM" was selected*** | | | | | |
| Opening time for entire manipulated variable range 0% -> 100% | rw | rw | Topen | 0.0 ... 60.0 s | 10.0 s |
| Closing time for entire manipulated variable range 100% -> 0% | rw | rw | Tclose | 0.0 ... 60.0 s | 10.0 s |

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# 14 Controller Modules

Functions, containing a control or displaying module, can be enabled or disabled directly at the device by enabling or disabling them in the submenu “Modules” of the main menu item “Configuration”.

**Disabled Control Functions (further on named *Function*)** can no longer be accessed via the menus "Parameter" and "Process Data" after returning to the main menu.
**Reactivation** is possible via the "Configuration" menu or by loading the original configuration.

**By disabling *Functions* with modules**, the information of the assigned inputs is no longer processed, assigned outputs are no longer updated with control outputs and can also no longer be selected in manual operation.

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| *Function*/Module active/not active | rw | rw | Module | On/Off | Off |

**All Changes of the parameter/configuration data** will be saved only **after returning to the main menu** – the message "**Save in EEPROM" is therefore briefly displayed.**

## 14.1 Common Settings

The operating modes described below and the general presettings are available in most of the process control or display modules (further on named "Modules"). Exceptions are listed here and described in more detail in the corresponding chapters via the individual modules.

### 14.1.1 Automatic and Manual Mode

Please, refer to chapter 8.3 “Operation Mode”.

### 14.1.2 Definitions for “Inversion” and “All Timers”

The following conventions are used:

- If the description does not mention any "inversion", e.g. of binary inputs, the "Flow switch" or module functions, then the normal scenario (not the inverted one) is described.
- The term **“all timers”** contains all timers used for
- limiting the actuator output (maximum output timer)
- the dosing process ("Biocide dosing", "Batch dosing")

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## 14.1.3 System Switch override function (Specialist level)

The "System Switch Override" function (function to override the original output value) is used to **set the module outputs to "0"** if the input used as System Switch detects a "Stand-By" of the superior control system.
This function is active in automatic and manual mode.
To prevent an excessive switching frequency a **delay time** can be parameterized.

The "System Switch Override" function can be activated separately for each Control Function (further on named *Function*) in which a control module is configured.
If the "System Switch Override" function is enabled for a *Function* with a module, the corresponding module outputs will be overridden with "0" as long as the "System Switch" is active.
The module MONITOR_PV does not support this function.

Input to work as System Switch:
- binary input or
- potentialfree binary input or
- 4…20mA input or
- frequency input

Proper function of the System Switch override:
- assignment of an according input
- setting the System Switch enabled

The configuration of the assigned binary input applies also to the System Switch.
Consequently the inversion of the assigned binary input applies also to the System Switch.

If the "**System Switch Override" function** is activated, the **manual control output will be reset to "0"!**

| **Binary input as "System Switch"** | | |
|---|---|---|
| **input voltage** | **logical value** | |
| | Input signal:<br>**Not inverted (Inv = No)** | Input signal:<br>**Inverted (Inv = Yes)** |
| 0 … 4.5 V (*) | 0 / Ok | 1 / Stand-By |
| 13 … 35 V (*) | 1 / Stand-By | 0 / Ok |

| **Potentialfree binary input as "System Switch"** | | |
|---|---|---|
| **input voltage** | **logical value** | |
| | Input signal:<br>**Not inverted (Inv = No)** | Input signal:<br>**Inverted (Inv = Yes)** |
| Open contact (*) | 0 / Ok | 1 / Stand-By |
| 0 … 4.5 V (*)<br>13 … 35 V (*) | 1 / Stand-By | 0 / Ok |

(*) The input voltage has to be applied continuously in the according range longer than the parameterized delay time, before the logical value is accepted or changes.

| **Frequency- or 4-20mA-input as “System Switch”** | |
|---|---|
| **input value** | **logical value** |
| **<** SP Stand-By (**) | 1 / Stand-By |
| **>=** SP Stand-By (**) | 0 / OK |

(**) The input value has to be available according to the requirement (< or >=) longer than the parameterized delay time, before the logical value is accepted or changes.

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### Configuration

| Configuration System Switch | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbre-viation (menu)) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| "System Switch" function Enable/Disable | rw | rw | System Switch | On/Off | Off |
| Set point (*) Stand-By | rw | rw | SP | -99999 … 99999 (in the unit of assigned input) | 0.0 |
| Delay time | rw | rw | Delay | 0 … 1800 s | 1.0 s |
| Input | r | rw | Input | DigIn 1, DigIn 2, DigIn 3, DigIn 4, No Input | No Input |

(*) will be only displayed if a 4-20mA or frequency input is selected as „System switch“ input

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## 14.1.4 Flow Switch override function (Specialist level)

The "Flow Switch Override" function (function to override the original output value) is used to **set the module outputs to "0"** if the input used as Flow Switch detects "No Flow".
Furthermore the common alarm will be actuated if “No Flow” is detected.
This function is active in automatic and manual mode.
To prevent an excessive switching frequency a **delay time** can be parameterized.

The "Flow Switch Override" function can be activated separately for each *Function* in which a control module is configured.
If the "Flow Switch Override" function is enabled for a *Function* with a module, the corresponding module outputs will be overridden with "0" as long as the "Flow Switch" is active.
The modules MONITOR_PV and CORROSION_DISPLAY do not support this function.

Input to work as Flow Switch:
- binary input or
- potentialfree binary input or
- 4…20mA input or
- frequency input

Proper function of the Flow Switch override:
- assignment of an according input
- setting the Flow Switch enabled

The configuration of the assigned binary input applies also to the Flow Switch.
Consequently the inversion of the assigned binary input applies also to the Flow Switch.

If the "**Flow Switch Override" function** is active, the respective **manual control output will be reset to "0"!**

| **Binary input as "Flow Switch"** | | |
|---|---|---|
| **input voltage** | **logical value** | |
| | Input signal: **Not inverted (Inv = No)** | Input signal: **Inverted (Inv = Yes)** |
| 0 … 4.5 V (*) | 0 / Ok | 1 / No Flow |
| 13 … 35 V (*) | 1 / No Flow | 0 / Ok |

| Potentialfree binary input as "Flow Switch" | | |
|---|---|---|
| **input voltage** | **logical value** | |
| | Input signal:<br>**Not inverted (Inv = No)** | Input signal:<br>**Inverted (Inv = Yes)** |
| Open contact (*) | 0 / Ok | 1 / No Flow |
| 0 … 4.5 V (*)<br>13 … 35 V (*) | 1 / No Flow | 0 / Ok |

(*) The input voltage has to be applied continuously in the according range longer than the parameterized delay time, before the logical value is accepted or changes.

| Frequency- or 4-20mA-input as “Flow Switch” | |
|---|---|
| **input value** | **logical value** |
| **<** SP No Flow (**) | 1 / No Flow |
| **>=** SP No Flow (**) | 0 / OK |

(**) The input value has to be available according to the requirement (< or >=) longer than the parameterized delay time, before the logical value is accepted or changes.

## Configuration

| **Configuration Flow Switch** | **Access via Cfg.-menu** | **Access via XML-Cfg.-File** | **Abbre-viation (menu))** | **Value range** | **Default values** (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| "Flow Switch" function Enable/Disable | rw | rw | Flow Switch | On/Off | Off |
| Set point (*) No Flow | rw | rw | SP | -99999 … 99999 (in the unit of assigned input) | 0.0 |
| Delay time | rw | rw | Delay | 0 … 1800 s | 1.0 s |
| Input | r | rw | Input | DigIn 1, DigIn 2, DigIn 3, DigIn 4, No Input | No Input |

(*) will be only displayed if a 4-20mA or frequency input is selected as „Flow switch“ input

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### 14.1.5 Maximum Output Timer (MOT)

Some control modules contain a maximum output timer in order to **detect whether the output(s) has/have been failed**. If the module output emitted the maximum output longer than the adjustable maximum output time an **alarm** “Out fails” is generated, the common alarm output is actuated and in some of these modules the **controller output(s) are overridden with 0 %**.

**The MOT time period counter is reset to zero:**

- in Manual Mode
- if an input / sensor error occurs
- if there is an interruption by flow switch or system switch
- if the MOT alarm vanishes

As long as the MOT alarms is active, the MOT time period counter is frozen. The MOT alarm stays active also if there was a system switch/flow switch interruption.

**The MOT alarm vanishes:**

- if the operator confirmed the alarm in the corresponding module specific processdata menu (the confirmation screen is a large screen)
- if the MOT is disabled in the configuration menu and the specialist returned to the main menu
- if at least one of the parameters of the corresponding module was changed in the parameter menu
- or if a new configuration or parameter file was downloaded or a parameter was changed in the configuration menu

During active "ASL Pump Stop" the **MOT time period counter is stopped**, but not reset (valid in the combination of module PH_ONLY_ACID or PH_ACID_CAUS with the "ASL Pump Stop" of a connected module CORROSION_DISPLAY).

For further details - refer to the corresponding control module(s) description.

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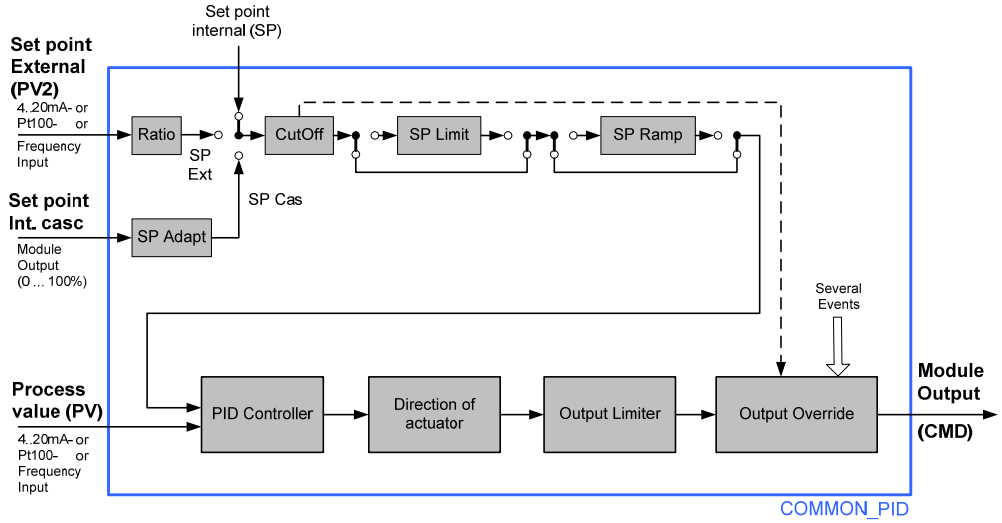
# 14.2 General PID controller (COMMON_PID)

The general PID controller module COMMON_PID is provided for the process control with a single actuator, e.g.:

- Flow control with a proportional valve
- Temperature control through heating or cooling.

The module is also suitable for configuring a cascade control.




These modules are explained below.

*Figure 25: (COMMON_PID)*

### *Set point preparation (Ratio, SP Adapt, CutOff, SP Limit, SP Ramp)*

Depending on the type of the preferred control, this controller module can be configured both for fixed value control with internal set point, follow-up control with external set point or cascading control.

### *Ratio control (Ratio) with external set point*

A ratio control is a special type of follow-up control with external set point input.The task of a ratio control is to cause a controlled variable (PV) to track another process variable (PV2, from external set point input) within a specific ratio **Kx. PV** is described as the **dependent** variable (controlled variable), and **PV2** as the **command variable.**

In the regulated condition of the ratio control, the following equation applies:

**Kx = PV / PV2**

This gives the resulting set point for the controlled variable PV:

$$SP\,Ext = Kx * PV2$$

Set the ratio set point Kx to 1.0 for regular follow-up control with external set point.

### *Set point adaptation (SP Adapt) with cascade control*

If this controller module is used as auxiliary controller of the subordinate control loop of a cascading control, a conversion of the control output 0 … 100%, specified by the main controller, to a set point with units is required for the subordinate control loop.

The set point value of the subordinate controller must therefore be configured as "int.casc" and connected with the control output of the main controller. The control output 0…100%, provided by the main controller, is then scaled proportionally in the set point Scal- … Scal+ for the subordinate control loop whereby Scal- and Scal+ represent the scaling limits of the process value of the subordinate control loop.

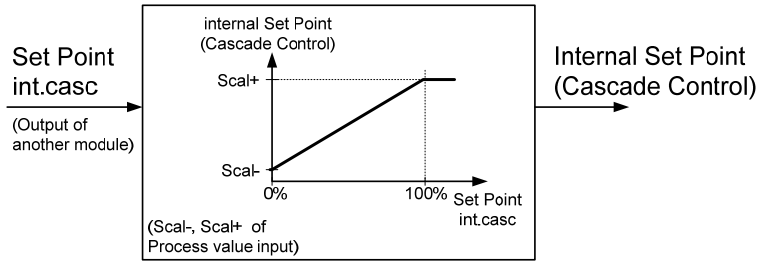



*Figure 26: Set point adaptation*

## *Tight-closing function (CutOff)*

This function causes the valve in automatic mode to close tightly or open all the way outside of a set value-related control range. This set value-related control range is hereby defined by a lower and upper set point limit.
If the current set point lies outside of the control range, the module output in automatic mode is overridden with 0% (tight-closing/zero-point cut-off) or 100% (open completely). The control mode is resumed again with a hysteresis of 1% in relationship to the scaled process value range.
A possible inversion of the actuator sense of action (see section "Effective direction of the actuator") causes an inversion of the module output even outside the set point-related control range:

**Example:**

Normal module sense of action, inverse actuator sense of action.

In automatic operation, the module output is overridden

- with 100% if the set value is smaller than Cut- or
- with 0% if the set value is greater than Cut+ .

The function mode also depends on the selected sense of action of the module (see Figure 27).

The tight-closing function can be run in different modes. In the **Cut- mode,** the set point is checked only in regard to the lower set point limit **Cut-**, in the **Cut+ mode** only in regard to the upper set point limit **Cut+**. In the **modes Cut- & Cut+,** the set point is checked regarding to lower and upper set point limit.

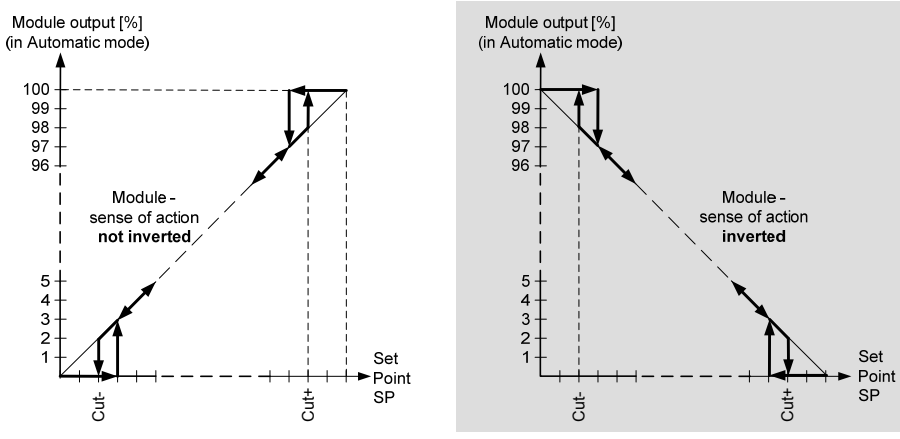



*Figure 27: Tight-closing function (CutOff) (COMMON_PID)*

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## *Set value limiter (SP Limit)*

The set point limiter is used to limit the adjustable set point through a minimum and maximum value in order to **prevent the definition of wrong set points,** that is, beyond this valid range by the user/operator.
In case of control with external set point or "cascade control" internal set point, the set point limiter can also be used to limit the min. and max. set point.

## *Ramp function for set point setting (SP Ramp)*

The ramp function serves to attenuate sudden changes of the set point and can be parameterized separately for positive and negative set point jumps. Possible instability problems can thereby be avoided which may occur with major set point changes in purely tuned systems.

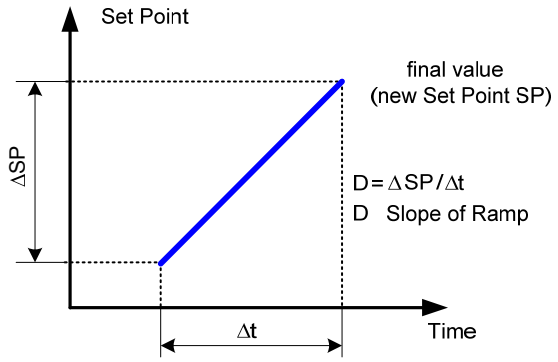


*Figure 28: Slope of the ramp*

If the ramp function is enabled and a sudden change of the set point occurs which is greater than the rise of the ramp, the **new set point is not immediately specified** to the controller. Over a period of time defined by the slope and the set point change, **small changes** will be fed to the controller until the desired new set point has been reached.

If the operator **switches from manual to automatic mode** while the ramp is activated, the set point will be increased/decreased from the last process value in manual mode to the set point in automatic mode according to the defined slope.

In **manual mode** the set point after ramp is set to the **current process value**.

The ramp function is parameterized via the separate specification of the rise for positive and negative set point changes. Each of the max. permitted positive (D+) and negative (D-) set point change must therefore be parameterized per minute.

## *PID Controller*

The Proportional Integral Differential (PID) Controller as well as the PI Controller is used to control the process values, e.g. with proportional actuators (proportional valves or pumps) - by outputting the control output 0 … 100 % as:

- Pulse Width modulated (PWM) signal or
- Pulse Frequency modulated (PFM) signal or
- Analog (4…20 mA) signal.

**Controller output limitation:**
The controller output is limited only in automatic mode by the parameterized lower and upper output limit (Lim-, Lim+).

**Cycle time Tsample:**
The cycle time of the controller can be set with the controller parameter “Tsample“ (in seconds). In that cycle time (in automatic mode) the current and the set point values will be regularly compared and a new control output will be calculated.

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**Gain/amplification factor Kp:**
The behaviour of the controller's P-part is influenced by the gain/amplification factor Kp. The gain/amplification factor Kp has units and is parameterized in (% / unit of the process value).

**Proportional part:** $\mathbf{Yp[\%] = Kp * (SP - PV)}$ (Module sense of action: normal)

The amplification Kp of the process controller relates to the scaled unit of the process value.

**Integral part (I-part):**
The integral part (I-part) of the PID Controller is usually used to prevent a steady state deviation from the set point.
**The reset time Tn** (in seconds) is the time required to achieve an equal correction variable change through the integral part as it develops because of the proportional part.

The **I-part** of the PID Controller can be **disabled**: by defining the reset time **Tn** at **9999.0 s.**

**Differential part (D-part):**
The Differential part (D-part) of the PID Controller is used for the quick response to changes of the control difference.
**The derivative time Tv** (in seconds) is the time required to achieve an equal correction variable change in case of a rise response of the controller through the D-part, as it develops because of the proportional part.
**Delay time Tz:** The D-part is realized with a delay Tz. Tz is automatically set internally depending on the derivative time Tv.

The **D-part** of the PID Controller can be **disabled**: By defining the derivative time **Tv** at **0.0 s.**

**Deadband:**
Because of the definition of the deadband, the PID Controller responds only after a certain control difference. This preserves the connected actuators. Refer to figure “Sense of action” for effect of the parameter deadband.
The deadband is parameterized in percent of the assigned range of the process value (Scal- and Scal+).

**The D-part** - in addition - has an additional deadband to prevent the control output jumps due to leaving the deadband. This deadband is set internally to twice the value of the set deadband value.

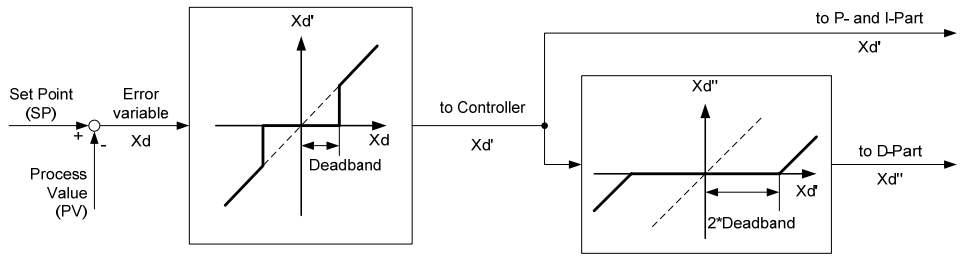
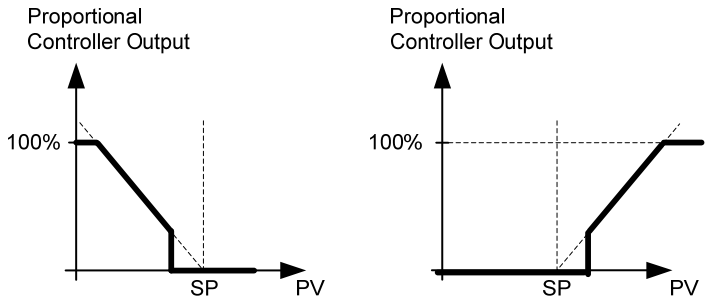



*Figure 29: Deadband (COMMON_PID)*

**Module Sense of Action:**
The module sense of action (controller sense of action) is reversible. The module sense of action is normally not inverted.
The module sense of action can be changed via the configuration file or in the menu item "Configuration" - see the following figure.




Module - sense of action: **normal** (InvMod = No)

Module - sense of action: **inverted** (InvMod = Yes)

*Figure 30: Sense of action of the module (COMMON_PID).*

## *Effective direction of the actuator*

The control output calculated by the controller can be adapted with this function to the effective direction of the actuator according to the following figure.

- Rise: Direct effective direction
- Scenario: Inverse effective direction

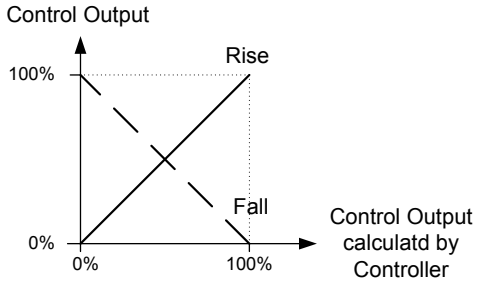



*Figure **31**: Effective direction of the actuator (COMMON_PID).*

If the connected actuator - when using a proportional controller with Start point (X0) 0% in the compensated state

- shall be selected with 0% → Select effective direction **Rise**
- shall be selected with 100% → Select effective direction **Fall**

## *Control output limitation*

The output control output is only restricted in the automatic mode through the control output limit. Either characteristic curve 1 or 2 (charact 1 or 2) can be chosen for the limit.

- charact 1
  - For simple control output limitation
- charact 2
  - For control output limitation with scaling of the control output on the control range
  - e.g. to select actuators a specific only approximately linear operating range
  - e.g. selection of proportional valves with PWM signal
  -

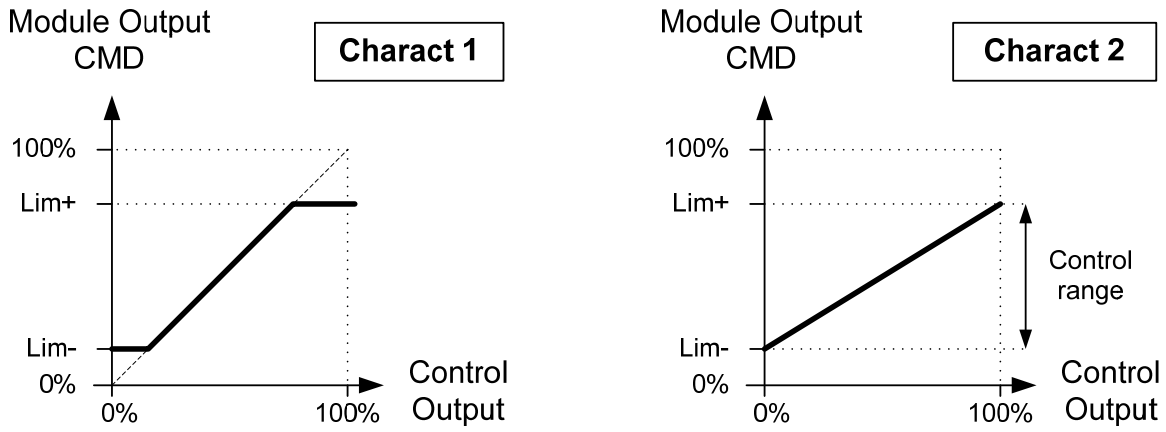



*Figure 32: Control output limitation COMMON_PID: Characteristic curves 1 and 2 (with control range)*

## Characteristic curve 1 (charact 1)

The control output is restricted only in automatic mode by the lower and upper control output limitation and output accordingly on the module output.

## Characteristic curve 2 (charact 2)

The module output is limited in automatic mode by the lower and upper output limit. At the same time, the lower and upper output limitation Lim- and Lim+ define the control range in automatic mode. This means, the control output 0…100% calculated by the controller is not put out directly as output signal 0…100% but relates to the control range and is put out as control output 0… 100% within the control range.

Certain actuators, e.g. proportional valves selected via PWM signal, work only approximately linear in a specific operating range. The selection of an actuator often causes the change of the process variable only from a specific minimum selection value **Lim**- just as the selection above a specific max. selection value **Lim+** no longer causes a change of the process variable.

Characteristic curve 2 is thereby especially used when selecting proportional valves to tune the module output signal as optimally as possible on the actuator used.

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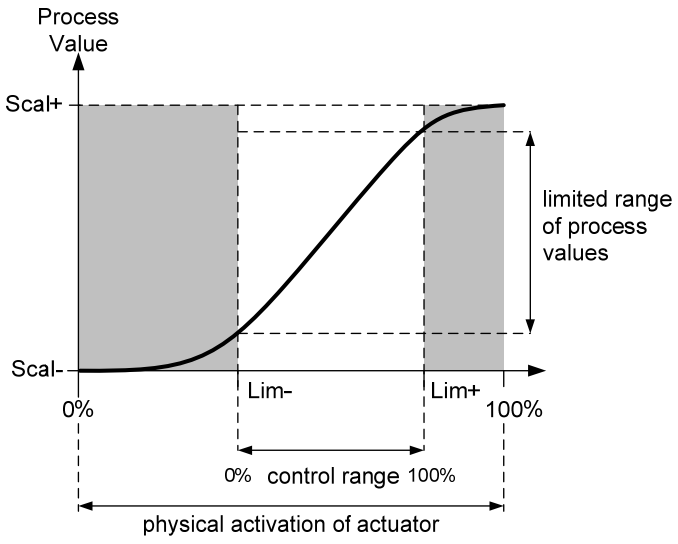


*Figure 33: Control output limitation with control range (COMMON_PID).*

When the pressure scenario changes, the selection values (i.e. lower and upper output limitation Lim- and Lim+) may need to be adjusted!

If a tight-closing function is required, the CutOff function must be parameterized accordingly!

## *Output Override*

The **output** of this module is **influenced** at certain states (see Figure 34).

The safety control output as well as, optionally, the System Switch / Flow Switch Override override both the automatic and the manual control output if enabled!

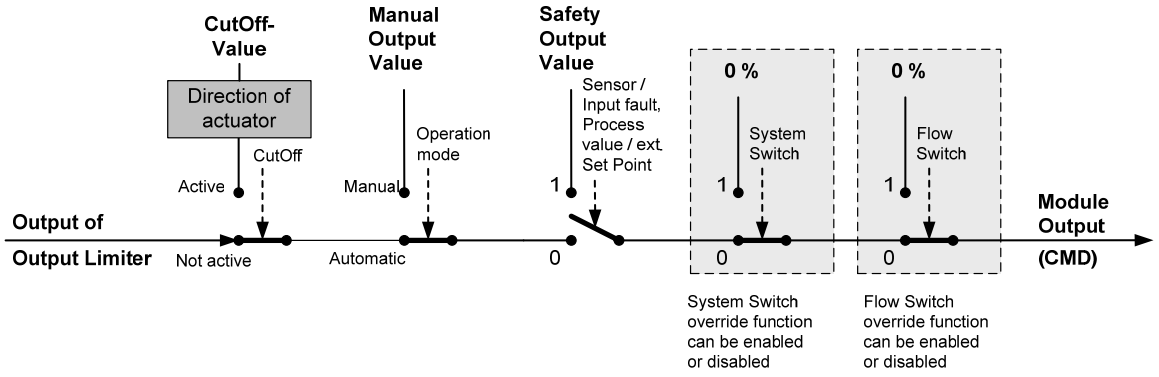


*Figure 34: Output override (COMMON_PID).*

## Processdata and Data Logging

| Displayed data | Abbre-viation (menu) | Display-Presentation | | | Data-Log. | Notes |
|---|---|---|---|---|---|---|
| | | Full Screen | Trend chart | Line | | |
| Process value | PV | x | x | x | x | |
| Process Value 2 (Set point External) | PV2 | x | | x | x | Only if SP input = External |
| Set point | SP | x | | x | x | |
| Set point vs. Process value | SP/PV | | x | | | |
| Module output | CMD | x | | x | x | |

## Parameter (CodeLevel: Operator)

| Parameter | Abbreviation (menu) | Value range | Default values (after successful down-load of Cfg-File) |
|---|---|---|---|
| Sample Time | Tsample | 0.05/0.1 … 60.0 s | 0.2 s |
| Set point (*) | SP | Scal- …Scal+ of the assigned input SPLim- ... SPLim+ (if SP Limit is enabled) | Scal- + ((Scal+ - Scal-) /2) |
| Ratio set point (****) | Kx | 0.001 … 9999.0 | 1.0 |
| **Set point ramp** | **SP Ramp** | | |
| Set point ramp | SP Ramp | Yes / No | No |
| Ramp rise: max. positive set point change per minute (**) | D+ | 0.1 … 99999 (unit of process value input) | 1 |
| Ramp rise: max. negative set point change per minute (**) | D- | 0.1 … 99999 (unit of process value input) | 1 |
| **CutOff** | **CutOff** | | |
| CutOff | Mode | Off / Cut- / Cut+ / Cut- & Cut+ | disable |
| Lower CutOff threshold (***) | Cut- | Scal- ... Scal+ (Scal- and Scal+ of process value input) | Scal- |
| Upper CutOff threshold (***) | Cut+ | Scal- ... Scal+ (Scal- and Scal+ of process value input) | Scal+ |
| ***PID Controller*** | | | |
| Deadband | Dbnd | 0.1 … 10.0 % of input range | 1.0 % |
| Gain/amplification factor | Kp | 0.001 … 9999.0 (in % / unit) | 1.0 |
| Reset time | Tn | 0.1 … 9999.0 s | 9999.0 s |
| Derivation time | Tv | 0.0 … 9999.0 s | 0.0 s |
| Start point | X0 | 0.0 … 100.0 % | 0.0 % |
| Lower output limit | Lim- | 0.0 … Lim+ | 0.0 % |
| Upper output limit | Lim+ | Lim- … 100.0 % | 100.0 % |
| Safety output value | CMDsafe | 0.0 … 100.0 % | 0.0 % |

(*) will be only displayed if the parameter „SP Input“ is selected as „intern“ in the menu „Configuration“
(**) will be only displayed if the parameter „SP Ramp“ is selected as „Yes“ in the menu „Parameter“
(***) will be only displayed if the selected „(CutOff) Mode“ supports the according parameter
(****) will be only displayed if the parameter „SP Input“ is selected as „External“ in the menu „Configuration“

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## Configuration (CodeLevel: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Module active/not active | rw | rw | Module | On/Off | Off |
| Inversion module sense of action | rw | rw | InvMod | Yes / No | No |
| Set point | rw | rw | SP Input | Internal / External / Int.Casc | Internal |
| **Set point limiter** | | | **SP Limit** | | |
| Set point limiter | rw | rw | SP Limit | Yes / No | No |
| Lower set point limit (*) | rw | rw | SPLim- | Scal- ... SPLim+ | Scal- of the assigned process value input |
| Upper set point limit (*) | rw | rw | SPLim+ | SPLim- …Scal+ | Scal+ of the assigned process value input |
| ***Module output*** | | | | | |
| Effective direction | rw | rw | Dir | Rise / Fall | Rise |
| Characteristic curve of the set point limitation | rw | rw | CMD Limit | Charact 1 / Charact 2 | Charact 1 |
| ***Output Override Functions*** | | | | | |
| System switch override | rw | rw | SSOR | Yes / No | No |
| Flow switch override | rw | rw | FSOR | Yes / No | No |

(*) will be only displayed if the parameter „SP Limit“ is selected as „Yes“

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# 14.3 Conductivity Control Modules

Several control strategies are implemented for a closed loop control of system water conductivity by means of a bleed valve. Depending on the fluctuation of the incoming water (make-up water) quality, either a simple or a ratio control should be used.

## Simple Control

If the incoming **water quality is relatively constant**, traditional volumetric dosing of Scale & Corrosion inhibitors combined with a single fixed conductivity control strategy (On-/Off- or PI-Control) is the standard approach (Simple control).

## Ratio Control

If the incoming **water quality is varying**, ratio control of the conductivity (e.g. within a cooling system) will be an extremely useful way to control system water concentration.

If the incoming water varies too much in its composition, it will be possible for the scale and corrosion inhibitors to be under or overdosed because the controller makes no allowance for the change in cycles of concentration (ratio of concentration of dissolved salts in incoming water and in the system or circulation water ).

The ratio control uses a **dual strategy for conductivity control:** on the one hand, in the incoming water and on the other hand, in the system water. Ratio control maintains the cycles of concentration within the cooling system by maintaining a fixed ratio between the incoming water and system water, thereby optimising the inhibitor concentrations level.

For ratio control either the On-/Off-Ratio-Control or the PI-Ratio-Control can be used.

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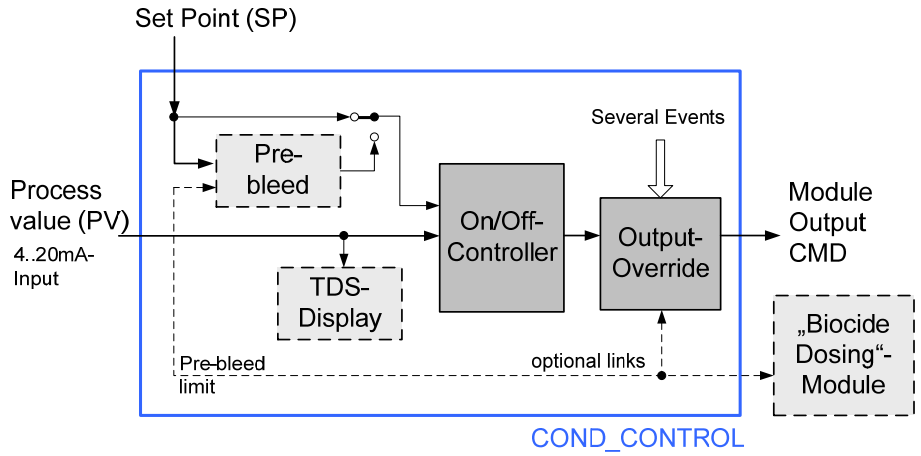
## 14.3.1 On-/Off-Control (COND_CONTROL)

This module allows a simple On-/Off Control of the conductivity with the optional interface to the "Biocide-Dosing" module.




These modules are explained below.

*Figure 35: COND_CONTROL*

### *Pre-bleeding and "Biocide Dosing" Module*

For optimizing the biocide dosing the **bleed valve** is held shut during the biocide dosing by means of output override so that the contact time of the dosed biocides is maximized. But there is the risk of hardness salts precipitating due to over concentration, since the dosed biocides increase the conductivity.

So the **biocide dosing usually starts with a pre-bleed phase**, in which the conductivity is reduced to a parameterized pre-bleed limit before the dosing of the biocide starts.

Therefore the "Biocide Dosing" module overrides the conductivity set point with the pre-bleed limit during the pre-bleed phase in **automatic mode**.
If the conductivity process value is equal or smaller than the **pre-bleed limit** or if the operational mode is switched to **manual mode**, the pre-bleed phase will be finished.

For more detailed information on the time-controlled biocide dosing process or "Biocide Dosing" module, please refer to the chapter 14.9.

For the use of the **pre-bleed function** the following things have to be provided:

- the pre-bleed functionality has to be **enabled (in the configuration file)**
- The link between conductivity module and "Biocide Dosing" module has to be configured correctly (in the configuration file),

the **pre-bleed limit** is smaller or equal than the current set point of the conductivity control

Only one of the Conductivity modules can be connected with the “Biocide Dosing” module!

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## On/Off-Controller

The On/Off-Controller is used to control simple on/off-outputs, e.g. a bleed valve. The On/Off-controller outputs either 0 % (off) or 100 % (on), depending on the current process value and the internal state of the controller (see Figure 36).

The controller sense of action is reversible. **Usually the sense of action is normal (**not inversed**).** The sense of action can be changed in the configuration menu or with the configuration file.

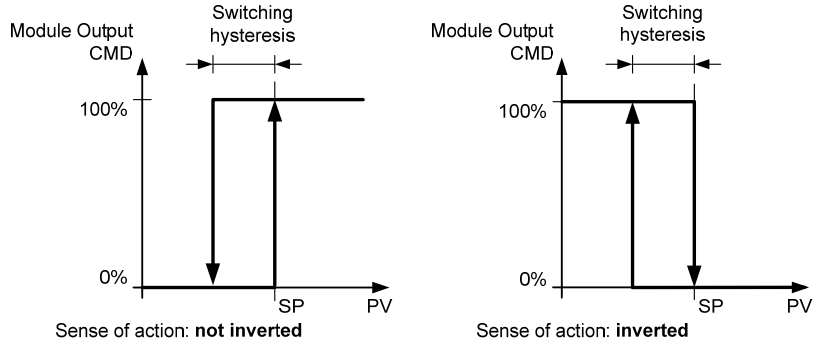


*Figure 36: Sense of action of the modules COND_CONTROL and COND_CONTROL_RATIO*

## Output Override

The **output** of this module is **influenced** at certain states (see figure).

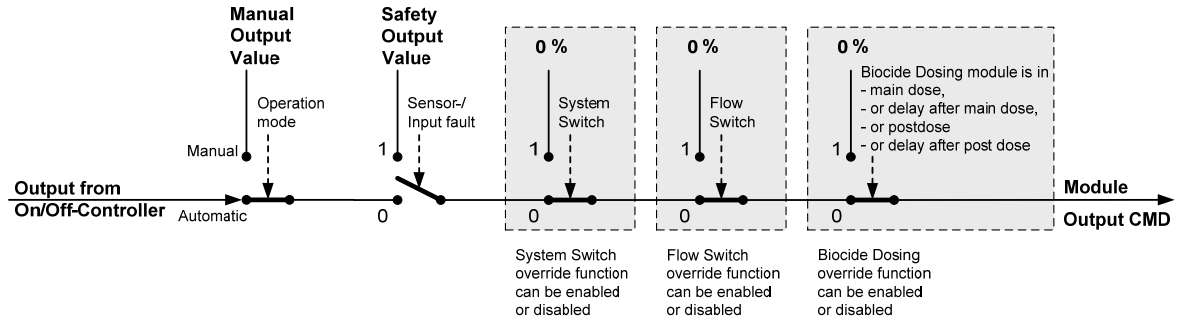


*Figure 37: Output override (COND_CONTROL)*

### *"Biocide dosing" override*

If the link between conductivity module and "Biocide Dosing" module is configured correctly, the **"Biocide Dosing" module will override the conductivity controller output with 0 %** after finishing or skipping the pre-bleed phase.
This means, the **conductivity controller will not work in the following phases** of biocide dosing:

- main dose,
- delay after main dose
- post dose
- delay after post dose.

Only one of the Conductivity modules can be connected with the “Biocide Dosing” module!



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## *Maximum Output Timer (MOT)*

This function monitors the controller output in automatic mode. If the controller output puts out the 100% control output longer than the defined max. output time (+Tm), the **"Out fails" alarm** is put out and the general alarm output is enabled.

The controller output will not be influenced by the alarm. The alarm message has to be acknowledged by the operator on the device, even if the operating mode was changed.

The internal timer which counts the period of the max. control output is reset if the control output equals 0% and the alarm has not yet been triggered.

The Maximum Output Timer can be enabled/disabled via configuration. For a general description of the MOT refer to chapter 14.1.5.

## *Total Dissolved Solids (TDS)-Display*

The TDS display indicates the total content of dissolved solids of the conductivity process value (e.g. the boiler water) in ppm. The concentration is calculated by correlating values from a diagram (see Figure 38) to the measured conductivity values (measured in µS/cm):

**TDS = C * S**

with C …… Measured conductivity value
S …… Slope of the graph (the factory setting is 0.8)

Since the relationship between **Conductivity and TDS** is essentially a **linear relationship**, it is possible for the controller to display TDS by converting the conductivity input information into TDS units (ppm). This conversion is possible by reference to graph in Figure 38 which is held in memory.

**Note!** The **slope of the curve can be adjusted** by the operator more closely **to actual boiler water conditions.**
Chemical analysis of the boiler water will establish the precise relationship between conductivity and TDS for a particular combination of factors. With these values the slope of the calibration graph can be adjusted, by entering **values for Conductivity (PV cal) and TDS (TDS cal) in the "Parameter" menu item.**

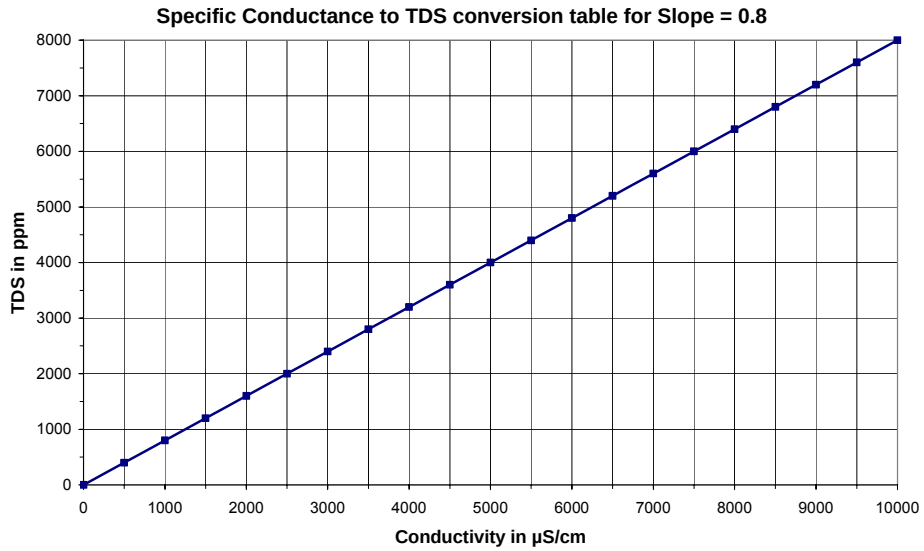


*Figure 38: Relationship between conductivity and TDS*

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## Processdata and Data Logging

| Displayed data | Abbre-viation (menu) | Display-Presentation | | | Data-Log. | Notes |
|---|---|---|---|---|---|---|
| | | Full Screen | Trend chart | Line | | |
| Process value | PV | x | x | x | x | |
| Process value (in ppm) | PV | x | | x | x | Only if TDS-Display is configured |
| Set point | SP | x | | x | x | |
| Set point vs. Process value | SP/PV | | x | | | |
| Module output | CMD | x | | x | x | |
| MOT Alarm (Maximum Output Timer Alarm) | | x | | | x | is displayed only if MOT was enabled and is expired; Data log in controller output |

## Parameter (CodeLevel: Operator)

| Parameter | Abbreviation (menu) | Value range | Default values (after successful download of Cfg-File) |
|---|---|---|---|
| Set point | SP | Scal- …Scal+ of the assigned input | Scal- + ((Scal+ - Scal-) /2) |
| Switching hysteresis | Hyst | 0.1 ... 10.0 % of input range | 1.0 % |
| Safety output value | CMDsafe | 0.0 ... 100.00 % | 0.0 % |
| ***Maximum output timer (MOT)*** | | | |
| Maximum output time (*) | +Tm | 1 ... 10800 s | 10800 s |
| ***For TDS-Calibration:*** | | | |
| Conductivity value (**) | PV cal | 1 ... 99999 (in units of the assigned process value input) | 1000 |
| TDS value (**) | TDS cal | 1 ... 99999 ppm | 800 ppm |

(*) will be only displayed if the parameter “MOT” is configured as “Yes”
(**) will be only displayed if the parameter “TDS Disp” is configured as “Yes”

## Configuration (CodeLevel: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Module active/not active | rw | rw | Module | On/Off | Off |
| Inversion module sense of action | rw | rw | InvMod | Yes / No | No |
| Pre-bleed and "Biocide Dosing Output Override" | rw | rw | Prebleed | Yes / No | No |
| TDS display | rw | rw | TDS Disp | Yes / No | No |
| System switch override | rw | rw | SSOR | Yes / No | No |
| Flow switch override | rw | rw | FSOR | Yes / No | No |
| Maximum Output Timer | rw | rw | MOT | Yes / No | No |

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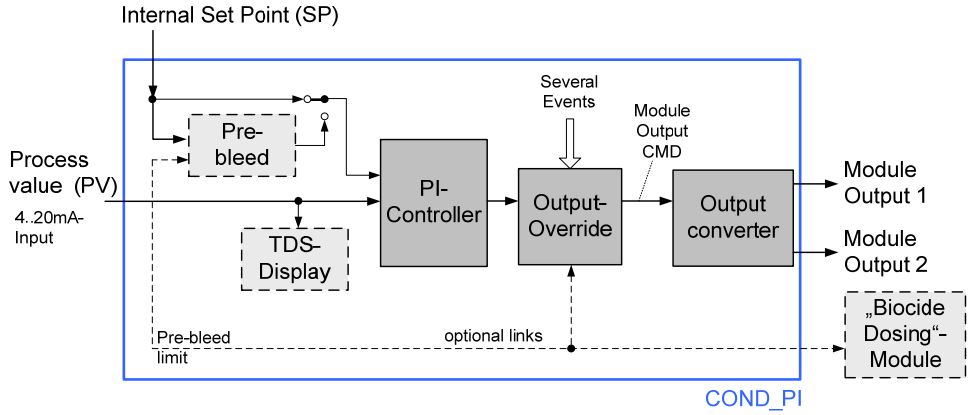
## 14.3.2 PI-Control (COND_PI)

This module permits a Proportional Integral (PI)-Control of the conductivity with an optional interface to the "Biocide-Dosing" module. The functionality is same as in the conductivity On/Off-Controller COND_CONTROL, except the internal PI-Controller.




These modules are explained below.

*Figure 39: COND_PI*

### *Pre-bleeding and "Biocide Dosing" Module*

It is the same module as described in the chapter above, (Chapter 14.3.1 in the section "Pre-bleeding and "Biocide Dosing" Module".

### *PI Controller*

The description of the Proportional Integral (PI)-Controller is consistent to the PI-part of the PID Controller in section “PID Controller” in chapter 14.2. Specifics / differences are described below.

**Proportional part / Module sense of action:**
The normal module sense of action is defined:

Proportional part: $\mathbf{Yp[\%] = -Kp * (SP - PV)}$

It can be illustrated as shown in the following figure:

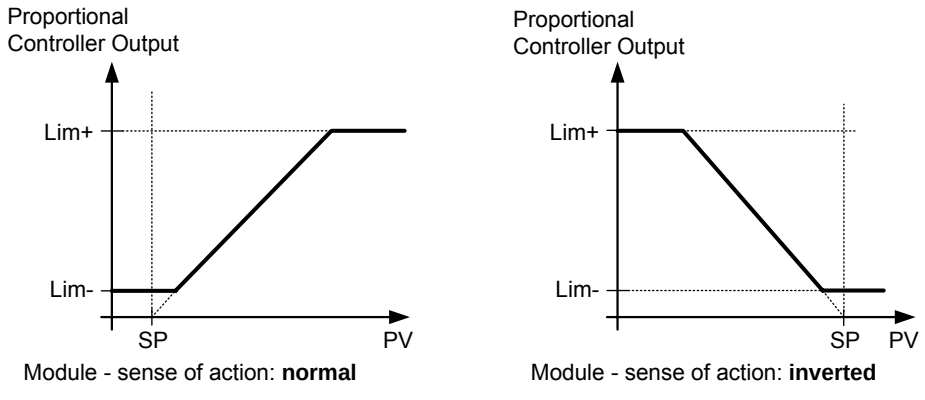



*Figure 40: Sense of action of the modules (COND_PI and COND_PI_RATIO)*

**Deadband:**
A deadband doesn’t exist for this module.



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## Output converter

Normally, the module output CMD for the selection of actuators is only looped through the output converter and directed directly to the real output linked via module output 1.
However, the module "COND_PI" is also provided for controlling a motorized (bleed) valve by means of a **time controlled 3-point-step-output**. For this purpose, the CMD module output is converted in the output converter with the appropriate configuration and divided to module output 1 (close) and module output 2 (opening). The settings of the 3-point-step-output can be accessed in the "Parameter" menu.

## Output Override

The **output** of this module is **influenced** at certain states (see figure).

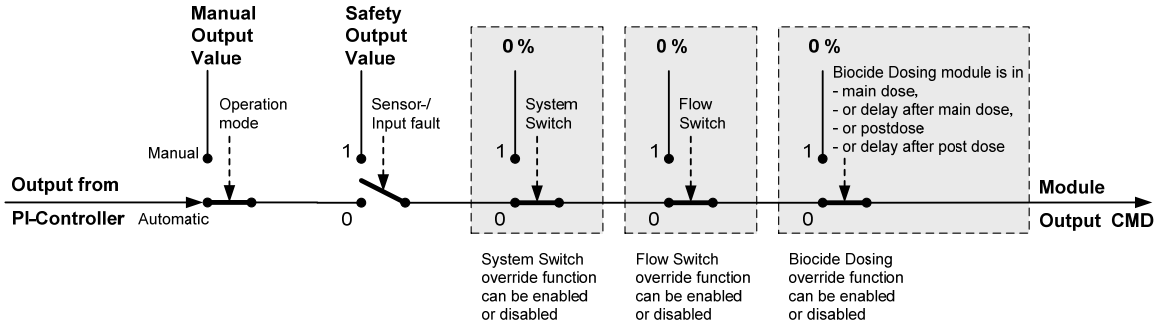


*Figure 41: Output override (COND_PI)*

### "Biocide dosing" override

Refer to the description on "Biocide Dosing" override in the section " Output Override" of chapter 14.3.1

## Maximum Output Timer (MOT)

This function monitors the controller output in automatic mode. If the controller output puts out the Maximum Output Timer longer than the defined max. output time (+Tm), an **"Out fails"** alarm is put out and the general alarm output is enabled.

The controller output will not be influenced by the alarm. The alarm message has to be acknowledged by the operator on the device, even if the operating mode was changed.

The internal timer counting the period of the maximum control output will be reset if the control output is smaller than the maximum control output and the alarm has not yet been triggered. The maximum output is determined by the parameter **"Upper output limit Lim+"**.

The Maximum Output Timer can be enabled/disabled through the configuration. For a general description of the MOT refer to chapter 14.1.5.

## Total Dissolved Solids (TDS)-Display

Please refer to the description on "Total Dissolved Solids (TDS)-Display" in chapter 14.3.1

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## Processdata and Data Logging

| Displayed data | Abbre-viation (menu) | Display-Presentation | | | Data-Log. | Notes |
|---|---|---|---|---|---|---|
| | | Full Screen | Trend chart | Line | | |
| Process value | PV | x | x | x | x | |
| Process value (in ppm) | PV | x | | x | x | Only if TDS-Display is configured |
| Set point | SP | x | | x | x | |
| Set point vs. Process value | SP/PV | | x | | | |
| Module output | CMD | x | | x | x | |
| MOT Alarm (Maximum Output Timer Alarm) | | x | | | x | is displayed only if MOT was enabled and is expired; Data log in controller output |

## Parameter (CodeLevel: Operator)

| Parameter | Abbreviation (menu) | Value range | Default values (after successful download of Cfg-File) |
|---|---|---|---|
| Sample Time | Tsample | 0.05/0.1 … 60.0 s | 0.2 s |
| Set point | SP | Scal- …Scal+ of the assigned input | Scal- + ((Scal+ - Scal-) /2) |
| Gain/amplification factor | Kp | 0.001 … 9999.0 (in % / unit) | 10.0 |
| Reset time | Tn | 0.1 ... 9999.0 s | 9999.0 s |
| Lower output limit | Lim- | 0.0 % ... Lim+ | 0.0 % |
| Upper output limit | Lim+ | Lim- ... 100.00 % | 100.00 % |
| 3-point step output (*): Period for opening the actuator from position 0% to 100% | Tco op | 1 ... 600 s | 60 s |
| 3-point step output (*): Period for closing the actuator from position 100% to 0% | Tco cl | 1 ... 600 s | 60 s |
| 3-point step output (*): Process switching difference | Psd | 0.01 ... 20.00 % | 2.0 % |
| Safety output value | CMDsafe | 0.0 ... 100.00 % | 0.0 % |
| ***Maximum output timer (MOT)*** | | | |
| Maximum output time (**) | +Tm | 1 ... 10800 s | 10800 s |
| ***For TDS-Calibration:*** | | | |
| Conductivity value (***) | PV cal | 1 ... 99999 (in units of the assigned process value input) | 1000 |
| TDS value (***) | TDS cal | 1 ... 99999 ppm | 800 ppm |

(*) will be only displayed if the parameter “3PS” is configured as “Yes” in the menu „Configuration“
(**) will be only displayed if the parameter “MOT” is configured as “Yes” in the menu „Configuration“
(***) will be only displayed if the parameter “TDS Disp” is configured as “Yes” in the menu „Configuration“

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## Configuration (Code Level: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Module active/not active | rw | rw | Module | On/Off | Off |
| Inversion module sense of action | rw | rw | InvMod | Yes / No | No |
| Pre-bleed and "Biocide dosing output override" | rw | rw | Prebleed | Yes / No | No |
| TDS display | rw | rw | TDS Disp | Yes / No | No |
| System switch override | rw | rw | SSOR | Yes / No | No |
| Flow switch override | rw | rw | FSOR | Yes / No | No |
| Maximum Output Timer | rw | rw | MOT | Yes / No | No |
| 3-point step output | r | rw | 3PS | Yes / No | No |

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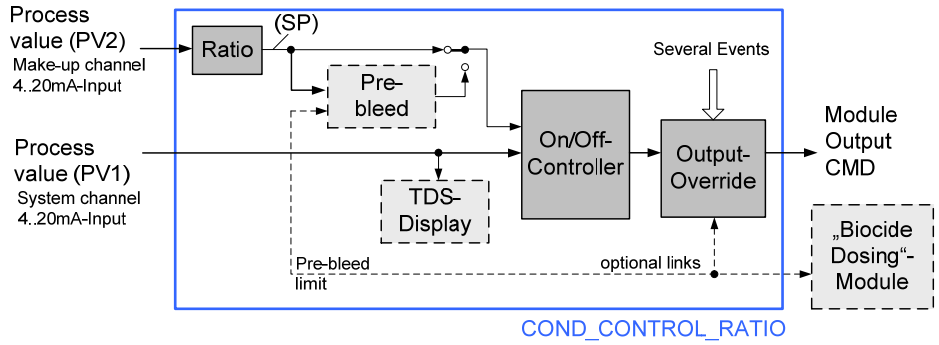
# 14.3.3 On-/Off-Ratio Control (COND_CONTROL_RATIO)

This module allows a simple On-/Off ratio control of the conductivity with an optional interface to the "Biocide-Dosing" module.




These modules are explained below.

*Figure 42: COND_CONTROL_RATIO*

## *Ratio*

Since the **quality of the incoming water** (make-up water) is varying, the conductivity of the incoming water is measured and used for **determining the current set point** of the conductivity control of the system water.

The **internal calculation** of the **set point SP** takes place as described below:

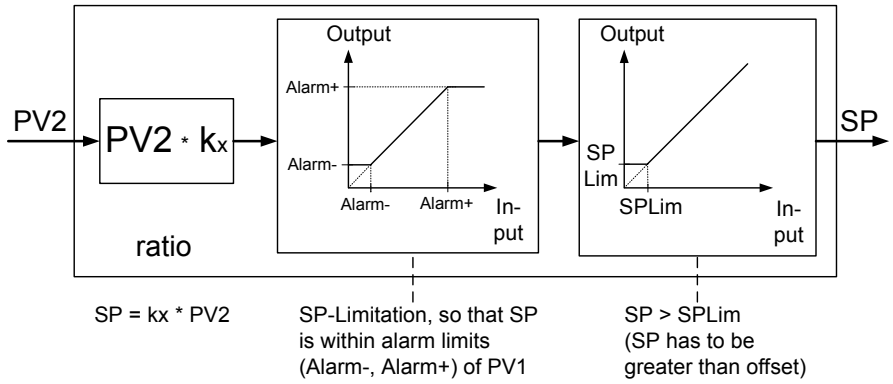



*Figure 43: Set point calculation (COND_CONTROL_RATIO)*

First the process value is multiplied with the **ratio factor Kx**. Afterwards the result is limited to the **input alarm limits** of the System Channel conductivity input, in order to avoid providing a set point, which causes later on an input alarm. Then the result is checked, whether it is smaller than the required set point minimum **SPLim** ("Set Point minimum", internal value). If not, it will be set to SPLim.

The set point minimum **SPLim is calculated internally** in the following way:

**SPLim = PV2** (of Make-Up Channel) **+ Offset + Switching Hysteresis** [µS/cm]

If a **sensor/input error** occurs on Make-Up-Channel, the last valid calculated set point will be used!

## *Pre-bleeding and "Biocide Dosing" Module*

Compare the section "Pre-bleeding and "Biocide Dosing" Module" in chapter 14.3.1.

## *On/Off-Controller*

Compare the section "On/Off-Controller" in chapter 14.3.1.

## *Output Override*

The **output** of this module is **influenced** at certain states (see figure).

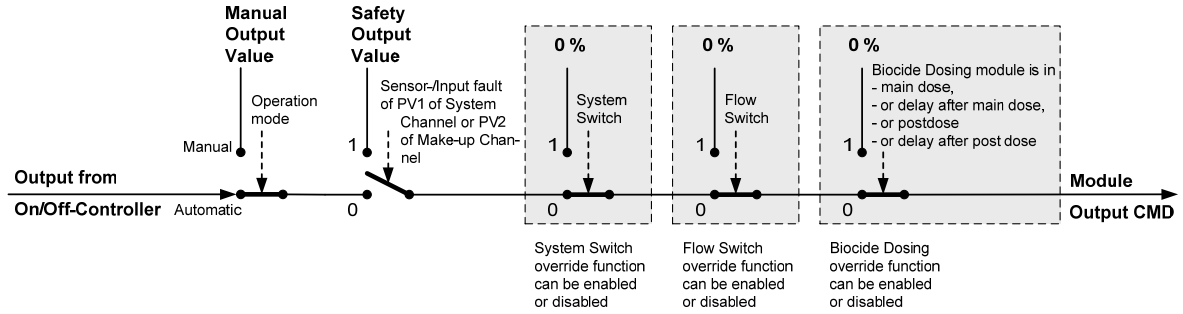



*Figure 44: Output override (COND_CONTROL_RATIO)*

### *"Biocide dosing" override*

Refer to the description on "Biocide Dosing" override in the section "Output Override" of chapter 14.3.1

## *Maximum Output Timer (MOT)*

Compare the description of the Maximum Output TImer in section "Maximum Output Timer (MOT)" in chapter 14.3.1.

## *Total Dissolved Solids (TDS)-Display*

The TDS display is **only available for** the conductivity process value of the **System Channel**.

Please refer to the description on "Total Dissolved Solids (TDS)-Display" in chapter 14.3.1

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## Processdata and Data Logging

| Displayed data | Abbre-viation (menu) | Display-Presentation | | | Data-Log. | Notes |
|---|---|---|---|---|---|---|
| | | Full Screen | Trend chart | Line | | |
| Process value System Channel | PV1 | x | x | x | x | |
| Process value System Channel (in ppm) | PV1 | x | | x | x | Only if TDS-Display is configured |
| Process value Make-Up Channel | PV2 | x | x | x | x | |
| Set point | SP | x | | x | x | |
| Set point vs. Process value System Channel | SP/PV1 | | x | | | |
| Module output | CMD | x | | x | x | |
| Alarm Maximum Output Timer | | x | | | x | is displayed only if MOT was enabled and is expired; Data log in controller output |

## Parameter (Code Level: Operator)

| Parameter | Abbreviation (menu) | Value range | Default values (after successful download of Cfg-File) |
|---|---|---|---|
| ***For Make-Up Channel:*** | | | |
| Ratio | Kx | 1.2 … 9.999 | 2.0 |
| Offset | Offset | 0 … 999.9 µS/cm | 10 µS/cm |
| ***For System Channel:*** | | | |
| Switching hysteresis | Hyst | 0.1 ... 10.0 % of input range | 1.0 % |
| Safety output value | CMDsafe | 0.0 ... 100.00 % | 0.0 % |
| ***Maximum output timer (MOT)*** | | | |
| Maximum output time (*) | +Tm | 1 ... 10800 s | 10800 s |
| ***For TDS-Calibration:*** | | | |
| Conductivity value (**) | PV cal | 1 ... 99999 (in units of the assigned process value input) | 1000 |
| TDS value (**) | TDS cal | 1 ... 99999 ppm | 800 ppm |

(*) will be only displayed if the parameter “MOT” is configured as “Yes” in the menu „Configuration“
(**) will be only displayed if the parameter “TDS Disp” is configured as “Yes” in the menu „Configuration“

## Configuration (CodeLevel: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Module active/not active | rw | rw | Module | On/Off | Off |
| Inversion module sense of action | rw | rw | InvMod | Yes / No | No |
| Pre-bleed and "Biocide dosing output override" | rw | rw | Prebleed | Yes / No | No |
| TDS display | rw | rw | TDS Disp | Yes / No | No |
| System switch override | rw | rw | SSOR | Yes / No | No |
| Flow switch override | rw | rw | FSOR | Yes / No | No |
| Maximum Output Timer | rw | rw | MOT | Yes / No | No |

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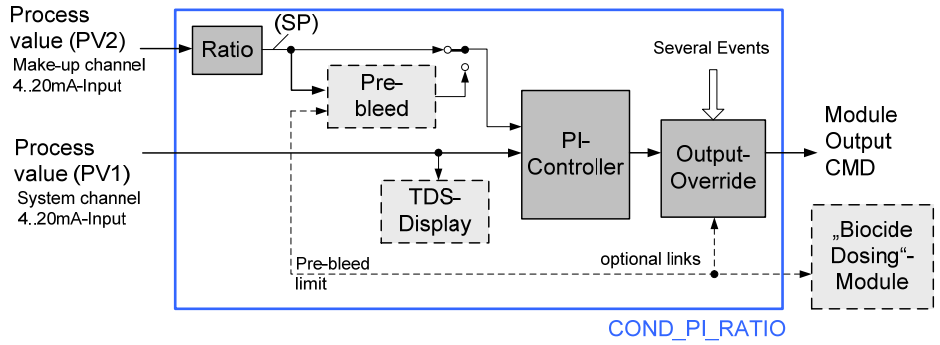
# 14.3.4 PI-Ratio Control (COND_PI_RATIO)

This module allows a simple PI ratio control of the conductivity with an optional interface to the "Biocide-Dosing" module.




These modules are explained below.

*Figure 45: COND_PI_RATIO*

### *Ratio*

Please refer to the description on section "Ratio" in chapter 14.3.3

### *Pre-bleeding and "Biocide Dosing" Module*

Please refer to the description on section "Pre-bleeding and "Biocide Dosing" Module" in chapter 14.3.1

### *PI Controller*

Please refer to the description on section "PI Controller" in chapter 14.3.2

### *Output Override*

The **output** of this module is **influenced** at certain states (see figure).

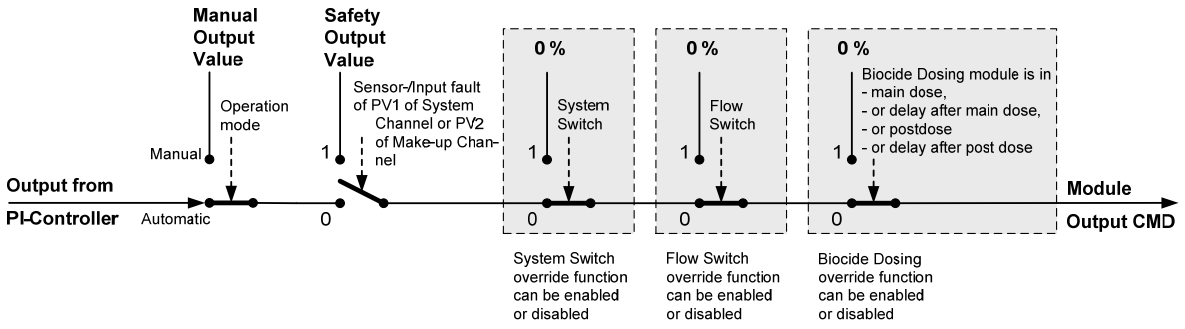



*Figure 46: Output override (COND_PI_RATIO)*

#### *"Biocide dosing" override*

Refer to the description on "Biocide Dosing" override in the section ”Output Override” in chapter 14.3.1.



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### *Maximum Output Timer (MOT)*

Compare the description of the Maximum Output Timer in section "Maximum Output Timer (MOT)" in chapter 14.3.2.

### *Total Dissolved Solids (TDS)-Display*

The TDS display is **only available for** the conductivity process value of the **System Channel**.

Please refer to the description on section "Total Dissolved Solids (TDS)-Display" in chapter 14.3.1

## Processdata and Data Logging

| Displayed data | Abbre-viation (menu) | Display-Presentation | | | Data-Log. | Notes |
|---|---|---|---|---|---|---|
| | | Full Screen | Trend chart | Line | | |
| Process value System Channel | PV1 | x | x | x | x | |
| Process value System Channel (in ppm) | PV1 | x | | x | x | Only if TDS-Display is configured |
| Process value Make-Up Channel | PV2 | x | x | x | x | |
| Set point | SP | x | | x | x | |
| Set point vs. Process value System Channel | SP/PV1 | | x | | | |
| Module output | CMD | x | | x | x | |
| Alarm Maximum Output Timer | | x | | | x | is displayed only if MOT was enabled and is expired; Data log in controller output |

## Parameter (CodeLevel: Operator)

| Parameter | Abbreviation (menu) | Value range | Default values (after successful download of Cfg-File) |
|---|---|---|---|
| Sample Time | Tsample | 0.05/0.1 … 60.0 s | 0.2 s |
| ***For Make-Up Channel:*** | | | |
| Ratio | Kx | 1.2 … 9.9 | 2.0 |
| Offset | Offset | 0 … 999.9 µS/cm | 10 µS/cm |
| ***For System Channel:*** | | | |
| Gain/amplification factor | Kp | 0.001 … 9999.0 (in % / unit) | 10.0 |
| Reset time | Tn | 0.1 ... 9999.0 s | 9999.0 s |
| Lower output limit | Lim- | 0.0 % ... Lim+ | 0.0 % |
| Upper output limit | Lim+ | Lim- ... 100.00 % | 100.00 % |
| Safety output value | CMDsafe | 0.0 ... 100.00 % | 0.0 % |
| ***Maximum output timer (MOT)*** | | | |
| Maximum output time (*) | +Tm | 1 ... 10800 s | 10800 s |
| ***For TDS-Calibration:*** | | | |
| Conductivity value (**) | PV cal | 1 ... 99999 (in units of the assigned process value input) | 1000 |
| TDS value (**) | TDS cal | 1 ... 99999 ppm | 800 ppm |

(*) will be only displayed if the parameter “MOT” is configured as “Yes” in the menu „Configuration“
(**) will be only displayed if the parameter “TDS Disp” is configured as “Yes” in the menu „Configuration“

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## Configuration (CodeLevel: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Module active/not active | rw | rw | Module | On/Off | Off |
| Inversion module sense of action | rw | rw | InvMod | Yes / No | No |
| Pre-bleed and "Biocide dosing output override" | rw | rw | Prebleed | Yes / No | No |
| TDS display | rw | rw | TDS Disp | Yes / No | No |
| System switch override | rw | rw | SSOR | Yes / No | No |
| Flow switch override | rw | rw | FSOR | Yes / No | No |
| Maximum Output Timer | rw | rw | MOT | Yes / No | No |

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# 14.4 Corrosion Display (CORROSION-DISPLAY)

The corrosion display **indicates the corrosion rate** measured by the corrosion transmitter. Although this function is not used directly for control purposes, it provides useful **system status information.**

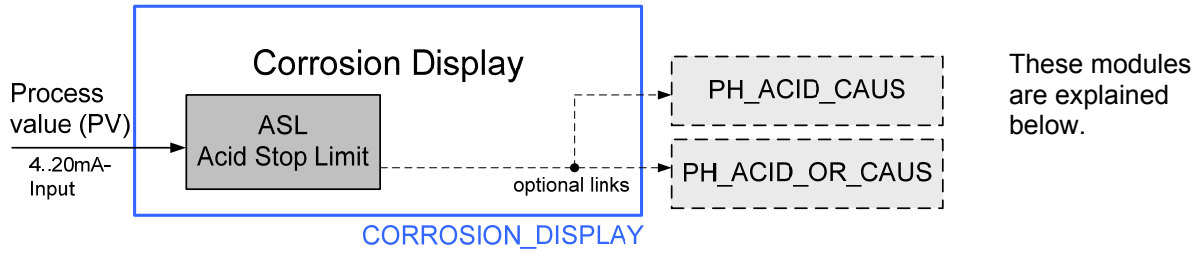


*Figure 47: CORROSION_DISPLAY*

## *Acid Stop Limit (ASL)*

If the **corrosion rate exceeds the predefined value,** the Acid Stop Limit ASL, the ASL alarm for this *Function* is activated and the general alarm output is triggered. The ASL alarm is disabled again if the process value is less than the ASL minus the ASL-hysteresis.

The **ASL-Alarm** can be used in combination with the controller modules PH_ACID_CAUS and PH_ACID_OR_CAUS as **additional failsafe for preventing overdosing of acids or bases.** Hereby both acid and caustic outputs (if existing) of the connected pH controller modules are set to "0" (shut off), as long as the ASL-Alarm is active. If the system switch override for this module is configured and becomes active (stand-by), the ASL alarm is disabled again.

Refer also to the description of the pH Controller Modules in chapter 14.5.1 and 14.5.2.

## Processdata and Data Logging

| Displayed data | Abbre-viation (menu) | Display-Presentation | | | Data-Log. | Notes |
|---|---|---|---|---|---|---|
| | | Full Screen | Trend chart | Line | | |
| Process value | PV | x | x | | x | |
| Acid Stop Limit | ASL | x | | | x | Data Logging: Only ASL alarm |

## Parameter (CodeLevel: Operator)

| Parameter | Abbreviation (menu) | Value range | Default values (after successful download of Cfg-File) |
|---|---|---|---|
| Acid Stop Limit | ASL | Scal- …Scal+ of the assigned input | Scal- + ((Scal+ - Scal-) /2) |
| ASL hysteresis | Hyst | 0.1 ... 10.0 % of input range | 1.0 % |

## Configuration (Code Level: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Module active/not active | rw | rw | Module | On/Off | Off |
| System switch override | rw | rw | SSOR | Yes / No | No |

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# 14.5 pH Controller Modules (PH_ACID_CAUS) and (PH_ACID_OR_CAUS)

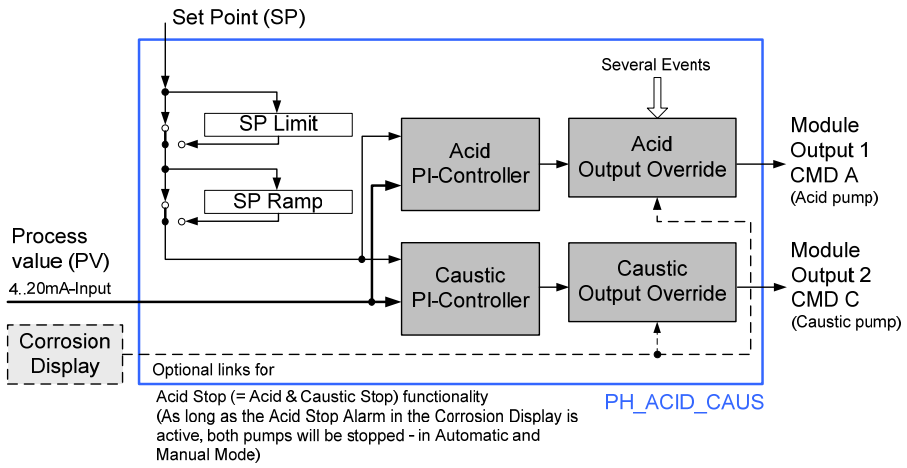
The pH control function is designed for P and PI control.

The implemented strategies for pH control include an **acid and caustic dosing** regime (PH_ACID_CAUS), whereas each section can be set independently.

Furthermore, the module PH_ACID_OR_CAUS is available, which realises a pH control with **only acid or only caustic substances dosing**.

## 14.5.1 pH-Control (PH_ACID_CAUS)

This module permits **a pH-Control with Acids *and* Bases** and with the optional interface to the "Corrosion Display" module for additional overdosing failsafe function.




These modules are explained below.

*Figure 48: (PH_ACID_CAUS)*

### *Set value limiter (SP Limit)*

The set point limiter is used to limit the adjustable set point through a minimum and maximum value in order to **prevent the definition of wrong set points,** that is, beyond this valid range by the user/operator.

### *Ramp for Set point adjustment (SP Ramp)*

The Ramp is used to **increase or decrease the set point of the controller in a series of small steps**, thereby avoiding possible instability problems which could occur if large changes to the set point were made on poorly tuned systems.

If the ramp is activated and the set point is changed to a new value, the **controller will not immediately respond** to the full range. Over a period of time defined by the slope, **small changes** will be fed to the controller until the desired new set point has been reached.

If the operator **switches from manual to automatic mode** and if the ramp is activated, the set point will be increased/decreased from the last process value in manual mode to the set point in automatic mode with the defined slope.

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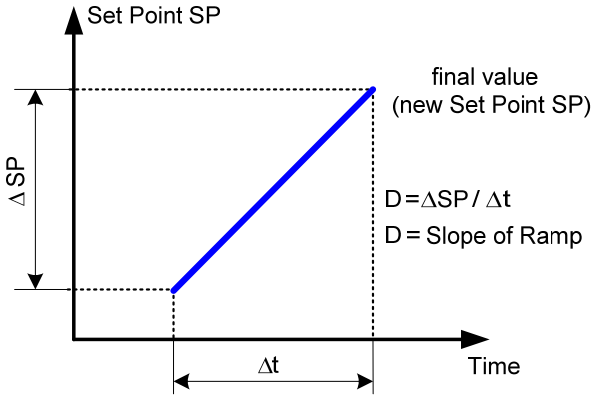


*Figure 49: Slope of the ramp*

In **manual mode** the set point according to the ramp function is set to the **current process value**.

If the ramp function is activated, the user can adjust the slope of the ramp to the particular conditions.



## *PI Controller*

The description of the Proportional Integral (PI)-Controller is consistent to the PI-part of the PID Controller in section “PID Controller” in chapter 14.2. Specifics / differences are described below.

**Gain/amplification factor Kp:**
In this module, the gain/amplification factor Kp can be parameterized separately for both controllers to adjust the resulting control output in each case as best as possible to the respectively used actuator.

**Integral part (I-part) / Reset time Tn:**
In this module, the reset time Tn influencing the I-part can be parameterized separately for both controllers.

**Proportional part / Module sense of action:**
The normal module sense of action is defined:

Proportional part: $\mathbf{YpAcid[\%] = -Kp_{Acid} * (SP - PV)}$

Proportional part: $\mathbf{YpBase[\%] = Kp_{Caus} * (SP - PV)}$

It can be illustrated as shown in the following figure:

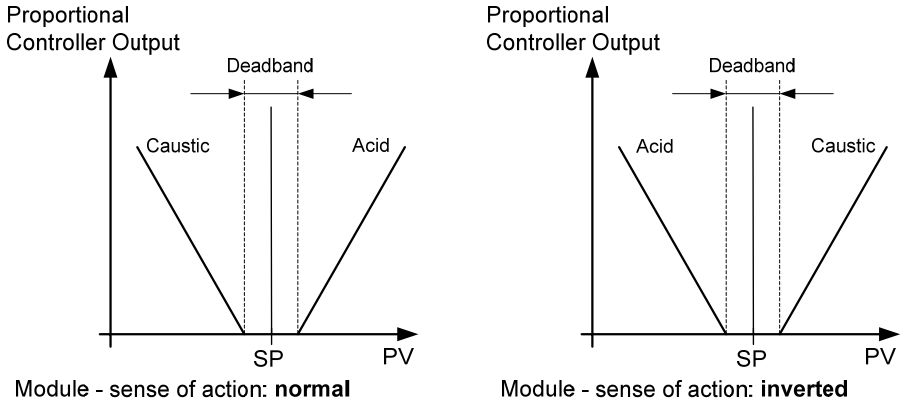


*Figure 50: Sense of action of the module and deadband*

## Output Override

The **output** of this module is **influenced** at certain states (see Figure 51).

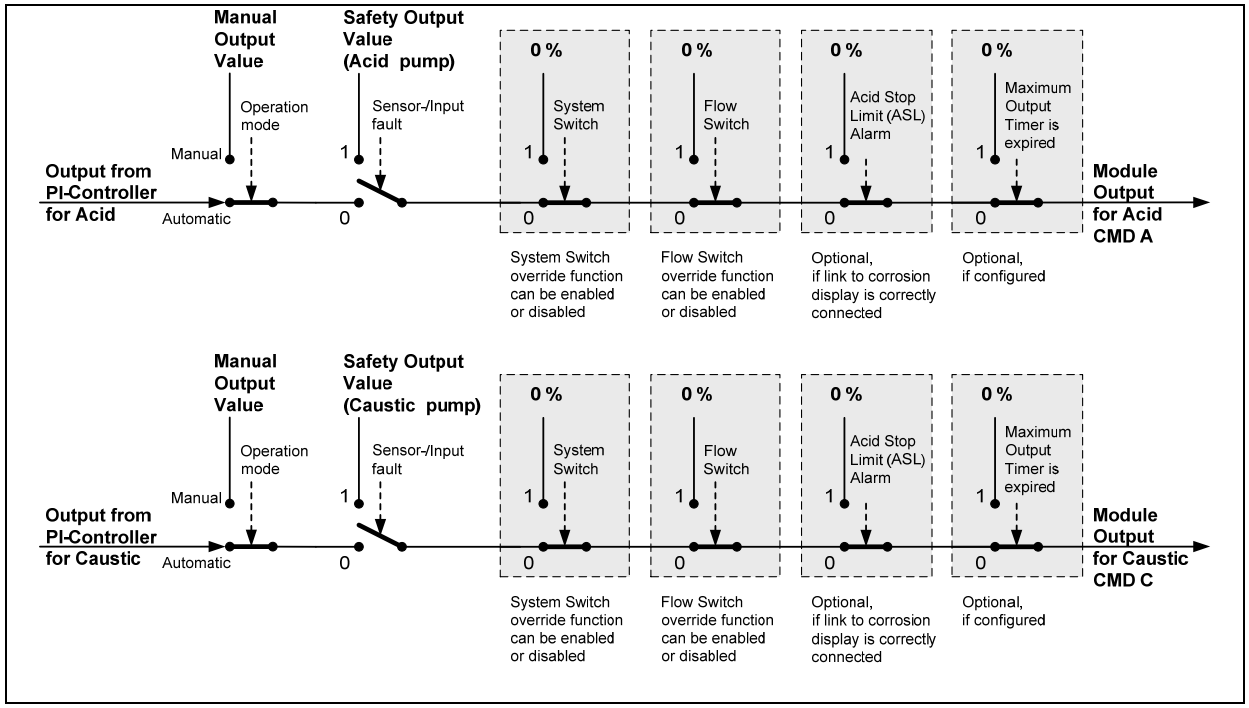


*Figure 51: Output override (PH_ACID_CAUS)*

## Acid Stop Limit – Pump Stop (ASL PumpStop)

The pH control module can be connected internally by means of configuration with a corrosion display for an additional failsafe function. Therefore the **ASL-Alarm** of the assigned *Function* (configured as corrosion display) is evaluated in order to **prevent overdosing of acids or bases.**

If the corrosion rate of the connected corrosion display exceeds the ASL alarm, this alarm becomes active. As long as the ASL alarm remains active, both controller outputs - for acids and bases - are overridden with "0%", i.e. disabled and the two dosing pumps (for acids and bases) are also shut off for this period.

## Maximum Output Timer (MOT)

This function monitors the acid and the caustic controller output of the pH controller in automatic mode in order to **detect whether the outputs have been failed**.

If one of the two controller outputs emits the maximum output longer than the defined maximum output time (MOT), then both **controller outputs will be overridden with "0 %".**

In this case an **alarm "Out fails"** is generated and the common alarm output is actuated, too.

Both pH controller outputs will be overridden with 0 % until the operator acknowledges the alarm message with the soft key buttons in the process data menu, even if operation mode was changed.

The internal timers for counting the time of maximum output will be reset if the control output is smaller than the maximum control output and the alarm was not yet triggered. The maximum control output is determined separately for each PI-controller by the parameter **"Upper output limit Lim+".**
The Maximum Output Timer can be enabled/disabled through the configuration. For a general description of the MOT refer to chapter 14.1.5.



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## Processdata and Data Logging

| Displayed data | Abbre-viation (menu) | Display-Presentation | | | Data-Log. | Notes |
|---|---|---|---|---|---|---|
| | | Full Screen | Trend chart | Line | | |
| Process value | PV | x | x | x | x | |
| Set point | SP | x | | x | x | |
| Set point vs. Process value | SP/PV | | x | | | |
| Module output Acid | CMD A | x | | x | x | |
| Module output Caustic | CMD C | x | | x | x | |
| Alarm Maximum Output Timer | | x | | | x | displayed only, if MOT enabled and expired;<br>Data log in Module output |

## Parameter (CodeLevel: Operator)

| Parameter | Abbreviation (menu) | Value range | Default values (after successful down-load of Cfg-File) |
|---|---|---|---|
| Sample Time | Tsample | 0.05/0.1 … 60.0 s | 0.2 s |
| Set point | SP | Scal- …Scal+ of the assigned input<br>SPLim- ... SPLim+ (if SP Limit is enabled) | Scal- +<br>((Scal+ - Scal-) /2) |
| Deadband | Dbnd | 0 … 100.0 % of input range | 1.0 % |
| **Set point ramp** | **SP Ramp** | | |
| Set point ramp | SP Ramp | Yes / No | No |
| Ramp rise: max. positive set point change per minute (*) | D+ | 0.1 … 99999 pH/min | 1 pH/min |
| Ramp rise: max. negative set point change per minute (*) | D- | 0.1 … 99999 pH/min | 1 pH/min |
| ***Acid Controller*** | | | |
| Gain/amplification factor | Kp | 0.001 … 9999.0 (in % / unit) | 10.0 |
| Reset time | Tn | 0.1 … 9999.0 s | 300.0 s |
| Lower output limit | Lim- | 0.0 … Lim+ | 0.0% |
| Upper output limit | Lim+ | Lim- … 100.0 % | 100.0 % |
| Safety output value | CMDsafe | 0.0 … 100.0 % | 0.0 % |
| ***Caustic Controller*** | | | |
| Gain/amplification factor | Kp | 0.001 … 9999.0 (in % / unit) | 10.0 |
| Reset time | Tn | 0.1 … 9999.0 s | 300.0 s |
| Lower output limit | Lim- | 0.0 … Lim+ | 0.0 % |
| Upper output limit | Lim+ | Lim- … 100.0 % | 100.0 % |
| Safety output value | CMDsafe | 0.0 … 100.0 % | 0.0 % |
| ***Maximum output timer (MOT)*** | | | |
| Maximum output time (**) | +Tm | 1 ... 10800 s | 10800 s |

(*) will be only displayed if the parameter “SP Ramp” is set to “Yes”
(**) will be only displayed if the parameter “MOT” is configured as “Yes” in the menu „Configuration“

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## Configuration (CodeLevel: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Module active/not active | rw | rw | Module | On/Off | Off |
| Inversion module sense of action | rw | rw | InvMod | Yes / No | No |
| **Set point limiter** | | | **SP Limit** | | |
| Set point limiter | rw | rw | SP Limit | Yes / No | No |
| Lower set point limit (*) | rw | rw | SPLim- | Scal- ...SPLim+ | Scal- of the assigned input |
| Upper set point limit (*) | rw | rw | SPLim+ | SPLim- …Scal+ | Scal+ of the assigned input |
| ASL pump stop | rw | rw | ASL PumpStop | Yes / No | No |
| Link to controller Module CORROSION_DISPLAY | r | rw | | linked *function* | -- |
| System switch override | rw | rw | SSOR | Yes / No | No |
| Flow switch override | rw | rw | FSOR | Yes / No | No |
| Maximum Output Timer | rw | rw | MOT | Yes / No | No |

(*) will be only displayed if the parameter “SP Limit” is set to “Yes”

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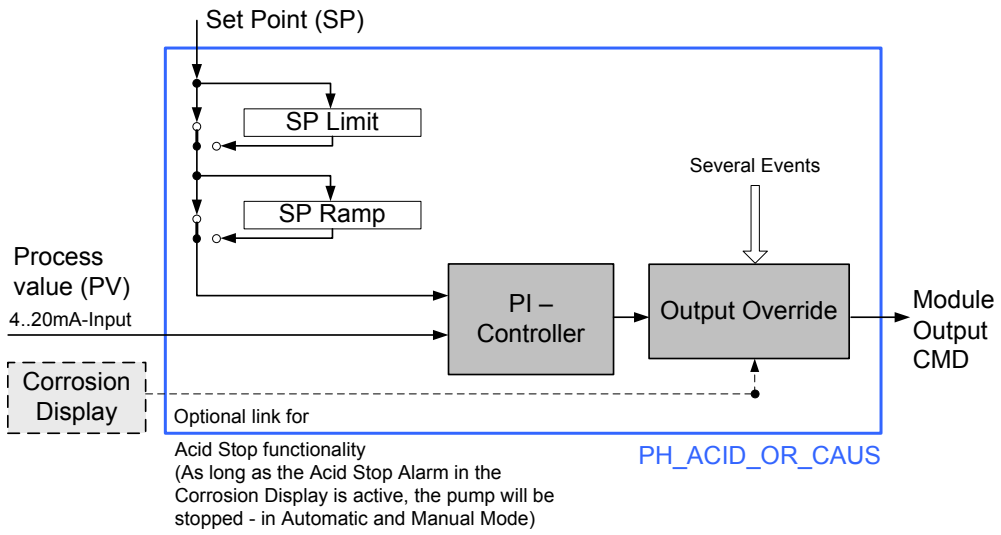
# 14.5.2 pH Control (PH_ ACID_OR_CAUS)

This module permits **a pH-Control with Acids *or* Bases** and with the optional interface to the "Corrosion Display" module for **additional overdosing failsafe function.**




These modules are explained below.

*Figure 52: (PH_ACID_ OR_CAUS)*

### *Set value limiter (SP Limit)*

Please refer to the description on section "Set value limiter (SP Limit)" in chapter 14.5.1

### *Ramp function for set point setting (SP Ramp)*

Please refer to the description on section "Ramp for Set point adjustment" in chapter 14.5.1

### *PI Controller*

The description of the Proportional Integral (PI)-Controller is consistent to the PI-part of the PID Controller in section “PID Controller” in chapter 14.2. Specifics / differences are described below.

**Proportional part / Module sense of action:**
The normal module sense of action is defined:

Proportional part: $$\mathbf{Yp[\%] = -Kp * (SP - PV)}$$

It can be illustrated as shown in the following figure:

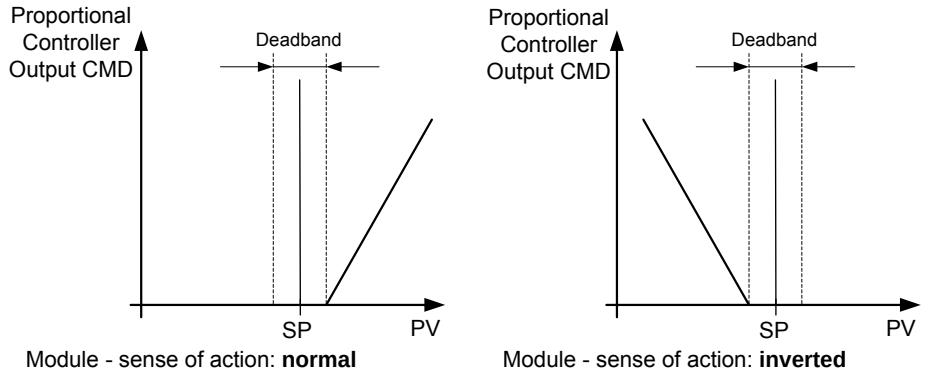



*Figure 53: sense of action and deadband*

Example:

If additional dosing of acids is desired, the "normal" sense of action is set,
If additional dosing of bases is desired, the "inverse" sense of action is set.

## *Output Override*

The **output** of this module is **influenced** at certain states (see Figure 54).

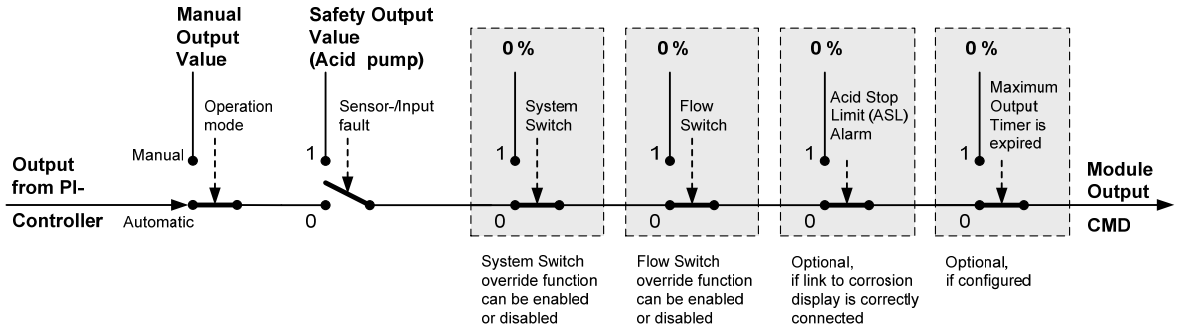



*Figure 54: Output override (PH_ACID_OR_CAUS)*

## *Acid Stop Limit – Pump Stop (ASL PumpStop)*

The pH control module can be connected internally by means of configuration with a corrosion display for an additional failsafe function. Therefore the **ASL-Alarm** of the assigned *Function* (configured as corrosion display) is evaluated in order to **prevent overdosing of acids or bases.**

If the corrosion rate of the connected corrosion display exceeds the ASL alarm, this alarm becomes active. As long as the ASL alarm remains active, the controller output is overridden with "0%", i.e. disabled and the acid or base dosing pump is thereby also shut off for this period.

## *Maximum Output Timer (MOT)*

This function monitors the controller output of the pH controller in automatic mode in order to **detect the faulty output.**

If the controller output emits the maximum control output longer than the defined maximum control output time (MOT), then the **controller output will be overridden with "0 %".**

In this case an **alarm "Out fails"** is generated and the common alarm relay is actuated, too.



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The pH controller output will be overridden with 0 % until the operator acknowledges the alarm message with the soft key buttons in the process data menu, even if operation mode was changed.

The internal timer counting the period of the maximum control output will be reset if the control output is smaller than the maximum control output and the alarm has not yet been triggered. The maximum output is determined by the parameter **"Upper output limit Lim+"**.

The Maximum Output Timercan be enabled/disabled through the configuration. For a general description of the MOT refer to chapter 14.1.5.

## Processdata and Data Logging

| Displayed data | Abbre-viation (menu) | Display-Presentation | | | Data-Log. | Notes |
|---|---|---|---|---|---|---|
| | | Full Screen | Trend chart | Line | | |
| Process value | PV | x | x | x | x | |
| Set point | SP | x | | x | x | |
| Set point vs. Process value | SP/PV | | x | | | |
| Module output | CMD | x | | x | x | |
| Alarm Maximum Output Timer | | x | | | x | displayed only, if MOT enabled and expired; Data log in Module output |

## Parameter (Code Level: Operator)

| Parameter | Abbreviation (menu) | Value range | Default values (after successful down-load of Cfg-File) |
|---|---|---|---|
| Sample Time | Tsample | 0.05/0.1 … 60.0 s | 0.2 s |
| Set point | SP | Scal- …Scal+ of the assigned input<br>SPLim- ... SPLim+ (if SP Limit is enabled) | Scal- +<br>((Scal+ - Scal-) /2) |
| Deadband | Dbnd | 0 … 100.0 % of input range | 1.0 % |
| **Set point ramp** | **SP Ramp** | | |
| Set point ramp | SP Ramp | Yes / No | No |
| Ramp rise: max. positive SP change per minute (*) | D+ | 0.1 … 99999 pH/min | 1 pH/min |
| Ramp rise: max. negative SP change per minute (*) | D- | 0.1 … 99999 pH/min | 1 pH/min |
| ***Controller*** | | | |
| Gain/amplification factor | Kp | 0.001 … 9999.0 (in % / unit) | 10.0 |
| Reset time | Tn | 0.1 … 9999.0 s | 300.0 s |
| Lower output limit | Lim- | 0.0 … Lim+ | 0.0% |
| Upper output limit | Lim+ | Lim- … 100.0 % | 100.0 % |
| Safety output value | CMDsafe | 0.0 … 100.0 % | 0.0 % |
| ***Maximum output timer (MOT)*** | | | |
| Maximum output time (**) | +Tm | 1 ... 10800 s | 10800 s |

(*) will be only displayed if the parameter “SP Ramp” is set to “Yes”
(**) will be only displayed if the parameter “MOT” is configured as “Yes” in the menu „Configuration“

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## Configuration (Code Level: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Module active/not active | rw | rw | Module | On/Off | Off |
| Inversion module sense of action | rw | rw | InvMod | Yes / No | No |
| **Set point limiter** | | | **SP Limit** | | |
| Set point limiter | rw | rw | SP Limit | Yes / No | No |
| Lower set point limit (*) | rw | rw | SPLim- | Scal- ...SPLim+ | Scal- of the assigned input |
| Upper set point limit (*) | rw | rw | SPLim+ | SPLim- …Scal+ | Scal+ of the assigned input |
| ASL pump stop | rw | rw | ASL PumpStop | Yes / No | No |
| Link to controller Module CORROSION_DISPLAY | r | rw | | linked *function* | -- |
| System switch override | rw | rw | SSOR | Yes / No | No |
| Flow switch override | rw | rw | FSOR | Yes / No | No |
| Maximum Output Timer | rw | rw | MOT | Yes / No | No |

(*) will be only displayed if the parameter “SP Limit” is set to “Yes”

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# 14.6 Dosing of oxygen absorption media

## 14.6.1 Flow and temperature-based dosing (O2_SCAV_CTRL_RATIO)

This module permits the **dosing of oxygen-absorbing substances** which are added to the hot water as anti-corrosive, based on the flow and temperature of the feed water).

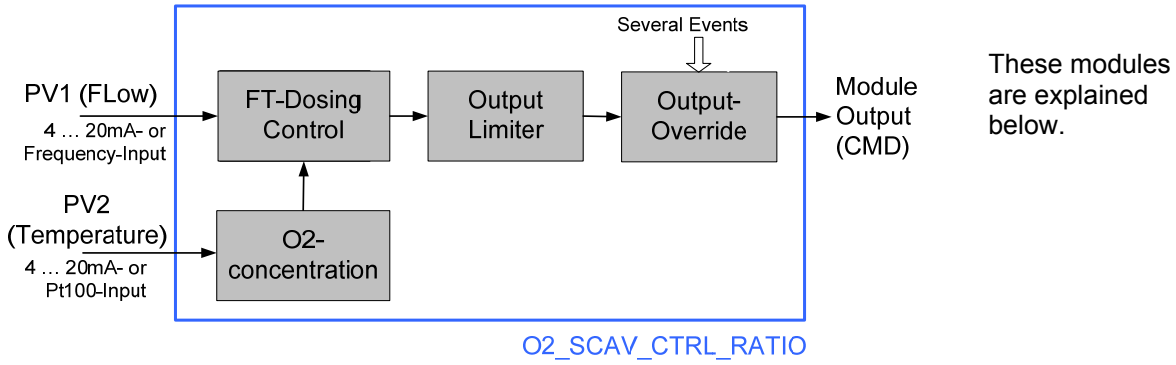


*Figure 55: O2_SCAV_CTRL_RATIO*

### *Flow-temperature dosing control (FT dosing control)*

Flow-temperature dosing control determines the output signal proportionally to the flow of the feed water and the oxygen dissolved in it - see the following figure.

The oxygen content is determined via the temperature of the feed water (see section "

Oxygen concentration"). For the calculation, the actual flow value is converted into a scaled flow 0…100% whereby 0% corresponds to the low scaling value Scal- and 100% to the high scaling value Scal+ of the flow input.

**Control output = a * b**

with a … flow (scaled value)
b … oxygen concentration (scaled value)

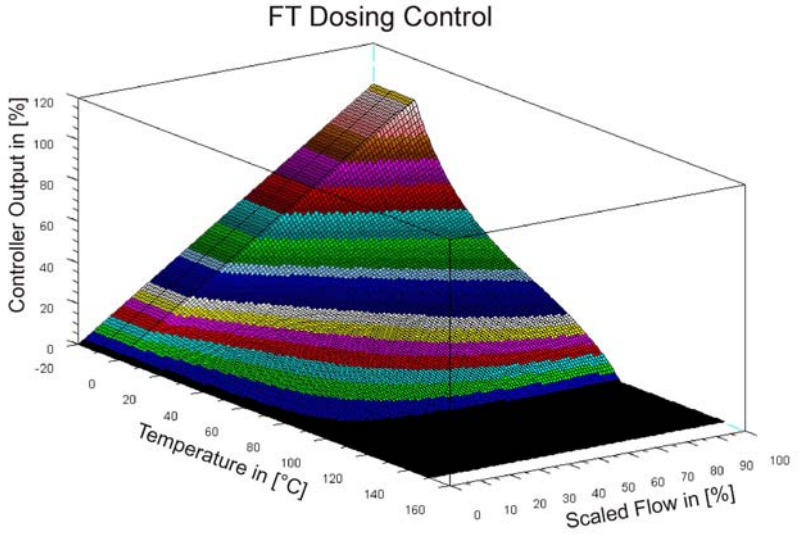


*Figure 56: FT Dosing control*



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## Oxygen concentration

Since the **relationship** between temperature and dissolved oxygen is **non-linear**, the module converts the temperature input information into "Dissolved oxygen concentration" [mg/l]. This conversion takes place on the basis of the **correlation curve** in the memory (see **Figure 57**).

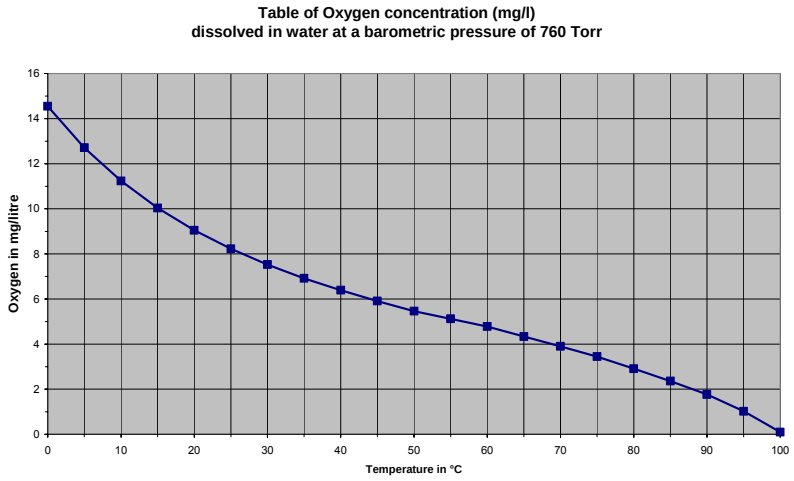


*Figure 57:*
*Impact of the temperature on the oxygen concentration*

## Control output limitation

The control output is restricted only in automatic mode by the lower and upper output limitation and output accordingly on the module output.

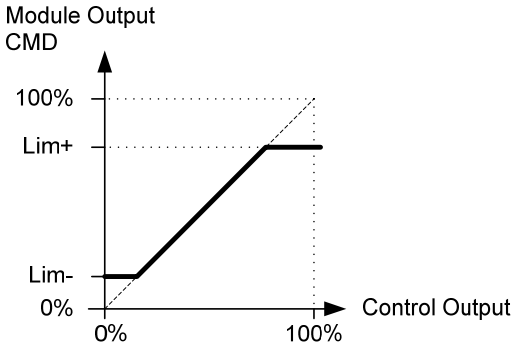


*Figure 58:*
*Control output limitation (O2_SCAV_CTRL_RATIO).*

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### *Output Override*

The **output** of this module is **influenced** at certain states (see figure).

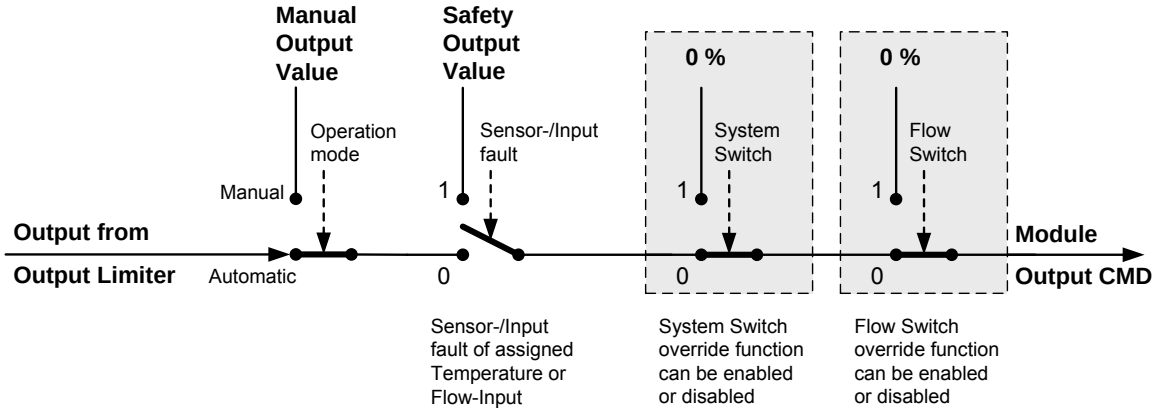


*Figure 59: Output override (O2_SCAV_CTRL_RATIO).*

## Processdata and Data Logging

| Displayed data | Abbre-viation (menu) | Display-Presentation | | | Data-Log. | Notes |
|---|---|---|---|---|---|---|
| | | Full Screen | Trend chart | Line | | |
| Flow Process value | PV1 | x | x | x | x | |
| Temperature Process Value | PV2 | x | x | x | x | |
| (calculated) Oxygen | O2 | x | | x | x | |
| Module output | CMD | x | | x | x | |

## Parameter (CodeLevel: Operator)

| Parameter | Abbreviation (menu) | Value range | Default values (after successful download of Cfg-File) |
|---|---|---|---|
| Lower output limit | Lim- | 0.0 … Lim+ | 0.0 % |
| Upper output limit | Lim+ | Lim- … 100.0 % | 100.0 % |
| Safety output value | CMDsafe | 0.0 … 100.0 % | 0.0 % |
| ***Oxygen Alarm*** | | (Range: 0 … 100 % Sat *) or 0.1 .. 14.55mg/L) | |
| Low alarm limit | Alarm- | 0.0 % Sat… Alarm+ or<br>0.1 mg/L … Alarm+ | 0.0 %Sat or<br>0.1 mg/L |
| High alarm limit | Alarm+ | Alarm- … 100 % Sat or<br>Alarm- … 14.55 mg/L | 100.0 %Sat or<br>14.55 mg/L |
| Alarm hysteresis | AlarmHys | 0.1 … 10.0 % of oxygen range | 1.0 % |
| Low warning limit | Warn- | Alarm- … Warn+ | 0.0 %Sat or 0.1 mg/L |
| High warning limit | Warn+ | Warn- … Alarm+ | 100.0 %Sat or 14.55 mg/L |
| Warning hysteresis | WarnHys | 0.1 … 10.0 % of oxygen range | 1.0 % |

*) Sat means Saturation

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## Configuration (Code Level: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Module active/not active | rw | rw | Module | On/Off | Off |
| Unit of O2 display | rw | rw | Oxygen | %Sat *), mg/L | %Sat |
| System switch override | rw | rw | SSOR | Yes / No | No |
| Flow switch override | rw | rw | FSOR | Yes / No | No |

*) Sat means Saturation

The alarm and warning limits must be adjusted if the **Unit of the oxygen display is changed**! There is **no automatic conversion!**

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## 14.6.2 Process-value-proportional dosing (OPEN_PROP)

This module calculates the control output proportionally to the scaled process value. The module can be used, e.g. for the **Dosing of oxygen-absorbing substances** if the temperature impact can be neglected and dosing shall be done only in proportion to the feed water flow.

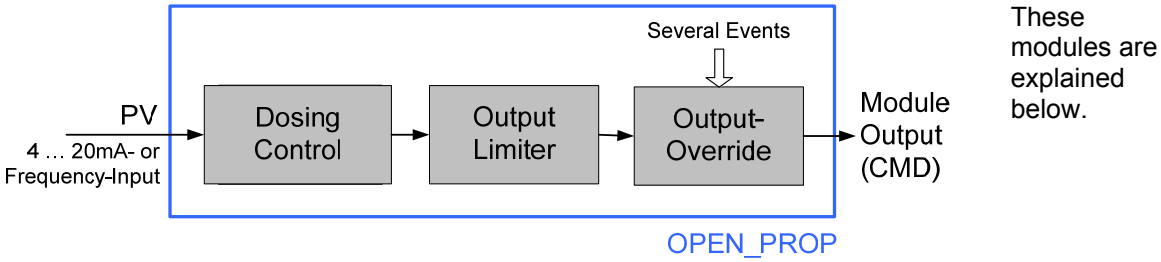


*Figure 60: OPEN_PROP*

### *Dosing control*

The dosing control calculates the output signal only in dependence on the process value (here: flow). The actual flow value is converted into a scaled flow 0…100% whereby 0% corresponds to the low scaling value Scal- and 100% to the high scaling value Scal+ of the process value input. The scaled process value is provided as control output.

**Control output = a** with a … Process value (scaled value)

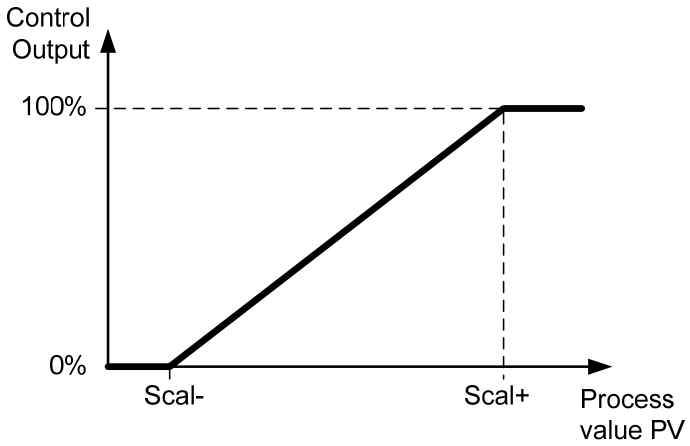


*Figure 61:*
*Dosing control (OPEN_PROP).*

### *Control output limitation*

Please refer to the description in section "Control output limitation" in chapter 14.6.1.

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### *Output Override*

The **output** of this module is **influenced** at certain states (see figure).

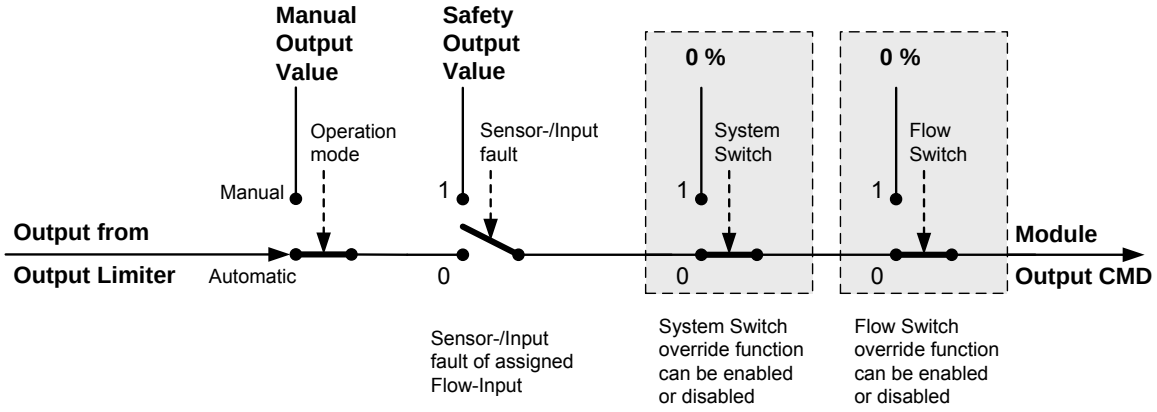


*Figure 62: Output override (OPEN_PROP).*

## Processdata and Data Logging

| Displayed data | Abbre-viation (menu) | Display-Presentation | | | Data-Log. | Notes |
|---|---|---|---|---|---|---|
| | | Full Screen | Trend chart | Line | | |
| Flow Process value | PV | x | x | x | x | |
| Module output | CMD | x | | x | x | |

## Parameter (CodeLevel: Operator)

| Parameter | Abbreviation (menu) | Value range | Default values (after successful download of Cfg-File) |
|---|---|---|---|
| Lower output limit | Lim- | 0.0 … Lim- | 0.0 % |
| Upper output limit | Lim+ | Lim+ … 100.0 % | 100.0 % |
| Safety output value | CMDsafe | 0.0 … 100.0 % | 0.0 % |

## Configuration (Code Level: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbre-viation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Module active/not active | rw | rw | Module | On/Off | Off |
| System switch override | rw | rw | FSOR | Yes / No | No |
| Flow switch override | rw | rw | SSOR | Yes / No | No |

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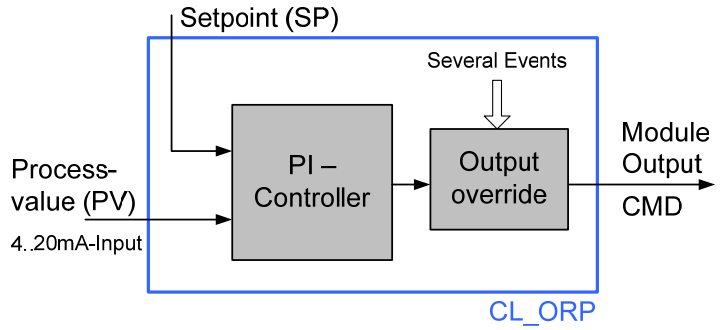
# 14.7 Chlorine / Redox Control (CL_ORP)

The chlorine/redox control function is designed for **P and PI control.**
The chlorine/redox output is designed to provide a series of output pulses (for the **control of** electronic solenoid operated **chemical dosing pumps**).




These modules are explained below.

*Figure 63: CL_ORP*

## *PI Controller*

The description of the Proportional Integral (PI)-Controller is consistent to the PI-part of the PID Controller in section “PID Controller” in chapter 14.2. Specifics / differences are described below.

**Proportional part / Module sense of action:**
The normal module sense of action is defined:

Proportional part: $\mathbf{Yp[\%] = Kp * (SP - PV)}$

It can be illustrated as shown in the following figure:

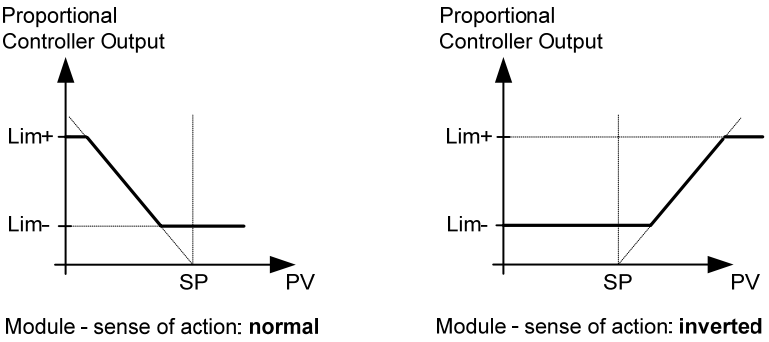



*Figure 64:*
*Sense of action of the module (CL_ORP)*

**Deadband:**
A deadband doesn’t exist for this module.

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## *Output Override*

The **output** of this module is **influenced** at certain states (see figure).

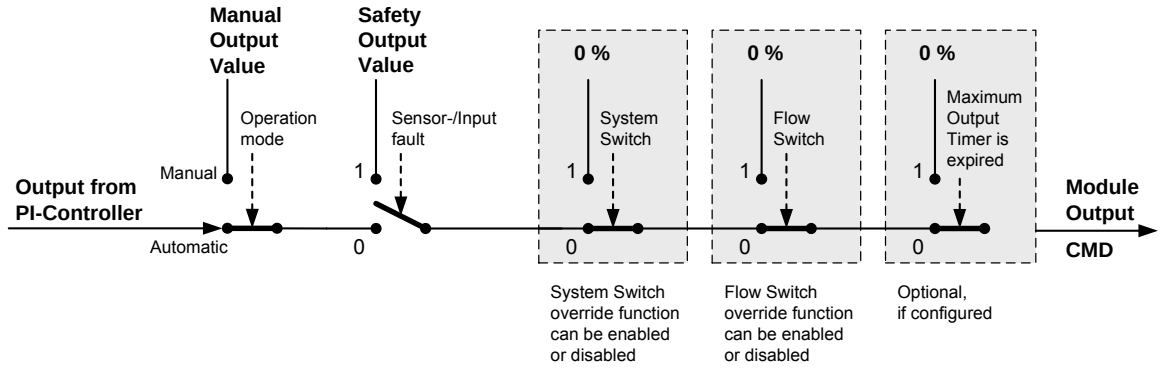


*Figure 65: Output override (CL_ORP)*

## *Maximum Output Timer (MOT)*

This function monitors controller output of the chlorine/redox controller in automatic Mode. If the controller output emits the maximum control output longer than the defined maximum control output time (+Tm), then the **controller output will be overridden with "0 %".**

In this case an **alarm "Out fails"** is generated and the common alarm relay is actuated, too.

The chlorine/redox controller output will be overridden with 0 % until the operator acknowledges the alarm message with the soft key buttons in the process data menu, even if operation mode was changed.

The internal timer counting the period of the maximum control output will be reset if the control output is smaller than the maximum control output and the alarm has not yet been triggered. The maximum output is determined by the parameter **"Upper output limit Lim+"**.

The Maximum Output Timercan be enabled/disabled through the configuration. For a general description of the MOT refer to chapter 14.1.5.

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## Processdata and Data Logging

| Displayed data | Abbre-viation (menu) | Display-Presentation | | | Data-Log. | Notes |
|---|---|---|---|---|---|---|
| | | Full Screen | Trend chart | Line | | |
| Process value | PV | x | x | x | x | |
| Set point | SP | x | | x | x | |
| Set point vs. Process value | SP/PV | | x | | | |
| Module output | CMD | x | | x | x | |
| Alarm Maximum Output Timer | | x | | | x | displayed only, if MOT enabled and expired;<br>Data log in Module output |

## Parameter (Code Level: Operator)

| Parameter | Abbreviation (menu) | Value range | Default values (after successful download of Cfg-File) |
|---|---|---|---|
| Sample Time | Tsample | 0.05/0.1 … 60.0 s | 0.2 s |
| Set point | SP | Scal- …Scal+ of the assigned input | Scal- + ((Scal+ - Scal-) /2) |
| Gain/amplification factor | Kp | 0.001 … 9999.0 (in % / unit) | 10.0 |
| Reset time | Tn | 0.1 … 9999.0 s | 9999.0 s |
| Lower output limit | Lim- | 0.0 … Lim+ | 0.0 % |
| Upper output limit | Lim+ | Lim- … 100.0 % | 100.0 % |
| Safety output value | CMDsafe | 0.0 … 100.0 % | 0.0% |
| ***Maximum output timer (MOT)*** | | | |
| Maximum output time (*) | +Tm | 1 ... 10800 s | 10800 s |

(*) will be only displayed if the parameter “MOT” is configured as “Yes” in the menu „Configuration“

## Configuration (Code Level: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Module active/not active | rw | rw | Module | On/Off | Off |
| Inversion module sense of action | rw | rw | InvMod | Yes / No | No |
| System switch override | rw | rw | SSOR | Yes / No | No |
| Flow switch override | rw | rw | FSOR | Yes / No | No |
| Maximum Output Timer | rw | rw | MOT | Yes / No | No |

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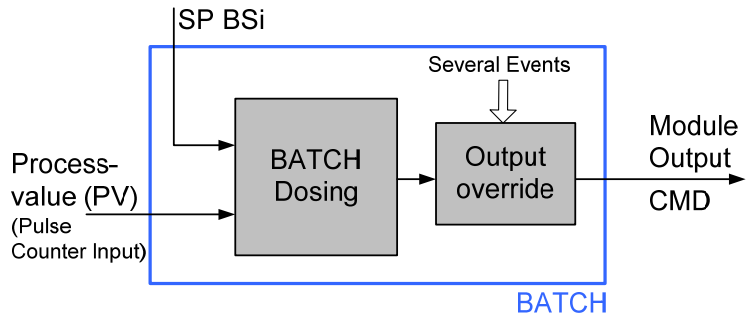
# 14.8 Batch Dosing (BATCH)

The input signal for the batch controller is derived from one of the digital inputs, configured as a pulse counter input.
The Batch dosing module is used to control a dosing pump (e.g. for inhibitors). A **detected amount of pulses (volume) leads to a dosing event** for predetermined time.




These modules are explained below.

*Figure 66: BATCH*

### *Batch Controller in Automatic Mode*

The **incoming pulses** at the assigned input **are counted.** The current number of incoming pulses is scaled by the K-Factor of the assigned input. The result is the current batch size PV BSi which corresponds to the number of incoming pulses since the last counter reset.

In the batch function the current batch size PV BSi is compared with the parameterized **target batch size (SP BSi)**. If the target batch size SP BSi is reached, the assigned output is energised for an adjustable time and the **counter of the incoming pulses will be reset.**

The output timer will be only energised if no dosing process is active on the assigned output. A new dosing event is only triggered, if the **previous dosing process** was **finished**. New dosing events in between expire.

The remaining dosing time will be displayed in the corresponding process data menu if the output is energised.

#### Dosing start delay function

The parameter **Tdelay** delays the start of the dosing output when a dosing event occures.

This start delay function can be used to dose 2 chemicals (one after the other) with 2 BATCH control functions dependent on one flow, for example.

In this case you must use the start delay to stagger dosing as required because there is no interlock between control functions. You also have to ensure that there is sufficient time between Batch dosing events for the Tdose and Tdelay. The reason therefor is: new dosing events during active start delay or dosing process expire.

**Example:**

2 BATCH control functions Batch1 and Batch2 are connected to the same Flow input.

- Batch1: SP BSi = 1000 L (Makeup), Tdose = 600 sec, TDelay = 0 sec
- Batch2: SP BSi = 1000 L (Makeup), Tdose = 180 sec, TDelay = 660 sec

...



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... When a dosing event occures,

- Batch1 immediately doses for 10 minutes.
- Batch2 waits 11 minutes, and doses afterwards for 3 minutes.

You have to ensure that your Makeup is lower than 1000 L in 24 minutes in order to stagger dosing as required.

### *Batch Controller in Manual Mode*

In manual Mode **no incoming pulses are counted** and the assigned **output is inactive**.
An **active dosing process** is also **cancelled** in manual Mode. The **dosing timer** will be **reset**.

**Attention:** If a binary input is configured as interface to the process system for the **system status (duty/stand-by)** or **as flow switch** and the binary input is enabled (i.e. system status = stand-by), then the counter for the incoming pulses is reset.

If a binary input is configured as a flow switch, the status of the **flow switch** has no effect on the batch dosing process.

### *Output Override*

The **output** of this module is **influenced** at certain states (see figure).

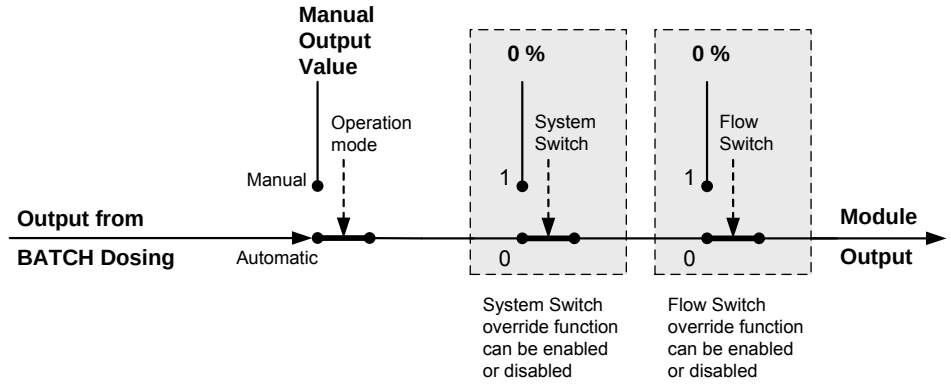


*Figure 67: Output override (BATCH)*

## Processdata and Data Logging

| Displayed data | Abbre-viation (menu) | Display-Presentation | | | Data-Log. | Notes |
|---|---|---|---|---|---|---|
| | | Full Screen | Trend chart | Line | | |
| Current Batch size | PV BSi | | | x | x | |
| Batch Size (target) | SP BSi | | | x | x | |
| Current State | Status | | | x | | Ready, Stand-By, StartDel, Dosing, No Flow |
| Module output | CMD | x | | x | x | |



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## Parameter (CodeLevel: Operator)

| Parameter | Abbreviation (menu) | Value range | Default values (after successful download of Cfg-File) |
|---|---|---|---|
| Unit of Batch Size | SP BSi unit | L, hL, m3, Gal US, bbl US, gal Imp, ft3, yd3, Pulse*) | L |
| Batch Size (target) | SP BSi | 0.1 … 9999.0 | 100 |
| Dose Time | Tdose | 1 … 10800 s | 120 s |
| Dosing start delay | Tdelay | 0 … 10800 s | 0 s |
| Module output during dosing | CMD on | 0 … 100 %<br>0 %, 100 % (if On/Off Output) | 100 % |

*) The unit „Pulse“ will be only accepted, if the unit pulses per “Pulse” is selected at “Unit K-Factor” at the dedicated input; other units are only accepted, if **not** the unit pulses per “Pulse” is selected at “Unit K-Factor”

## Configuration (CodeLevel: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Module active/not active | rw | rw | Module | On/Off | Off |
| System switch override | rw | rw | SSOR | Yes / No | No |
| Flow switch override | rw | rw | FSOR | Yes / No | No |

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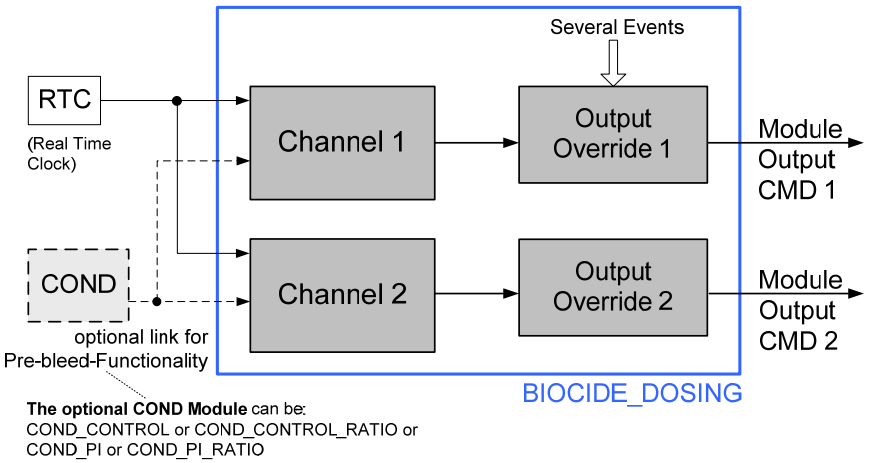
# 14.9 Time scheduled Biocide Dosing (BIOCIDE_DOSING)

The Biocide Dosing Module is designed for a fully automated dosing regime within 14 days.




These modules are explained below.

*Figure 68: BIOCIDE_DOSING*

### *Real Time Clock (RTC)*

Accurate timing is maintained by a battery backed-up **real time clock**. The real time clock can be adjusted by the operator.

### *Channel 1 and Channel 2*

Biocide dosing is controlled by a **dual channel 14-day timer**, programmable during the parameterization process. **Both channels** actuate **a separate output (relay)**. Accurate timing is maintained by the **real time clock**.

It is possible to set up to **8 individual biocide dosing events per day per channel.** That means, the start time of dosing and the dosing duration (Tdose) can be set individually for each dosing event.

The **delay** between main dosing and post dosing **(Tm1)** together with the delay after post dosing **(Tm2)** are the same for each dosing event of the same channel – refer also to Figure 69.

If only 1 channel is required for an application, channel 2 can be disabled via configuration file (set channel mode ChMode from "dual" to "single").

### *Channel Output in Automatic Mode*

For biocide dosing a **2/3rd -1/3rd strategy** is implemented. When the dosing process begins, the dosing pump is activated first for a period of **2/3rds of the dosing time (Tdose)**. The remaining 1/3rd of the dosing time is provided for post-dosing after a delay (Tm1). Once the dosing process has been completed, the **control of the bleed valve** is not immediately handed back to the conductivity controller - another delay (Tm2) prevents the conductivity controller from a possible opening of the bleed valve following immediately. A further timer (Tm2) delays conductivity control for an additional period, further **enhancing the contact time** and hence effective kill time of the biocide.

The control of the dosing pump during the dosage can be adjusted for each channel separately via the parameter **„CMD on“.**

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***Pre-bleed function:***

After the 14-day timer has started biocide dosing, it may be desirable to **delay the execution** until the corresponding system water conductivity was reduced to a lower level or the parameterizable max. duration of the pre-bleed function **+TmPB** was reached. The corresponding level of the system water conductivity before dosing is defined by the **PB value (Pre-Bleed Limit)** - compare Figure 69 and the chapters on the conductivity modules (**14.3.1** ff).

If a **non-ratio conductivity module** COND_CONTROL or COND_PI was linked with the biocide dosing module, then the value of the pre-bleed limit has to be set directly.

If a **ratio conductivity module** COND_CONTROL_RATIO or COND_PI_RATIO was linked with the biocide dosing module, then the value of the pre-bleed limit is determined by adding the parameter "**PB ratio"** to the current set point at the starting time of the pre-bleed; it will stay constant during the pre-bleed phase. The calculated pre-bleed is checked concerning its minimum value in order to prevent a non-reachable pre-bleed limit. If the pre-bleed limit is lower than the control output limiter (SPLim-), is is set to this value (compare section "Ratio" in chapter 14.3.3).

The pre-bleed function is not active if no **conductivity module** is linked with the biocide dosing module.

The purpose of this **pre-bleed before biocide dosing** is to allow the bleed valve (normally controlled by a conductivity control) to be held shut for the entire biocide event, thereby **maximising contact time** (kill time) without running the risk of hardness salts precipitating, due to over concentration.

If the **pre-bleed** was configured by assigning a matching conductivity module, the conductivity module will be controlled by the biocide dosing regime during the whole dosing process.

Should particular site conditions mean that you cannot take full advantage the above features, it is possible to disable the functions as follows:

| | |
|---|---|
| • Pre-bleed | If a **non-ratio conductivity controller module** (COND_CONTROL or COND_PI) is linked with the Biocide Dosing:<br>The function is disabled by defining the **pre-bleed limit (PB)** to a value **above the set point** of the assigned conductivity controller.<br>If a r**atio conductivity controller module** (COND_CONTROL_RATIO or COND_PI_RATIO) is linked with the Biocide Dosing:<br>The function is disabled by defining the **pre-bleed pre-bleed ratio (PB ratio)** at a value of **"0".** |
| • Maximum duration of the pre-bleed function. | By defining the configuration setting of the max. pre-bleed timer MTPB to "Off", the duration of the pre-bleeding is not restricted in terms of time for both channels. |
| • Biocide 2/3 – 1/3 split | By setting the **delay Tm1 = "0",** all the biocide of a dosing event will be added in one process. |
| • Post dose delay | Setting the **delay Tm2 = "0", to zero** will enable the assigned conductivity controller to continue controlling immediately after the dosing process is completed. |

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The Figure 69 demonstrates the relationship between system water conductivity and biocide dosing.

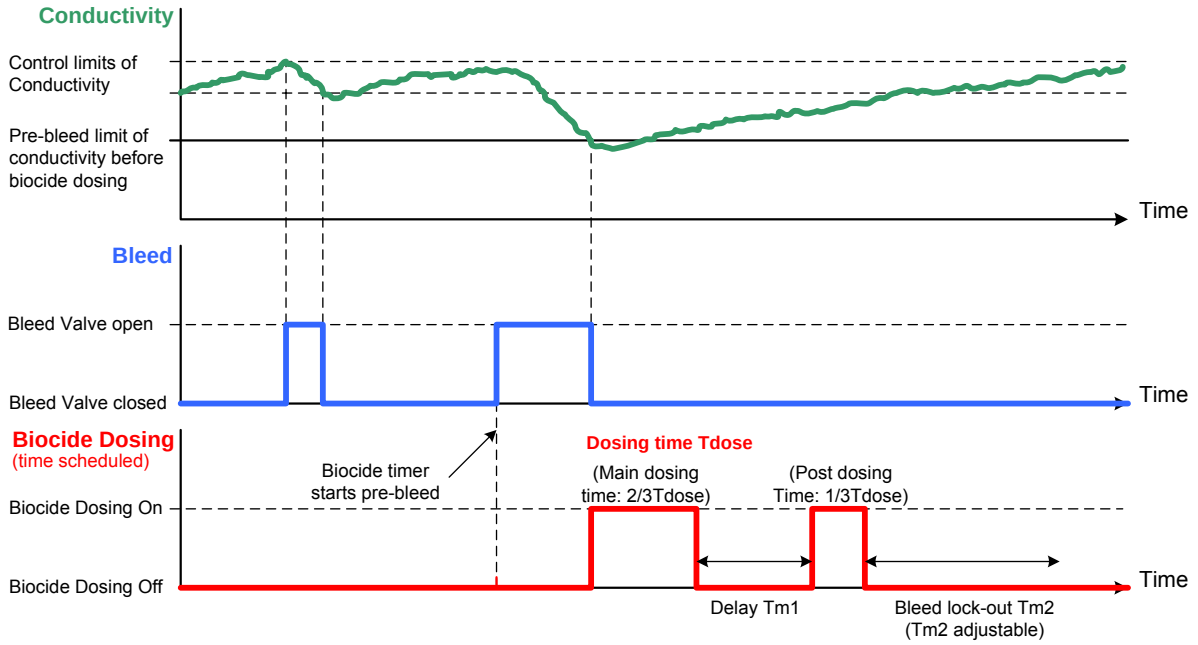


*Figure 69: Strategy of biocide dosing*

***Rules for the biocide dosing:***

- A **new biocide dosing event** will be only triggered, if the **previous** biocide **dosing process** on this channel is **finished**. The new biocide dosing event in between expires.
- Both **biocide dosing channels** work **independently.**
- If a biocide dosing process is running on one channel and the second channel begins, too, the **internal status of the conductivity controller** will not be changed:
  - If the channel one has left the pre-bleed, the pre-bleed for the later starting second channel will be skipped and the **second channel will begin immediately** with the dosing process.
  - If channel one is in the pre-bleed phase and the second channel starts, too, the **minimum of the pre-bleed limits from both channels** will be taken in order to determine the end of the pre-bleed process. The max. duration of the pre-bleed phase is determined by the greater one of the max. pre-bleed durations of both channels.
  - If both biocide dosing channels are active, the **control will return to** the assigned **conductivity controller** if both channels have finished the dosing process.
- If at least one of the digital inputs is configured as a binary input for system status or as a flow switch and if at least one of these binary inputs gets or is active, **all active biocide dosing** processes will be **cancelled and no new biocide dosing events** will be triggered and started.

## *Channel Output in Manual Mode*

In manual Mode **all active biocide dosing processes are cancelled.** The control of biocide dosing is assumed by the operator, who must now manually control the biocide dosing by operating the dosing valves with soft keys on the „Type 8620 mxCONTROL“ (in the "Process Data" menu).

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### *Output Override*

The **output** of this module is **influenced** at certain states (see the following figure).

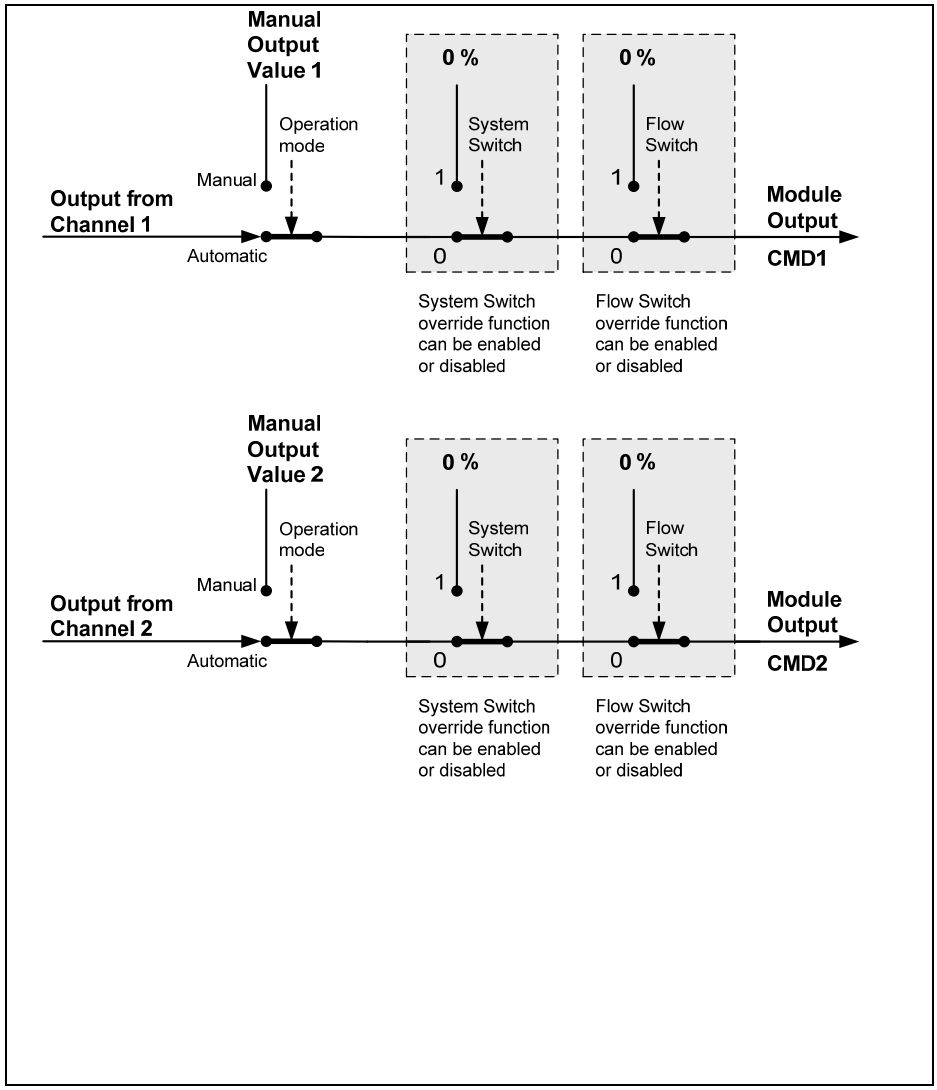


*Figure 70: Output override (BIOCIDE_DOSING)*

## Processdata and Data Logging

| Displayed data | Abbre-viation (menu) | Display-Presentation | | | Data-Log. | Notes |
|---|---|---|---|---|---|---|
| | | Full Screen | Trend chart | Line | | |
| State Channel 1 | | | | x | x | |
| State Channel 2 | | | | x | x | If ChMode = Dual |
| Next dosing event Channel 1 | | | | x | | |
| Next dosing event Channel 2 | | | | x | | If ChMode = Dual |
| Module output channel 1 | CMD 1 | x | | | x | |
| Module output channel 2 | CMD 2 | x | | | x | If ChMode = Dual |

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## Parameter (CodeLevel: Operator)

| Parameter | Abbreviation (menu) | Value range | Default values (after successful download of Cfg-File) |
|---|---|---|---|
| ***Channel 1*** | | | |
| Pre-bleed limit (in combination with COND_CONTROL and COND_PI) | PB | 0 … 99999 (The unit is defined by the unit of the process value of the linked conductivity module) | Scal- + ((Scal+ - Scal-)/2) Centre of the input range (Scal- … Scal+) of the assigned conductivity module, e.g.: Scal- = 0 µS, Xo = 1000 µS PB default value = 500 µS |
| **Note!** If the feed water quality is unknown, the maximum process value less 50 µS should be chosen as **Pre-bleed limit value**. (e.g.: **PB = max. PV - 50 µS**) | | | |
| Pre-bleed limit (only in combination with COND_CONTROL_RATIO and COND_PI_RATIO) | PB ratio | -99999 ... 1.0 (The unit is defined by the unit of the process value of the linked conductivity module) | -50.0 |
| Max. duration of the pre-bleed phase (*) | +TmPB | 1 ... 180 min | 180 min |
| Delay after Main dose | Tm1 | 0 … 180 min | 1 min |
| Delay after Post dose | Tm2 | 0 … 180 min | 1 min |
| Module output during dosage | CMD on | 0 … 100 %<br>0 … 100 % (if binary output) | 100 % |
| ***Dosing Events***<br>*Selection of the day for parameterizing dosing events of this day by selection of week (week 1 or 2) first, then by selection of week day (Monday, Tuesday, …, Sunday)* | | | |
| Enable/Disable all dosing events of a day | Dosing Events 1-8 | enable/disable | disable |
| Dosing Event 1 | Dos 1 | | |
| Dosing Event 2 | Dos 2 | | |
| … | … | | |
| Dosing Event 8 | Dos 8 | | |
| ***Dosing Event X*** | | | |
| Enable/Disable dosing Event X | | enable/disable | disable |
| Start Time | Start | 00:00 … 23:59 | 00:00 |
| Dosing Time (Duration) | Tdose | 1 … 180 min | 1 min |
| ***Channel 2***<br>***All parameters of channel 1 are also available for channel 2 if the channel mode ChMode is set to dual.*** | | | |

(*) will be only displayed if the parameter “TmPB” is configured as “Yes” in the menu „Configuration“

The following figure shows the steps for the parameterizing of the dosing timer.

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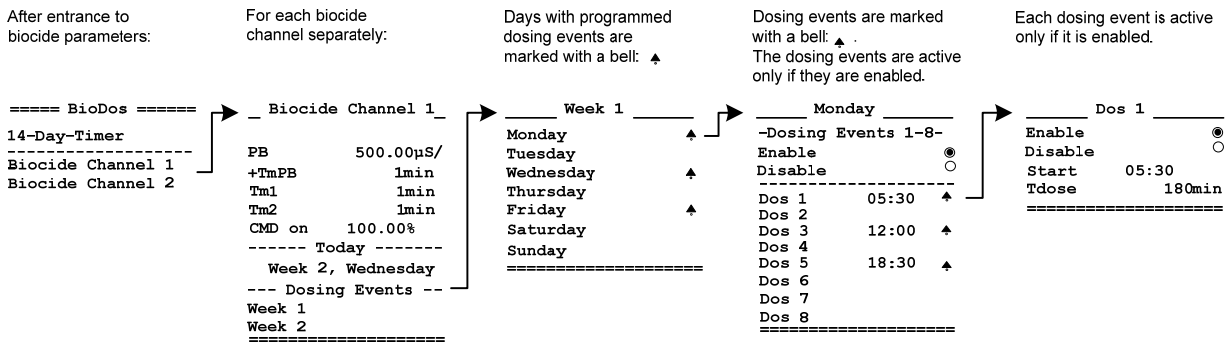


*Figure 71: Parameterizing the Biocide 14-Day Dosing Timer*

The "Dosing Events" must be selected **as "On" in order to actually activate** the dosing events Dos 1 to Dos 8 for this day.

**Even if** all dosing events of a day are marked **as "Off"**, their **start time and the „bells" will be displayed!**

For **prevention of the expiring of dosing events** in a channel in automatic mode, the start times in a channel should be chosen due to the following rule:

**Start Time >=** Start time previous dos. + dosing time previous Dos(Tdose) **+ 1min**
+ Channel delay after main dos. (Tm1) + Channel delay after post-dos. (Tm2)
+ typical duration or max. duration (+TmPB) for pre-bleed phase

(Start time previous dos.: Start time of the chronologically previous dosing event)

## Configuration (CodeLevel: Specialist)

| **Configuration** | **Access via Cfg.-menu** | **Access via XML-Cfg.-File** | **Abbreviation (menu)** | **Value range** | **Default values** (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Module active/not active | rw | rw | Module | On/Off | Off |
| Channel mode | r | rw | ChMode | Dual, Single | Dual |
| Reference-Date for Week1 | rw | rw | Ref.Date Week 1 | yyyy-mm-dd (Menu) | 2007-01-01 (Menu) |
| Max. pre-bleed timer for active channels | rw | rw | MTPB | Yes / No | No |
| Type of link to conductivity module | -- | rw | -- | NONE, NORMAL, RATIO | NONE |
| Link to conductivity module (pre-bleed) | r | rw | Link | linked *function* | -- (Menu)<br>0 (File) |
| System switch override | rw | rw | SSOR | Yes / No | No |
| Flow switch override | rw | rw | FSOR | Yes / No | No |

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# 14.10 Monitoring Process Values (MONITOR_PV)

This module is designed for **external monitoring of up to two process values**, e.g. via the optional **4...20 mA output**. But also the **relay outputs** or the **transistor outputs** can be connected.

It is possible to use an input signal as a source for another (controller) module and **loop the same input signal through for external monitoring.**

This module can also be used for logging process values only without any output connected.

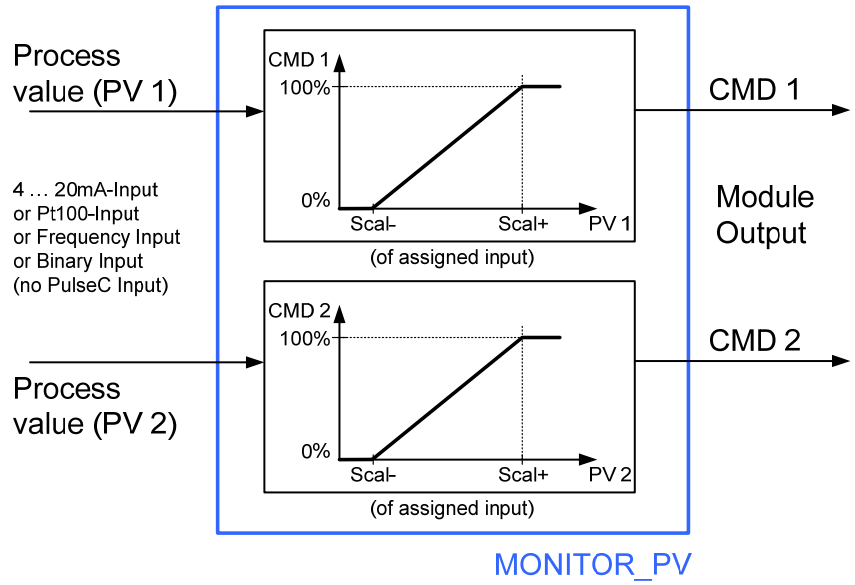


*Figure 72: MONITOR_PV*

Each controller **output** signal is calculated **depending on** the configured **input type.**
If the input signal has a continuous input range (digital frequency input, analog inputs), the input range will be represented linearly on the controller output. Please refer to the following table.

| Input type | Input range | Controller output | Controller output connected with 4...20 mA output |
|---|---|---|---|
| Digital binary input | 0, 1 | 0 %, 100 % | 4 mA, 20 mA |
| Digital pulse counter input | -- | 0 % | -- |
| Digital frequency input | Scal- … Scal+ | 0 … 100 % | 4 … 20 mA |
| Analog 4…20 mA input | Scal- … Scal+ | 0 … 100 % | 4 … 20 mA |
| Analog Pt100 Input | Scal- … Scal+ | 0 … 100 % | 4 … 20 mA |

## Processdata and Data Logging

| Displayed data | Abbre-viation (menu) | Display-Presentation | | | Data-Log. | Notes |
|---|---|---|---|---|---|---|
| | | Full Screen | Trend chart | Line | | |
| Process value 1 | PV1 | x | x | x | x | |
| Process value 2 | PV2 | x | x | x | x | if ChMode = Dual |
| Module output 1 | CMD1 | x | | x | x | |
| Module output 2 | CMD2 | x | | x | x | if ChMode = Dual |

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## Parameter (CodeLevel: Operator)

No parameter available.

## Configuration (Code Level: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbre-viation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Module On / Off | rw | rw | Module | On/Off | Off |
| Channel Mode | r | rw | ChMode | Dual, Single | Single |

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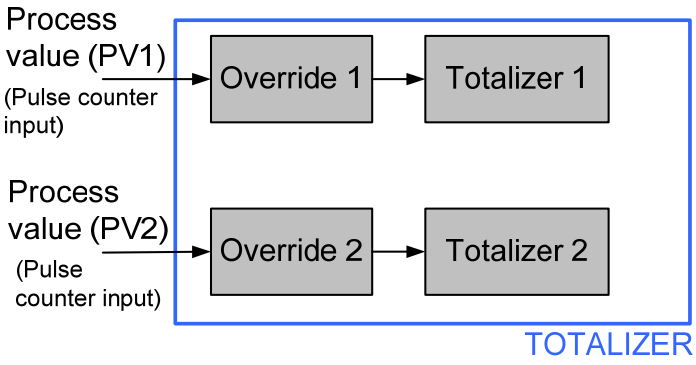
# 14.11 Dual Channel Totalizer (TOTALIZER)

This module allows separate summarizing of total amount of flow from up to 2 digital pulse counter inputs. By means of configuration file the totalizer can be reduced from dual channel to single channel.




These modules are explained below.

*Figure 73: TOTALIZER*

### *Totalizer 1, 2*

Each of the both totalizers has a main and a daily totalizer. The detected amount of the process value is summed up in the totalizer corresponding to the configured K-Factor of the pulse counter input and the parameterized unit of the totalizer.

If the counted volume in the parameterized unit is to large for displaying (Volume >= 1000000 units), its value is converted into a larger unit for displaying. Each totalizer can count / display max. 999999 m³. If more volume is counted, the totalizer begins to count and display from 0 in the parameterized unit.

The value of the main and the daily totalizer are stored every 10 minutes in a non-volatile memory.

Each Totalizer 1, 2 can be reset independently in the configuration menu - main and daily totalizer are reset at the same time. The reset is done when returning to the main menu. So both totalizators can be reset at the same time, if required.

The daily totalizers can be reset independently with code level Operator in the menu Processdata and in the corresponding Parameter menu.

For displaying purposes the current flow rate of each module input is calculated from the amount of incoming pulses per second and displayed in the module specific process data menu in a configurable unit.

### *Override*

The activity of the module TOTALIZER can be influenced by certain states (see figure). If the system switch override function or the flow switch override function is enabled for this module and the corresponding system switch / flow switch function is active, incoming pulses will be ignored and both totalizers will not be incremented.

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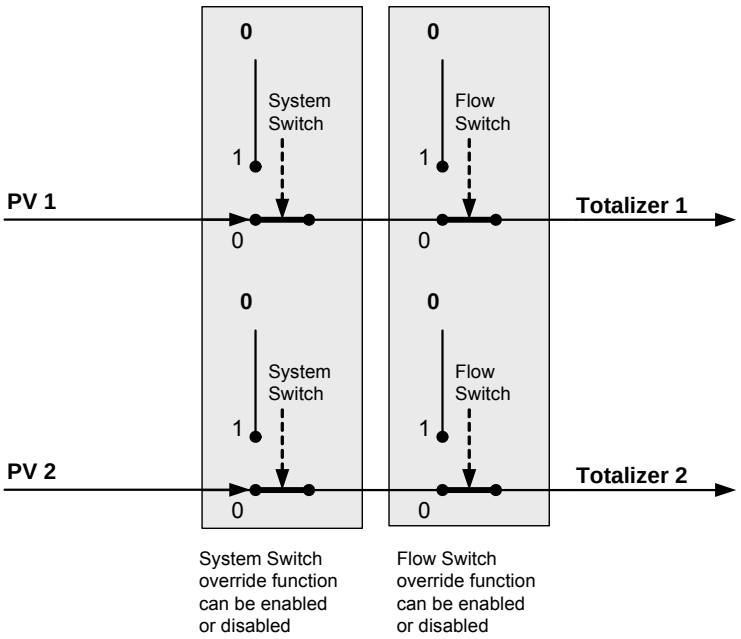


*Figure 74: Override (TOTALIZER)*

## Processdata and Data Logging

| Displayed data | Abbre-viation (menu) | Display-Presentation | | | Data-Log. | Notes |
|---|---|---|---|---|---|---|
| | | Full Screen | Trend chart | Line | | |
| Process value 1 | PV1 | | | x | | |
| Main Totalizer 1 | TOT1 | | | x | x | |
| Daily Totalizer 1 | TOT1. | | | x | x | Reset with Codelevel Operator possible |
| Process value 2 | PV2 | | | x | | Only displayed if ChMode = Dual |
| Main Totalizer 2 | TOT2 | | | x | x | |
| Daily Totalizer 2 | TOT2. | | | x | x | Only displayed if ChMode = Dual<br>Reset with Codelevel Operator possible |

## Parameter (Code Level: Operator)

| Parameter | Abbrevia-tion (menu) | Value range | Default values (after successful download of Cfg-File) |
|---|---|---|---|
| ***TOT1.*** | | | |
| Reset Daily Totalizer 1 | Reset | Yes | -- |
| ***TOT2.*** | | | |
| Reset Daily Totalizer 2 | Reset | Yes | -- |

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## Configuration (Code Level: Specialist)

| Configuration | Access via Cfg.-menu | Access via XML-Cfg.-File | Abbreviation (menu) | Value range | Default values (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Module On / Off | rw | rw | Module | On/Off | Off |
| Channel Mode | r | rw | ChMode | Dual, Single | Dual |
| **(Main & Daily) Totalizer 1** | | | **TOT1** | | |
| Unit | rw | rw | Unit | L, hL, m3, Gal US, bbl US, gal Imp, ft3, yd3 | L |
| Reset | w | -- | Reset | Yes | -- |
| ***PV1*** | | | | | |
| Unit PV1 | rw | rw | Unit | L/s, L/min, L/h, m3/min, m3/h, Gal/s US, Gal/m US, Gal/h US, gal/s Imp, gal/m Imp, gal/h Imp, bbl/s US, bbl/m US, bbl/h US, ft3/s, ft3/min, ft3/h, P/s, P/h | L/s |
| **(Main & Daily) Totalizer 2** | | | **TOT2** | | |
| Unit | rw | rw | Unit | same as for TOT1 Unit | L |
| Reset | w | -- | Reset | Yes | -- |
| ***PV2*** | | | | | |
| Unit PV2 | rw | rw | Unit | same as for Unit PV1 | L/s |
| ***Output override*** | | | | | |
| System switch override | rw | rw | SSOR | Yes / No | No |
| Flow switch override | rw | rw | FSOR | Yes / No | No |

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# 15 Alarm and Error Messages

## 15.1 Alarm function

This function **actuates the common alarm output** whenever a controlled variable exceeds adjustable upper and lower alarm limits or the datalogging failed.

If an alarm occurs in at least one of the processes (see Figure 10), this is indicated by the **yellow flashing LED on the A/M-Key**.

**Note!** If a **switching hysteresis** is present, the triggering of the alarm is impacted by the value definition (e.g.: Switching takes place above and below the alarm set point to prevent excessive switching frequency - compare Figure 75).

**Warning limits** can be additionally set for displaying and logging purposes only.

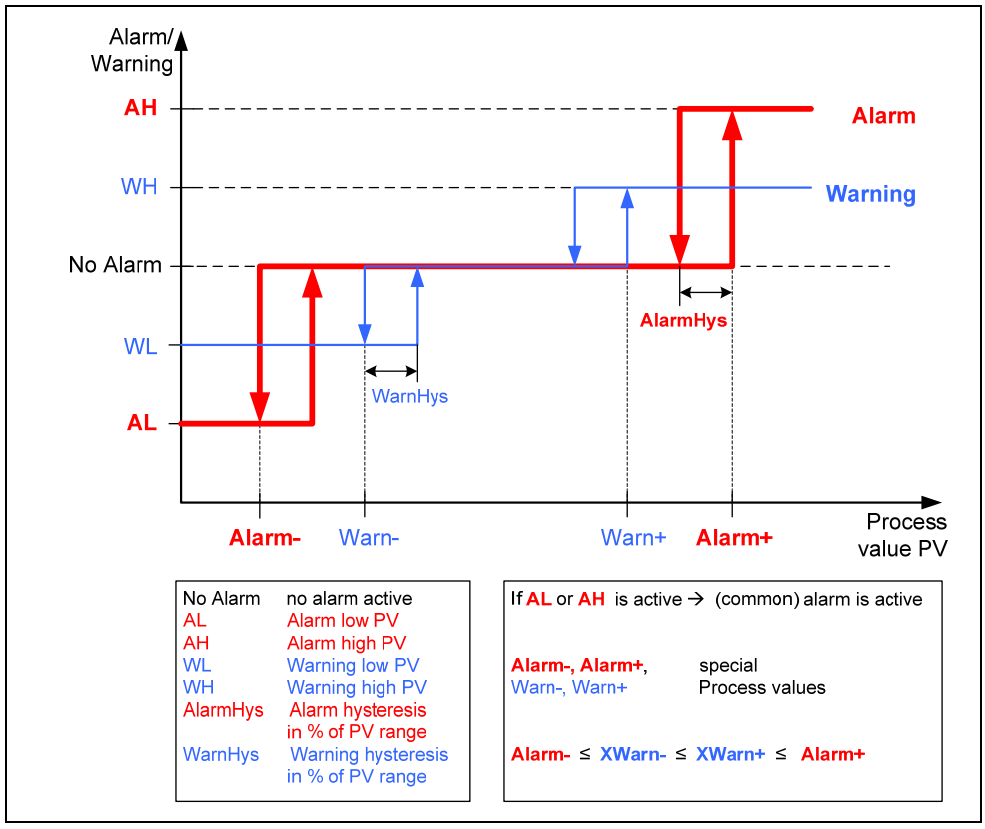


*Figure 75: Alarm/warning - switching hysteresis*

**Adjustable alarm parameters:**

| | Analog inputs | Digital inputs | | Oxygen |
|---|---|---|---|---|
| | 4-20mA, Pt100 | Frequency | Binary | Module O2_SCAV _CTRL_RATIO |
| High alarm limit Alarm+ | X | X | - | X |
| Low alarm limit Alarm- | X | X | - | X |
| Switching alarm hysteresis AHyst | X | X | - | X |
| Low or High Alarm with delay | - | - | X | - |
| ***For displaying and logging purposes only:*** | | | | |
| High warning limit Warn+ | X | X | - | X |
| Low warning limit Warn- | X | X | - | X |
| Switching warning hysteresis WarnHys | X | X | - | X |

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The alarm and warning limits for inputs can be changed in the configuration menu in the menu of the desired input.

The alarm and warning limits for oxygen (module O2_SCAV_CTRL_RATIO) can be set in the "Parameter" main menu in the submenu belonging to the module.

## Configuration (Code Level: Specialist)

| **Configuration** | **Access via Cfg.-menu** | **Access via XML-Cfg.-File** | **Abbreviation (menu)** | **Value range** | **Default values** (after factory reset or at start of Cfg-File-Download) |
|---|---|---|---|---|---|
| Alarm output function | rw | rw | Output | enable/disable | disable |
| Output used for alarm output | r | rw | Alarm output | depending on configured and activated outputs and adapted options:<br>Relay 1 … Relay 5,<br>4…20mA output 1 …<br>4…20mA output 4,<br>Transistor 1 …<br>Transistor 4,<br>Not output | No Output |

The output used as **alarm output** has to be a configured and enabled output, which is not used concurrently as output of another module.

The yellow LED indicates also **in case of disabled alarm output function** that an alarm occurs.

- 

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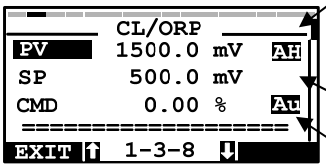
# 15.2 Displaying (Input-) Alarms and different (Output-) States

The input alarms and output states are displayed in the "Process data" main menu in the "Input" submenu items and in the submenus of the corresponding modules.

Display




| Input State | | | |
|---|---|---|---|
| **AL** | Lower Alarm | **FS** | Sensor Fault |
| **AH** | Higher Alarm | **FA** | AD-Fault |
| **WL** | Lower Warning | **FC** | Configuration Fault |
| **WH** | Higher Warning | **Fc** | Calibration Data Fault |
| **FI** | Input Fault | **nA** | Input not active |
| | OK | | |
| **Output status or output is calculated/impacted by:** | | | |
| **Au** | Automatic Mode | **fo** | an other module |
| **Ma** | Manual Mode | **fF** | (active) Flow-Switch |
| **OF** | 4…20 mA Output error | **fS** | (active) System Switch |
| **YA** | ASL-Pump-Stop | | |
| **YS** | Safety control output (CMDsafe) is active | **Fc** | Calibration Data Fault (only in menu “Out-puts” for 4-20 mA outputs) |
| **YF** | Out fails (MOT is expired) | | |

Additionally the following icons are displayed in parent menus for easy alarm / warning identification:

| Icon | Priority | Description |
|---|---|---|
| **A!** | 1 (High) | There is at least one alarm in the submenus. |
| **W** | 2 | There is at least one warning in the submenus |
| **!** | 3 | There is at least one configuration error in the submenus |
| | 4 (Low) | OK |

Only the item with the highest priority is displayed, if there is a mixture of alarms / warnings / configuration errors in the submenus.

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# 15.3 Error Messages and Warnings

Most of the error messages and warnings are displayed as a short message for approx. 2 seconds on the display. There is an internal display buffer for maximum 20 short messages. If one of the 4 soft keys below the display is pressed while a short message is shown, the short message will disappear.

A permanent message is displayed until the operator acknowledges the message with the OK-key. There is an internal display buffer for maximum 10 permanent messages.

If a permanent message is already displayed and a new short message has to be displayed, then the short message will be displayed firstly and afterwards the permanent message will be displayed again until it is acknowledged by the operator.

| Warning or Error message | Displayed as | Displaying interval | Cause | Remedy |
|---|---|---|---|---|
| 4-20mA Out X failed | short message<br><br>permanent message | once<br><br>once | Internal communication with the 4…20 mA output X has failed:<br>more than 3 times in series<br>more than 20 times in series<br>(After a successful communication the internal error counter is reset.) | Contact the Bürkert Sales Center.<br>The device has to be replaced. |
| AD Fault<br>(Input state: FA) | Icon in menu *Processdata/ Inputs* | as long as fault is not remedied | A/D-Conversion failed | If this error message occurs more than once, then contact the Bürkert Sales Service.<br>Earlier: Download the calibration file (Master password needed).<br>If this did not function, the device has to be replaced. |
| Battery failed! | permanent message<br><br>short message<br>flashing message in menu 8 (*Clock*) | Once after initialization<br>every 60 seconds, as long as the clock is not set and the internal real time clock has passed the 59th second | The back-up battery of the internal real time clock (RTC) failed.<br>Year of internal clock is lower than 2007. | The back-up battery (Type CR 2032, 3V DC) on the reverse side of the printed circuit board needs to be replaced by qualified personnel.<br>Set the clock to current date and time. |
| CalibFault 4-20mA In<br>(Input state: FK)<br>CalibFault Pt100 In<br>(Input state: FK) | permanent message<br>Icon in menu *Processdata/ Inputs*<br>Icon/flashing message in full screen view of correspondent Process Value | once after init of config data<br>as long as fault is not remedied | Defect Calibration data for at least one configured 4…20 mA / Pt100 Input.<br>The concerned inputs will be treated as inputs with input fault. | Contact the Bürkert Sales Center. |

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| Warning or Error message | Displayed as | Displaying interval | Cause | Remedy |
|---|---|---|---|---|
| CalibFault 4-20mA Out<br>(Output state: FK) | permanent message<br>Icon in menu *Processdata/ Outputs* | once after init of config data<br>as long as fault is not remedied | Defect Calibration data for at least one configured 4…20 mA Output.<br>The concerned outputs will output 0 mA. | Contact the Bürkert Sales Center. |
| CalibFault RTC | permanent message | once after init of config data | Defect Calibration data for the internal real time clock (RTC).<br>Data is set to default values. This may lead to a non-accurate clock. | Contact the Bürkert Sales Center. |
| Check Clock | permanent message | once | Clock time and date may be incorrect due to battery failure or due to too large difference between internal time and RTC time. | Check the clock (menu 8, *Clock*) concerning the right date and time and set it to the current date / time, if necessary. |
| Datalog IS NOT ACTIVE | permanent message | once | Data Logging was stopped due to fault whilst writing to SD card or due to removed SD card. | Check whether the SD card was removed during data logging (error message "No SD detected" appeared?)<br>If not, check the free storage capacity. If the SD card memory is not full, the SD card must be replaced. |
| Download cancelled | short message | once | Download was cancelled by the operator.<br>Previous data is restored. | -- |
| EEPROM fault XXY | permanent message | once | EEPROM data fault;<br>Y = error number;<br>XX = affected Eeprom data;<br>**Y =**<br>1 - Error checksum<br>2 - Error Eeprom page<br>3 - Error write<br>4 - Error read write<br>5 - Error after download of Config/Param/Calib file<br>6 - Internal address error<br>7 - Error acknowledge (Communication with Eeprom)<br>8 - Error during Startup<br>9 - Error during Factory Reset<br>**XX =**<br>00 - Config / Param file data<br>01 - Cyclically saved module<br>... specific data of control<br>08 function 1 … 8<br>21 - Cold / warm starts<br>22 - User calibration data<br>23 - Factory calibration data<br>24 - Device base data<br>**Device is set into Manual Mode.** | If this fault occurred immediately after a firmware update, please ignore.<br>For errors with:<br>**XX = 00, Y = 1:**<br>Try first a factory reset and restore the configuration and parameterization data via download;<br>**XX = 01 … 08, Y = 1:**<br>Check the corresponding module values in the process data menu and reset the cyclically saved parameters (e.g. Module Totalizer: Main / Daily Totalizers).<br>**XX = 21, Y = 1:**<br>Reset these counters in the Menu System settings.<br>**X = 22, Y = 1:**<br>Proceed as for XX = 00, Y = 1, afterwards the user calibration of the 4-20mA outputs has to be repeated.<br>**Y = 2, Y = 6:** |

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| Warning or Error message | Displayed as | Displaying interval | Cause | Remedy |
|---|---|---|---|---|
| | | | **XX = 01 … 08, 21, Y = 1:** The cause is often a power-on-reset or software reset while updating Eeprom values. | Report this error to Bürkert Sales Center.<br>**All other errors:** Proceed as for XX = 00, Y = 1. If this error occurred more than once, then the device has to be replaced.<br>Contact the Bürkert Sales Center regarding replacing the device. |
| Email failed | short message | | Error while communicating with SMTP server - transmission of email failed. | Refer to error message “SMTP Error X Y”, which was displayed before. |
| Error ISR Timing X | permanent message | once | Internal Timing Error in cyclical executed function. | Contact your local Bürkert Sales Center and provide the current configuration and parameter files. |
| Factory Reset | short message | once | All configuration and parameter data is reset to default values and the mxCONTROL can initially no longer work as controller. | The continuation of the operating as controller is possible after the downloading of a new configuration and parameterization. |
| False code | short message | once | Wrong code for current required code level. Access to target menu item(s) is denied. | Input the right code for the required code level. |
| Fault Ethernet | permanent message | Once each minute - as long as fault is not remedied or Ethernet function is disabled | Communication with internal Ethernet module failed. | Contact the Bürkert Sales Center if the error occurs more often. |
| Fault RTC | short message<br><br>permanent message | once<br><br>once | Communication with internal RTC failed. Time is generated internally.<br>Initialization of RTC failed or RTC delivered inconsistent time. | Contact the Bürkert Sales Center if the error occurs more often.<br><br>Set the clock. Then restart the device. If the error occurs again (more than 3 times), contact the Bürkert Sales Center. |
| Input Fault<br>(Input state: FI) | Icon in menu *Processdata/ Inputs*<br>Icon/flashing message in full screen view of correspondent Process Value | as long as fault is not remedied | Analog input:<br>4…20 mA: Current below approx. 3.5 mA<br>Pt100:<br>Resistance < input range or Pt100 not connected | Check the wiring from the corresponding sensor to mxCONTROL. |

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| Warning or Error message | Displayed as | Displaying interval | Cause | Remedy |
|---|---|---|---|---|
| Max.Value overflow | short message | once | The current set value is greater than the maximum value of this parameter.<br>The value is set to the maximum value and can be edited before confirmation. | Edit the value, if required, and then confirm the new value by pressing ENTER. If the old value should be kept, press ESC. |
| Min.Value underflow | short message | once | The current set value is lower than the minimum value of this parameter.<br>The value is set to the minimum value and can be edited before confirmation. | |
| MOT expired | permanent message | once | At least one of the maximum output timer has expired and the corresponding outputs are set to zero. | Search for the corresponding module in the *Process data*.<br>To enable the associated outputs again, the MOT alarm has to be acknowledged in the corresponding process data menu of the associated module. |
| No Permission | permanent message | once | A file is downloaded without the right authorization (current code level restricts the download of this file type). The downloaded data is not accepted. | If you are authorized, return to the main menu under the menu item *Upload/Download*, enter the correct password this time (CodeLevel: Specialist / Master) and start the download again. |
| No SD-Card detected | short message<br>during upload or data logging: permanent message | once<br>once | No SD card detected. | Check, if the SD card is inserted correctly into the SD card slot.<br>Then return in the menu structure to the according menu item<br>- Upload or<br>- Download or<br>- Data Logging<br>and start the procedure again. |
| SD can be removed | short message | once | SD card has operated successfully and can be removed from the SD card slot. | -- |

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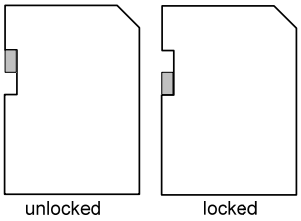
| Warning or Error message | Displayed as | Displaying interval | Cause | Remedy |
|---|---|---|---|---|
| SD-Card locked | short message<br><br>(during upload in file selection window) | once | SD card is locked. No writing operation possible.<br>  <br> | If the writing should be allowed:<br>1. Return in the menu structure to that point, where the short message “SD can be removed” is displayed.<br>2. Remove the SD card. Set the switch of the SD card to the position “unlocked”.<br>3. Put the SD card into the SD card slot again.<br>4. Retry the unsuccessful procedure. |
| SD: Disk is full! | permanent message | once | SD card memory capacity is totally allocated. No additional data can be written to SD card. | For Upload- / Data Logging Purposes the SD card has to be exchanged with an SD card with sufficient memory. |
| SD: Do not remove! | short message | once | SD card is in operation and should not to be removed before the message “SD can be removed” appears. Otherwise an earlier removal may result in a fault of SD card operation up to data loss. | -- |
| SD: Error ChDir | short message | once | An error occurred during changing the directories on the SD card. | Try at least 3 times again. If error persists, try another SD card. |
| SD: Error FileSystem | short message | once | The file system of the SD card could not be initialized.<br>Only SD cards with FAT-16 file system can be accessed. | Check the file system of the SD card: Only FAT-16 is supported.<br>If the SD card has another format,<br>• Save all the folders and files from SD card to your PC.<br>• Format the SD card with FAT-16 file-system.<br>• Restore the saved folders and files from PC to SD card. |

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| Warning or Error message | Displayed as | Displaying interval | Cause | Remedy |
|---|---|---|---|---|
| SD: Error Open File | short message<br><br>during upload or data logging: permanent message | once<br><br>once | File on SD card could not be opened. Current Operation failed. | Try again up to 3 times.<br>If no success, then check the SD card with the program Chkdsk.exe (MS Windows only).<br>If unsuccessful, format the SD card as described for the error message "SD: Error FileSyst".<br>If no success try another SD card. |
| SD: Error Partition | short message | once | The partition table of the SD card could not be initialized. | Compare the troubleshooting description for "SD: Error Open File". |
| SD: Error Root-Dir | short message | once | An error occurred during reading the root directory of the SD card. | Compare the troubleshooting description for "SD: Error Open File". |
| SD: Error Sync | short message | once | An error occurred during synchronizing the SD card. The writing process is cancelled. The SD card may be ejected before finishing the synchronizing process. | If this happened after an file upload to SD card, repeat the last upload. |
| SD: Error Writing | permanent message | once | An error occurred during writing to the SD card. The Write Process is terminated with loss of data: The file written to the SD card is incomplete.<br>If this error occurs during data logging, data logging is disabled automatically. | Check the free memory capacity.<br>If the SD card memory is not full, the SD card has to be replaced. |
| SD: Timeout | short message | once | No proper communication to SD card. Current Operation failed. | Try again. If error persists, try another SD card. |
| SD: Wrong file! | short message | once | The downloaded file is not a Configuration or Parameter file. No data is accepted by the device. | Check, whether the downloaded file was really a valid Configuration or Parameter file. |
| Sensor Fault<br>(Input state: FS) | Icon in menu *Processdata/ Inputs*<br>Icon/flashing message in full screen view of correspondent Process Value | as long as fault is not remedied | Analog inputs:<br>4…20 mA: Current greater than approx. 20.5 mA<br>Pt100:<br>Resistance > Input area | Check the wiring from the corresponding sensor to mxCONTROL. |

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<table>
<tr><th>Warning or Error message</th><th>Displayed as</th><th>Displaying interval</th><th>Cause</th><th>Remedy</th></tr>
<tr><td>SMTP Error X Y</td><td>short message</td><td>once</td><td>Communication with SMTP mail server failed<br><br>X: Communication phase:<br>CONNECT, HELO, MAIL, RCPT, RCPT 1, RCPT 2, DATA, QUIT<br><br>Y: SMTP error code<br><br>(see table below)</td><td>A: Check your configured email recipients.<br>B: Check your configured mailserver settings.<br>C: Contact your local network administrator. Report this error message. Check, if the requirements for email notification were met.<br>D: If this error occurred regulary, report this error message to your Buerkert Sales Center.</td></tr>
<tr><td>Used by FCT X</td><td>short message</td><td>once</td><td>The selected alarm output in the menu Configuration\Modules\Alarm is already assigned as output of another module in Function X.<br>The current alarm output is set to "No output".</td><td>Choose another output if available. Otherwise Alarm Output can not be used with the current configuration.</td></tr>
</table>

| Y | Details | Reme-dy |
|---|---|---|
| **421** | Mail server service not available | B, C |
| **450** | Recipient temporarely unavailable | A, C |
| **451** | Mail server: local error in processing | C |
| **452** | Mail server: insufficient system storage | C |
| **455** | as 555, but only temporarely | C |
| **500** | Syntax error, command unrecognised | C |
| **501** | Syntax error in parameters or arguments | C, D |
| **502** | Command not implemented | C |
| **503** | Bad sequence of commands | C, D |
| **504** | Command parameter not implemented | C |
| **521** | Mail server does not accept mail | C |
| **550** | Recipient unavailable | A, C |
| **551** | Recipient not local | A, C |
| **552** | Mail server: exceeded storage allocation | C |
| **553** | Recipient not allowed | A, C |
| **554** | Transaction failed | C, D |
| **555** | Mail server can not handle particular MAIL FROM or RCPT TO commands | C |
| **900** | Connection to mail server failed | B, C |
| **910** | No recipients configured | A |
| **998** | Timeout error (after 60 sec)<br>If X = CONNECT | D<br>B, C |
| **999** | Unknown error | D |

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| Warning or Error message | Displayed as | Displaying interval | Cause | Remedy |
|---|---|---|---|---|
| User Calib failed | permanent message | once | User calibration of 4-20mA Output failed. Old user calibration values kept. | Check the wiring and make sure that you connected load and the ampmeter correctly.<br>Try again.<br>Refer also to Description of User Calibration in Chapter 13.2 “Calibration of 4 ... 20 mA Outputs”. |
| Wrong ParamFile! | short message | once | The currently downloaded Parameter-File does not suit the current configuration.<br>The old parameters are restored after the download has finished or has been cancelled. | Download the right parameter file.<br>Usually the Parameter file has a similar file name like the configuration file, but begins with “Par” or “Param” instead of “Cfg”. |

The controller carries out a **self test** each time **power is restored**, including checking current date, calibration data and EEPROM data.

The analog inputs are checked periodically during the input-sampling process.

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# 16 Maintenance and troubleshooting

## 16.1 Safety Notes

**DANGER!**

**Danger from electrical voltage!**

Reaching into the system presents an acute risk of injury.

Always switch off the power before beginning with the work activities and secure it against being switched back on inadvertently! Obey the applicable accident prevention and safety regulations for electrical devices!

**WARNING!**

**Danger from improper maintenance work!**

Improper maintenance may result in injuries as well as damages to the device and its environment.

Maintenance work may only be carried out by authorized technical personnel and with suitable tools.

**Danger from unintentional operation!**

Dangerous situations may develop from unintentional operation of the plant. Prevent the possibility of unintentional operation of the plant through suitable measures.

## 16.2 Maintenance work

If correctly used the controller will work **without any maintenance**. Faults may occur by setting errors, improper line connections or defective components.
Only **authorized personnel** with suitable tools are allowed to carry out the required **repair work**.
For the repair of the „Type 8620 mxCONTROL“ contact your responsible Burkert Service.

An controller which is used daily may be contaminated, and if so it should be cleaned using an appropriate cleaning agent. Use only suitable cleaning agents and soft rags for the required cleaning. **You may need to check** the **cleaning agents** for compatibility **before using** them. Prevent cleaning agent or other liquids from entering the controller, in particular into the unprotected areas of the electrical/electronic connections.

## 16.3 Malfunctions

If controller’s hardware does not work as expected, please check the electrical connections of the supply and signal lines in the controller as well as on the connected devices.

In the case that such checks do not correct the condition, please contact the responsible Burkert Service.

To submit service queries, please state the data on the type plate as well as the parameters and values indicated on the display under the menu item "System settings" / "Device info".
It would be of great advantage to send the configuration/parameter files.

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# 17 Spare parts

**CAUTION!**

**Danger from wrong accessories and wrong spare parts!**

Wrong accessories and unsuitable spare parts may cause injuries and damages to the device or its environment.

Use only original accessories and original spare parts of Bürkert Werke GmbH & Co. KG.

# 18 Packing and transport

**CAUTION!**

**Transport damages!**

Insufficiently protected devices can be damaged during transport. Protect the device from moisture and dirt during transport, using shockproof packaging, preferably in its original package.

Avoid heat and cold impact which may lead to exceeding or falling below the permitted storage temperature.

# 19 Storage

**CAUTION!**

**Wrong storage may cause damage to the device!**

Store the device in a dry and dustfree location, preferably in its original package.

The **max. storage temperature** is **+60 °C.**

# 20 Disposal

**CAUTION!**

**Environmental damages through electronic parts!**

To prevent environmental stress and facilitate the reclamation of raw materials, end-of-life electronic devices should be submitted to proper disposal according to the electrical and electronic devices regulation.

Dispose of the device and the packaging in an environmentally friendly manner and in compliance with the local disposal regulations.

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# 21 Appendices

## 21.1 Project (for example "BW 06")

### 21.1.1 Input/Output Assignment – project "BW 06"

| AnalogIn 1 | AnalogIn 2 | AnalogIn 3 | AnalogIn 4 |
|---|---|---|---|
| 4-20mA | 4-20mA | 4-20mA | -- |
| Conductivity | Flow | Temperature | -- |

| DigIn 1 | DigIn 2 | DigIn 3 | DigIn 4 |
|---|---|---|---|
| Binary | -- | -- | Pulse Counter |
| System-Status (Stand-By) | -- | -- | Water-Meter |

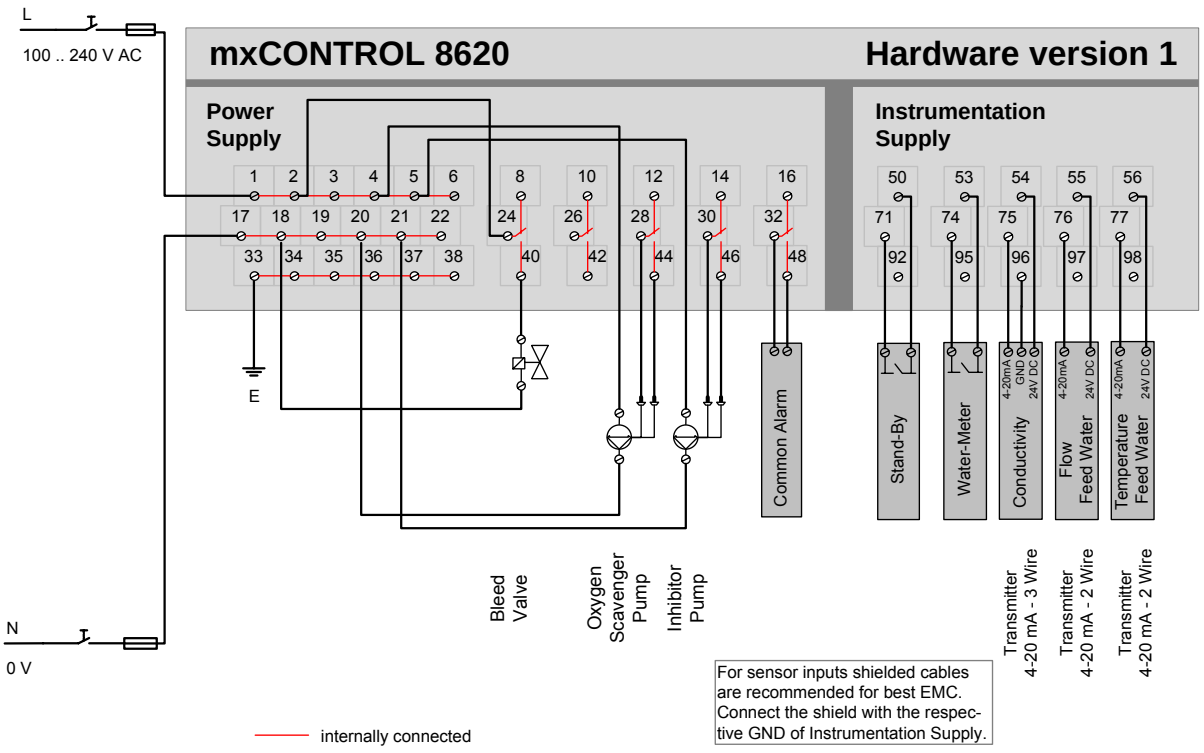
| Slot 1 | Slot 2 | Slot 3 | Slot 4 |
|---|---|---|---|
| COND_ CONTROL | O2_SCAV_ CTRL_RATIO | BATCH | -- |
| Set Point with Hysteresis | -- | -- | -- |

| Alarm |
|---|
| -- |
| -- |

| System-Switch |
|---|
| -- |
| -- |

| Relais 1 | Relais 2 | Relais 3 | Relais 4 | Relais 5 |
|---|---|---|---|---|
| On/Off | -- | Pulse | On/Off | On/Off |
| Bleed Valve | -- | Oxy.Scavenger Pump | Inhibitor Pump | Common Alarm |

### 21.1.2 Wiring Diagram Example for Project "BW 06"

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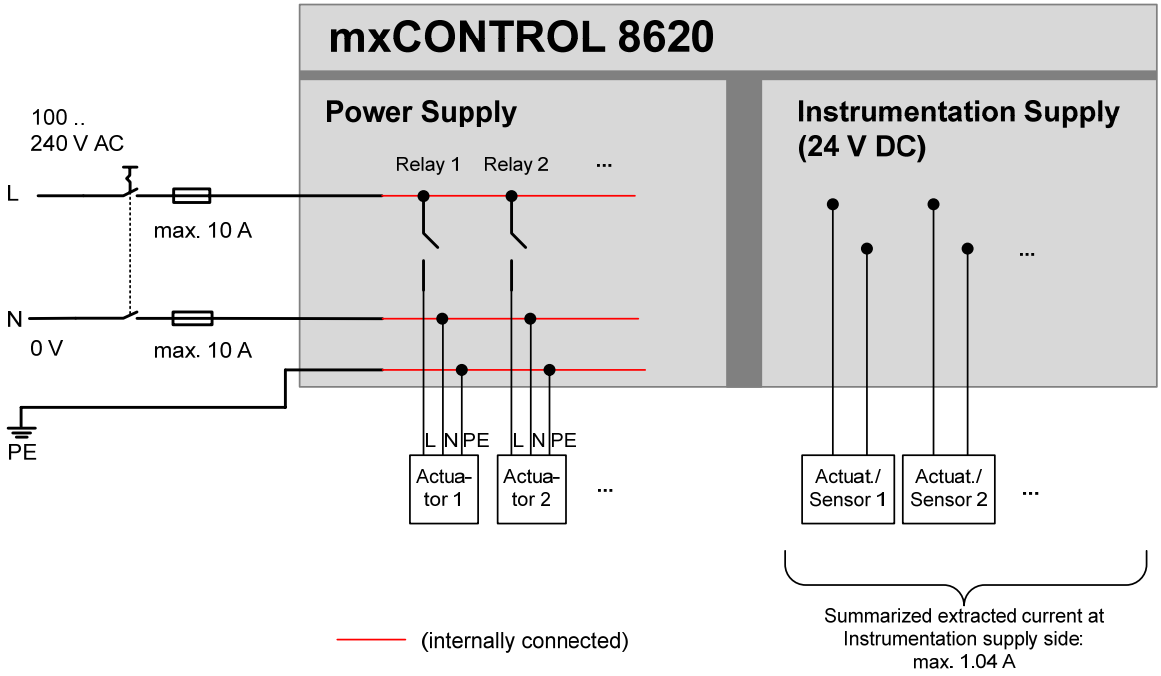
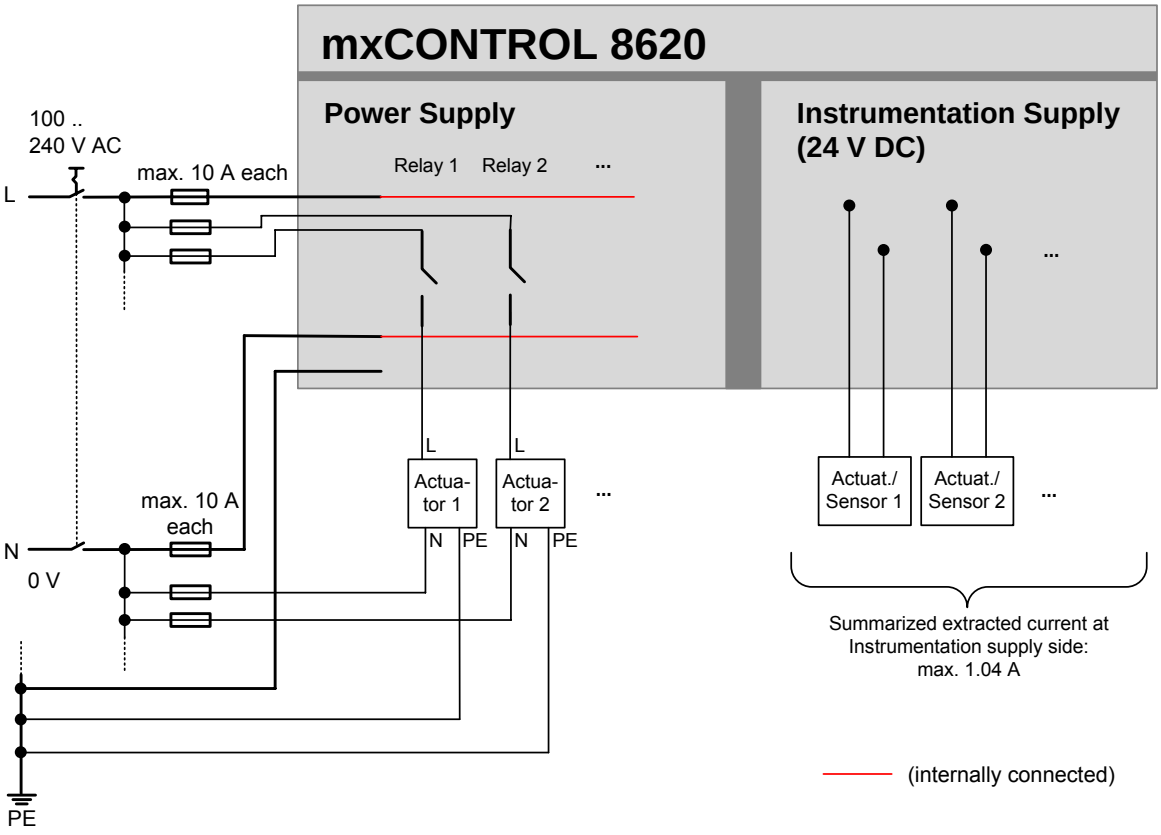
# 21.2 Power Supply of Actuators/Sensors

## 21.2.1 Power Supply out of the mxCONTROL




## 21.2.2 Separate Power Supply



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# 21.3 Hardware Version 1

## 21.3.1 PIN Assignment for Power Supply Level (Power Supply)

| Pin No. | Signal | Function | Input or Output Type |
|---|---|---|---|
| **1** | L | AC_Power_IN | Net Supply<br>100 – 240 V AC, 50/60 Hz |
| 17 | N | | |
| 33 | PE | | |
| **2** | L | AC_Power_OUT | 100 – 240 V AC, 50/60 Hz |
| 18 | N | | |
| 34 | PE | | |
| **3** | L | AC_Power_OUT | 100 – 240 V AC, 50/60 Hz |
| 19 | N | | |
| 35 | PE | | |
| **4** | L | AC_Power_OUT | 100 – 240 V AC, 50/60 Hz |
| 20 | N | | |
| 36 | PE | | |
| **5** | L | AC_Power_OUT | 100 – 240 V AC, 50/60 Hz |
| 21 | N | | |
| 37 | PE | | |
| **6** | L | AC_Power_OUT | 100 – 240 V AC, 50/60 Hz |
| 22 | N | | |
| 38 | PE | | |
| **7** | NC | -- | |
| 23 | NC | | |
| 39 | NC | | |
| **8** | break contact | Relay 1 | On/Off or PFM or PWM |
| 24 | center | | |
| 40 | make contact | | |
| **9** | NC | -- | |
| 25 | NC | | |
| 41 | NC | | |
| **10** | break contact | Relay 2 | On/Off or PFM or PWM |
| 26 | center | | |
| 42 | make contact | | |
| **11** | NC | -- | |
| 27 | NC | | |
| 43 | NC | | |
| **12** | break contact | Relay 3 | On/Off or PFM or PWM |
| 28 | center | | |
| 44 | make contact | | |
| **13** | NC | -- | |
| 29 | NC | | |
| 45 | NC | | |
| **14** | break contact | Relay 4 | On/Off or PFM or PWM |
| 30 | center | | |
| 46 | make contact | | |
| **15** | NC | -- | |
| 31 | NC | | |
| 47 | NC | | |
| **16** | break contact | Relay 5 | On/Off or PFM or PWM |
| 32 | center | | |
| 48 | make contact | | |

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## 21.3.2 PIN Assignment for Low Voltage Level (Instrumentation Supply)

| PIN no. | Signal | Function | Designation in the configuration menu |
|---|---|---|---|
| **49** | +24 V DC-INPUT | DC_Power_IN | -- |
| 70 | GND | | |
| 91 | PE | | |
| **50** | +24 V DC (Sensor/Transmitter Supply) | Digital/Frequency Input 1 | DigIn 1 |
| 71 | INPUT | | |
| 92 | GND | | |
| **51** | +24 V DC (Sensor/Transmitter Supply) | Digital/Frequency Input 2 | DigIn 2 |
| 72 | INPUT | | |
| 93 | GND | | |
| **52** | +24 V DC (Sensor/Transmitter Supply) | Digital/Frequency Input 3 | DigIn 3 |
| 73 | INPUT | | |
| 94 | GND | | |
| **53** | +24 V DC (Sensor/Transmitter Supply) | Digital/Frequency Input 4 | DigIn 4 |
| 74 | INPUT | | |
| 95 | GND | | |
| **54** | +24 V DC (Sensor/Transmitter Supply) | 4…20 mA Input 1 | AnalogIn 1 |
| 75 | INPUT | | |
| 96 | GND | | |
| **55** | +24 V DC (Sensor/Transmitter Supply) | 4…20 mA Input 2 | AnalogIn 2 |
| 76 | INPUT | | |
| 97 | GND | | |
| **56** | +24 V DC (Sensor/Transmitter Supply) | 4…20 mA Input 3 | AnalogIn 3 |
| 77 | INPUT | | |
| 98 | GND | | |
| **57** | +24 V DC (Sensor/Transmitter Supply) | 4…20 mA Input 4 | AnalogIn 4 |
| 78 | INPUT | | |
| 99 | GND | | |
| **58** | Pt100-current-source | 3-wire Pt100 Input 1 | AnalogIn 1 |
| 79 | INPUT | | |
| 100 | GND | | |
| **59** | Pt100-current-source | 3-wire Pt100 Input 2 | AnalogIn 2 |
| 80 | INPUT | | |
| 101 | GND | | |
| **60** | Pt100-current-source | 3-wire Pt100 Input 3 | AnalogIn 3 |
| 81 | INPUT | | |
| 102 | GND | | |
| **61** | Pt100-current-source | 3-wire Pt100 Input 4 | AnalogIn 4 |
| 82 | INPUT | | |
| 103 | GND | | |
| **62** | +24 V DC | 4…20 mA Output 1 | **OPTION** 4…20 mA outputs 1 to 4 |
| 83 | OUTPUT | | |
| 104 | GND | | |
| **63** | +24 V DC | 4…20 mA Output 2 | |
| 84 | OUTPUT | | |
| 105 | GND | | |
| **64** | +24 V DC | 4…20 mA Output 3 | |
| 85 | OUTPUT | | |
| 106 | GND | | |
| **65** | +24 V DC | 4…20 mA Output 4 | |
| 86 | OUTPUT | | |
| 107 | GND | | |
| **66** | +24 V DC | Transistor Output 1 | **OPTION** Transistor outputs 1 to 4 |
| 87 | PNP-OUTPUT | | |
| 108 | GND | | |
| **67** | +24 V DC | Transistor Output 2 | |
| 88 | PNP-OUTPUT | | |
| 109 | GND | | |
| **68** | +24 V DC | Transistor Output 3 | |
| 89 | PNP-OUTPUT | | |
| 110 | GND | | |
| **69** | +24 V DC | Transistor Output 4 | |
| 90 | PNP-OUTPUT | | |
| 111 | GND | | |

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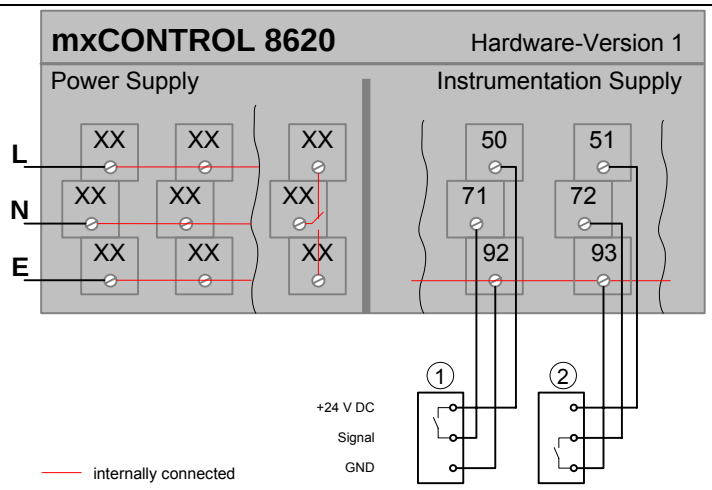
# 21.3.3 Connection Examples for Inputs and Outputs

## Digital-/Frequency Inputs




**Input is configured as:**
- Potentialfree binary input
- Frequency input
- Pulse counter input

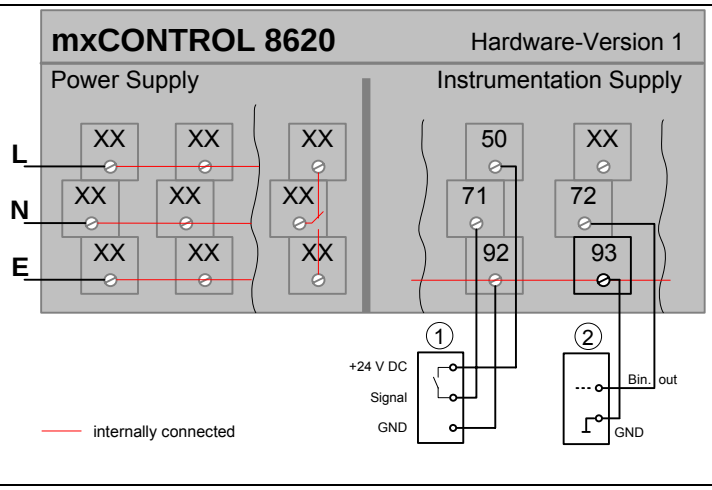
**Examples:**

Connection of a potentialfree contact/frequency outputs/ pulse output

**(1):**
acting as PNP
to DigIn 1

**(2):**
acting as NPN
to DigIn 2

## Digital Inputs




**Input is configured as:**
- Binary input

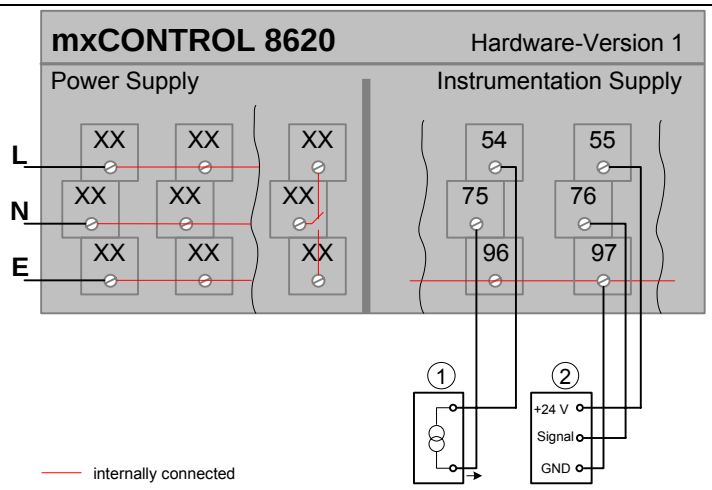
**Example:**

Connection of a simple binary input

**(1):** to DigIn 1
external signal source with power supply from „Type 8620 mxCONTROL“

**(2):** to DigIn 2
external signal source with own power supply (e.g. binary output of PLC)

## Analog Inputs 4…20 mA




**Examples:**

**(1):**
Connection of a 2-wire-sensor to AnalogIn 1

**(2):**
Connection of a 3-wire-sensor to AnalogIn 2



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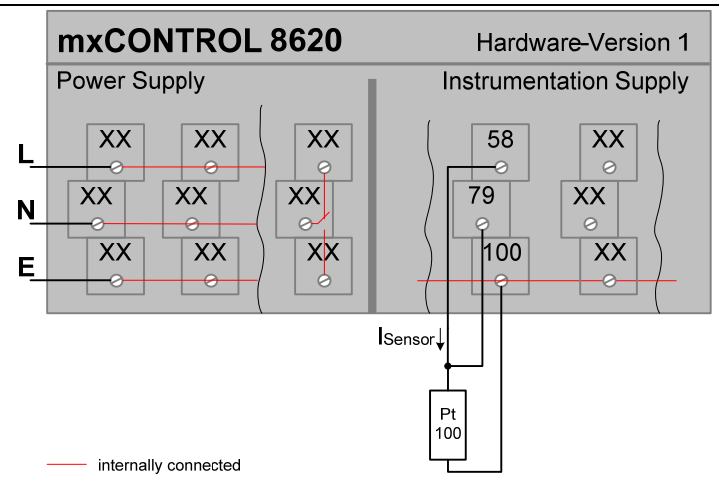
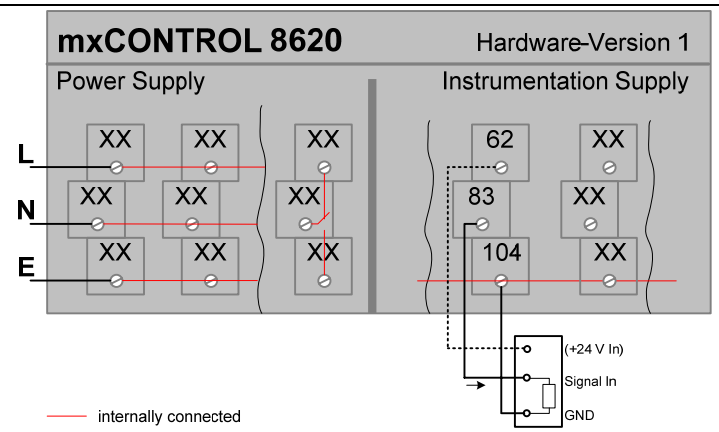
## Pt100 Inputs




**Example:**

Connection of a Pt100-sensor to AnalogIn 1

## Analog Outputs 4…20 mA

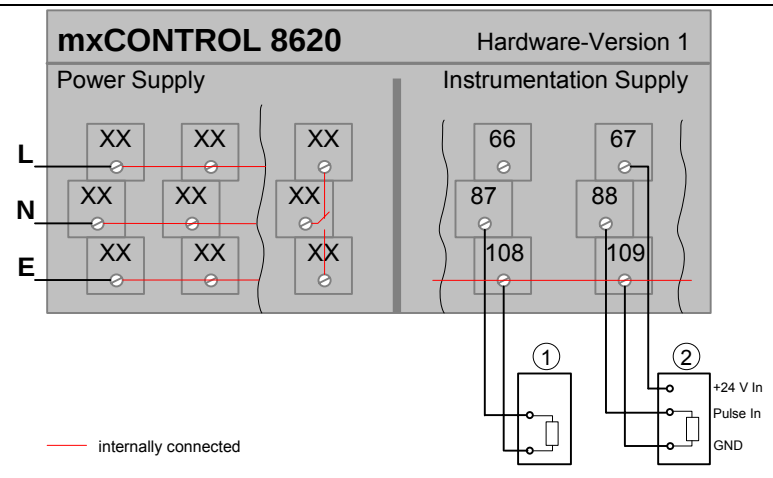



**Example:**

Connection of a device with analog output 4…20 mA
to 4…20mA-Ausgang 1

(if necessary – connection of the device also to the 24 V DC-supply – Pin 62)

## Transistor Outputs




**Examples:**

**(1):**
Connection of a proportional valve etc.
to Transistor output 1

**(2):**
Connection of a device with Pulse- (PWM-) input
to Transistor output 2

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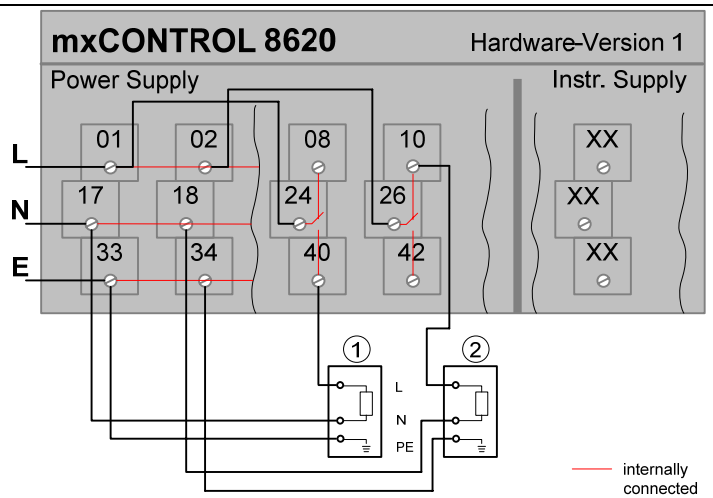
## Relay Outputs




**Examples:**

Connection of a device working with mains voltage

**(1):**
to the „break contact“ of Relay output 1

**(2):**
to the „make contact“ of Relay output 2

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# 21.4 Hardware version 2

## 21.4.1 PIN assignment for power supply level (power supply)

| Pin No. | Signal | Function | Input or Output Type |
|---|---|---|---|
| **1** | break contact | Relay 1 | On/Off or PFM or PWM |
| 2 | center | | |
| 3 | make contact | | |
| 4 | L | AC_Power_OUT | 100 – 240 V AC, 50/60 Hz |
| 5 | N | | |
| 6 | PE | | |
| **7** | break contact | Relay 2 | On/Off or PFM or PWM |
| 8 | center | | |
| 9 | make contact | | |
| 10 | L | AC_Power_OUT | 100 – 240 V AC, 50/60 Hz |
| 11 | N | | |
| 12 | PE | | |
| **13** | break contact | Relay 3 | On/Off or PFM or PWM |
| 14 | center | | |
| 15 | make contact | | |
| 16 | L | AC_Power_OUT | 100 – 240 V AC, 50/60 Hz |
| 17 | N | | |
| 18 | PE | | |
| **19** | break contact | Relay 4 | On/Off or PFM or PWM |
| 20 | center | | |
| 21 | make contact | | |
| 22 | L | AC_Power_OUT | 100 – 240 V AC, 50/60 Hz |
| 23 | N | | |
| 24 | PE | | |
| **25** | break contact | Relay 5 | On/Off or PFM or PWM |
| 26 | center | | |
| 27 | make contact | | |
| 28 | L | AC_Power_OUT | 100 – 240 V AC, 50/60 Hz |
| 29 | N | | |
| 30 | PE | | |
| **31** | L | Internal power supply | 100 – 240 V AC, 50/60 Hz |
| 32 | N | | |
| 33 | PE | | |
| 34 | L | AC_Power_IN | Net Supply<br>100 – 240 V AC, 50/60 Hz |
| 35 | N | | |
| 36 | PE | | |

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## 21.4.2 PIN Assignment for Low Voltage Level (Instrumentation Supply)

| PIN no. | Signal | Function | Designation in the configuration menu |
|---|---|---|---|
| **37** | +24 V DC-Input | DC_Power_IN | -- |
| 57 | GND | | |
| 77 | PE | | |
| **38** | +24 V DC-Input | DC_Power_IN | -- |
| 58 | GND | | |
| 78 | PE | | |
| **39** | +24 V DC (Sensor/Transmitter Supply) | Digital/Frequency Input 1 | DigIn 1 |
| 59 | INPUT | | |
| 79 | GND | | |
| **40** | +24 V DC (Sensor/Transmitter Supply) | Digital/Frequency Input 2 | DigIn 2 |
| 60 | INPUT | | |
| 80 | GND | | |
| **41** | +24 V DC (Sensor/Transmitter Supply) | Digital/Frequency Input 3 | DigIn 3 |
| 61 | INPUT | | |
| 81 | GND | | |
| **42** | +24 V DC (Sensor/Transmitter Supply) | Digital/Frequency Input 4 | DigIn 4 |
| 62 | INPUT | | |
| 82 | GND | | |
| **43** | +24 V DC (Sensor/Transmitter Supply) | Digital Input 5 | DigIn 5 |
| 63 | INPUT | | |
| 83 | GND | | |
| **44** | +24 V DC (Sensor/Transmitter Supply) | Digital Input 6 | DigIn 6 |
| 64 | INPUT | | |
| 84 | GND | | |
| **45** | +24 V DC (Sensor/Transmitter Supply) | Digital Input 7 | DigIn 7 |
| 65 | INPUT | | |
| 85 | GND | | |
| **46** | +24 V DC (Sensor/Transmitter Supply) | Digital Input 8 | DigIn 8 |
| 66 | INPUT | | |
| 86 | GND | | |
| **47** | +24 V DC (Sensor/Transmitter Supply) | 4…20mA Input 1 | AnalogIn 1 |
| 67 | INPUT | | |
| 87 | GND | | |
| **48** | +24 V DC (Sensor/Transmitter Supply) | 4…20mA Input 2 | AnalogIn 2 |
| 68 | INPUT | | |
| 88 | GND | | |
| **49** | +24 V DC (Sensor/Transmitter Supply) | 4…20mA Input 3 | AnalogIn 3 |
| 69 | INPUT | | |
| 89 | GND | | |
| **50** | +24 V DC (Sensor/Transmitter Supply) | 4…20mA Input 4 | AnalogIn 4 |
| 70 | INPUT | | |
| 90 | GND | | |
| **51** | Pt100-current-source | 3-wire Pt100 Input 1 | AnalogIn 5 |
| 71 | INPUT | | |
| 91 | GND | | |
| **52** | Pt100-current-source | 3-wire Pt100 Input 2 | AnalogIn 6 |
| 72 | INPUT | | |
| 92 | GND | | |
| **53** | +24 V DC | 4…20 mA Output 1 | 4…20 mA Output 1 |
| 73 | OUTPUT | | |
| 93 | GND | | |
| **54** | +24 V DC | 4…20 mA Output 2 | 4…20 mA Output 2 |
| 74 | OUTPUT | | |
| 94 | GND | | |
| **55** | +24 V DC | Transistor Output 1 | Transistor 1 |
| 75 | PNP-OUTPUT | | |
| 95 | GND | | |
| **56** | +24 V DC | Transistor Output 2 | Transistor 2 |
| 76 | PNP-OUTPUT | | |
| 96 | GND | | |

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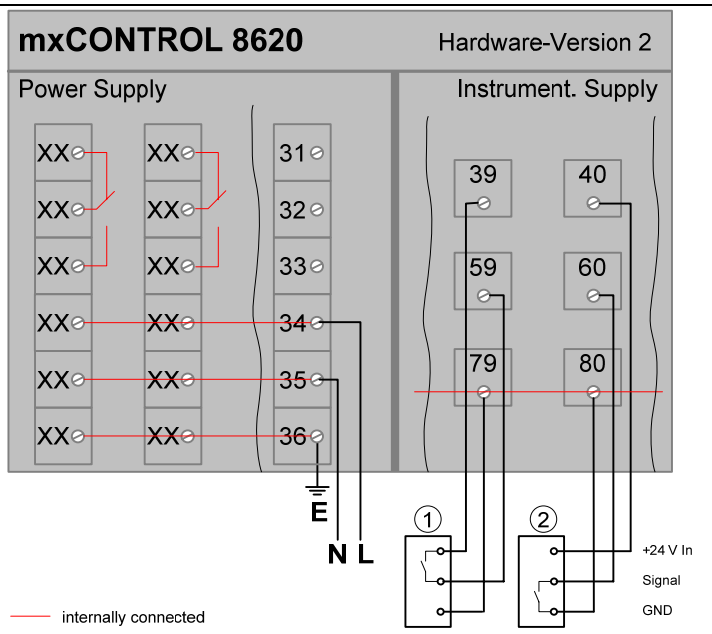
# 21.4.3 Connection Examples for Inputs and Outputs

## Digital-/Frequency Inputs




**Input is configured as:**
- Potentialfree binary input
- Frequency input
- Pulse counter input

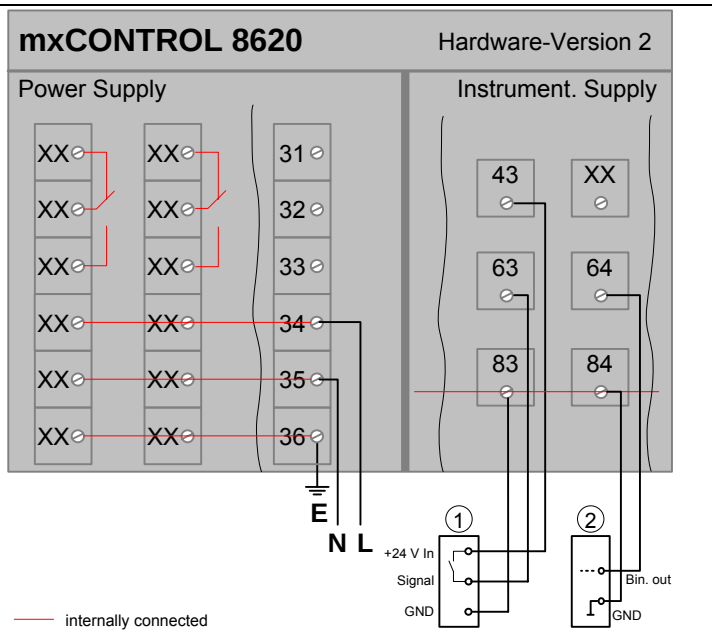
**Examples:**

Connection of a potentialfree contact/frequency outputs/ pulse output

**(1):**
acting as PNP
to DigIn 1

**(2):**
acting as NPN
to DigIn 2

## Digital Inputs




**Input is configured as:**
- Binary input

**Example:**

Connection of a simple binary input

**(1):** to DigIn 5
external signal source with power supply from „Type 8620 mxCONTROL“

**(2):** to DigIn 6
external signal source with own power supply (e.g. binary output of PLC)

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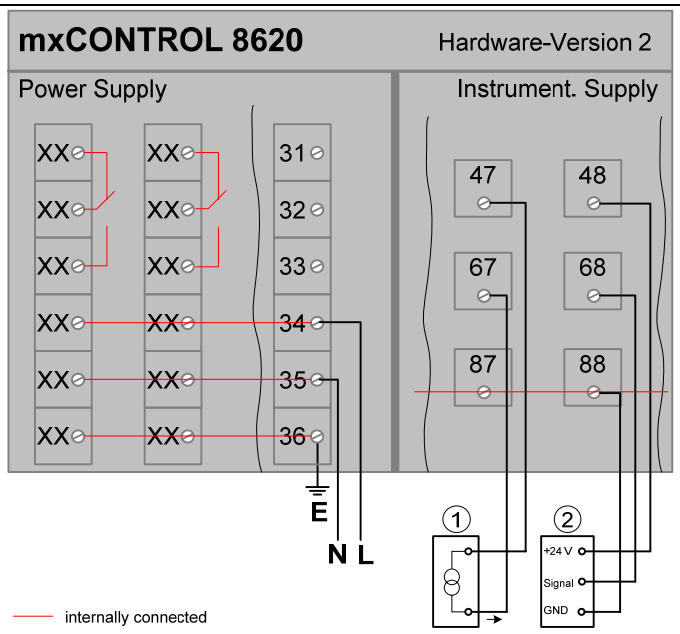
## Analog Inputs 4...20 mA

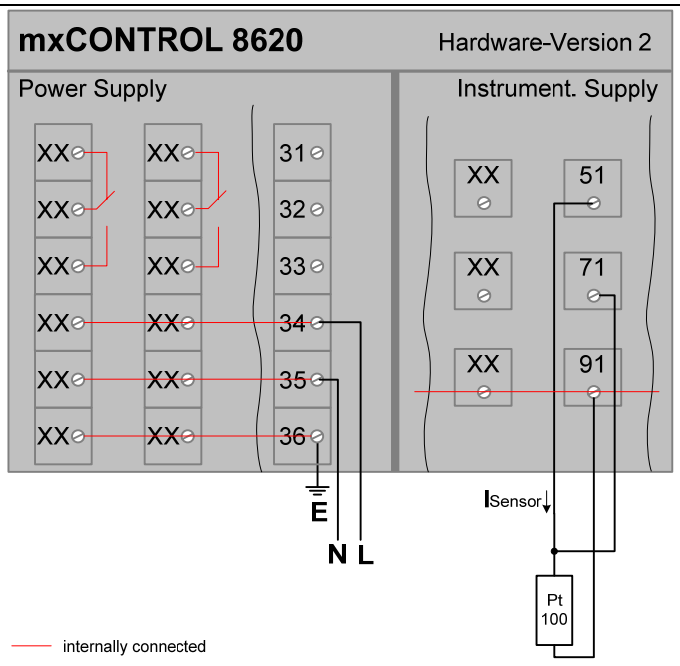



**Examples:**

**(1):**
Connection of a 2-wire-sensor to AnalogIn 1

**(2):**
Connection of a 3-wire-sensor to AnalogIn 2

## Pt100 Inputs




**Example:**

Connection of a Pt100-sensor to AnalogIn 5

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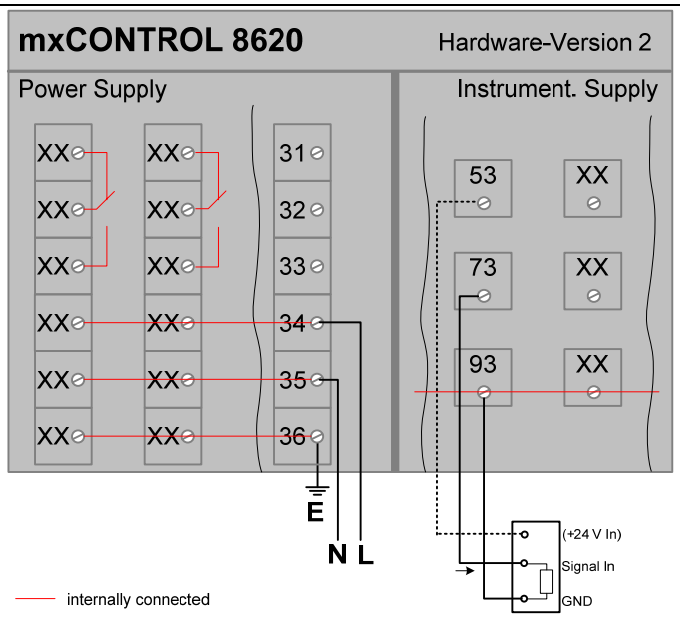
## Analog Outputs 4…20 mA

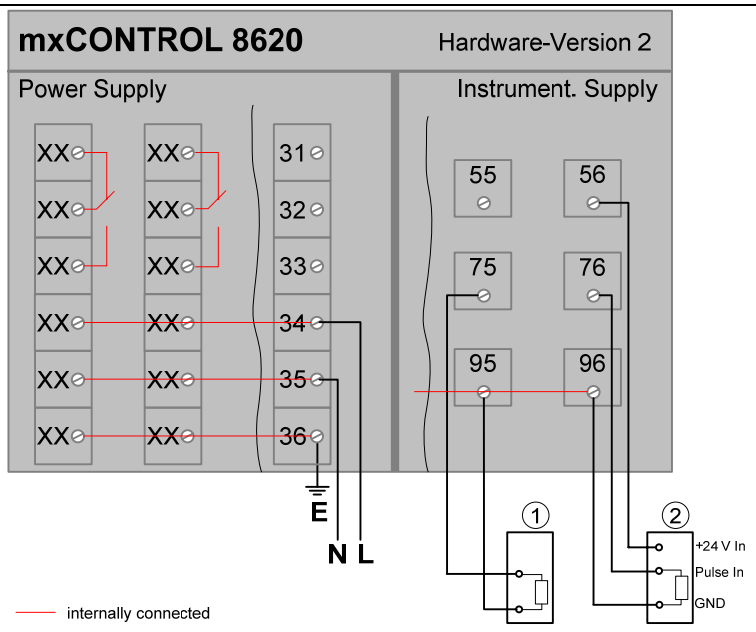



**Example:**

Connection of a device with analog output 4…20 mA
to 4…20mA-Ausgang 1

(if necessary – connection of the device also to the 24 V DC-supply – Pin 53)

## Transistor Outputs




**Examples:**

**(1):**
Connection of a proportional valve etc.
to Transistor output 1

**(2):**
Connection of a device with Pulse- (PWM-) input
to Transistor output 2

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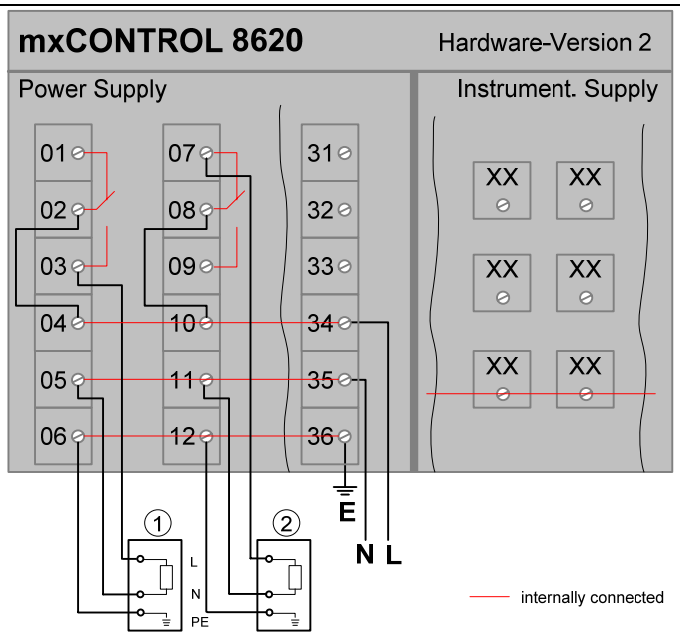
## Relay Outputs




**Examples:**

Connection of a device working with mains voltage

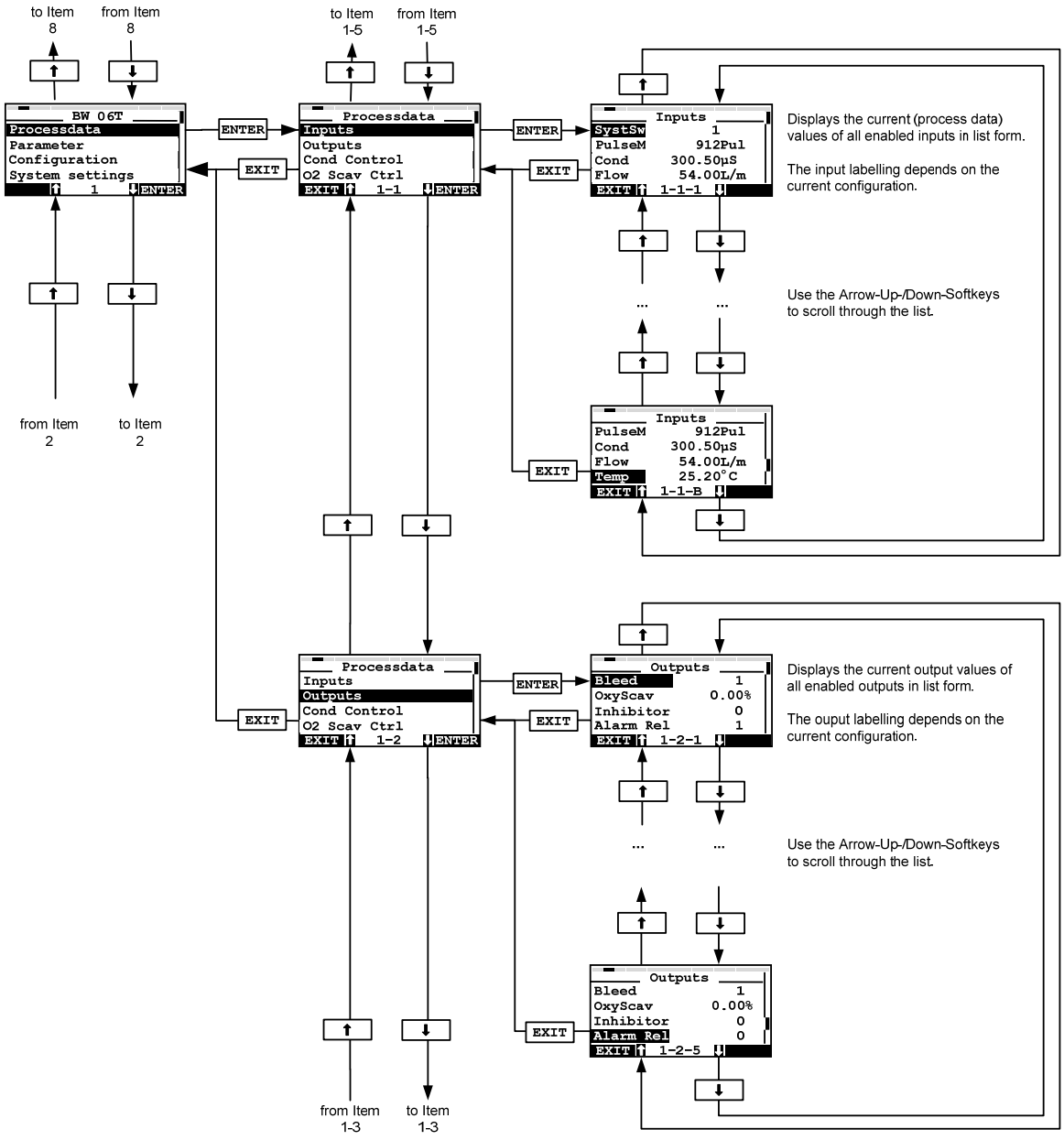
**(1):**
to the „break contact“ of Relay output 1

**(2):**
to the „make contact“ of Relay output 2

# 21.5 Main Menu Structure – Menu Tree (Example for Project "BW 06T")

## 21.5.1 Processdata – Inputs – Outputs

These menu tables are examples. The menu is logically structured and self-explanatory. More detailled and complete information can be found in the belonging chapters before – summarized in the process data, parameter and configuration tables.

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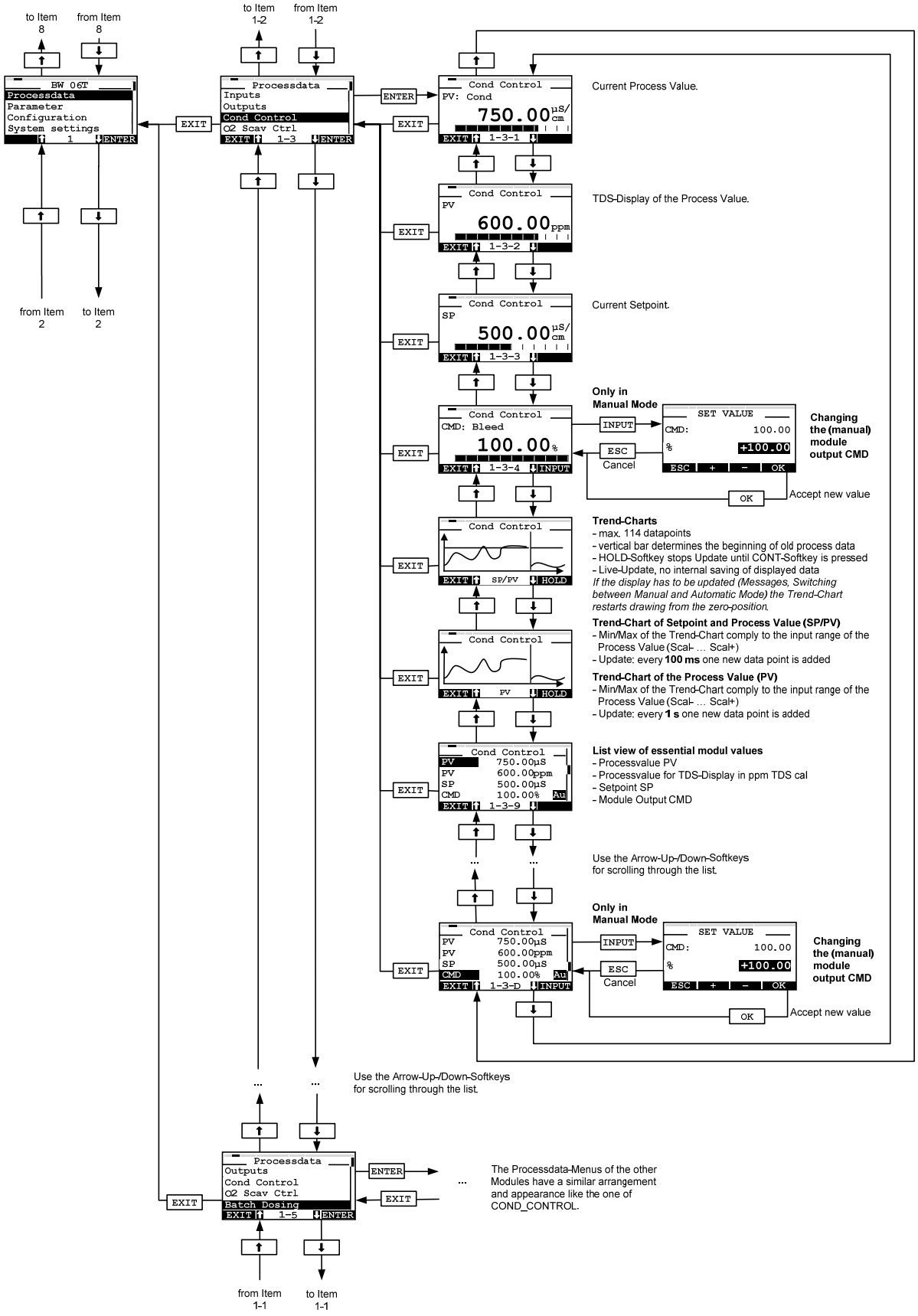
# 21.5.2 Processdata – Cond Control

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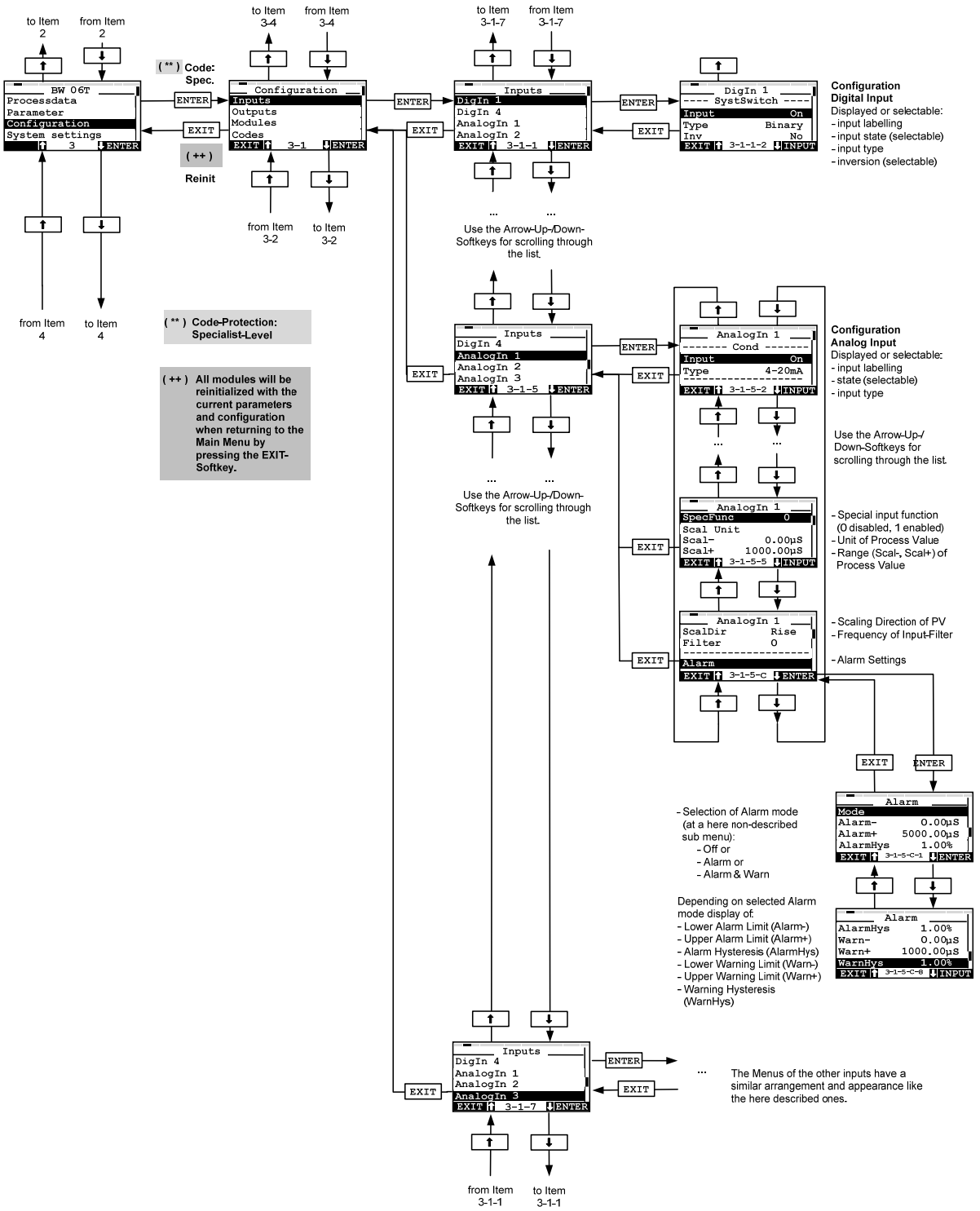
# 21.5.3 Configuration of Inputs

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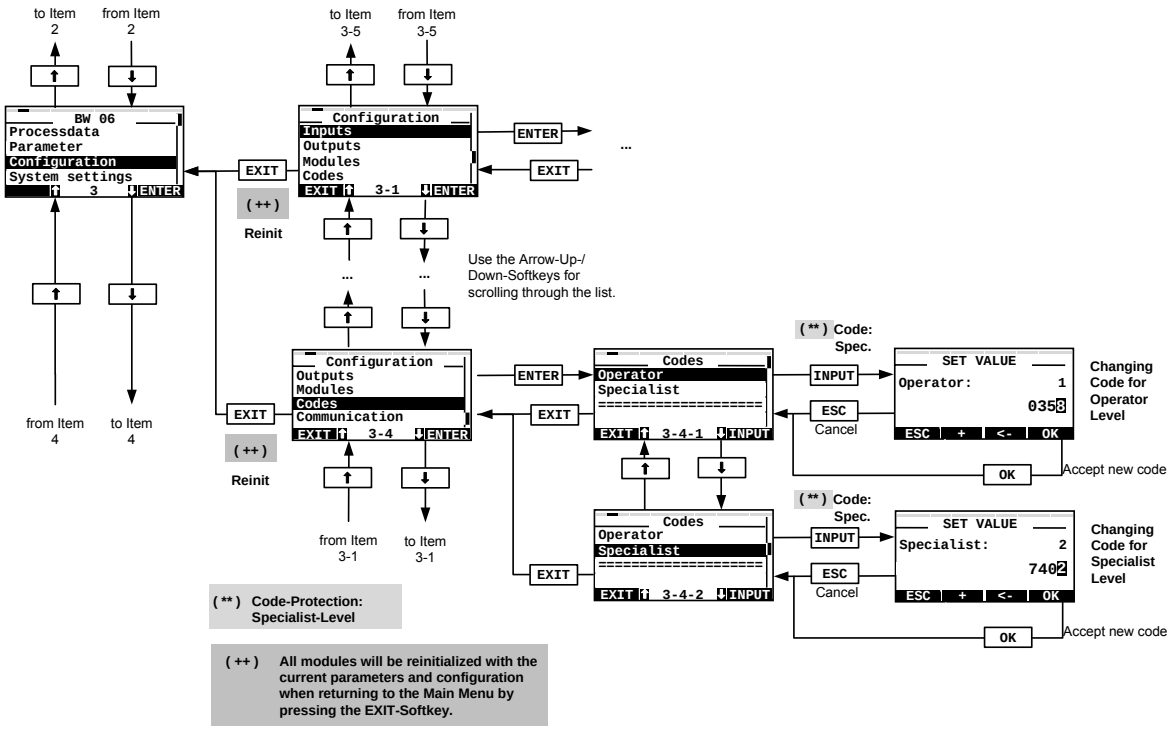
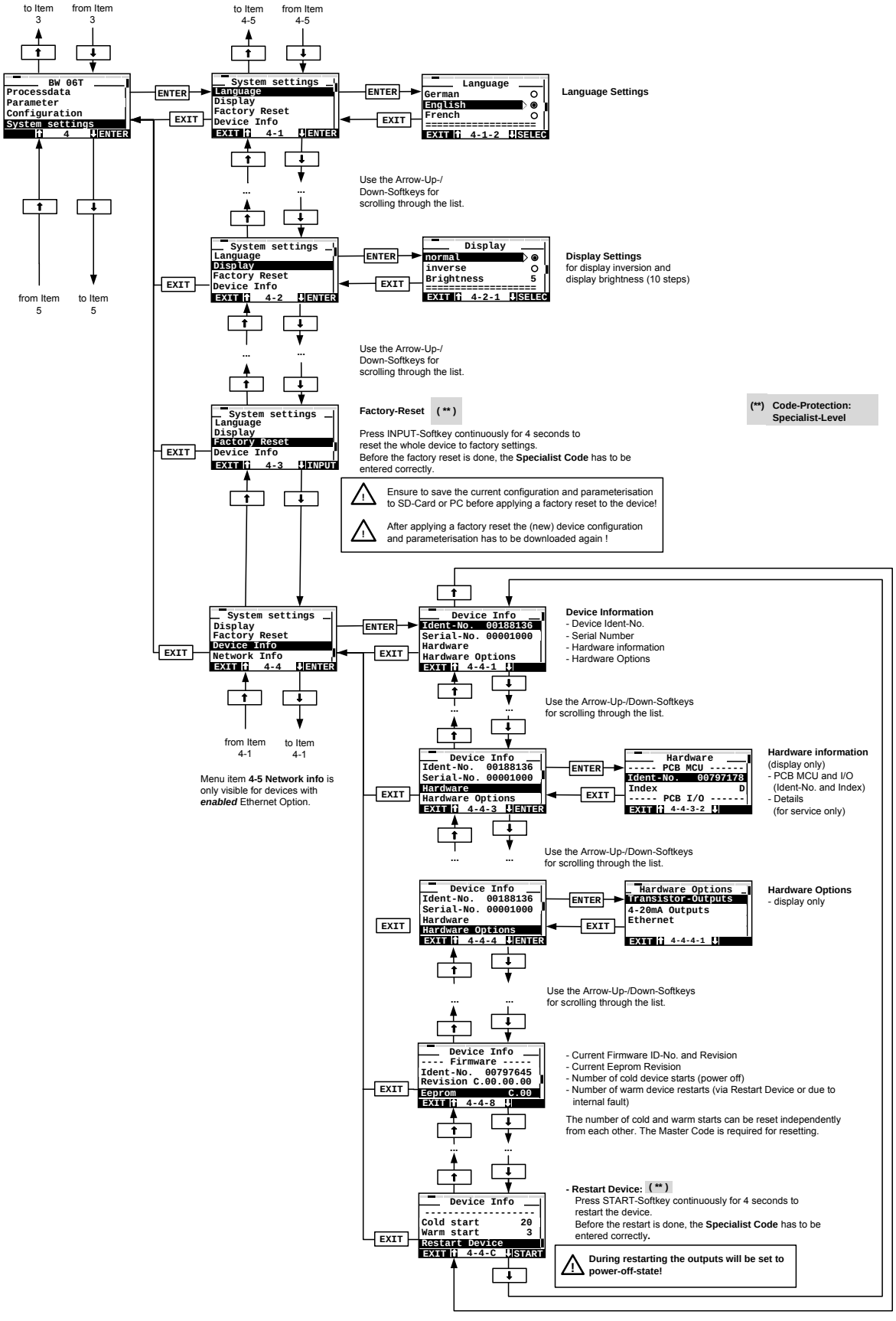
# 21.5.4 Configuration of the Codes



# 21.5.5 System Settings

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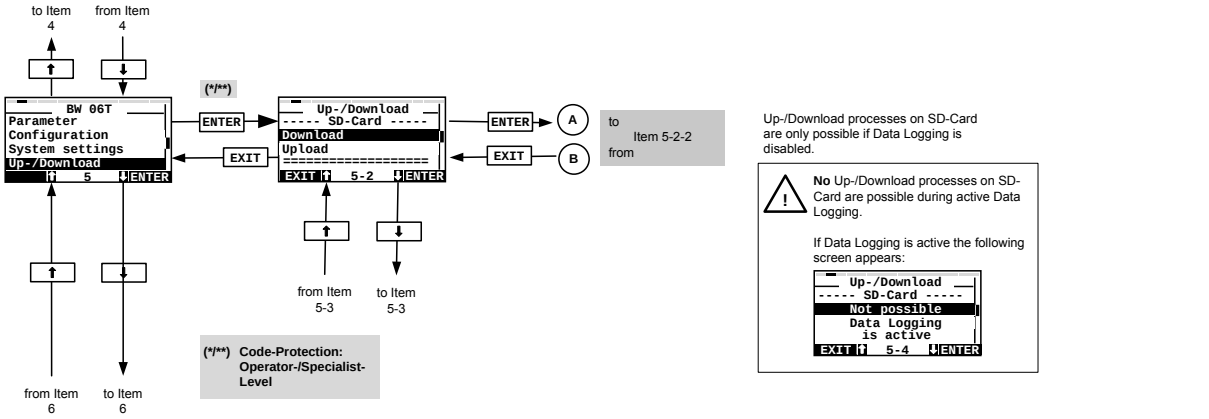
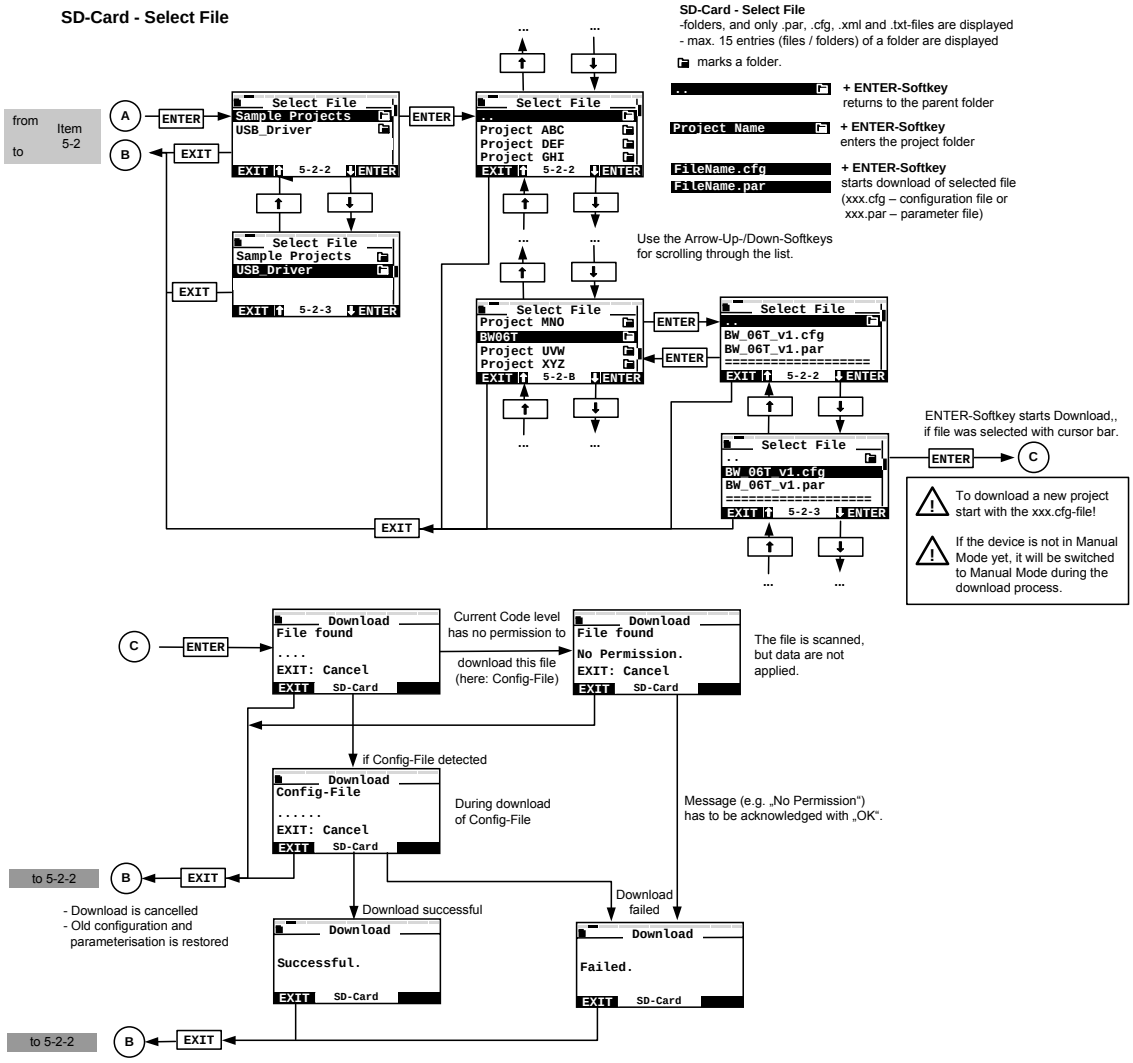
# 21.5.6 Up-/Download - Download

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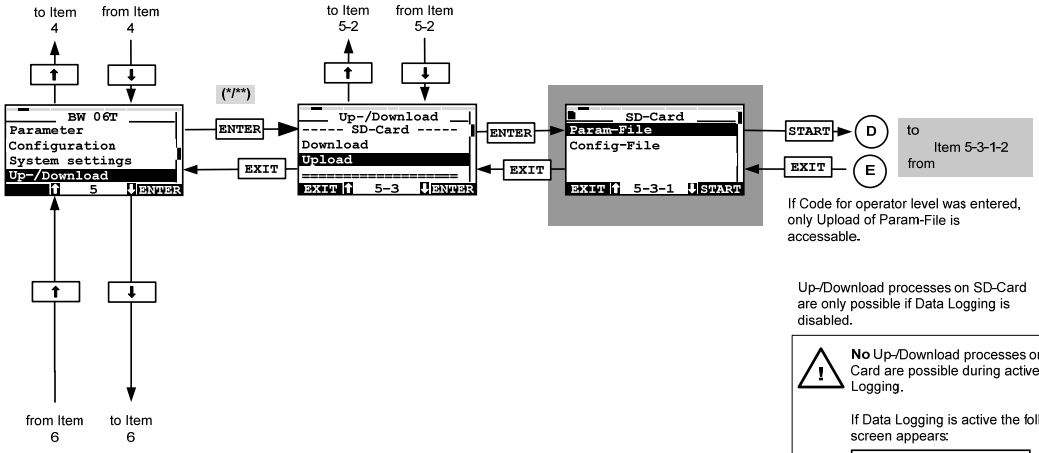
# 21.5.7 Up-/Download – Upload

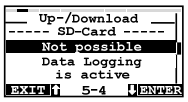



If Code for operator level was entered, only Upload of Param-File is accessable.

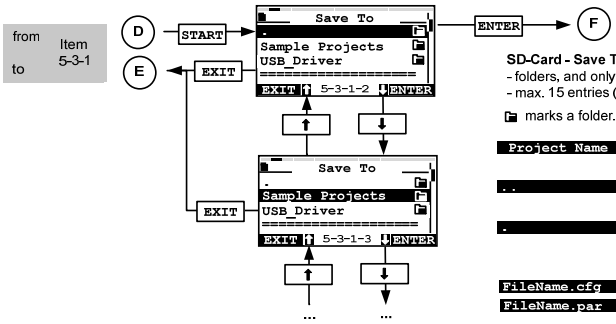
Up-/Download processes on SD-Card are only possible if Data Logging is disabled.

**No** Up-/Download processes on SD-Card are possible during active Data Logging.

If Data Logging is active the following screen appears:




**SD-Card - Save To**




**SD-Card - Save To**
- folders, and only .par, .cfg, .xml and .txt-files are displayed
- max. 15 entries (files / folders) of a folder are displayed

marks a folder.

Project Name **+ ENTER-Softkey** enters the project folder

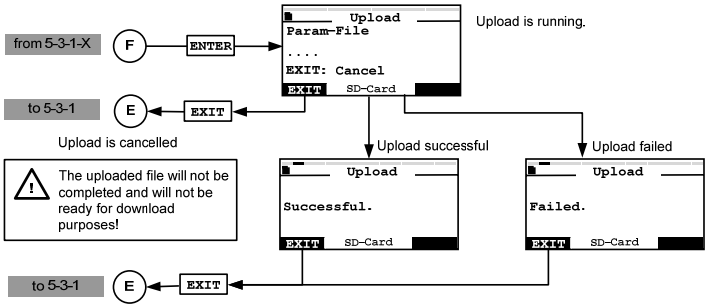
.. **+ ENTER-Softkey** returns to the parent folder

. **+ ENTER-Softkey** saves the current file (with the saved name from the download) to the current folder

FileName.cfg
FileName.par
**+ ENTER-Softkey** starts upload of the current file to the selected file.

If a file in this folder already exists, the user will be requested, whether the existing file shall be overwritten or shall be kept.

If the existing file shall be kept, the internally saved file name (from the download process) is extended with an ending „v00" to „v99".

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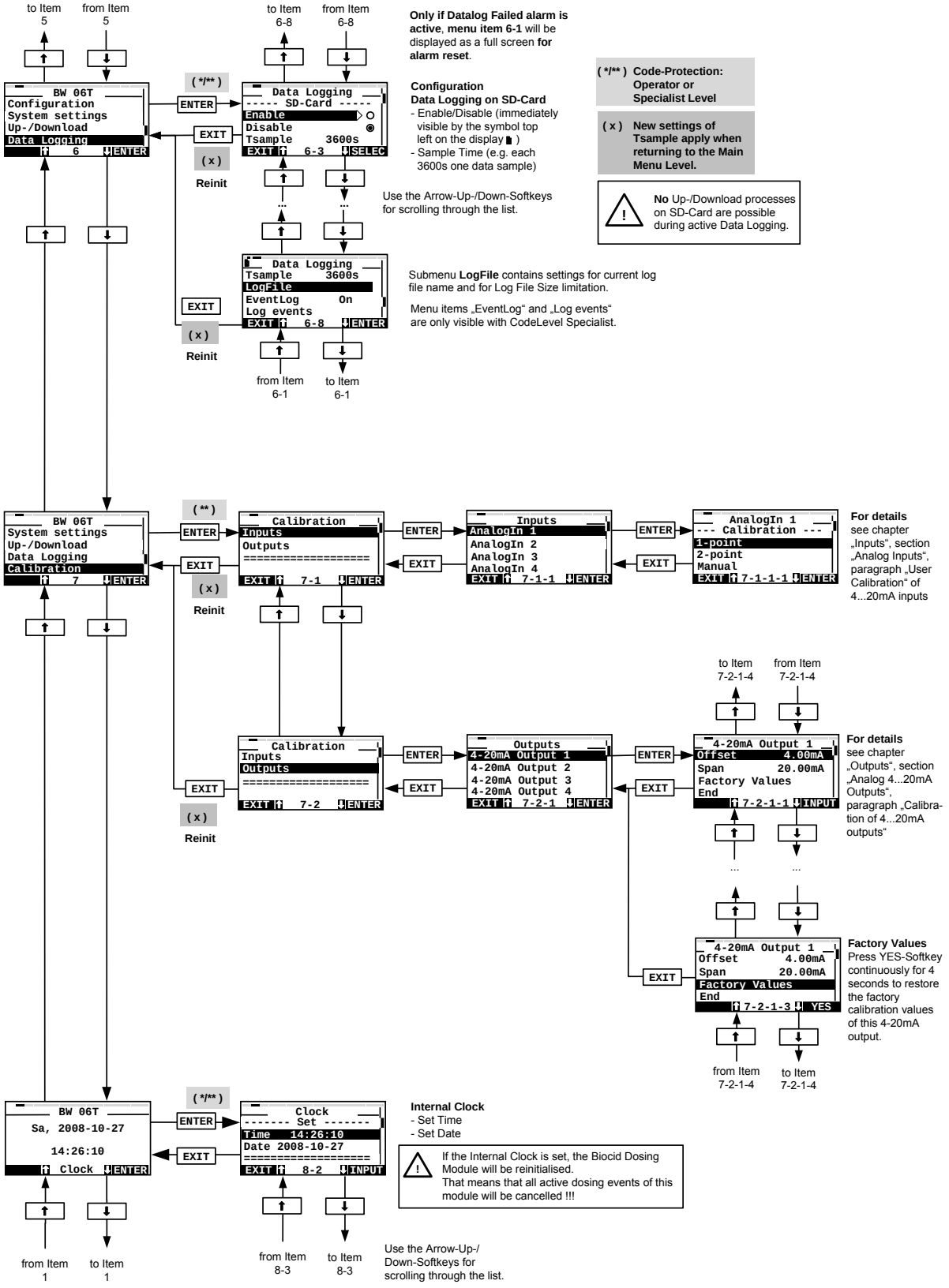
# 21.5.8 Data Logging / Calibration / Clock

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# 21.6 Data Logging File – Example

> Only the module outputs are logged on the output side.
>
> Exception for transistor outputs in PWM or Fast-PWM mode: the speed limitated output value is logged.

**#HEADER**

| | | | |
|---|---|---|---|
| DatalogFile | Rev | A.00 | |
| | Source | DEVICE | |
| Device | ID | 188133 | |
| | Serial | 1001 | |
| Firmware | ID | 797645 | |
| | Rev | C.00.00.00 | |
| Project | Name | Project ABCD | |
| Cfg-File | Name | Project_ABCD.cfg | |
| | Applied | 19.04.2010 | 14:33:19 |
| Param-File | Name | Project_ABCD.par | |
| | Applied | 21.04.2010 | 12:19:52 |

**#PROCESSDATA**

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***line 1:*** | | | | | | | CL ORP | | | | | Cond Control | | | | | Biocide Dosing | | | | |
| ***line 2:*** | | | | | | | CL ORP | | | | | Cd | | | | | BioDos | | | | |
| ***line 3:*** | 0-0-1 | 0-0-2 | 0-1-1 | 0-1-2 | 0-2-1 | 0-3-1 | 1-11-1 | 1-11-2 | 1-11-7 | 1-11-20 | 1-11-21 | 2-8-1 | 2-8-2 | 2-8-7 | 2-8-20 | 2-8-21 | 3-10-24 | 3-10-20 | 3-10-21 | 3-10-25 | 3-10-22 | 3-10-23 |
| ***line 4:*** | date | time | hex | str | fl | fl | fl | str | fl | fl | str | fl | str | fl | fl | str | fl | fl | str | fl | fl | str |
| | | | | | Manual | Common | | State | | | State | | State | | | State | State | | State | State | | State |
| ***line 5:*** | Date | Time | LogEvent | Event | Mode | Alarm | PV1 | PV1 | SP | CMD | CMD | PV1 | PV1 | SP | CMD | CMD | Ch1 | CMD1 | CMD1 | Ch2 | CMD2 | CMD2 |
| ***line 6:*** | | | | | | | CL ORP | | | CL ORP | | Cond | | | Bleed | | | Bioci- | | | Bioci- | |
| ***line 7:*** | YYYY-MM-DD | HH:MM:SS | | | | | mV | | mV | % | | µS/cm | | µS/cm | % | | | de 1 % | | | de 2 % | |
| | 2010-04-22 | 13:32:13 | 00000014 | LogEvent | 0 | 0 | 458.52 | OK | 500.00 | 0.00 | fS | 823.45 | OK | 1000.0 | 0.00 | fS | 7 | 0.00 | fS | 7 | 0.00 | fS |
| | 2010-04-22 | 13:32:33 | 00000080 | Mask: | 0 | 0 | 441.87 | OK | 500.00 | 0.00 | fS | 901.61 | OK | 1000.0 | 0.00 | fS | 7 | 0.00 | fS | 7 | 0.00 | fS |
| | 2010-04-22 | 13:32:40 | 00010000 | ffffffff | 0 | 0 | 441.45 | OK | 500.00 | 100.00 | Au | 902.08 | OK | 1000.0 | 0.00 | Au | 1 | 0.00 | Au | 1 | 0.00 | Au |
| | 2010-04-22 | 13:32:53 | 00000080 | | 0 | 0 | 442.35 | OK | 500.00 | 100.00 | Au | 901.59 | OK | 1000.0 | 0.00 | Au | 1 | 0.00 | Au | 1 | 0.00 | Au |
| | 2010-04-22 | 13:32:59 | 00010000 | | 0 | 0 | 441.99 | OK | 500.00 | 100.00 | Au | 1040.3 | OK | 1000.0 | 100.00 | Au | 1 | 0.00 | Au | 1 | 0.00 | Au |
| | 2010-04-22 | 13:33:13 | 00010080 | | 0 | 0 | 513.63 | OK | 500.00 | 0.00 | Au | 1040.3 | OK | 1000.0 | 100.00 | Au | 1 | 0.00 | Au | 1 | 0.00 | Au |
| | 2010-04-22 | 13:33:17 | 00010000 | | 0 | 0 | 513.63 | OK | 500.00 | 0.00 | Au | 779.60 | OK | 1000.0 | 0.00 | Au | 1 | 0.00 | Au | 1 | 0.00 | Au |
| | 2010-04-22 | 13:33:20 | 00100000 | | 1 | 0 | 513.63 | OK | 500.00 | 20.00 | Ma | 933.40 | OK | 1000.0 | 0.00 | Ma | 0 | 0.00 | Ma | 0 | 0.00 | Ma |
| | 2010-04-22 | 13:33:33 | 00010080 | | 1 | 0 | 513.74 | OK | 500.00 | 20.00 | Ma | 932.91 | OK | 1000.0 | 100.00 | Ma | 0 | 0.00 | Ma | 0 | 0.00 | Ma |
| | 2010-04-22 | 13:33:53 | 00000080 | | 1 | 0 | 520.74 | OK | 500.00 | 20.00 | Ma | 931.30 | OK | 1000.0 | 100.00 | Ma | 0 | 0.00 | Ma | 0 | 0.00 | Ma |
| | 2010-04-22 | 13:35:00 | 00110000 | | 0 | 0 | 524.10 | OK | 500.00 | 0.00 | Au | 933.41 | OK | 1000.0 | 0.00 | Au | 1 | 0.00 | Au | 1 | 0.00 | Au |
| | 2010-04-22 | 13:35:05 | 0a010000 | | 0 | 1 | 530.19 | AH | 500.00 | 0.00 | Au | 1069.2 | OK | 1000.0 | 100.00 | Au | 1 | 0.00 | Au | 1 | 0.00 | Au |
| | 2010-04-22 | 13:35:13 | 00000080 | | 0 | 1 | 532.10 | AH | 500.00 | 0.00 | Au | 1071.6 | OK | 1000.0 | 100.00 | Au | 1 | 0.00 | Au | 1 | 0.00 | Au |
| | 2010-04-22 | 13:35:23 | 0a010000 | | 0 | 1 | 535.38 | AH | 500.00 | 0.00 | Au | -- | FI | 1000.0 | 0.00 | YS | 1 | 0.00 | Au | 1 | 0.00 | Au |
| | and so on … | | | | | | | | | | | | | | | | | | | | | |

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**Legend**

| | |
|---|---|
| ***Line 1:*** | (User defined) names of Control Functions |
| ***Line 2:*** | Configured modules (short module name) |
| ***Line 3:*** | Internal code for PC-Tool |
| ***Line 4:*** | Data format |
| ***Line 5:*** | Internal names of the monitored variables |
| ***Line 6:*** | User defined name of assigned input/output |
| ***Line 7:*** | Units of observed variables |

**Biocide Dosing "State Ch1" and "State Ch2"**

| | |
|---|---|
| **0** | **Manual Mode** |
| **1** | Ready - Waiting for next dosing start |
| **2** | Prebleed |
| **3** | Main Dose |
| **4** | Delay after Main-Dose |
| **5** | Post Dose |
| **6** | Delay after Post-Dose |
| **7** | Stand-By (System switch active, Biocide Dosing not active) |
| **8** | No Flow (Flow switch active, Biocide Dosing not active) |
| | Other values are undefined |

**State PV (English)**

| | |
|---|---|
| **AH** | Higher Alarm |
| **AL** | Lower Alarm |
| **CM** | Calibration mode: 4-20mA input is currently calibrated without Hold function |
| **FA** | Internal AD-Fault |
| **Fc** | Calibration DataFault |
| **FC** | Configuration Fault |
| **FI** | Input Fault |
| **FS** | Sensor Fault |
| **HO** | Value Hold during User Calibration |
| **nA** | Input not active |
| **OK** | Value OK |
| **WH** | Higher Warning |
| **WL** | Lower Warning |

**State CMD (English)**

| | |
|---|---|
| **Au** | Automatic Mode - the output is calculated by assigned controller |
| **CM** | Calibration mode: 4-20mA output is currently calibrated |
| **Fc** | Calibration Data Fault (only 4…20 mA Outputs) |
| **fF** | Output value set to "0" - Cause: The flow switch is active and causes an alarm: No flow |
| **fo** | Output value is forced/controlled by another module |
| **fS** | Output value set to "0" - Cause: The binary system switch is active |
| **Ma** | Manual Mode - the output has to be controlled by the operator |
| **OF** | Output Fault (4…20mA-Outputs) |
| **YA** | Output of pH controller set to "0" - Cause: Alarm: ASL Pumps Stop - The corrosion rate has exceeded the ASL limit |
| **YF** | Output value set to "0" - Cause: "Out Fails" (Maximum Output Timer(MOT)) has expired |
| **YS** | Output is set to the value of "YSavePos" - Cause: Input or sensor error on at least one assigned module input |