Supplementary instructions

delta® Solenoid Metering Pump Control Module delta®

Three sets of operating instructions are required for the safe, correct and proper operation of the metering pumps: The supplementary instructions, the "General Operating Instructions for ProMinent® Solenoid Metering Pumps" and the "Solenoid Metering Pump delta® with controlled solenoid drive optoDrive®"! These are only valid when read together.

Please carefully read these operating instructions before use! · Do not discard!
The operator shall be liable for any damage caused by installation or operating errors!
Technical changes reserved.

Part no. 986236 **Original Operating Instructions (2006/42/EC)** BA DE 022 11/11 EN

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General non-discriminatory approach

In order to make it easier to read, this document uses the male form in grammatical structures but with an implied neutral sense. It is aimed equally at both men and women. We kindly ask female readers for their understanding in this simplification of the text.

Supplementary information

Please read the supplementary information in its entirety.

The following are highlighted separately in the document:

- Enumerated lists

→ Instructions

⇨ Outcome of the instructions

Information

This provides important information relating to the correct operation of the device or is intended to make your work easier.

Safety information

The safety information includes detailed descriptions of the hazardous situation.

Table of contents

1 Introduction

These operating instructions describe the technical data and functions of the control module delta®.

1.1 Safety and responsibility

1.1.1 General Safety Information

WARNING!
Live parts!
Possible consequence: Fatal or very serious injuries

- Measure: Disconnect the mains power supply prior to opening the housing
- De-energise damaged, defective or manipulated units by disconnecting the mains plug

WARNING!
Unauthorised access!
Possible consequence: Fatal or very serious injuries

- Measure: Ensure that there can be no unauthorised access to the unit

WARNING!
Operating errors!
Possible consequence: Fatal or very serious injuries

- The unit should only be operated by adequately qualified and technically expert personnel
- Please also observe the operating instructions for controllers and fittings and any other component groups, such as sensors, measuring water pumps ...
- The operator is responsible for ensuring that personnel are qualified

CAUTION!
Electronic malfunctions
Possible consequence: Material damage to destruction of the unit

- The mains connection cable and data cable should not be laid together with cables that are prone to interference
- Measure: Take appropriate interference suppression measures

NOTICE!

Correct and proper use

Damage to the product or its surroundings

- The unit is not intended to measure or regulate gaseous or solid media
- The unit may only be used in accordance with the technical details and specifications provided in these operating instructions and in the operating instructions for the individual components

NOTICE!

Correct sensor operation / Run-in time

Damage to the product or its surroundings

- Correct measuring and dosing is only possible if the sensor is working perfectly
- It is imperative that the run-in times of the sensors are adhered to
- The run-in times should be allowed for when planning initial operation
- It may take a whole working day to run-in the sensor
- Please read the operating instructions for the sensor

NOTICE!

Correct sensor operation

Damage to the product or its surroundings

- Correct measuring and dosing is only possible if the sensor is working perfectly
- Check and calibrate the sensor regularly

NOTICE!

Compensation of control deviations

Damage to the product or its surroundings

- This controller cannot be used in control circuits which require rapid compensation (< 30 s)

1.1.2 Specific safety instructions for the control module delta®

WARNING!

Emergency stop switch

Possible consequence: Fatal or very serious injuries

An emergency stop switch on the complete system. This should enable the complete system to be switched off in event of an emergency in such a way that the complete system is stopped in a safe condition.

WARNING!

- Hazardous substances
- Danger resulting from contact, breathing in or other contaminations with / from substances or media
- Observe the safety data sheet of the substances / media used
- The system operator must ensure that these safety data sheets are available and that they are kept up to date

WARNING!

- Unexpected starting after a failure, malfunction of the controller / power supply or as an action wanted due to a control process
- Danger due to unexpected actions of the system
- In event of a failure / malfunction of the controller or power supply, the measuring / control station must be disconnected from the power supply. For further information, read the operating instructions of the devices and sensors used

NOTICE!

- Secure the measuring / control station against unauthorised access
- Please also observe the operating instructions for controllers and fittings and any other component groups, such as sensors, sample water pumps ...
- Observe the resistance of the wetted materials for all modules (see also, e.g. also the ProMinent resistance list in the product equipment catalogue or at www.prominent.com)
- Protect the measuring / control station against direct sunlight and other UV sources
- Observe the basic rules for ergonomic principles

1.1.3 Correct and proper use

NOTICE!

Compensation for control deviations

Damage to the product or its surroundings

- The controller can be used in processes, which require compensation of > 30 seconds

NOTICE!

Correct and proper use

The unit is intended to measure and regulate liquid media. The marking of the measured variables is located on the controller and is absolutely binding.

The unit may only be used in accordance with the technical details and specifications provided in this operating manual and in the operating manuals for the individual components (such as, for example, sensors, fittings, calibration devices, metering pumps etc.).

Any other uses or modifications are prohibited.

2 Functional description

Brief functional description

The control module delta® expands the delta® pump series to include measurement dependent metering pumps. The control module delta®has an active 4-20 mA input for combination with the measuring transducers pHV1, RHV1 or the chlorine sensor CLE-3mA. The control module delta® has PID control characteristics so that the delta® solenoid metering pump can be optimally matched to process requirements. If a two-sided control is required, a second pump can be controlled via the optional pacing relay.

Table of measured variables: Assignment of the measured variable to the measuring input of the control module delta®

Measured variable	mA input	Part no.:
Chlorine	X	
pH	X*	809126
Redox	X*	809127
	*with measuring transducer	

2.1 Application example control module delta®

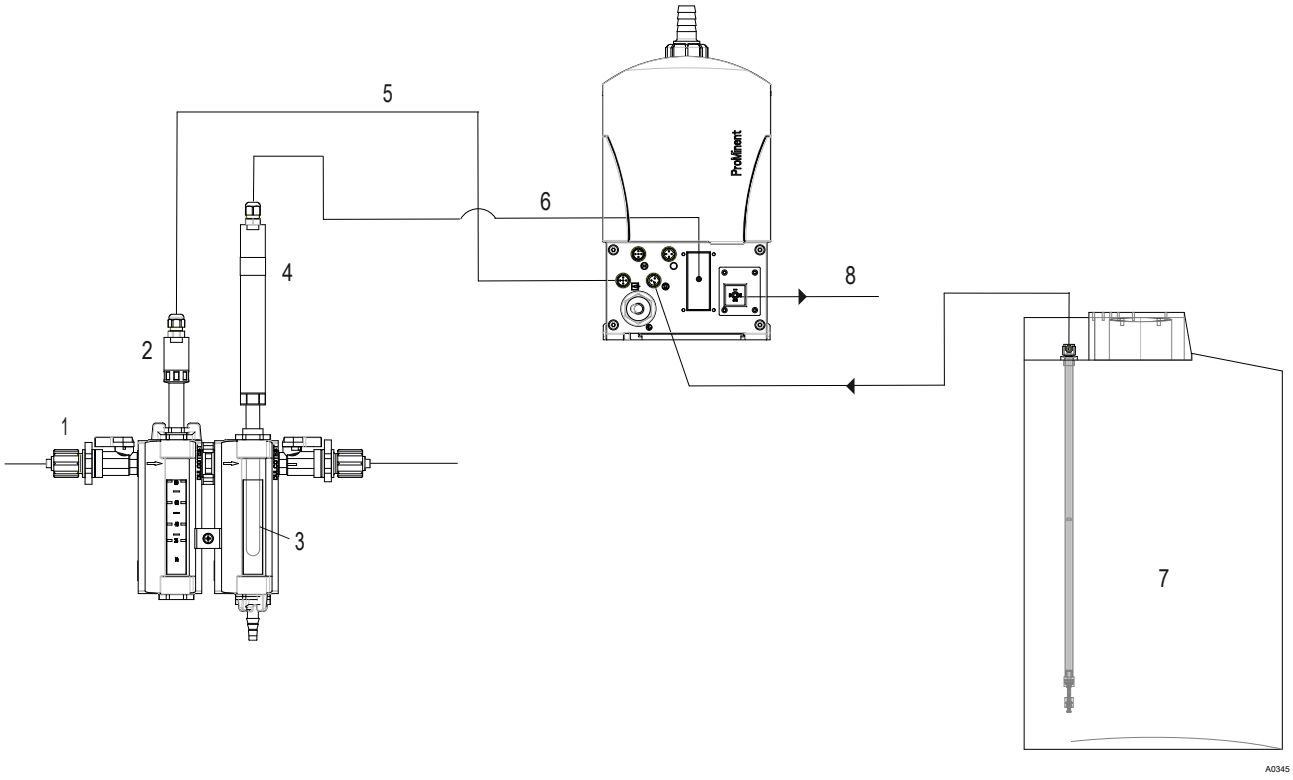


Fig. 1: Application example of pH or redox system for one-sided control

1. Sample water feed (30 - 60 l/h)
2. Flow sensor (part of DGMA)
3. pH sensor (PHEP 112SE) or redox sensor (e.g. RHEP-Pt-SE)
4. pH measuring transducer (pHV1 / 809126) or redox measuring transducer (RHV1 / 809127)
5. Universal control cable (e.g. 1001300)
6. External cable (2-pole / e.g. 707702)
7. Tank with two-stage lance
8. Relay cable (optional part of the delta® solenoid metering pump)

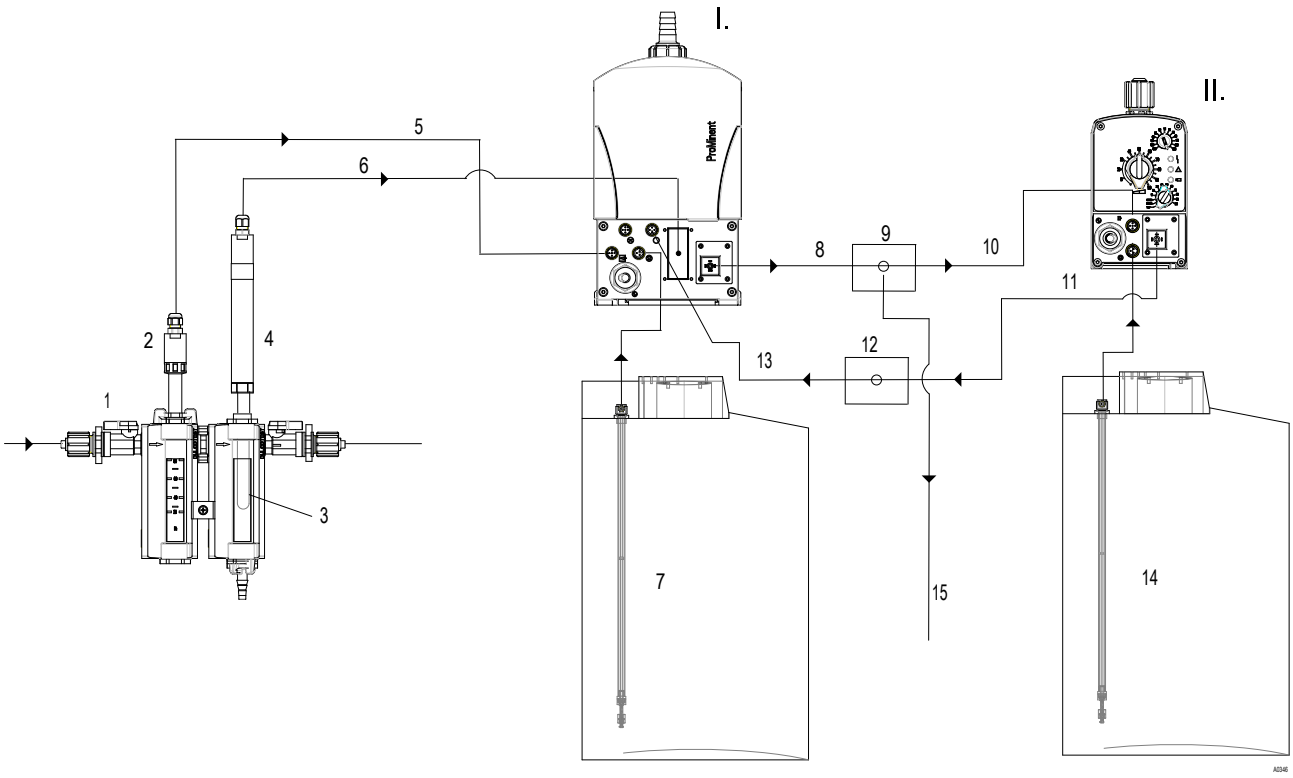


Fig. 2: Application example of pH or redox system for two-sided control

I. First pump delta® with control module delta®
II. Second pump e.g. Beta®
1. Sample water feed (30 - 60 l/h)
2. Flow sensor (part of DGMA)
3. pH sensor (e.g. PHEP 112SE) or redox sensor (e.g. RHEP-Pt-SE)
4. pH measuring transducer (pHV1 / 809126) or redox measuring transducer (RHV1 / 809127)
5. Universal control cable (e.g. 1001300)
6. External cable (2-pole / e.g. 707702)
7. Tank with two-stage lance
8. Optional relay cable (part of the delta® solenoid metering pump)
9. Junction box 1
10. External cable (2-pole / e.g. 707702)
11. Relay cable (3-conductor, part of the external pump)
12. Junction box 2
13. Diaphragm rupture cable
14. Suction lance
15. Collective alarm

2.2 Electrical interfaces

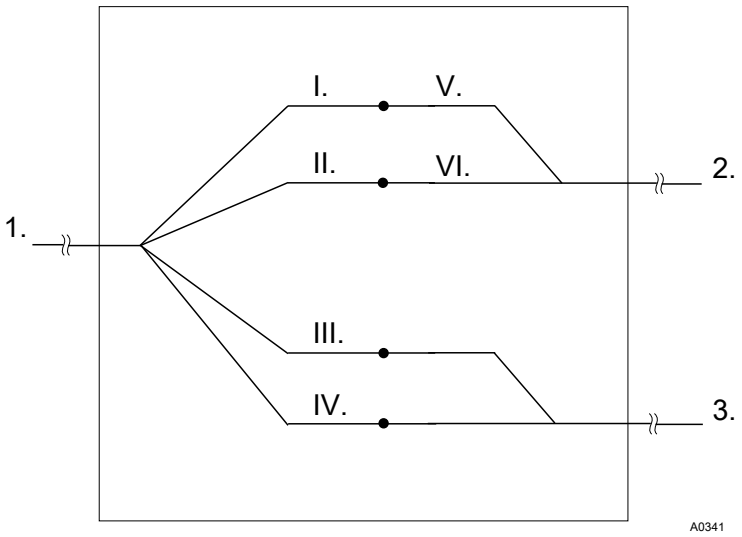


Fig. 3: Connection box 1 (IP 65)

1. Relay cable 4-pin
2. External cable for the second pump
3. Fault indicating relay = External overall alarm (max. load 24 V / 100 mA)

I. White (pacing pulse relay)
II Brown (pacing pulse relay)
III. Yellow (fault indicating relay)
IV. Green (fault indicating relay)
V. White
VI. Brown

Connection of the external pump via a 4-pin relay cable.

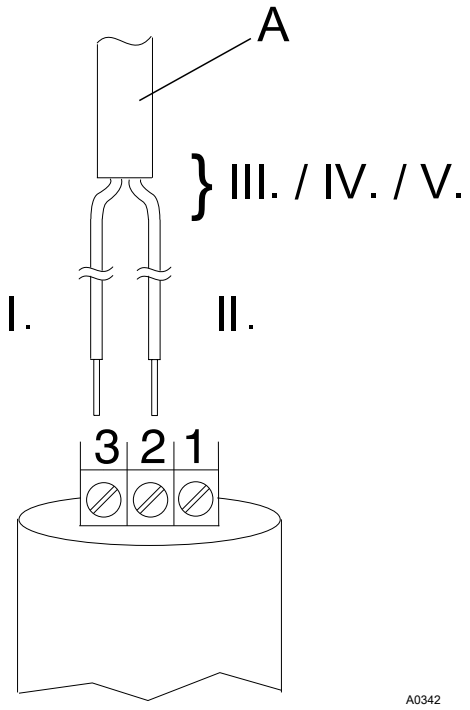


Fig. 4: Connection of the flow gauge

A. 5-pin universal cable
I. Black
II. Brown
III. Blue (not used)
IV. Grey (not used)
V. White (not used)

Functional description: As soon as the flow falls below the set threshold, the contact is opened and the delta® solenoid metering pump switches to *'PAUSE'*.

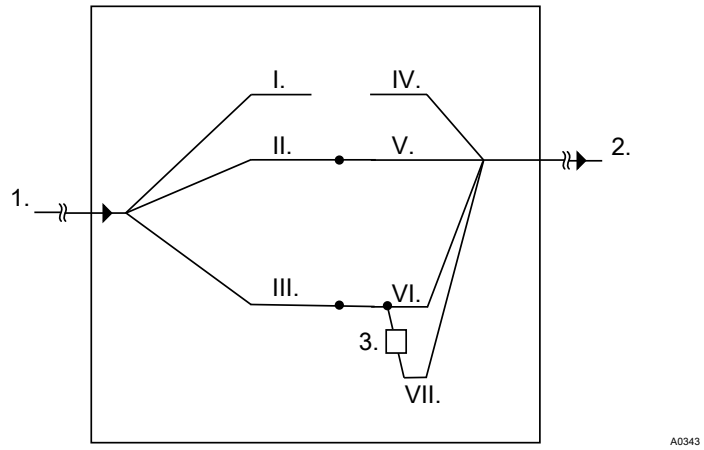


Fig. 5: Connection box 2 (IP 65)

1. Relay cable 3-pin Beta
2. Delta diaphragm rupture cable
3. Resistance 300 Ω

I. White (open)
II. Green (NC)
III. Brown (C)
IV. White (open)
V. Blue (signal)
VI. Black (ground)
VII. Brown (5 V)

Connecting the alarm relay of the external pump to the input of the diaphragm rupture alarm of the delta® solenoid metering pump. As soon as the external pump reports an error, this error is passed on to the delta® via the input of the diaphragm rupture alarm. The delta® solenoid metering pump stops and outputs a collective alarm.

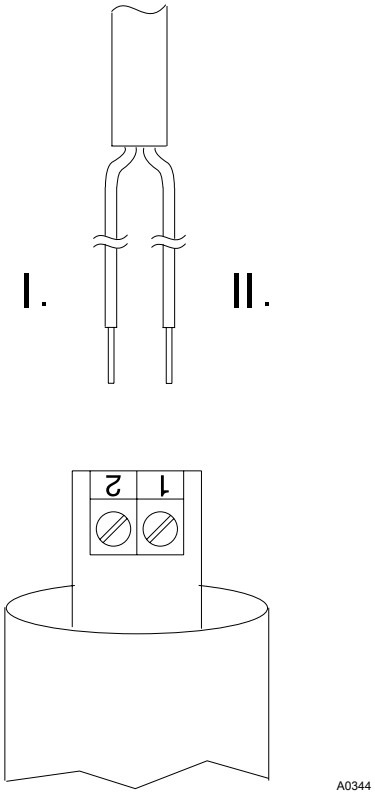


Fig. 6: Connecting the sensor or measuring transducer

I. White
II. Brown

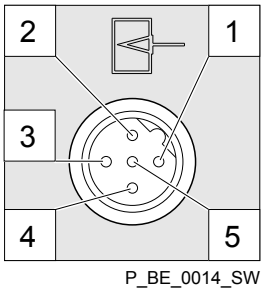


Fig. 7: Assignment on the control module

1 Free
2 Supply voltage approx. 25.5 Volt
3 Ground
4 Voltage input
5 Free

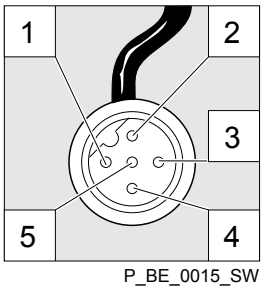


Fig. 8: Assignment on the cable / 2-wire external cable

1 Voltage input
2 Brown / supply voltage approx. 25.5 Volt
3 Free
4 White / voltage input
5 Free

3 Installation

NOTICE!

Mounting position and conditions

- Ensure that there is unimpeded access for operation
- Secure, low-vibration fixing
- Avoid direct sunlight
- Permissible ambient temperature at fixing position: -10 ... + 45 °C at max. 95% relative air humidity (non-condensing)

NOTICE!

Operating instructions for all components used

Possibility of material damage due to incorrect installation.

When installing the system also observe the operating instructions for all components used.

Read-off and operating position

- *Install the device at a favourable position for reading-off and operating (preferably at eye level)*

The control module delta® is fully integrated in the delta® solenoid metering pump and does not require separate installation.

3.1 Installation (hydraulic)

CAUTION!

- Observe the maximum permissible operating parameter for the entire installation of the measuring / control station (e.g. pressure, temperature, flow)
- In the process, observe the lowest maximum permissible operating parameter of the parts of the measuring / control and the sensors installed (see their operating instructions)
- Please also observe the operating instructions for controllers and fittings and any other component groups, such as sensors, sample water pumps ...
- Observe the flow direction of the measured water.
- One pressure reducer must be installed.
- Danger resulting from media under pressure.
- Before working with hydraulic parts of the measuring / control station, this must be depressurised in a controlled manner via the sampling cock.
- Wear protective goggles

Fittings

The bypass fitting (flow gauge) used depends particularly on the measured water, in some cases also from the measured variable or or the combination of the measured variables. The type DGMA with flow controller is always used for all clear water types and the type DLG III for contaminated water is also used for upstream flow controlling.

Hydraulic connection, pipework

With the DGMa, the hydraulic connection of the measured water is carried out using an 8 x 5 mm hose connection. A shut-off ball valve is installed before and after the bypass fitting. The optionally available measuring water filter is installed before the bypass fitting. Each of the bypass fittings have a mounted sampling cock.

3.2 Hydraulic test run after installation

A hydraulic test run of the measuring / control station is necessary after successful installation.

- The sampling cock must be closed! Otherwise measured water will escape
- Check all screw connections before the initial commissioning
- Open the shut-off ball valve on the inlet and outlet ends.
- The system must now be hydraulically tight. No fluid must leak out.

If fluid should leak out, the reason for this must be determined and eliminated.

3.2.1 Set the flow meter switching point

1. For testing, reduce the flow - the delta® Solenoid metering pump must indicate *'Pause'*
2. Check the screw connection for leaks.

The flow gauge DGMa:

Goal: Reduction in flow should switch - *'Pause'* on the delta® solenoid metering pump when the inlet is closed

1. Set the flow using the ball valve.
2. Set value: 40 l/h
3. Test value: 30 to 60 l/h (read-off from the top edge of the float)
4. Loosen the flow gauge.
5. Push the flow gauge upwards in the rail until the delta® Solenoid metering pump switches to *'Pause'* .
6. Push the flow gauge down far enough until *'Pause'* on the delta® solenoid metering pump has just cancelled.
7. Fasten the flow gauge.
8. For testing, reduce the flow

   ⇨ - the delta® Solenoid metering pump must switch to *'Pause'* .

3.3 Commissioning sensors

WARNING!

– Hazardous substances
– Danger resulting from contact, breathing in or other contaminations with / from substances or media
– Observe the safety data sheet of the substances / media used
– The system operator must ensure that these safety data sheets are available and that they are kept up to date

CAUTION!

- The sampling cock must be closed! Otherwise measured water will escape
- The measured water must be free of air bubbles to guarantee a reliable measurement and control! If air has to be carried along in the measuring water due to the process, the air must be discharged using a suitable technical method.
- Please also observe the operating instructions for controllers and fittings and any other component groups, such as sensors, sample water pumps ...

Preparation

1. Retighten all screw connections and check for leaks.
2. Check the position of all shut-off valves. The position of the shut-off valves must guarantee that the measuring / control station is tight and the flow of the measured water is given.
3. Commission the measuring / control station

3.3.1 Run-in time

A run-in time must be observed for the chlorine sensor. Depending on the sensor, this may vary between 1 hour and 24 hours. For this purpose, the respective sensor must be located in the measured water to be measured and connected electrically. This measured water must already contain the measured variables in a quality and quantity sufficient for the process.

The running-in of the sensors is described in the operating instructions of the sensor.

3.4 Switching of inductive loads

If you connect an inductive load, i.e. a consumer which uses a coil (e.g. an alpha motorised pump), then you must protect your controller with a protective circuit. If in doubt, consult an electrical technician for advice.

The RC member protective circuit is a simple, but nevertheless very effective, circuit. This circuit is also referred to as a snubber or Boucherot member. It is primarily used to protect switching contacts.

When switching off, the connection in series of a resistor and capacitor means that the current can fade out in a damped oscillation.

Also when switching on, the resistor acts as a current limiter for the capacitor charging process. The RC member protective circuit is highly suited to AC voltage supplies.

The magnitude of the resistance R of the RC member is determined according to the following equation:

$R=U/I_L$

(U= Voltage divided by the load // I_L = load current)

Units: R = Ohm; U = Volt; I_L = Ampere; C = µF

The magnitude of the capacitor is determined using the following equation:

$C=k * I_L$

k=0,1...2 (dependent on the application).

Only use capacitors of class X2.

Units: R = Ohm; U = Volt; I_L = Ampere; C = µF

If consumers are connected which have a high starting current (e.g. plug-in, switched mains power supplies), then a means of limiting the starting current must be provided.

The switching-off process can be investigated and documented using an oscilloscope. The voltage peak at the switch contact depends on the selected RC combination.

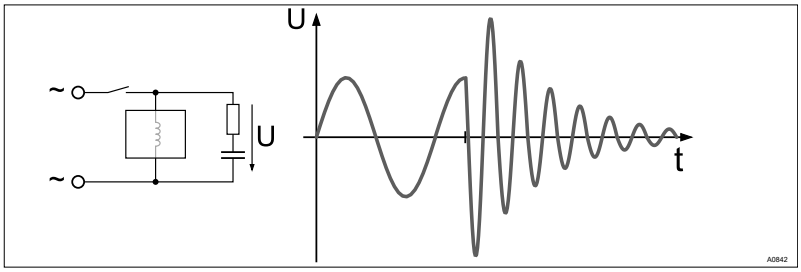


Fig. 9: Switching-off process shown on the oscillogram.

WARNING!

Mains voltage

Possible consequence: Fatal or very serious injuries

If mains voltage is connected to one of the terminals XR1-XR3 or XP, then no protective low voltage may be connected to any other of these terminals (SELV).

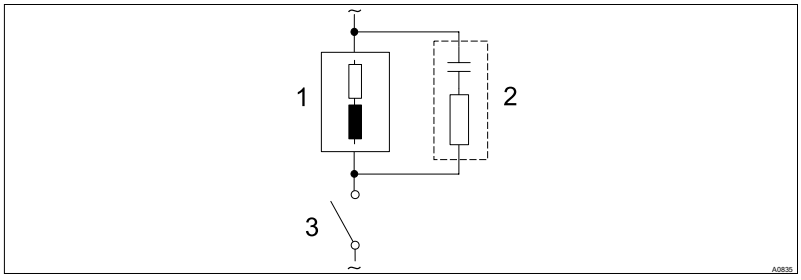


Fig. 10: RC protective circuit for the relay contacts

Typical AC current application with an inductive load:

- 1) Load (e.g. alpha motorised pump)
- 2) RC-protective circuit
  - Typical RC protective circuit at 230 V AC:
  - Capacitor *[0.22µF/X2]*
  - Resistor *[100 ohm / 1 W]* (Metal-oxide (pulse-resistant))
- 3) Relay contact (XR1, XR2, XR3)

4 Commissioning

WARNING!

Run-in time of sensors

This can result is hazardous incorrect metering

Take into consideration run-in times when commissioning

- Correct measuring and metering is only possible if the sensor is working perfectly
- It is imperative that the run-in times of the sensors are adhered to
- The run-in times should be allowed for when planning initial operation
- It may take a whole working day to run-in the sensor
- Please read the operating manual for the sensor

4.1 Initial Commissioning

The control module delta® has the same language settings as the control module delta® connected to the delta® solenoid metering pump.

4.1.1 Selecting the operating language

Setting the operating language is carried out via the setting menu of the connected delta® solenoid metering pump.

4.1.2 Selection of the Measured Variable and Measuring Range

WARNING!

Incorrect metering due to incorrect metering range

Possible consequence: Fatal or serious injuries

- **The measuring range of the sensor is essential for the measuring range!**
- If the assignment of the measuring range is modified, the settings must be checked in all menus
- If the assignment of the measuring range is changed, the sensor must be recalibrated

5 Operating diagram/ Display Symbols

Operation of the delta® solenoid metering pump with regulated solenoid drive optoDrive®

The delta® solenoid metering pump with regulated solenoid drive optoDrive® operating instructions are available for basic operation of the delta® solenoid metering pump. The control module delta® operating instructions describe the advanced operating options of the control module delta® used in conjunction with the delta® solenoid metering pump.

Access to the settings for the control module delta®

To gain access to the settings of the control module delta® you must stop the delta® solenoid metering pump using key . The symbols and appear in the display. Only now do you have access to the settings for the control module delta®.

5.1 Overview of device / operating elements

Contents of the LCD display

The content of the LCD display can vary depending on the Identcode of the delta® solenoid metering pump.

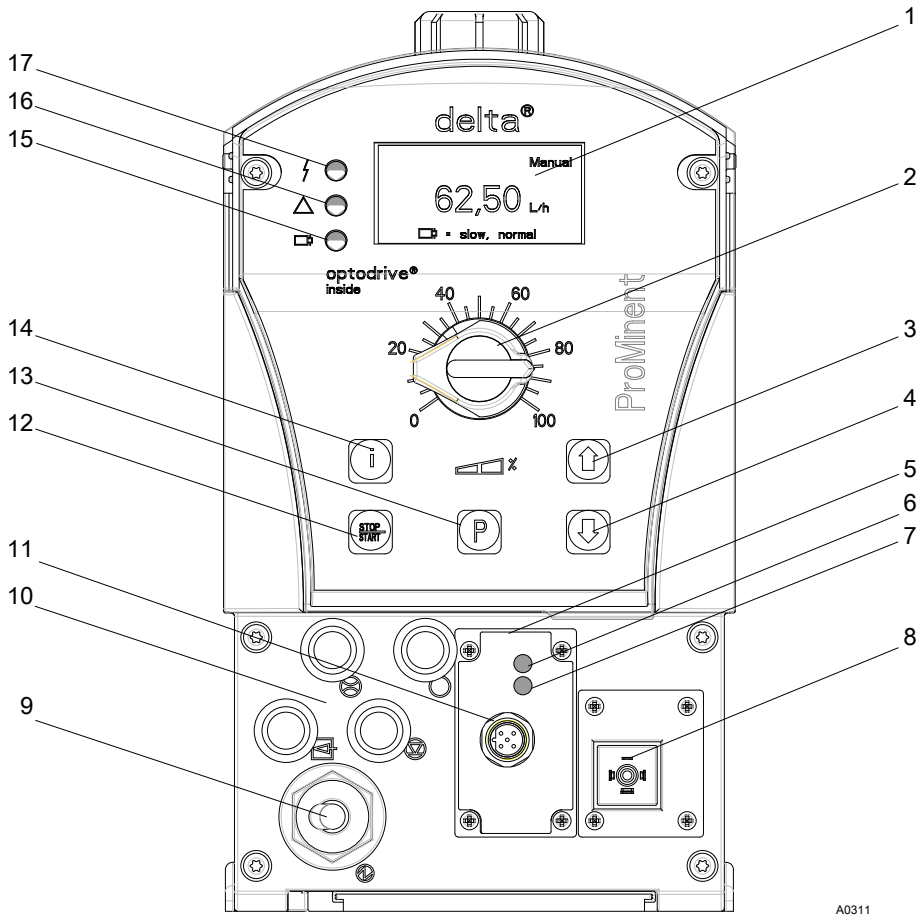
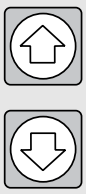


Fig. 11: Operating elements of the delta® solenoid metering pump

1 LCD display
2 Stroke length adjustment knob
3 UP key
4 DOWN key
5 Control module delta®
6 Device LED-LED
7 Connecting LED
8 Relay insert (optional)
9 Mains power
10 Terminal for the additional functions
11 Sensor connection
12 STOP / START key
13 P key
14 i key
15 Operating indicator (green)
16 Warning indicator (yellow)
17 Fault indicator (red)

5.1.1 Key functions

Key	Operation	In continuous displays (Operation)	In setting mode (Settings)
STOP / START key 	briefly pressed (0.2 - 1 s)	stop pump start pump	stop pump start pump
P key 	briefly pressed (0.2 - 1 s)	start batch (only in operating mode "Batch")	Confirm entry - Jump to next menu option or in the continuous display
	2 s pressed	go to setting mode	----
	3 s pressed	----	Return *[ESCAPE]* to the continuous display
i key 	briefly pressed (0.2 - 1 s)	toggle between the continuous displays	----
	long pressed (> 1 s)	go to the second level of the continuous display	----
Arrow keys UP or DOWN 	individually pressed (until double arrows appear)	change directly adjustable variables	select another setting. change individual figure or number. at the upper end of a selection, effect similar to the ESC key
	simultaneously pressed	suction (in continuous display "stroke frequency")	----

5.2 Continuous display add-on, control module delta®

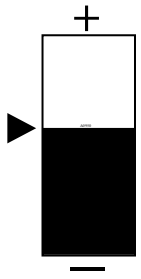


Fig. 12: Setpoint symbol (12x24 pixels)

In the main display, extra displays for the control module delta® can be inserted in addition to the delta® solenoid metering pump displays.

The control module delta® displays are the values for the setpoint and actual values of the control module delta®.

- I. Setpoint (of the control module delta®) in very large portrayal (12x24 pixels) in the selected units (ppm, pH or mV)
- II. Actual value *[i]* (Input value for the control module delta®) in very large portrayal (12x24 pixels) in the selected units (ppm, pH or mV)
- III. Existing continuous displays of the delta® solenoid metering pump

Format for the main displays:

- = Setpoint
- Chlorine: XXX.YY ppm
- pH: XX.YY pH
- Redox: XXX mV

Display: Only the measured value is displayed = Actual value

Display: Measured value with a in front of it = Setpoint

5.3 Secondary display control module delta®

Both the setpoint value and the current actual value of the control module delta® are displayed In the secondary display.

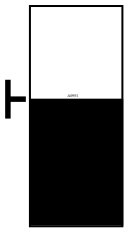


Fig. 13: Setpoint symbol (8x8 points)

- I. Setpoint (of the control module delta®) in the selected units (ppm, pH or mV)
- II. Actual value *[i]* (input value of the control module delta®®) in the selected units (ppm, pH or mV)
- III. Current value (input value of the control module delta®) in xx.xx mA
- IV. Existing continuous displays of the delta® solenoid metering pump

Format for the secondary displays

- (= Setpoint):
- Chlorine: XXX.YY ppm
- pH: XX.YY pH
- Redox: XXX mV

Display: Only the measured value is displayed = Actual value

Display: Measured value with a in front of it = Setpoint

5.4 Activate/deactivate control module delta®

The following menu is used to place the delta® solenoid metering pump in control module delta® operating mode.

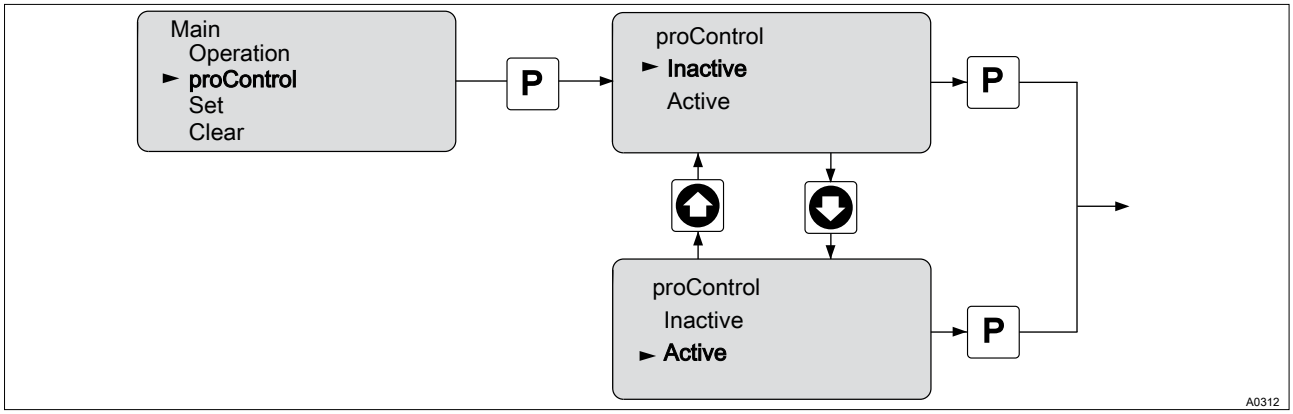


Fig. 14: Activate/deactivate control module delta®

If the control module delta® is *'switched'* to active then regulation or control of the delta® solenoid metering pump is carried out by the control module delta®. This independent of which operating mode the delta® solenoid metering pump was previously in. If the control module delta® is switched to *'inactive'*, then the delta® solenoid metering pump returns to its original operating status.

In the inactive state, no error or warning messages are transferred to the delta® solenoid metering pump.

If the control module delta® was *'switched'* to active then the symbol appears in the operating indicator of the delta® solenoid metering pump to signal that the control module delta® is working in active mode. At the same time, the *'Connection LED'* switches to green in control mode.

The text ***'↑ Raise'*** or ***' ↓ Lower'*** appears in the operating mode *[display text]*.

5.5 Selection of the Measured Variable and Measuring Range

The control module delta® has a 4 - 20 mA input. A sensor can be connected to this input. The control parameter, the menu navigation and the continuous display are sensor specific.

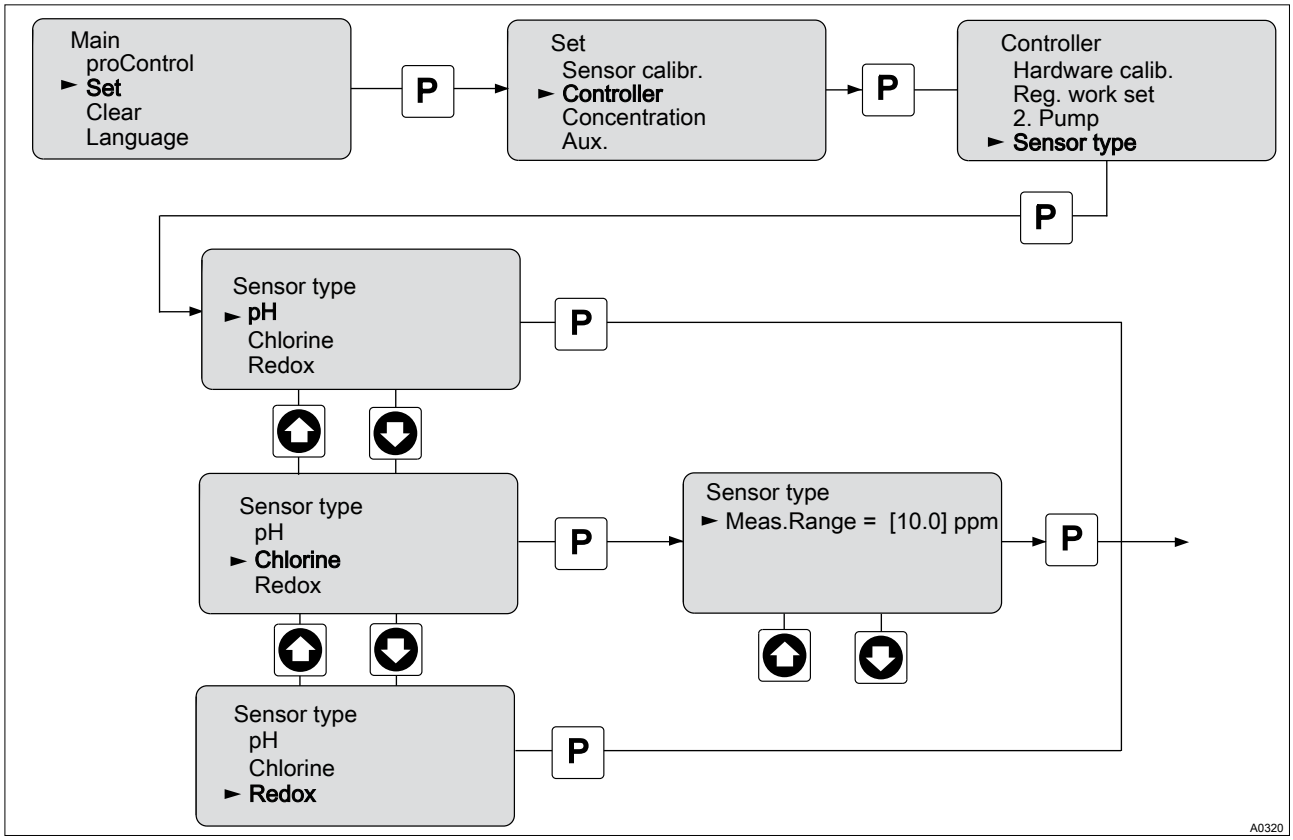


Fig. 15: Selection of the Measured Variable and Measuring Range

Using the menu item *'Sensor Type'* , you are able to select the respective sensor. The different versions or measurement ranges of the sensors can also be selected in this menu item.

Sensors	Types
Redox	Only one sensor version is operated with the measuring transducer "RhV1". ■ 1,000 mV ➡ 20 mA ■ 0 mV ➡ 4 mA
Chlorine	■ Measuring range from 0 ... 20 ppm
pH	Only one sensor version is operated with the measuring transducer "pHV1". ■ -500 mV ~ pH 0 ➡ 20 mA ■ 500 mV ~ pH 14 ➡ 4 mA

5.6 Setting the limit values

Hysteresis

An hysteresis is installed here so that when in the range of the limit value of the control module delta®, switching is not constantly carried out between the control and base load metering.

The hysteresis is approx. 2% of the measuring range:

– *('Limit value up' minus 'Limit value down') * 2 %*

You have the possibility of setting the permissible value for the controlling for each sensor type. When a measurement value lies outside this limit value, the control will be discontinued. Basic load control is only active in this case.

If the measurement value lies outside the limit value than a warning is reported and the symbol is displayed in the status display of the delta® solenoid metering pump.

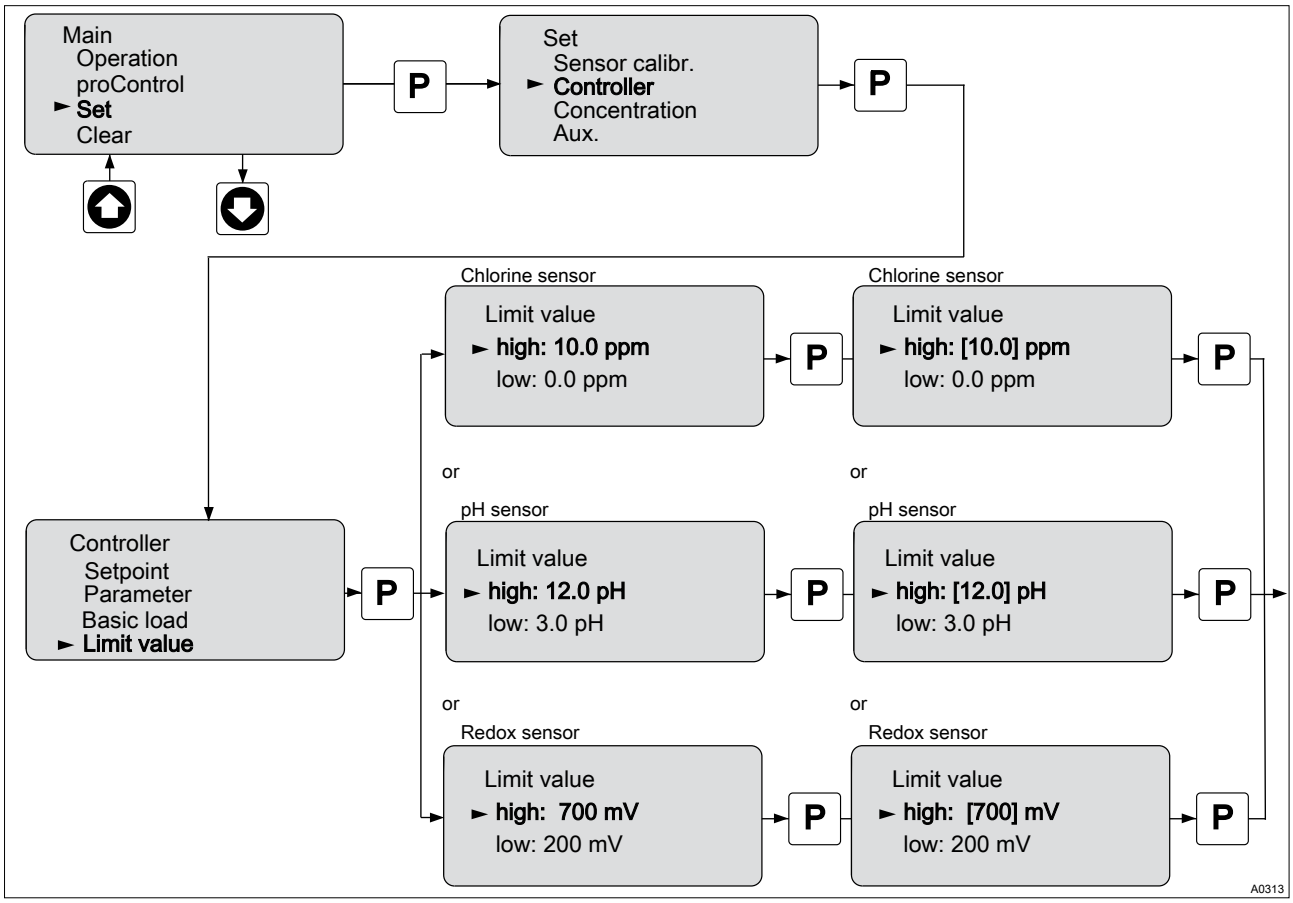


Fig. 16: Setting the limit values

Sensor	Factory setting		Settings
	top	bottom	
Chlorine	0 ppm	20 ppm	0 ppm up to the maximum value of the sensor. In increments of 0.1 ppm
pH	0 pH	14 pH	0 pH to 14 pH. In increments of 0.1 pH
Redox	0 mV	1,000 mV	0 mV to 1,000 mV. In increments of 1 mV

5.7 Setting the basic load

Basic load

It may be necessary to meter the feed chemical with a basic load.

You can switch the basic load control on or off using this menu. You switch the basic load on by entering a percentage proportion of the maximum set value.

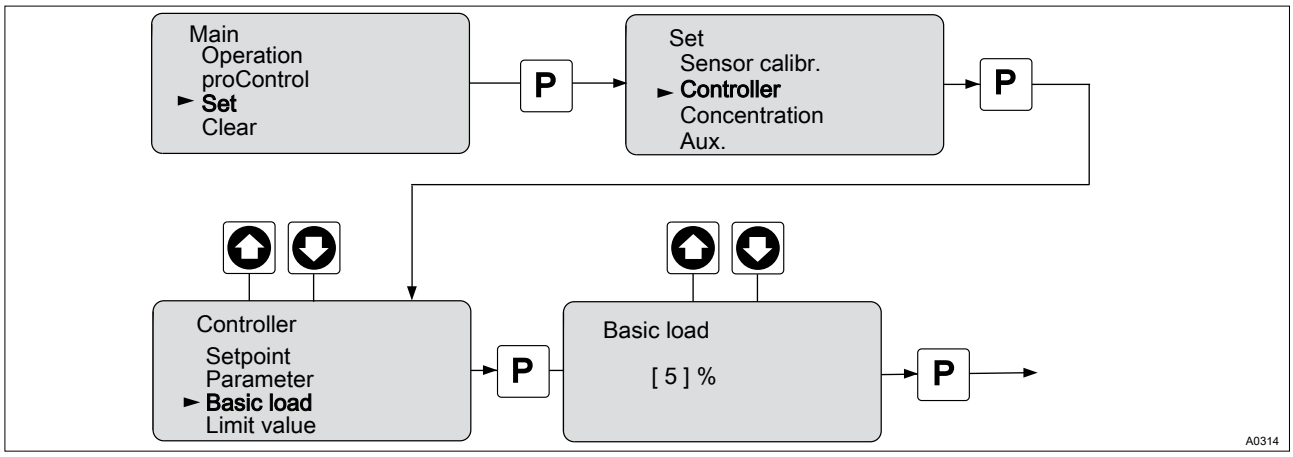


Fig. 17: Setting the basic load

Basic load	Settings
Setting values	0 % to 100 % in increments of 1 %. Start value of 0 %. 0 % = Basic load off.

5.8 Setpoint adjustment

The setpoint can be set from this menu. In the continuous display a ▮ is placed in front of the setpoint display value.

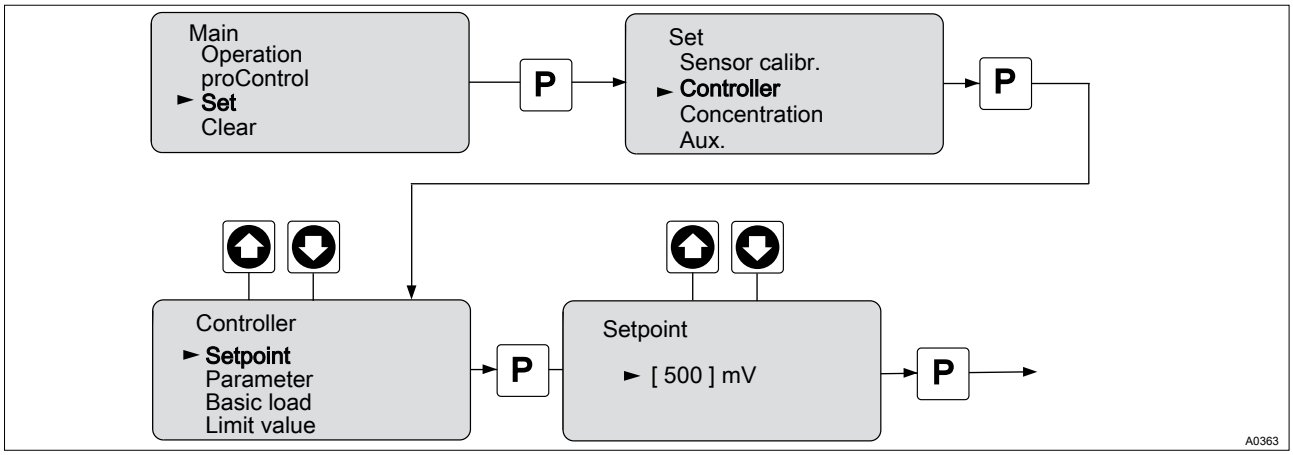


Fig. 18: Setpoint adjustment

Setting		Possible values			
Display	**Starting value**	**Increment**	**Lower value**	**Upper value**	**Remarks**
mV	500 mV	1 mV	0 mV	999 mV	Redox
pH	pH 7.00	pH 0.01	pH 0.00	pH 14.00	
Chlorine	5.00 ppm	0.01 ppm	0 ppm	20 ppm	

The upper and lower value can only be set within the range of the set limit values, see *Chapter 5.6 'Setting the limit values' on page 23*. The values in the table show the maximum possible range.

5.9 Checkout time adjustment

Monitoring of the control path

The checkout time monitors the control path. The checkout time mechanism permits detection of possible defective sensors.

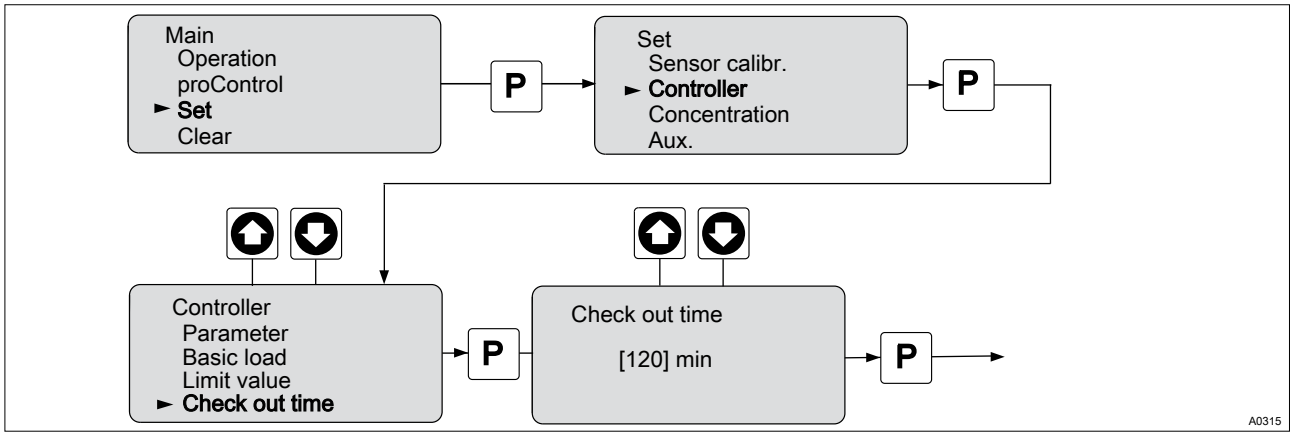


Fig. 19: Checkout time adjustment

Determining the dead time and setting the checkout time

Each control path has a dead time. The dead time is the time, which the control path requires to detect a change or addition of metered chemicals using its own instrumentation.

You must select the checkout time so that it is greater than the dead time. You can determine the dead time, by operating the metering pump in manual mode and, for example, metering acid.

NOTICE!

Dead time determination

You should only determine the dead time if the current process cannot be negatively influenced by manual metering.

You must determine the time, which the control path (i.e. the entirety of controllers, sensors, measurement water, in-line probe housings, etc.) requires to detect a first change in the measured value starting from the beginning of metering. This time is the *'dead time'*. A safety margin, e.g. 25%, must be added to this dead time. You must allocate an appropriate safety margin for your own particular process. If after the checkout time has elapsed, the setpoint is not reached, see *Chapter 5.8 'Setpoint adjustment' on page 25*, the metering pump switches to base load metering.

If the control module delta® has not reached the defined thresholds once the checkout time has elapsed, then the control module delta® switches over to base load operation. In the higher-level system, in this case the delta® solenoid metering pump, a warning is emitted and the symbol !🕒 is output to the status display of the delta® solenoid metering pump.

The threshold value equals 90 % of the setpoint. This value (90 % of the setpoint) must be achieved within the checkout time.

Settings	Comment
Settings	1 min to 999 min in 1 min steps
Starting value	Off = 0 min)

Resetting after activation of the checkout time

If the control module delta® is in *'checkout time'* mode, then base load metering is active. However it you want to return to normal control mode, then the control time must be restarted. To restart the control time, the STOP key must be pressed.

5.10 Setting the control module delta®

The controlled system can be adjusted via this menu. The feed chemical that will be metered must be selected, e.g. "raise" or "lower".

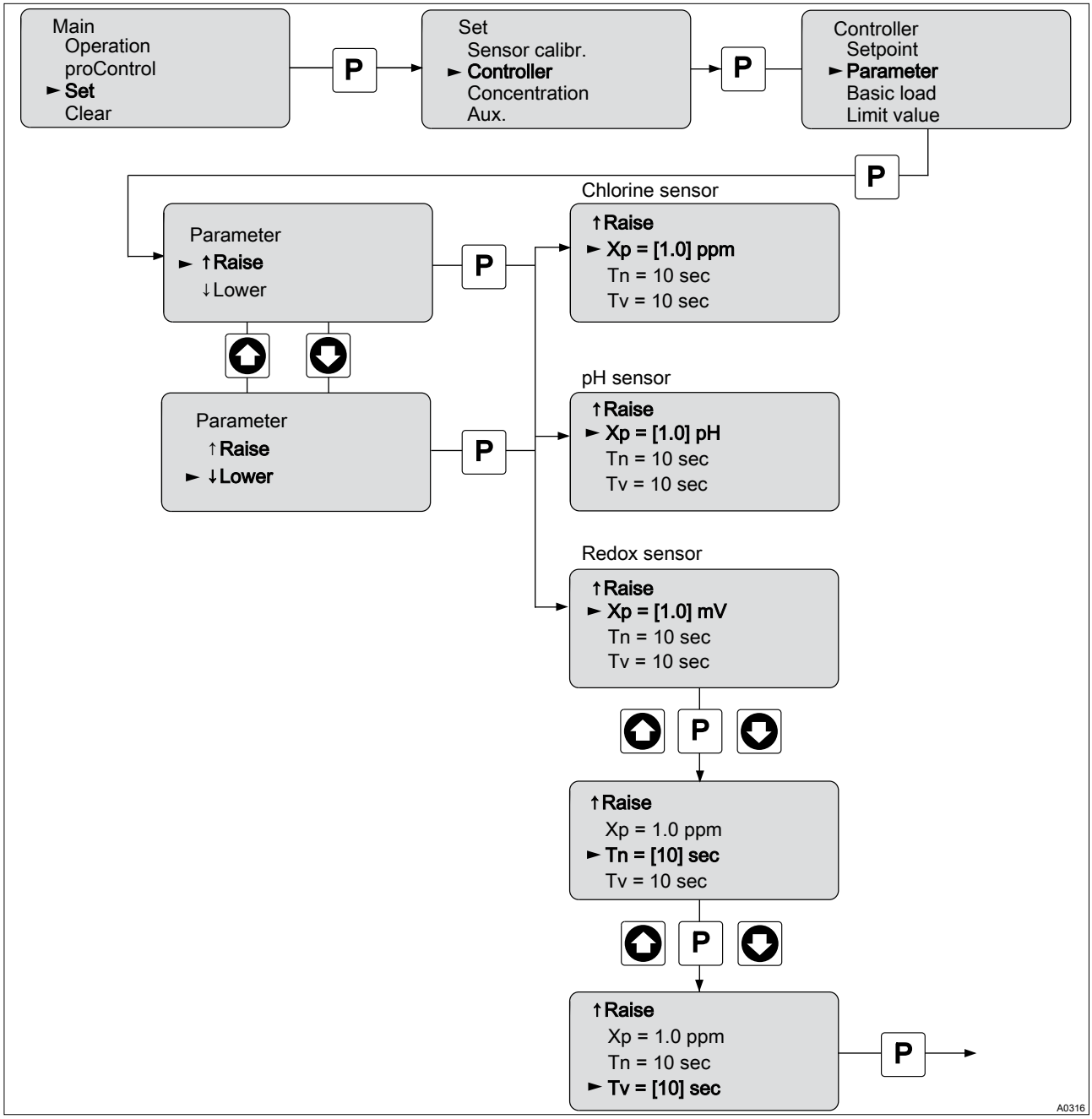


Fig. 20: Setting the control module delta®

Then the parameter for the controlled system can be adjusted. These are:

- X_p ➡ KP (reciprocal proportional coefficient)
- T_N ➡ I-controller reset time in seconds
- T_V ➡ Derivative time of D-control in seconds

T_N	T_V	Controllers
0	0	P controller
>0	0	PI controller

T_N	T_V	Controllers
0	>0	PD controller
>0	>0	PID controller

Sensor	Parameter	Comment
Chlorine	Set point	0.01 ppm to the upper limit of the measuring range. In increments of 0.01 ppm. Start value: 50 % of the measuring range
	X_p	0 to measuring range in increments of 0.01 ppm. Start value: 10 % of the measuring range
	T_N	0 s to 9999 s in increments of 1s. Start value 0 s.
	T_V	0 s to 9999 s in increments of 1s. Start value 0 s.
pH	Set point	pH 0,01 pH to 14 pH in increments of 0.01 pH. Start value 50 % of measuring range
	X_p	0 pH to measuring range in increments of 0.01 pH. Start value: 10 % of the measuring range
	T_N	0 s to 9999 s in increments of 1s. Start value 0 s.
	T_V	0 s to 9999 s in increments of 1s. Start value 0 s.
Redox	Set point	0 mV to 1,000 mV in increments of 1 mV. Start value: 50 % of the measuring range
	X_p	0 mV to 1,000 mV in increments of 1 mV. Start value: 10 % of the measuring range
	T_N	0 s to 9999 s in increments of 1s. Start value 0 s.
	T_V	0 s to 9999 s in increments of 1s. Start value 0 s.

5.11 Factory settings of the control module delta®

The factory settings that are loaded always refer to the current sensor used (pH, Redox or chlorine).

If the request is acknowledged with *'yes'* , then the default values for the characteristic curve data, measurement range, set value and control parameters can be loaded.

Default values for the characteristic curve data

As the parameters for the characteristic curve are default values, the sensors must be calibrated.

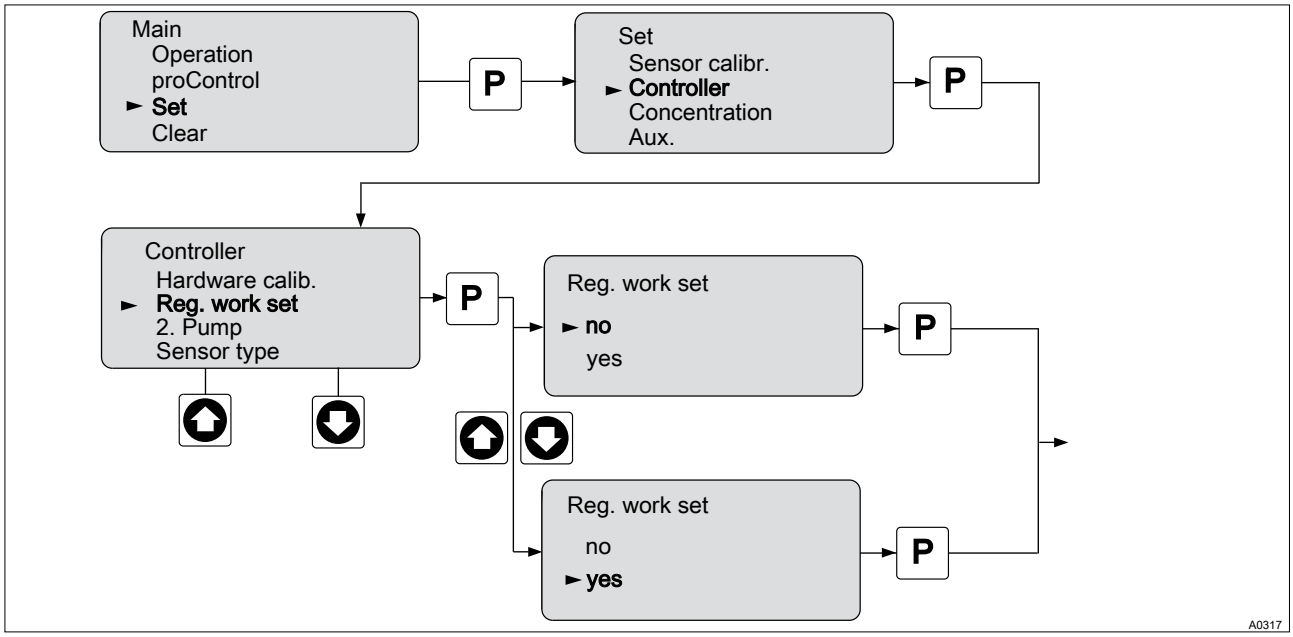


Fig. 21: Factory settings of the control module delta®

Parameter	Value			Comment
	Chlorine	pH	Redox	
Measuring range bottom	0 ppm	0 pH	0 mV	
Measuring range top	10 ppm	14 pH	1000 mV	
Set point	50 % of the measuring range			
Set point	50 % of the measuring range			
Parameter X_p	10 % of the measuring range			
Parameter T_N	0 sec.			
Parameter T_V	0 sec.			
Characteristic curve	Default			Default parameter for the characteristic curve

5.12 Setting up "Two pump operation"

The control module delta® can also be operated in two pump operation. To do this different parameters can be entered for the second pump.

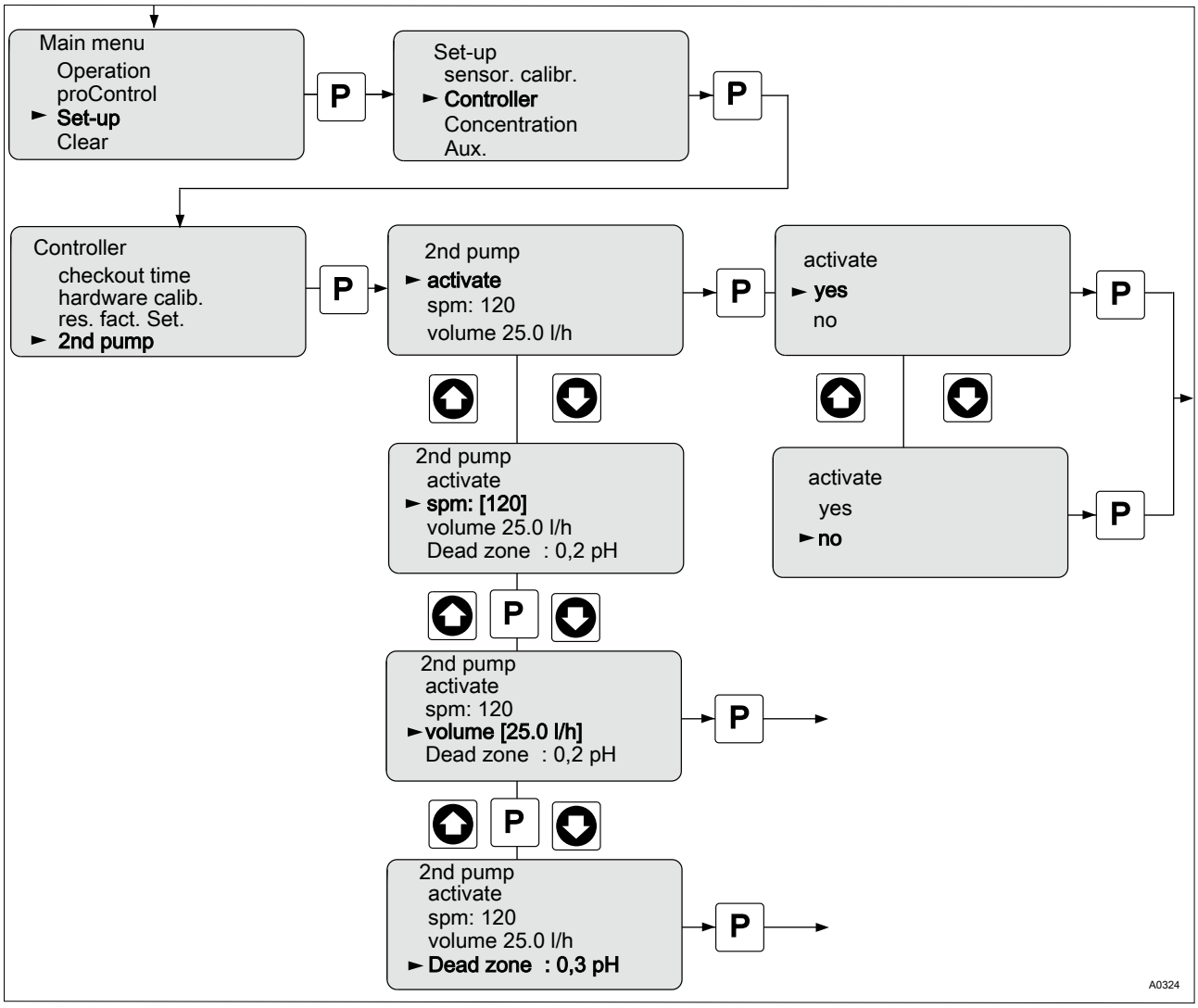


Fig. 22: Setting up "Two pump operation"

The control module delta® now directly controls the second pump via the relay output of the delta® solenoid metering pump.

Settings	Comment
Activate	The control is only active if the control relay in the delta® solenoid metering pump has been activated.
Strokes/min.	Pump stroke rate in strokes/minute. Maximum 180/min.
Volume	Volume in l/hour
Dead zone	During switching over of metering from pump 1 to pump 2 there is an interval during which no pump is metering. This interval is the dead zone.

5.12.1 Setting the controller pulse of the second pump

NOTICE!

Calibrating the delta® solenoid metering pump

To enable the second pump to be controlled by the delta® solenoid metering pump, the delta® solenoid metering pump must have been calibrated. Notes for this purpose: Operating instructions "Solenoid metering pump delta® with controlled solenoid drive opto-Drive®", chapter *'Settings for the function "Calibration" (CALIBRATION menu)'*

Depending on the pump type that should be connected to the control relay of the delta® solenoid metering pump, it is necessary to set the controller pulse accordingly. The controller pulse can be a growing or a falling pulse of the controller relay. Take note that this menu can only be called up when a control relay has been installed in the delta® solenoid metering pump.

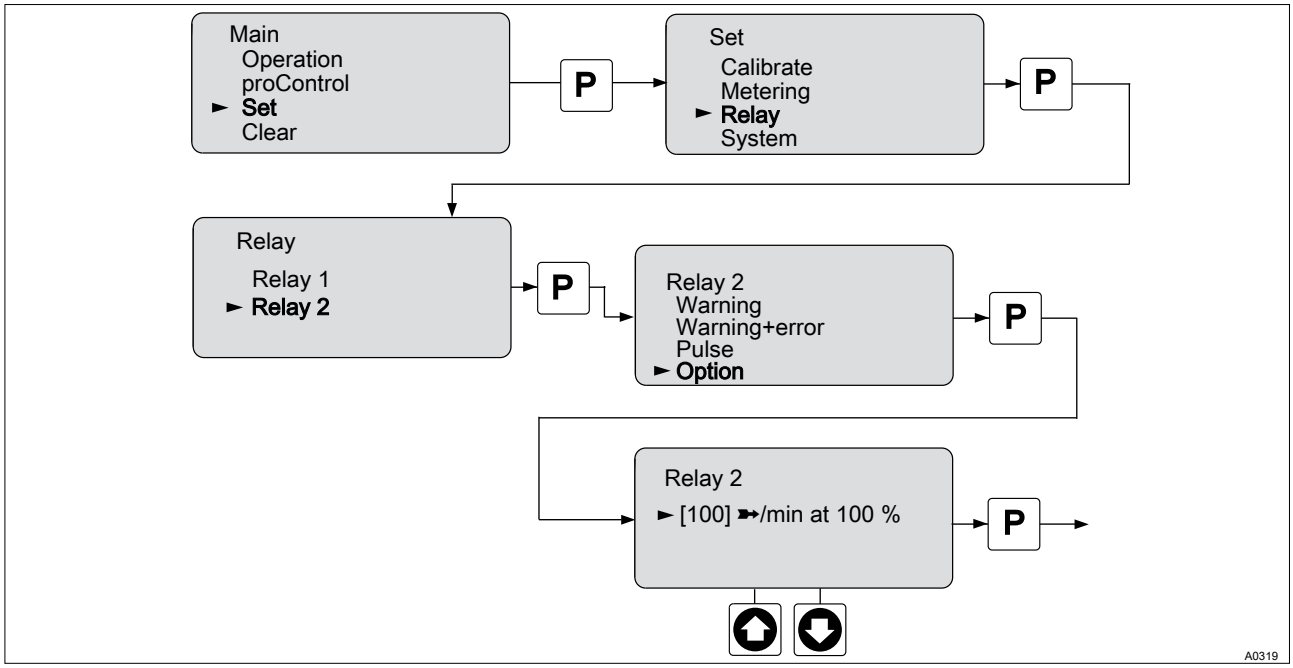


Fig. 23: Menu for adjusting the controller pulse of the second pump

5.13 Use of the current output of the delta®®

It is possible, using the current output of the delta® to output the current which is measured at the control module current input. To enable this function, the control relay with current output must be installed in the delta®.

Hence this menu can only be called in the display if a control relay with current output is installed in the delta®.

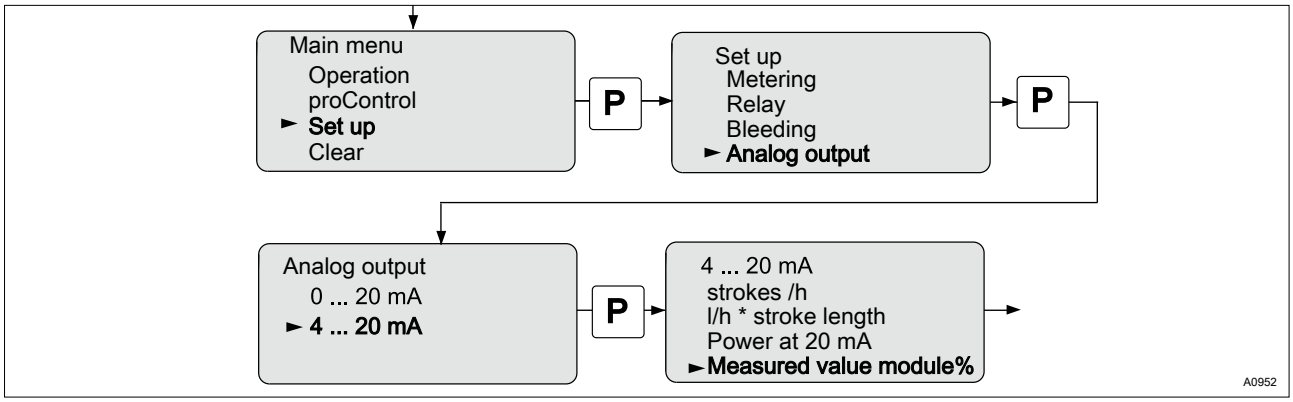


Fig. 24: Current output activation menu

6 Measured variables control module delta®

WARNING!

Danger of incorrect metering

This can result in hazardous incorrect metering

During initial commissioning, the measured variable and the measuring range of the sensor must be set prior to calibration.

During all work on or with the sensors, also observe the relevant technical documentation of the sensors.

Sensor measuring range

You must match the controller measuring range to the measuring range of the chlorine sensor used.

Measured variable	Default measuring range
Chlorine	10 ppm
The measuring ranges can be continuously adjusted from 0.5 ... 20 ppm.	

pH Measured variable	Typical measuring range
Measuring range	0 ... 20 mA
Display range	At least pH -1.45 … 15.45
Reference temperature	+ 25 °C
Resolution	pH 0.01

Redox measured variable	Typical measuring range
Measuring range	0 mV ... + 1000 mV
Resolution	1 mV

6.1 Calibrating the sensor for chlorine

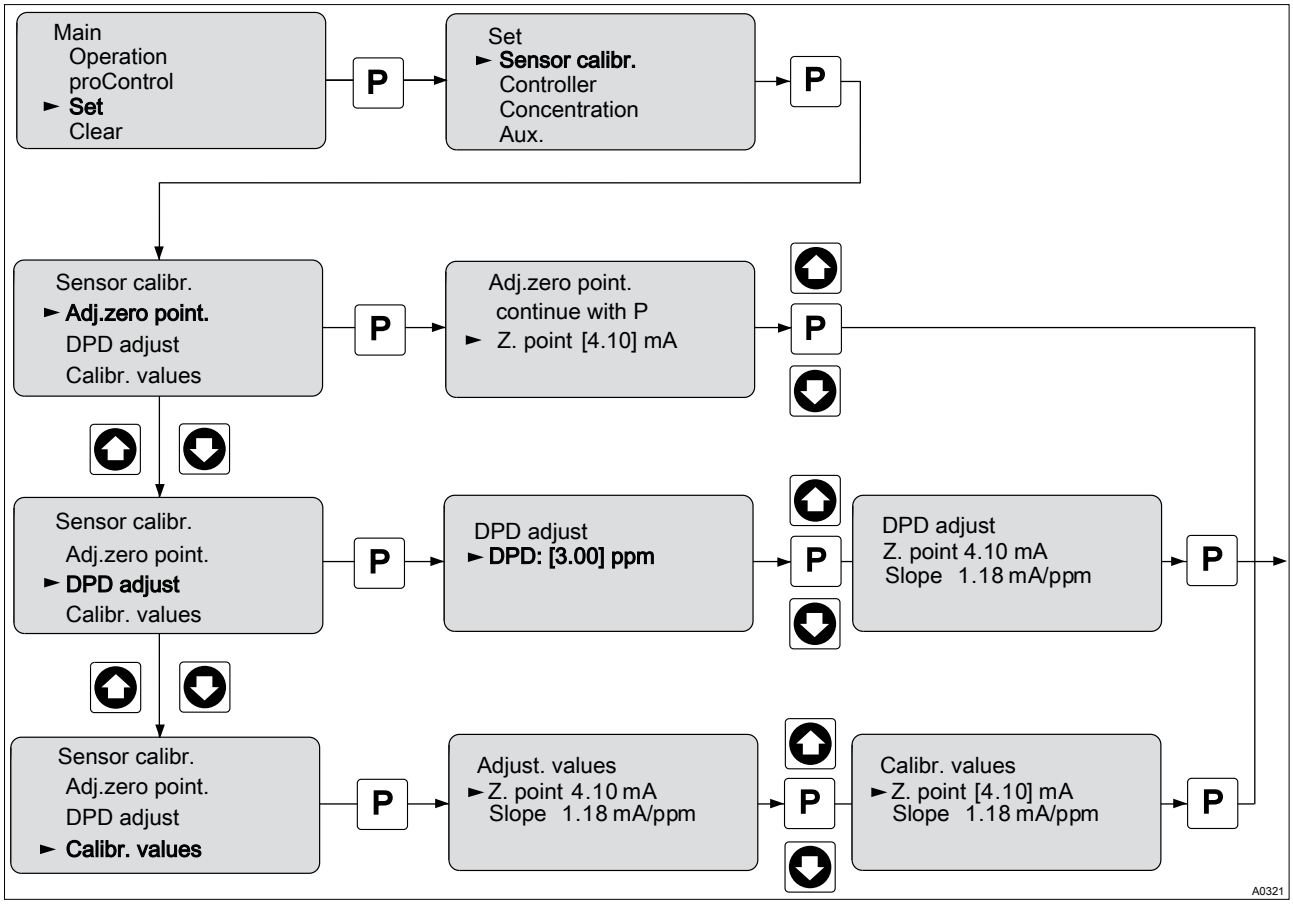


Fig. 25: Calibrating the sensor for chlorine

6.1.1 Preparing the calibration of the sensor for chlorine

CAUTION!

Correct sensor operation / Run-in time

Damage to the product or its surroundings

- Correct measuring and metering is only possible if the sensor is working perfectly
- Please read the operating manual for the sensor
- Please also read the operating manuals for the fittings and other components used
- It is imperative that the run-in times of the sensors are adhered to
- The run-in times should be allowed for when planning initial operation
- It may take a whole working day to run-in the sensor

Necessity of calibrating the zero point

Calibration of the zero point is not generally necessary. Calibration of the zero point is only necessary if the sensor is operated at the lower limit of the measuring range or if the 0.5 ppm sensor version is used.

During the calibration, the control module delta® sets the actuating outputs to *'0'*. The mA standard signal outputs are frozen. The reading frozen at the start of calibration is suggested as a DPD value. The DPD value can be set using the arrow keys.

6.1.2 Calibration of Zero Point and Gradient

NOTICE!

Prerequisites for correct calibration of the sensor gradient

- The DPD method required by the metering medium employed will be used
- The run-in time for the sensor has been adhered to
- There is permitted and constant flow at the flow gauge
- There is temperature equalisation between the sensor and the sample water
- There is a constant pH value in the permitted range

Calibrating the chlorine sensor: slope

The sensor is fitted, flushed with sample water and connected electrically to the control module delta® and run-in.

There has to be adequate metering medium in the sample water for calibration (> 2% of the measuring range of the sensor).

Remove sample water directly at the measuring point and using an appropriate reference method (e.g. DPD, titration etc.), determine the content of metering medium in the sample water in *'ppm'*. Enter this value in the control module delta® as follows:

1. Select the calibration menu *[Sensor Calibration]*. The press the button P
2. Take a sample of water and perform a reference measurement immediately.
3. Select the unit *'DPD adjust'* to be calibrated using the buttons ⇩ or ⇧
4. The press the button P
   ⇨ The current reading will now be frozen.
5. When necessary, adapt the ppm value determined using keys ⇩ and ⇧
   ⇨ The ppm value of the sensor shown in this display now corresponds to the reading in *'ppm'*.
6. The press the button P
   ⇨ The display now shows the value determined for the zero point and gradient. Refer to the Error Message table should an error be displayed

Necessity of calibrating the zero point

Calibration of the zero point is not generally necessary. Calibration of the zero point is only necessary if the sensor is operated at the lower limit of the measuring range or if the 0.5 ppm sensor version is used.

Calibrating the chlorine sensor: Zero point

A container with water, which is free of additives that could falsify the measured result, is needed for calibration. Immerse the sensor removed that is still connected to the control module delta® electrically into this water. Stir the sensor around the water for approx. 5 minutes until the reading on the on the control module delta® is displayed steady and close to *'0'* .

1. Select the calibration menu *[Sensor Calibration]*. The press the button P
2. Select the unit *'Adj. zero point'* to be calibrated using the buttons ⇩ or ⇧
3. Continue with P
   ⇨ A prompt is shown in the display
4. Adapt the *' Zero point'* value displayed during the calibration using the buttons ⇩ or ⇧ and when necessary, accept the value using the button P
   ⇨ Refer to the Error Message table should an error be displayed

NOTICE!
Then definitively calibrate the gradient with a suitable reference method (e.g. DPD. titration etc.).

6.2 Sensor pH calibration

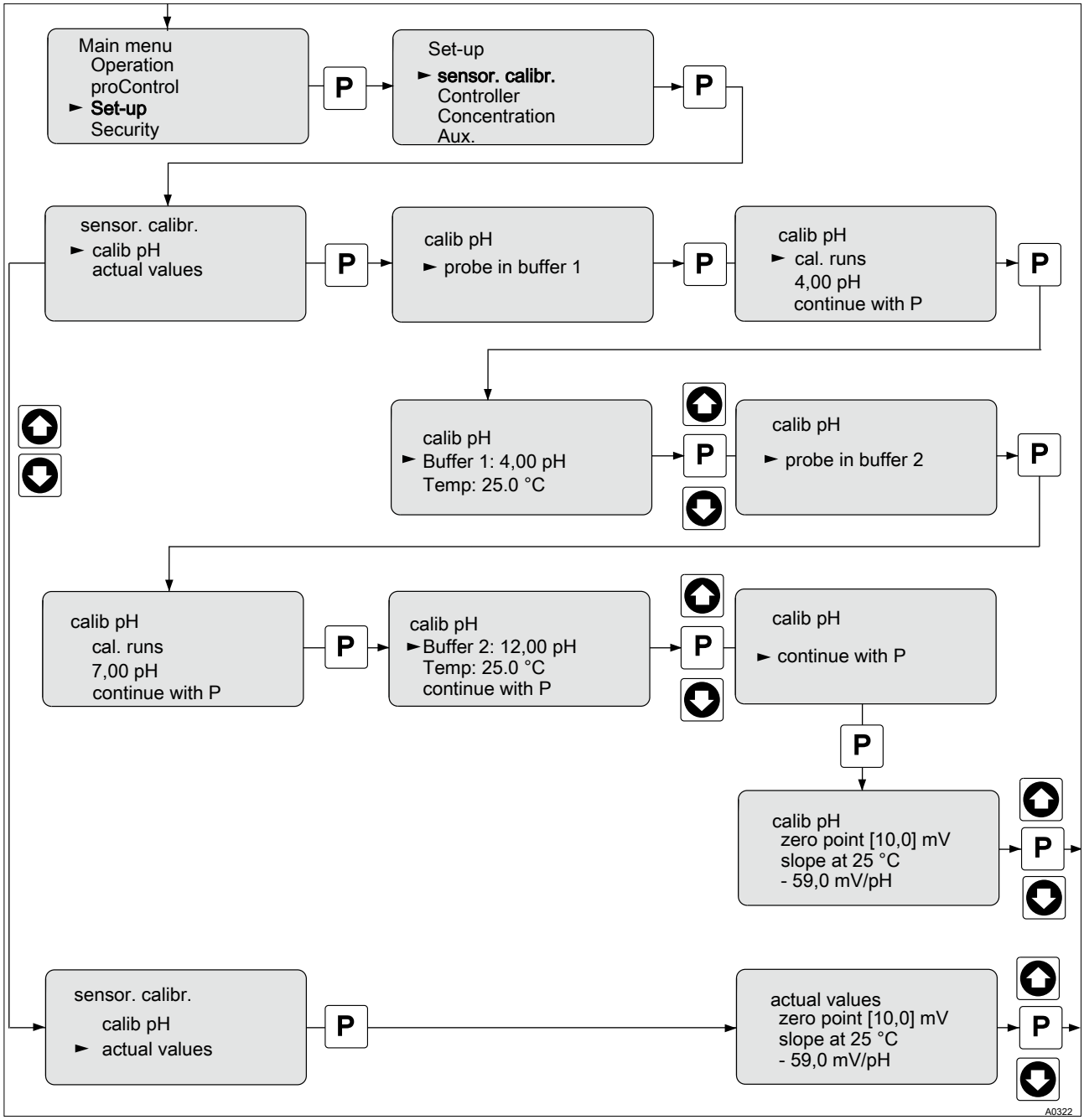


Fig. 26: Sensor pH calibration

6.3 Calibrating the sensor for Redox

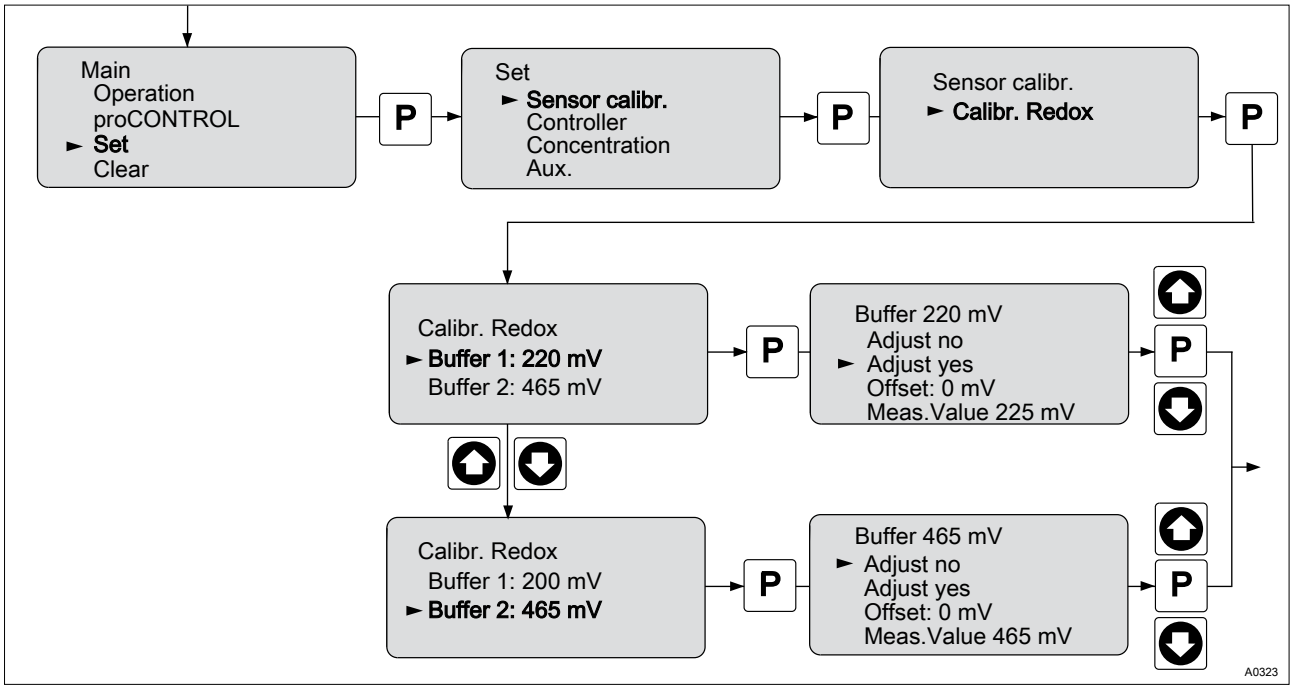


Fig. 27: Calibrating the sensor for Redox

7 Troubleshooting

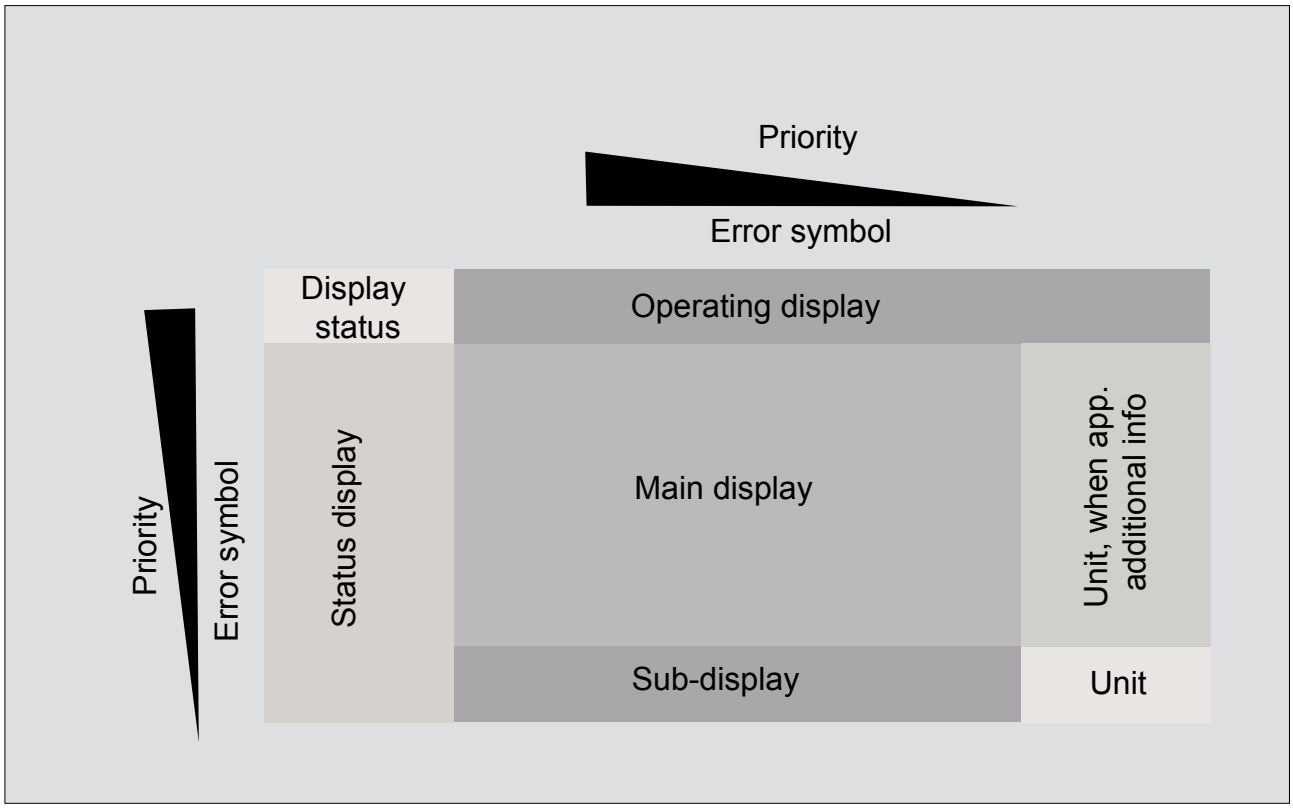


Fig. 28: Overview of the operating indicator of the delta® solenoid metering pump

	Operating indicator control module	Standard indicator in control mode. If the control module delta® is not activated, then the symbol is not displayed.

7.1 "Fault" status display

In the inactive state of the control module delta®, no error messages or warning messages are transferred to the delta delta® solenoid metering pump.

The symbol will be displayed in the status display. Then the respective error symbol flashes in the main display. If several errors occur simultaneously, these will be displayed one after another.

Photo	Error	Description
	Control module	In the control module delta®, an error has been detected ■ EEProm error ■ Data error ■ When in the field *'Status display'* the symbol is displayed additionally then an error has been detected when calibrating the Redox sensor (deviating from the buffer value >+/- 40 mV)
i < 4 mA	Control module	A value less than 4. mA has been measured at the voltage input
i > 20 mA	Control module	A value greater than 20. mA has been measured at the voltage input
20 mA!	Control module	The 20 mA interface has been put in an error state. ■ Short circuit ■ Overcurrent (> approx. 50 mA) ■ Counter voltage (< 0 V)
	Control module missing	Option module is missing or communication with the option module cannot be established If the option module "Control module" has been switched into the active state, then the delta® solenoid metering pump expects the login of the control module delta®. If no login takes place then this symbol will be displayed

7.2 Error control module delta®

Error	Description
Hardware error	A hardware error has been detected ■ Access error to EEProm ■ Overcurrent / undercurrent sensor ■ Communication error
Software / data	Configuration values cannot be used, e.g. the control parameters (X_P, T_V, T_N) are all set to zero.

7.3 Status display Warning

The display flashes The bottom line gives an explanation of the warning. In this condition the control module delta® is still operational.

Image	Warning	Description
	Control module	A warning from the control module delta®) has been detected ■ Feedforward control error (control module delta®) continues to work nevertheless) ■ Overflow of the control module output value (control module delta®) continues to work nevertheless) ■ A communication error between the pump ® and control module delta® has been detected. The connection LED illuminates in red.
	Checkout time	A warning from the control module delta®) has been detected ■ Checkout time elapsed (control module delta®) works in basic load)
	Limit	The limit has been exceeded/undershot ■ The delta® control module is in basic load control mode
	Calibration	A calibration error has been detected If an error has been detected, the calibration data are not adopted. Operation continues with the old data. This relates to the calibration for the current interface and the sensors. If a warning is displayed during a sensor calibration, then this may refer to sensor error.

7.4 Warnings control module delta®

Warning	Description
Communication	A continuous communication error has been determined
Software / data	■ Configuration values are inconsistent ■ Communication error (unknown reply, wrong checksum)
Controllers	■ Limit value undershot / exceeded ■ Checkout time elapsed

7.5 LED status displays of the control module delta®

The LED status displays signal the current operating status of the control module delta®. There are different LED status displays: The devices LED and the Connection LED. The LED status displays do not have a flashing mode.

Devices LED

LED	Status
Green	Operating indicator
Red	Fault display ■ Internal hardware error ■ Sensor error
Orange	Warning indicator ■ Configuration error ■ limit value ■ Checkout time

Connection LED

LED	Status
-	Passive controller operation, otherwise OK
Green	Active control operation
Red	No connection to the pump Communication error

8 Technical data, maintenance, disposal

Electrical data

Voltage input

	Value
Measuring range	0/4 mA - 25 mA (at 50 Ohm measurement resistor)
Accuracy	After calibrating ± 0.5% of the measuring range transmitting value at calibration temperature
Resolution	10-12 Bit
Input voltage protected against incorrect polarity and return of electric energy to ± 30 V.	

Switchable voltage output

	Value
Output voltage	22.5V-26V load dependent, < 50 Ohm; maximum 50mA
Output voltage protected against incorrect polarity and return of electric energy to ± 30 V.	

Galvanic Isolation to the delta® front panel. Load current limiting to approx. 55mA (51 mA - 58 mA).

Deactivation with short circuit (approx. 70 mA) due to foldback and by software. Reactivation using software.

Maintenance

The control module delta ® is maintenance free.

Disposal of Used Parts

NOTICE!

Regulations governing disposal of used parts

– Note the current national regulations and legal standards which apply in your country

ProMinent Dosiertechnik, Heidelberg / Germany is prepared to take back the decontaminated and cleaned used parts.

The current valid Declaration of Decontamination can be obtained as download at *www.prominent.com*.

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