

# ProMaqua® Equipment Catalogue

## Products:

- **For Disinfection**
- **For Oxidation**
- **Membrane Technology**
- **Gravity Filters**

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## **Chapter 1 UV systems Dulcodes**

## **Chapter 2 Ozone systems OZONFILT<sup>®</sup> and Bono Zon<sup>®</sup>**

## **Chapter 3 Chlorine dioxide systems Bello Zon<sup>®</sup>**

## **Chapter 4 Electrolysis systems CHLORINSITU<sup>®</sup>**

## **Chapter 5 Membrane technology**

## **Chapter 6 Gravity filter**

# 1 Dulcodes UV systems

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# 1 Dulcodes UV systems

## 1.1 General Notes On UV Treatment

Disinfection is a fundamental step in modern water treatment. UV disinfection is being used to an ever increasing extent here, as a safe, chemical-free and reliable disinfection process. Extensive research projects and numerous trouble-free operational systems prove the safety and reliability of UV disinfection.

With UV disinfection, the water to be disinfected is irradiated with ultraviolet light, which involves a purely physical, chemical-free process for water disinfection.

UV-C radiation in particular, with a wavelength in the 240 to 280 nm range, attacks the vital DNA of the bacteria directly. The radiation initiates a photochemical reaction and destroys the genetic information contained in the DNA. The bacteria lose their reproduction capability and are destroyed. Even parasites such as Cryptosporidia or Giardia, which are extremely resistant to chemical disinfectants, are efficiently reduced.

The initiation of photochemical reactions is utilised in other applications too. The undesirable combined chlorine in swimming pool water is reduced by UV radiation, as a result of which enormous fresh water savings are achieved. Oxidants such as ozone, chlorine or chlorine dioxide are reliably reduced in the production water used in the food and beverages industry, avoiding the need for costly activated charcoal filters.

Special version systems with special lamps and special composition of the radiation chamber can be used for reduction of TOC (Total Organic Carbon) in the treatment of ultrapure water.

UV disinfection has many advantages:

- Immediate and safe destruction of the bacteria without addition of chemicals
- Photochemical reduction of undesirable substances
- No THM or AOX formation, no formation of other undesirable substances
- No impairment of odour or taste of the water
- No storage and handling of chemicals required
- Effect is independent of pH
- No reaction vessel or reaction tank required
- Low space requirement
- Low investment and operating costs with high reliability and efficiency

### 1.1.1 Applications Of Dulcodes UV Systems

A large number of UV disinfection systems have been supplied worldwide, for the most diverse applications:

- **Own source water suppliers and municipal water works**  
for disinfection of drinking water
- **Food and beverages industry**  
to destroy the bacteria in the water needed for food and beverages production and for disinfection of service water  
to reduce the chlorine dioxide in the production water
- **Pharmaceuticals and cosmetics industry**  
to maintain the high microbiological requirements of the production water  
to destroy residual ozone in the production water without use of activated charcoal filters
- **Reverse osmosis plants**  
for permeate disinfection
- **Municipal sewage plants**  
for reduction of the bacterial count in the sewage plant outflow  
for reduction of the bacterial count in the industrial water extracted from the sewage plant outflow
- **Horticulture**  
for disinfection of the irrigation water
- **Spa pools and swimming pools**  
for disinfection of the pool water  
for chloramine reduction in the pool water
- **Semiconductor industry**  
for reduction of TOC and to maintain the high microbiological requirements of the production water

# 1 Dulcodes UV systems

## 1.1.2

### Description Of Dulcodes UV Systems

**Basically, Dulcodes UV disinfection systems consist of:**

- High-quality radiation chambers made from stainless steel (DIN 1.4404 or 1.4571 or ANSI 316 Ti) or UV-resistant plastic
- Lamp protection tubes made from high-quality quartz, easily removable for cleaning purposes
- Lamps with a particularly high UV output in the 254 nm range, ensuring an outstanding disinfection characteristic
- Highly selective UV sensors with good long-term and temperature stability
- UV system controllers and modern electronic ballasts fitted in a control cabinet

**The special features of our Dulcodes UV disinfection systems are:**

- Even irradiation of the entire water flow through optimised system hydraulics, so ensuring outstanding disinfection results
- Flow-optimised inlet zone
- Longitudinal flow against UV lamps with high turbulence
- Use of UV lamps with long lamp life time and high UV-C output
- Automatic cleaning system for the sleeve of medium-pressure lamps
- Manual cleaning system for the sleeve of system type Dulcodes R or Dulcodes S
- System controller with comprehensive monitoring and reporting functions
- Display of all important operating parameters and reporting of faults in plain text
- Trend display of the variation of the UV sensor signal with time
- Analogue output sensor signal and alarm relay
- Use of modern electronic ballasts with bus technology for lamp-friendly ignition and operation
- Individual lamp monitoring
- Direct control of automatic isolation and flushing valves

### Dulcodes UV Lamps

#### Standard low pressure lamp

Robust low pressure mercury lamp with a life expectancy of approx. 10,000 to 14,000 operating hours. The operating temperature of the lamp is 30-50 °C. This is why its use is limited to water temperatures between 5 and 40 °C. The output is approx. 100 W per metre arc length.

#### Low pressure lamp High-Flux

Low pressure amalgam lamp with a life expectancy of approx. 8,000 to 10,000 operating hours. The operating temperature of the lamp is 100-130 °C. This is why its use is limited to water temperatures of up to 70 °C. The output is independent of the water temperature and is approx. 200 W per metre arc length.

#### Low pressure lamp Opti-Flux

Doped, high-performance low pressure amalgam lamp with a life expectancy of approx. 14,000 operating hours. The operating temperature of the lamp is 100-130 °C. This is why its use is limited to water temperatures of up to 70 °C. The output is independent of the water temperature and is approx. 300 W per metre arc length.

#### Medium pressure lamp Powerline

Medium pressure mercury lamp with a life expectancy of approx. 6,000 to 10,000 operating hours, depending on lamp size. The high output of these lamps (up 10,000 W per metre arc length) permits the treatment of very large flows. Thanks to their broad range spectrum, these lamps are specifically suitable for photochemical processes. The operating temperature of the lamp is 650-850 °C. Powerline medium pressure lamps are typically operated with a mechanical wiper system. This is why their use is limited to water temperatures of up to 40 °C.

# 1 Dulcodes UV systems

## Dulcodes UV Controllers

### Compact controller

Compact unit for control of all basic functions of the UV system. The large graphical display shows the current UV-C output, the operating hours and the number of lamp switch-ons. With the fixed-setting warning and safety threshold levels, a warning signal is generated and a relay output (230 V / 0.2 A) for operation of an isolation valve is actuated if the UV output is too low. Alternatively, this output can also be used as a common alarm relay (230 V / 2.5 A).

### Comfort control

The Dulcodes comfort control includes a large, graphical display for viewing the UVC sensor signal. Shown as a trend display, the lamp ageing, any possible deposit formation on the lamp protection tube or a change in water quality can be seen in a time window. The freely programmable safety and alarm thresholds are also shown as well as the number and times of the lamp activations. All operating and error messages are shown in full text. Setting the operating parameters is facilitated by the clear menu navigation. The control offers a selection of 9 different languages.

The control is connected to the ballasts via a bus system which permits monitoring of each individual lamp. This also facilitates a spatial separation of the control over long distances from the radiation chamber including lamps and ballasts.

Various additional functions such as the automatic flushing of the system in a freely programmable flushing time, the control of a shut-off valve as well as of a circulating pump are integrated as standard. For this purpose, 2 voltage outputs 230 V / 0.2 A and a switching output 230 V / 2.5 A are integrated.

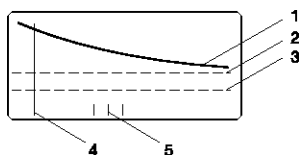
The UVC sensor signal can be monitored online via a standard signal output 0/4-20 mA. If the alarm and safety thresholds are undershot, two relay outputs (230 V / 2.5A) send a corresponding signal. All other faults are signalled via a combined alarm relay (230 V / 2.5 A).

3 potential-free control inputs facilitate linking of the control with external information: The error input can e.g. be used for an external temperature monitoring, the operation of the system can be normally interrupted using the pause input, the flow monitoring can be of help in connection with flushing processes.

### Comfort control Powerline

This control type in addition includes the option for an external power control via a standard signal 0/4-20 mA (not for Dulcodes M 2 kW, 3 kW, and Dulcodes S). The systems can thus e.g. be controlled independent of the flow or the lamp output can be automatically adapted to a defined UVC sensor signal. This saves energy costs and extends the lamp life time of the lamps.

The control also is equipped with a display and monitoring of the temperature of the radiation chamber as well as with a freely programmable control of the mechanical wiper system for an automatic cleaning of the lamp protection tube (manual mechanical wiper system for Dulcodes S systems).



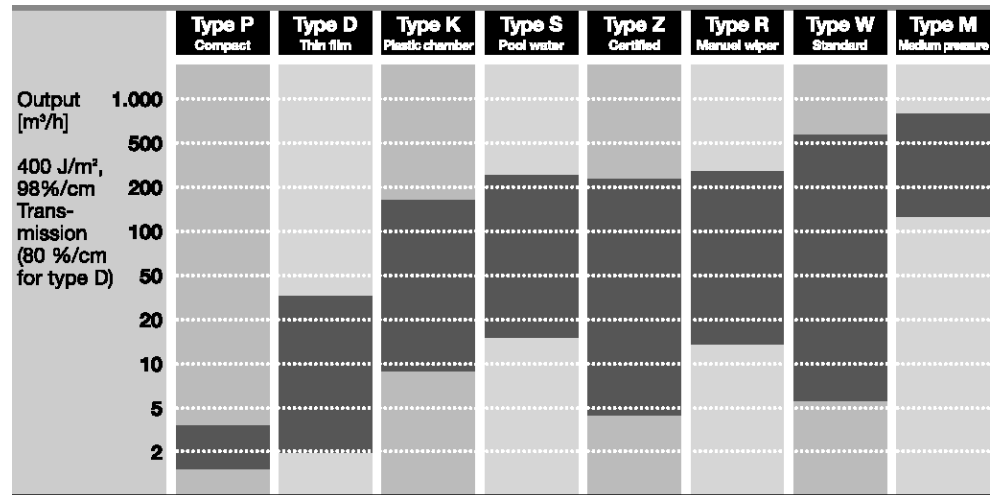
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- 1 UV sensor signal
- 2 Warning threshold
- 3 Safety threshold
- 4 Calibration
- 5 On/off contacts

# 1 Dulcodes UV systems

## 1.2 Performance Overview Of Dulcodes UV Systems

ProMaqua offers a wide range of UV systems for the most diverse applications. The following overview shows the output and main applications of our standard systems:



Application	Type P	Type D	Type K	Type S	Type Z	Type R	Type W	Type M
Drinking water	■				■	■	■	■
Industrial water	■	■	■	■	■	■	■	■
Swimming pool water			■	■		■	■	■
Waste water		■						
Salt water			■					

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We offer a full advisory service covering everything required for safe use of a Dulcodes UV system:

- Assessment of the situation on site by trained, competent field employees.
- All water parameters needed for an optimal system design can be measured in our water laboratory.
- Design and planning of the system.
- Commissioning and system maintenance by our trained service technicians.



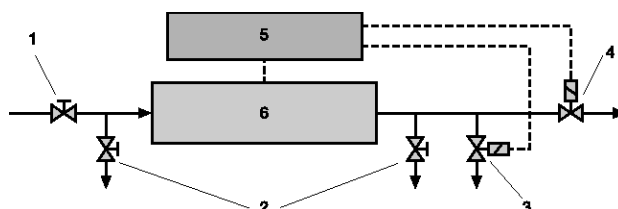
# 1 Dulcodes UV systems

## 1.2.1

### Notes On Planning And Designing An UV System

- The system must always be designed for the greatest water flow.
- The system must always be designed for the worst anticipated UV transmission.
- Fireproof sampling cocks for microbiological tests must be provided before and after UV disinfection systems.
- A manual isolation valve must be provided before the UV system to isolate the system for maintenance work.
- With drinking water disinfection and similar applications, an electrically-controlled isolation valve must be provided after the UV disinfection system, which also closes automatically on mains failure (solenoid valve, automatic closing flap valve or similar).
- With service water disinfection, it is normally sufficient to provide a manual valve to isolate the system for maintenance work, instead of the electrically-controlled valve.
- With drinking water disinfection and similar applications, a flushing valve must be provided after the UV disinfection.
- It must be ensured that there is sufficient space available for removing the lamp protection tube and lamp replacement.
- Modern electronic ballasts only allow a limited cable length between ballast and lamp, so that the control box with the ballasts must be positioned close to the lamp. On the other hand, the controller can be fitted in a control area, for example. However, the maximum cable lengths specified by us must not be exceeded in this case.

- 1 Isolation valve
- 2 Sampling cock
- 3 Flushing valve
- 4 Isolation valve
- 5 Controller/ballast
- 6 Radiation chamber



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Typical installation schematic of a UV disinfection system

The following details are required for design of a UV system:

- Application of the system
- Maximum water flow
- Minimum UV transmission of the water

The UV transmission must be determined by means of a laboratory measurement of the absorption at 254 nm.

A full water analysis gives important conclusions on the operating conditions of the system. The following questionnaire provides our project engineers with the information needed to design an appropriate system.

# 1 Dulcodes UV systems

## 1.3 Questionnaire For Designing A UV System

**Application of the UV system:**

- for disinfection of
  - drinking water
  - production water in the food industry, cosmetics or pharmaceuticals
  - utility water
  - wastewater
  - salt water or brackish water
  - \_\_\_\_\_
  
- for photochemical reduction of
  - \_\_\_\_ ppm ozone
  - \_\_\_\_ ppm chlorine dioxide
  - \_\_\_\_ ppm chlorine
  - \_\_\_\_ ppm chloramine

**Water data:**

Maximum water flow \_\_\_\_\_ m<sup>3</sup>/h      Maximum water pressure \_\_\_\_\_ bar

Minimum UV transmission at 254 nm \_\_\_\_\_ %/1 cm      \_\_\_\_\_ %/10 cm      \_\_\_\_\_ SAC 254 nm

Turbidity \_\_\_\_\_ FTU      \_\_\_\_\_ NTU

Suspended particles content \_\_\_\_\_ mg/l

Water quality       constant       fluctuating

Total hardness \_\_\_\_\_ mmol/l      \_\_\_\_\_ °dH

Carbonate hardness \_\_\_\_\_ mmol/l      \_\_\_\_\_ °dH

Chloride \_\_\_\_\_ mg/l

Manganese \_\_\_\_\_ mg/l

Iron \_\_\_\_\_ mg/l

Water temperature \_\_\_\_\_ °C

**Other requirements:**

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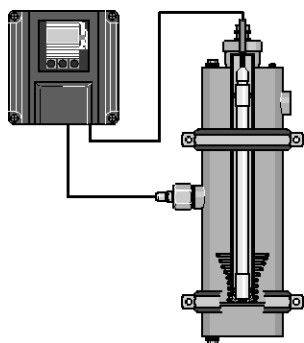
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# 1 Dulcodes UV systems

## 1.4 Dulcodes P UV Systems



Dulcodes P UV systems are used for disinfection of drinking water and service water and – depending on transmission – can be used with flows up to 4 m<sup>3</sup>/h.

### Features

- Flow: up to 4 m<sup>3</sup>/h (depending on transmission)
- Controller with switching output, to which an isolation valve or fault indicating device can be connected
- High-quality, factory-calibrated UV sensor
- Graphical display to show UV intensity, total number of operating hours and number of lamp switchings
- Standard low pressure lamp with a lamp life time of approx. 10,000 – 14,000 operating hours
- Radiation chamber made from high-grade stainless steel 1.4571
- Controller and ballast in compact plastic housing

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### Main applications

Drinking water	Industrial water	Swimming pool water	Wastewater	Salt water
✓	✓			

### Technical Data

Type	Max. flow m <sup>3</sup> /h	Lamp power W	Connect- ed load W	Radiation chamber length mm	Minimum clearance for lamp replacement mm	Ø mm	Empty weight/ Operating weight approx. kg	Connection nominal diameter
16P	1,5*	16	30	382	350	114	6/10	G 3/4"
45P	3,8*	45	60	940	900	114	10/20	G 1 1/4"

<b>Lamp type</b>	Standard low pressure lamp (see Chap. 1.3.1)
<b>Controller type</b>	Compact controller (see Chap. 1.3.2)
<b>Permissible operating pressure</b>	10 bar
<b>Permissible ambient temperature</b>	5–45 °C
<b>Permissible water temperature</b>	5–40 °C

\* 98 %/cm transmission , 400 J/m<sup>2</sup>

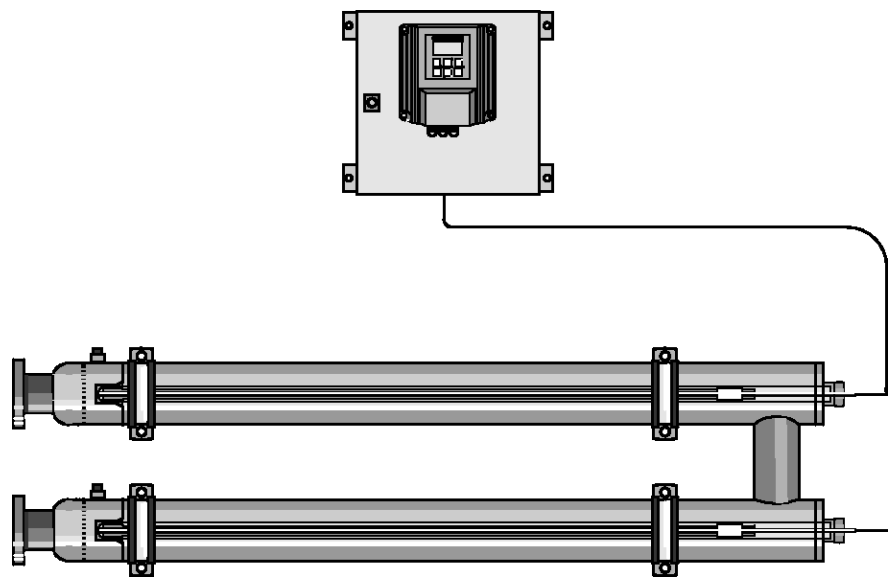
### Spare Parts For Dulcodes P UV Systems

Name of the item	Order no.
UV lamp 16 W	1002472
UV lamp 45 W	1002473
O-ring for fixing the lamp in the lamp sleeve	481016
Lamp protection tube for 16 P	1004450
Lamp protection tube for 45 P	1002468
O-ring lamp protection tube/lamp cover	1004920
UVC sensor P/D/W/R G 3/4 1.4539 for systems delivered from Sept. 2006	1004734
O-ring UVC sensor	1002175
Sensor cable 2 m long	1004411
Screwed plug G 1/4"	1002752
O-ring for G 1/4" screwed plug	741256

# 1 Dulcodes UV systems

## 1.5 Dulcodes D UV Systems For High Turbidity Water

Dulcodes D thin-film type UV systems with High-Flux lamps are used for disinfection of high turbidity or discoloured service water or wastewater and – depending on transmission – can be used with flows up to 33 m<sup>3</sup>/h.



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### Features

- Flow: up to 33 m<sup>3</sup>/h (depending on transmission)
- Standard chambers made up of one or more longitudinal flow radiation chambers arranged one after the other, each with its own lamp
- High-efficiency low pressure High-Flux lamp with special amalgam technology, increased UV output, largely independent of temperature
- Lamp life time: 8.000-10.000 h
- Ballasts with BUS interface for ignition and monitoring of each individual lamp
- Variable lamp current, hence lamp-friendly ignition process and precise adjustment of the optimal lamp operating current
- Long-term stable UV-C sensor for monitoring the disinfection capability and transmission (UV transmission factor) of the water, factory-calibrated
- Large graphical display for display of the sensor signal
- Monitoring of lamp ageing, lamp sleeve fouling and changes in water quality
- Freely programmable controller, e.g. for different flushing, warning and shutdown procedures
- Radiation chambers made from high-grade stainless steel 1.4571
- Control cabinets made from coated steel
- Complete cleaning system available as an accessory and consisting of acid tank, circulating pump, valves and hoses for rapid chemical cleaning of lamp sleeve and radiation chamber.

### Main applications

Drinking water	Industrial water	Swimming pool water	Wastewater	Salt water
—	✓	—	✓	—

# 1 Dulcodes UV systems

## Technical Data

Type	Max. flow m <sup>3</sup> /h	Lamp power W	Connected load W	Radiation chamber length mm	Minimum clearance for lamp replacement mm	Ø mm	Empty weight/ Operating weight approx. kg	Connection nominal diameter
<b>1x45 D**</b>	2,0*	1x45	60	940	900	89	10/15	1"
<b>1x130 D</b>	4,6*	1x130	150	940	900	89	10/15	1"
<b>1x230 D</b>	8,2*	1x230	250	1.500	1.400	89	18/25	DN 65
<b>2x230 D</b>	16,0*	2x230	500	1.500	1.400	89	36/50	DN 65
<b>3x230 D</b>	25,0*	3x230	750	1.500	1.400	89	54/75	DN 65
<b>4x230 D</b>	33,0*	4x230	1.000	1.500	1.400	89	72/100	DN 65

\* 80 %/cm transmission, 400 J/m<sup>2</sup>

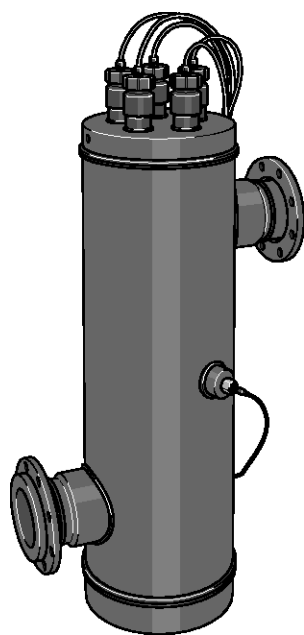
<b>Lamp type</b>	Standard low pressure lamp (see Chap. 1.3.1) with 1x45 D High-Flux low pressure lamp (see Chap. 1.3.1) with 1x130 D - 4x230 D
<b>Controller type</b>	Compact controller (see Chap. 1.3.2) with 1x45 D De luxe controller (see Chap. 1.3.2) with 1x130 D - 4x230 D
<b>Permissible operating pressure</b>	10 bar
<b>Permissible ambient temperature</b>	5–40 °C
<b>Permissible water temperature</b>	5-70 °C **5-40 °C

## Spare Parts For Dulcodes D UV Systems

	Order no.
<b>UV lamp 45 W</b>	1002473
<b>High-Flux UV lamp 130 W</b>	1002486
<b>High-Flux UV lamp 230 W</b>	1002487
<b>Lamp protection tube für Dulcodes 45 D und 130 D</b>	1002468
<b>Lamp protection tube for Dulcodes 1-6x230 D</b>	1002469
<b>O-ring lamp protection tube/lamp cover</b>	1004920
<b>UVC sensor P/D/W/R G 3/4 1.4539 for systems delivered from Sept. 2006</b>	1004734
<b>O-ring UVC sensor</b>	1002175
<b>Sensor cable, 5 m long</b>	1004412
<b>Screwed plug G 1/4"</b>	1002752
<b>O-ring for G 1/4" screwed plug</b>	741256
<b>Replacement filter mat for control cabinet ventilation (2 pcs. required per control cabinet)</b>	1004212
<b>Hook spanner (special tool required for lamp replacement)</b>	1002764

# 1 Dulcodes UV systems

## 1.6 Dulcodes K UV Systems With PE-HD Radiation Chamber



The Dulcodes K range of UV systems with High-Flux lamps can be used for disinfection of saline water (thermal spring water, sea water). The radiation chambers are made from high-grade plastic and are optimised for compressive strength by special welding procedures (can be used up to an operating pressure of 4 bar). Depending on transmission, the range can be used with flows up to 170 m<sup>3</sup>/h

### Features

- Flow: up to 170 m<sup>3</sup>/h (depending on transmission)
- High-efficiency low pressure High-Flux lamp with special amalgam technology, increased UV output, largely independent of temperature
- Lamp service life: 8,000-10,000 h
- Ballasts with BUS interface for ignition and monitoring of each individual lamp
- Variable lamp current, hence lamp-friendly ignition process and precise adjustment of the optimal lamp operating current
- Long-term stable salt water-resistant UV-C sensor for monitoring the disinfection capability and transmission (UV transmission factor) of the water, factory-calibrated
- Large graphical display for display of the sensor signal
- Monitoring of lamp ageing, lamp sleeve fouling and changes in water quality
- Freely programmable controller, e.g. for different flushing, warning and shutdown procedures
- Radiation chambers made from UV-stabilised PE-HD
- Control cabinets made from coated steel

### Main applications

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Drinking water	Industrial water	Swimming pool water	Wastewater	Salt water
✓	✓	✓	—	✓

### Technical Data

Type	Max. flow m <sup>3</sup> /h	Lamp power W	Connected load W	Radiation chamber length mm	Minimum clearance for lamp replacement mm	Ø mm	Empty weight/ Operating weight approx. kg	Connection nominal diameter
1x130K	8,7*	1x130	150	1.371	1.400	125	12/18	DN 50
2x130K	37,0*	2x130	280	1.371	1.400	280	38/78	DN 100
3x130K	54,0*	3x130	420	1.371	1.400	280	40/78	DN 100
4x130K	99,0*	4x130	550	1.371	1.400	400	48/160	DN 150
5x130K	122,0*	5x130	680	1.371	1.400	400	50/160	DN 150
6x130K	148,0*	6x130	810	1.371	1.400	400	52/160	DN 150

\* 98 %/cm transmission, 400 J/m<sup>2</sup>

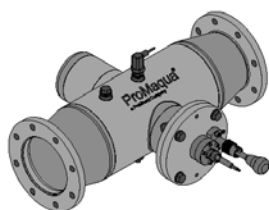
<b>Lamp type</b>	High-Flux low pressure lamp (see Chap. 1.3.1)
<b>Controller type</b>	De luxe controller (see Chap. 1.3.1)
<b>Permissible operating pressure</b>	4 bar
<b>Permissible ambient temperature</b>	5–40 °C
<b>Permissible water temperature</b>	5–30 °C

### Spare Parts For Dulcodes K UV Systems

	Order no.
High-Flux UV lamp 130 W	1002486
Lamp protection tube for Dulcodes K	1006385
O-ring lamp protection tube/lamp cover	1006332
UVC sensor K red brass	1006329
O-ring UVC sensor	1002175
Sensor cable, 5 m long	1004412
Replacement filter mat for control cabinet ventilation (2 pcs. required per control cabinet)	1004212

# 1 Dulcodes UV systems

## 1.7 Dulcodes S UV Systems For Chloramine Control In Pool Water



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Dulcodes S UV treatment systems are suitable for a photochemical degradation of combined chlorine (chloramine) in swimming pool water treatment. Special medium pressure UV lamps generate the intensive polychromatic UV radiation to reduce the odour-intensive and eye-irritating substances. The result is an improved water quality for healthy and pleasant bathing.

### Features

- Extremely compact inline system with low space requirement
- Simple installation thanks to little installation work, quick refitting
- Highest level of installation flexibility due to free choice of mounting orientation
- Flow: up to 200 m<sup>3</sup>/h (depending on transmission)
- Powerline type medium pressure lamp with a mercury vapour pressure above 1 bar, hence high connection loads of up to 3 kW per metre of arc length
- High gas pressure as well as relatively high operation temperature of the lamp of 600 up to 800 °C, hence large emission spectrum
- Lamp life time: approx. 6,000-8,000 h depending on lamp type
- Long-time stable UVC sensor for monitoring the lamp output, the lamp protection tube contamination as well as changes in the water quality
- Integrated temperature sensor for monitoring the water temperature in the radiation chamber
- Large graphical display for monitoring the sensor signal with trend line
- Manual power control to optimally adapt the system to the relevant capacity needed (not for Dulcodes 1 x 0.65 and 1S)
- Automatic chloramine value-dependent control of the UV system, e.g. in combination with DULCOMARIN® II
- Manual wiper for efficient removal of deposits on the lamp protection tube
- Radiation chambers made of stainless steel 1.4571
- Control cabinet made of coated steel
- Uniform radiation of the entire water flow thanks to optimised system hydraulics

### Application focuses

Drinking water	Industrial water	Swimming pool water	Waste water	Salt water
-	✓	✓	-	-

# 1 Dulcodes UV systems

## Technical Data

Type	Max. flow m <sup>3</sup> /h	Lamp power kW	Connected load kW	Radiation chamber length mm	Minimum clearance for lamp replacement mm	Min. distance from wall mm	Empty weight/ Operating weight approx. kg	Connection nominal diameter can be selected mm
<b>1x0.65S</b>	17,0*	0,65	0,75	500	300	160	14/19	65/80
<b>1x1S</b>	51,0*	1,00	1,10	700	300	450	21/37	100/125
<b>1x2S</b>	89,0*	2,00	2,10	700	400	550	31/58	125/150
<b>1x3S</b>	177,0*	3,00	3,10	800	500	650	52/118	200/250

\* 98 %/cm transmission 600J/m<sup>2</sup>

\*\* Technical data will follow

<b>Lamp type</b>	Powerline S medium pressure lamp (see Chap. 1.3.1)
<b>Controller type</b>	Powerline S comfort control
<b>Permissible operating pressure</b>	6 bar
<b>Permissible ambient temperature</b>	5–40 °C
<b>Permissible water temperature</b>	5–40 °C

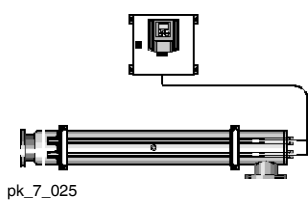
## Replacement parts for Dulcodes S UV systems

	Order no.
UV lamp Powerline 0.6/1 kW	1035179
UV lamp Powerline 2 kW	1035057
Powerline UV lamp 3 kW	1035180
Lamp protection tube for Dulcodes 0.6 S	1035218
Lamp protection tube for Dulcodes 1 S	1035166
Lamp protection tube for Dulcodes 2 S	1035041
Strahlerschutzrohr for Dulcodes 3 S	1035193
O-ring lamp protection tube/lamp cover	790410
UVC-U sensor M 1.4539 from 03/2009	1034147
O-ring UVC sensor	1002175
Sensor cable, 5 m long	1009398
Replacement filter mat for control cabinet ventilation (2 pcs. required per control cabinet)	1004212



# 1 Dulcodes UV systems

## 1.8 Dulcodes Z UV Systems With Certified Performance



Dulcodes Z UV disinfection systems serve the disinfection of drinking and industrial water and can be used - depending on transmission - for flows between 2 and 230 m<sup>3</sup>/h.

All Dulcodes Z systems are DVGW-certified and meet the requirements of the DVGW Test Regulation W 294. This test regulation requires comprehensive biosimetric measurements as a proof of the required effectiveness of the disinfection.

The list of the treatment substances and disinfection processes according to section 11 German Drinking Water Ordinance 2001 specifies that in Germany only UV systems may be used for drinking water disinfection which meet the requirements according to the DVGW Test Regulation W 294.

### Features

- Flow: up to 230 m<sup>3</sup>/h (depending on transmission)
- High-efficiency low pressure Opti-Flux lamp with special amalgam technology, increased UV output, largely independent of temperature
- Lamp life time: 14,000 h
- Low maintenance costs as a result of higher output per lamp and longer lamp life time
- Electronic ballasts with BUS interface for ignition and monitoring of each individual lamp
- Variable lamp current, hence lamp-friendly ignition process and precise adjustment of the optimal lamp operating current
- DVGW certified UV-C sensor for monitoring the disinfection capability and transmission (UV transmission factor) of the water
- Large graphical display for display of the sensor signal and operating messages in plain text
- Monitoring of lamp ageing, lamp sleeve fouling and changes in water quality
- Freely programmable controller, e.g. for different flushing, warning and shutdown procedures
- Radiation chambers made from high-grade stainless steel 1.4404
- Radiation chamber hydraulics optimised by computer simulation
- Control cabinets made from coated steel

### Main applications

Drinking water	Industrial water	Swimming pool water	Wastewater	Salt water
✓	✓	—	—	—

### Technical Data

Type	Max. flow	Lamp power	Connected load	Radiation chamber length	Minimum clearance for lamp replacement	Ø	Empty weight/ Operating weight	Connection nominal diameter
	m <sup>3</sup> /h	W	W	mm	mm	mm	approx. kg	
75Z***	4,5*	1x75	90	1.115	910	140	12/27	G 1 1/4"
200Z	10,0*	1x200	220	1.040	785	140	16/30	DN 50
300Z	20,0*	1x300	320	1.540	1.285	140	25/47	DN 80
2x300Z	60,0*	2x300	650	1.590	1.560	219	39/97	DN 100
3x300Z	110,0*	3x300	1.000	1.625	1.695	219	39/97	DN 150
4x300Z	165,0*	4x300	1.300	1.630	1.563	273	56/143	DN 150
5x300Z	230,0*	5x300	1.600	1.630	1.590	273	56/144	DN 200
7x300Z	230,0**	7x300	2.200	1.630	1.590	324	73/201	DN 200

\* 98 %/cm transmission, 400 J/m<sup>2</sup>

\*\* 94 %/cm transmission

#### Lamp type

Standard low pressure lamp (see Chap. 1.3.1) with Type 75 Z Opti-Flux low pressure lamp (see Chap. 1.3.1) with Types 200 Z to 7x300 Z

#### Controller type

De luxe controller (see Chap. 1.3.2)  
UVC sensor signal in W/m<sup>2</sup> which can be calibrated with the help of a reference radiometer (see Chap. 1.11)

#### Permissible operating pressure

10 bar

#### Permissible ambient temperature

5–40 °C

#### Permissible water temperature

5 - 70 °C \*\*\*5-30 °C

# 1 Dulcodes UV systems

## Spare Parts For Dulcodes Z UV Systems

	<b>Order no.</b>
OptiFlux UV lamp 75 W	1020911
Opti-Flux UV lamp 200 W	1021008
Opti-Flux UV lamp 300 W	1020929
Lamp protection tube for Dulcodes 75 Z	1020845
Lamp protection tube for Dulcodes 200 Z	1021010
Lamp protection tube for Dulcodes 1-5x300 Z	1020846
O-ring lamp protection tube/lamp cover	1023569
UVC sensor Z 1.4404 DVGW	1022347
Sensor window G 1x20 for Dulcodes 75, 200, 2x300Z	1021113
Sensor window G 1x30 for Dulcodes 300, 3x300Z	1022377
Sensor window G 1x47.5 for Dulcodes 4-7x300Z	1023884
O-ring sensor window	1023570
Sensor cable, 3.5 m long	1017867
Sensor cable, 7.5 m long	1024826
Sensor cable, 5 m long	1021041
Extension for sensor cable, 5 m long	1024825
Screwed plug G 1/4"	1002752
O-ring for G 1/4" screwed plug	741256
Replacement filter mat for control cabinet ventilation (2 pcs. required per control cabinet)	1004212

# 1 Dulcodes UV systems

## 1.9 Dulcodes R UV Systems With Manual Wiper

Dulcodes R UV systems are used for the purpose of disinfecting drinking water and service water as well as for photochemical degradation of chloramines in swimming pool water. Dulcodes R UV systems are particularly suitable for water which tends to form deposits on the protection tubes. These deposits can be easily removed with the manual wiper mechanism even at full operating pressure without the need to interrupt operation.

Thanks to the Opti-Flux high-performance UV lamps with a power output of 300 W, maximum flow rates are achieved with a minimum number of lamps. With the long lamp life time of the UV lamps of up to 14,000 operating hours, compared to conventional systems, lamps need to be replaced less frequently thus reducing costs.

Depending on the water transmission rate and the required radiation level, the system can be used at volumetric flow rates of up to 438 m<sup>3</sup>/h.

### Features

- Flow rate: Up to 438 m<sup>3</sup>/h (depending on transmission and radiation level).
- Auto-adjusting wiper elements made from food-grade PTFE.
- Cleaning possible without interrupting operation: The manual wiper is easy to use even under maximum operating pressure of the system. Thanks to their self-sharpening function, the wiper elements achieve maximum cleaning effect in connection with a long lamp life time.
- Opti-Flux high-performance low-pressure UV lamps featuring special amalgam technology, increased UV output, largely unaffected by temperature.
- Lamp life time: up to 14,000 hours.
- Increased output with fewer lamps: a lamp power output of 300 W enables a higher flow rate per lamp, longer service cycles, lower operating costs.
- Electronic ballast units with BUS interface for ignition and monitoring of each individual lamp.
- Variable lamp current and thus gentle ignition and exact adaptation of the optimal lamp operation.
- Factory-calibrated UV-C-sensitive sensor.
- Large graphic display for showing sensor signal and operating messages in plain text.
- Freely programmable control, e.g. for various flushing, warning and shut-off procedures.
- Radiation chambers made from high-grade stainless steel 1.4404, hydraulically optimised by way of computer simulation.
- Coated steel control cabinets.

### Main applications

Drinking water	Industrial water	Swimming pool water	Waste water	Saltwater
✓	✓	✓	—	—

### Technical Data

Type	Max. flow m <sup>3</sup> /h	Lamp power W	Connected load W	Radiation chamber length mm	Minimum clearance for lamp replacement mm	Ø mm	Empty weight/ Operating weight approx. kg	Connection nominal diameter
1x300R	30,0*	1x300	320	1.562	1.438	140	45/67	DN 80
2x300R	95,0*	2x300	650	1.633	1.438	220	75/134	DN 150
3x300R	179,0*	3x300	1.000	1.638	1.438	273	90/182	DN 200
4x300R	274,0*	4x300	1.300	1.652	1.438	330	120/253	DN 250

\* 98 %/cm transmission, 400 J/m<sup>2</sup>

<b>Lamp type</b>	Opti-Flux low-pressure UV lamp (see Section 1.3.1)
<b>Controller type</b>	De luxe controller (see Chap. 1.3.1)
<b>Permissible operating pressure</b>	10 bar
<b>Permissible ambient temperature</b>	5–40 °C
<b>Permissible water temperature</b>	5–70 °C

# 1 Dulcodes UV systems

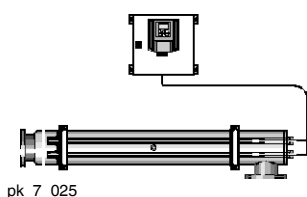
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## Spare parts for Dulcodes R UV systems

	<b>Order no.</b>
<b>Opti-Flux UV lamp 300 W</b>	1020929
<b>Lamp protection tube for Dulcodes R</b>	1020846
<b>O-ring lamp protection tube/lamp cover</b>	1023569
<b>Wiper element (2 required per UV lamp)</b>	1027879
<b>UVC-U sensor P/D/W/R 1.4539 from Sep. 2006</b>	1028115
<b>Sensor cable, 3.5 m long</b>	1017867
<b>Sensor cable, 7.5 m long</b>	1024826
<b>Sensor cable, 5 m long</b>	1021041
<b>Extension for sensor cable, 5 m long</b>	1024825
<b>O-ring for screw plug G 1/4"</b>	792872
<b>Replacement filter mat for control cabinet ventilation (2 pcs. required per control cabinet)</b>	1004212

# 1 Dulcodes UV systems

## 1.10 Dulcodes W UV Systems



Dulcodes W UV systems with High-Flux lamps are used for irradiation of a very wide range of water types and – depending on transmission – can be used with flows up to 600 m<sup>3</sup>/h.

### Features

- Flow: up to 600 m<sup>3</sup>/h (depending on transmission)
- High-efficiency low pressure High-Flux lamp with special amalgam technology, increased UV output, largely independent of temperature
- Lamp life time: 8,000 – 10,000 h
- Ballasts with BUS interface for ignition and monitoring of each individual lamp
- Variable lamp current, hence lamp-friendly ignition process and precise adjustment of the optimal lamp operating current
- Long-term stable UV-C sensor for monitoring the disinfection capability and transmission (UV transmission factor) of the water, factory-calibrated
- Large graphical display for display of the sensor signal
- Monitoring of lamp ageing, lamp sleeve fouling and changes in water quality
- Freely programmable controller, e.g. for different flushing, warning and shutdown procedures
- Radiation chambers made from high-grade stainless steel 1.4571
- Control cabinets made from coated steel

### Main applications

Drinking water	Industrial water	Swimming pool water	Wastewater	Salt water
✓	✓	✓	—	—

### Technical Data

Type	Max. flow m <sup>3</sup> /h	Lamp power W	Connect- ed load W	Radiation chamber length mm	Minimum clear- ance for lamp replacement mm	Ø mm	Empty weight/ Operating weight approx. kg	Connection nominal diameter
1x75W**	5,7*	75	90	1.115	910	140	12/27	G 1 1/4"
1x80W**	5,4*	80	100	630	600	114	8/14	G 1 1/4"
1x130W	8,7*	130	150	940	900	114	10/20	G 2
1x230W	20,0*	230	250	1.468	1.400	140	24/46	DN 65
2x230W	64,0*	2x230	500	1.640	1.500	220	41/96	DN 125
3x230W	117,0*	3x230	750	1.665	1.500	273	53/138	DN 150
4x230W	184,0*	4x230	1.000	1.690	1.600	324	65/150	DN 200
5x230W	228,0*	5x230	1.200	1.690	1.600	324	70/190	DN 200
6x230W	273,0*	6x230	1.400	1.790	1.600	406	75/200	DN 250
7x230W	369,0*	7x230	1.700	1.920	1.600	406	115/310	DN 250
8x230W	418,0*	8x230	1.900	1.920	1.600	406	115/310	DN 250
9x230W	467,0*	9x230	2.100	1.920	1.600	406	130/320	DN 250
10x230W	514,0*	10x230	2.400	1.920	1.600	406	130/320	DN 250
11x230W	561,0*	11x230	2.600	1.920	1.600	406	130/320	DN 250
12x230W	600,0*	12x230	2.800	1.920	1.600	406	130/320	DN 250

\* 98 %/cm transm., 400 J/m<sup>2</sup>

<b>Lamp type</b>	High-Flux low pressure lamp (see Chap. 1.3.1)
<b>Controller type</b>	De luxe controller (see Chap. 1.3.1)
<b>Permissible operating pressure</b>	10 bar
<b>Permissible ambient temperature</b>	5–40 °C
<b>Permissible water temperature</b>	5–70 °C    **5–30 °C

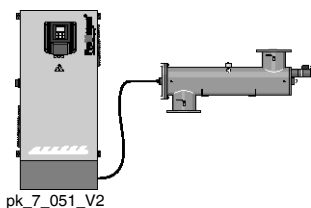
# 1 Dulcodes UV systems

## Spare Parts For Dulcodes W UV Systems

	<b>Order no.</b>
OptiFlux UV lamp 75 W	1020911
High-Flux UV lamp 80 W	1002485
High-Flux UV lamp 130 W	1002486
High-Flux UV lamp 230 W	1002487
Lamp protection tube for Dulcodes 75 W	1020845
Lamp protection tube für Dulcodes 80 W	1002467
Lamp protection tube für Dulcodes 130 W	1002468
Lamp protection tube for Dulcodes 230 W	1002469
Lamp protection tube für Dulcodes 2-5x230 W	1002470
Lamp protection tube für Dulcodes 6-12x230 W	1002471
O-ring lamp protection tube/lamp cover	1004920
UVC-U sensor P/D/W/R 1.4539 from Sep. 2006	1028115
O-ring UVC sensor	1002175
Sensor cable, 5 m long	1004412
Screwed plug G 1/4"	1002752
O-ring for G 1/4" screwed plug	741256
Replacement filter mat for control cabinet ventilation (2 pcs. required per control cabinet)	1004212
Hook spanner (special tool required for lamp replacement)	1002764

# 1 Dulcodes UV systems

## 1.11 Dulcodes M UV Systems With Powerline Medium Pressure Lamps



pk\_7\_051\_V2

Dulcodes M UV systems with Powerline medium pressure lamps are used for treatment of large water quantities and – depending on transmission – can be used with flows up to 800 m<sup>3</sup>/h. Their special lamp makes these systems particularly suitable for photochemical reduction of chloramine in swimming pool water, chlorine dioxide in the beverages industry, or chlorine and ozone in other applications.

### Features

- Flow: up to 800 m<sup>3</sup>/h (depending on transmission)
- Powerline type medium pressure lamp with a mercury vapour pressure above 1 bar, hence high connected loads of up to 10 kW per metre of arc length
- High gas pressure and relatively high lamp operating temperature of 600 to 800 °C, hence broad emission spectrum
- Particularly suitable for chemical photochemical reduction of chloramine in swimming pool water, chlorine dioxide in the beverages industry, or chlorine and ozone in other production water, for example, due to the broad emission spectrum of the lamps
- Lamp life time: approx. 8,000-10,000 h
- Ballasts with BUS interface for ignition and monitoring of the lamp
- Variable lamp current, hence lamp-friendly ignition process and precise adjustment of the optimal lamp operating current
- Long-term stable UV-C sensor for monitoring the disinfection performance and UV transmission of the water
- Large graphical display for monitoring the sensor signal with trend line
- Monitoring of lamp ageing, lamp sleeve fouling and changes in water quality
- External power control via 0/4-20 mA signal for optimal adjustment of the system to changing operating conditions such as flow fluctuations, for example
- Automatic adjustment of lamp power to a defined UV-C sensor signal saves energy and extends lamp life time (as from 4 kW systems)
- Automatic motorised wiper for efficient removal of deposits on the lamp protection tube
- Freely programmable controller, e.g. for different flushing, warning and shutdown procedures
- Radiation chambers made from high-grade stainless steel 1.4571
- Control cabinets made from coated steel

### Main applications

Drinking water	Industrial water	Swimming pool water	Wastewater	Salt water
✓	✓	✓	—	—

### Technical Data

Type	Max. flow m <sup>3</sup> /h	Lamp power kW	Connected load kW	Radiation chamber length mm	Minimum clearance for lamp replacement mm	Ø mm	Empty weight/ Operating weight approx. kg	Connection nominal diameter
1x2ML	88,0*	2	2,3	850	1.750	220	146	DN 100
1x3ML	158,0*	3	3,2	850	1.750	220	156	DN 150
1x4ML	229,0*	4	4,2	1.200	2.450	270	190	DN 200
1x6ML	406,0*	6	6,2	1.200	2.450	320	230	DN 250
1x8ML	541,0*	8	8,2	1.500	3.050	320	240	DN 250
1x10ML	600,0*	10	10,2	1.500	3.050	320	240	DN 250
1x10ML	800,0*	10	10,2	1.500	3.050	400	283	DN 300

\* 98 %/cm transmission, 600 J/m<sup>2</sup>

<b>Lamp type</b>	Powerline medium pressure lamp (see Chap. 1.3.1)
<b>Controller type</b>	Powerline de luxe controller (see Chap. 1.3.1)
<b>Permissible operating pressure</b>	10 bar
<b>Permissible ambient temperature</b>	5–40 °C
<b>Permissible water temperature</b>	5–40 °C

# 1 Dulcodes UV systems

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## Spare Parts For Dulcodes M UV Systems

	<b>Order no.</b>
Powerline UV lamp 3 kW	1035180
Powerline UV lamp 4 kW	1009386
Powerline UV lamp 6 kW	1009387
Powerline UV lamp 8 / 10 kW	1009388
Lamp protection tube for Dulcodes 2 ML / 3 ML	1009214
Lamp protection tube for Dulcodes 4/6 ML	1009215
Lamp protection tube for Dulcodes 8/10 ML	1009216
O-ring lamp protection tube/lamp cover	1027553
UVC sensor M 1.4539	1025685
UVC-U sensor M 1.4539 from 03/2009	1034147
O-ring UVC sensor	1002175
Sensor cable, 5 m long	1009398
Replacement filter mat for control cabinet ventilation (2 No. required per control cabinet)	791038



# 1 Dulcodes UV systems

## 1.12 Accessories For Dulcodes UV Systems

### Transmission Photometer TMX 02

Photometer for measurement of the UV transmission at 254 nm in accordance with DIN 38404.

Supplied in sturdy aluminium case complete with 40 mm quartz cuvette, 4 x NiMH rechargeable batteries and charger.

#### Technical Data

<b>Dimensions L x W x H (mm)</b>	370 x 330 x 150
<b>Weight</b>	3,0 kg
<b>Voltage supply</b>	4 x 1,500 mAh NiMH batteries
<b>UV-C lamp</b>	Mercury medium pressure lamp
<b>Measurement resolution</b>	Transmission in 0.1 %
<b>Measurement accuracy</b>	Transmission in $\pm 0.5$ %

#### Order no.

<b>Transmission Photometer TMX 02</b>	1027956
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### Reference radiometer RRM

Reference radiometer for checking and recalibrating DVGW-certified Dulcodes Z UV systems. The portable instrument complies with DVGW technical standard W 294/Part 3/2003 and is fitted with an insertion sensor which is inserted directly in the radiation chamber of the Dulcodes Z UV system in place of the sensor to be calibrated, so that the radiation intensity can be measured without interrupting operation. Suitable UV protective glasses must be worn as UV radiation escapes from the radiation chamber during this procedure.

#### Technical Data

<b>Measurement range</b>	20/200/2.000/20.000 W/m <sup>2</sup> (switchable)
<b>Display</b>	3-digit
<b>Voltage supply</b>	Battery, 9 V Type 6F22 or equivalent
<b>Wavelength range</b>	220 ... 290 nm, spectral adjustment in accordance with W 294
<b>Angular field of view</b>	40° in accordance with W 294, Item 7.2

#### Order no.

<b>Reference radiometer RRM</b>	1025094
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### UV protective glasses

Protective glasses to protect against harmful to the eye UV radiation when working on open UV systems.

#### Order no.

<b>UV protective glasses</b>	1025243
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### Protective gloves

Protective gloves made from white cotton to avoid fingerprints on UV lamps and lamp sleeves. 1 pair in universal size.

#### Order no.

<b>Protective gloves</b>	1032815
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# 1 Dulcodes UV systems

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## Sampling cock

Fireproof sampling cock made from stainless steel.

	<b>Order no.</b>
<b>Sampling cock</b>	on request

## Cleaning system

Cleaning system for flushing the radiation chamber with a cleaning concentrate to remove deposits on the lamp tubes and internal surfaces of the UV system. Consists of chemical tanks, booster and dosing pumps, valves and complete automatic or manual controller. Design and technical equipment are matched to the particular UV system and its application.

	<b>Order no.</b>
<b>Cleaning system</b>	on request

## Clip-on thermostat

A thermostat is fitted to the outside of the radiation chamber. It monitors the temperature of the water and can be connected to the control. The flushing valve opens when the preset limit temperature is exceeded.

	<b>Order no.</b>
<b>Clip-on thermostat</b>	on request

- **Service**
- **Sales**

You can make full use of our services even if you are not yet one of our customers. Our pre-sales services ensure that you get the optimum solution for your individual needs:

- Advice in choosing the products
- Application and process optimisation
- Project planning

However, our commitment does not end with delivery. We offer you a comprehensive after-sales service, which lasts for the entire service life of your equipment. That maximises your productivity and minimises your operating costs:

- Assembly/installation
- Commissioning
- Maintenance
- Spare parts service
- Repair
- Troubleshooting

Thanks to our worldwide presence in over 100 countries, our service is available wherever you need it.

## 1.1

### Services

#### Mounting/installation

Quality starts with the correct installation of our systems. That's why we offer you a professional installation by trained service technicians.

We offer the following installation work:

- running pipelines in PE, PVC and PVDF materials
- carrying out electrical installation work
- linking the system to a PLC

If required, we also carry out conversions and plant extensions. Your advantage: plant and installation from a single source.

#### Commissioning: the right start for your system

Our service technicians will ensure professional system commissioning and start-up. You profit from knowing that the processes are set up correctly and the machine is running optimally from the very outset. Following successful commissioning, the service technician will provide information on the set system parameters and will train the system operators.

#### Maintenance: an essential requirement for consistently high reliability

Routine preventative maintenance performed by our service technicians increases operational reliability, lowers operating costs and extends the service life of your system. We offer maintenance contracts for this, individually tailored to your needs.

#### Repairs: on our premises or yours

Whether it's a works repair or an express job on site, you're assured of a professional repair using genuine spare parts.

#### Troubleshooting: If really something shouldn't work

Of course, queries on the operation of our products or systems do come up from time to time. Maybe the operation is not quite clear, or you'd like to change the process, or make other modifications, perhaps one of our products just isn't working correctly, for whatever reason at all. No problem. Our technical advisers will be pleased to help you. In most cases, your query can be answered over the telephone.

If that's not possible, our adviser will take the necessary steps to help you as quickly as possible. This can be by sending in a service technician, despatch of spare or replacement parts, or other measures, depending on the situation.

# 1 Service

## 1.2 Service Contacts

### For customers from Germany:

Some services are rendered by ProMaqua GmbH.

Services	Telephone +49 6221 6489-	Fax +49 6221 6489-	eMail
Mounting/installation	-402	-400	service@promaqua.com
Commissioning	-402	-400	service@promaqua.com
Maintenance	-402	-400	service@promaqua.com
On-site repair	-402	-400	service@promaqua.com

Repairs	Telephone +49 6221 842-	Fax +49 6221 842-	
for postcode areas 0 ... 4	-328	-441	CustomerCare@prominent.de
for postcode areas 5 ... 9	-308	-441	CustomerCare@prominent.de

### For customers from other countries:

Please contact your local ProMinent branch or agency.

## 1.3 Training

The training programme offered by the ProMinent Academy for Water Technology is targeted at customers resident in Germany. We would kindly ask customers from other countries to contact their local ProMinent branch office or agency, the website addresses of which can also be found at "Company – Locations", either for the purpose of contacting them or to obtain further information.

Our extensive range of courses provides you with the opportunity to efficiently obtain information and knowledge about our units, familiarise yourself with new units and exchange information.

The courses are split into free subject seminars and intensive courses for which a charge is made. The subject seminars offer all process managers, planners, plant engineers and plant constructors the opportunity to familiarise themselves with the full ProMinent product range across all sectors. Specialised subject seminars on the drinking water and swimming pool sectors and on legionella prevention are also offered.

The intensive seminars are intended for all users from operational, maintenance and service fields who would like to gain more in-depth practical experience with specific ProMinent units. As well as workshops on metering pumps, we also offer workshops on measuring and control equipment, Bello Zon® chlorine dioxide plants and DVGW-certified (German Gas and Water Association) Dulcodes UV systems.

All training courses are held in our Seminar Centre in Heidelberg, equipped with the very latest media equipment and two practical training rooms. We limit the numbers on each course to 15 to enable us to deal with customers' needs individually and as comprehensively as possible. We would be pleased to arrange individual seminar dates or on-site sessions for you by prior agreement for a group of 5 participants or more.

## 1.4 Training Contacts

Detailed information on the current training programme is available on our website ([www.prominent.com](http://www.prominent.com)) under "Service" or directly from our training department.

<b>Address:</b>	ProMinent Dosiertechnik GmbH ProMinent Academy for Water Technology Im Schuhmachergewann 5-11 69123 Heidelberg
<b>Training Manager:</b>	Dr. Klaus Fuchs
<b>Telephone:</b>	06221 842-318 Administrative office 06221 842-0 (Main reception)
<b>Fax:</b>	06221 842-453 Administrative office
<b>E-mail:</b>	training@prominent.com

### For customers from other countries:

Please contact your local ProMinent branch office or agency.

## 2 Sales

### 2.1 The ProMinent Group

#### Head Office

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69123 Heidelberg · Germany  
info@prominent.com  
www.prominent.com

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+49 6221 6489

-0  
-433 Management  
-617 Sales Chemical Fluid Handling  
-419 Exports  
-220 Purchasing  
-435 Research and Development  
-627 EDP/Technical/Legal  
-432 Advertising  
-400 Sales ProMaqua

#### Affiliated Companies In Europe

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www.prominent.at

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info@prominent.be  
www.prominent.be

ProMinent Fluid Controls BG **(Bulgaria)**  
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office@prominent.bg  
www.prominent.bg

ProMinent Dosiertechnik CS s.r.o.  
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Addresses of distributors are available from ProMinent Dosier Technik GmbH · Im Schuhmachergewann 5-11 · 69123 Heidelberg · Germany

## 2 Sales

### 2.2 General Terms And Conditions Of Delivery

The valid General Terms and Conditions, which can be viewed on the ProMinent homepage, become material part of the contract.

#### I. Scope of application

- (1) The present terms and conditions of delivery shall apply exclusively; deviating conditions or conditions contrary of the customer shall only apply provided the supplier approved of this in writing.
- (2) The present General Terms and Conditions of Delivery shall also apply to subsequent orders and to replacement parts deliveries without necessitating repeated pointing out of this fact.
- (3) Supplements and representations as well as modifications or amendments to a contract concluded in writing or by telex must be in writing.

#### II. Offer and order confirmation

- (1) Offers shall only be binding provided a time-limit for acceptance is stated in the offer. To be legally binding, offers shall require the written confirmation of the supplier.
- (2) The supplier reserves any titles to and copyrights in figures, drawings, calculations, and other offer documentation and similar information of physical and non-physical type - also in electronic form; these may only be disclosed to third parties on the supplier's written approval and shall be immediately returned to the supplier on request if no order is awarded to the supplier.

#### III. Scope of deliveries and services

- (1) The deliveries and services are determined based on the mutual written declarations. If no such declarations exist, the written order confirmation of the supplier shall be decisive. For mere sales contracts, the agreed upon delivery provisions shall be interpreted according to the INCOTERMS valid at the conclusion of the contract.
- (2) Data in brochures, catalogues or general technical documentation shall only be binding if reference is made to them in writing.
- (3) The costs for an agreed mounting and assembly, including all and any required ancillary costs such as travel expenses or costs for the transport of tools or personal luggage shall be remunerated separately by the customer, if not otherwise agreed upon.
- (4) If software is part of the delivery scope, the customer shall be granted a non-exclusive right of use in the software. The customer may copy or edit the software only in the legally permissible scope.
- (5) Partial deliveries shall be permissible, provided it is reasonable for the customer, considering the interests of both the supplier and the customer.
- (6) In case of deliveries abroad, the supplier's obligation shall be under the proviso that any necessary export licences are granted.

#### IV. Prices and terms of payment

- (1) All prices shall be in EURO unless otherwise stated. They shall apply to mere delivery transactions "ex works" (EXW), exclusive of packaging.
- (2) The prices do not include any turnover tax. This tax is itemised separately in the invoice in the statutory amount applicable at the date of invoicing.
- (3) The deduction of discounts shall require a special agreement in writing.
- (4) If not otherwise shown in the order confirma-

tion, the sales price shall be due for payment 30 days from invoice date without any deduction.

- (5) If the customer does not comply with the date for payment, the customer shall pay default interest in the amount of 8 percentage points above the base interest rate pursuant to §247 German Civil Code from the due date. Payment of further damages remains reserved.
- (6) If not otherwise agreed upon, the delivery of goods for deliveries abroad shall be under the proviso that an irrevocable commercial letter of credit is issued by the customer in favour of the supplier, and confirmed by a German banking institution.
- (7) In case of delayed payment, the supplier may suspend the performance of his own obligations until total payment was received, giving written notice to the customer.
- (8) The customer may only set off claims or assert a right of retention, provided these are undisputed or have become non-appealable.

#### V. Time-limits for deliveries or services

- (1) With regard to time-limits, the mutual written declarations or, in the absence of such declarations, the written order confirmation of the supplier shall be decisive. The time limit shall be deemed observed, provided all and any documentation to be provided by the customer are received in time, and all and any required permits, releases, in particular plans, are provided, and the agreed upon terms of payment and other obligations are met by the customer. If these prerequisites are not met in time, the time-limit shall be prolonged reasonably; this shall not apply if the supplier is responsible for the delay.
- (2) If non-observance of the time-limits is the result of force majeure, e.g. mobilization, war, riot or similar events, e.g. strike or lock-out, the agreed upon time-limits shall be prolonged reasonably.
- (3) If mounting and assembly are not part of the agreed upon services, the time-limit shall be deemed observed if the goods ready for operation were shipped or collected within the time-limit. Should the delivery be delayed for reasons for which the customer is responsible, the time-limit shall be deemed observed upon notification of readiness for shipment.
- (4) If the supplier is responsible for the non-observance of the time-limit, the customer, provided the customer suffered an actual loss, may request compensation for delay for each full week of delay of a maximum of 0.5%, however, not exceeding 5% of the price for the part of the delivery which could not be taken into relevant operation because of the delay. Claims for compensation of the customer exceeding the limits stipulated in item 5.4 shall be excluded in all cases of delayed delivery or service, also after expiry of any grace period set to the supplier. This shall not apply to the extent mandatory liability exists in cases of intent, gross negligence or personal injury; a shift of the burden of proof to the disadvantage of the customer is not given in this case.
- (5) The customer's right to withdraw after ineffectual expiry of a grace period for the supplier shall remain unaffected. The grace period, however, must be reasonable and

amount to at least four weeks.

- (6) If shipment or delivery are delayed for more than one month after notice of readiness for shipment on the customer's request, warehouse charges in the amount of 0.5% of the price of the delivery goods, however, not exceeding a total of 5%, may be charged to the customer for each month started. The parties to the contract shall remain free to furnish proof of higher or lower warehouse charges.

#### VI. Passage of utility and risk; insurance; packaging

- (1) The risk of deliveries and services rendered by the supplier shall pass to the customer as follows, even in case of deliveries freight paid.
  - a) for deliveries without mounting or assembly, even in case of partial deliveries, if these have been shipped or collected. Shipments shall be insured by the supplier against the usual transport risks upon wish and at the expense of the customer. If such insurance exists, the supplier shall be immediately notified about any damages to goods in transit.
  - b) for deliveries with mounting or assembly on the day of acceptance in the customer's operations or, if agreed upon, after perfect test operation.
- (2) If the shipment, delivery, start, performance of mounting or assembly, acceptance in the customer's operations or test operation is/are delayed for reasons attributable to the customer or if the customer delays acceptance for other reasons, the risk shall pass to the customer.
- (3) The shipment is in principle made in standard packagings of the supplier. The latter shall be entitled to choose special types of packaging deemed necessary in the supplier's discretion. The costs of these packagings shall be borne by the customer.

#### VII. Mounting and assembly

The mounting, assembly and installation of the equipment and devices of the supplier may only be performed by specialists, observing the supplier's guidelines and the applicable technical standards. If mounting and/or assembly are performed by the supplier, the following provisions shall apply, if not otherwise agreed upon in writing:

- (1) The customer shall assume and provide in time at the customer's expense:
  - a) all earthwork, construction work and other different ancillary work, including there-quired specialists and auxiliary staff, materials and tools,
  - b) the commodities and materials such as scaffolds, cranes and elevators and other devices, fuels, lubricants, and chemicals required for assembly and commissioning,
  - c) energy and water at the site of use, including connections, heating, and illumination,
  - d) sufficiently large, suitable, dry and lockable rooms at the assembly site for storing machine parts, fixings, materials, and tools etc., and suitable working and recreation rooms for the assembly staff, including appropriate sanitary installations. For the protection of the supplier's pro-



perty and the assembly staff, the customer shall also take the measures he normally would take to protect his own property.

- e) protective clothing and protective devices which are necessary because of special circumstances at the assembly site.
- (2) Prior to the start of the assembly work, the customer shall unsolicitedly provide the required information about the position of sub-surface energy, gas, water conduits or similar installations as well as the required data on statics.
- (3) Prior to the start of mounting or assembly, the additions and objects required to start the work must be at the mounting or assembly site and all preparations prior to start of the installation must be advanced such that the mounting or assembly can be started as agreed upon and can be performed without any interruptions. Access routes and the mounting or assembly site must be flattened and clear of any objects.
- (4) Should mounting, assembly or commissioning be delayed for reasons beyond the control of the supplier, the customer shall bear the costs for waiting time and additionally required travels of the supplier or the assembly staff in an adequate amount.
- (5) If a plant cannot be installed immediately after delivery, the customer shall be responsible for a proper storage according to the supplier's guidelines.
- (6) The customer shall provide the supplier with weekly information on the duration of the working hours of the assembly staff and shall immediately confirm the completion of mounting, assembly or commissioning.
- (7) The commissioning may only be performed by technicians acknowledged by the supplier and according to the supplier's instructions. The technicians shall be entitled to refuse commissioning of the plant if the operating conditions to be provided by the customer do not guarantee a safe operation of the plant. The customer shall bear the costs of any delay in commissioning incurred to the supplier.
- (8) Should the supplier request acceptance of the deliveries and services after completion, the customer shall be obliged to do so within two weeks. Otherwise, the acceptance shall be deemed made, too, if the delivery goods and services - also after completion of an agreed test phase, if any - have been taken in use.

### VIII. Warranty

- (1) Should goods delivered or services rendered by the supplier prove to be defective because they do not possess the agreed quality or because they are not suitable for the agreed or usual use, the supplier shall in its discretion either remedy the parts or services concerned or deliver or render them again at no cost within the limitation period, provided the cause of the defect already existed at the time of risk passing.
- (2) Claims for material defects become statute-barred after 12 months, for ProMinent® pump drives and DULCOMETER® controllers the period is 24 months. The time-limit shall start with passing of the risk (item 6). The above provisions shall not apply to the extent the law mandatorily prescribes longer time-limits according to §§438(1) no. 2 German Civil Code (goods for edifices), §479(1) German Civil Code (right of recourse), and §634a German Civil Code (structural defects). The warranty period may be prolonged up to 60 months in suitable cases, provided the customer concludes a maintenance

contract for the corresponding period.

- (3) The customer shall immediately give notice of defects to the supplier.
- (4) In the event of notices of defects, payments of the customer may be retained in the volume which shows a reasonable ratio to the material defects incurred. The customer may retain payments only if a notice of defect is given whose justification is beyond doubt. If the notice of defect is given wrongfully, the supplier shall be entitled to request from the customer compensation for the expenses incurred to the supplier.
- (5) At first, the supplier shall always be given the opportunity to post-perform within a reasonable time-limit. The customer shall grant the supplier the time and opportunity required to do so. Should the customer refuse this, the supplier shall be exempted from the liability for defects.
- (6) If the post-performance fails, the customer - notwithstanding possible claims for damages - may withdraw from the contract or reduce the compensation. The customer may not claim compensation for futile expenses.
- (7) Claims for defects do not exist in case of minor deviations from the agreed or assumed quality, minor impairment of usability, natural wear or damages incurred after passing of the risk because of incorrect or negligible handling, excessive use, unsuitable operating material, faulty construction work, unsuitable subsoil or because of special external influences which are not established in the contract as well as in case of non-reproducible software errors. If the customer or third parties perform improper modifications or repair work, no claims for defects will exist for these and the resulting consequences.
- (8) The supplier shall not bear the additional expenditure, in particular transport, travelling, labour and material costs, which result from the fact that the subject matter of the delivery was later transported to a different location than the customer's branch or the original place of destination, except the transport corresponds to its proper use.
- (9) In all cases, the customer shall be obliged to take any possible and reasonable steps to keep the expense for the purpose of post-performance as small as possible. The supplier shall participate in the costs for a recall campaign only if this is necessary based on the factual and legal situation. The customer shall be obliged to either return defective products or keep them ready for inspection and tests, in the supplier's discretion.
- (10) Claims for recourse of the customer against the supplier shall only exist to the extent the customer did not conclude any agreements with the customers' purchaser which exceed the statutory claims for defects. In addition, item 8.8 shall apply correspondingly to the scope of the right for recourse of the customer against the supplier.
- (11) Furthermore, item 11 (Other claims for damages) also applies to claims for damages. More extensive or other claims than stipulated in the present item 8 of the customer against the supplier and its persons employed in performing the obligations because of a material defect shall be excluded.

### IX. Industrial property rights and copyright; defects of title

- (1) If not otherwise agreed upon, the supplier shall be obliged to render the delivery free of any industrial property rights and copyrights of third parties (hereinafter called: property rights) solely in the country of the place of delivery. To the extent a third party makes justified claims against the customer because of

infringement of property rights by deliveries rendered by the supplier and used according to contract, the supplier shall be liable to the customer within the time-limit stipulated in item 8.2 as follows:

- a) The supplier shall at the supplier's expense and in the supplier's discretion either obtain a right of use for the deliveries concerned, modify them such that the property right is not infringed or exchange them. Should the supplier not be able to do so under reasonable conditions, the customer shall be entitled to statutory cancellation or reduction rights. The customer may not claim compensation for futile expenses.
- b) The supplier's obligation to pay damages shall be subject to item 11.
- c) The above mentioned obligations of the supplier shall only be given provided the customer immediately informs the supplier in writing about claims asserted by third parties, refuses to acknowledge an infringement, and all and any measures of protection and settlement proceedings remain reserved to the supplier. Should the customer discontinue the use of the delivery goods for the purpose of reducing the damage or for other reasons, the customer shall be obliged to inform the third party about the fact that the discontinuance of use does not represent an acknowledgement of the property rights infringement.
- (2) Claims of the customer shall be excluded to the extent the customer is responsible for the property rights infringement.
- (3) Claims of the customer shall furthermore be excluded to the extent the property rights infringement was caused by special standards stipulated by the customer, by use not foreseeable by the supplier or by the fact that the delivery goods were modified by the customer or used in conjunction with products not delivered by the supplier.
- (4) In the event of property rights infringements, the claims of the customer stipulated in item 9.1 a) shall apply, in addition the provisions in item 8.4, item 8.5, and item 8.10 shall apply correspondingly. In case of other defects of title, the provisions of item 8 shall apply correspondingly.
- (5) More extensive or other claims than stipulated in the present item 9 of the customer against the supplier and its persons employed in performing the obligations because of a defect of title shall be excluded.

### X. Impossibility; adaptation of contract

- (1) To the extent the delivery is not possible, the customer shall be entitled to claim damages, except the impossibility is attributable to the supplier. The customer's claims for damages, however, shall be limited to 10% of the part of the delivery which cannot be taken into relevant operation because of the impossibility. This limitation shall not apply to the extent mandatory liability exists in cases of intent, gross negligence or personal injury; a shift of the burden of proof to the disadvantage of the customer is not given in this case. The customer's right to withdraw from the contract shall remain unaffected.
- (2) In case of temporary impossibility, item 5 (Time-limits) shall apply.
- (3) Should unforeseeable events in the sense of item 5.2 significantly change the economic meaning or the content of the delivery or have a significant effect on the supplier's operations, the contract shall be adapted in good faith. To the extent this is not economi-

## 2 Sales

cally reasonable, the supplier shall be entitled to withdraw from the contract. If the supplier intends to assert this right to withdraw, the supplier, after having obtained knowledge about the scope of the event, shall immediately inform the customer to this effect. This shall also apply if a prolongation of the delivery period was agreed upon with the customer at first.

### XI. Other claims for damages

- (1) Any claims for damages and reimbursement of expenses the purchaser may have due to the infringement of primary or collateral duties resulting from the relationship under the law of obligation, from unauthorized action or any other legal reasons, shall be excluded.
- (2) For all products with network connection, the risk of loss or data alteration and the risk of faulty data transmission will be passed to the customer as soon as the first network interface related to the product is crossed. For software products, the risk of loss or data alteration and the risk of faulty data transmission will be passed to the customer as soon as the software is installed. Despite careful control of the data, ProMinent does not assume any liability for data entering the system of the customer or other systems via an open network interface.
- (3) This exclusion does not apply when liability is imperative, e.g. according to the Product Liability Law (Produkthaftungsgesetz), for cases of intent, gross negligence or personal injuries, due to the warranty for the presence of a specific quality or the breach of material contractual obligations. Damage claims asserted on the basis of a breach of material contractual obligations shall be limited to foreseeable damages that are typical to the contract unless there is intent or gross negligence involved or the liability is based on physical injury or a warranty for the presence of a specific quality. No reversal of the burden of proof to the disadvantage of the purchaser is associated with the above provisions.
- (4) Unless longer limitation periods are imperatively prescribed by law, all claims for damages shall be subject to the limitation periods mentioned in sub-paragraph 8.2.

### XII. Warranty and product description

- (1) Warranties shall only be effective if made in writing.
- (2) Data described in catalogues, tender documentation and other printed matter as well as general advertising statements do not represent an offer for the conclusion of a warranty agreement.

### XIII. Reservation of title

- (1) The supplier reserves the title in the delivery goods (reserve goods) until the customer has made the complete payment due from the business relationship. The reservation of title shall also include the acknowledged balance, to the extent the supplier enters the claims against the customer in current account (current account reserve).
- (2) If the supplier accepts return of the delivery goods, this shall mean a withdrawal from the contract. Upon return of the goods purchased, the supplier shall be entitled to realise these goods; the realisation proceeds shall be credited to the customer's obligations - minus reasonable realisation fees. In the event the delivery goods are attached, the supplier shall be entitled to withdraw from the contract without setting a time-limit. In case of attachment or other interventions by third parties, the customer shall immediately inform the supplier in writing for the supplier

to be able to file action pursuant to §771 German Code of Civil Procedure. To the extent third parties are not able to reimburse the judicial and extrajudicial expenses of an action pursuant to §771 German Code of Civil Procedure to the supplier, the customer shall be liable for the loss incurred by the supplier

- (3) The customer shall be entitled to resell the delivery goods in the proper course of business; however, the customer already now assigns to the supplier all and any claims in the amount of the final invoice amount, including value added tax, which are due to him from the resale against his purchaser or third parties, independent of the fact whether the delivery goods were resold without or after processing. The customer shall be entitled to collect this claim also after its assignment. The supplier's power to collect the claim himself remains unaffected; the supplier, however, agrees not to collect the claim as long as the customer meets his payment obligations properly and is not delinquent. In this case, the supplier may request the customer to disclose the assigned claims and their debtors, to provide the information required for collection, to provide the relevant documentation and to inform the debtor (third party) about the assignment.
- (4) The processing and transformation of the delivery goods by the customer shall always be performed for the supplier. If the delivery goods are processed together with other objects not belonging to the supplier, the supplier shall obtain co-ownership in the new object in the proportion of the value of the delivery goods to the other processed objects at the time of processing. Otherwise, the same provisions as for reserve goods shall apply to the matter created by processing. The customer shall also assign to the supplier the claims for securing the supplier's claims which are due to the customer against a third party by joining the delivery goods with a real property.
- (5) If the delivery goods are mixed inseparately with other objects not belonging to the supplier, the supplier shall obtain coownership in the new object in the proportion of the value of the delivery goods to the other mixed objects at the time of mixing. If the mixing is done such that the matter of the customer is to be deemed a main component, the parties agree that the customer shall assign to the supplier proportional co-ownership. The customer shall keep the sole property or co-property for the supplier. The customer shall insure it in the usual scope against usual risks such as e.g. fire, theft, water, and similar. The customer shall already now assign to the supplier the customer's claims for compensation which are due to him from damages of the above mentioned type against insurers or other third parties, in the amount of the invoice value of the goods.
- (6) If the realisable value of the securities due to the supplier exceed the supplier's total claims by more than 10%, the supplier shall be obliged to release in the supplier's discretion securities on request of the customer or a third party affected by the excessive security.

### XIV. Repair conditions

- (1) The ordering party (customer) agrees by means of a legally binding declaration (Declaration of Decontamination) that any devices or parts returned for repair or maintenance will be thoroughly cleaned in order to avoid any hazard to the independent contractor due to re-contamination. The devices must be sent to the supplier free of any flammable, toxic, caustic, noxious, irritant or any other substances detrimental to health. The Declaration of Decontamination must be affixed to the

outside of the packaging used to return the devices. If no Declaration of Decontamination is affixed to the delivery, ProMinent has the right to refuse acceptance of the devices.

- (2) If a cost estimate is prepared on order of the orderer, the costs incurred in this connection may be charged to the orderer, independent of the fact whether a repair order is issued subsequently or not. Because the search time for defects is working time, the time expended and to be proven shall be charged to the orderer if an order cannot be executed because:
  - a) the defect complained about could not be determined, observing the rules of technology;
  - b) the order was withdrawn while executing the order;
- (3) The warranty period for all and any workmanship (repairs) as well as for built in material shall be six months. Otherwise, the warranty rules for suppliers and services from item VIII shall apply.
- (4) The payment terms from item IV shall apply. In addition, the following retention of title shall be agreed:
  - a) To the extent the replacement parts or similar built in during repairs do not become material components, the independent contractor shall reserve retention of title in these built in parts until the settlement of all and any claims of the independent contractor from the contract.
  - b) If the orderer delays in payment or does not meet the orderer's obligations from the retention of title, the supplier shall be entitled to request the return of the object for the purpose of removing the built in parts. All and any costs of the return and the removal shall be borne by the orderer.
  - c) If the repair is performed at the orderer's premises, the orderer shall give the supplier the opportunity to perform the removal at the orderer's premises. Labour and travel costs shall be at the expense of the orderer.
- (5) The place of jurisdiction for all disputes arising from this contract shall be the place of business of the contractor, if the person ordering is a merchant. However, the contractor is also entitled to institute legal proceedings at the place of business of the person ordering.

### XV. Place of jurisdiction and applicable law

- (1) The place of jurisdiction for all and any disputes arising out of the present contract shall be the supplier's headquarters, provided the customer is a merchant. The supplier, however, shall be entitled to file action at the customer's headquarters.
- (2) German law shall apply to the contractual relationships. The UN Convention on the International Sale of Goods (CISG) shall be excluded.

### XVI. Severability

Should any individual provisions of the present contract be legally ineffective, the validity of the remaining provisions shall in no way be affected. This shall not apply if abiding by the contract would constitute an unreasonable hardship for the other party to the contract.

### XVII. Terms and conditions for the participation in the exchange device programme

- (1) The exchange device programme applies to

## 2 Sales

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pumps without Profibus interface and without self-ventilation as well as for amperometric sensors.

- (2) The purchaser agrees with the participation in the exchange device programme that the device is assigned to ProMinent Dosiertechnik GmbH. By delivering the device, the ownership in the delivered devices shall pass on to ProMinent Dosiertechnik. In return, the

purchaser shall receive a used, similar and at least equal device.

- (3) Within the scope of each exchange process, a maximum of 5 exchange devices per customer may be ordered.
- (4) Already exchanged devices can no longer participate in the exchange device programme.

- (5) The warranty for exchange pumps shall be 6 months.

**ProMinent Dosiertechnik GmbH**

Valid 11/2009