Dulcometer®
Typ CLWS/CDWS/OZWS

Instruction Manual

ProMinent®

T. No. 985845.7 e

Part Numbers:

Type CLWS		Type CDWS		Type OZWS	
F1K2	92.50.21.8	F1K2	92.49.19.4	K2	92.50.30.9
TFK2	92.50.22.6	TFK2	92.49.20.2	3P	92.50.31.7
TFM	92.50.23.4				
3P	92.50.24.2				
IL2	92.50.25.9				

11/91 ProMinent Dosiertechnik GmbH · D-6900 Heidelberg · Germany DM-BA-079

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Dear user,

You have made a good choice in purchasing this reliable, sturdy and versatile chlorine or chlorine dioxide analyser/controller.

In order that you may make full use of the benefits the system offers you please follow our advice and

read this instruction manual

throughout before you install the system and start operation. If treated in accordance with the instructions given, the Dulcometer® system will reward you with many years of faultless performance.

First of all, please check by means of the packing list whether the shipment is complete.

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1. Applications of Dulcometer® CLWS/CDWS/OZWS Series

The Dulcometer® CLWS/CDWS/OZWS series is used to measure and control the chlorine residual the chlorine dioxide and O_3 concentration in the treatment of water and wastewater, in industrial process systems and in the food and beverage industry. A variety of control characteristics adaptable to different process requirements enables the system to pace ProMinent® electronic metering pumps and to actuate solenoid valves, motor valves and servo-motors. In conjunction with the Dulcometer® proportional feed-forward control system, even motor-driven metering pumps of the Meta and MAKRO series are capable of being process-controlled.

2. Installation

Remove the bezel around the perspex cover by loosening the four cross head screws. This will provide access to the two wall mounting holes at the left and right at 126 mm centers.

For panel mounting provide a cut-out of 139 x 115 mm (wide x high). When mounted, the system is 83 mm deep. The electrical connections can be made after the unit is mounted since the terminals are accessible both from the front (wall mounting) and the rear (panel mounting).

2.1 Probe installation

Install the probe (type CLE II T, CDM 1, CDE 1.2, OZE) in an in-line probe housing type ProMinent® DLG III (Order No. 91.49.55.0 with hose nozzles, or 91.49.56.8 with solvent sockets). The probe should be operated under atmospheric pressure conditions. The recommended flow rate is 0.5 to 1 l/min. Please also refer to the Instruction Manual for the respective probe.

3. Electrical connections

Remove the front or rear cover of the terminal box.

Connect as follows:

Terminal 1:	Protective earth PE
Terminal 2:	Line L
Terminal 3:	Neutral N

Terminals 4, 5 and 6: Output relay K 1. Relay K 1 pulls in when the measured value drops below the lower set value (types F1K2, TFK2, K2)

Terminals 7, 8 and 9: Output relay K 2. Relay K 2 pulls in when the measured value exceeds the upper set value (types F1K2, TFK2, TFM, K2)

These relays can be used for the remote annunciation of the measured value being out of the allowable range

Terminals 10, 11 and 12: Relay, time check. This relay pulls in when the pre-selected time for the time check has expired. It can be used to annunciate that due to some fault the set value has not been achieved

The relay terminals are marked as follows:

C: Common

NC: Normally closed

NO: Normally open

Maximum contact load: 250 V, 3 A, 700 VA

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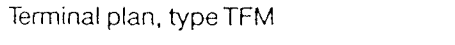

Terminal plan, type TFM

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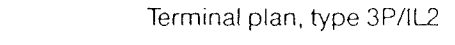


Terminal plan, type 3P/IL2

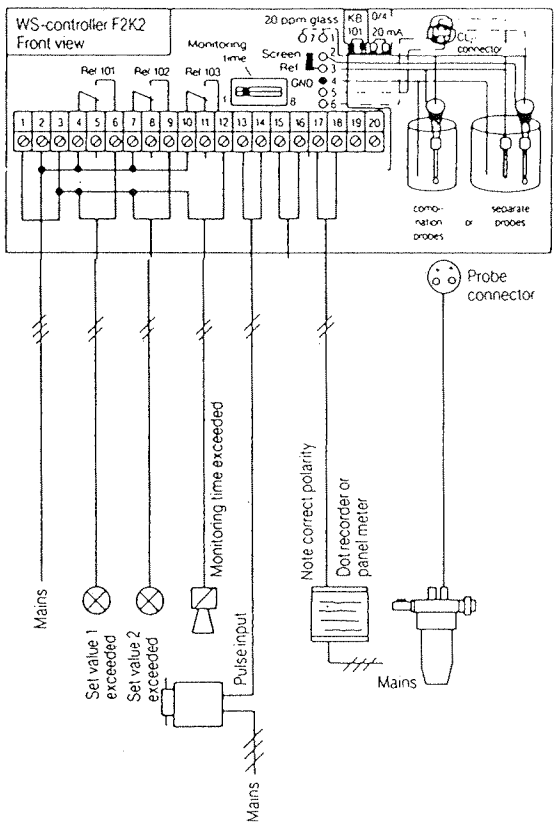
Attention: With type 3P/IL2, terminals 4 and 6 of relay K 1 and 7 and 9 of relay K 2 carry a pulse train for actuating a positioning motor.

Attention: With type TFM, terminals 4 and 6 of relay K 1 carry a pulse train for modulating a solenoid valve.

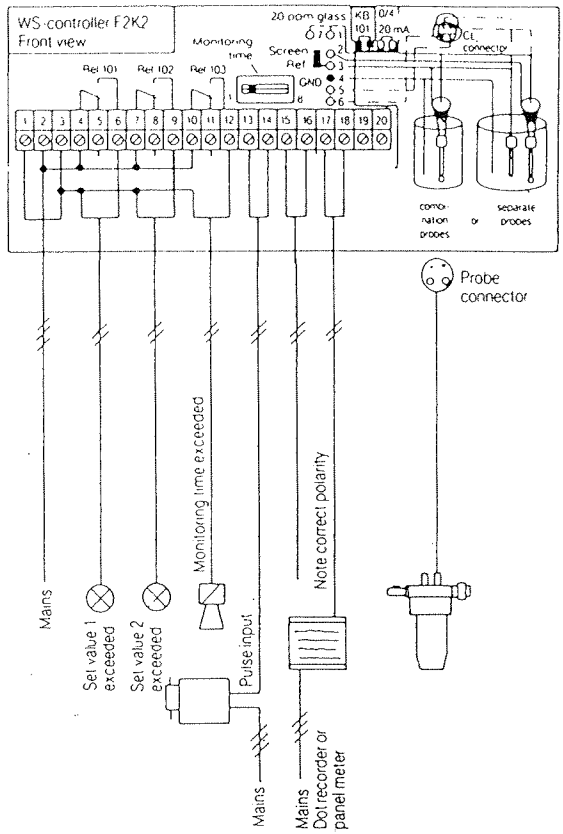
With type TFM the reed relays, terminals 15/16 or 13/14 pull in when the measured value exceeds or drops below the respective set value.

Caution: Maximum contact load 24 V/50 mA.

As an option, the pulse train outputs F1 and F2 of the 3P and IL2 types (13/14 and 15/16) can be activated so that the controller can be operated either as a duty-factor type or a three-position step type controller.



Terminal plan, type F1K2



Terminal plan, type TFK2

The pulse train output, terminals 13 and 14, can be used to pace a ProMinent® solenoid-driven metering pump for feeding chlorine (types F1K2 and TFK2).

With type TFK2, terminals 15 and 16 can be used to pace a second ProMinent® solenoid-driven metering pump. This pump will operate synchronously with the first one.

If Option WS 02 "Standard signal output" was ordered, terminals 17 and 18 carry a 0/4...20 mA standard signal. Note the polarity (terminal 17 +, terminal 18 -) when connecting an indicating or recording instrument.

Jumper KB 102 in the terminal box is used to change the output signal from 0...20 mA to 4...20 mA and vice versa. With the jumper removed the signal will be 0...20 mA, with the jumper plugged home it will be 4...20 mA.

Terminals 19 and 20 are not connected.

Caution: If inductive loads (e.g. contactors, solenoid valves, positioning motors) are to be connected to relays K1 or K2, protect the contacts by connecting an RC combination in parallel. Typical values are 0.47 μF/47 Ohms.

4. Connecting the probe (types CLE 2.2, CDM 1, CDE 1.2, OZE 1)

Connect the probe by means of the special signal cable by plugging it into the socket (marked blue) of the analyser. Protect cable and connectors against moisture.

4.1 Measuring ranges

The measuring range of the CLWS/CDWS/OZWS analysers/controllers covers 0...5 mg/l of Cl_2, ClO_2 or O_3. The control range covers 0...2 mg/l. If Option WS 020 is included, the measuring and control range is extended to 0...20 mg/l Cl_2 or ClO_2.

If the chlorine dioxide sensor type CDE 1.2 is used, Option WS 200 is required for type CDWS. With this option the measuring range is 0...500 μg/l ClO_2, and the control range 0...200 μg/l ClO_2.

For further information please refer to the Instruction Manual "Chlorine dioxide sensor type CDE 1.2"

4.2 Calibrating the probe

Prior to its installation and calibration, fill the probe with the filling solution supplied with it, adhering strictly to the respective Instruction Manual. Make sure that no air bubbles, which could interfere with the measurement, remain in the membrane cap.

4.2.1 Zero calibration ←o→

As a rule, no zero calibration is required since the chlorine and chlorine dioxide probes have a stable zero. Electrical zero of the analyser can be checked by short- circuiting the two sockets of the probe cable and adjusting zero by means of zero potentiometer 11.

4.2.2 Slope calibration

Install the probe in the probe housing and adjust the flow rate of the sample water by means of a suitable regulating valve. Run the system for about one hour. Then take a water sample from the effluent of the probe housing and determine the residual of free chlorine the chlorine dioxide or ozone concentration by means of the DPD method or by titration.

By means of slope potentiometer 12 adjust the display to read the value thus determined.

Again, refer to the Instruction Manual for the probe used.

5. Putting into service

5.1 Setting set value

With type F1K2, pressing the pushbutton key 3 will cause the set value to be displayed, which can then be set by means of potentiometer 7.

All other types allow setting a set value range. The lower set value can be displayed by means of pushbutton key 3 and set by means of potentiometer 7, the upper one by means of pushbutton key 4 and potentiometer 8, respectively.

Note: The display shows a negative sign as long as pushbutton key 3 or 4 is pressed.

5.2 Functions of the individual analyser/controller types

5.2.1 Types CLWS F1K2 / CDWS F1K2

Type F1K2 offers a pulse-train output to pace a ProMinent® solenoid-driven metering pump or a BelloZon® chlorine dioxide generator, and two relay outputs to actuate two other devices.

Feeding chlorine or chlorine dioxide

When the actual value drops below the set value, relay K 1 will pull in, the red LED 5 will be lit and the voltage-free pulse-train output (terminals 13 and 14) will emit pulses proportional to the error signal. The pulses will be indicated by LED 1. The pulse-train output can be used both to pace ProMinent® solenoid-driven metering pumps or BelloZon® chlorine dioxide generators.

5.2.1.1 Setting proportional bandwidth

The proportional bandwidth can be varied by means of potentiometer 9.

The term "proportional bandwidth" is used to express the ratio of the final controlling signal to the error signal; in other words that deviation of the chlorine residual or chlorine dioxide concentration from the set value that causes the pulse rate to reach its maximum of 6000 pulses per hour.

In the fully counterclockwise position of potentiometer 9 the maximum pulse rate will be generated when the measured value has departed from the set value by 0.2 mg/l of chlorine or chlorine dioxide, in the fully clock- wise position by 0.1 mg/l of chlorine or chlorine dioxide.

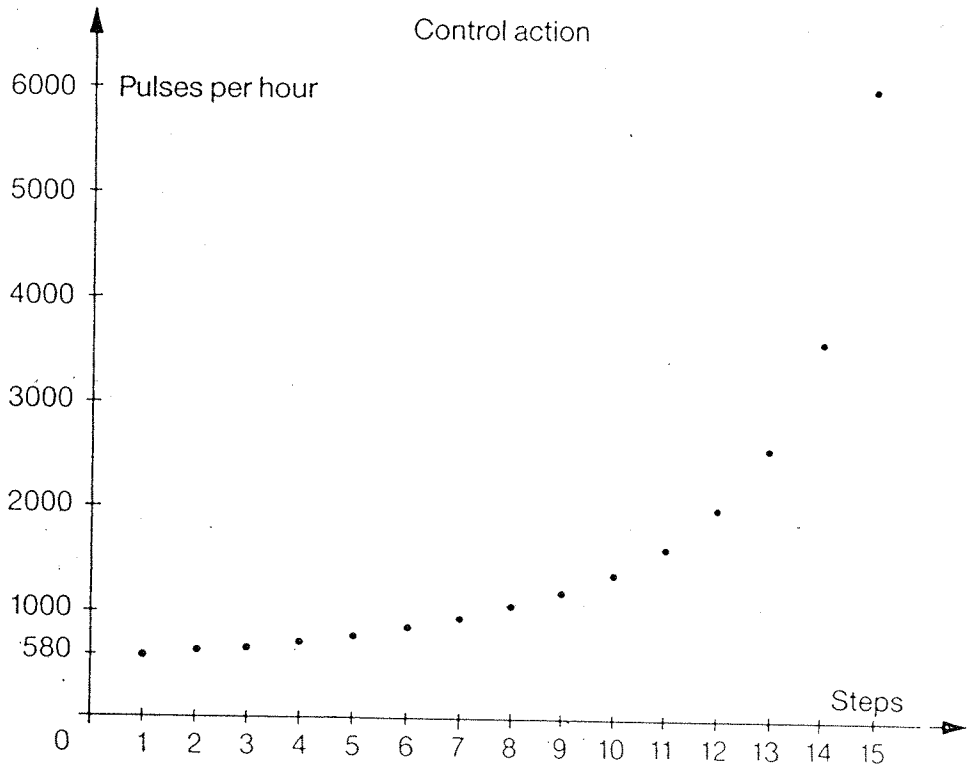
By varying the proportional bandwidth one can suit the control characteristics to the process in an optimum manner, that is, opposing the disturbance as quickly as possible and yet avoiding overshooting of the set value.

The procedure recommended for bringing the system into operation is to start with the maximum proportional bandwidth (potentiometer turned fully clockwise) and, as overshooting occurs, to decrease the proportional bandwidth until there is no more overshooting.

5.2.2 Type CLWS/CDWS TF

This is multiple-speed floating control system developed to pace ProMinent® solenoid-driven metering pumps. In a more general way, this type can be used for all continuous processes. It is characterized by the fact that within a neutral zone between the two set values the pulse train continues with the pulse rate last attained, thus providing a feed rate covering the basic demand.

The analyser/controller varies the pulse rate in 15 fixed steps from the minimum pulse rate of 580 pulses per hour to the maximum pulse rate of 6000 pulses per hour.



Proportional bandwidth diagramm II W/S

Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
T(ms)	6200	5800	5400	5000	4600	4200	3800	3400	3000	2600	2200	1800	1400	1000	400+200
pph	580	620	666	720	783	860	950	1060	1200	1385	1636	2000	2570	3600	6000

When switched on, the analyser/controller starts with step 1, that is the lowest pulse rate. At a preselectable fixed step rate (see 5.3.2.), the system advances one step, thus increasing the pulse rate. The system advances from step to step until the measured chlorine residual or chlorine dioxide concentration enters the neutral zone.

In the neutral zone the system continues to generate a constant pulse train at a rate corresponding to that of the last step. If the measured value passes through one of the set points, the system steps up or down until the measured value reenters the neutral zone.

The pulse output will be discontinued when, in the first step, the measured value still exceeds the upper set value. The system will continue to generate the maximum pulse rate if, in the fifteenth step, the lower set value is not yet achieved.

The pulses will be indicated by flashing of the respective yellow LED 1 or 2. The pulled-in state of relay 1 (measured value below lower set value) will be indicated by the red LED 5, that of relay 2 (measured value above upper set value) by the red LED 6.

5.2.2.1 Setting step rate, type TF

The step rate must be suited to the process. It depends mainly on the response time of the process system.

The interval between two steps can be varied by means of potentiometer 13 between 9 seconds (turned fully clockwise) and 420 seconds (turned fully counterclockwise). Accordingly the analyser/controller requires from 135 seconds to 105 minutes to go through all 15 steps.

During start-up the response time between the point of injection and the point of measurement should be estimated, or measured by means of a dye test, and the step rate adjusted accordingly.

5.2.2.2 Setting maximum pulse rate

If overshooting occurs even at the lowest step rate, the maximum pulse rate can be reduced by potentiometer 14 from 6000 pulses per hour (turned fully clockwise) to 2000 pulses per hour (turned fully counterclockwise). It is recommended to start with the maximum pulse rate.

5.2.3 Type CLWS TFM

This is a multiple-speed floating control system used to modulate solenoid valves. Its control characteristic is particularly suited to processes with long response times and slow changes of the measured variable.

The duration of the actuating pulse is 10 seconds. The interval is proportional to the error signal and varies in 255 steps from 10 to 112 seconds. The solenoid valve will be actuated at a constant period as long as the measured value is within the neutral zone. If the measured variable exceeds the upper set value or drops below the lower set value, the interval will be respectively extended or reduced step by step. The pulse output will be discontinued when, with the longest interval, the measured value still excceeds the lower set value.

5.2.3.1 Setting step rate, type TFM

The interval between two steps can be varied by means of potentiometer 13 between 2 seconds (turned fully clockwise) and 160 seconds (turned fully counterclockwise). Accordingly the analyser/controller requires from 8.5 minutes to 680 minutes to go through all 225 steps.

5.2.4 Type CLWS 3P

This is a three-position step-type control system to actuate servo-motors, stroke-positioning motors or motor- driven valves relative to process demand. The duration of the pulse actuating the motor when the measured value exceeds or drops below the set value can be varied between 1 second and 10 seconds by means of potentiometer 13a. The interval is proportional to the error signal and is automatically varied between 10 seconds and 500 seconds.

The pulled-in state of the two output relays will be indicated by the red LEDs 5 and 6.

Caution: The two output relays should be interlocked with each other in order to avoid their pulling in simultaneously if the set values are mixed up crosswise. This could result in damages to the positioning motor.

5.2.4.1 Setting proportional bandwidth

To suit the CLWS 3P to different process requirements the proportional bandwidth can be adjusted by means of potentiometer 9 or 10. If the respective potentiometer is turned fully clockwise the minimum interval of 10 seconds will be generated when the measured value has departed from the set point by Δ 0.1 mg/l chlorine; if turned fully counterclockwise, when the measured value has departed from the set point by Δ 0.2 mg/l chlorine. Thus, the speed of, e.g. a stroke positioning motor, can be varied. Potentiometer 9 is effective when the actual values drops below the set value, potentiometer 10 when it exceeds it.

5.2.5 Type CLWS IL2

This control system is also used to modulate positioning motors or solenoid valves. In this system the duty factor of the output pulse train is capable of being varied. At the maximum deviation the on-time is 20 seconds, the off-time 5 seconds.

At the minimum deviation the pulse/interval ratio is 2.5/150 seconds. This results in an excellent control dynamics which can be further adapted to the process by means of potentiometer 9 and 10. The functions of these potentiometers are identical with those of the 3P version. The maximum on-time can be limited by means of potentiometer 13.

The electrical connections correspond to those of the 3P type.

5.2.6 Type OZWS 05K2

This type is provided with two set valves that can be accurately set with the aid of the digital display and two associated change-over relay alarm outputs.

When the actual value drops below the set value, relay K1 will pull in and the red LED 5 will be lit. When the actual value is higher than the upper set value, relay K2 will pull in and the red LED 6 will be lit.

5.2.7 Type OZWS 05 3P

This is a three-step neutral zone control system with two change-over relays for modulating a positioning motor, e.g. the positioning motor of the variable transformer of a Bono Zon® generator.
The pulse duration (on-time) can be varied between 0.3 sec. and 4.5 sec. by means of potentiometer 13a.
The pulse interval time can be adjusted between 12 and 300 sec. by means of potentiometer 14.

The time range for the pulse duration can be doubled or quadrupled by means of a plug-in jumper. In the same manner the time range for the interval can be halved or doubled. If the measured value leaves the desired range of set values, the positioning motor will be adjusted at a constant rate as set.

Caution: The two output relays should be interlocked with each other in order to avoid their pulling in simultaneously if the set values are mixed up crosswise. This could result in damages to the positioning motor.

5.3. Mode selector switch "Measurement – Automatic – Manual"

The selector switch 20 is used to select the three modes of the CLWS/CDWS/ OZWS

- Top position (7) Measurement

  The transmitter acts as an indicating transmitter only. The pulse train outputs are inactive.

- ~~C~~entre position Automatic ◯

  This is the normal operating position.

- Lower position ☟ Manual

  In this position a range of measured values can be simulated by means of potentiometer 19 in order to check the control function or to set a certain stroking rate.

6. Time check

In their standard versions the chlorine/chlorine dioxide analysers/controllers are equipped with an automatic time check. The time check is started when the measured value exceeds the upper set value or drops below the lower set value (switch 15 in "ON" position). The green LED 17 indicates that the time check is running. If the measured variable does not pass through the respective set value within the pre-selected time, LED 17 will be extinguished and the red LED 18 will indicate that the preselected check time has been exceeded. Simultaneously the alarm relay 3, which can be used for remote fault annunciation, will pull in. The final controlling elements (metering pump, solenoid valve, etc.) will cease to operate. They can be restarted by means of switch 15 (off-on).

6.1 Setting check time

Opening the terminal box provides access to a 8-position time range selector switch. The factory setting is in position 3, which covers a time range from 32...90 minutes.

The fine adjustment is made by means of potentiometer 16. By way of demonstration, its relatve position may be taken from the illustration below.

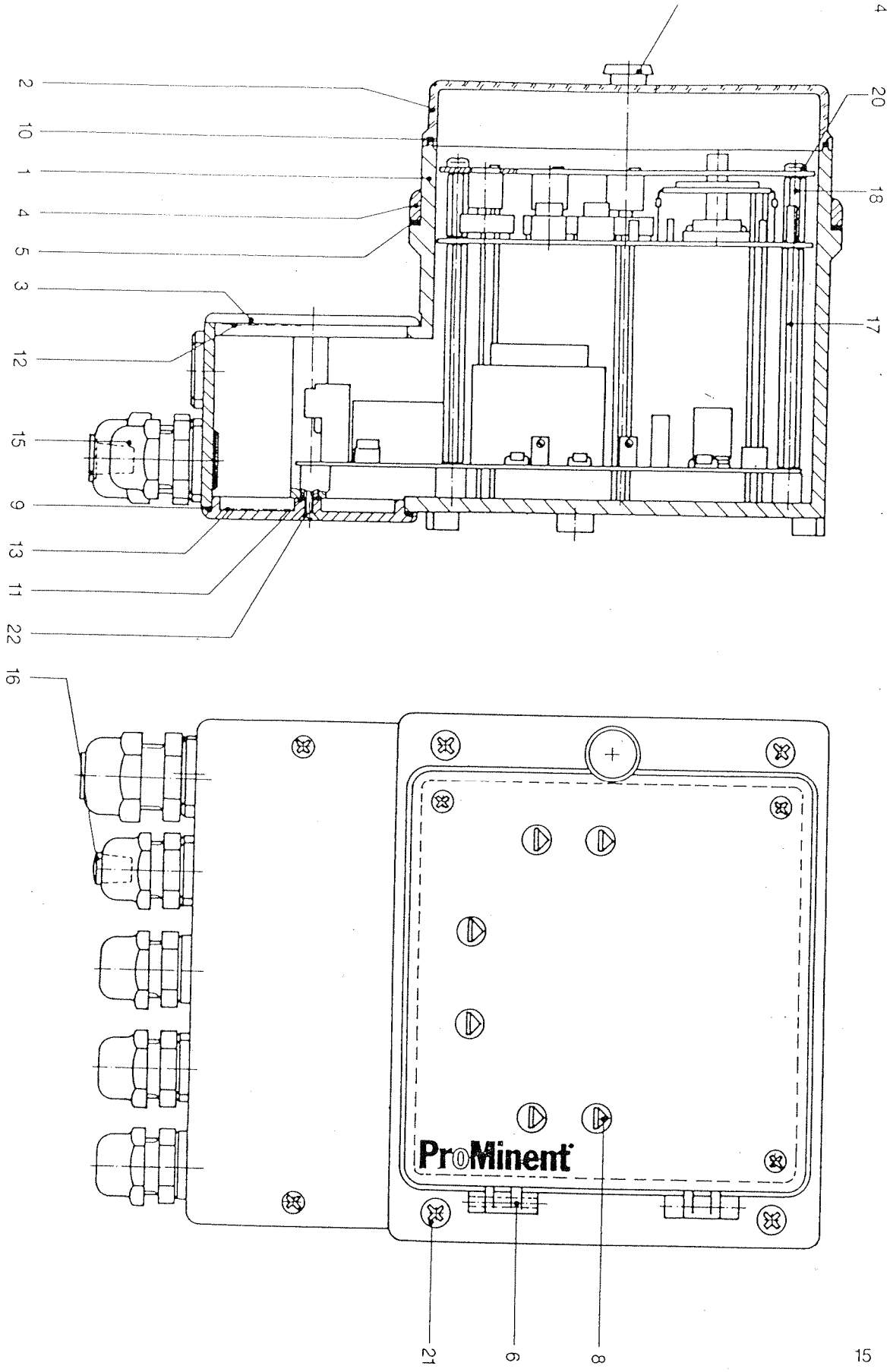
7. Probes and consumable material

	Part No.
Chlorine probe Dulcotest® type CLE II T Amperometric sensor for free, effective chlorine, measuring range 0...20 mg/l, with built-in temperature correction, temperature range: +0...+50 °C, including filling solution, capable of being installed in an in-line probe housing DLG III	91.49.58.4
Chlorine dioxide probe Dulcotest® type CDM 1 as above, but for determining chlorine dioxide, measuring range 0...20 mg/l	91.49.59.2
Chlorine dioxide probe Dulcotest® type CDE 1.2 as above, but range of measurement 0...2 mg/l ClO_2. Resolution: 0.001 mg/l (1 ppb)	
Ozone probe Dulcotest® type OZE 1 as above, but for determining ozone, measuring range 0...5 mg/l	91.49.23.8
Fitting aide, required for the initial installation of the CLE 2.2, CDM 1, CDE 1.2 or OZE 1 probes into the DLG III	81.50.79.9
Filling solution suitable for all chlorine probes type CLE, 100 ml	50.62.70.8
Filling solution for chlorine dioxide probe CDM 1, 100 ml	50.62.71.6
Filling solution for chlorine dioxide probe CDE 1.2, 100 ml	50.62.72.4
Filling solution for ozone probe OZE 1, 100 ml	50.62.73.2
Membrane cap for types CLE 2.2, CDM 1 and CDE 1.2	81.50.93.0
Membrane cap for types CDE 1.2	81.50.73.2
Probe cable for types CLE 2.2, CDM 1 and CDE 1.2, OZE 1 both ends with 4-pole connector 2 m	81.84.55.8
5 m	81.84.56.6
10 m	81.84.70.7

8. Spare parts list – CLWS/CDWS/OZWS

Item*	No.	Description	Part No.
1	1	Housing (w/o fastening material)	14.11.46.1
2	1	Perspex cover "ProMinent®"	14.11.49.5
3	2	Cover	14.11.47.9
4	1	Bezel	14.11 48.7
5	1	Seal for bezel	48.35.32.8
6	2	Cylindrical pin d 2.5 m 6 x 18	46.07.04.0
8	6	Control knob d 10 x 12.5	70.35.24.9
9	2	Seal for cover	48.40.12.0
10	1	Seal for perspex cover	48.40.13.8
11	4	Retaining washer d 5 x 2.5 x 0.5	48.39.50.2
12	1	Terminal plan, front	60.63.04.4
13	1	Terminal plan, rear	60.63.05.1
15	5	Cable gland PG 9 Skintop gray	70.38.83.9
16	5	Plug IL4-073	14.04.48.2
17	4	Spacer M 3x60 female/male	46.01.06.8
18	4	Spacer M 3x18 female/male	46.01.07.6
20	4	Raised c'sk. hd. screw M 3x6	46.86.02.8
21	4	Raised c'sk. hd. screw M 4x12	46.86.15.0
22	4	C'sk. hd. screw M 3x10	46.87.06.7
24	1	Knurled screw M 3x20	46.62.13.6
	1	Housing assembly (items 1-24)	81.49.96.5
	1	Front plate CLWS F1K2	60.64.11.7
	1	Front plate CLWS TFK2	60.64.12.5
	1	Front plate CLWS TFM	60.64.13.3
	1	Front plate CLWS 3P	60.64.14.1
	1	Front plate CLWS IL2	60.40.43.0
	1	Front plate CDWS F1K2	60.63.99.4
	1	Front plate CDWS TFK2	60.63.00.2
	1	Front plate OZWS 05 K2	60.64.67.9
	1	Front plate OZWS 05 3P	60.64.68.7
	1	4-pole connector and plug	81.84.62.4
	1	Main circuit board	81.90.27.4
	1	Signal processing circuit board	81.90.29.0
	1	Display circuit board	81.90.28.2
	1	Extra circuit board TF II	81.90.36.5
	1	Extra circuit board TFM	81.90.37.5
	1	Extra circuit board 3P/IL2	81.90.30.8
	1	Extra circuit board OZWS 05 3P	81.44.66.9
	1	Jumper strip	71.39.95.9
	1	Pin socket black	70.42.28.6
	1	Signal output, potential-separated, 0/4...20 mA = 0...1 mg/l chlorine or chlorine dioxide, O_3/l	91.49.32.9
	1	Signal output, potential-separated, 0/4...20 mA = 0...2 mg/l chlorine or chlorine dioxide, O_3/l	92.49.25.1

* see drawing page 15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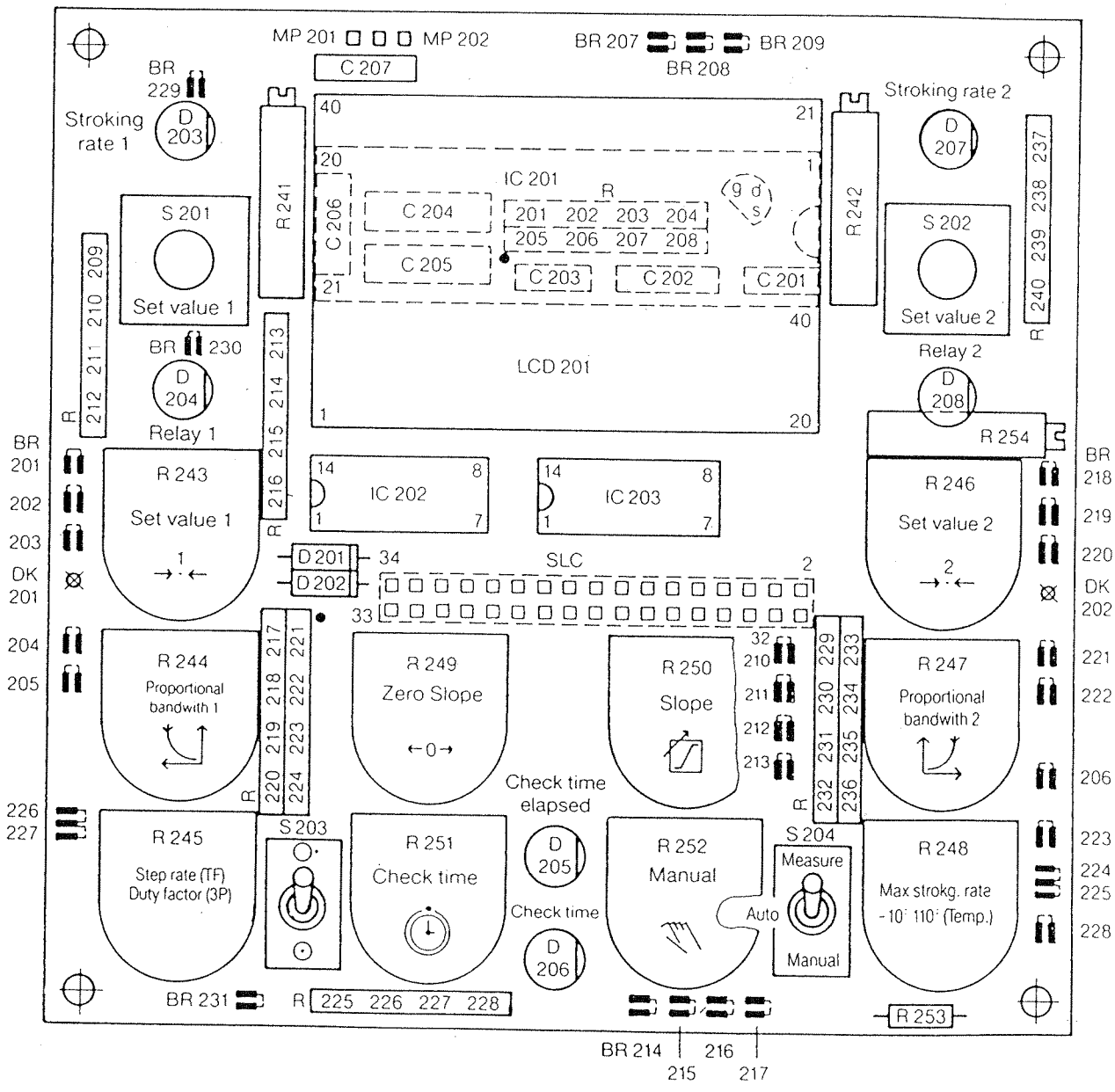
9. Component diagrams

Component diagram for front circuit board WS transmitter/controller F2K2



Component diagram for main circuit board WS analyser/controller F2K2