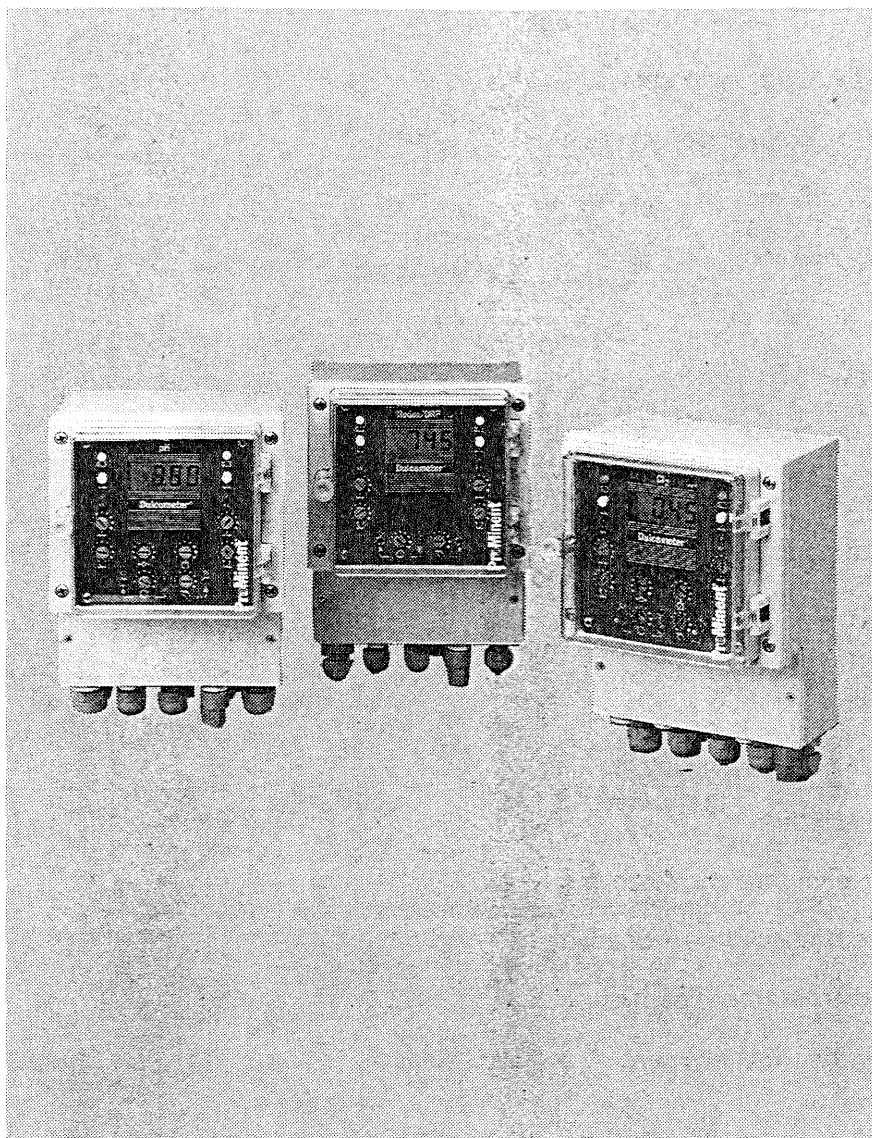


Dulcometer[®] Typ RHWS 1000

Instruction manual

T.No. 985867.1

e



Part No. Type

F2K2 92.50.11.9

TF 92.50.12.7

TFM 92.50.13.5

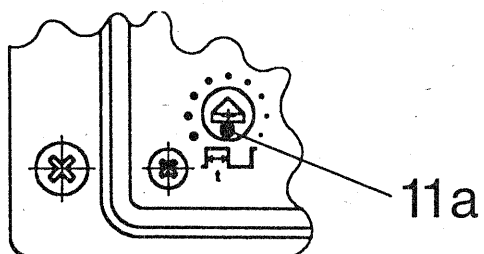
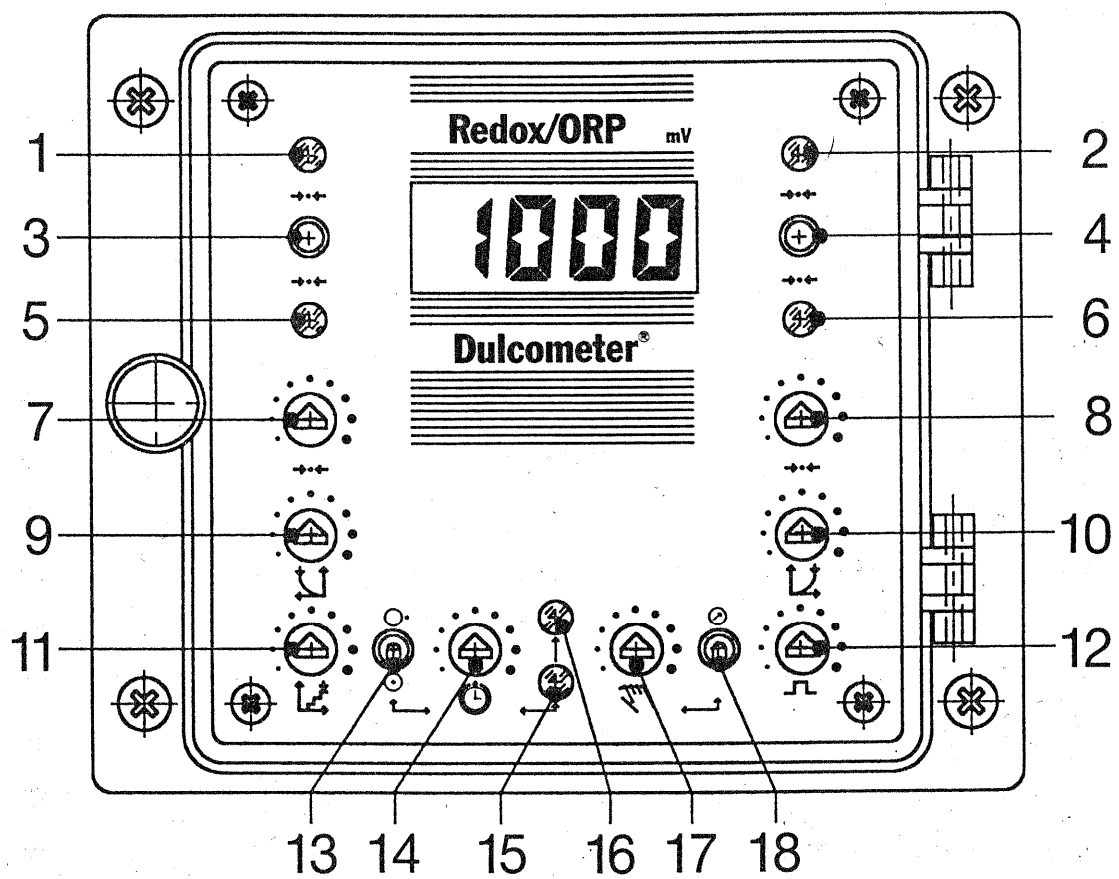
3P 92.50.14.3

IL2 92.50.15.0

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Front panel controls

1. Stroke indication (LED, yellow), oxidant feeding
2. Stroke indication (LED, yellow), reducing agent feeding
3. Pushbutton key to display lower set value
4. Pushbutton key to display upper set value
5. State of relay K 1 (LED, red)
6. State of relay K 2 (LED, red)
7. Adjustment of lower set value
8. Adjustment of upper set value
9. Adjustment of proportional bandwidth, oxidant feeding
10. Adjustment of proportional bandwidth, reducing agent feeding
11. Adjustment of the step rate
(types TF and TFM only, not available with type F2K2)
12. Adjustment of maximum pulse rate (type TF only)
13. On/off-reset switch, time check
- 13a. Adjustment of switch-on time (type 3P-IL2
14. Adjustment of check time
15. Indicator (LED, green), time check running
16. Indicator (LED, red), check time exceeded
17. Adjustment of simulated measured value
18. Mode selector switch: Measurement - Automatic - Manual

Dear user,

You have made a good choice in purchasing this reliable, sturdy and versatile redox measurement and control system.

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 instal 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.

1. Applications of Dulcometer® RHWS 1000 Series

The Dulcometer® RHWS 1000 series is used to measure and control the redox potential (ORP) 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 servomotors. In conjunction with the Dulcometer® proportional 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.

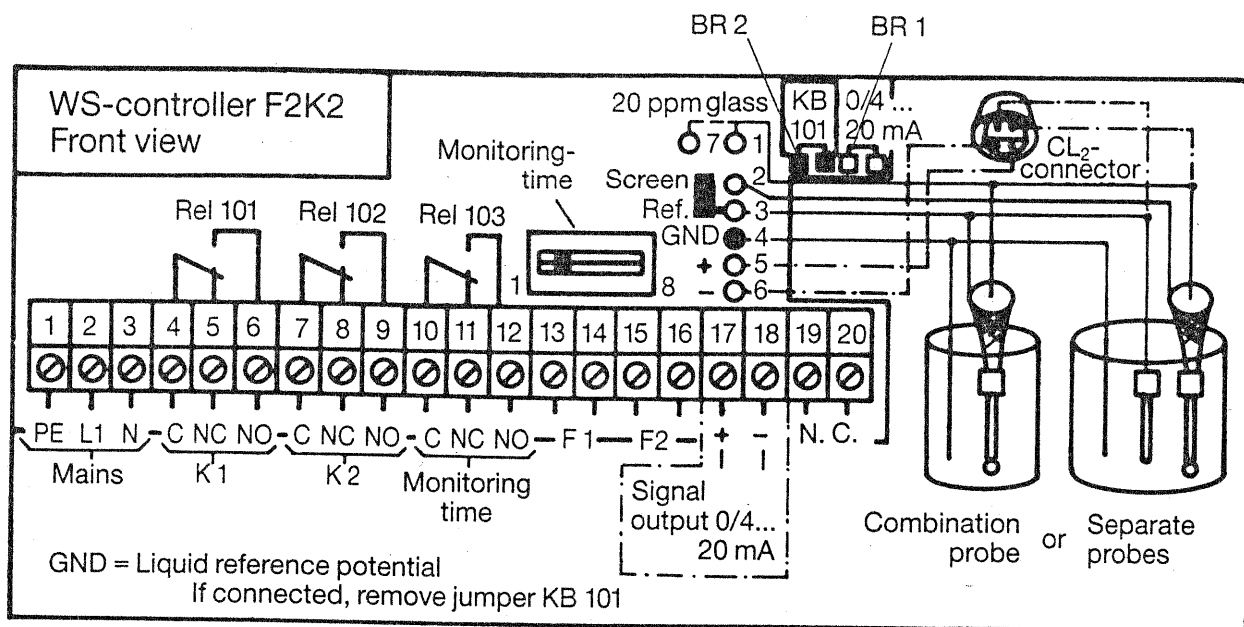
For panel mounting provide a cut-out of 139 x 115 mm (wide x high). The electrical connections can be made after the unit is mounted since the terminals are accessible both from the front (wall mounting) and the rear (panel mounting).

2.1 Installation of the probe

Redox probes are usually installed in an in-line probe housing (e.g. ProMinent® type DLG III) or an immersion probe housing (e.g. ProMinent® type ETS I) which must be equipped with a stainless steel bar serving as a sample reference potential. The probe should be operated under atmospheric pressure conditions; with in-line probe housings a visible check of the effluent should be possible. To allow maintenance of the probe, in-line probe housings should be provided with isolating valves which at the same time allow an adjustment of the flow rate. The recommended flow rate is 0.5 to 1 l/min.

3. Electric 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 F2K2 and TF). |
| Terminals 7, 8 and 9: | Output relay K 2. Relay K 2 pulls in when the measured value exceeds the upper set value (types F2K2, TF and TFM) 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:

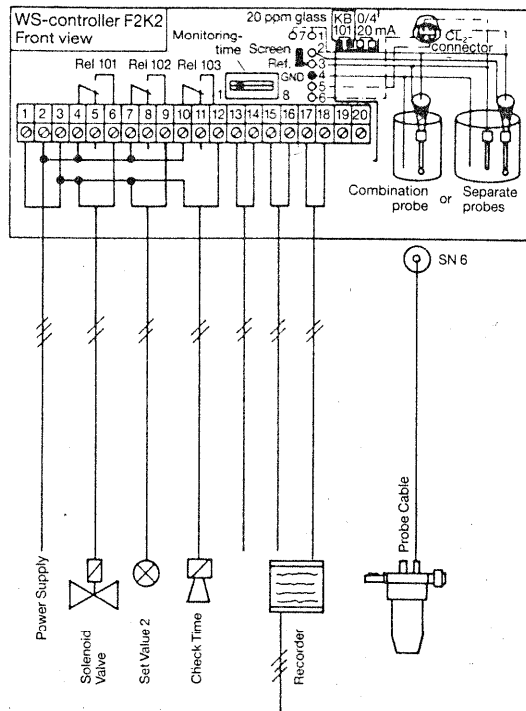
- C: Common
NC: Normally closed
NO: Normally open

Contact load:
max. 250V / 3A / 700VA
max. 24V / 25mA

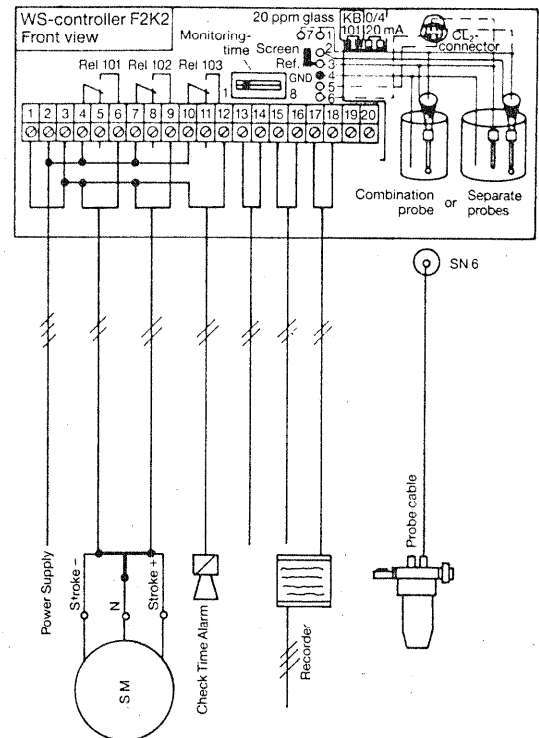
Attention:

With type TFM, terminals 4 and 6 of relay K 1 carry a pulse signal for the actuation of a solenoid valve.

With type 3P-IL, terminals 4 and 6 of relay K 1 and 7 and 9 of relay K 2 carry pulse signals for the actuation of a positioning motor.



Terminal Connecting Plan Type RHWS-TFM



Terminal Connecting Plan Type RHWS-3 P

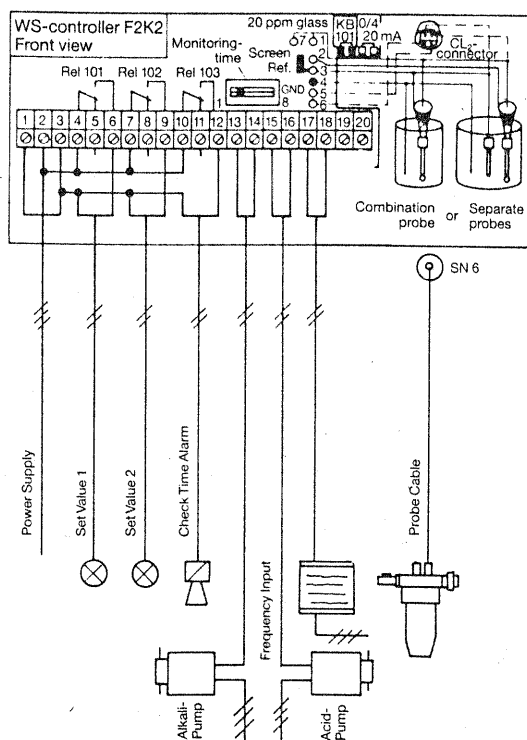
To change the direction of control, interchange terminals 6 and 9 of relays K1 and K2.

Terminals 15 and 16 carry a pulse train signal to pace a ProMinentg® solenoid-driven metering pump for reducing agent feeding (type F2K2 and TF).

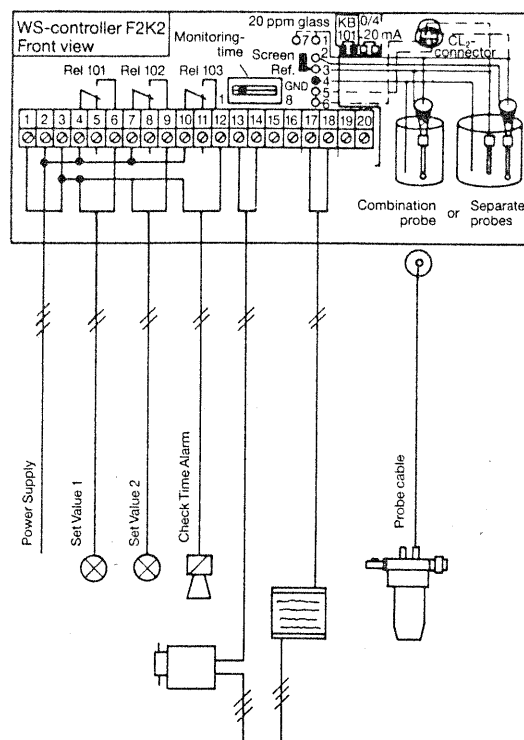
With type TFM the respective reed relays, terminals 15/16 or 13/14 pull in when the measured value exceeds or drops below the respective set value.

Caution: Maximum contact load 24 V / 50 mA.

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



RWHS-F2K2
(1650/4)



RHWS-TF
(1653/4)

Terminals 19 and 20 are not connected.

If either option WS 01 or WS 02 "Standard signal output" is included, terminals 17 and 18 carry a 0/4...20 mA standard signal. Mind the polarity (terminal 17 +, terminal 18 -) when connecting an indicating or recording instrument.

Jumper Br 1 in the terminal box serves to change the output signal from 0...20 mA to 4...20 mA and vice versa. When the jumper is removed the signal will be 0...20 mA, when the jumper is inserted it will be 4...20 mA.

4. Connecting the redox probe

Connect the redox combination probe by means of a special signal cable (see accessories, p.) by plugging the moistureprotected SN 6 connector into socket . Protect cable and connectors against moisture. Run the special low-noise cable separate from other cables and keep the distance between the point of measurement and the transmitter as short as possible.

The service life of a redox combination probe depends entirely on the operating conditions, such as liquid pressure, temperature or tendency towards fouling. Under favorable conditions, the service life in swimming pool applications should be 1...2 years.

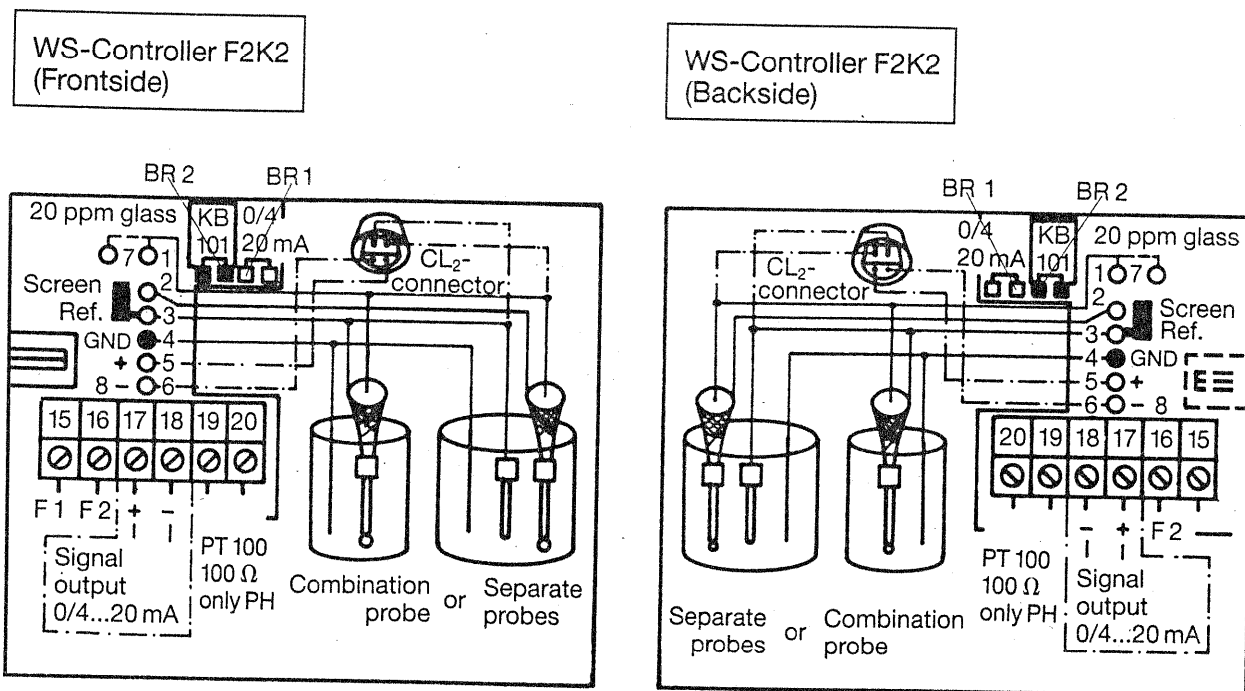
Note: Redox probes are subject to ageing also in storage and have a limited shelf life.

Please refer to Bulletin DM-BA-066 for further instructions of how to use and service redox probes.

4.1 Special connectors; connection of separate probes

Option P0 2 (Order No. 81.81.33.1) allows the connection of a probe cable with a DIN connector. In this version, the transmitter will be fitted with a female connector according to DIN 19262, the SN 6 socket being omitted.

If separate probes are used instead of a combination probe the transmitter/controller can be converted as follows:



1 Metal electrode – 2 Screen – 3 Reference electrode – 4 Sample ref.potential

In order not to endanger the high impedance of the input amplifier this conversion should be made in the factory.

4.2 Sample reference potential

If the reading should be found to drift or leap, connecting the sample reference potential will help to suppress electrical noise. To this end, the stainless steel bar in the in-line or immersion probe housing is to be connected with the banana socket by means of the cable supplied with the transmitter/controller.

Note: When the sample reference potential is connected, jumper Br 2 in the terminal box must be removed.

It is imperative that jumper Br 2 be in place when the probe is put into a standardizing solution, e.g. of 465 mV, Part No. 91.49.21.2, for calibration.

5.2 Setting set values

All RHWS series systems allow the selection of an upper and a lower set value.

Pressing the pushbutton key 3 will cause the lower set value to be displayed, which can then be set by means of potentiometer 7.

The upper set value can be displayed by means of pushbutton key 4 and set by means of potentiometer 8.

5.3 Functions of the individual transmitter/controller types

5.3.1 RHWS 1000 F2K2

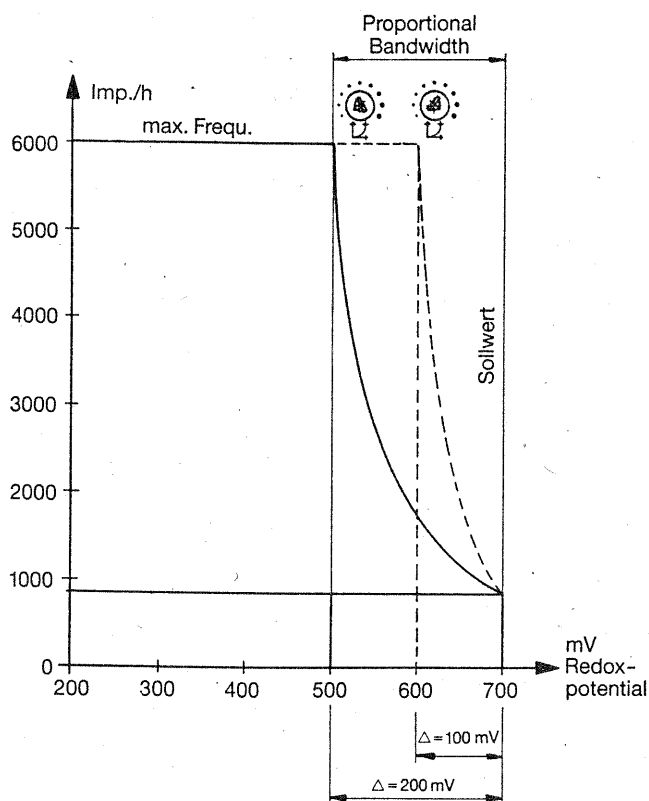
Type F2K2 offers two separate pulse-train outputs to pace two ProMinent® solenoid-driven metering pumps, and two relay outputs to actuate two other devices.

Feeding oxidants (e.g. chlorine)

When the input signal drops below the lower set value, relay 1 will pull in, the red LED 4 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.

Feeding reducing agents

When the input signal exceeds the upper set value, relay 2 will pull in, the red LED 6 will be lit and the voltage-free pulse-train output (terminals 15 and 16) will emit pulses proportional to the error signal. The pulses will be indicated by LED 2.



5.3.1.1 Setting proportional bandwidth

The proportional bandwidth for oxidant feeding can be varied by means of potentiometer 9, that for reducing agent feeding by means of potentiometer 10.

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 error signal from the set value that causes the pulse rate to reach its maximum of 6000 pulses per hour.

In the fully counterclockwise position of the potentiometers 9 and 10 the maximum pulse rate will be generated when the measured value has departed from the set value by 200 mV, in the fully clockwise position by 100 mV (see illustration).

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.

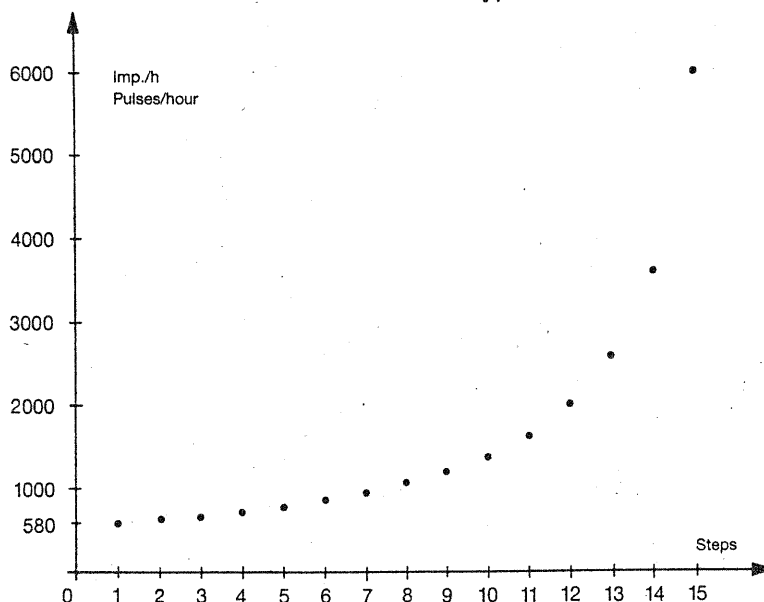
The procedure recommended for bringing the system into operation is to start with the maximum proportional bandwidth (potentiometer turned fully clockwise) and, as overshooting occurs, to decrease the proportional bandwidth until there is no more overshooting.

5.3.2 Type RHWS 1000 TF

This is a single-speed floating control system developed to pace ProMinent® solenoid-driven metering pumps, particularly in swimming pool application. 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 transmitter/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.

Control Action Type TF



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
Imp/h	580	620	666	720	783	860	950	1060	1200	1385	1636	2000	2570	3600	6000

When switched on, the transmitter/controller starts with step 1, that is the lowest pulse rate. At a pre-selectable fixed step rate (see 5.3.2.1), the system advances one step, thus increasing the pulse rate. The system advances from step to step until the measured redox voltage 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 latest step. If the measured value passes through one of the set points, the system steps up or down until the measured value re-enters the neutral zone.

The pulse output will be discontinued when, at the lowest pulse rate, the measured value remains below the lower set value. The system will continue to generate the maximum pulse rate if at the highest pulse rate the upper set value is not yet achieved.

Note: The control action is to be reversed for reducing agent feeding (inverse direction of control).

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.

5.3.2.1 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 transmitter/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.

5.3.2.2 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.

5.3.3 Type RHWS 1000 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 reduced or extended step by step. The pulse output will be discontinued when, at the lowest pulse rate, the measured value remains below the lower set value.

Note: The control action is to be reversed for reducing agent feeding (inverse direction of control).

5.3.3.1 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 transmitter/controller requires from 8.5 minutes to 680 minutes to go through all 225 steps.

5.3.4 Type RHWS 1000 3P

This is a duty-factor 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 13. 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 LED's 5 and 6.

5.3.4.1 Setting proportional bandwidth

To suit the RHWS 3P to different process requirements the proportional bandwidth can be adjusted by means of potentiometer 9. If it is turned fully clockwise the minimum interval of 10 seconds will be generated when the measured value has departed from the set point by 100 mV; if it is turned fully counterclockwise, when the measured value has departed from the set point by 200 mV. Thus, the speed of, e.g. a stroke positioning motor, can be varied.

5.3.5 RHWS 1000 IL2

Type IL2 is also used for modulating positioning motors and solenoid valves.

The pulse duration is varied to relate the system error. At maximum system error the pulse duration is 20 seconds, the interval 5 seconds.

At minimum system deviation the pulse/interval ratio is 2.5 seconds to 150 seconds. This results in an excellent control dynamics which, in addition, can be tuned to the process by means of potentiometers 9 and 10. Potentiometer 13 can be used to limit the maximum pulse duration.

The electric connections are to be made analogous to those of type 3P.

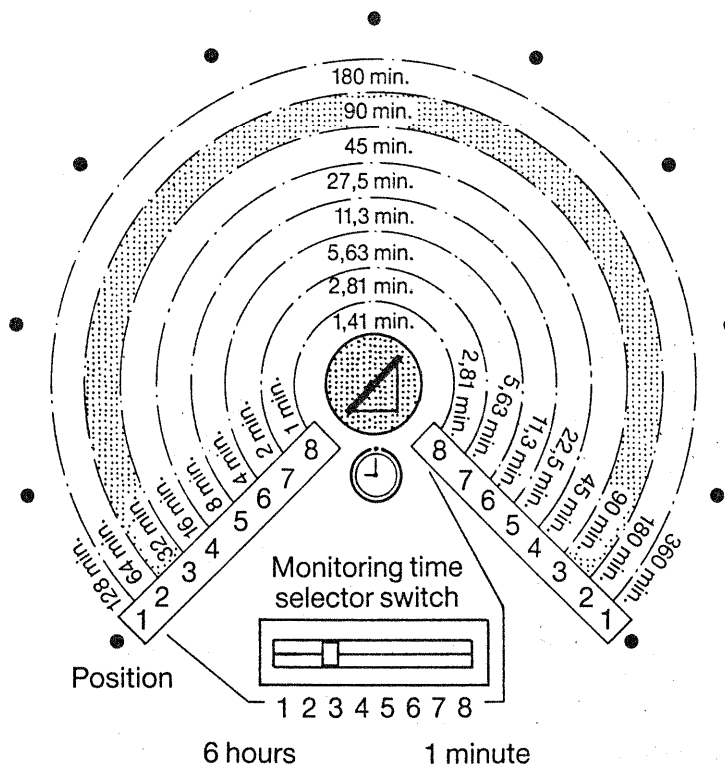
6. Time check

As a standard the type WS transmitters/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 relative position may be taken from the illustration below.



7. Consumable material

Order No.

Standardizing solution 220 mV,	50 ml	91.49.20.4
Standardizing solution 465 mV,	50 ml	91.49.21.2
3-MKCl solution,	500 ml	91.49.25.3
Redox combination probe, type RHE, Pt-SE		30.50.02.8
T = 0...60 deg. Centigrade, max. 5 m WC		
Redox combination probe, refillable		30.50.91.1
type RHEN, platinum, T = 0...90 deg. Centigrade		
Refill		30.50.58.0
Redox combination probe, type RHEX-Pt-SE,		30.50.97.8
T = 0...110 deg. Centigrade, P max. = 16 bar (25 deg. C.)		
P max. = 6 bar (100 deg. C.)		
Dulcotest® signal cable with SN 6 S plugs, 5 m		30.49.56.6
Dulcotest® signal cable with SN 6 plugs, 5 m		30.50.73.9

Spare parts list RHWS

Item*	No.	Description Order	No.
1	1	Housing (without fastening material)	141146.1
2	1	Perspex cover "ProMinent"	141149.5
3	2	Cover 141147.9 4 1 Bezel	141148.7
5	1	Seal for bezel	483532.8
6	2	Cylindrical pin	460704.0
8	6	Control knob d 10 x 12.5	703524.9
9	2	Seal for cover	484012.0
10	1	Seal for perspex cover	484013.8
11	4	Retaining washer d 5 x 2.5 x 0.5	483950.2
12	1	Terminal plan, front	606304.4
13	1	Terminal plan, rear	606305.1
15	5	Cable gland PG 9 Skintop gray	703883.9
16	5	Plug IL4-073	140448.2
17	4	Spacer M 3x60 female/male	46106.8
18	4	Spacer M 3x18 female/male	460107.6
20	4	Raised c'sk. hd. screw M 3x6	468602.8
21	4	Raised c'sk. hd. screw M 4x12	468615.0
22	4	C'sk. hd. screw M 3x10	468706.7
24	1	Knurled screw M 3x20 466213.6	
	1	Housing assembly (items 1-24)	814996.5
	1	Front plate F2K2	606385.3
	1	Front plate TF	606386.1
	1	Front plate TFM	606387.9
	1	Front plate 3P	606388.7
	1	Frontplate IL2	606409.1
	1	SN 6 socket	818398.0
	1	DIN socket	704224.5
	1	Main circuit board	819027.4
	1	Signal processing circuit board	819029.0
	1	Display circuit board	819028.2
	1	Extra circuit board TF	818198.4
	1	Extra circuit board TFM	818199.2
	1	Extra circuit board 3P	819030.8
	1	Extra circuit board IL2	819030.8
	1	Signal output	914949.3
	1	Signal output, potential-separated	914932.9
	1	Jumper strip	713995.9
	1	Pin socket black	704228.6

* see drawing page 15

