

**BU1048**

**MAINTENANCE**  
**of**  
**PH-METERS**

PRINTED BY **RADIOMETER A/S**  
COPENHAGEN — DENMARK



**RADIOMETER A/S · EMDRUPVEJ 72 · DK-2400 · COPENHAGEN NV · DENMARK**

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## MAINTENANCE OF pH-METERS

A: General

A1: Introduction

The object of this bulletin is to present the user of Radio-meter pH-meters with a guide to the necessary maintenance of apparatus and electrodes which he should take upon himself to perform. Mentioned also are tests which may be carried out without special tools or instruments to ensure satisfactory performance. Actual repairs will not be mentioned, however, as we shall assume that these are undertaken by the local representative or the factory.

Whenever the term pH-meter is used in the following instructions, our comments shall be understood to cover all types of pH-meters, the AME1 equipment and the TTT1 titrator included, as both the AME1 and TTT1 in principle are pH-meters with special accessories embodied. Moreover, our remarks will have bearing on all glass- and calomel-electrodes inclusive of the micro-electrode G297. Where special considerations call for exceptional measures, the instrument in question will be clearly identified in each case.

A2: Power Line

Whenever practicable, it must be recommended never to disconnect the power line once the pH-meter has been put into service. Instead, set the switch to position HEAT if a longer interruption of operations is expected. This simple precaution will ensure that the temperature inside the pH-meter always remains higher than outside so as to protect the instrument against moisture. It should be noted in this connection that such measures will not cause wear of the instrument, as the amplifier is disconnected in position HEAT, the required heating being provided by a small heating element. Whenever pos-

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sible where thermostatted electrodes are employed, e.g. the Astrop method, leave the water thermostat turned on.

#### A3: Ground Leads

The pH-meter proper must always be connected to an adequate ground lead. All accessories must likewise be suitably grounded, but always to the same point as the pH-meter.

Our best advice is to connect the accessories to the grounding jack on the meter by means of short leads. If the pH-meter is grounded through the power line, a second lead should be avoided, the accessories as before simply being connected to the grounding jack on the meter.

#### A4: Shielding

A glass electrode and its leads to the pH-meter must always be shielded against electrostatic influence by means of a grounded conductor. Thus, electrodes that are plugged directly into the pH-meters (PHM4, PHM22, PHM23) are surrounded by a metal shield which must be in position whenever measurements are carried out.

In cases where the electrodes are connected through leads, the cable of the glass electrode will be furnished with a shielding that reaches almost down to the membrane, but leaves the membrane itself and the lower part of the glass stem unshielded. The volume of test sample used in such instances must, therefore, be large enough to cover minimum 2-3 cm of the stem, thereby providing the necessary shielding. If the volume of the test sample is inadequate, it may be necessary to envelope the test beaker in a grounded metal sheath (aluminium foil).

Particularly favourable possibilities for establishing satisfactory grounding are provided when thermostatted setups are employed - for instance: the micro-electrode G297 - the

circulating thermostatted water being made conductive by adding potassium nitrate, potassium carbonate or other salts (but not chlorides) in quantities of 3 grams per liter water.

#### A5: The Influence of Temperature

Two factors in particular are influenced by temperature, viz. the electrode potential and the electrode stability, whereas the pH-meter under normal conditions is not affected.

The potential of the glass electrode increases by 0.34% for every 1°C rise in temperature, even when the pH-value of the test sample is kept constant. This increment is adjusted by means of TEMPERATURE COMPENSATION. In order to understand the significance of TEMP.COMP., assume that a series of samples is being tested, and that all samples have identical pH-values, but different temperatures. Now, if TEMP.COMP. before measuring is set to the temperature of each sample, the result will be that the same readings are obtained for the entire series.

On the other hand, if a sample is heated, a simultaneous change in its pH-value will normally occur. No compensation is provided for this change, the influence of temperature on the glass electrode alone being compensated. Nor will compensations be provided for the effect that temperature changes have on the calomel electrode. For this and similar reasons, always perform buffer adjustments when buffer and test sample have attained the same temperature.

#### A6: Stability of Temperature

If the temperature of the electrodes should change, their performance (and particularly the performance of the calomel electrode) will temporarily become unstable. Just how much time is required for the electrodes to regain their op-

imum stability in these circumstances is first and foremost dependent on how great the change of temperature has been. To some extent, this effect can be neutralized by frequent buffer adjustments, and such measures will at the same time furnish a ready means for observing just when stability has been re-established.

B: Measurements

B1: Before Measuring

- a: The amplifier of the pH-meter must be switched on a couple of minutes before operations can begin. (All positions of the switch except HEAT.)
- b: The glass electrode must be soaked (see notes C1 and C2, page 7), and the black rubber cap be removed from the calomel electrode.
- c: Check that the calomel electrode is filled with potassium chloride, and that crystals are visible in the solution.
- d: Set TEMP. COMP. to temperature of test sample (and buffer).
- e: We shall assume that the instrument is in regular use. If, on the other hand, the instrument has not been used for some time, follow instructions in sections D and E before proceeding.
- a: Buffer adjustment (see sections D1 and D2, page 9).
- b: Rinsing the electrode with distilled water (see section C2, page 7).
- c: Measuring.
- d: Rinsing the electrode (see section C2, page 7).

B2: While Measuring

During

When not required immediately afterwards for new test series:

- a: Storage of the glass electrode takes place with the membrane immersed in a buffer with pH between 4 and 7. During very long storage (more than 3-4 weeks), the electrode should be stored with the bulb clean and dry.
- b: Replace the rubber cap on the calomel electrode or place the electrode in saturated potassium chloride - never in water or other solutions (see section C3, page 7).
- c: Set pH-meter switch to HEAT.

New glass electrodes or electrodes which have not been immersed in water during storage must be soaked for 4 hours in 0.1 n hydrochloric acid and afterwards transferred for half an hour to a buffer solution (the same as used for adjustments). In a pinch, an unsoaked electrode may be used, provided that it be taken into account that the electrode will be unstable and the pointer indication slow. Buffer adjustments immediately before and after measurements will then be required.

C2: Rinsing of Electrodes

Normally, the electrodes are rinsed with distilled water (by means of a wash bottle or rinsing bowl, or by drawing water through the micro-electrode, etc.), but always without touching the glass electrode. Any drops adhering to the electrodes are carefully removed with the rim of the waste beaker, the calomel electrode being treated first. Ordinarily, the elec-

B3: After Measuring

During

C: Handling the Electrodes

C1: New Glass Electrodes

trodes are not wiped dry, but if required: use only moistened filter paper or the like, and dry the calomel electrode before the glass electrode.

When badly contaminated, the electrodes will require a more vigorous remedy; thus:

Oils and fats are removed by flushing with acetone.

Proteins are removed with 0.1% pepsin in 0.1 n hydrochloric acid.

#### C3: Calomel

##### Electrodes

##### Continuous

##### Measurements

If the calomel electrode is used for continuous measurements, or if this electrode for other reasons is left standing in some solution other than saturated potassium chloride, it will be necessary to renew the saturated solution at regular intervals: daily for K100 and K101, weekly for the other electrodes. Where K497 is concerned, the solution inside the well into which the plastic capillary of G297 dips (but not that in the side branch) must be renewed daily.

#### C4: Metal Elec-

##### trodes

The problems associated with this type of electrode closely resemble those which may be encountered when glass electrodes are used, apart from the fact that the potential as a rule is measured directly in millivolts, so that all considerations having direct bearing on the buffer adjustment will not be discussed.

On the other hand, the proper care of metal electrodes is a matter of still greater importance than is the case when glass electrodes are employed. The steps to be taken for keeping the metal electrodes in good working order are nevertheless very simple:

Platinum- and Gold-Electrodes  
To be stored in distilled water.

Rinse frequently by placing for some hours in concentrated nitric acid.

##### Silver-Electrodes

To be stored in distilled water.

Rinse frequently by placing for one hour in concentrated ammonia water.

Mercurous sulphate electrodes require exactly the same treatment as calomel electrodes with the single modification that saturated potassium sulphate be used in place of saturated potassium chloride in all cases where the latter solution has been indicated in this bulletin.

#### C5: Mercurous Sul-

##### phate Electrodes

#### D: Buffer Adjust-

##### ments

#### D1: Buffer Adjust-

##### ment. Series

##### of Analyses

Buffer adjustments between measurements may in certain cases be omitted when a series of uniform samples is being analyzed. Just how often buffer adjustments are required will depend on the condition of the electrodes, on the nature of the tests, and on the degree of accuracy called for. If the samples contain protein (e.g. blood), a buffer adjustment must follow upon each single measurement, but adjustments between measurements are in any case to be recommended whenever a new series is launched, and also when the electrodes are new. As the tests proceed, adjustments after alternate measurements will suffice, and later still, adjustments after every third measurement, etc. Eventually, experience

will prove a reliable guide for selecting the appropriate number of adjustments in each case.

## D2: Buffer Adjustments. Continuous Measurements

Exactly the same procedure should be followed for continuous measurements of long duration: frequent adjustments at first - preferably every half hour - then fewer and fewer as you proceed, spacing the intervals according to experience.

## D3: The Two-Buffer-Test

This test should be made at least once a week and whenever the readings seem unreliable.

### I: Procedure

- a: Set TEMP.COMP. to correct temperature.
- b: Adjust against usual buffer.
- c: Rinse the electrodes, then measure in a second buffer of known value (preferably deviating at least 2 pH from the former. When measurements are made on the expanded scale, however, a deviation of 0.5 pH will suffice). The instrument, as well as the electrodes, is in working order if the pH-meter indicates the correct value of the second buffer with the desired accuracy.

### II: Aging of the Electrode

A slightly inaccurate reading will be noticeable in the second buffer when the glass electrode has been in use for some time. In cases where the second buffer has a lower value than the first buffer, the readings obtained will be too high, and conversely, where its value is the higher, the readings will be too low. This is due to quite normal aging of the electrode, and it may be compensated for in the following manner:

### III: Correction for Lack of Sensitivity

- a: While the electrode is immersed in the first buffer, the reading is adjusted by means of the BUFFER ADJUSTMENT: not to the value of the buffer, but, instead, to the zero position of the pH-meter used (i.e.: for PHM22, (and AME1), PHM23, PHM24 and TTT1 to pH = 7; for PHM25 and PHM27 to pH = 7.778 (green line); for PHM28 to pH = 8). For PHM4 a special instruction can be procured from Radiometer.
- b: When the electrodes afterwards are immersed in the second buffer, the reading obtained will of course not indicate the value of the solution. The required value is found as follows:  
Let A represent the first buffer, B the second, N the zero position, and X the unknown value - then
$$X = N - (A - B).$$
Should an incorrect reading be obtained for the second buffer, adjust by means of TEMP.COMP. or pH-SPAN. On instruments without pH-SPAN, the TEMP.COMP. will now indicate a lower temperature than the actual sample temperature, but this is of no consequence. The simple practice of habitually noting down the TEMP.COMP. setting in the case record will enable the analyst at a glance to see in advance when replacement is required.
- c: While the electrodes still are immersed in the second buffer, adjust the reading to value B by means of BUFFER ADJUSTMENT.
- d: When this adjustment cannot be made, because TEMP.COMP. or pH-SPAN cannot be regulated further downwards, the glass electrode is too old, so that replacement is necessary.

D4: Setting BUFFER ADJUSTMENT

As long as the electrodes are new, the BUFFER ADJ. will be operative in its mid-dial position. The value indicated by the BUFFER ADJ. knob after completion of the two-buffer-test should be entered in the record. A possible "drift" in the values recorded will provide advance information as to how soon a necessary replacement of the electrodes must be made, so that substitutes may be ordered in good time.

E: Checking Regularly

The following items must be checked once a month or whenever the results obtained make it necessary:

E1: Checks

- a: Make sure that all parts are clean and dry. It is very important that all external surfaces of the apparatus be kept clean and dry. Especially so for measuring beakers, titration beakers, electrodes and the water jacket, but it is a sound policy to keep all components clean and dry.
- b: Check that all ground leads are connected, and that the shielding is in order (see sections A3 and A4, page 4).
- c: Check that your standard solutions are clear and pure, and that they have been in use less than a month.
- d: If thermostatted electrodes are employed, ascertain that the thermostat water is pure (see section E2, page 12).

E2: Thermostats

Contamination of the thermostat water usually occurs when hard water is used, and when the water is not preserved against micro-organisms. Many well-known chemical agents may be used to advantage for disinfecting the water; for

instance potassium chromate, which should be added in quantities of 1 to 2 grams per liter water.

If the water is contaminated, the sooner the thermostat system is cleaned the better. The first step is to disconnect the tubings from the thermostat and flush the system very thoroughly with fresh water from the tap - first one way, then the other. Meanwhile, the thermostat is emptied, rinsed, and then filled with distilled water in which potassium nitrate, potassium carbonate or the like (but not chlorides) has been admixed in a quantity of 3 grams to each liter of water (see section A4, page 4).

F: Trouble Shooting

F1: Description of Defect

- Cause of trouble being:
- Unstable reading - either fluctuating or drifting.....a
  - Pointer deflects to either end-scale position and settles there.....b
  - Reading does not alter, although composition of solution is changed.....c
  - Inferior reproducibility.....d
  - Results presumed to be unreliable.....e
  - pH-measurements, rH-measurements: Buffer adjustments no longer possible as BUFFER ADJ. has reached end position.....f
  - Slow response.....g
  - Other defects.....h

## F2: Remedying

### a: Unstable Reading

- I: Make sure that all ground leads and shieldings are in order (see sections A3, A4, page 4 and E2, page 12). Often this kind of trouble will be noticed when the operator's hand approaches the glass electrode or touches nearby metal surfaces, and it will cease immediately when his other hand grips ground-connected metal parts.
- II: Check that the electrodes are in working order and properly connected. Check especially that the membrane of the glass electrode is clean and in perfect condition. (See section A4, page 4.)
- III: Measurements on media of low conductivity and small buffer capacity (e.g. distilled water, organic solvents, etc.) require special preparation. Consult your dealer or Radiometer.

### b: Pointer deflects to end-scale position

- The electrode chain is broken. Check if electrode plugs are firmly inserted in instrument jacks.
- I: Observe whether air bubbles are present in the calomel electrode. If so, expel by shaking and fill up with saturated potassium chloride (see section B1, page 6).
  - II: When the electrodes have been in use for some time, the potassium chloride crystals in the calomel electrode will sometimes form a cluster which may block the halow stem. The electrode should be heated to approximately  $60^{\circ}\text{C}$  in a water bath, whereby some of the crystals become dissolved and can be poured out. Fresh, cold, saturated potassium chloride is then added, heated, etc., until the crystal lump is dissolved.

Note: It should be borne in mind that the electrode

may become temporarily unstable when so treated. If this is the case, follow the instructions given in section C1, page 7.

- III: Air bubbles will occasionally appear in the bulb-shaped membrane of the glass electrode, especially after transport. Expel by shaking.
- IV: When filling the capillary electrode, type G297, air will sometimes be sucked in with the solution. In such cases, the sample cannot be saved. Instead, clean the electrode and perform a new buffer adjustment.
- I: Will be observed during the two-buffer-test. As a rule, the reading will show 4–5 pH irrespective of the buffer solution used. The glass membrane is cracked and the electrode unserviceable.
- II: If the reading remains at pH 7 (for PHM25 and 27: 7.77, for PHM28: 8.00), check whether the dial light is lit. If not, the flow of current to the instrument has probably been interrupted. Replace old fuse (see Instruction Manual).
- I: The setting of BUFFER ADJ. changes from measurement to measurement: The electrodes have not been cleaned properly (see section C2, page 7).
- II: Setting of BUFFER ADJ. is constant, and the two-buffer-test gives correct result. The results obtained shift continuously in one direction only: The instrument is in working order, but the composition of the test sample is

### c: Reading is constant

### d: Inferior reproducibility

changing (the pH-value of blood, for instance, decreases by 0.002 pH per minute at 38°C).

III: The temperature is not kept at a constant level.

IV: Any one of the errors listed in section F may manifest itself in poor reproducibility even though the characteristic symptoms of failure are not so pronounced as described above. Hence, if one of the foregoing three items, a, b, or c, does not meet the case in hand, section F must be gone through step by step.

e: The results obtained are presumed to be unreliable

Carry out two-buffer test. The pH-meter and electrodes are in order when a correct response is obtained.

I: If this difficulty has become gradually more pronounced (see sections D3II, D4, pp. 10 and 12), one of the electrodes (or possibly both) is too old and must be replaced. Begin by replacing the glass electrode.

II: If this difficulty suddenly occurs: see section F2, a, b, and c, pp. 13, 14, and 15.

g: Response is too slow

The pointer settles very slowly, but will indicate correct values if the operator waits long enough.

The response time is measured in the following manner:

Place both electrodes in a buffer of known value.

Wait three minutes, then read meter: the permanent value.

Next, rinse the electrodes and again place them in the

buffer. When immersed, immediately start a stop watch.

Now wait until the reading is less than 0.01 pH from the permanent buffer value, then stop the watch. The time read on the stop watch indicates the response time. It must not exceed 30 seconds.

If the response time is too long, the membrane may be contaminated, see section C2, page 7. When no faults are detected, the electrode must be placed in 0.1 n hydrochloric acid throughout the night. The test is then repeated. If the response time is still too long, the electrode may be too old; see section D3, page 9.

If the above directions should fail to provide a remedy for the trouble, do not waste more time on the matter, but instead, immediately contact your dealer or Radiometer, and provide a full description of the problem.

h: Defect is not cured



## ELETTRODO DI VETRO MOD. G202 B o C

L'elettrodo di vetro mod. G202, è un elettrodo di vetro standard, atto all'impiego con tutti i misuratori di pH RADIOMETER da laboratorio. L'elettrodo è ugualmente indicato per le titolazioni, ad esempio se impiegato in un Complesso di Titolazione, mod. TTA3 o TTA1, in unione ad un'apparecchiatura RADIOMETER per la titolazione automatica. L'elettrodo di vetro dovrebbe essere usato preferibilmente insieme ad un elettrodo a calcolano, mod. K401 o K101. Il tipo "C" deve essere sempre preferito, quando le determinazioni siano nel campo -12 pH soltanto, poiché la robustezza della membrana lo rende assai meno soggetto a rotture degli elettrodi con membrana tipo "B". Inoltre l'elettrodo di vetro "C" può essere impiegato nel campo di temperatura 0° -50° C., mentre la membrana "B" fornisce una risposta lenta al di sotto di 20° C. Peraltro il vantaggio della membrana "B" consiste nel fatto che non necessitano correzioni nel campo 0-14 pH, mentre quella tipo "C" richiede una correzione al di sopra di 12 pH, quando si desiderano misure di elevata accuratezza. Il nomogramma riportato sul retro di questa pagina, viene impiegato per le correzioni. Il nomogramma riporta soltanto l'errore dello ione sodio o litio. L'errore dello ione potassio è circa 10 volte inferiore.

## TRATTAMENTO PRELIMINARE DELL'ELETTRODO

Tenere immerso il bulbo dell'elettrodo per almeno 8 ore in una soluzione 0,1 N di HCl, a temperatura ambiente. Risciacquare il bulbo e quindi tenerlo per alcune ore in una soluzione tampone avente pH compreso tra 4 e 7.

N. B.: Il tempo di risposta dell'elettrodo diminuirà progressivamente nei primi giorni dopo il decappaggio. Di conseguenza questo trattamento del bulbo dovrà durare il più a lungo possibile prima dell'uso ( sino ad una settimana).

## IMPIEGO DELL'ELETTRODO

1. Montare l'elettrodo di vetro insieme a quello a calomelano nel supporto o nel complesso nel quale deve essere impiegato. Collegare l'elettrodo di vetro al terminale corrispondente del misuratore di pH. ( Rimuovere dapprima il portaelettrodi H22, se esiste). Collegare il cavo dell'elettrodo a calomelano al terminale relativo del misuratore di pH.
2. Quando si effettui la standardizzazione rispetto ad un tampone a pH noto mentre la determinazione viganti di un pH sconosciuto, procedere come descritto nel manuale Istruzioni per il misuratore di pH impiegato.

## PRECAUZIONI PER GARANTIRE UN'EFFICACIA PROLUNGATA DELL'ELETTRODO

1. Mantenere pulita la membrana dell'elettrodo. Evitare qualsiasi contatto con sostanze grasse.
  2. La corretta conservazione dell'elettrodo di vetro si ottiene immergendo la membrana del bulbo in un tampone avente pH compreso tra 4 e 7. In caso di periodi di inattività prolungata (più di 3-4 settimane) l'elettrodo dovrebbe essere mantenuto con il bulbo pulito ed asciutto.
- N. B.: Si deve evitare la conservazione dell'elettrodo nel campione o in acqua distillata. Dopo la conservazione allo stato asciutto, l'elettrodo deve essere nuovamente trattato come descritto al paragrafo " Trattamento preliminare dell'elettrodo " .

## ALTRE INFORMAZIONI

Allatto di determinazioni di pH o di titolazioni in mezzi non acquosi, pH potrà risultare superiore a 14 o inferiore a 0. In tali casi le misure devono essere effettuate con il selettore di campo del misuratore di pH (o del titolatore) nel campo di mV. Pertanto vengono escluse le regolazioni della temperatura e del tampone, ma quando sia determinato il valore di mV di un tampone avente pH noto, il pH della soluzione in esame può essere calcolato dalla formula :

$$pH \text{ soluzione in esame} = \frac{E_{\text{tampone}} - E_{\text{soluzione in esame}}}{0,198 T} + pH_{\text{tampone}}$$

dove E indica la lettura in mV e T la temperatura assoluta. Questo genere di determinazioni di pH è sempre in relazione al solvente del tampone. Per ulteriori dettagli, si prega di riferirsi a : "Non-Aqueous Titrations " di N. Linnér, pubblicato dalla RADIOMETER come estratto SF 24 ( SF 30 in tedesco).

Per evitare di eseguire le misure nel campo di mV, si può impiegare il Compensator di mV mod. PHA802, ottenendo così di riferirle alla scala di pH.

## ELETTRODO A CALOMELANO MOD. K401

### 1. CARATTERISTICHE -

Le caratteristiche dell'elettrodo a Calomelano, mod. K401 sono:

- Giunzione liquida tra il liquido elettrolitico e il campione, tramite un setto poroso.
- Alzita e rinnovo della giunzione liquida in forma automatica.

- Minimo contaminazione del campione da parte della soluzione di KCl durante le determinazioni.

L'elettrodo è del tipo a calomelano saturo. Il suo potenziale rispetto all'elettrodo standard all'idrogeno, alle diverse temperature, è il seguente:

| t°C. | 0     | 10    | 20    | 30    | 40    | 50    | 60    | 70    | 80    | 90    |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| E mV | 260.2 | 254.1 | 247.7 | 241.1 | 234.3 | 227.2 | 219.9 | 212.4 | 204.7 | 196.7 |

(Riferimento: Reference Electrodes, Theory and Practice, D. Ives e G. Janz, Academic Press, 1961, pag. 161).

Nota: Il potenziale dell'elettrodo viene determinato dalla temperatura della mezza-cellula a calomelano, situata in corrispondenza della testa superiore nera.

### 2. PREPARAZIONE DELL'ELETTRODO -

- 1) Togliere il cappuccio di gomma nera della punta dell'elettrodo.
- 2) Togliere il manicotto di gomma che copre il foro di riempimento dell'elettrodo. Conservare questo manicotto dovendo lo stesso essere riutilizzato durante i periodi di inattività prolungata dell'elettrodo (vedere 3).
- 3) Controllare che l'elettrodo sia pieno di soluzione saturo di KCl, e che siano visibili i cristalli liberi di KCl. All'interno non debbono essere presenti bolle d'aria.

### 3. IMPIEGO -

- 1) Tra due misure risciacquare la punta dell'elettrodo con acqua distillata.
- 2) Regolare la posizione dell'elettrodo in modo che la superficie libera della soluzione di KCl venga sempre a trovarsi ad un livello superiore a quello del campione.

### MANUTENZIONE -

- 1) Conservare l'elettrodo sempre pieno di soluzione saturo KCl. Cristalli liberi di KCl debbono sempre essere visibili.
- 2) Se i cristalli di KCl riemergono dalle bolle d'aria internamente all'elettrodo, e le stesse non possono venire allontanate scuotendolo, immergere la punta in acqua distillata calda sino a che la maggior parte dei cristalli si sia disciolta. A questo punto le bolle d'aria possono venire allontanate scuotendo l'elettrodo. Non introdurre mai nell'elettrodo soluzioni diverse da quella di KCl saturo.
- 3) Durante prolungati periodi di inattività conservare l'elettrodo all'asciutto. Applicare il manicotto di gomma sul foro di riempimento e il cappuccio di gomma nera sulla punta. Per brevi periodi di inattività si raccomanda la conservazione in soluzione saturo di KCl.

Nota: Non conservare mai l'elettrodo immerso in un campione o in acque distillate.

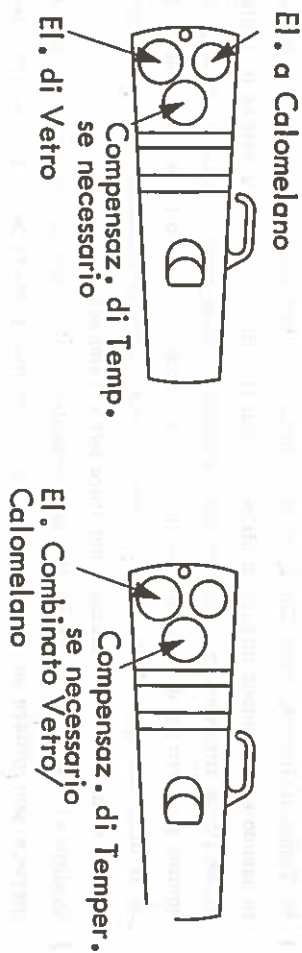


# RADIOMETER COPENHAGEN

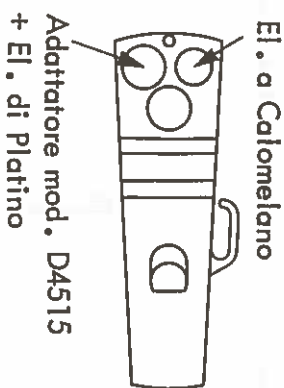


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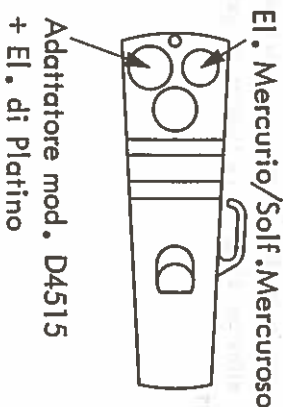
## SCHEMA 1



## SCHEMA 2



## SCHEMA 3



## SCHEMA 4

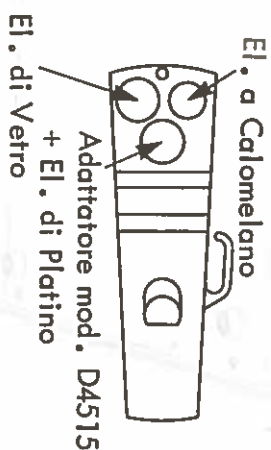


FIG. 2 Testa Elettroica mod. 809-151 e combinazioni montaggio elettrodi (v. sez. C par. 1-4)

### MANUALE ISTRUZIONI PER IL PORTA-ELETTRODI MOD. E126

#### A. DESCRIZIONE GENERALE

Il porta-elettrodi mod. E126 è stato progettato per l'impiego in unione con uno qualsiasi dei Misuratori di pH Radiometer mod. PHM25 - 26 - 27 o 28, e con il Titolatore Radiometer mod. TTT11.

Il porta-elettrodi rende possibile in un unico supporto l'applicazione di tutte le combinazioni di elettrodi potenziometrici.

#### B. SPECIFICAZIONI

Il porta-elettrodi mod. E126 consta di :

|        |         |  |
|--------|---------|--|
| 1 cod. | 809-151 | testa elettroica                         |
| 1 cod. | 809-152 | asta                                     |
| 1 cod. | 809-153 | supporto con 1 vite cod. 020-220         |
| 1 cod. | 863-603 | anello di tenuta con 1 vite cod. 020-201 |
| 1 mod. | D631    | bicchierino protettivo con orovatta      |
| 1 mod. | D632    | tappo di gomma                           |
| 1 mod. | D4515   | adattatore elettroico                    |
| 3 mod. | V104    | bicchierini con coperchio                |
| 1      |         | manuale di istruzioni                    |

#### ; IMPIEGHI

Il porta-elettrodi mod. E126 si presta alla realizzazione delle seguenti combinazioni fondamentali di elettrodi :

#### 1) Misure di pH (vedi schema 1)

|  |                  |
|--|------------------|
| Elettrodo di Vetro:                          | mod. G202B o C   |
| Elettrodo a Calomelano :                     | mod. K101 o K401 |
| oppure: Elettrodo Combinato Vetro/Calomelano | mod. GK2026C     |

Se richiesto, può essere applicato sul Porta-Elettrodo anche un Compensatore di Temperatura mod. T401 (per PHM25 o 27) o mod. T501 (per PHM26).

#### 2) Misure Redox (vedi schema 2)

|                          |                  |
|--------------------------|------------------|
| Elettrodo di Platino :   | mod. P101        |
| Elettrodo a Calomelano : | mod. K101 o K401 |

3) Misure dell'Attività degli Ioni Argento o degli Ioni Alogeni (vedi schema 3)

- Elettrodo d'Argento : mod. P4011  
Elettrodo al Mercurio/Solito  
Mercurioso mod. K601

mod. K601

- 4) Misure combinate di pH e Redox (vedi schema 4)  
1 Elettrodo di Vetro,  
1 Elettrodo a Calomelano, e  
1 Elettrodo di Platino  
possono essere posti sul supporto contemporaneamente.

D. MONTAGGIO

Il Porta-Elettrodi mod. E126 può essere montato sui Misuratori di pH mod. PHN25 - 26 - 27 e 28. Qualora il Misuratore di pH sia impiegato in unione con il Titolatore mod. TT1 sarà consigliabile, nella maggior parte dei casi, applicare il Porta-Elettrodi al Titolatore.

- (1) Appoggiare il misuratore di pH (o il Titolatore) sulla parte posteriore.
- (2) Togliere le due viti poste sui lati del pannello di fondo dello strumento.
- (3) Applicare il Sostegno, cod. 809-153, impiegando le due viti suddette. Si consiglia di applicare il Porta-Elettrodi sul lato destro, benché sia possibile anche l'applicazione sul lato opposto. Nota: In conseguenza dell'introduzione del Porta-Elettrodi mod. E126, sono stati praticati sul pannello di fondo di alcuni modelli di misuratori di pH due copie di fori per l'applicazione a scelta del porta-elettrodi nella posizione desiderata.
- (4) Montare l'Asta, cod. 809-152, sul supporto.
- (5) Infilare l'Anello di Fermo, cod. 863-603 sull'asta.
- (6) Montare la Testa Elettrodica, cod. 809-151, sull'asta. Premere l'una contro l'altra le due alette di arresto spingendo la testa elettrodica lungo l'asta.
- (7) Adattare la posizione della testa elettrodica.
- (8) Montare gli elettrodi secondo le combinazioni del paragrafo C.
- (9) Far passare i cavi degli elettrodi nel fermaglio sistemato su un lato della testa elettrodica.
- (10) Regolare la posizione dell'Anello di fermo ad un'altezza tale che la punta degli elettrodi non tocchino mai il fondo del recipiente usato per le determinazioni.

E. PREPARAZIONE DEGLI ELETTRODI

Preparare gli elettrodi secondo le istruzioni contenute nei manuali relativi. Il Bicchierino Protettivo, mod. D631, può venire impiegato per il decappaggio dell'elettrodo di vetro (ma anche, dopo l'uso, per la conservazione dell'elettrodo a contatto delle apposite soluzioni).

F. FUNZIONAMENTO

Qualsiasi recipiente avente diametro interno non inferiore a 25 mm. (1") può essere usato per contenere la soluzione in esame. Tre bicchierini di polipropilene, mod. V104, vengono forniti con il Porta-Elettrodi: uno o due di essi possono venire adibiti alle soluzioni di taratura (le soluzioni tampone per le misure di pH). Il complesso può quindi essere usato come segue :

- (1) Per il risciacquo degli elettrodi si può impiegare una spruzzetta, sollevando la testa elettrodica verso la sommità dell'asta e ponendo un bicchierino sotto gli elettrodi per raccogliere il liquido di risciacquo, oppure collocare sul tavolo sotto gli elettrodi un bicchierino contenente la soluzione di risciacquo per immergervi le punte degli stessi.

G. ISTRUZIONI PARTICOLARI

- (1) Un Tappo di Gomma, mod. D632, viene fornito con il Porta-Elettrodi. Viene impiegato quando si richiedono misure di pH nelle quali il campione non deve essere in contatto con l'aria atmosferica. In questi casi, procedere come segue : Infilare nel tappo di gomma gli elettrodi di vetro e a calomelano, in modo che le loro punte sporgano di circa 30 mm. dal tappo. Il Bicchierino mod. V104 si adatta direttamente al tappo di gomma può venire impiegato come contenitore per il campione.

- (2) Qualora si desideri proteggere dall'aria atmosferica il campione, immettendovi un gas inerte, si può infilare un tubicino di plastica, facendolo passare per il piccolo foro posto nella testa elettrodica, attraverso uno dei forellini del tappo di gomma. I quattro forellini nel tappo di gomma non sono passanti. Due di essi dovranno essere perforati con un ago da siringa o un attrezzo simile, per consentire il passaggio dei tubi di plastica per l'ingresso e l'uscita del gas).

7. 67

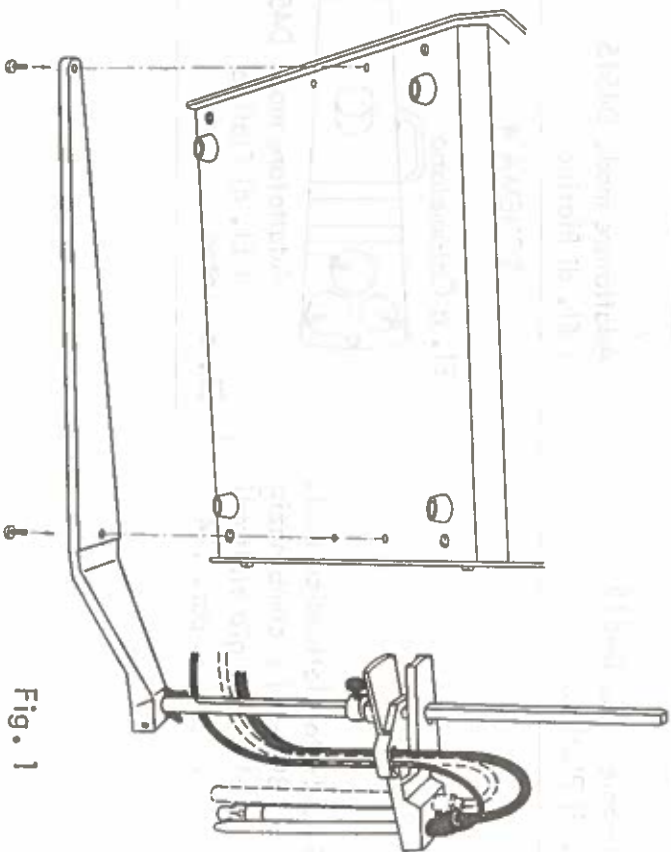


Fig. 1