MODEL PCLM3

CHLORIDE METER

OPERATING MANUAL

SAFETY

Please read this information carefully prior to installing or using this equipment.

1. The unit described in this manual is designed to be operated only by trained personnel. Any adjustments, maintenance and repair must be carried out as defined in this manual, by a person qualified to be aware of the hazards involved.

2. It is essential that both operating and service personnel employ a safe system of work, in addition to the detailed instructions specified in this manual.

3. The covers on the unit should only be removed by personnel who have been trained to avoid the risk of shock.

4. References should always be made to the Health and Safety data supplied with any chemicals used. Generally accepted laboratory procedures for the safe handling of chemicals should be employed.

5. If it is suspected that safety protection has been impaired in any way, the unit must be made inoperative and secured against any intended operation. The fault condition should immediately be reported to the appropriate servicing authority.

MODEL PCLM3
CHLORIDE METER
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CONTENTS

SECTION 1

INTRODUCTION

1.1 INSTRUMENT DESCRIPTION

The Model PCLM3 Chloride Meter has been designed as a dual purpose chloride analyser with three measurement ranges.
Two measurement ranges are for use in Clinical determinations and require either 20μl or 100μl samples. The third measurement range is specifically for Industrial applications and requires a 500μl sample.
The system operates on the proven coulometric titration principle, providing a quick and easy method to multiple measurements. Automatic indication is given when the reagent requires replacing or the electrodes need cleaning.

1.2 INSTRUMENT SPECIFICATIONS

	Clinical	Industrial
Range:	10 to 299mmol/l	10 to 999mg/l
Sample Volume:	20μl or 100μl	500μl
Reproducibility:	$\pm$1% for 100μl sample at 100mmol $\pm$1.5% for 20μl sample at 100mmol/l	$\pm$3mg/l
Linearity:	Better than $\pm$1mmol/l or $\pm$1% of concentration value (whichever is the greater) over the range 10 to 299mmol/l	$\pm$3mg/l or 1% (whichever is the greater) in the range 10 to 999mg/l
Power:	230/115V a.c. $\pm$10% @ 50/60Hz	
Size:	240 x 215 x 160mm	
Weight:	3.1Kgs	

SECTION 2

INSTALLATION

2.1 UNPACKING

Remove the Model PCLM3 from the packaging and ensure the following items are present:

1. Model PCLM3 Chloride Meter (504 043 Clinical or 504 044 Industrial)
2. Mains Cable
3. Acid Buffer (500ml bottle) (025 011)
4. Gelatin (30ml bottle) (025 012)
5. Chloride Standard - Clinical (180ml bottle) (025 013) **OR**
   Chloride Standard - Industrial (180ml bottle) (025 014)
6. 3 Silver Electrodes (1 cathode, 2 detectors)
7. 2 Silver Anodes
8. Vial of Electrode Polish (060 028)
9. Glass Beaker (024 018)
10. Stirrers
11. Tweezers

Any shortages or damage should be reported immediately to the Manufacturer or your local Distributor.

2.2 INSTALLATION

1. If not already fitted to the unit, the three short sleeved electrodes should be inserted into the gold plated sockets in the underside of the electrode arm.
The shorter unsleeved portion of the electrode is the end to be inserted; the longer unsleeved portion will be at the lower end and eventually sit in the beaker of reagent buffer.

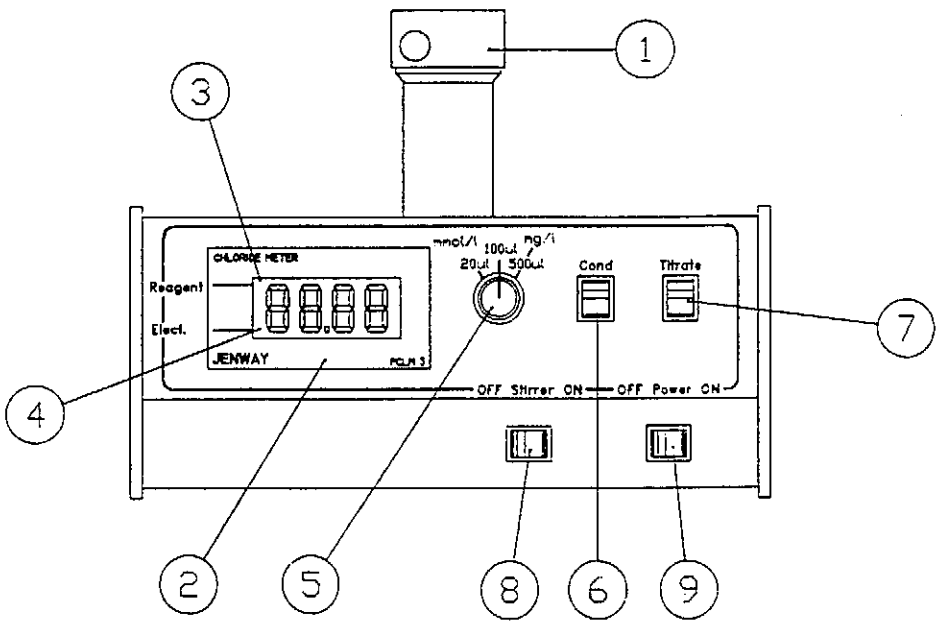
2. Insert the larger diameter anode into the front left hand socket and adjust the length protruding down to equal the length of the other three sleeved electrodes. Tighten the thumbscrew on the front of the electrode head to secure into position.

3. Inspect the electrodes and ensure that all four are of approximately equal length and are straight and parallel.

SECTION 2 (continued)

2.3 DISPLAYS/CONTROLS

Fig. 2.3.1 - Front Panel Displays and Controls



1. **ELECTRODE HEAD ASSEMBLY** — Housing for the electrodes and anode.

2. **DISPLAY** — LED display.

3. **REAGENT INDICATOR** — This indicator illuminates when the reagents are exhausted, i.e; after 20 samples on the mmol/l ranges and 6 samples on the mg/l range.
NOTE: When the unit is switched on at the commencement of each use, this lamp may illuminate, but will be extinguished as soon as the first condition cycle is run. This does not constitute faulty operation.

4. **ELECT. INDICATOR** — This indicator is illuminated when no current is flowing between the cathode and anode, i.e; the electrodes are raised in free air or in distilled water. The indicator will extinguish when current flows through a buffer solution containing free chloride ions.

2.3 DISPLAYS/CONTROLS (continued)

5. **RANGE SWITCH**	Used to select measurement mode (sample size and concentration units).
6. **COND. SWITCH**	This switch activates a conditioning cycle which is run every time the buffer solution is changed at the beginning of each run of samples.
7. **TITRATE SWITCH**	This switch starts the titration cycle after a five second delay. The display will also be reset to zero.
8. **STIRRER SWITCH**	On/Off rocker switch. Controls power to the magnetic stirrer motor. This switch is set to the OFF position when there is a long pause between batches of samples. During this time the unit remains switched on, but in a standby readiness mode. (Also used momentarily if the stirrer bar does not follow the stirrer magnet on placing the beaker on the platform).
9. **POWER SWITCH**	On/Off rocker switch. Controls power to the unit.

SECTION 2 (continued)

2.4 INPUTS/OUTPUTS

MAINS SUPPLY

The Model PCLM3 is designed to operate on 230 and 115V a.c. supplies (±10%) 50/60Hz.

The standard 2 metre mains lead supplied with the unit is fitted with an IEC type connector which can be plugged directly into the POWER IN socket on the rear panel.

Fuse rating: 230/115 volts = 250mA

Ensure the correct fuse is fitted prior to powering up the unit.

VOLTAGE SELECT

Before connecting the unit to the mains supply ensure the VOLTAGE SELECT switch on the rear panel is set to the correct position for the mains supply to be used (230 or 115V).

MAINS CONNECTIONS

A suitable plug should be connected to the three wires on the mains lead. These are colour coded to conform to the internationally recognised standard such that:

BROWN	**LIVE**
BLUE	**NEUTRAL**
GREEN/YELLOW	**EARTH**

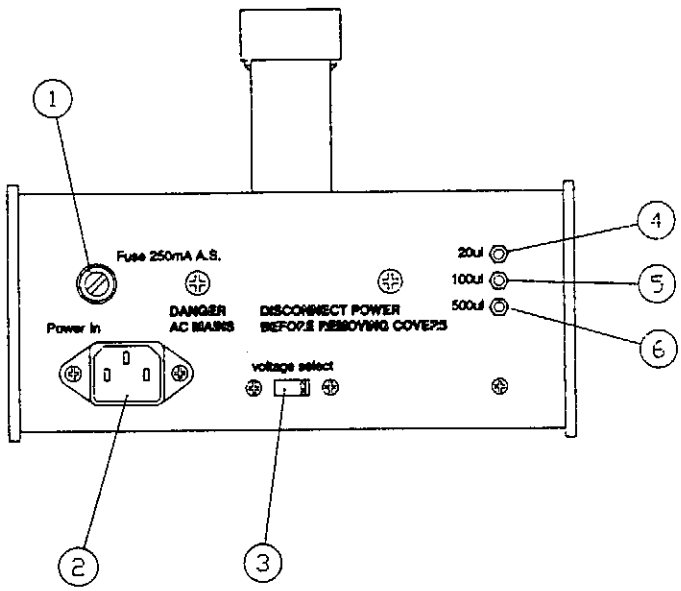
IMPORTANT: THE UNIT MUST BE EARTHED.

The Green/Yellow wire in the a.c. supply cable must be connected to a properly grounded terminal.

SECTION 2 (continued)

2.4 INPUTS/OUTPUTS

Fig. 2.4.1 Rear Panel Layout



1. **FUSE HOLDER** — Screw in holder for mains fuse. Fuse rating: 230/115V = 250mA

2. **POWER SOCKET** — IEC type connection socket for mains cable.

3. **VOLTAGE SELECT** — 2 position slide switch for selection of line voltage.

4. **20µL POTENTIOMETER** — Fine calibration control for 20µl range.

5. **100µl POTENTIOMETER** — Fine calibration control for 100µl range.

6. **500µl POTENTIOMETER** — Fine calibration control for 500µl range.

SECTION 3

OPERATION

NOTE: PRIOR TO HANDLING ANY OF THE REAGENTS USED WITH THIS PRODUCT, PLEASE REFER TO THE HEALTH AND SAFETY SECTION AT THE REAR OF THIS MANUAL.

3.1 PRINCIPLES OF OPERATION

The sample to be measured is added volumetrically to a buffer solution. A constant current is passed between two silver electrodes which then liberate silver ions at a constant rate into the solution.

These silver ions combine with the chloride ions in solution and are precipitated as insoluble silver chloride. When all the chloride has combined with the generated silver, free silver ions become available in the solution and their presence is detected by two further silver electrodes.

During the generation of silver the digital readout of the unit is advanced at a constant rate until the presence of excess silver ions is detected. At this point the advance of the digital readout is halted, and is then equivalent to the concentration of the original sample added.

Further samples may be added to the same buffer solution and the process repeated.

The Industrial range will allow 6 samples on one aliquot of buffer, with a measurement time of approximately 60 seconds for a 200mg/l sample.

Types of samples: Aqueous based with low ionic strength, neutral pH and free of silver halides, other silver reactive components (other than chloride), low solid matter and low levels of dissolved solids.

The Clinical range will allow 20 samples on one aliquot of buffer, with a measurement time of approximately 30 seconds for a 100mmol/l sample.

Types of sample: Serum, Plasma, CSF, Sweat, etc. Urines may be measured but the number that may be measured on one aliquot of buffer is limited, due to reactive substances which may be present.

3.2 CALIBRATION

Prior to despatch the unit will have been calibrated with a pipette accurate to ±1% of the nominal volume. However, it may be found that with other pipettes and operator technique, the unit may deviate more than an acceptable value from the calibration standard. If this is the case, recalibration can be accomplished by adjustment of the appropriate "fine calibration" controls at the rear of the unit (refer Section 2.4).

Adjustments to these controls should be progressive, i.e; running standards after each small adjustment until the correct value is obtained. When it is believed that the setting is correct, a number of repetative standards should be run to validate the new setting.

Using a different pipette could result in the need to recalibrate the unit. It is advised, therefore, that the same standard/sample pipette should be kept with the unit for single purpose use.

3.3 SAMPLE MEASUREMENT

NOTE: Instrument reproducibility is highly dependent on the care that is taken to ensure that accurate and repeatable pipetting of samples.

1. Connect the unit to the correct mains supply to be used and switch on. The digital display will illuminate and indicate 000. (Some production units may give a random number at switch on, but will read zero on start of the condition cycle).

2. Dispense 15ml of acid buffer reagent into a sample beaker. Add 0.3ml (10 drops) of gelatin reagent and a stirrer bar into the beaker.

3. Raise the electrode head assembly and place the sample beaker onto the platform. Lower the electrodes into the sample beaker and switch the stirrer on. The stirrer bar should rotate and rapidly stir the contents of the beaker.

4. Select the required measurement range and pipette either:
   a) 20µl or 100µl of 100mmol/l Cl. standard (Clinical) (025 013) or
   b) 500µl of 200mg/l Cl. standard (Industrial) (025 014)

into the sample beaker.

5. Depress the CONDITION switch momentarily. After approximately 5 seconds the display should start to run and will eventually stop at a number greater than the value of the standard added to the sample. (This value is unimportant and should be ignored).

3.3 SAMPLE MEASUREMENT (continued)

NOTE: It is essential to complete steps 4 and 5 at the commencement of each batch of samples run in an aliquot of fresh acid buffer/gelatin mixture. Omission of this step will result in false results being obtained.
It is also important because:
a) It resets the "change solution" lamp counter to zero, eliminating the need to manually count the number of samples added to the beaker.
b) It titrates any contamination by chloride from the beaker, etc.
c) It places the correct amount of silver ions into the buffer at the end of a single titration, which is detected as the "end point" by the detector electrodes.

If the unit fails to count in the condition cycle, depress the CONDITION switch for four more cycles. If a problem still exists it is recommended that the electrodes should be cleaned (refer Section 4, Maintenance).

6. Add a further amount of standard (the amount dependent on the range selected) and depress the TITRATE switch momentarily. The digital display should immediately set to zero and after approximately 5 seconds should increment to the value of the standard and stop close to its value.
Check the value.

7. Pipette the sample (the amount dependent on the range selected) and depress the TITRATE switch momentarily. The digital display should immediately set to zero and after approximately 5 seconds should increment and stop at the value of the sample. Note this value.

8. Repeat step 7, as required for each sample, until the REAGENT lamp illuminates. At this point the acid buffer/gelatin reagent should be replaced.

It is possible to titrate a few more samples after the REAGENT light illuminates, but this should not exceed 25 clinical or 7 industrial samples.

3.4 LOW LEVEL RESULTS ON MG/L RANGE

Reproducibilty of results below 50mg/l can be improved by:

1. Dispense 5ml of acid buffer reagent into a sample beaker. Add 0.3ml (10 drops) of gelatin reagent, 10ml of distilled water and a stirrer bar.

2. Condition the reagent, as normal.

3.4 LOW LEVEL RESULTS ON MG/L RANGE (continued)

3. Titrate a standard solution whose value is just greater than that expected from the unknown sample.

4. After pipetting 500μl of the first sample wait 5 seconds for complete mixing prior to pressing the TITRATE switch.

5. Repeat step 4 for four further samples and then repeat from step 1 until all samples are tested.

NOTE: AT THESE LEVELS IT IS EVEN MORE CRITICAL TO KEEP ALL FOUR ELECTRODES CLEAN.

3.5 CHANGING REAGENTS

1. Switch the stirrer off. Lift the electrode arm and remove the beaker from the platform.

2. Remove the stirrer bar from the reagent using the plastic tweezers provided with the unit. **DO NOT REMOVE BY HAND.** Rinse in deionised water.

3. The used contents of the beaker should be diluted with copious amounts of water and disposed of down a suitable drain or preferably in a laboratory collection point for waste liquid material.

4. Replenish the beaker with fresh reagents and add the stirrer bar.

3.6 STANDBY/SHUTDOWN PROCEDURES

Between batches of samples switch the stirrer to the off position.

Place a beaker, three quarters filled with deionised /distilled water, on the platform and immerse the electrodes in the water by lowering the head assembly.

It is important that the electrode tips are covered with deionised/distilled water at all times when not in use. They should not be allowed to become dry. Failure to observe this may result in an inability to get the unit to run at first. As a result of this it may be necessary to clean the electrodes (refer Section 4, Maintenance).

SECTION 4

MAINTENANCE

4.1 GENERAL

The Model PCLM3 has been designed to give optimum performance with minimal maintenance. It is only necessary to keep the external surfaces clean and dust free. To give added protection when the unit is not in use the unit should be switched off and covered with the optional dust cover.

4.2 DAILY AND RUNNING MAINTENANCE

Inspect the larger left hand silver anode regularly. Adjust the position of the anode, so that the tip is level with the tips of the other sleeved electrodes. The anode will become wasted at the end with use, and should be trimmed by cutting, so that the end is not pointed.

It is possible to reverse the anode by turning it upside down. or clamping the worn end uppermost, exposing a fresh thick portion at the end which was originally clamped. In this way the maximum life can be obtained from the electrode.

When both ends have become worn down the anode should be replaced.

4.3 ELECTRODE CLEANING

1. Unplug the electrodes from the electrode head assembly.

2. Moisten a tissue or a soft cloth with electrode polish (060 028) and gently rub the exposed ends of the electrodes until they are clean and bright. Final polishing should be done with a clean dry tissue or cloth to remove all traces of polish. Ensure no polish is pushed under the sleeving.

3. Refit the electrodes to the unit and lower into a beaker of deionised/distilled water. Depress the CONDITION switch. To rinse the electrodes thoroughly running the condition cycle a few times is recommended.

If the electrodes become very discoloured and the electrode polish is ineffective the following procedure should be adopted:

1. Fill a beaker with equal parts of concentrated nitric acid and deionised/distilled water and place on the platform.

2. Lower the electrodes into the solution FOR NO LONGER THAN 1 MINUTE.

4.3 ELECTRODE CLEANING (continued)

3. Rinse the electrodes in another beaker containing clean water. Rinse and repeat several times, replacing the water between each rinse.

4. Place the electrodes in a beaker of fresh water and run the condition cycle a few times to ensure the electrodes are rinsed thoroughly.

4.4 ELECTRODE REPLACEMENT

The cathode and detection electrodes are fitted with silicon rubber sleeves which, when fitted, sheath the gold electrode sockets. When changing electrodes they can be pulled gently from their sockets.

Replacing the electrodes necessitates sliding the silicon rubber sleeve down the electrode, exposing the bare silver end, gently pushing into the gold socket and then sliding the silicon rubber sleeving up over the socket.

SECTION 5

SPARES

5.1 SPARES

The following list of items are available as spares for the Model PCLM3:

Order Code	Description
504 053	Pack of 3 silver anodes
504 052	Pack of silver electrodes (1 cathode, 2 detectors)
060 028	Electrode polish
025 011	Acid Buffer solution (500ml)
025 012	Gelatin (30ml)
025 013	Chloride Standard (Clinical) (180ml)
025 014	Chloride Standard (Industrial) (180ml)
060 029	Stirrer Bar (pack of 10)
024 018	Glass Beaker

SECTION 6

TROUBLESHOOTING

6.1 FUSE REPLACEMENT

At power on, if the unit does not respond, replace the fuse by unscrewing the cover cap on the rear panel. If the replacement fuse blows contact your local Distributor for service.

6.2 ELECTRODE FAILURE

If the unit fails to start and the readout remains at "zero" reading, it is probably due to dirty electrodes. This may be confirmed by carrying out the following check:

Lift the electrode head from the sample beaker of buffer. Press the CONDITION switch as for normal operation and after approximately 5 seconds the counter should start to accumulate normally.
If this is the case then the electrodes are dirty and will require cleaning (refer Section 4.3).

To check the sensing circuit, short together the two ends of the two rear electrodes by means of a small screwdriver (or paper clip). This should stop the counter accumulating and further demonstrates that the cause is dirty electrodes. This also indicates that the sensing circuit is operating correctly.

6.3 ELECTRICAL TEST

An electrical test may be performed as follows:

1. Connect a milliammeter (0 - 100 milliamp range) to the two front electrodes (+ve to left hand electrode). The electrodes should be in free air.

2. Set the POWER switch to the ON position, and then press the CONDITION switch as for normal operation.

3. After approximately 5 seconds the milliammeter should indicate current
and at the same time the counter should start running.

Ranges will indicate approximately:

Clinical - 5mA on 20μl range
- 20mA on 100μl range

Industrial - 8mA on mg/l range

4. Ensure all the digits of the display are incrementing the sequence correctly. The counter may now be stopped by shorting together the two ear electrodes. This confirms that the sensing circuit is functioning correctly.

SECTION 6 (continued)

6.4 INSTRUMENT TEST

1. Proceed as in the Electrical Test.

2. Clean the electrodes and proceed to run the instrument as in the normal operating procedure.

3. If the instrument does not perform satisfactorily re-clean the electrodes once more.

4. Re-run the instrument. If still not operating satisfactorily, check the performance with a new batch of buffer, gelatin and standard solution.

5. If the results obtained are imprecise or do not reproduce, then check the pipette and operator technique.

6. If all the above fail to produce satisfactory results, contact the Manufacturer or your local Distributor for assistance.

HEALTH & SAFETY INFORMATION

NOTE: **NORMAL SAFETY PRECAUTIONS MUST BE OBSERVED WHEN HANDLING THESE CHEMICALS.**

ACID BUFFER - ORDER CODE: 025 011

This solution contains Acetic and Nitric Acid and the following precautions should be noted:

1. Harmful if swallowed.
2. Irritating to skin on prolonged contact. Avoid contact with skin. If accidental skin contact occurs wash off immediately with plenty of running water. If irritation persists seek medical advice.
3. Risk of damage to eyes on contact. Avoid contact with eyes. In the case of accidental contact with eyes rinse immediately with plenty of running water. SEEK MEDICAL ATTENTION.
4. Keep container tightly closed.
5. Handle open container with care.
6. Avoid spillage on clothing. Remove contaminated clothing IMMEDIATELY.
7. Used material should be diluted with copious amounts of water and disposed of by pouring down a suitable drain or preferably in a laboratory collection point for waste liquid material.
8. Stirrer bars should only be removed from the titration beaker using the plastic tweezers supplied with the instrument and then rinsed in distilled/deionised water prior to re-use.

GELATIN SOLUTION - ORDER CODE: 025 012

1. Safe and non toxic. Contains Gelatin obtained from natural materials and a small amount of non toxic mould inhibitor.

CLINICAL STANDARD - ORDER CODE: 025 013
INDUSTRIAL STANDARD - ORDER CODE: 025 014

1. Safe and non toxic. Contains Sodium Chloride in the concentration shown on the label, plus a small amount of a non toxic mould inhibitor.

ELECTRODE POLISH - ORDER CODE: 060 028

1. Safe and non toxic. Contains a mild abrasive in a water base. However, avoid contact with eyes and ingestion.

EC Declaration of Conformity

Jenway Model PCLM3 Chloride Meter complies with the following European Standards:

EN 50081-1:1992 Electromagnetic compatibility - Generic emission standard

EN 50082-1:1992 Electromagnetic compatibility - Generic immunity standard (Performance criterion B)

EN 61010-1:1993 Safety requirements for electrical equipment for measurement, control and laboratory use

Following the provision of:

EMC Directive - 89/336/EEC and Low Voltage Directive - 73/23/EEC

Thank you for reading this data sheet.

For pricing or for further information, please contact us at our UK Office, using the details below.

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