The Palintest® System

Instructions

The Palintest® System

Palintest®

Soil Tests

Photometer 5000
System

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The Palintest® System

Soil testing plays a vital role in modern agricultural and horticultural management. Regular assessment of major nutrient and trace element levels in the soil is essential to make fertilizer recommendations, to prevent micro-nutrient efficiencies and to ensure optimum growing conditions.

The Palintest system of soil testing is unique. Simple to use test equipment, and reagents in stable tablet form, mean that reliable results can be obtained by all - users - with or without formal training in soil analysis.

This is why the Palintest system is used by farmers, growers and specialists throughout the world - you can rely on years of Palintest experience for your soil testing needs.

Palintest® Soil Tests - Photometer 5000 System

The Palintest Photometer system offers a precise modern means of soil analysis. The system features the Palintest Photometer 5000 an advanced solid-state digital-readout colorimeter instrument.

The Palintest Photometer 5000 is integrated with the Palintest range of soil extraction and reagent tablets. It offers therefore an instrumental method of analysis for an extensive range of soil tests.

The tests are carried out by first extracting nutrients or trace elements from the oil, and then testing the extracts by simple Calorimetric test procedures. The photometer 5000 accurately assesses the colour formed in the test sample and displays the reading as a digital transmittance readout. The instrument is used conjunction with a calibration chart for each test and in this way gives an accurate measure of the soil parameter under test.

The tests for soil pH and lime requirement are carried out without the need for separate extraction using the Palintest Soiltester or Palintest pH meter. Certain tests, for example, those for calcium and chloride, do not use the photometer. These tests are carried out on the appropriate soil extract using the Palintest tablet count method.

SOIL ANALYSIS APPLICATIONS

Soil analysis is a complex subject. The wide variation in soil types and crops under cultivation has promoted many different methods of soil analysis. Often the results obtained must be related to the method of analysis used.

Whilst precise laboratory analysis undoubtedly has a vital role, simple methods field testing can be immensely useful in soil management. In particular suits can be obtained quickly and economically. Field tests can be conducted order to make fertilizer recommendations, to check if further tests are needed to determine if samples should be collected for specialist analysis.

Palintest soil tests are equally suited for use in the field and in the laboratory. faintest soil test kits are an important part of any agricultural or horticultural management program.

CORRELATION OF RESULTS

Chemical elements are often strongly bonded or complexed within the soil structure. Soil analysis measures the nutrients or trace elements which are ‘exchangeable' or 'extractable under the conditions of the test. The amounts will depend on the nature of the extraction method and the time of contact. Thus whilst a general relationship exists between different methods of soil analysis, precise correlation can sometimes be difficult.

In developing Palintest methods regard has been paid to standard laboratory methods of soil testing (Ref. 1, 2). Correlations have been established for the pH, Lime Requirement, Nitrate (N), Phosphate (P), Potassium (K) and Magnesium methods (Ref. 3). These tests should give similar results to United Kingdom ADAM methods for normal agricultural soils. However, in view of the wide variation in soil types it is not possible to guarantee that precisely similar results will be obtained in all cases.

Test results should always be considered in relation to the fertilizer program applied and the conditions of cultivation. In the event of unexpected test results being obtained, such as very high or very low values, then it is recommended hat samples are submitted for laboratory analysis.

FERTILIZER RECOMMENDATIONS

Fertilizer recommendations are outside the scope of these soil test instructions. t is suggested that users refer to standard fertilizer recommendations such as hose published by ADAS (Ref. 4) in the United Kingdom and by government agencies in other countries.

REFERENCES

1. The Analysis of Agricultural Materials; Agricultural Development and Advisory Service; Ministry of Agriculture, Fisheries and Food; Reference Book RB 427

2. Methods of Soil Analysis; American Society of Agronomy, 1965, 5th printing 1 979.

3. Comparison of Palintest Soil Test Methods with Standard Laboratory Procedures, Colin Marks and Valerie Argent, Palintest Ltd.

4. Fertilizer Recommendations; Agricultural Development and Advisory Service; Ministry of Agriculture, Fisheries and Food; Reference Book 209.

Test Instructions - Photometer 5000 System

Booklets supplied with test kits may contain only the relevant test instruction sheets. Additional sheets describing other tests, test equipment or instruments may however also be included.

Palintest
Soil Test Instructions

SOIL SAMPLING AND EXTRACTION

SOIL SAMPLING

A soil sample should be collected from each plot or area to be examined. Separate samples should be collected from each area which differs in soil type, previous cropping history or type of soil management.

Preferably samples of soil should be taken using sampling auger which enables "cores" of soil to be taken from below the surface. Alternatively a piece of narrow rigid tubing may be used. Between 10 and 25 individual cores should be taken from each area to make up the soil sample for analysis. It is customary when the sampling large areas of agricultural land to take cores along the shape of an imaginary W covering the area being sampled. Cores should not be taken close to hedgerows, under trees or adjacent to buildings.

To provide the sample for analysis, the individual cores should be thoroughly mixed in a bucket. Stones and foreign materials should be removed by hand. The soil can be passed through a 2 mm sieve or similar if this is available. The sample can then be transferred to a polythene sample bag.

For field analysis the tests may be conducted directly on the moist sample. Where analysis is to be carried out at a later time it is preferable to dry the sample by spreading it out on a tray or plastic sheet and allowing it to stand in air.

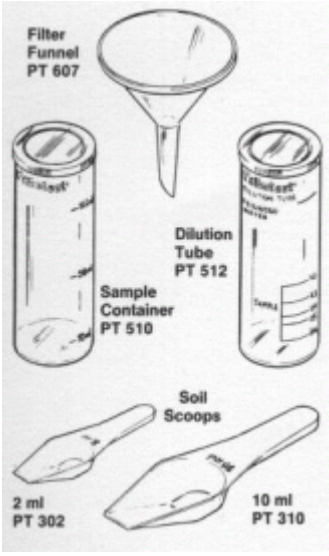
SOIL EXTRACTION

The first stage in the analysis of soil is the preparation of a soil extract. This involves shaking the soil with an extracting solution. Different solutions are used for different tests or groups of tests.

In the Palintest system of soil analysis the extracting solutions are prepared by dissolving the appropriate Extraction Tablet in demonized water (five tablets in 50 ml water). For certain tests the soil is extracted with water alone. Palintest extraction tablet and reagent pack labels are colour coded to ensure that the correct reagents are used with the correct extraction system.

An outline of the extraction scheme used for the various tests is shown in the following table.

Test	Extract	Extraction Tablets	Water	Soil	Label Colour
Soil pH Lime Requirement	No extraction required. Tests are carried out directly on the Soil Sample.				White
Nitrate (N) Manganese	Extract N	5 Extraction N plus Nitratest Powder	50 ml	2 ml	Green
Phosphate (P)	Extract P	5 Extraction P	50 ml	2 ml	Blue
Potassium (K)	Extract K	One level 2.5 scoop Extraction K Powder	50 ml	2 ml	Yellow
Calcium Magnesium Aluminum Ammonia Iron	Extract A	5 Extraction A	50 ml	10 ml	Pink
Copper	Extract C	5 Extraction C	50 ml	10 ml	Purple
Chloride Sulphate	Extract W	Demonized Water Only	50 ml	10 ml	White



Palintest Soil Test kits contain extraction tablets appropriate to the tests included in the kit.

Equipment Needed

The equipment needed to prepare the soil extracts, and included in Palintest soil test kits, is listed below.

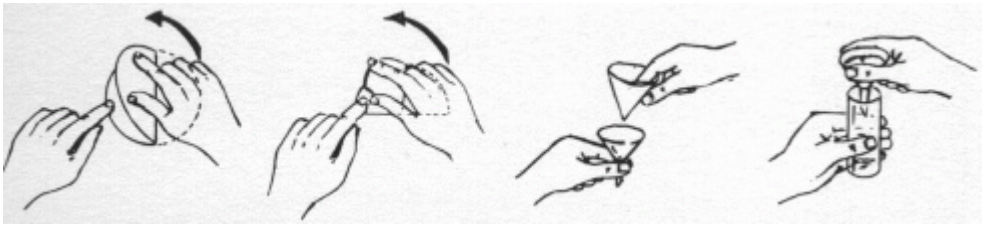
Two Palintest Sample Containers 100/50/10 ml, plastic (PT 510)
Soil Scoop 2 ml (PT 302) or 10 ml (PT 310)
Filter Funnel 7 cm, plastic (PT 607)
Filter Papers No. 40, 11 cm diameter (PT 618)

It is important to ensure that the sample containers and the filter funnels are clean before the start of each extraction. It is important to wash out all traces of the previous extracting solution as these can seriously contaminate subsequent tests. The sample containers and filter funnel must be thoroughly washed out and then rinsed with demonized water between each extraction. Syringes used to measure extract solutions must be thoroughly cleaned between each test.

Filtering and Extract

After the soil has been shaken with the extracting solution for the prescribed period it must be filtered through filter paper to produce a clear extract. The filtration is carried out in the following manner.

Take the filter paper circle, fold in half and then fold again into a quarter. Insert a finger between the folds and form the paper into the shape of a cone. Insert the filter paper cone into the filter funnel then place the funnel on the top of a clean sample container.



Pour the soil slurry into the funnel and allow the extract to drip through into the sample container. Discard the first few drops of the extract, then collect the extract in the sample container.

It is not necessary to collect all of the extract solution. Most of the Palintest procedures have been based on a 10 ml sample of extract for the tests to be carried out then discard the rest of the soil slurry.

Diluting Soil Extracts

The composition of different soils varies enormously and test results can extend over a wide range of values. Palintest soil test ranges have been selected to cover the test values most likely to be encountered in garden or agricultural soils. With particular soil types however, or for certain tests, higher values then the test range may be encountered. In these cases it is necessary to dilute the soil extract to bring the solution within the test range.

To simply dilution procedures a special Dilution Tube is included in kits. The Dilution Tube enables the extract to be diluted by a factor of 2, 3, 4, 5, or 10 times (see GEN.6).

It is not possible to dilute the sample when carrying out the Soil pH or Lime Requirement tests.

Temperature

Temperature affects the rate of soil extraction and the rate of chemical reactions. Palintest soil tests have been calibrated at a temperature of 20°C. Palintest soil extraction procedures and chemical tests should be carried out with the solution as close to 20°C as possible for optimum results.

Important

The success of the soil tests will depend on following the test instructions carefully and on maintaining clean working conditions throughout the test procedures. Always wash and rinse equipment thoroughly before and after use.

SOIL EXTRACTION PROCEDURES

Soil extraction is the first stage in soil testing. The soil is shaken with an extracting solution in order to extract the nutrient or trace element from the soil. These test instructions give the procedures for preparing soil extracts.

Prepare the soil extract according to the procedure below, appropriate to the soil test being carried out. Turn then to the test instructions for the particular test parameter. These give the procedures for completing the test on the prepared soil extract.

Certain groups of tests use the same extraction procedure. It is only necessary to prepare a single extract for each group of tests. When carrying out a full analysis of the soil the procedures outlined below will be helpful in planning out the most logical sequence for carrying out the tests. Note that individual test kits may not contain all the test listed.

NOTE THAT THE EXTRACTION PROCEDURES USE TWO DIFFERENT SIZES OF SOIL SAMPLE SCOOP - 2 ML AND 10 ML

Extract N for Nitrate and Manganese Tests

1. Fill the sample container to the 50 ml mark with deionised water.
2. Add five Extraction N tablets, cap tube and shake to disintegrate.
3. Add one level 2 ml scoop of soil, cap tube and shake for one minute.
4. Add one level cap-spoonful of Nitratest N Powder, cap tube and shake for one minute.
5. Filter and collect Extract N in a clean sample container.

Extract P for Phosphate Test

1. Fill the sample container to the 50 ml mark with deionised water.
2. Add five Extraction P tablets, cap tube and shake to disintegrate.
3. Add one level 2 ml scoop of soil. Cap tube and shake for one minute. With acid soils some effervescence may be produced - release tube cap periodically to allow any pressure build-up to escape.
4. Filter and collect Extract P in a clean sample container.

Extract K for Potassium Test

Extraction K has now been changed to a powder formulation. A blue 2½ ml scoop is included in the Extraction K bottle - it is important that this scoop should **NOT** be used for measuring soil.

1. Fill the sample container to the 50 ml mark with deionised water.
2. Add one level 2½ ml scoop of Extraction K powder, cap tube and shake to disperse.

3. Add one level 2 ml scoop of soil, cap tube and shake for one minute.

4. Filter and collect Extract K in a clean sample container.

Extract A for Calcium, Magnesium, Aluminum, Ammonia and Iron Tests

1. Fill the sample container to the 50 ml mark with deionised water.

2. Add five Extraction A tablets, cap tube and shake to disintegrate.

3. Add one level 10 ml scoop of soil, cap tube and shake for two minutes.

4. Filter and collect Extract A in a clean sample container.

Extract C for Copper Test

1. Fill the sample container to the 50 ml mark with deionised water.

2. Add five Extraction C tablets, cap tube and shake to disintegrate.

3. Add one level 10 ml scoop of soil, cap tube and shake for two minutes.

4. Filter and collect Extract C in a clean sample container.

Extract W for Chloride, Sulphate and Conductivity Tests

1. Fill the sample container to the 50 ml mark with deionised water.

2. Add one 10 ml scoop of soil, cap tube and shake for two minutes.

3. Filter and collect Extract W in a clean sample container.

Soil pH and Lime Requirement

No extraction required. Tests are carried out directly on soil sample.

Palintest
Soil Test Instructions

SOIL pH

Colour Match Method
Using Palintest Soiltester
RANGE 4 - 8

Soil pH is a measure of the hydrogen ion activity and is important in determining the availability of plant nutrients. Agricultural soils generally lie within the pH range of 4 - 8.

Neutral soils have a pH value close to 7.0. Soils are considered alkaline if the pH is above 7, and acidic if the pH is below 7. Soils below pH 5 are strongly acidic and will only support acid loving plants.

In the Palintest Soil pH test a sample of the soil is shaken in water with an indicator/flocculant tablet. The coloured layer which separates out is compared against colour standards in the Palintest pH Soiltester.

Reagents and Equipment

Palintest Soil pH Tablets
Palintest pH Soiltester (PT 320)
Soil Scoop 2 ml (PT 302)

Test Procedure

Use the left-hand side of the Soiltester for acid soils and the right-hand side for neutral or alkaline soils. For unknown soils use both sides of the Soiltester.

1. Take a level 2 ml scoop of soil and place in the Soiltester tube. Fill to the 10 ml mark with deionised water.

2. Add one Soil pH tablet then shake the Soiltester gently for one minute.

3. Allow the soil to settle then compare the solution against the Soiltester colour standards under daylight conditions. The reading obtained represents the soil pH value.

Note:

With certain soils the suspension may be slow to settle and the colours may appear weak. In such cases the test should be repeated using two Soil pH tablets.

Palintest
Soil Test Instructions

LIME REQUIREMENT

Colour Match Method
Using Palintest Soiltester
0 - 34 tonne/ha

The "Lime Requirement" of a soil is a measure of the quantity of liming material required to raise the pH of the soil to a specified value. The specified pH value is 6.5 for mineral soil, 6.2 for organic soil and 5.8 for peaty soil. It is not necessary to test soils where the existing pH is higher than these values since, in such cases, the lime requirement will be zero.

In the Palintest Lime Requirement test, the soil is shaken with a pH buffer and the extent to which the soil modifies the buffer pH is used to determine the lime requirement. The test is carried out as a extension of the Soil pH test. The value given is the amount of calcium carbonate required to raise a 20 cm depth of soil to the pH value specified for the particular soil type.

Reagents and Equipment

Palintest Soil pH Tablets
Palintest Lime Buffer Tablets
Palintest pH Soiltester (PT 320)
Soil Scoop 2 ml (PT 302)

Test Procedure

Use the left-hand side of the Soiltester for acid soils with an anticipated high lime requirement. For unknown soils use both sides of the Soiltester.

This test may be carried out as a continuation of the Soil pH test. In this case go directly to step 3 of the instructions below.

1. Take a level 2 ml scoop of soil and place in the Soiltester tube. Fill to the 10 ml mark with deionised water.

2. Add one Soil pH tablet then shake the Soiltester gently for one minute.

3. Add one Lime Buffer tablet and shake the Soiltester gently for two minutes.

4. Allow the soil to settle then compare the solution against the Soiltester colour standards under daylight conditions. Note the Modified pH reading of the buffer.

5. Refer to the Lime Requirement table appropriate to the type of soil under test. The tables show the lime requirement expressed in terms of calcium carbonate ($CaCO_3$). Quantities are given in various units commonly used in agriculture.

Lime Requirement Tables

Mineral Soils

Mineral soils contain less than 10% organic material

Soiltester Reading (Modified pH)	Lime Requirement ($CaCO_3$)			
	tonne/ha	gram/m^2	cwt/acre	oz/sq yard
4.0	30	3000	240	90
4.5	25	2500	200	75
5.0	20	2000	160	60
5.5	15	1500	120	45
6.0	10	1000	80	30
6.5	4	400	30	12
7.0	0	0	0	0
7.5	0	0	0	0
8.0	0	0	0	0

Organic Soils

Organic soils contain 10 - 25% organic material

Soiltester Reading (Modified pH)	Lime Requirement ($CaCO_3$)			
	tonne/ha	gram/m^2	cwt/acre	oz/sq yard
4.0	32	3200	225	95
4.5	26	2600	210	78
5.0	21	2100	165	61
5.5	15	1500	120	45
6.0	10	1000	75	28
6.5	4	400	30	12
7.0	0	0	0	0
7.5	0	0	0	0
8.0	0	0	0	0

Peaty Soils

Peaty Soils contain greater than 25% organic material

Soiltester Reading (Modified pH)	Lime Requirement ($CaCO_3$)			
	tonne/ha	gram/m^2	cwt/acre	oz/sq yard
4.0	34	3400	270	100
4.5	28	2800	225	85
5.0	22	2200	180	65
5.5	17	1700	135	50
6.0	11	1100	85	32
6.5	5	500	40	15
7.0	0	0	0	0
7.5	0	0	0	0
8.0	0	0	0	0

The lime requirement values given in the above tables should be regarded as maximum values. Over liming should be avoided as this may give rise to trace element deficiencies.

Liming Materials

The results of the Palintest Lime Requirement test are given in terms of calcium carbonate (ground limestone or chalk). In practice, a variety of liming materials are used and regard must be paid to the neutralising value of these materials in order to determine the amounts required from the results given as calcium carbonate.

Palintest
Soil Test Instructions

POTASSIUM (K)

Photometer Method
520 nm
0-725 mg/l K

Potassium, the third of the major nutrients, increases resistance to disease and hardens plant tissue.

In the Palintest Potassium (K) test, the soil is extracted using 0.1M magnesium acetate in a soil:water ratio of 1:25. The extracted potassium is reacted with sodium tetraphenylboron to form an insoluble white complex which produces a turbidity in the test sample. The degree of turbidity is proportional to the potassium level in the soil sample and is determined by using a Palintest Photometer.

Reagents and Equipment

Palintest Potassium K Tablets
Palintest Photometer
Round Test Tubes, 10 ml glass (PT 515)

Soil Extraction

This test is carried out on **Extract K** (see SOIL.3)

Test Procedure

1. Fill a round glass test tube to the 10 ml mark with Extract K.
2. Add one Potassium K tablet, crush and mix to dissolve.
3. Stand for two minutes. A cloudy solution indicates the presence of potassium.
4. Select wavelength 520 nm on Photometer.
5. Take photometer reading (%T) in usual manner (see photometer instructions).
6. Consult Potassium (Soil) calibration chart to find the potassium concentration in the soil.

POTASSIUM mg/l K **520 nm** **SOIL** **1:25 EXTRACTION**										
%T	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
90	15	20	25	35	40	45	50	55	55	60
80	65	65	70	75	75	80	80	85	90	90
70	95	95	95	100	100	105	105	105	110	110
60	110	115	115	115	120	120	120	125	125	130
50	130	130	135	135	135	140	140	140	145	145
40	150	150	155	155	160	160	165	165	170	170
30	170	175	175	180	180	185	190	195	200	205
20	215	225	230	240	250	260	270	280	295	315
10	330	350	365	385	405	430	450	475	500	430
0	560	595	625	725	-	-	-	-	-	-

NOTES

1. Photometer readings on turbidity-based tests should be carried out under shaded conditions to avoid light being reflected into the instrument. Always shade the top of the Photometer when taking readings under strong light or sunlight.

2. High levels of ammonia nitrogen may interfere with the potassium test. The test should not be used within two weeks following application of farmyard manure.

Palintest
Soil Test Instructions

NITRATE (N)

Colour Match Method
Palintest Soiltester
0 - 25 mg/l N

Nitrate Nitrogen (N) is an important plant nutrient which promotes foilar growth and increases yield.

In the Palintest Nitrate test, the soil is extracted using 1 M ammonium chloride at a soil:water ratio of 1:25. The extracted nitrate is reduced to nitrite and reacted to form a red azo-dye. The intensity of the red colour produced is proportional to the nitrate in the soil sample and is determined by comparison against colour standards in the Palintest N/P Soiltester.

Reagents and Equipment

Palintest Extraction N Tablets
Palintest Nitratest N Powder
Palintest Nitricol N Tablets
Palintest N/P Soiltester (PT 321)

Sample container and equipment for soil extraction and filtration as previously described.

Soil Extraction - Extract N

1. Fill the sample container to the 50 ml mark with deionised water.

2. Add five Extraction N tablets, cap the tube and shake to disintegrate.

3. Add one level 2 ml scoop of soil, cap the tube and shake for one minute.

4. Add one level cap-spoonful of Nitratest N powder, cap the tube and shake for one minute.

5. Filter and collect Extract N in a clean sample container. For optimum results, carry out the test as soon as sufficient extract has been collected.

Test Procedure

1. Fill the lefthand side of the N/P Soiltester with Extract N to the 10 ml mark.

2. Add one Nitricol N tablet, crush and mix to dissolve.

3. Stand for 10 minutes to allow full colour development.

4. Compare the solution colour against the Soiltester colour standards. The matching colour represents the nitrate nitrogen level in the soil as milligrams per litre N.

Palintest
Soil Test Instructions

PHOSPHATE (P)

Colour Match Method
Palintest Soiltester
0 - 120 mg/l P

Phosphate (p) is a major plant nutrient. It is particularly beneficial in stimulating root growth.

In the Palintest Phosphate test the soil is extracted using 0.5 M sodium bicarbonate at a soil:water ration 1:25. The extracted phosphate is then reacted with ammonium molybdate under reducing conditions in acidic solution to form a blue coloured complex. The intensity of the blue colouration is proportional to the phosphate level in the soil and is measured by comparison against colour standards in the Palintest N/P Soiltester.

Reagents and Equipment

Palintest Extraction P Tablets
Palintest Acidifying P Tablets (or Palintest Acidifying S Tablets)
Palintest Phosphate P Tablets
Palintest N/P Soiltester (PT 321)

Sample container and equipment for soil extraction and filtration as previously described.

Soil Extraction - Extract P

1. Fill the sample container to the 50 ml mark with deionised water.

2. Add five Extraction P tablets, cap the tube and shake to disintegrate.

3. Add one level 2 ml scoop of soil, cap the tube and shake for one minute. With acid soils some effervescence may be produced; release the tube cap periodically to allow any pressure to escape.

4. Filter and collect exactly 10 ml Extract P in a clean sample container. Remove filter funnel or transfer to a new container.

5. Take the sample container containing exactly 10 ml Extract P and add one Acidifying P tablet (or three Acidifying S tablets). The tablet will effervesce. Do not cap the tube or shake vigorously. Allow the tube to stand until the effervescence ceases, then crush the remainder of the tablet and mix to dissolve.

Test Procedure

1. Fill the rightthand side of the N/P Soiltester with Acidified Extract P to the 10 ml mark.

2. Add one Phosphate P tablet, crush and mix to dissolve.

3. Stand for 10 minutes to allow full colour development.

4. Compare the solution colour against the Soiltester colour standards. The matching colour represents the nitrate nitrogen level in the soil as milligrams per litre P.

Palintest
Soil Test Instructions

MAGNESIUM (Mg)

Photometer Method
520 nm
0 - 500 mg/l Mg

Magnesium is an essential element for the growth of green plants. The ration of calcium to magnesium is also an important factor in determining the availability of nutrients If there is an excess of magnesium over the amount of calcium in the soil, plant growth can be seriously affected.

In the Palintest Magnesium test, the soil is extracted using 1M potasium chloride at a soil:water ratio of 1:5. The extracted and exchanged magnesium is then reacted to form an orange complex. The reagent produces a yellow colour in the absence of magnesium. The intensity of the orange colour produced is proportional to the magnesium in the soil sample and is determined by using a Palintest Photometer.

Reagents and Equipment

Palintest Magnecol S Tablets
Palintest Photometer
Round Test Tubes, 10 ml glass (PT 515)
Syringe, 1 ml, plastic (PT 361)

Soil Extraction

The test is carried out on **Extract A** (see Soil.3)

Test Procedure

1. Using the plastic syringe take exactly 1 ml Extract A. Discharge the syringe into a round test tube, then fill the tube to the 10 ml mark with deionized water.

2. Add one Magnecol S tablet, crush and mix to dissolve.

3. Stand for 2 minutes to allow full colour development.

4. Select wavelength 520 nm on Photometer.

5. Take Photometer reading (%T) in usual manner (see Photometer Instructions).

6. Consult Magnesium (Soil) calibration chart to find the magnesium concentration in the soil.

MAGNESIUM SOIL				mg/l Mg			**520 nm 1:5 EXTRACTION/1 ML Extract**			
%T	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
80	--	--	--	--	--	--	--	--	--	0
70	20	35	45	50	55	55	60	60	65	65
60	70	70	70	75	75	80	80	85	85	90
50	95	95	100	105	105	110	115	120	125	130
40	135	140	145	150	155	160	165	175	175	180
30	185	190	195	200	205	215	220	225	230	235
20	245	250	260	265	275	285	290	300	310	320
10	335	345	360	370	390	410	425	445	470	500

Palintest
Soil Test Instructions

ALUMINUM

Photometer Method
570 nm

0 - 50 mg/l Al

Aluminum is a commonly occuring element found in the majority of inorganic soils. Soluable aluminum can be toxic to many plants. Solubility is promoted by acid conditions and liming is often used to prevent the take-up of aluminum.

In the Palintest Aluminum test the soil is extracted using 1M potassium chloride at a soil:water ratio of 1:5. The extracted and exchanged aluminum is reacted with eriochrome cyaninie under conditions to produce a red coloured complex. In the absence of the aluminum the reagent gives a yellow coloration. The intensity of teh red colour produced is proportional to the aluminum level in the soil and is determined by using a Palintest Photometer.

Reagents and Equipment

Palintest Aluminum No 1S Tablets
Palintest Aluminum No 2S Tablets
Palintest Photometer
Round Test Tubes, 10 ml glass (PT 515)
Syringe, 1 ml plastic (PT 361)

Soil Extraction

This test is carried out on **Extract A** (see Soil.3).

Test Procedure

1. Using the plastic syringe take exactly 1 ml Extract A. Discharge the syringe into a round test tube, then fill the tube to the 10 ml mark with deionized water.
2. Add one Aluminum No 1S tablet, crush and mix to dissolve.
3. Add one Aluminum No 2S tablet, crush and mix to dissolve. Avoid vigorous agitation.
4. Stand for 5 minutes to allow full colour development.
5. Select wavelength 570 nm on the Photometer.
6. Take Photometer reading (%T) in usual manner (see Photometer instructions).
7. Consult Aluminum (Soil) calibration chart to find the aluminum concentration in the soil.

Aluminum Soil			mg/l Al						**570 nm 1:5 EXTRACTION/1 ml Extract**	
%T	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
90	--	--	--	--	--	--	0.0	0.8	1.3	2.0
80	2.8	3.5	4.3	5.0	5.5	6.5	7.5	8.3	9.3	10.3
70	11	12	13	14	15	17	18	19	21	23
60	25	27	29	32	35	40	45	50	--	--

Palintest
Soil Test Instructions

AMMONIA

Photometer Method
640 nm

0 - 75 mg/l N

Ammonia nitrogen is a rapidly available form of nitrogen and encourages green plant growth. Ammonia nitrogen forms the basis of some nitrogen fertilizers which are mainly used on horticultural soils and composts.

In the Palintest Ammonia Nitrogen test the soil is extracted using 1M potassium chloride at a soil:water ratio of 1:5. The extracted ammonia is then reacted to form a green indophenol complex. The reagents produce a yellow colour in the absence of ammonia. The intesity of teh green colour produced is proportional to the ammonia nitrogen content of the soil sample and is determined by using a Palintest Photometer.

Reagents and Equipment

Palintest Ammonia No 1S Tablets
Palintest Ammonia No 2S Tablets
Palintest Photometer
Round Test Tubes, 10 ml glass (PT 515)
Syringe, 1 ml plastic (PT 361)

Soil Extraction

This test is carried out on **Extract A** (see Soil.3).

Test Procedure

1. Using the plastic syringe take exactly 1 ml Extract A. Discharge the syringe into a round test tube, then fill the tube to the 10 ml mark with deionized water.
2. Add one Ammonia No 1S tablet and one Aluminum No 2S tablet. Crush and mix to dissolve both tablets.
3. Stand for 15 minutes to allow full colour development.
4. Select wavelength 640 nm on the Photometer.
5. Take Photometer reading (%T) in usual manner (see Photometer instructions).
6. Consult Ammonia (Soil) calibration chart to find the ammonia nitrogen concentration in the soil.

Ammonia Nitrogen **Soil**			mg/l N						**640 nm** **1:25 EXTRACTION/1 ml Extract**	
%T	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
80	--	0.0	0.3	0.7	1.1	1.4	1.8	2.2	2.6	2.9
70	3.3	3.7	4.1	4.5	5.0	5.4	5.8	6.2	6.7	7.1
60	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0
50	12.5	13.0	13.5	14.0	14.5	15.0	16.0	16.5	17.0	17.5
40	18.0	19.0	19.5	20.0	21.0	21.5	22.5	23.0	24.0	24.5
30	25	26	27	28	29	30	31	32	33	34
20	35	36	37	38	39	41	42	43	45	46
10	48	49	51	53	55	57	60	62	65	68
0	71	75	--	--	--	--	--	--	--	--

Palintest
Soil Test Instructions

CALCIUM

Tablet Count Method

0 - 2500 mg/l Ca

The amount of exchangeable calcium is an important factor in classifying soil and in making fertilizer recommendations. Calcium stimulates root development and influences the uptake of other nutrients. The ratio of calcium to magnesium is particularly important in determining nutrient availability.

In the Palintest Calcium test, the soil is extracted using 1M potassium chloride at a soil:water ratio of 1:5. The extracted and exchanged calcium is then determined by the Palintest tablet count method. Tablets are added to a sample of the extract one at a time until the colour changes from pink to violet. The result of the test is calculated from the number of tablets added to the extract sample.

Reagents and Equipment

Palintest Calcium S Tablets
Palintest Sample Container, 100/50/10 ml plastic (PT 510)

Soil Extraction

The test is carried out on **Extract A** (see Soil.3)

Test Procedure

1. Take 10 ml Extract A in the sample container. Add deionised water to make up to approximately the 50 ml mark. (The amount of deionised water added is not critical - this is merely to increase the working volume of the solution to aid dissolving the tablets and observation of the colour change).

2. Add one Calcium S tablet and shake the container until the tablet disintegrates.

3. Continue adding tablets, one at a time, until the colour of the solution changes from pink to violet.

4. Note the number of Calcium S tablets used. Calculate the result of the test using the formula given below. This gives the calcium level in the soil expressed as mg/l Ca.

   Calcium (mg/l) = Number of Tablets x 250

LOW CALCIUM SOILS

For soils with an expected low calcium content, it is preferable to carry out this test on 50 ml of Extract A, made up to approximately 100 ml with deionised water. The result should then be calculated as follows:

Calcium (mg/l) = Number of Tablets x 50

Palintest
Soil Test Instructions

COPPER

Photometer Method
520 nm

0 - 25 mg/l Cu

Copper is an important trace element. Copper deficiency can cause stunting of growth and reduction in crop yield.

In the Palintest Copper test the soil is extracted using 0.05M disodium EDTA at a soil:water ration of 1:5. The extracted copper is reacted with a specific copper reagent to produce a purple coloration. The intensity of the purple coloration is proportional to the copper level in the sample and is determined by using a Palintest Photometer.

Reagents and Equipment

Palintest Coppercol No 1S Tablets
Palintest Coppercol No 2S Tablets
Palintest Photometer
Round Test Tubes, 10 ml glass (PT 515)

Soil Extraction

This test is carried out on **Extract C** (see Soil.3).

Test Procedure

1. Fill a round test tube to the 10 ml mark with Extract C.
2. Add one Ammonia No 1S tablet, crush and mix to dissolve.
3. Add one Ammonia No 2S tablet, crush and mix to dissolve.
4. Stand for 15 minutes to allow full colour development.
5. Select wavelength 520 nm on the Photometer.
6. Take Photometer reading (%T) in usual manner (see Photometer instructions).
7. Consult Copper (Soil) calibration chart to find the copper concentration in the soil.

COPPER mg/l Cu **520 nm**
SOIL **1:5 EXTRACTION**

%T	9	8	7	6	5	4	3	2	1	0
90	0.0	0.0	0.2	0.3	0.5	0.7	0.9	1.0	1.2	1.4
80	1.5	1.7	1.9	2.0	2.2	2.4	2.6	2.8	3.0	3.2
70	3.4	3.6	3.8	4.0	4.2	4.3	4.5	4.7	4.8	5.0
60	5.2	5.4	5.7	5.9	6.1	6.4	6.6	6.9	7.2	7.4
50	7.6	7.9	8.1	8.4	8.7	9.0	9.3	9.6	9.8	10.0
40	10.4	10.7	11.0	11.4	11.7	12.0	12.3	12.7	13.0	13.5
30	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.2	17.5	18.0
20	18.5	19.0	19.5	20.0	20.5	21.0	21.5	22.0	23.0	24.0
10	25.0	--	--	--	--	--	--	--	--	--

Palintest
Soil Test Instructions

IRON

Photometer Method
520 nm

0 - 5 mg/l Fe

Copper is an important trace element and is essential to plant growth. Iron is thought to act as a catalyst to photosynthesis.

In the Palintest Iron test the soil is extracted using 1M potassium chloride at a soil:water ratio of 1:5. The extracted and exchanged iron is then reacted with a specific iron reagent PPST to form a red coloured complex. The intensity of the red coloration produced is proportional to the iron level in the soil sample and determined by using a Palintest Photometer.

Reagents and Equipment

Palintest Iron LR S Tablets
Palintest Photometer
Round Test Tubes, 10 ml glass (PT 515)

Soil Extraction

This test is carried out on **Extract A** (see Soil.3).

Test Procedure

1. Fill a round test tube to the 10 ml mark with Extract A.
2. Add one Iron LR S tablet, crush and mix to dissolve.
3. Stand for 10 minutes to allow full colour development.
4. Select wavelength 520 nm on the Photometer.
5. Take Photometer reading (%T) in usual manner (see Photometer instructions).
6. Consult Iron (Soil) calibration chart to find the iron concentration in the soil.

IRON SOIL				mg/l Fe					**520 nm 1:5 EXTRACTION**	
%T	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
90	--	--	--	--	--	--	0.00	0.02	0.07	0.12
80	0.18	0.23	0.28	0.33	0.39	0.44	0.50	0.55	0.61	0.67
70	0.73	0.78	0.84	0.90	0.96	1.05	1.10	1.15	1.20	1.30
60	1.35	1.40	1.50	1.55	1.65	1.70	1.75	1.85	1.90	2.00
50	2.05	2.15	2.25	2.30	2.40	2.50	2.55	2.65	2.75	2.85
40	2.95	3.05	3.10	3.20	3.30	3.45	3.55	3.65	3.75	3.85
30	4.0	4.1	4.2	4.4	4.5	4.6	4.8	4.9	5.0	--

Palintest
Soil Test Instructions

MANGANESE

Photometer Method
640 nm

0 - 25 mg/l Fe

Copper is an important trace element which promotes germination and functions in the metabolism of plant growth.

In the Palintest Manganese test teh soil is extracted using 1M ammonia chloride under reducing conditions at a soil:water ratio or 1:25. The extracted and exchanged manganese is then oxidized to permanganate, and reacted with leuco-malachite green indicator to form a blue-green complex. The intensity of the blue-green colour produced is proportional to the manganese level in the soil sample and is determined by using a Palintest Photometer.

Reagents and Equipment

Palintest Manganese No 1S Tablets
Palintest Manganese No 2S Tablets
Palintest Photometer
Round Test Tubes, 10 ml glass (PT 515)
Syringe, 1 ml plastic (PT 361)

Soil Extraction

This test is carried out on **Extract N** (see Soil.3).

Test Procedure

1. Using the syringe, take exactly 1 ml Extract N. Discharge syringe into test tube, then fill up to 10 ml mark of deionized water.
2. Add two Manganese No 1S tablets, crush and mix to dissolve.
3. Add two Manganese No 2S tablets, crush and mix to dissolve. Cap tube immediately.
4. Stand for 20 minutes to allow full colour development.
5. Select wavelength 640 nm on the Photometer.
6. Take Photometer reading (%T) in usual manner (see Photometer instructions).
7. Consult Manganese (Soil) calibration chart to find the manganese concentration in the soil.

MANGANESE mg/l Mn **640 nm** **SOIL** **1:25 EXTRACTION/1 ml Extract**										
%T	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
70	0.00	0.00	0.25	0.50	0.50	0.75	1.00	1.00	1.25	1.25
60	1.50	1.75	2.00	2.00	2.25	2.50	2.75	2.75	3.00	3.00
50	3.25	3.50	3.50	3.75	4.00	4.25	4.50	4.75	5.00	5.00
40	5.25	5.60	5.75	6.00	6.25	6.50	6.75	7.00	7.25	7.50
30	7.75	8.00	8.50	8.75	9.25	9.75	10.0	10.5	11.0	11.5
20	12	13	14	15	16	17	19	22	25	--

Palintest
Soil Test Instructions

SULPHATE

Photometer Method
520 nm

0 - 300 mg/l S

Sulphate sulphur is essential for normal plant growth. Crops grown in soils with very low sulphur content can exhibit sulphur deficiency.

In the Palintest Sulphate test, the soil is extracted with water at a soil:water ratio of 1:5. The extracted sulphate is then reacted with the barium chloride to form an insoluble barium salt which produces turbidity in the test sample. The degree of turbidity is proportional to the sulphate level in the soil sample and is determined using a Palintest Photometer.

Reagents and Equipment

Palintest Sulphate S Tablets (Sulphate Turb)
Palintest Photometer
Round Test Tubes, 10 ml glass (PT 515)

Soil Extraction

This test is carried out on **Extract W** (see Soil.3).

Test Procedure

1. Fill a round test tube to the 10 ml mark with Extract W.
2. Add one Sulphate S tablet, crush and mix to dissolve. A cloudy solution indicates the presence of sulphate.
3. Select wavelength 520 nm on the Photometer.
4. Take Photometer reading (%T) in usual manner (see Photometer instructions).
5. Consult Sulphate (Soil) calibration chart to find the sulphate concentration in the soil.

SULPHATE **SOIL**			mg/l S						**520 nm** **1:5 EXTRACTION**	
%T	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
90	5	8	11	13	15	17	20	22	23	25
80	27	28	30	32	33	35	37	40	42	43
70	45	47	48	50	52	53	55	57	58	60
60	62	63	65	67	70	72	75	77	80	82
50	84	86	88	90	93	95	98	100	103	107
40	108	112	113	117	120	123	125	128	132	135
30	138	142	145	150	155	158	162	167	172	178
20	183	188	193	200	207	213	222	230	238	247
10	258	270	284	300	--	--	--	--	--	--

Note

Photometer readings on the turbidity-based tests should be carried out under shaded conditions to avoid light being reflected into the instrument. Always shade the top of the Photometer when taking readings under strong light or sunlight.

SAMPLE DILUTION

INSTRUCTIONS FOR USE OF THE PALINTEST DILUTION TUBE AND DILUTION SYRINGES

Palintest tests are usually carried out directly on the sample collected. In some situations however it is desirable to dilute the sample in order to bring it within the correct test range. Indeed dilution of samples is a very useful technique in that it enables the range of the test to be greatly extended.

Whilst dilution is a simple operation, it often causes confusion to test kit users. The Palintest Dilution Tube (PT 512) has been developed to provide simple means of sample dilution for water and aqueous extracts. The dilution tube can be used to dilute the sample by a factor of 2, 3, 4, 5, or 10 times.

Palintest Dilution Syringes are used in those situations where a greater degree of dilution is required. Dilution syringes are available in two sizes and are used in conjunction with the dilution tube. Dilution syringe 10/100 (PT 375) can be used to dilute the sample by a factor of 10, 20, 25, 50 or 100 times. Dilution syringe 100/1000 (PT 376) can be used to dilute the sample by a factor of 100, 200, 250, 500 or 1000 times.

Using the Dilution Tube

1. Decide on the degree of sample dilution required. For example, if the solution is about 5 times too strong for the test range being used, then the sample should be diluted by a factor of five.

2. Fill the tube with the sample to one of the sample marks as appropriate. For example, if a 5 times dilution is required, fill to the x5 mark.

3. Fill the tube with demonized water to the line marked ‘Demonized Water’.

4. Cap the tube and mix the solution.

5. Use the diluted sample in the test being carried out in the normal manner.

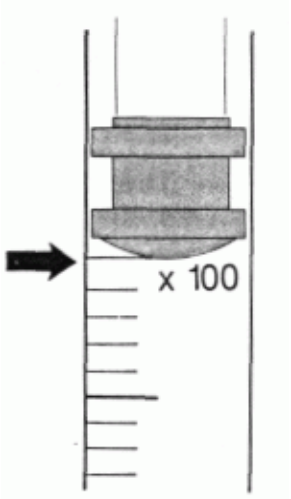
6. Multiply the test result obtained by the dilution factor used. For example, if the tube was originally filled to the x5 mark, then the kit result should be multiplied by 5 to give the concentration in the original sample.

Using the Dilution Syringe

1. Decide on the degree of sample dilution required. For example, if the solution is about 100 times too strong for the test range being used, then the sample should be diluted by a factor of 100.

2. Dip the tip of the syringe into the sample and draw up the sample into the syringe. Adjust the level of the sample in the syringe until it corresponds to the appropriate mark (see figure).

3. Discharge the solution from the syringe into a clean dilution tube. Fill the tube with demonized water to the line marked ‘Demonized Water’.



4. Cap the tube and mix the solution.

5. Use the diluted sample in the test being carried out in the normal manner.

6. Multiply the test result obtained by the dilution factor used. For example, if the syringe was originally filled to the x100 mark, then the test kit result should be multiplied by 100 to give the concentration in the original sample.

Demonized Water

Demonized water is required for sample dilution and for the general rinsing of test tubes, etc. The Palintest De-Ion pack has been specially developed to provide demonized water with test kits both in the field and in the laboratory.

The Palintest De-Ion pack produces approximately 5 litres of demonized water in 2-5 minutes from mains water or from clean natural water sources. Instructions for using the De-Ion pack are given on the product label and carton.

Notes

1. In certain Palintest methods the dilution stage is written into the test procedure. It is not necessary to multiply by the dilution factor if the test kit or calibration chart is already calibrated for a similarly diluted sample.

2. When using the Palintest Interface Photometer 7000, it is possible to key in the dilution factor at the start of the test. In this way the instrument can be used to get a direct reading of the test result for the original sample.

3. Dilution tubes and syringes should be rinsed thoroughly after use with demonized water. For accurate results it is most important to ensure that diluted solutions are not contaminated with undiluted samples.

PHOTOMETER 5000

Instructions for using the
Palintest Photometer 5000 Instrument

The Palintest Photometer 5000 is a precision colorimeter with wide application in colour matching and analytical chemistry. Most importantly the photometer is integrated with the Palintest system of analysis. It offers therefore, an instrumental method of analysis for an extensive range of water and soil tests.

The Palintest Photometer 5000 features solid-state digital electronics and built-in filters. It is lightweight and portable for field or laboratory use. The instrument is direct reading, has automatic blank setting, automatic power cut-off and operates on a single press of the ON button.

OPERATING PRINCIPLE

The Palintest Photometer 7000 is an instrument for measuring colour intensity. Light from an incandescent lamp is passed through a test tube containing the sample solution, and then through a coloured filter into a photocell. Five built-in filters offer a choice of wavelengths covering the visible spectrum. Light detected by the photocell is displayed as a digital response. The display shows the percentage transmittance (%T) - the proportion of incident light which reaches the photocell.

When the test solution is completely colourless all of the light passes through the sample and reading of 100% transmittance is obtained. With coloured solutions light of certain wavelengths is absorbed and the light passing thtough the sample is proportionately reduced. A lower transmittance is therefore recorded. In this way the instrument gives an accurate measure of teh colour intensity of the solution.

In Palintest colour match tests the Photometer 5000 is used to measure the colour produced when reagent tablets are added to the sample solution. In these tests the colour intensity is proportional to the concentration of the parameter under test. In order to obtain the test result, the transmittance reading is compared against a calibration chart provided for each test.

Calibrations are normally given at the wavelength at which maximum light absorbance occurs so as to provide the most sensitive test result. In certain cases calibrations at two different wavelengths may be given so that different concentration ranges can be covered for the same test. The Photometer 5000 can accurately assess very low intensities of colour and will give an accurate test result even at very low concentrations of the test parameter.

Specification (Mk.2)

Wavelength Range:	390 - 660 nm
Operational Wavelengths:	5 built-in filters 410, 490, 520, 570, 640 nm
Filter Band Pass:	+/- 20 nm
Display:	10 mm LCD
Range:	0 - 100% Transmittance
Resolution:	1 % Transmittance
Power:	8 x 1.5v 'AA' batteries (included) Automatic power cut-off after 6 - 8 seconds
Size:	Instrument only 170 x 130 x 53 nm
Weight:	Instrument only 550 g
Test Tubes (PT 515):	10 ml glass test tubes, 20 mm OD, 18 mm path length

Blank and Sample Tubes

A Blank Tube is used in the Photometer each time a test reading is taken. This enables the instrument to be set automatically to 100%T and compensates for any inherent colour in the test sample. It is important therefore to understand the meaning of the term 'Blank Tube'.

The blank tube is a test tube filled with untreated sample (water, soil extract, etc.). It is important to use the actual sample as a blank whenever any inherent colour or particulate matter is present. When the instrument is being used only with samples which are completely clear and colourless, then deionized water may be used as a blank if preferred.

The Photometer is provided with a tube holder, adjacent to the test chamber, to keep the blank tube conveniently at hand whilst using the instrument.

The term 'Sample Tube' is used to describe the tube containing the test sample to which the reagent tablets have been added. This tube is used to take the Photometer reading.

Operating Instructions:

1. Select required wavelength by moving the slide control left or right. The required wavelength is stated in the instructions for each test and on calibration charts.

2. Place BLANK tube in the test chamber.

3. Press the ON button. Keep depressed until display reads 100 (100%T).

4. Release button. Remove Blank tube and place in tube holder.

5. Place SAMPLE tube in the test chamber. Note displayed reading when steady. Instrument turns off automatically after 6-8 seconds.

6. Compare displayed reading (%T) against appropriate calibration chart to obtain test result.

Note that the instrument must always be set using a Blank prior to each test reading. If further test readings are to be taken, repeat steps 2-6. This procedure ensures that the photometer is always correctly set for each wavelength.

To obtain the most accurate and consistent results make sure test tubes are kept clean, and always place plastic cap on tube before taking the photometer reading. Palintest tablet reagents are designed to give a completely clear test solution. In practice always allow the test solution to stand for a few seconds for any undissolved particles to settle before taking the test reading.

Use of Calibration Charts

The Palintest Photometer 5000 is a universal instrument with application for many different analytical tests. This versatility is achieved by the use of calibration charts for each different test. The use of the easy-to-read calibration charts enables the user to use the Photometer for all test requirements without further modification, and to set-up user originated calibrations if required.

Full calibration charts for Palintest methods are given in the appropriate test instructions. In addition, durable plastic calibration charts are supplied for certain tests, these are designed to be placed on the front of the instrument for easy reference.

IRON LR				Iron mg/l Fe						**520 nm**
%T	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
90	--	--	--	--	--	--		--	--	0
80	0.01	0.02	0.03	0.04	0.05	0.06		0.08	0.09	0.10
70	0.11	0.12	0.13	0.14	0.15	0.16		0.18	0.20	0.21
60	0.22	0.23	0.24	0.26	0.27	0.28		0.31	0.32	0.33
50	0.35	0.36	0.38	0.39	0.41	0.42		0.45	0.47	0.48
40							0.61	0.63	0.65	0.67
30	0.69	0.71	0.73	0.75	0.78	0.80	0.83	0.85	0.88	0.91
20	0.93	0.96	0.99	1.02	--	--	--	--	--	--

Other Applications

The Palintest Photometer 5000 is ideally suited for general analytical applications. The instrument can be used with user-generated calibration graphs for standard or new colorimetric methods; or for matching or comparison of coloured solutions for research, development or quality control purposes. The instrument should be used in accordance with the general operating procedures given earlier.

Care and Maintenance

The Palintest Photometer 5000 is designed to give long and trouble-free operation. The instrument is suitable for both laboratory and field use. Care should be taken however to avoid test solutions being spilt over the instrument, and to prevent excessive amounts of moisture entering the instrument under outdoor conditions. Spillage or moisture should be wiped off immediately with a dry cloth. On no account should solvents or abrasive materials be used to clean the instrument.

The only routine maintenance required is battery replacement. Replace the battery when the 

symbol appears on the display. Access to the battery is in the base of the instrument and is secured by four screws. Use 8 x 1.5v Alkaline batteries, MN 1500, LR6, E91, AM3 or equivalent. To avoid corrosion damage through battery leakage, remove batteries from instrument if it is to be stored or left unused for a period of time.

The photometer is fitted with a long-life bulb and contains no user-serviceable components. If the instrument requires servicing or repair this can be arranged through our Technical Services department.

To ensure accurate test results, it is important that the test tubes are kept in a clean condition. Test tubes should be washed and dried carefully after use. Dirty tubes may be soaked in weak detergent solution if necessary. Tubes which become stained or scratched in use should be replaced.

Guarantee

Palintest Photometers are guaranteed for a period of one year from the date of purchase, excluding accidental damage caused by unauthorized repair or misuse. Should repair be necessary, contact our Technical Services department quoting the serial number shown on the back of the instrument. This guarantee does not effect statutory rights.

<Note - Photometer MK.1. uses 1 x 9v battery).

MICROCOMPUTER pH METER

Inst.2

Operating Instructions for the Palintest Microprocessor based pH Meter with automatic temperature Compensation, Temperature Measurement and Millivolt Measurement

The Palintest pH Meter is a portable, micro-processor-based instrument complete with pH electrode and an automatic temperature compensation (ATC) probe. The pH, °C and mV ranges and other controls are easily accessed by a membrane keyboard, and until automatically compensates for temperature variations. Pushbutton calibration is stored in memory, even after the unit has been shut off.
Each meter includes a silver-chloride type pH electrode with BNC connector and sealed epoxy body. An ATC probe with miniature phone jack, stainless steel sheath (5mm OD x 109mm L) and plastic handle is also included. Both electrode and ATC probe have a one-meter cable. The Meter is supplied in a soft black vinyl carrying case and a battery is also included.
For a fast response, the tip of the electrode should always be kept moist. A rubber cap is supplied to cover the tip end of the electrode. Before use, remove the cap. If the cap has been left off and the tip dry, dip it in KCI solution for 30 minutes or tap water for two hours.
When the electrode is not in use, replace this cap filled with KCI solution. If this solution is not available, use tap water. Do not use distilled water, under any circumstances.

Specification

Ranges:	0.00 to 14.00 pH 0.0 to ± 399.9 mV (ISE) 0. To ± 1999 mV (ORP) 0.0 to +100°C
Resolution:	0.01 pH - 0.1 mV - 0.1°C
Accuracy:	0.01 pH - 0.2 mV - 0.4°C
Input resistance:	10^{12} ohm
Readout:	½ inch LCD
Calibration Span-offset:	±1 pH
Slope Range:	85 to 105%
Temperature compensation	automatic from 0 to +100°C
Type of electrodes:	HI 1211 screw-type epoxy-body combined pH electrode (included); length 155 m, diameter 12 mm. HI 7666 epoxy-body and stainless steel temperature probe (included); length 160 mm, diameter 5 mm, with one meter cable
Power:	one 9 V battery (included); life 50 hours continuous use
Size:	instrument only 180L x 83W x 46H mm
Weight:	instrument and probe only 300 g; complete with electrode, temperature probe and soft carrying case (included) 550 g

Front Panel Controls

The function keys on the front panel of the instrument are as follows:

ON - OFF:	Switches the unit on and off.
RANGE:	Selects pH, °C or mV ranges
TEMPERATURE:	Use these keys only when ATC probe is disconnected
CALIBRATION:	The key CAL is used to start the pH calibration procedure and the CON to confirm the calibration data

pH Calibration

A new instrument must be calibrated before use in pH measurements. Recalibration will be necessary after the battery is replaced, or if the pH electrodes or the ATC probe are replaced.

The instrument can be calibrates with a pH of 7.00 and either pH 4.01 or pH 10.00 standard technical buffers. If you are measuring between 0 and 7 pH (acid to neutral) use pH 7.00 and pH 4.01 buffers. If your measurements will be between 7 and 14 pH (neutral to base), use pH 7.00 and pH 10.00 buffers.
When using the ATC probe, the meter automatically compensates for changes in buffer temperature. (Ideally, buffer solutions should be kept at 25°C for calibration.) When not using the ATC probe, make sure that the temperature is set manually to reflect the temperature of the solution.

To calibrate for pH:

1. Place the electrode in a pH 7.00 buffer solution. Wait approximately 30 seconds for the sensor to stabilize, and then press CAL.
2. If the electrode recognizes the pH 7.00 solution, the exact value will appear on the display in accordance with the pH and temperature chart below (i.e., pH 7.01 at 25°C). If not, the symbol "E4" will be displayed - see "Error Code Guide".
3. Wait 30 seconds and then push CON again to accept the buffer value.

- *The first calibration is now finished. "E5" will appear on the display at this point, indicating the instrument has entered the slope calibration mode. If slope calibration is to be performed, follow the instructions below. Otherwise, switch the instrument on.*

4. Take the electrode out of the pH 7.00 solution, rinse it with distilled water and dip it into the pH 4.01 or 10.00 solution. "E5" will disappear when the electrode is placed in the second buffer, and the value of the chosen buffer will then appear on the display. Wait 30 seconds and press CON. The instrument is now calibrated, and will remain even after the unit is shut off.

Temperature		**Buffer Values (pH)**		
°C	**(°F)**	**4.01**	**7.00**	**10.00**
0	32	4.01	7.12	10.33
5	41	4.01	7.09	10.25
10	50	4.00	7.06	10.18
15	59	4.00	7.04	10.11

20 25 30 35	68 77 86 95	4.00 4.01 4.01 4.02	7.02 7.00 6.99 6.98	10.05 10.00 9.95 9.92
40 45 50 55	104 113 122 131	4.03 4.04 4.06 4.07	6.98 6.97 6.97 6.98	9.88 9.85 9.82 9.80
60 70 80 90	140 158 176 194	4.09 4.12 4.16 4.20	6.98 6.99 7.00 7.02	9.77 9.73 9.69 9.66

This chart is for reference only when calibrating the instrument. Temperature compensation is automatic when the meter is in normal use with the ATC probe.

Using the Instrument

1. Connect the pH electrode and the ATC probe (if ATC probe is to be used).

2. Push the ON/OFF switch to turn the unit on.

3. Then push RANGE until the display indicates the desired mode.

- **For pH measurement:** When the instrument is switched on, it is already in the pH mode. Dip the pH electrode and the temperature sensor in the solution. The pH value displayed will stabilize after a few seconds.

- **For temperature measurement:** Press the key RANGE until the symbol "°C" appears on the display. Dip the temperature sensor in the solution and wait until the reading stabilizes (about 30 seconds).

- **For mV measurement:** Press the key RANGE until the symbol "mV" appears on the display. For values within ± 400 mV, tenths of mV are also displayed; for values outside 400 mV, only the mV is displayed. Note that the change in scale is automatic. (See ORP and ISE measurement below).

4. When measurements have been taken press the ON/OFF switch again to turn the unit off. *When using the instrument, press the keys firmly and hold for half second. Otherwise the microprocessor will reduce the meter's response time to conserve the battery.*

Temperature Compensation

When the temperature probe is plugged in, temperature compensation is automatic within the range 0 to 100°C.

Without the ATC probe, temperature compensation can be set manually using the arrow keys to increase and decrease the value. ("Up" arrow increases the temperature; "down" arrow decreased temperature.)

When the temperature probe is not plugged in, the display will show a blinking °C symbol while the meter is in °C mode.

ORP and ISE Measurement

In order to use the meter for the measurement of oxidation-reduction potential, it must be connected to an ORP electrode (available as an optional extra) and switched to the mV range. Similarly the meter may be connected to an ISE electrode for specific ion determination in accordance with the electrode instructions.

Error-Code Guide

Five error codes are programmed into the pH meter to indicate error messages. These are as follows:

Display reads...	Problem is...	Possible solutions
"E 1"	Out of range on pH scale	a. Make sure that the sample falls within the pH range. b. Check meter for proper calibration c. Check pH electrode. If empty, refill it; if defective, replace it.
"E 2"	Out of range in °C	a. Make sure temperature is within the unit's range.
"E 3"	Out of range in mV	a. Make sure signal is within the ±1999 range.
"E 4"	Offset calibration with wrong buffer	a. Make sure you are using the pH 7.00 buffer. b. Use fresh buffer solution.
"E 5"	Slope calibration with wrong buffer	a. Make sure you are using a pH 4.01 or 10.00 buffer. b. Use fresh buffer solution.

Battery Replacement

The instrument uses a 9-volt battery with a life of approximately 50 hours. From the moment that the far left hand side decimal point is lit, the battery has 3 more hours of life.

To change the battery, unscrew the back cover of the unit. Replace the old battery and close the case.

The meter will need to be recalibrated after changing the battery.

Temperature Sensor Calibration

The pH has been calibrated with the ATC probe supplied and is ready for measurements. If, for any reason this temperature sensor is replaced, follow this procedure for recalibration:

1. Remove the back cover and locate the two temperature trimpots (adjustments).
2. Dip the ATC probe for at least 3 minutes into an ice bath (about 0°C, ± 1°C), and then adjust the LOW TEMP trimpot until the display reads the same temperature measured by a second

thermometer.

3. Dip the ATC probe for a few minutes into water at 50°C and adjust the HIGH TEMP trimpot until the display reads the same temperature measured by a second thermometer. *When calibrating the ATC probe, the pH electrode should not be connected to the unit or immersed with the ATC probe.*

Cleaning the Electrodes

The sensitive part of the electrode should always be kept clean. Rinse the electrode with deionized water after use. Before storage, rinse with tap or deionized water, shake dry and replace the protective cap filled with KCI solution. Make sure the cap contains enough KCI solution to cover the end.

When measurements are taken in fatty or oily substances (i.e., proteins), or to avoid a change in offset calibration, periodically clean the electrode with alcohol and a cotton wad. If the reference junction becomes clogged with these types of products, it may be cleaned by soaking in methanol (approximately one hour). *Rinse the electrode thoroughly with deionized water after each cleaning.*

Trouble-Shooting Guide

Symptom is...	**Problem is...**	**Possible solutions**
Unit does not function with ATC probe	Defective ATC probe	Replace probe and recalibrate pH electrode and ATC probe.
Unit will not calibrate or gives erroneous readings	Defective pH electrode	Replace electrode and recalibrate pH electrode and ATC probe.
Unit gives slow response or erroneous readings	Dry electrode or clogged junction	Attempt cleaning procedures. If unsuccessful, replace pH electrode and recalibrate electrode and ATC probe.
Unit will not accept second buffer	Defective pH electrode	Attempt cleaning procedures. If unsuccessful, replace pH electrode and recalibrate electrode and ATC probe.
Readings drift on LCD display	Defective pH electrode (minute crack in grass)	Replace pH electrode; recalibrate pH electrode and ATC probe.
Left decimal indication on LCD display	Low battery	Replace battery and recalibrate pH electrode and ATC probe.

Guarantee

Palintest instruments are guaranteed for a period of 12 months from date of purchase excluding damage caused by misuse or unauthorized repair. Please contact out Technical Services Dept. quoting the instrument serial number before returning meters for repair.

Product Codes

PT 110	Palintest Microcomputer pH Meter (complete with electrodes in soft carrying case)
PT 110/1	pH Electrode Type HI 1211 (replacement electrode for PT 110)
PT 110/2	Temperature Probe Type HI 7666 (replacement probe for PT 110)
PT 110/3	ORP Electrode Type HI 3111 (oxidation-reduction electrode for PT 110)
PT 105/4	Palintest Potassium Chloride (KCI) Pack (for filling and storing electrodes)
PT 105/6	Palintest Buffer Pack, Combined Pack pH 4, 7 and 10
PT 105/7	Palintest Buffer Pack, pH 4
PT 105/8	Palintest Buffer Pack, pH 7
PT 105/9	Palintest Buffer Pack, pH 10

CONDUCTIVITY METER

Inst.3

Operating Instructions for the Palintest Conductivity Meter and Micro 900 Waterproof Conductivity Meter

The Palintest Conductivity Meter (PT 115) and Micro 900 Waterproof Conductivity Meter (PT 117) are portable battery operated meters with automatic temperature compensation. The instruments use a conductivity probe comprising 4 steel rings mounted on a PVC body. The measurement area of the probe is protected by a PVC sleeve. The function of the sleeve is to screen the liquid flow and is essential for correct operation of the meters. It is not possible to take measurements without protective sleeve.

When not in use the electrode should be kept dry in air. The electrode should not be exposed to high temperatures due to its plastic construction.

Specification

Ranges:	0-199.9 μS (Distilled and Deionized Water, Condensates, etc.) 0-1999 μS (Natural and Drinking Waters, etc.) 0-19.99 mS (Waste Waters, Industrial Waters, etc.) 0-199.9 mS (Sea Water and Brine)
Resolution:	0.1 μS
Accuracy:	± 1%
Readout:	½ inch LCD
Power:	1000 Hz
Temperature compensation:	Automatic, 0 to 50°C (PT 115)/0 to 40°C (PT 117)
Probe:	PVC body with stainless steel electrodes, cable 1.5 m
Battery:	One 9 volt battery (included); life 80 hours continuous use
Size:	Instruments only 180 x 83 x 40 mm (PT 115)/196 x 80 x 57 mm (PT 117)
Weight:	Instrument and probe only 400 g (PT 115)/425 g (PT 117)

Front Panel Controls

The function keys on the front of the panel of the instrument are as follows:

ON-OFF	Switches the unit on and off
RANGE KEYS	The four keys select the appropriate conductivity test range
TEMPERATURE COFFICIENT	Sets the automatic temperature compensation for different temperature coefficients (PT 115 only - see Temperature Coefficient Control)

Temperature Compensation

Temperature influences the measurements of conductivity. To provide a common method of comparing different conductivity readings it is normal practice to express conductivity values at 25°C. The Palintest Conductivity Meters are provided with automatic temperature compensation and will automatically display the conductivity value at 25°C when used with solutions within the specification temperature range.

Temperature Coefficient Control

The effect of temperature on conductivity readings is not the same for all solutions. The Palintest Conductivity Meter (PT 115) is provided with a control so that the Temperature Coefficient of different solutions can be set. For water and commonly used aqueous solutions of salts the temperature coefficient is 2%. For most purposes therefore it will be satisfactory to leave the Temperature Coefficient Control set at 2%. The control may be set at other values if these are required when working with special solutions.

The Micro 900 Conductivity Meter (PT 117) is for use with water and aqueous solutions only. The temperature coefficient is fixed at 2% on this instrument.

Using the Instruments

Use the instruments for normal conductivity readings as follows:

1. Press the ON key. (PT 115 only - Set the Temperature Coefficient Control to 2% or to the desired value).
2. Dip the probe into the solution to be measured ensuring that the side holes in the probe are covered. Stir gently to allow any trapped air in the probe to escape.
3. Push the 199.9 μS key. Note the reading displayed on the instrument.
4. If the reading is higher than the selected range, the number 1 will appear on the left of the display. In this event, press the next higher range key until a proper reading is displayed on the instrument.
5. Allow the instrument to come to a steady reading. This will only take a few seconds if teh temperature of the solution and the probe are similar. However if the temperature difference is large, up to 2 minutes should be allowed.
6. The reading displayed is the conductivity of the solution at 25°C expressed as microsiemens (μS) or millisiemens (mS) depending on the instrument range selected.

Calibration

The Palintest Conductivity Meters are calibrated during manufacture. However it is desirable to check the calibration periodically. This can be done by immersing the probe in a solution of known conductivity such as the Palintest Standard Conductivity Solution. This solution has a conductivity of 12.88 at 25°C.

1. Press the ON key. (PT 115 only - Set the Temperature Coefficient Control to read 2%).
2. Dip the probe in Palintest Standard Conductivity Solution ensuring that the side holes in the probe are covered. Stir gently to permit any trapped air in the probe to escape.
3. Press the 199.9 mS range key. The display should read 12.88 mS.
4. If the display does not agree with this reading adjust the calibration trimmer using a small screwdriver backwards or forwards until the meter reads 12.88 mS. On Conductivity Meter (PT 155) the trimmer is located in a small hole on the left-hand side of the instrument. On Micro 900 Waterproof Meter (PT 117) the trimmer is located under the plastic cover next to the probe

connector.

Probe Cleaning and Maintenance

Periodically, at least once a month, it is useful to remove the protective sleeve from the probe and carefully clean the probe body and steel rings. This should be carried out using a cotton wool pad dipped in alcohol or methylated spirits. If the electrode is constantly used in highly alkaline, scale forming or salty solutions then the probe should be cleaned more frequently, for example on a daily basis. When replacing the protective sleeve the side holes must be positioned towards the top probe.

The probe body is made of PVC with steel rings and has a limited resistance to temperature. Exposure to high temperatures can open the connection between the rings and probe body allowing solution to ingress and give a false reading. The probe can be easily checked as follows:

Remove the protective sleeve from the probe, switch the meter to the 199.9 μS range and hold the dry electrode in the air. The meter display should read 0.0 or, at most, 0.1 or 0.2. A higher reading, for example 10.0, indicates that the electrode has been damaged. In this event the meter should be returned for a new probe to be fitted.

Battery Replacement

The instruments use a 9 volt battery with a life of approximately 80 hours continuous use. When the battery is almost discharged a warning symbol appears on the display. The instrument can still be used to perform further measurements but the battery should be replaced as soon as possible.

To replace the battery remove the cover plate on the back of the instrument, fit a new battery then refit the cover.

Guarantee

Palintest instruments are guaranteed for a period of twelve months from the date of purchase. The probe is guaranteed for a period of six months. This guarantee excludes damage caused by misuse or unauthorized repair. Please contact our Technical Services Department quoting the instrument serial number before returning meter for repair.

Product Codes

PT 115	Palintest Conductivity Meter
PT 115/1	Replacement Probe for PT 115 (factory fitting only)
PT 117	Palintest Micro 900 Waterproof Conductivity Meter
PT 117/1	Replacement Probe for PT 117 (plug-in)
PT 115/4	Palintest Standard Conductivity Solution

BUFFER TABLETS

Inst.7

Instructions for using Palintest Buffer Tablets

Palintest rapid dissolving Buffer Tablets are the quick modern way to buffer pH measuring instruments. The tablets provide colour-coded one-shot buffer solutions for use in standardizing pH meters and recorders. Palintest Buffer Tablets are particularly suitable for use with Palintest pH Meters and Sensors.

Traditional practice has been to prepare a large volume of buffer solution and to store this for subsequent use. This practice runs the risk of contamination between use and of different pH buffers being confused with each other. In either event the result can be an incorrectly calibrated instrument.

Palintest Buffer Tablets eliminate these problems by providing a quick, simple means of preparing one-shot buffer solutions. Each tablet makes 20 ml of buffer solution sufficient for all standard pH electrodes. pH 4, pH 7 and pH 10 Buffer Tablets are available and the solutions produced are colour coded to avoid any mix up. After use the solutions are simply discarded to eliminate storage problems and risk of contamination.

Buffer Packs

Palintest Buffer Packs comprise 50 Buffer Tablets and a 20 ml plastic tube. Packs are available for each of the three buffer values. Combined packs for pH 4/7 pH 7/10 and pH 4/7/10 are also available.

Buffer pack labels and the buffer solutions produced are colour coded for easy identification. The colour coding is as follows:

pH 4 Red solution
pH 7 Yellow solution
pH 10 Green solution

The solution colours act as pH indicators. Any severe user contamination of the solution can be detected by a change in the solution colour.

Instructions for Use

1. Fill the plastic tube to the 20 ml mark with deionized water.
2. Add one Buffer Tablet of the required value and shake the tube until the tablet disintegrates.
3. Stand the tube for approximately two minutes to ensure the buffer is completely dissolved and to allow any insoluble particles to settle.
4. Check that the solution colour corresponds to the buffer value required.
5. Insert pH electrode into the tube and calibrate the meter in accordance with the instructions supplied with the instrument.
6. Remove electrode and rinse thoroughly in deionized water. It is important to rinse the electrode before immersing in buffer solution of a different value.
7. Discard solution, then rinse and dry tube.

Note - The buffer solution may be transferred to a separate container when dealing with unusual shaped pH electrodes. When calibrating Palintest pH Sensors a portion of the solution may be conveniently poured into the sensor cap for calibration.

Buffer Values

The pH value of buffer solutions varies with the temperature of solution. The precise buffer values given by Palintest Buffer Tablets at different solution temperatures are shown in the following table:

Temperature/pH Chart

Temperature		Buffer Values (pH)		
°C	**(°F)**	**4.01**	**7.00**	**10.00**
0	32	4.01	7.12	10.33
5	41	4.01	7.09	10.25
10	50	4.00	7.06	10.18
15	59	4.00	7.04	10.11
20	68	4.00	7.02	10.05
25	77	4.01	7.00	10.00
30	86	4.01	6.99	9.95
35	95	4.02	6.98	9.92
40	104	4.03	6.98	9.88
45	113	4.04	6.97	9.85
50	122	4.06	6.97	9.82
55	131	4.07	6.98	9.80
60	140	4.09	6.98	9.77
70	158	4.12	6.99	9.73
80	176	4.16	7.00	9.69
90	194	4.20	7.02	9.66
Solution Colour		**Red**	**Yellow**	**Green**

For precise calibration the temperature of the solution should be measured and the meter standardized against the appropriate value. Note that when calibrating the Palintest Microcomputer pH Meter the standardization procedure automatically takes into account the temperature of the solution.

Deionized Water

Buffer solutions should always be made up in deionized water. Deionized water can be readily provided using the Palintest De-lon Pack (PT 500) - a unique product which produces deionized water from mains water or from clean natural water sources.

The Palintest De-lon Pack comprises a plastic envelope containing a deionizing resin which is simply shaken with water to remove hardness and other natural salts. Each pack will produce approximately five litres of deionized water.

ELECTRODES

Inst.8

Instructions for using Palintest pH Electrodes and ORP Electrodes

Palintest Electrodes are supplied with Palintest pH meters and as replacement items. Palintest Electrodes are suitable for use with other types of general purpose pH meter.

Modern combination pH electrodes are of precision construction and comprise a glass electrode and reference electrode in a single unit. The porous 'liquid junction' provides continuity between the electrode and the test solution.

The operation of the pH meter is entirely dependent on the status of the pH electrode. For this reason it is important that the electrode is properly looked after and carefully maintained. Attention to electrode maintenance will ensure correct pH readings and long electrode life. If the electrode is neglected increasingly inaccurate readings may be obtained and a new electrode will soon be required.

pH electrodes, by their very nature, have a limited life span. It is difficult to predict how often a pH electrode will need to be replaced as this will depend on the nature and frequency of its use and on how well it is maintained. Under normal conditions when testing water or simple aqueous solutions a typical electrode life of 6-12 months can be expected. Where the electrode is being used with agressive solutions such as acids and alkalis, solutions containing particulate matter or with solutions containing non-aqueous solvents, then a shorter electrode life can be expected.

ORP (oxidation-reducing potential) electrodes comprise a platinum electrode in combination with a reference cell. Whilst the operation of ORP electrodes is somewhat different from pH electrodes they require similar care and maintenance. These instructions can therefore be applied generally for the maintenance of ORP electrodes.

Both pH and ORP electrodes come with a protective plastic sleeve covering the refill hole in the electrode body. For rapid response time the sleeve should be pulled down to expose the hole whilst the electrode is being used to take readings.

Electrode Types

Various different types of electrode are supplied with Palintest meters depending on the model and serial number. Electrodes may be of glass-bodied or epoxy-bodied construction. In some cases a combined pH electrode/temperature probe is supplied. Electrode connectors can be of the screw-in type, or with a lead terminating in a BNC (quarter-turn) connector.

When ordering replacement electrodes it is important to specify the model of pH meter, the type of electrode required and the type of connection fitted.

Electrode Installation

1. Remove the protective cap from the tip of the electrode and retain for future use.
2. Remove any salt deposits which my have formed on the surface of the electrode by thoroughly rinsing with deionized water.

3. Check that the electrode is filled with electrolyte solution. The level must be within 25 mm (1 inch) of the fill hole. If the electrolyte is below this level, lower the rubber sleeve on the electrode and top-up with Palintest Electrode Filling Solution (PT 105/4/1).
4. Examine the junction area of the electrode for trapped air bubbles. If any are present, shake the electrode gently downwards.
5. Soak the electrode for one hour by dipping into Palintest Electrode Storage Solution (PT 105/4/2). if this is not available the electrode may be soaked in water to which a little potassium chloride has been added. Do not soak the electrode in deionized water.
6. Connect the electrode to the pH meter.

Electrode Calibration (Buffering)

All pH electrodes are inherently unstable over time and for this reason it is essential to calibrate the electrode regularly against buffer solutions of known pH value. The calibration procedure is described in the instructions provided with the pH meter. The frequency of calibration against pH buffers will depend on the nature of use and the accuracy required. For most purposes it will be sufficient to calibrate the meter daily. For highly accurate work it may be necessary to calibrate the meter each time it is used.

Palintest Buffer Tablets provide a simple means of making up buffer solutions for electrode calibration. The use of these tablets is described on a separate leaflet (INST. 7).

ORP electrodes provide a stable output and do not ordinarily require recalibration before or during use. Note however that passivation and poisoning of the electrode surface can result in a change of reading.

Electrode Storage

To ensure that the electrode gives a rapid response, the tip of the electrode and the liquid junction must not be allowed to dry out. Care should be exercised therefore when storing the electrode between use.

For short-term storage between measurements or up to one week, keep the electrode dipped in Palintest Electrode Storage Solution. If this solution is not available use water containing a small amount of potassium chloride. Do not leave the electrode standing in deionized water.

For long-term storage of more than one week, make sure that the electrode is correctly filled with electrolyte solution and that the fill hole is covered. Cover the electrode tip with the protective cap containing a few drops of Palintest Electrode Storage Solution. When returning the electrode to use prepare it as for a new electrode.

Electrode Maintenance

Inspect the electrode once a month for scratches and cracks. Rinse off any salt build-up with distilled water.

Drain off the electrolyte from the electrode, rinse out with Palintest Electrode Filling Solution and then re-fill to within 25 mm (1 inch) of the fill hole. Allow the electrode to stand upright for one hour dipping into just enough electrode storage solution to cover the tip of the electrode membrane. Then keep the electrode dipping into Storage Solution for subsequent use.

Cleaning the Electrode

If the electrode becomes dirty it can be cleaned by one of the following procedures:

General cleaning - Soak the electrode in 0.1 M hydrochloric acid for at least one hour.

Inorganic deposits - Soak the electrode in 0.1 M EDTA tetrasodium salt for 15 minutes.

Oil and grease - Rinse the electrode in methylated spirits or alcohol solution. In severe cases the liquid junction may become completely clogged with grease. In such cases gently tease down slightly the nylon strands which make up the liquid junction using a fine pair of tweezers.

Protein - Soak the electrode in a solution of 1% pepsin in 0.1 M hydrochloric acid for 15 minutes.

After performing any of the above cleaning procedures, thoroughly rinse the electrode with deionized water. Then drain the electrolyte solution from the electrode and refill with Palintest Electrode Filling Solution. Stand the electrode in Palintest Electrode Storage Solution for at least one hour before use.

Trouble Shooting Guide

If the pH meter will not give a steady reading, or fails to give a reading of the expected value, check that the meter is being operated in accordance with the instructions supplied then investigate the electrode status.

General (unstable or intermittent readings) - Check that all connections between the electrode, temperature probe and pH meter are clean and tightly fitting. Connections should be cleaned with a small piece of cotton wool moistened with methylated spirits or alcohol.

Noise (readings fluctuate up and down) - Rinse electrode tip with distilled water drain out electrolyte solution and then refill with Palintest Electrode Filling Solution.

Drift (readings constantly move in one direction) - Soak the electrode tip in warm 4 M potassium chloride solution for one hour. Then rinse tip of electrode with deionised water, drain and refill with Palintest Electrode Filling Solution.

Low Slope (electrode will not calibrate/meter cannot be adjusted to buffer solution pH) - Normally caused by hairline cracks in the glass electrode. Replace electrode if this is suspected.

Slow response (long time to steady reading/excessive drift) - Clean electrode thoroughly as described earlier. Drain the electrode, rinse and refill with Palintest Electrode Filling Solution. Allow the electrode to stand for at least one hour in Palintest Electrode Storage Solution. If no improvement in electrode performance is obtained, replace electrode.

Sample application (steady reading in buffer solution but not in sample) - Check that the sample has been correctly prepared and is not subject to pH drift through continuing reaction, temperature effects or interfering substances.

Guarantee

Palintest electrodes are guaranteed for a period of three months from the date of purchase. This period of guarantee applies both for electrodes supplied with the original pH meter and for replacement electrodes. This guarantee excludes damage caused by neglect or misuse. Please contact our Technical Services Department before returning electrodes for replacement under guarantee.

Product Codes

PT 110/1S	Epoxy-bodied pH Electrode - screw connector.
PT 110/1B	Epoxy-bodied pH Electrode - BNC connector.
PT 110/2	Temperature Probe (for Palintest Microcomputer pH Meter).
PT 112/2	Temperature Probe (for Palintest Micro 900 pH Meter).
PT 110/3S	Epoxy-bodied ORP Electrode - screw connector.
PT 100/3B	Epoxy-bodied ORP Electrode- BNC connector.
PT 105/4	Electrode Care Pack
	Contains 30 ml Palintest Electrode Filling Solution and 500 ml Palintest Electrode Storage Solution.
PT 105/6	pH 4/7/10 Combined Buffer pack.
PT 105/7	pH 4 Buffer pack.
PT 105/8	pH 7 Buffer pack.
PT 105/9	pH 10 Buffer pack.
	Palintest Buffer Packs contain 50 Buffer Tablets of the stated value and a 20 ml plastic tube for use in meter calibration.