

RPU-120 PASTEURISATION MONITOR.

Redpost Electronic Products Ltd.

ESSENTIAL READING!

To avoid invalidating the guarantee by incorrect use of this equipment please read at least Section 3 and Section 6 of this manual.

Pages 7-1 and 7-2 also contain suggestions that, if followed, should ensure reliable operation.

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OPERATING AND SERVICING MANUAL.

RPU-120 PASTEURISATION MONITOR.

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NOTES

Due to improvements in design and the availability of new materials it is possible that the equipment may vary in minor details from that described in this manual.

DESCRIPTION AND SPECIFICATIONS.

GENERAL DESCRIPTION.

The RPU-120 P.U. Monitor is a sealed, solid-state recording instrument that employs microprocessor techniques to produce an immediate display of the total P.U.s achieved during a pasteurising run. The unit is self-contained and does not require a playback unit to retrieve the information collected.

The results of the pasteurising run are displayed by the instrument on a large, bright, four digit LED display which can supply the following information:-

- (i) Total P.U.s achieved.
- (ii) Total run time.
- (iii) Maximum temperature achieved.
- (iv) Total time within 2 °C of maximum.

It is also possible to display the complete set of recorded temperatures with the time of each recording. The built in thermometer function allows the current temperature of the probe to be displayed if required.

The instrument is built into a strong, permanently sealed case which does not require any further protection in the pasteuriser. Operation is possible in ambient temperatures of up to 85 degrees Centigrade.

The microprocessor is used to run frequent self-tests of the instrument and to keep the operator informed of the condition of the battery, the probe and the solid-state memory. In this way it is possible to be sure that the instrument is working correctly before it is loaded into the pasteuriser.

When a printed record of the results is required the RPC-42 Printer/Charger can print out all the information described above together with a graphical representation of the recorded data. The battery in the RPU-120 will be recharged while printing takes place.

The older model RPC-40 printer/charger can also be used with the RPU-120.

SPECIFICATIONS.

RANGES OF OPERATION.

P.U. Display : 0 to 999.9 P.U.
Recording Temperature : -5 to 100 °C
Ambient Temperature : -5 to 85 °C

ACCURACY.

The Monitor is designed to be most accurate over the normal working range of 40 to 80 °C. Outside this range the accuracy and the resolution gradually reduce towards the extremes of the recording range.

The first set of accuracy figures given below is for the normal working range and assumes that the instrument itself is within 20 °C of the temperature being recorded.

Range 40 to 80 °C

P.U. Calculation : +/- 4% (or 0.5 P.U. if greater)
Temperature : +/- 0.2 °C (circuit & lineariser)
Probe : +/- 0.1 °C
Time : +/- 2.0 seconds/hour

Range -5 to 100 °C

P.U. Calculation : +/- 5% (or 0.5 P.U. if greater)
Temperature : +/- 1.0 °C (at extremes of range)
Probe : +/- 0.2 °C (worst case)
Time : +/- 2.5 seconds/hour

Note.

P.U. calculation is only possible from 38 to 85 °C

RESOLUTION.

P.U. : 0.1 P.U.
Temperature : 0.1 °C
(40 to 80)
(-5 to 100) : 0.4 °C (at extremes of range)
Time : 0.5 Minutes

RECORDING INTERVAL.

Fixed : 0.5 Minutes

RECORDING TIME.

Maximum : 2 Hours (240 recordings)

P.U. CALCULATION.

The P.U. value is calculated in the instrument according to the standard definition that one Pasteurisation Unit is obtained by holding for one minute at 60 °C (140 °F). The value is calculated every half minute based on the mean temperature recorded in that time. The P.U. value is defined as increasing or decreasing 10 fold for every 7 degrees Centigrade change in temperature. Pasteurisation Units are assumed to be additive where the temperature is changing and the total P.U. achieved is calculated by summing the P.U. value calculated for each half minute of the recording run.

P.U. CUT-OFF.

The instrument is able to calculate the P.U. value over the temperature range 38 to 85 °C but the customer can specify a cut-off temperature below which no P.U.s will be calculated.

BATTERY.

Type	: Sealed Lead/Acid rechargeable.
Life	: A fully charged battery will be good for up to 6 recording runs of 2 hours each with 20 minutes idle time and 10 minutes display time per run.

PROBE.

Sensor type	: Thermistor
Material	: Stainless steel

A wide range of probe lengths is available with fittings to suit various sizes and styles of bottles and cans. Special probes can be supplied on request.

CASE.

Overall size	: 456 x 153 x 149 mm.
Instrument section	: 213 x 153 x 114 mm.
Overall weight	: 5.2 Kg.
Material	: Stainless steel
Window material	: "Makralon" (self-extinguishing) (TM) Bayer AG. or toughened glass.

Overall size (and weight) is for the P.U. Monitor mounted on a can or bottle holder with carrying handle.

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NOTES

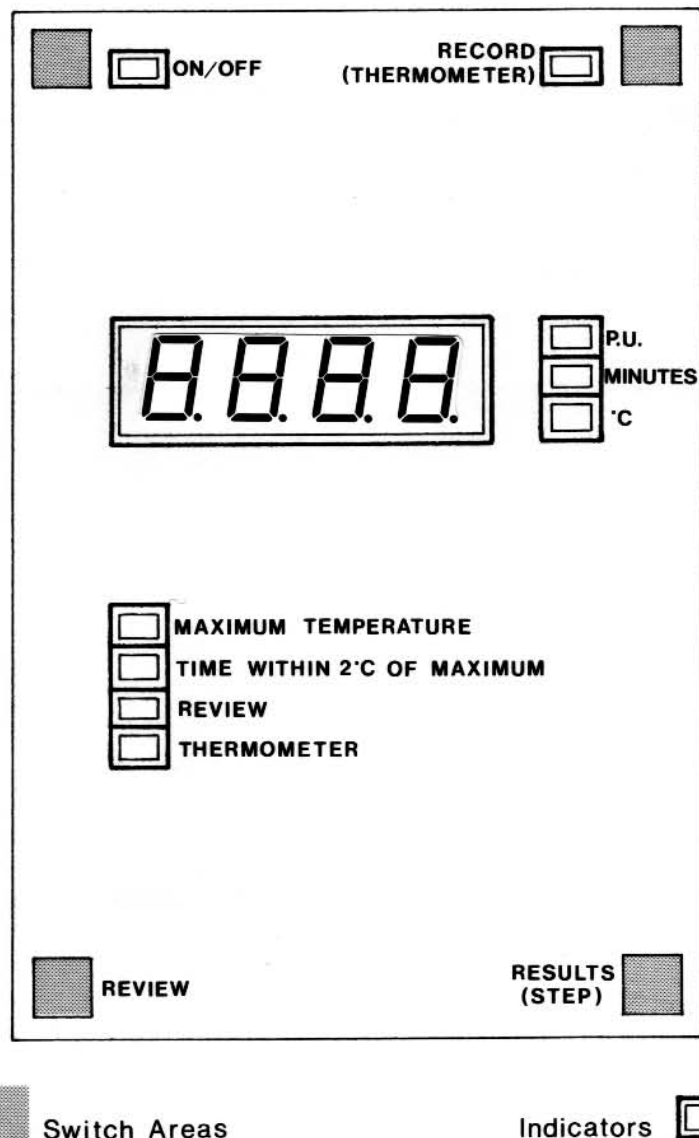
The extended range option will register up to 9999 P.U. and the resolution becomes 1 P.U. With this option the P.U. calculation is possible from 45 to 92 °C. The instrument itself is still limited to an ambient temperature of 85 °C maximum.

CONTROL SWITCHES.

GENERAL DESCRIPTION.

The control switches are situated in the four corners of the top panel of the instrument. They are operated with a magnetic actuator which should be held with its unmarked end close to the square white areas printed on the panel. Wait until a beep is heard, indicating that the switch has operated. This may take up to two seconds.

TOP PANEL LAYOUT.



MAKING A RECORDING RUN.

TO SWITCH POWER ON. Operate the ON/OFF switch. The serial number of the instrument is displayed briefly and then all the display segments and indicators are illuminated, indicating that the self-test routine has started. The main self-test routine will show the status of the instrument and its battery. The output messages from the self-test routine are explained in section 4.

If the instrument passes the self-test it will return to idle mode. In the idle mode the indicator light near to the ON/OFF switch flashes every two seconds and the instrument is ready to receive any of the commands described below.

TO START RECORDING. Connect the temperature probe, ensuring that the plug is pushed fully in and that the locking ring is turned until it clicks home. Operate the RECORD switch, and in this case only, hold until three beeps are heard. The pre-record self-test will run and will show the status of the probe and battery. The output messages from the self-test routine are explained in section 4.

Only if the instrument, probe and battery pass the self-test is the first recording made and timing started. The first recording is assigned to time 0.0 minutes. Recordings continue to be made at 30 second intervals until stopped as below or until 2 hours have elapsed. In the recording mode the indicator light near to the RECORD switch will flash every two seconds together with the indicator light near to the ON/OFF switch.

If the memory already contains recordings the message "FULL" is displayed and recording will not start. If these previous recordings are no longer required they can be erased by switching the power off and then on again. A new recording run can then be started.

TO STOP RECORDING. Either unplug the temperature probe or operate the RECORD switch once. The instrument will return to idle mode. DO NOT SWITCH POWER OFF or the recordings will be lost.

OBTAINING THE RESULTS.

No extra equipment is needed to obtain the details of the recording run. Immediately the run is over it is possible to view the calculated results on the instrument's own display.

TO CHECK RESULTS. Operate the RESULTS switch when the instrument is in idle mode. The results are calculated from the recorded data and each result is then displayed for about 5 seconds after which the instrument returns to idle mode. The results displayed are described in detail in Section 5.

If no recordings have been made the message "NULL" is displayed for 5 seconds and the instrument then returns to idle mode.

TO REVIEW RECORDINGS. It is also possible to review the recording run in terms of the temperatures recorded. Operate the REVIEW switch when the instrument is in idle mode to see the first record. The "Review" function indicator will light. The time of the recording is shown for 1 second with the units indicator showing "Minutes". The temperature recorded at that time is then shown for 3 seconds with the units indicator showing "°C". This time/temperature display is repeated continuously unless the STEP switch is operated. "Time" in this context means the time elapsed in minutes since the start of recording.

Operate the STEP switch once to move to the next record. Hold the STEP switch to move faster through the records. If the STEP switch is not operated for more than 30 seconds the instrument will return to idle mode. If the final record is being displayed and the STEP switch is operated or if no recordings have been made the message "ALL" is displayed for about 5 seconds and the instrument then returns to idle mode.

TO PRINT RESULTS. If a printed record of the results is required the instrument can be connected to the RPC-42 Printer/Charger. DO NOT SWITCH POWER OFF until printing is finished or the recordings will be lost. Full instructions for printing the results are included in the manual for the Printer/Charger.

TO SWITCH POWER OFF. Operate the ON/OFF switch. All functions are suspended and the instrument memory is erased.

OTHER USES.

TO USE AS THERMOMETER. Connect the temperature probe, operate the REVIEW switch and then operate the THERMOMETER switch. The display shows the current temperature of the probe updated approximately every second. The "Thermometer" function indicator will light and the units indicator will show "°C". After 60 seconds the instrument returns to idle mode.

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A shortened version of these instructions is printed
on the top panel of the instrument itself.

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MESSAGE DISPLAY.

One of the major features of the RPU-120 is a comprehensive range of messages shown on the display that give the operator important information about the status of the instrument.

The message outputs are divided into four groups;

- (i) Two word messages where the words are displayed alternately.
- (ii) Single word non-flashing messages.
- (iii) Single word flashing messages.
- (iv) Other fault indicators.(Dots, bars etc.)

The same word may appear in the messages of different groups (e.g. in flashing or non-flashing form). The meaning in each case will be slightly different.

(i) TWO WORD MESSAGES.

These messages are all produced by the self-test routine, either when the instrument is first switched on or when the RECORD function is selected.

PASS GROUP.

If the self-test routine finds that the instrument is functioning correctly the PASS message is shown twice, alternating with the battery state message.

PASS HALF

PASS HALF. The battery has half of the full charge or less. There is at least sufficient charge in the battery for a maximum 2 hour recording run.

PASS HIGH

PASS HIGH. The battery has more than half of the full charge.

PASS CHGE

PASS CHARGE. The battery is actually being charged. (Recording is not possible when the instrument is connected to the charger.)

FAIL GROUP.

If the self-test routine finds that the instrument is not functioning correctly the FAIL message is shown 5 times alternating with a message giving the reason for the failure. The self-test will be repeated up to 5 times to allow the fault to be corrected if possible.

FAIL LO

FAIL LOW. The battery is not sufficiently charged for a maximum 2 hour recording run. The instrument should be switched off and then connected to the charger as soon as possible. ** See footnote.

FAIL Pr. 0

FAIL PROBE OPEN. Probe open-circuit. The temperature probe is not plugged in, the circuit is broken (because of connector or cable damage), the temperature probe itself is damaged or the temperature of the probe is below the recording range of the instrument.

FAIL Pr. 5

FAIL PROBE SHORT. Probe short-circuit. The temperature probe is short circuited (because of connector or cable damage), the temperature probe itself is damaged or the temperature of the probe is above the recording range of the instrument.

FAIL ELEC.

FAIL ELECTRONICS. Electronics fault. The recording memory is faulty or the microprocessor has found a fault in its own operation. Further operation of the instrument is impossible.

**** Footnote.**

Sometimes when the instrument is first switched on the battery will have a slight overcharge and will exhibit higher than normal internal impedance when first tested. This is a temporary effect and so, although the first self-test may fail, if the instrument is left to retest itself after the normal 10 second delay the next self-test will usually pass and normal operation will follow.

(ii) SINGLE WORD NON-FLASHING MESSAGES.

These messages are produced by the routines selected by the panel switches. The switch used or the routine running is shown in brackets after the message word.

FULL FULL. (Record Switch operated) The recording memory already contains data. If the data is no longer required, switch the instrument off and then on in order to clear the memory and allow new recordings to be made.

NULL NULL. (Results Switch operated) No recordings have been made since the instrument was switched on and therefore no results can be calculated.

ALL ALL. (Review or Step Switch operated) The final recording has been reviewed or the recording memory was empty.

Pr. 0 PROBE OPEN. (Thermometer routine) The temperature probe is not plugged in, the circuit is broken (because of connector or cable damage), the temperature probe itself is damaged or the temperature of the probe is below the recording range of the instrument. This message replaces the normal numerical display of temperature.

Pr. 0 PROBE OPEN. (Review routine) One of the above conditions existed at the time the recording being reviewed was made. This message replaces the numerical display of temperature in the time/temperature display. The time of the recording is displayed normally.

Pr. 5 PROBE SHORT. (Thermometer routine) The temperature probe is short-circuited (because of connector or cable damage), the temperature probe itself is damaged or the temperature of the probe is above the range of the instrument. This message replaces the normal numerical display of temperature.

Pr. 5 PROBE SHORT. (Review routine) One of the above conditions existed at the time the recording being reviewed was made. This message replaces the numerical display of temperature in the time/temperature display. The time of the recording is displayed normally.

A special case of the single word message is the instrument serial number which is displayed briefly when the instrument is first switched on.

(iii) SINGLE WORD FLASHING MESSAGES.

LO LOW. (Any routine) The battery voltage has fallen too low for accurate results to be obtained. If this failure took place during recording then the recording run will have been stopped. If the instrument is connected to the charger (without switching off), any results obtained before the battery failure may be read on the display or printed out. The instrument should then be switched off and allowed to charge fully.

Even if the battery voltage has returned to normal before the attempt is made to select a function, the flashing LOW message is shown before the selected routine begins. This warns the operator that normal operation (e.g. recording function) was interrupted by low battery voltage.

Pr. 0 PROBE OPEN. (Results routine) Results cannot be calculated because recordings contain one or more open-circuit or off-scale low readings. The review routine can be used normally.

Pr. 5 PROBE SHORT. (Results routine) Results cannot be calculated because recordings contain one or more short-circuit or off-scale high readings. The review routine can be used normally.

(iv) FAULT INDICATORS.

These indicators flash briefly every two seconds under fault conditions.

. The self-test routine has failed. There is a ten second delay before the self-test routine runs again during which time this fault indication is given and the cause of the failure can be investigated. If the fault can be corrected (e.g. by plugging in the temperature probe) the next self-test will pass and normal operation will begin.

- - - - - The self-test routine has failed after five attempts or a secondary test routine that runs constantly has discovered that the data stored in the recording memory has become corrupted. All functions are disabled and the instrument must be switched off and the cause of the failure investigated.

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Message display

RESULTS DISPLAY.

P.U. ACHIEVED.

The P.U. value is calculated according to the definition that one minute at 60 degrees Centigrade produces one pasteurisation unit. For every increase or decrease of seven degrees Centigrade the P.U. value changes by a factor of ten. The instrument is able to calculate the P.U. value over the range of temperatures from 38 to 85 degrees Centigrade. Normally this wide range is not needed and a cut-off temperature is specified. If the temperature is less than or equal to this cut-off the P.U. value will be calculated as zero.

The P.U. value is calculated for each half minute of the recording run and the display shows the sum of all these values which is the total P.U. achieved. The units indicator shows "P.U.".

RUN TIME.

Timing starts after the instrument has passed the pre-record self test and the PASS messages have been displayed. The first recording is taken at this time which is designated time zero (0.0 minutes). (Note that timing does not start immediately the RECORD switch is operated.)

The display shows the total time from time zero until the recording was stopped. The value is rounded to the nearest half minute below. The units indicator shows "Minutes".

MAXIMUM TEMPERATURE.

This is simply the highest temperature (in degrees Centigrade) reached at any time during the recording run. The first recording (made at time zero) is included in the calculation. The function indicator shows "Maximum Temperature" and the units indicator shows "°C".

TIME WITHIN 2 DEGREES OF MAXIMUM.

Each record is checked to find how close it is to the maximum temperature. The total time during which the records are within two degrees Centigrade of the maximum gives the required result. If the recording has several peaks, all reaching to within two degrees of the maximum, then the total time of all these periods is given.

The display shows the time rounded to the nearest half minute below. Times near maximum of less than half a minute (one record only) will give a zero result. Only a very sudden isolated peak can give this unusual result. The function indicator shows "Time within 2 °C of Maximum" and the units indicator shows "Minutes".

The two degrees Centigrade figure for the selection limit is accurate when the maximum falls within the normal working range of 40 to 80 degrees Centigrade. For maxima outside this range the selection limit will be broader.

OFF SCALE RECORDS.

If the recorded data includes any records that are off-scale (below -5 or above 100 degrees Centigrade) the majority of the results would be meaningless and so the results are not displayed. A flashing message is shown to indicate the problem (Probe short or Probe open). See Section 4(iii) for more details of the flashing messages.

Using the REVIEW function will show at what time the off-scale recordings were made because the normal temperature display is replaced by an off-scale message. This may help to give an explanation of the problem. The fault finding suggestions on probe damage in Section 8 may help to trace any faults.

If the recording was stopped because the battery voltage fell too low for accurate operation then the flashing "LOW" message is shown to warn the operator. The Monitor should be recharged as soon as possible without switching the power off and then any results obtained before recording stopped can be displayed. See Section 4(iii) for more details of the flashing "LOW" message.

PRINTED RESULTS.

When the results are printed out by the RPC-42 Printer/Charger two further results are produced concerning the P.U. lower cut-off temperature. For details see the manual for the Printer/Charger.

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BATTERY.

BATTERY LIFE.

The battery capacity of the RPU-120 has been calculated to allow the instrument to operate for about 15 hours (or two normal shifts) without recharging. When the battery is fully charged it has sufficient capacity to make 6 full 2 hour recording runs. This assumes that each 2 hour run is followed by 10 minutes display time and 20 minutes idle time. A proportionately greater number of shorter recording runs can be made.

Display time places a particularly heavy drain on the battery because of the current required by the LED display. For maximum recording time the display time should therefore be minimised. Idle time places only a low drain on the battery.

BATTERY CHARGING.

Printer/Charger RPC-42.

If the instrument is used with the RPC-42 Printer/Charger it will receive a fast charge every time a print-out is made. This has the advantage that the instrument is not out of service for long periods during charging.

Sufficient charge for a full 2 hour run will be given by the time the "High Charge" lamp on the RPC-42 goes out. Charging will normally be completed to this level before the print-out is completed. Full details of the charging operation are given in the manual for the Printer/Charger.

Other Chargers.

If the RPU-120 is used to display the results without making a print-out, the self-test routine will indicate when charging is required. This self-test is run every time the instrument is switched on and before a recording run is started.

It is best to recharge the battery when it has reached the half fully charged state as indicated by the "Pass Half" message. If necessary the instrument can continue in service until the "Fail Low" message is obtained but then it must be recharged before it can be used any further. The instrument should be left on charge for the time recommended for the particular type of charger. Full details of the self-test message displays are given in Section 4.

Only chargers supplied with or recommended for the RPU-120 should be used. Damage and possible danger may result from the use of incorrect charging methods.

The RPC-42 will not allow charging to take place when the temperature of the instrument is below -10°C or above 60°C . These limits should also be observed when using other chargers.

MONTHLY CHARGING.

Once every month the instrument should be left on charge for a longer period in order to fully charge the battery and to balance the charge in the individual cells. This longer charge will help to prolong the life of the battery.

For the RPC-42 Printer/Charger this longer charge should last about 8 hours. This time may be longer for other types of charger but details are given with the charger instructions. Do not leave the instrument on charge for more than 24 hours.

VENTING OF GASES.

During charging, small quantities of the gases hydrogen, oxygen and carbon dioxide may be given off by the battery depending on its state of charge. To vent these gases to the atmosphere, the bottom cover of the lower section of the instrument's case is fitted with two small breather holes.

IMPORTANT NOTE.

NO SMOKING DURING CHARGING

Although the quantity of gas evolved is very small NO NAKED FLAMES and NO SMOKING should be allowed near to the instrument during charging. This is standard practice when any lead/acid battery is being charged.

The instrument should be charged in a well ventilated room.

LONG TERM STORAGE.

Always switch the instrument off when it is not in use. If the instrument is to be stored unused for long periods it should be periodically recharged for about one hour. This charge should be considered as essential maintenance and should take place at least every 2 months and preferably every month. In addition to replacing charge lost by the inevitable self-discharge of the battery it will also vent any gases that have built up in the case as a result of the self-discharge.

DEEP DISCHARGE AND PERMANENT DAMAGE.

If the battery is allowed to stand in a discharged state or allowed to self-discharge for long periods without recharging it may enter a state of "deep discharge". In this state the internal resistance rises to such a high value that recharging is impossible.

When connected to a charger only a negligible current will flow and it may therefore be assumed that the battery is fully charged. However when the charger is disconnected the battery voltage quickly falls to a low level and the instrument will not operate.

If the battery is left on charge for 24 to 72 hours it is possible that enough charge will be accepted to lower the internal resistance and allow normal charging to resume. If after 72 hours no improvement in battery function is noted then it must be accepted that the battery is damaged beyond recovery and the instrument must be returned for a new battery set to be fitted.

Batteries that have been damaged by neglect of the charging instructions cannot be considered for replacement under the guarantee.
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BATTERY PACK REPLACEMENT.

The battery pack is a removeable unit and can be replaced with a new pack if necessary. See page 8-5 or contact Redpost for more details.

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MAINTENANCE AND CALIBRATION.

MONTHLY MAINTENANCE.

The only regular maintenance that is required for the RPU-120 is the monthly battery charging described in Section 6 and the connector lubrication described below. If the battery is to remain in good condition it is very important to follow the charging recommendations, particularly if the instrument is to be stored, unused, for any length of time.

YEARLY PREVENTIVE MAINTENANCE.

To ensure continued trouble free operation of the equipment it is recommended that a new battery pack and socket connector panel should be fitted every year. Both items will normally last longer than a year but experience has shown that they will often require replacement during the second year. Both items are designed for easy replacement without returning the instrument. The shelf life of the battery pack is limited to approximately six months at normal temperatures (less when stored at above 20 °C) and they should be ordered only as required.

CARE OF THE INSTRUMENT.

Top Window.

If the transparent window requires cleaning, only liquid glass cleaners should be used. Never use an abrasive cleaner or the surface of the window will be scratched. Never use any solvents or hydrocarbons (eg. petrol) that may damage the window or the seal around it. It is recommended that self-adhesive labels should not be stuck to the window since the solvents in the adhesive may weaken the window material.

Connector.

When fitting the probe, always check that the plug is pushed fully in and that the locking ring is turned until it clicks home.

Take care not to bend the pins of the plug. Always line up the keyway on the connector before applying pressure to the locking ring. If the pins appear to be bent it is important to straighten them carefully before attempting to use the instrument. The pins of the connector should only be

straightened with non-conducting pliers or possibly with a small piece of wood or plastic. This is to avoid short-circuiting adjacent pins.

The connector pins and sockets should be lubricated and protected with silicone grease. This grease should be applied once per week. A suitable grease in an aerosol spray is available from the Electrolube company under the name "Silicone Compound" and from R.S. Components under the code number 554-872. Redpost part number is SGA-120.

General care.

NEVER send the instrument through the pasteuriser without the probe plugged in.

NEVER attempt to open the sealed case of the instrument.

ALWAYS fully tighten the probe plug locking ring:- turn it until it clicks home.

ALWAYS send the instrument through the pasteuriser with the window upwards.

ALWAYS store the instrument with the window upwards.

ALWAYS switch the instrument off when its recorded data is no longer required.

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CHECKING CALIBRATION.

In order to check the calibration of the instrument or the probe it is necessary to use test equipment that is more accurate than either the instrument or the probe. This implies a temperature controlled water or oil bath with a stirrer and a thermometer accurate (and readable) to better than 0.1°C over the range 40 to 80°C . A resistance box accurate (and settable) to at least 0.1 ohms over the range 240 to 1200 ohms will be needed to check the instrument in isolation from the probe.

The calibration should preferably be checked at two temperatures in the working range of 40 to 80°C . If this range is correctly calibrated then the whole temperature range of the instrument will be correct within the specified limits. See Section 2. In order to give the most accurate results the instrument itself should be within 20°C of the temperature being checked.

Procedure.

To check the instrument and probe together, immerse the probe in a well stirred water or oil bath at the required temperature. Immerse an accurate thermometer as near as possible to the probe. It is most important that the bath is well stirred otherwise it is possible for temperature differences of several degrees to exist between different parts of the bath. Now, with the probe plugged into the instrument and using the "Thermometer" function, it is possible to compare the temperature reading on the instrument with that on the accurate thermometer. Any differences should be within the limits set out in Section 2.

If any inaccuracy is found it can be isolated to the probe or the instrument by checking the instrument alone, using a resistance box to replace the probe. Set the resistance box to the resistance value corresponding to the required temperature and then use the "Thermometer" function to check that the instrument is reading correctly.

A special lead can be supplied to connect the resistance box. A table of resistance input values for different temperatures in the working range is given overleaf. Alternatively, an accurate, fixed resistor can be supplied to simulate a temperature of 60°C . This gives a simple method of running a limited check on the instrument without the expense of a complete resistance box.

TEMPERATURE / RESISTANCE TABLE.

°C	OHMS
40	1065.4
45	874.0
50	720.6
55	597.2
60	497.6
65	416.6
70	350.4
75	295.8
80	251.0

Resolution.

The resolution of the instrument in the working range is given in the specifications as 0.1 °C. This is the average resolution over the working range. The process of linearising the temperature scale involves several calculation steps and rounding errors in these calculations result in a very small number of particular temperature values never being shown. For example, a probe temperature of about 63 °C might be shown as 62.9 or 63.1 °C but might never be shown as 63.0 °C.

Recalibration.

If the calibration appears to be outside the specified limits then it may be necessary to return the equipment for repair or recalibration. See Section 10-2. Neither the probe nor the instrument can be serviced by the user. In particular, no attempt must be made to open the upper, sealed section of the RPU-120.

Battery Drain.

Remember that the Thermometer function puts a fairly heavy load on the battery and it is recommended that the battery should be fully charged before beginning the calibration check. The flashing "low" message will be shown if the battery voltage does fall too low. See Section 4-4.

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FAULTY OPERATION & PROBLEM SOLVING.

General.

The self-testing programs of the RPU-120 will identify most of the common sources of incorrect operation. The messages displayed should lead the operator to the problem areas. Section 4-2 describes the messages that are displayed when the self-test fails. Suggestions are given below for the repair of the more common faults.

Sometimes the fault will interfere with the working of the microprocessor in such a way that operation becomes totally abnormal. In these cases the equipment must normally be returned for repair but see below under "Instrument Dead".

PROBE PROBLEMS.

Self-test Fails.

Damage to the probe or the probe cable can cause the probe to become short-circuit or open-circuit. The self-test will identify both these conditions.

Probe Cable Damaged.

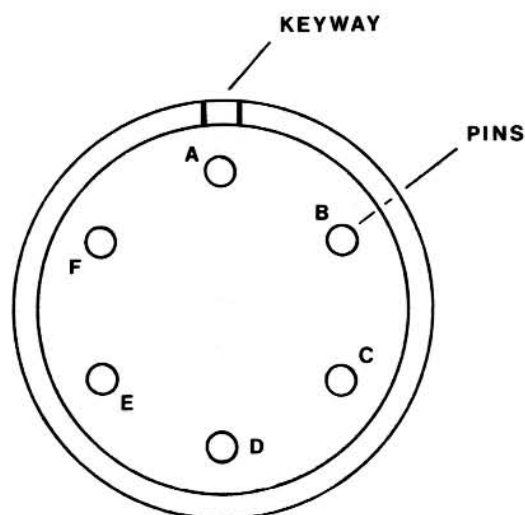
If the probe cable is damaged the probe should be returned for repair. The connecting block is a sealed unit and the connector is filled with a waterproofing compound after assembly making repairs impossible without special equipment.

Quick Check for Probe.

The probe can be quickly checked using a multi-meter with a resistance range. Measure the resistance between connector pins "A" and "F" (see diagram) with the probe lying on the bench. A reading between 1500 and 3000 ohms should be obtained, corresponding to a room temperature between 15 and 30 °C. Check that the resistance falls when the probe is gently heated. For a more complete calibration check see Section 7-3.

Probe problems can sometimes be caused by a damaged connector. See below under "Connector Damage".

PROBE CONNECTION DIAGRAM.



BATTERY PROBLEMS.

Self-test Fails.

The most common battery problem is caused by the battery being left uncharged for too long a time or not receiving enough charge when connected to the charger. Always leave the instrument on charge for the recommended time. See Section 6 for details of charging procedure and the problem of deep discharge.

Instrument Will Not Stay On.

A very low battery may allow the instrument to beep when first switched on but the internal cut-out will immediately switch the instrument off again so that the on/off switch appears to have no effect. This is to protect the battery from over discharge. Connecting the charger should allow the instrument to be switched on normally. Follow the charging procedure given in Section 6 or in the working instructions for the RPC-42 printer/charger.

Instrument Will Not Charge.

If the instrument appears not to be receiving any charge when connected to the charger, check for cable or connector damage (see below) or check for deep discharge (See Section 6-3).

The RPC-42 printer/charger uses a temperature sensor inside the RPU-120 to control the charge rate and so, if this sensor is faulty or the connections to it are short or open circuit (either in the cable or the connector), then charging will be prevented. The working instructions for the RPC-42 also describe this problem.

The temperature sensor can be checked using a multi-meter with a resistance range. The sensor should give a reading between 500 and 1600 ohms under normal conditions. (Nominal value is 930 ohms at 30 °C). The sensor is connected between socket pins "A" and "E".

ELECTRONIC FAULTS.

Self-test fails.

If the "Fail Elec" or "----" message displays are given every time the instrument is switched on it will normally be necessary to return the instrument for repair. The fault is internal to the instrument and does not lie in the probe or battery.

Remember that the "----" message may indicate that the self-test routine has been retried five times and failed each time because of, say, a damaged probe. Switch the instrument off and then on again to check the self-test message display. (See Section 4-5).

CONNECTOR DAMAGE.

The pins of the connector can be damaged if care is not taken when plugging in the probe or the charger. Always align the keyway on the connector before applying pressure to the locking ring.

If the pins are badly bent they may not make good contact and may therefore give incorrect temperature readings from the probe or may prevent the battery from charging.

Always use insulated tools to straighten any bent pins.

A badly damaged connector can cause two pins to contact each other which may short-circuit the battery and blow the fuse. See below.

The connector can be replaced if necessary. See page 8-5 or contact Redpost for more details.

INSTRUMENT DEAD.

If the battery fails or if the battery fuse blows the instrument will be completely dead and there will be no response from any of the control switches. If the battery charger is connected the instrument should operate correctly because the charger will supply power. When the charger is disconnected the instrument stops working at once.

The battery fuse is located in the end section of the case and can be reached by removing the end cover. (8 screws around edge of cover.) A replacement fuse can be supplied if required together with fitting instructions.

The fuse is in a waterproof fuse-holder and can be replaced with a standard 6.3 Amp quick-blow 5 x 20mm fuse. (e.g. R.S.Components Ltd. part number 413-541 or "Littelfuse" type 19193 6.3A). Make sure that the cover of the fuse holder and the end cover of the instrument are firmly replaced. A new gasket should be fitted if the old one appears to be damaged in any way. Contact Redpost for details.

Always check the cause of the fuse failure. Often the fuse will blow because of a short-circuit in the battery charger cable or damage to the connector on the probe or the battery charger.

Never try to straighten bent connector pins with uninsulated tools which could bridge two of the contacts and cause a short-circuit.

LEAKS IN THE CASE.

Sometimes a leak in the case will cause the instrument to malfunction. If liquid is ever seen inside the window of the instrument, stop using it at once. Further damage can be caused by using an instrument that has a leak.

The lower section of the case is vented through the bottom cover plate. It is possible for small amounts of water to run out of the vent when the instrument is removed from the pasteuriser. It is important that the instrument is always the right way up (window upwards) when passing through the pasteuriser, being hosed down or being stored so that the vent can drain the lower compartment.

Leaks can be caused by damage to the case or window or by attempts to open the case that damage the window seal.

Never send the instrument through the pasteuriser without the probe plugged in.

BATTERY PACK REPLACEMENT.

The battery pack is a removeable unit and it can be replaced without disturbing the main sealed section of the instrument. Full fitting instructions are sent with the replacement battery pack.

PROBE CONNECTOR REPLACEMENT.

The probe connector is designed to allow replacement without disturbing the main sealed section of the instrument. If the probe connector is damaged, the end cover of the instrument that carries the connector can be removed and the wiring disconnected by an internal plug and socket. The end cover assembly can then be replaced complete with the probe connector. Full fitting instructions are sent with the replacement panel.

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REDPOST RPU-120
Maintenance &
Calibration

NOTES

SAFETY.

ELECTRICAL.

Voltage levels within the RPU-120 and its probe are too low to present any electrical shock hazard. A fuse in the battery circuit prevents high currents from flowing and therefore removes the danger of overheating if the pins of the connector are short circuited.

BATTERY GASES.

When the battery is being charged hydrogen and oxygen are vented from the case in small quantities. This is a potentially explosive mixture and so the normal precautions for charging a lead/acid battery should be taken. No naked flames and no smoking should be allowed near the instrument when the battery is on charge. The charging should take place in a well ventilated room.

CASE MATERIALS.

The case of the instrument is made of stainless steel throughout except for the transparent window which is made from a self-extinguishing grade of poly-carbonate plastic sheet. The window is sealed into the case with a silicone rubber sealant which has a low order of toxicity. The connecting socket is made of nickel plated aluminium alloy with polychloroprene (self extinguishing) insulators. On later instruments the window is made of toughened glass.

DAMAGE TO CASE.

It must be stressed that there are no user serviceable parts in the upper, sealed compartment of the instrument and that no attempt should be made to open it.

If the non-sealed compartments are opened for repairs or if the sealed compartment is opened accidentally or is damaged to such an extent that internal components are exposed, several potential safety hazards are produced. These are outlined below.

Battery.

The battery cells are capable of producing very high currents of the order of 150 Amps if short circuited. There is therefore a danger of severe skin burns if metal watch straps or rings are accidentally touched across the

terminals. If the cells have broken free from their fixing bracket they may become short circuited on the metal parts of the case and may become overheated creating a potential fire hazard.

Identifying the battery.

The battery cells are normally clamped in a group of four inside the lower compartment of the case. They are cylindrical in shape, about 35mm in diameter and 60 mm long.

Cells which become hot through short circuiting should be immediately immersed in water in a plastic bucket or other non-conducting container.

If the cells are ruptured they should not be handled with bare hands. Cell components are lead, lead dioxide and sulphuric acid. The battery is constructed without free liquid acid but if any of the cell contents come into contact with the skin, neutralise with 10% solution of sodium carbonate and follow by rinsing in cold water.

Other electronic parts.

Electrolytic capacitors (bead shape and cylindrical) may contain liquid electrolyte. The chemical constituents vary from manufacturer to manufacturer but in general, if the components are damaged, skin contact should be avoided and any liquid washed away in cold water.

There are remote potential hazards from the display and indicators if they become damaged and their cases broken open. These devices may contain small quantities of gallium phosphide and other toxic materials.

In general any damaged electronic component should not be handled if at all possible.

Desiccant.

A moisture-absorbing bag is fitted inside the case. This bag is made from a type of paper and is filled with a special clay product which is non-toxic.

FIRE.

If the equipment is involved in a fire it should be remembered that PVC covered wire and other plastics may give off noxious fumes when burning. The amount of plastic material in the instrument is small and should not create a dangerous concentration of fumes in a normal room.

The batteries cannot explode in a fire because a valve in the case releases internal pressure. If possible disconnect from mains operated equipment such as the printer/charger.

PROBE.

The probe tube is made of stainless steel with a nylon connecting block and a stainless steel gland nut for the coiled PVC covered cable. The universal bottle adapter is made of butyl rubber with a stainless steel tightening clip. The connecting plug has a nickel plated aluminium alloy body with polychloroprene (self extinguishing) insulating parts.

All materials used in the internal construction of the probe are of low toxicity. The tube is filled with zinc-oxide loaded heat conducting silicone grease: no berillium compounds are used.

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REDPOST RPU-120
Safety

NOTES

GUARANTEE. (U.K. CUSTOMERS.)

TWO YEAR GUARANTEE. (Electronics.)

The electronic circuits and other components that are sealed into the upper compartment of the case of the RPU-120 P.U. Monitor are guaranteed against defects arising in normal use for a period of two years from the date of purchase provided that the defect has not been caused by misuse, abnormal conditions of operation or by any attempt to open the sealed compartment of the monitor.

The battery pack in the lower compartment of the RPU-120 P.U. Monitor is guaranteed against defects arising in normal use for a period of one year from the date of purchase provided that the defect has not been caused by misuse, abnormal conditions of operation or by failure to follow the battery charging instructions given elsewhere in this manual.

Redpost Electronic Products Ltd will repair or replace (at their discretion) the faulty equipment if it is returned to them, carriage paid, within the guarantee period.

Pack the equipment carefully and send it with a note describing the fault to the address shown in the front of this manual.

This guarantee is offered in addition to any statutory rights to the original purchaser only.

This guarantee is offered to U.K. customers only. Customers outside the U.K. should contact the distributor from whom the instrument was purchased to check the guarantee and service arrangements for that particular country.

The connector mounted on the end compartment of the case of the RPU-120 P.U. Monitor is not covered by this guarantee because conditions of use are outside our control. However, with normal use and regular protective lubrication as described elsewhere in this manual, the connector should have a life of more than one year.

REPAIRS & SERVICING.

RETURNING EQUIPMENT FOR REPAIR.

Should any fault develop, the equipment should be returned, carefully packed and carriage paid, to Redpost Electronic Products Ltd at the address shown in the front of this manual.

If the guarantee has expired or if the fault is the result of misuse then repairs will not be carried out until a price has been agreed and an official order received.

Normally repairs will be completed within one working week from receipt but failing this we will often be able to loan replacement equipment until the original items are fully repaired. (U.K. mainland only.)

Please include the model number and serial number of the instrument in any communication regarding service.

Customers outside the U.K. should contact the distributor from whom the instrument was purchased to check on the service arrangements for that particular country.

NOTE. THE ELECTRONIC COMPONENTS OF THE
RPU-120 P.U. MONITOR ARE PERMANENTLY SEALED
INTO THE UPPER COMPARTMENT OF THE CASE AND
ARE THEREFORE NOT USER SERVICEABLE.

SPARES FOR THE RPU-120.

<u>DESCRIPTION</u>	<u>PART NUMBER</u>
Operating Magnets (pair)	OMP-120
Replacement Connector Panel	RCK-120
Replacement Battery Pack	BPK-120
Silicone Grease Aerosol	SGA-120

For spare probes please state type and size of bottle or can.

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