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It is my hope that you find the file of use to you personally – I know that I would have liked to have found some of these files years ago – they would have saved me a lot of time !

Colin Hinson

In the village of Blunham, Bedfordshire.

Instruction Leaflet

3143/92 THERMOHYGROGRAPH
DE LUXE VERSION



CASELLA

Casella Limited

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England

THERMOHYGROGRAPH

Catalogue Ref: E9270/Z (Day/week) Celsius
E9272/Z (Monthly) Celsius
100112E (Quartz weekly) Celsius

GENERAL APPLICATION

Variations in relative humidity can affect many manufacturing processes, storage of raw materials, weights of items such as wool, paper, tobacco, confectionery, computer operation as well as being an important factor in human comfort. Since temperature is often linked to relative humidity changes this instrument also records temperature changes on the same chart.

PRINCIPAL OF OPERATION

Humidity Measurement

The element sensitive to changes in relative humidity is connected through a linkwork to a pen arm so that changes are recorded on a chart wrapped round a circular clockwork or battery (quartz) driven drum. This element is made up from a number of strands of specially treated human hair which shorten as relative humidity decreases and lengthens as it increases. The linkwork is designed to give a close to linear movement over most of the chart range.

Temperature Measurement

The element sensitive to changes in temperature is a coil formed from bimetal which changes its free end position relative to its fixed end position with change of temperature. A spindle passing through the centre of the coil is rotated by an attachment to the free end of the coil. The pen arm is attached to the spindle and moves the pen up and down on the chart.

To get information most easily from the chart, temperature and humidity are recorded on the same portion. To distinguish the records two different coloured inks are used and one record is set to a time ahead of the other. To allow pens to pass each other the relative humidity one is shorter than the temperature one and thus allows the temperature pen arm to pass over it. Relative humidity is always scaled from 0-100% and temperature span is 50°C. This span can be selected over the range - 10° to + 50°. To distinguish one scale from the other, relative humidity figures are in grey and temperature figures are in red.

To provide easy trouble free writing fibre tipped pens are now supplied. These have enough ink in the body to write for many months. At the end of their life they are discarded.

When the instrument is received a special chart is fitted on which are printed instructions for setting temperature span to adjust to range of chart selected. We calibrate either 0° to +50°C.

TO PUT INTO USE

Open carton, remove packing and lift out chart box inside of which will be found two foil sachets containing pens and a plastic bag containing adjusting spanner, and hexagon wrench. Remove thermohygrograph and clock drum. Remove thermohygrograph from plastic bag and raise the cover. Remove clock drum lid and slide out chart clip. Wrap a new chart round drum, ensure that it touches flange and that lower line where it crosses the overlap aligns on each side. Failure to observe these points will cause an error in reading. Replace chart clip. Remove knurled nut from spindle and lower clock onto spindle. See that gears mesh before replacing and tightening knurled nut. Wind clock and replace lid. Take one pen out of each sachet, short, black ink for humidity is M118004, long, green ink for temperature is M119003, leave other pens sealed for future use. Rotate pen lifter outwards. Steady humidity pen arm between fingers of right hand, hold short pen in fingers of left hand and slide it onto arm. NOTE: raised edges on back of pen block have inner taper to secure pen to arm. Push pen until pen arm end touches raised spot. Repeat with long pen on temperature pen arm. Rotate clock to give approximate time under long pen, remove and discard protective caps from pen tips. Do not press pens onto paper to see how they write, this may well damage fine tips of pens and prevent ink flow. Rotate pen lifter inwards to allow pens to almost touch the chart, rotate clock drum to show correct time making the last movement anti-clockwise to eliminate backlash. Continue to rotate pen lifter to allow pens to rest against the chart. Allow instrument to stabilise to temperature and humidity of surroundings. If possible choose a place free from draughts, temperature gradients or source of variable humidity. Place a thermometer as near to bimetal temperature element as convenient and allow instrument to record for 15 minutes. Adjust to correct temperature by use of knurled headed screw A. Clockwise will raise the pen. Screw adjustment is enough to allow instrument to be altered at any time to fit charts within our standard range. It is not possible to alter the span of 50°C.

Measure relative humidity with whirling, sling or other aspirated hygrometer, do not use stationary or unaspirated types as error may be large. If humidity reading is not correct adjust screw B with a screwdriver through aperture in base cover. Clockwise will lower pen.

Daily/weekly spring driven clocks need to be wound each week and monthly clocks once a month. At intervals between 2 and 4 weeks measure relative humidity and check reading of instrument. At the same time check temperature. Readjust if necessary. For Quartz clocks generally follow the procedure outlined for the spring drive drum chart movement but when fitting the quartz movement drum ensure that when the internal gear of the drum meshes correctly with pinion the pen is aligned as closely as possible to the correct time. Final adjustment can be made by turning the drum as for the spring driven clock or for a more definite fine adjustment by rotating the white turn button located on the underside of the quartz movement.

The clock is started by operating the stop/start switch which is adjacent to the turn button under the quartz movement. Access to the turn button stop/start and battery compartment is through the rectangular cut-out in the instrument base cover.

Before switching on ensure that battery is fitted and that correct polarity is observed as indicated in the battery compartment.

MAINTENANCE

No routine service is required. Do not oil spindle pivots as this attracts dust which makes movement slow and causes inaccuracy. If the instrument is used in a dusty environment use a fin brush to remove the dust from hair and pivots. Do not wash hair with water except at long intervals or for special reasons. Wetting hair will upset calibration temporarily.

Clock should not require attention for approximately 2-4 years and does not need cleaning if it keeps good time, never stops unaccountably and has a normal sounding, regular tick. If timing needs altering regulator is under a swing plate under top lid CMA59. A competent clock repairer can clean and regulate the clock when necessary. Casella London can do the work if required. When clock is sent for cleaning or repairing spindle CMA37 should also be sent. Remove three screws in holes C which hold clock base to instrument and send it with the clock. Do not remove spindle from clock base. All clocks are now fitted for weekly or daily rotation using a pinion which is interchangeable between two shafts at the bottom of the clock. As supplied the pinion is positioned for weekly rotation. To change for daily rotation pull pinion from shaft marked 7 D and replace it firmly on shaft marked 1D.

QUARTZ CLOCK

The quartz clock should not require any attention apart from battery replacement which should be one a year. Quartz movements are not repairable. If the movement fails a replacement is available from Casella.

To fit a new quartz movement. Remove chart drum. Undo four screws E and remove thermohygrograph movement from base cover. Undo screwed bush N (Fig.1) and remove quartz clock movement. Remove pinion 03-100664A which is a tight push fit on the driving spindle and refit onto replacement movement. Replace the new movement/pinion assembly ensuring that rubber disc (supplied with movement CM415) is in place between the movement and mechanism base and that pinion hole locates on the support pin of part 03-100175A (Fig.1)

Reassemble thermohygrograph movement into base cover.

SERVICE

Original setting of temperature element will remain correct for a long period and would need attention only in the case of damage. Humidity element does not have such a long life and will need replacement. Interval depends on exposure and general care during use. Indication of need for replacement is when checks on accuracy show large errors or when re-adjustment is needed very frequently or erratic hysteresis errors are noticed. If a temperature check and a humidity check is felt necessary the temperature check must be carried out first.

TEMPERATURE CHECK

Two water baths are needed about twice as wide and twice as long as the thermohygrograph and able to contain between 8 to 10cms depth of water. Means of heating, controlling and measuring the after temperature to $\pm 1/2$ °C must be provided. Remove hair element. Remove clock. undo the four screws E and lift the movement from the base cover. Remove the clock base its spindle and pen. Fit a metal strip with a scale on it to correspond with chart scale.

Stand instrument in one bath so that the coil is totally immersed. Raise the bath temperature to 50°C about room temperature and adjust pen arm by loosening grub screw F and moving pen to read at the top division on the scale. Transfer to second bath at room temperature and read scale and water temperature. If water bath temperature difference is for example 50°C but pen arm has only registered a change of 48°C then fitting G should be moved one hole further round the coil. A one hole movement will change the span by about 2°. Fitting H and J must be tight, since effective length of bimetal is measured between edges of fittings not from hole centres. Repeat several times until best set of readings is obtained. Dry the instrument movement. Replace the clock base and its spindle. Fit new hair element ready for calibration as described in the next section. Replace the movement into the base cover and fit clock complete with chart. Fit new fibre tipped pens. Allow instrument to stabilise for about 15 minutes in a draught free room with no temperature gradient. Reset pen to correct reading on chart using screw A.

HUMIDITY

More equipment is needed in order to fit a new hair element, check and calibrate to its original accuracy. If this equipment is not available it may be more convenient to return the instrument to Casella.

Equipment required is an airtight box or cabinet with a glass door and internal volume about three times that of the instrument volume complete with means to circulate air inside as well as a means of altering humidity from about 20% to 90%. A small fan will stir the air whilst a dish containing a saturated salt solution will produce known humidities. The solutions listed in the following table will be found useful

TABLE

Salt	%R.H.at 20°C
MgCl ₂ .6H ₂ O	33
Mg(NO ₃).6H ₂ O	55
KNO ₃	93

To fit a new hair element. Undo four screws E and remove movement from base cover. Undo screw B to release hook and remove old element. Remove and clean all spindle pivot points. Replace but do not use lubricating oil, see that all pivots are free. Do not touch new hair element with fingers. Handle only by end clips. When hooking new element onto the instrument see that hairs are not twisted or individual hairs out of place. Now make the following preliminary settings:-

- 1 Set lever K to leave approximately 2mm protruding about the outside diameter of the pivot arbor
- 2 Set the hair lever arm L to leave approximately 8mm protruding below the outside diameter of its pivot arbor
- 3 Set pen to room humidity and place in cabinet

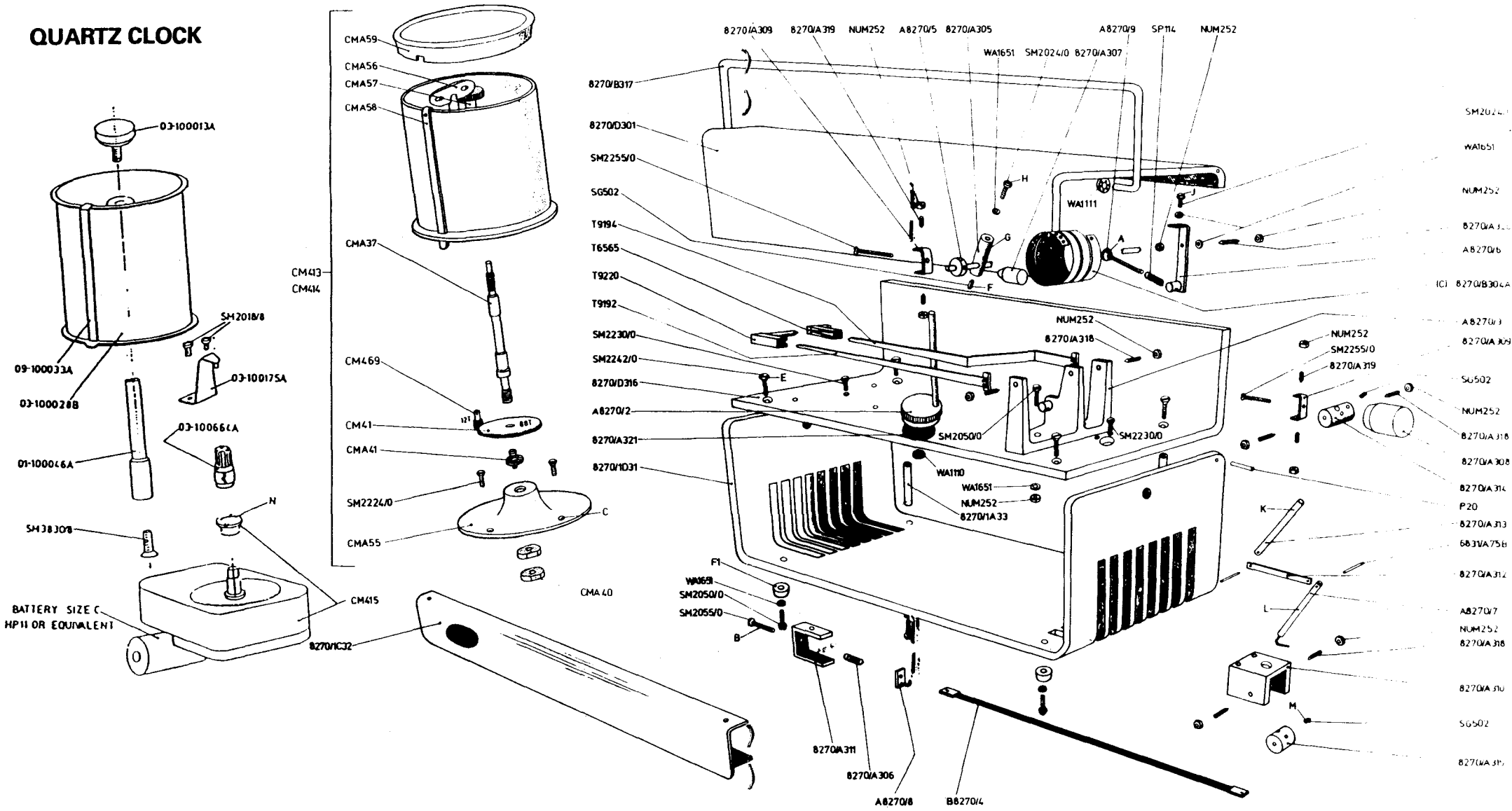
Raise cabinet to high level of R.H. 93% and read instrument say 95. Do not adjust but lower R.H. in cabinet to 33 and note instrument reading say 30. Subtract low from High 33 from 93 =60 and similarly the two instruments readings 30 from 35 = 65. To correct this alter the magnification by moving hair lever arm L. Loosen grub screw M move the lever arm towards the hair hook to reduce the magnification so that the pen reads lower by amount of the error, that is 5. Reset using screw B to room humidity and repeat. Carry on until satisfied. After a number of trails it should be possible to get within $\pm 3\%$ between 20% and 80% R.H.

ALTERATION WITHOUT NOTICE

This leaflet supersedes previous editions: the contents are subject to alteration without notice. As specifications and the design of instruments are under continual review the illustrations and descriptions should not be taken as being correct in every detail.

SPRING DRIVEN CLOCK

QUARTZ CLOCK



SPARE PARTS

When ordering from list below, quote catalogue reference number

T9190	Charts (State chart number) 200
M118004	Pen, short, black ink humidity
M119003	Pen, long, green ink for temperature
CM414	Clock daily weekly (Brass lacquered)
CM413	Clock monthly, (Brass lacquered)
8270/B302	Pen arm for temperature element
8270/B303	Pen arm for humidity element
B8270/4	Humidity element

When ordering from list below, prefix current part number with catalogue reference number

Part No.

CMA16	Escapement
CMA24	Main spring
CMA56	Key
CMA57	Knob
CMA58	Chart clip
A8270/2	Pen lifter
A8270/9	Hair adjustment bar
A8270/9	Bimetal adjustment screw
8270/B304A	Bimetal element °C
8270/A306	Hair adjustment sprint
8270/A309	Pen arm gate
8270/A318	Spindle pivot screw
8270/A319	Pen arm gate pivot screw
8270/A320	Pivot screw double ended
8270/A321	Felt washer. Pen lifter
6831/A75B	Link pin for humidity element
SP114	Spring, bimetal adjustment screw
F1	Foot

Accessories

HK2	Hexagon key
A7192	Correction for temperature table
HK208	Spaner double ended

SPARE PARTS (QUARTZ CLOCK)

When ordering from list below, prefix current part number with catalogue reference number.

Part No.

T6580	Quartz movement
03-100664A	Pinion assembly
09-100033A	Chart clip
08-100028B	Clock drum

Screws, nuts & washers (10 per pack)

SM2024/0	Bimetal to actuator arm Bimetal to adjustment arm
SM2050/0	Pivot support body to base Foot to base cover, spacer and front plate
SM2230/0	Hair adjustment bracket to base Hair pivot arm bracket to base
SM2242/0	Base to spacer and front plate Clock base to instrument base
SM2255/0	Counter weight to hair pen arm pivot arbor Counter weight to bimetal pivot arbor
SG502	Bimetal actuator arm to pivot arbor Pen lever arm to hair arm pivot Hair arm assembly to hair arm lower pivot
NUM252	Pivot support body to base Pivot screw to pivot support body Pivot screw to hair adjustment bracket Actuator arm to pivot screw double ended Clock base to instrument base Pivot screw double ended to pivot support body Pivot screw to pen arm gate
WA1651	Clock base to instrument base Foot to base cover, spacer and front plate Bimetal to actuator arm Bimetal adjustment arm spacer Pivot support body to base Bimetal to adjustment arm
WA1110	Pen arm lifter retaining clip