MODEL RTO FILLED SYSTEM TEMPERATURE RECORDERS, RPO PRESSURE RECORDERS & RECORDERS CONTROLLERS (ELECTRICAL CONTROL)

Instruction Manual

The chart drive and control system on this system may be operated from a mains voltage supply.
The mains must be switched off before any mechanical adjustments (other than of the set pointer) or carrying out any maintenance or fault finding procedures.
When making electrical adjustments observe the warning notes in the text.

Rototherm
instrumentation and control

SPECIFICATIONS

Accuracy +/- 1 % FSD.
Ambient -20°C to +50°C
Chart Drive Synchronous electric, battery or mechanical spring wound. 24 hour or 7 day. (Other rotations on request).
Inking System Disposable fibre tipped pens. Single pen: red. Two pen: red and blue. Three pen: red, blue and green
Case Glass filled polyester resin. Protection rated to IP55.
Window Acrylic.

Power Supply 200 to 250 volts, 50 Hz (60Hz available); 100 to 110 volts, 50 Hz (60Hz available). Instruments without electrical control require no power supply provided that a clockwork drive is fitted. Battery operated chart drives require 1.5 volt 'C' type cell.

Electrical Alarm and Control

Contact Rating (when fitted) 0.1A at 250v A.C. (non inductive) 0.01A at 250v D.C. (non inductive)
Relay contact rating: (when fitted) 10A at 250v 50Hz. 5A at 415v 50Hz.
Contact Adjustment Range 2% to 100%

Weight (approx.) Single pen: 6.5kg (14.25 lb) Two pen: 7 kg (15.5 lb) Three pen: 7.5 kg (16.75 lb) Portable single pen: 8.6 kg (19 lb) The above weight includes 3 metres (10 ft) of capillary. For each additional 3 metres add 0.25 kg (0.5 lb).

Mounting Suitable for surface or panel mounting. (Pipe mounting and portable options available)

For instruments fitted with Temperature Systems

Measuring Element Rototherm thermal bourdon tube temperature compensated.
Capillary Microbore stainless steel tube with 3mm diameter stainless steel cover (type C1) as standard, other capillaries are available.
Bulb and Stem Stainless Steel BS970 316 S16.
Fittings Compression gland (adjustable). stainless steel 8S970 316 (1/2" BSP is standard). Other BSP NPT API etc. are available on request. (Suitable for pressures up to 3.5 Bar).

For Instruments Fitted with Pressure Systems

Measuring Element Stainless Steel or Phosphor Bronze Bourdon tube or pressure capsule as applicable.

Connection

Standard 3/8" BSP male with nut and tail pipe suitable for 6.35mm (0.25") outside diameter tube or 3/8" inside diameter tube.
Portable 3/8" BSP male with nut and tail pipe suitable for 6.35mm (0.25") outside diameter tube or 3/8" inside diameter tube.
Receiver type 1/4" BSP female. input 3-15 p.s.i. (0.2 - 1 Bar)

INTRODUCTION

The RTO and RPO series of instruments are designed to measure, record and control process variables such as temperature, pressure and humidity. A maximum of three measuring systems can be provided in each instrument; a fluid expansion/gas expansion system is used for temperature recording, a wet and dry bulb system for humidity and a bourdon or diaphragm capsule for pressure measurement. The measured values are continuously recorded on a calibrated circular chart which is rotated at a constant speed by a mechanical or electrical clock. Control of the process variable is provided electrically.

Description of Operation

Temperature Recorder

As the temperature rises, the fluid in the thermometer bulb expands and partially uncoils the Bourdon tube fitted inside the instrument. This movement is transferred by a mechanical linkage to the pen arm which records the temperature on a calibrated chart.

Humidity Recorder - Wet and Dry Bulb

The relative humidity can be obtained from the temperatures measured by the wet and dry bulb thermometer using hygrometric or psychrometric tables.

Pressure Recorder

On medium and high pressure ranges an increase in pressure partially uncoils a Bourdon tube fitted inside the instrument. This movement is transferred by mechanical linkage to the pen arm which records the pressure on a calibrated chart.

A capsule stack is fitted for low pressure ranges and the expansion of the system resulting from an increase in pressure is transferred by a mechanical linkage to the pen arm.

For vacuum range a contraction of the capsule stack results from an increase in vacuum and this movement is transferred by a mechanical linkage to the pen arm.

Receipt of Recorder

The temperature recorder complete with a packet of charts, case keys and pen packs is dispatched in a protective casing which should be preferably replaced after inspection, as protection until the instrument is ready for installation.

The spare pen pack(s) are inside the protective case. The case keys are attached to the bottom right hand mounting stud.

When fitted the capillary tubing between the bulb and recorder is coiled for despatch purposes. Immediately prior to installation, this tubing must be uncoiled carefully in order to avoid twisting or kinking

To assist with inspection, a label attached on the inside face of the case door states the instrument serial number, chart number, ranges of each pen and the rotation speed of the chart drive. If the chart drive is electrical the supply voltage is stated.

Installation

Ideally the site chosen should be free from dust, corrosive fumes, vibration and extremes of temperature.
The instrument is suitably compensated against normal ambient temperature variations.

Mounting

The recorder may be surface or flush panel mounted.

For surface mounting, remove the screws holding the three brackets at the rear of the case, reverse and refit the brackets with their ends projecting from the edges of the case.
The bracket with the keyhole slot must remain at the top of the case.

Drill three holes in the mounting surface, of the size and at the centres given in Fig. 1. Fit a screw (max. major diameter 6.35mm(0.25 inch)) in the top hole.

Locate the instrument on this screw and fit two smaller screws through the remaining brackets.

For Flush Panel Mounting, make a panel cut-out to the dimensions given in Fig 1. Drill the holes and slot to the cut-out edge as shown. Remove the nuts and washers from the studs projecting from behind the case flange, pass the recorder through the cut-out and refit the washers and nuts to secure the instrument.

Access to Recorder

To open the instrument door press the plunger of the door lock and pull the door forward from the right. As the door is opened the pen lifter raises the pen (or pens) away from the chart. Remove the cotton thread that secures the pens to the pen lifter for transit purposes.

To make electrical connections and to set contacts, remove the chart plate by loosening the three retaining screws and carefully lift out the chart plate via the finger hole (care is necessary to avoid pen lifter interference with pens and control pointers). Pull the bottom edge clear of the instrument and lower the chart plate from behind.

Electrical Connection

Before making any electrical connections to the instrument switch off the mains supply to be connected.

All electrical connections are made to terminal blocks in the lower part of the case behind the chart plate.

Insert the leads through the cable glands in the underside of the case and make connections shown on the terminal labels or the wiring diagram supplied.

It is important to select the correct supply voltage connection. The live line should be switched and fused with a 2 Amp fuse. The mains supply should be earthed and connected at the appropriate terminal within the recorder.

Alarm systems should have an independent power supply to safeguard alarm operation in the event of mains failure.

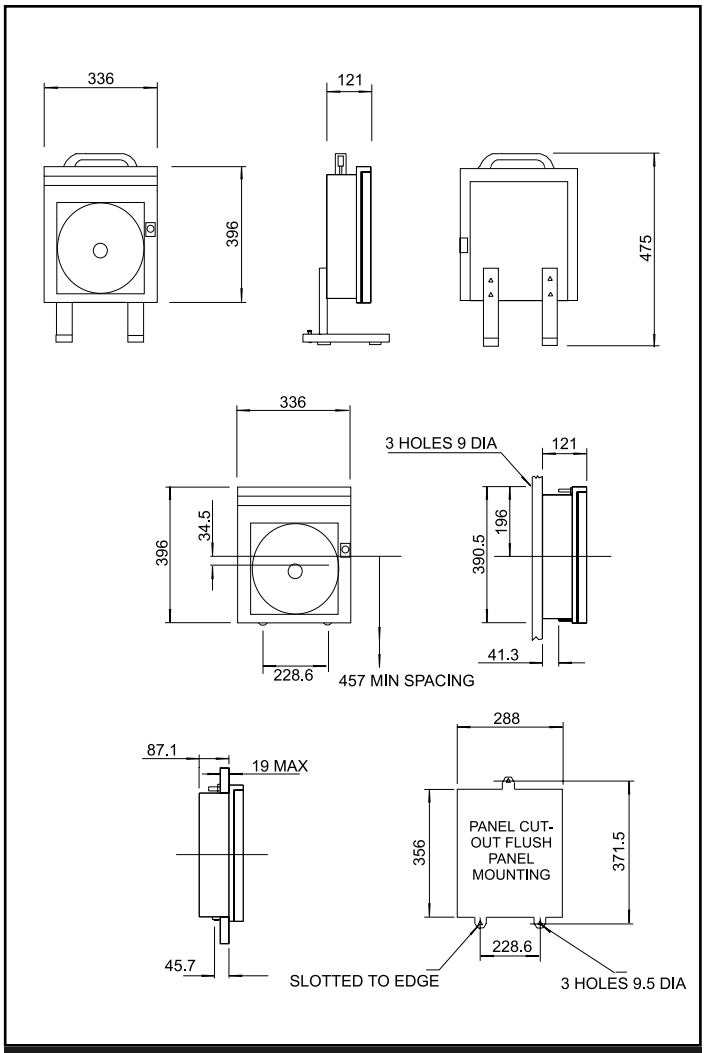

Fig. 1

all dimensions are in mm

ALARM SYSTEMS SHOULD HAVE AN INDEPENDANT POWER SUPPLY TO SAFEGUARD ALARM OPERATION IN THE EVENT OF A MAINS FAILURE

PROCESS CONNECTIONS

To avoid confusion on instruments with more than one measuring system, capillary connections to the instruments are - marked with the same colours as the inks used for the corresponding pens.

FOR INSTRUMENTS FITTED WITH TEMPERATURE SYSTEMS

Capillary Tubing

The tubing between the bulb and recorder should be routed so that it is not subjected to large temperature changes and should be supported in cleats. Bends must not be less than 25mm(1 inch) in radius and under no circumstances must the tubing be cut.

Where the tubing is likely to be exposed to an extreme corrosive atmosphere, the exterior should be treated with corrosion resistant paint.

LOCATION OF BULB (DETECTING ELEMENT)

Immersion Types

The instrument bulb should be located where it is subject to the true temperature of the measured medium. Temperature gradient within the medium must be allowed for, and with bulbs allowing variable depth of immersion (compression gland type), the bulb position should be varied experimentally until the optimum position is found.

The full length of the sensitive portion must at all time be immersed in the medium, but direct contact with the source of heat to the medium must be avoided.

When securing the bulb in its location, it should be prevented from twisting.

Where a pocket is supplied, this should be securely installed before the bulb is inserted. It may be that the thermal response of a pocketed bulb is improved by filling the intervening space with a medium such as oil.

Capillary Type Bulb

This type of bulb should be installed by means of its end brackets and to allow maximum circulation of air or gas around it, the coil should be extended to a length of 610mm (2ft) or such that the interval between the adjacent turns does not exceed 12.5mm (0.5 inch).

Any extension beyond this length may affect the zero reading at the recorder. The bulb must be kept free of moisture.

PROCESS CONNECTIONS - HUMIDITY MEASURING ELEMENTS (WET AND DRY BULBS)

Install the sensing elements (bulbs) where the humidity is to be measured as described for temperature measuring instruments.

The wet bulb (red pen system) is kept moist by a fabric covering, forming a wick which dips into a constant level water bath.

A distilled water supply tank should be connected to the inlet feed pipe with a head of between 1 and 6 metres.

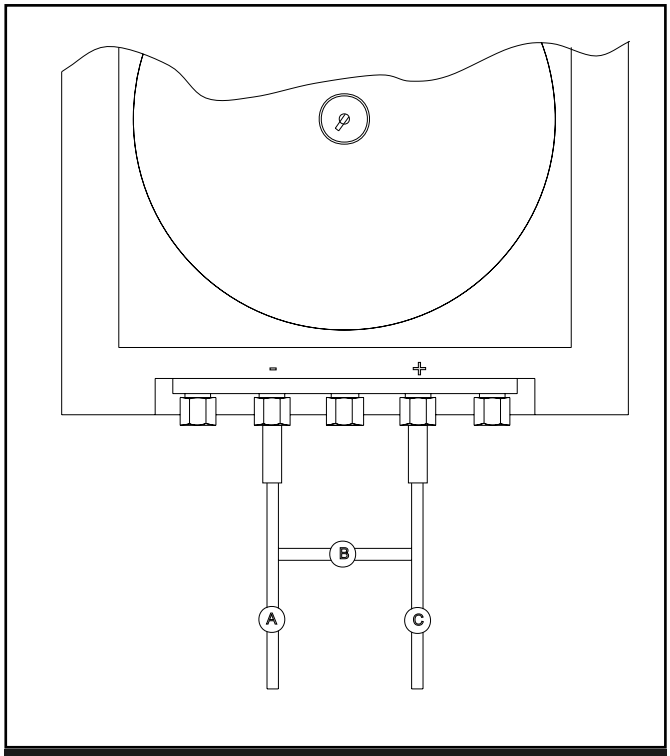

Fig. 2

PROCESS CONNECTIONS - FOR INSTRUMENTS FITTED WITH PRESSURE SYSTEMS

Use 0.25" (6.35mm) o.d. or 3/8"(9.5mm) bore solid drawn copper tubing that has been well annealed cleaned and pressure test before soldered into or over the tail pipe.

The solder joint and other joints in the pipeline must be secure and leak proof. The use of PTFE tape is recommended for all thread connections. Ensure that the sealing washer is in place when assembling the tail pipe to the instrument connector.

A suitable seal must be inserted in the system if the medium under pressure is liable to have a corrosive action on the pressure element.

Gauge and Absolute Pressure Controllers.

It is recommended that a needle valve be installed in the pressure line close to the instrument to enable pressures to be admitted gradually. It can also be used to damp out any pressure pulsations.

A second needle valve, situated between the damping valve a the controller, can be arranged to vent the instrument to enable the zero to be checked.
This valve must not be fitted where steam or corrosive gases or liquids are present.

Differential Pressure Controllers

There are two pipes to each differential pressure measuring unit. Connect the lower pressure to the (-) connector and the high pressure to the (+) connector. Three needle valves should be installed close to the controller, one isolating valve in each pressure line and one balancing valve as arranged in figure 2.

OPERATION

FITTING A CHART

For Recorders Fitted with an Electrical Chart Drive

Release the chart clamp as shown in figure 3. Fit the chart onto the spindle of the clamp and rotate the chart until the pen tip is on the correct time line. Lower the chart clamp and press it firmly to ensure that the locating pips pierce the chart.
Place the chart beneath the outer chart clips.

INKING SYSTEM

The writing system uses the fibre pen capsules.
A recess on the capsule fits onto the pen arm and the pen capsules are easily replaced when the ink is exhausted. To fit a capsule, pull the arm gently clear of its mountings, slide off the used capsule and replace it with a new one of the appropriate colour.

Where there are two or more measuring systems, different colour inks are used to distinguish the traces. The fibre tip is protected by a plastic cap, which should be removed by pulling in line with its length, gripping the end only and gently twisting.
Do not bend. The upper pen (red) has a long fibre Tip compared to the lower pen (blue) which has a short fibre tip.

On instruments fitted with a third measuring system, the third pen (green) has the longest fibre tip.

All recorders and recorder controllers are fitted with disposable fibre tipped pens. These pens slide onto the pen arms.
The recorder pen arm is removable from the pen mechanism see fig. 4. It is advisable to remove the pen arm from the mechanism of recorders when fitting new pens because of the possibility of undue forces being applied to the mechanism thus causing a possible error shift.

Recorder controller pen arms are fixed to the mechanism and must remain in situ when changing pens.

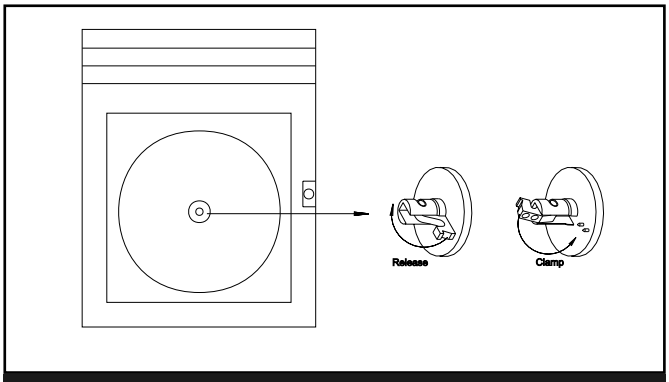

Fig. 3

SET POINT ADJUSTMENT (Fig. 5)

For instruments fitted for Temperature Systems

Disconnect Mains Power Supply

For low alarm set point slacken the lock nut securing the low contact adjustment screw and screw the adjustment until the moving contact just makes contact with the low contact at the point required, the set point. Re-tighten the lock nut.

For high alarm set point, slacken the lock nut, securing the high contact adjustment screw and screw the adjustment until the moving contact just makes contact with the low contact at the point required, the set point. Re-tighten the lock nut.

Note: For the low alarm, unscrewing the adjustment reduces the set point and for the high alarm, unscrewing the adjustment increases the set point

ZERO ADJUSTMENT (TEMPERATURE)

Note: After making any zero adjustments to instruments fitted with control or alarm contacts the set point operating point must be checked and adjusted as described in the section.
Zero Adjustment - temperature recorders and wet and dry bulb humidity instruments see Fig 6.
All instruments are calibrated against reference standards before despatch but should be checked in case of slight disturbance during transit. Immerse a standard thermometer with a bulb and check the readings. If adjustment is necessary open the door and rotate the small knurled nut in Fig 6. to bring the pen to the correct reading.

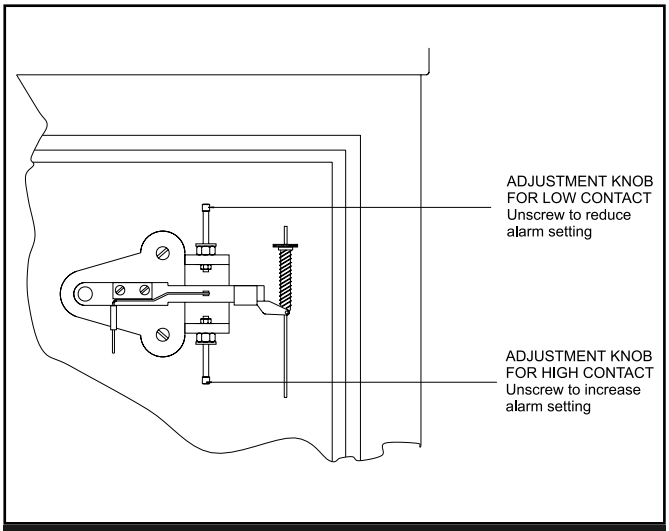

Fig. 5. Alarm Contact Adjustment

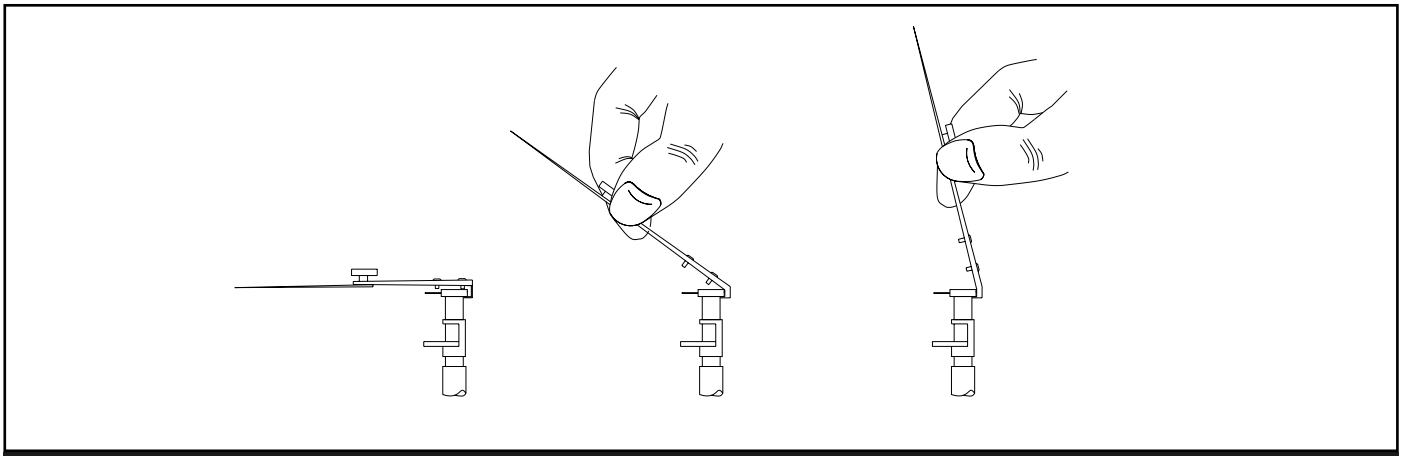

Fig. 4 Pen Arm / Ink Cartridge Fitting / Removal

SET POINT ADJUSTMENT

For instruments fitted with Pressure Systems

Disconnect Mains Power Supply

For low alarm set point slacken the lock nut securing the low contact adjustment screw and screw the adjustment until the moving contact just makes contact with the low contact at the point required, the set point. Re-tighten the lock nut.

For high alarm set point, slacken the lock nut, securing the high contact adjustment screw and screw the adjustment until the moving contact just makes contact with the low contact at the point required, the set point. Re-tighten the lock nut.

Note: For the low alarm, unscrewing the adjustment reduces the set point and For the high alarm, unscrewing the adjustment increases the set point

ZERO ADJUSTMENT (Fig. 6)

Gauge Pressure

Vent the recorder to the atmosphere and check the reading of the pen on the chart. If the pen does not read zero, adjust by means of the zero nut (4 or 12).

Absolute Pressure

If the range covers atmospheric pressure, the accuracy can be checked by venting the instrument to the atmosphere and checking the reading against an accurate barometer.

If the range does not cover atmospheric pressure, a pressure within this instrument range, measured against a standard pressure gauge should be applied to the instrument.
Any adjustment is made by the zero nut (4 or 12).

Differential Pressure (Flg. 2)

To obtain a zero reading, open balance valve B and close isolating valves A and C.

START-UP CHECK

Before putting the recorder into operation make the following checks to ascertain that it is correctly installed and operational.

1. The pen(s) operate freely, write clearly on the chart and pass each other without touching.
2. Measuring elements are correctly installed.
3. Measuring elements are indicating correctly.
   If not, refer to zero adjustment.
4. Ensure that, in case of instruments with mechanical clocks, the clock is running and that the correct electrical connections have been made in instruments fitted with electrical clocks.
5. Fit a new chart with its edge under the guide clips, set it to the correct time line and clamp the centre fixing device

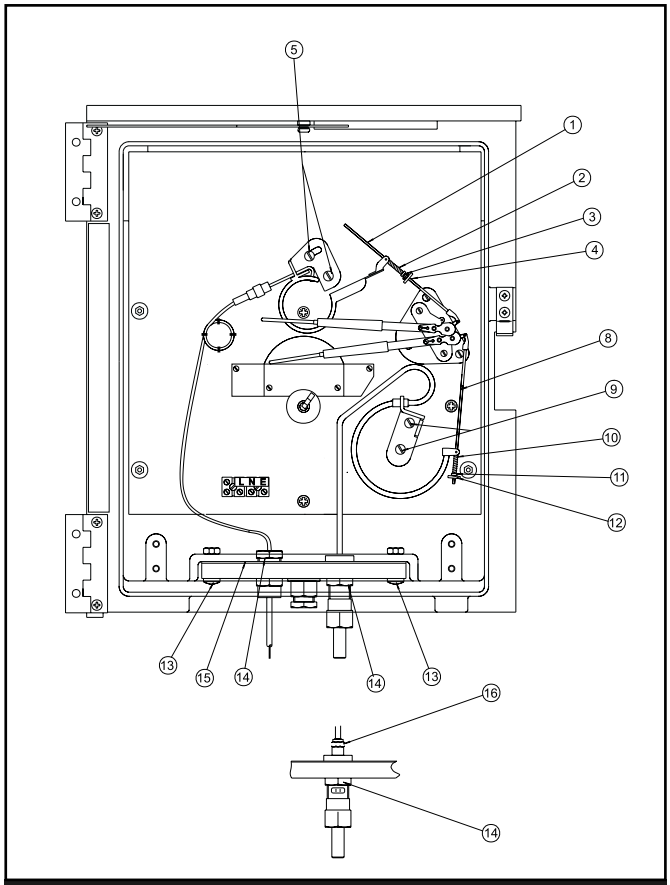

Fig. 5. Alarm Contact Adjustment

CONTACT DIFFERENTIAL ADJUSTMENT FOR TEMPERATURE AND PRESSURE RECORDERS

The procedure in the following paragraphs are for single pen or dual pen instruments.
Refer to figure 7 for mechanism detail.

With the chart plate removed, cut a segment of chart and place on the chart clarnp. Set the desired value pointer (1 or 2) to the required value by means of the setting knob (3 or 4).
Move the actual value pen (5 or 6) until it just makes contact with the switch arm (7).

Move the actual value pen (5 or 6) to the required deviation above the desired value pointer (1 or 2) and adjust the high contact (9 or 10) until it just makes contact with the switch arm (7).

Low contact is set by moving the actual value pen (5 or 6) to the required deviation below the desired value pointer (1 or 2) and adjusting the low contact screw (8 or 11) until it just makes contact with the switch arm (7).

Warning

Before adjusting the Contact Differential with the insulated spanner provided, ensure that the mains supply is isolated and use a continuity tester to establish switching points.

START-UP PROCEDURE

Be sure that all steps in the start-up check have been completed.

1. Switch on the mains supply to the recorder.
2. Adjust set point on desired alarm/control value (if applicable).
3. Switch on mains supply to external electric alarm/control systems (if applicable).

CALIBRATION

Three adjustments are provided for calibration purposes:-

"Zero Adjustment" - to correct the lowest reading

"Range Adjustment" - to correct highest reading

"Scale Form Adjustment" - to correct midpoint reading

FOR INSTRUMENTS FITTED WITH TEMPERATURE SYSTEMS

Warning

Unless the range is such that the same liquid can be used in all baths the bulb should be wiped dry when transferring from one bath to another.

This is particularly important when a "wide span" range; for example 0 to 450°C, where the "low point" bath would hold water and the "high point" bath fusible salts. In such a case, it is dangerous to insert a bulb wet with water into the salts bath.

Note

In transferring from one temperature to another there will be a short time lag before the bulb reaches the bath temperature. This will vary according to the range. Also, transferring a "cold" bulb to a hot bath will affect the temperature of the bath liquid until the thermostat has corrected for this.

Therefore, always check the bath temperature against a certified test thermometer before taking a reading of the pen position and making adjustments. This also applies when taking an Ice point or that of the boiling water in baths not thermostatically controlled.

Ice Point

The bulb should be immersed in a bath of clean crushed ice with a large percentage of free water. The ice must not contain any salt or other contaminant and the bulb should be cleaned before immersion. It is good practice to check the temperature with a mercury-in-glass thermometer.

Boiling Point of Water

The boiling point of water varies with the barometric pressure and a mercury-in-glass thermometer should be used to check the actual temperature of the bath.

The bulb must not be allowed to come into contact with the heating source.

FOR INSTRUMENTS FITTED WITH TEMPERATURE SYSTEMS

In the following paragraphs, the operation numbers refer to Fig 8.

1. Adjust zero nut (4 or 14) until the range adjustment screw (5 or 6) is at right angles to the screwed link (7 or 8).

   Ease the pen arm boss (12) from the pen arm spindle taper and set the pen to the centre line of the chart.

   Press the boss firmly on the taper when positioned. When making this adjustment, do not turn the pen arm boss on its taper except against the slightest friction, or the pen arm retaining prongs will be bent.

2. Immerse the bulb in the low temperature bath, allow sufficient time for the bulb to attain the bath temperature and adjust the zero nut (4 or 14) until the pen arm registers the temperature shown on the test thermometer.

3. Transfer the bulb to the high temperature bath, allow sufficient time for the bulb to attain the bath temperature and note the position of the pen.

4. If the pen rests below the correct line, halve the error by adjusting the ranging screw (5 or 6) anticlockwise. If the pen rests above the line, adjust the ranging screw (6) clockwise to bring the pen to the top of the chart.

5. Return the bulb to the low temperature bath and adjust the zero nut (4 or 14) to bring the pen to the correct line.

6. Check the top point and if still in error, repeat steps 4 and 5 until the bottom points are correct.

7. Transfer the bulb to the midpoint bath. If the pen reads correctly, the instrument can be put into service. If there is an error note its magnitude and proceed to step 8.

8. Ease the pen arm boss (12) from the spindle taper and set the pen approximately 8 times the value of of the error on the opposite side of the mid-chart line.
   Press the boss firmly on the taper.
   This adjustment is not possible on instruments fitted with differential contact mechanisms as the pen boss is factory set.

9. Return the bulb to the low temperature bath and adjust the zero nut (4 or 14) to bring the pen to the correct value on the scale.

10. Transfer the bulb to the midpoint bath. If not correct, repeat step 8 (the multiple of 8 is a value, which in most cases, will correct the midpoint error). However it may be varied according to the results obtained.

11. Test the high temperature and if necessary, repeat steps 4, 5 and 8.

12. When all points are correct, remove the pen arm as Fig. 4, position a centre punch in the hole in the centre of the pen arm boss (12) and with a 4 ounce hammer **lightly applied**, fix the boss on the spindle spear.

13. Replace the pen arm and return the instrument to service.

FOR INSTRUMENTS FITTED WITH TEMPERATURE SYSTEMS

In the following paragraphs, the operation numbers refer to Fig 8.

1. Adjust zero nut (4 or 14) until the range adjustment screw (5 or 6) is at right angles to the screwed link (7 or 8). Ease the pen arm boss (12) from the pen arm spindle taper and set the pen to the centre line of the chart. Press the boss firmly on the taper when positioned. When making this adjustment, do not turn the pen arm boss on its taper except against the slightest friction, or the pen arm retaining prongs will be bent.

2. With no pressure on the element, adjust the zero nut until the pen registers zero on the chart.

3. Apply top range pressure to the element and note the position of the pen. This may be short of the point.

4. If the pen rests below the correct line, halve the error by adjusting the ranging screws (5 or 6) anticlockwise.

   If the pen rests above the line, adjust the ranging screw (6) clockwise to bring the pen to the top of the chart.

5. Open the connection to atmosphere and adjust the zero nut (4 or 14) to bring the pen to zero on the chart.

6. Check the top point as step 3 and if still in error, repeat steps 4 and 5 until the bottom points are correct.

7. Apply mid range pressure to the elements. If the pen reads correctly, the instrument can be put into service. If there is an error note its magnitude and proceed to step 8.

8. Ease the pen arm boss (12) from the spindle taper and set the pen approximately 8 times the value of the error on the opposite side of the mid-chart line.
   Press the boss firmly on the taper.
   This adjustment is not possible on instruments fitted with differential contact mechanisms as the pen boss is factory set.

9. Open the connection to atmosphere and adjust the zero-nut (4 or14) to bring the pen to zero on the chart.

10. Apply midpoint pressure to the element. If not correct, repeat step 8 (the multiple of 8 is a value, which in most cases, will correct midpoint error. However, it may be varied according to the results obtained).

11. Test the top point as step 3, and if necessary repeat from step 4 to step 6.

12. When all points are correct, remove the pen arm as Fig 4, position a centre punch in the hole in the centre of the pen arm boss (12) and with a 4 ounce hammer, **lightly applied**, fix the boss on the spindle spear.

13. Replace the pen arm and return the instrument to service.

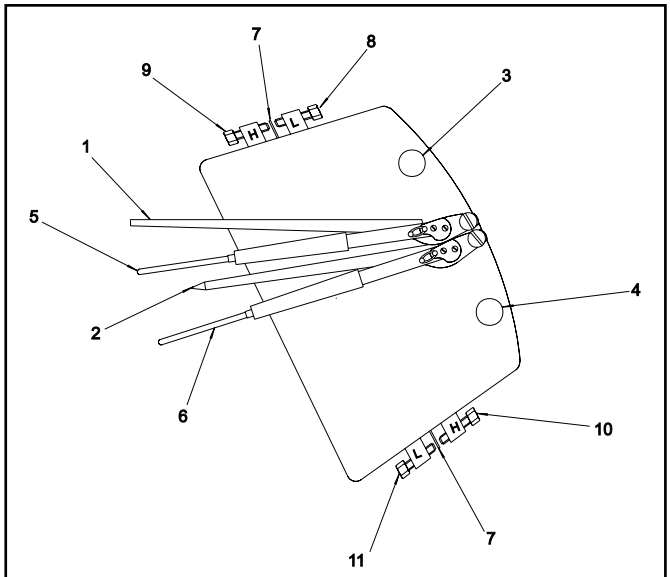

Fig. 7

INSTRUMENT COMPENSATION

The recorder is fully compensated for changes in ambient temperature.

The linkage between the Bourdon tube element and pen mechanism incorporates bimetallic washers which expand or contract for increase and decrease of ambient temperature.

OVERLOAD PROTECTION SPRING

To protect the pen mechanism in the event that the measured variable goes significantly outside the span of the instrument, the connecting link(s) incorporate "overload" springs.
The overload spring is used if the measured variable is likely to go significantly above the maximum chart reading. Under these conditions the movement of the Bourdon tube drives into the spring allowing the pen mechanism to rest against the top point stop. Under normal operation where the pen records within the instrument range the spring is fully extended.

INSTRUMENT COMPENSATION

General

- Keep the instrument clean and treat with care.
- Where there is a risk of corrosion, the bulb should be inspected periodically.
- If corrosion is evident, it should be removed, if possible by non-abrasive treatment.
- Any contamination on the bulb should be removed.

Caution

Before removing the bulb or pocket, ensure that the plant is shut down and the bulb is not under any pressure.

Zero Adjustment (For temperature Systems)

If a careful check against a known and steady temperature shows the pen reading to be in error this can be corrected by means of the zero nut (4 or 12) shown in Fig 6.

Other Adjustments

If the zero error found above is large, the top value of the range should be checked after the zero error has been corrected. A small error in the span can be corrected by adjusting the ranging screw (6) clockwise to shorten the range or anticlockwise to lengthen the range. If the error is large, the measuring element is suspect and should be renewed.

MAINTENANCE

REPLACING A FILLED SYSTEM

Removal of a faulty system (Fig 6)

1. If an electronic clock is fitted, switch off and disconnect the mains supply.

2. Remove the bulb from its location and remove the instrument to a clean work bench.

3. Open the recorder door and remove the pen(s) and chart plate.

4. If the lower system of a duplex instrument is faulty, unscrew the zero nut (12) and remove compensation washers (11) from the link (8), noting the number and arrangement. (these items will be required for the new systems). Remove the two Bourdon securing screws (9) and slide the Bourdon, including overload spring assembly (10) off the screwed link (8).

5. If the upper system is faulty remove the two Bourdon securing screws (5) and slide the Bourdon, including overload spring assembly (2) off the screwed link (1). Leave the zero adjustment nut (4) and compensation washers (3) on the link (these will be required for the new system).

6. Slacken the lock nut on the system adaptor (14) and remove the outlet plate securing screws (13), draw the outlet plate away from the case, taking care not to damage the second system of a duplex instrument.

7. Unscrew the lock nut (14) and remove the system from the outlet plate, passing the capillary through the slot. Pass the Bourdon through the case aperture and the gasket (15).

REPLACING A PRESSURE SYSTEM

Removal of a Faulty System.

1. If an electric clock is fitted, switch off and disconnect the mains supply.

2. Disconnect the pressure input and remove the recorder to a clean workbench.

3. Open the recorder door and remove the chart plate.
If the upper system is a Bourdon, unscrew adaptor lock nut (14) and carefully remove adaptor from outlet plate. If the system is a diaphragm assembly, unscrew 1/8" BSP nut from adaptor on the outlet plate (16).

4. For lower systems, unscrew zero nut (12), remove the securing screws (9) and slide the pressure element, including overloading spring assembly (10), off the screwed link (8).

5. For upper systems, remove the two screws (5) and slide the pressure element including overload spring assembly (2) off the screwed link (1).

FITTING A NEW SYSTEM

1. Slide the overload spring assembly on the pressure element over the screwed link and secure the element with two screws.

   If a lower system, screw the zero nut (12) on to the screwed link.

2. If a Bourdon system, insert the adaptor into the outlet plate and secure with the lock nut (14). If a diaphragm unit, connect the nut and nipple (16) to the adaptor on the outlet plate.

3. Cut a segment of the recorder chart and with suitable rigid backing clamp in position ready for calibration. Support the case in a vertical position.

4. Connect suitable pressure test equipment to the input connector.

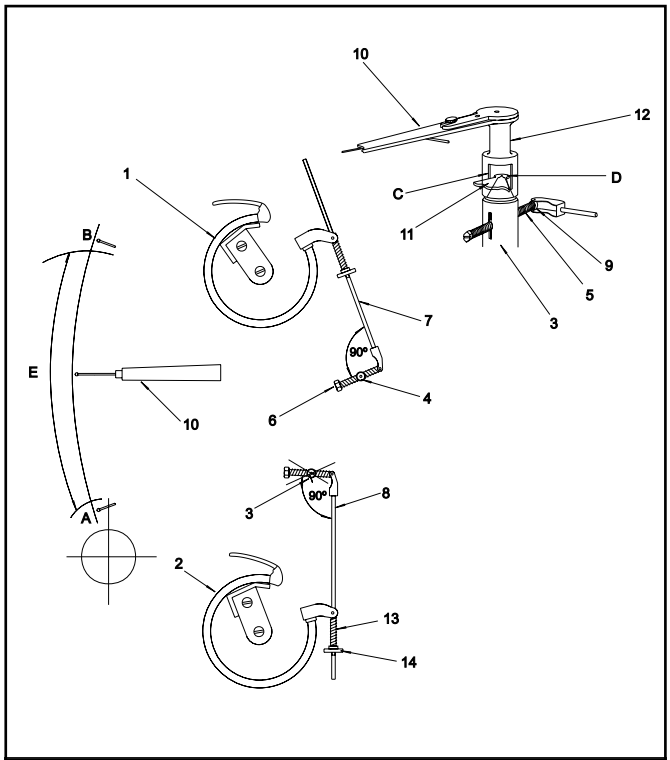

Fig. 8

FAULT FINDING

Recorder pen inaccurate or gives no indication

Probable Cause Measuring element broken; capillary plugged or broken
Action Check element / capillary; replace system if necessary

Probable Cause Damaged linkage in recorder
Action Repair and re-connect if possible; replace linkage if necessary

Probable Cause Recorder out of calibration, measuring element damaged
Action Set-up and recalibrate

Probable Cause Pen boss disengaged from mechanism spindle
Action Refer to calibration & Fig 8

No record or poor trace on chart

Probable Cause Pen not inking
Action Fit new capsule

Probable Cause Pen tension insufficient
Action Re-tension pen arm

Probable Cause Pen trace unsatisfactory
Action Re-tension pen arm; replace ink capsule

Chart not rotating (mechanical clock)

Probable Cause Clock unwound
Action Rewind, replace if broken (refer to spares page)

Probable Cause Clock over-wound
Action Replace clock

Chart not rotating (electric clock)

Probable Cause Mains supply disconnected
Action Connect mains supply to instrument

Probable Cause Chart not secured in chart clamp assembly
Action Fit new chart and secure

Probable Cause Chart not secured in chart clamp assembly
Action Tighten Clamp

Probable Cause Chart clamp assembly loose
Action Re-tighten chart clamp assembly; replace if broken (refer to spares page)

AFTER CARRYING OUT THE FAULT FINDING, THE PROBLEM IS STILL EVIDENT, CONTACT BRITISH ROTOTHERM OR YOUR LOCAL AUTHORISED BRITISH ROTOTHERM DISTRIBUTOR FOR SPARES INFORMATION AND TECHNICAL SUPPORT AND ADVICE

SPARES LIST

Note
For replacement of measuring systems the instrument serial number must be supplied and in the case of instruments which have more than one measuring system, the position of the system.

Measuring system		Quote instrument serial number for replacement
Chart		Quote number on chart supplied or range and rotation
Pen Arm (red)		23985-11
Pen Arm (blue)		23984-11
Pen Arm (green)		23985-11
Pen Pack (red)		PK2
Pen Pack (blue)		PK1
Pen Pack (green)		PK4
Chart Clamp Assembly		28279-04 (for instruments fitted with an electrical clock)
Link Assembly (100mm) (inc. zero nut)		19152-04
Link Assembly (150mm) (inc. zero nut)		19153-04
Overload Spring Assembly		18916-04
Recorder Case & Door Assembly		25524-04
Door Lock & Keys (2)		24834-11
Door Window		16622-51
Cable Gland (Nylon)		16381-11
Terminal Block (12 way)		16378-11
Platinum Contact Assembly		19904-04
10 Amp Relay (11 Pin)		
	24V	27494-11
	240V	24979-11
	110V	23951-11
Electric Clock		Quote RTO chart speed, voltage & frequency
Battery Chart Drive 24 Hour Rotation		27190-11
Battery Chart Drive 7 Day Rotation		27173-11
Battery Chart Drive Chart Mount		29804-52
Mechanical / Battery Chart Drive Chart Knob		17404-52
Mechanical Chart Drive Chart Mount		17405-52
Mechanical Chart Drive 1 hour		28938-11
Mechanical Chart Drive 8 hour		28762-11
Mechanical Chart Drive 12 hour		24062-11
Mechanical Chart Drive 24 hour		24063-11
Mechanical Chart Drive 7 day		24065-11
Mechanical Chart Drive 28 day		28731-11
Mechanical Chart Drive 24 hour / 7 day		28937-11
Bimetal Compensation Washer Normal		24773-51
Bimetal Compensation Washer Reverse		29168-51
6" Wick wet & Dry Bulb System		100016

For instruments fitted with Pressure Systems

3/8 inch BSP Gland Nut Brass	16692-51
3/8 inch BSP Gland Nut St/Steel	17599-51
3/8 inch BSP Tail piece Brass	16992-51
3/8 inch BSP Tail piece St/Steel	17600-51
3/8 inch BSP Fibre Washer 16695-11	16695-11

THE LIST CONTAINS PARTS CONSIDERED NECESSARY UNDER NORMAL SERVICING CONDITIONS. FOR INFORMATION CONCERNING FURTHER SPARES PLEASE CONTACT THE MANUFACTURER

ISO 9001
Certificate No. FM11958

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instrumentation and control