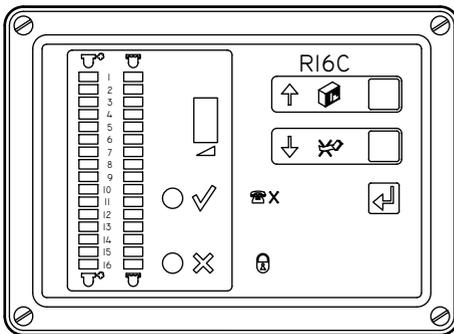


Spiratec R16C
Automatic Steam Trap Monitor

Installation, Commissioning and Fault Finding Instructions



1. Safety information
2. General product information
3. Installation
4. Commissioning
5. Remote facilities
6. Maintenance
7. Fault finding

1. Safety information

Safe operation of this product can only be guaranteed if it is properly installed, commissioned, used and maintained by qualified personnel (see Section 1.11) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

In the UK, your attention is drawn to IEE Regulations (BS 7671). Elsewhere, other regulations will normally apply.

All wiring materials and methods shall comply with relevant EN and IEC standards where applicable.

Warning

This product is designed and constructed to withstand the forces encountered during normal use. Use of the product other than as an automatic steam trap monitor, or failure to install the product in accordance with these Instructions, product modifications or repair could:

- Cause damage to the product/property.
- Cause injury or fatality to personnel.
- Invalidate the  marking.

Isolate the mains supply before opening the product as hazardous voltages may be exposed.

These instructions must be stored in a safe place near the installation of the steam flow computer at all times.

Warning

This product complies with Electromagnetic Compatibility Directive 2004/108/EC and all its requirements.

This product is suitable for Class A Environments (e.g. industrial). A fully detailed EMC assessment has been made and has the reference number STM R16C 2009.

The product may be exposed to interference above the limits of Heavy Industrial Immunity if:

- The product or its wiring is located near a radio transmitter.
- Excessive electrical noise occurs on the mains supply. Power line protectors (ac) should be installed if mains supply noise is likely. Protectors can combine filtering, suppression, surge and spike arrestors.
- Cellular telephones and mobile radios may cause interference if used within approximately 1 metre (39") of the product or its wiring. The actual separation distance necessary will vary according to the surroundings of the installation and the power of the transmitter.

This product complies with Low Voltage Directive 2006/95/EC by meeting the standards of:

- EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use.

Static precautions (ESD)

Static precautions must be observed at all times to avoid damage to the product.

1.1 Intended use

- i) Check that the product is suitable for use with the intended fluid.
- ii) Check material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous overpressure or overtemperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.
- iii) Determine the correct installation situation and direction of fluid flow.
- iv) Spirax Sarco products are not intended to withstand external stresses that may be induced by any system to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimise them.
- v) Remove protection covers from all connections and protective film from all name-plates, where appropriate, before installation on steam or other high temperature applications.

1.2 Access

Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required.

1.3 Lighting

Ensure adequate lighting, particularly where detailed or intricate work is required.

1.4 Hazardous liquids or gases in the pipeline

Consider what is in the pipeline or what may have been in the pipeline at some previous time. Consider: flammable materials, substances hazardous to health, extremes of temperature.

1.5 Hazardous environment around the product

Consider: explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

1.6 The system

Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk?

Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

1.7 Pressure systems

Ensure that any pressure is isolated and safely vented to atmospheric pressure. Consider double isolation (double block and bleed) and the locking or labelling of closed valves. Do not assume that the system has depressurised even when the pressure gauge indicates zero.

1.8 Temperature

Allow time for temperature to normalise after isolation to avoid danger of burns.

1.9 Tools and consumables

Before starting work ensure that you have suitable tools and/or consumables available. Use only genuine Spirax Sarco replacement parts.

1.10 Protective clothing

Consider whether you and/or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high/low temperature, radiation, noise, falling objects, and dangers to eyes and face.

1.11 Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions.

Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety.

Post 'warning notices' if necessary.

1.12 Handling

Manual handling of large and/or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

1.13 Residual hazards

In normal use the external surface of the product may be very hot.

Many products are not self-draining. Take due care when dismantling or removing the product from an installation.

1.14 Freezing

Provision must be made to protect products which are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

1.15 Disposal

Unless otherwise stated in the Installation and Maintenance Instructions, with the exception of the battery, this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

1.16 Returning products

Customers and stockists are reminded that under EC Health, Safety and Environment Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

— 2. General product information —

2.1 General description

The Spirax Sarco Spiratec R16C automatic steam trap monitor consists of two main parts; the sensor chamber with sensor assembly (or steam trap with integral sensor) and the R16C monitor.

The R16C can detect traps leaking steam and traps that have failed shut causing condensate to back-up. To detect steam leaks, a standard SS1 sensor is installed in a sensor chamber or steam trap. To detect steam leaks and waterlogging, a WLS1 waterlogging sensor assembly is used. Passing or failing traps are shown clearly on the R16C front panel.

Important note:

This manual contains information relevant to the installation, commissioning and fault finding. It should only be made available to maintenance personnel qualified to work with hazardous voltages. For general operation refer to the Operators Instructions.

2.2 Product application

The R16C automatic steam trap monitor constantly measures the conditions in the steam lines through the Spiratec sensors adjacent to steam traps.

If a steam trap is operating correctly, hot condensate will cover the sensor that is installed either in the sensor chamber or the steam trap. In the case of steam leakage (i.e. the trap has failed open), then steam will blast through the line exposing the sensor to live steam. The R16C monitor measures the resistance at the sensor, detecting whether the sensor is submerged in condensate or surrounded by steam. In this way the R16C monitor determines if a trap is operating correctly or failing.

The combined steam leak and waterlog sensors monitor steam leakage in the same way as above, but also have an in-built temperature sensor. In the case of the trap failing closed, the condensate surrounding the sensor will start to cool. The R16C monitor detects the lower temperature and shows a fail signal.

The R16C is supplied with steam leak and waterlog default values set and ready for operation. The default values are specified clearly in Section 2.4. Normally it will not be necessary to alter any of the R16C settings after installation. The changes which may be required after installation are the setting of the steam leak and waterlog levels via the keypad (see Section 4, Commissioning for full details).

2.3 Technical data

Supply voltage	100 to 240 Vac	
Supply frequency	50 to 60 Hz	
Supply current consumption	50 mA	
	Operating temperature range	0°C to 50°C
Environmental limits	Maximum operating relative humidity	80% up to 31°C decreasing linearly to 34% at 50°C
	Maximum altitude	2 000 m above sea level
	Maximum voltage	24 Vac/dc
Relay rating	Maximum current	0.5 A
	Maximum power	10 W
Enclosure rating	IP65 with correct cable glands (wall mounting unit only)	
Electrical connections	Screw terminals	

2.4 Threshold levels

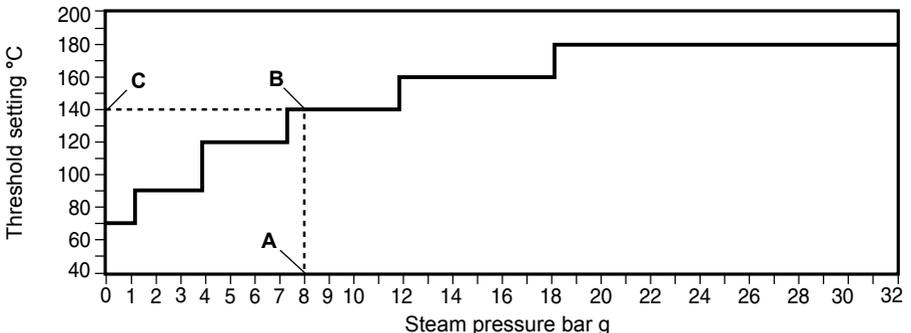
2.4.1 R16C automatic steam trap monitor steam leak and waterlog threshold levels

Note: The R16C monitor is set with the default levels shown when despatched from the factory.

Micro Siemens	Steam leak thresholds (kilo ohms)	Value displayed on R16C
Off	Off	0
21.3 μ S	47 k	1
10.0 μ S	100 k	2
4.5 μ S	220 k - Default level	3 - Default level
2.1 μ S	470 k	4
1.6 μ S	620 k	5
1.3 μ S	750 k	6
1.1 μ S	910 k	7

Waterlog thresholds $^{\circ}$ C	Value displayed on R16C
Off - Default level	0 - Default level
50	1
70	2
90	3
120	4
140	5
160	6
180	7

2.4.2 Float and bucket trap waterlog threshold setting



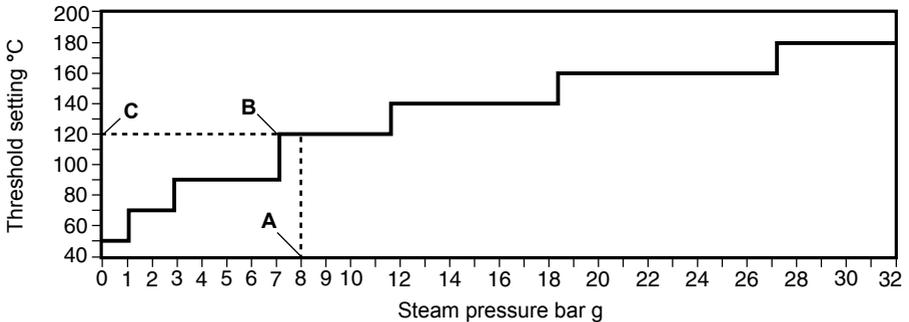
Example:

At 8 bar g a float or bucket trap will have a threshold of 140 $^{\circ}$ C.

Method:

1. Draw a vertical line from the 8 bar g point (A) on the steam pressure axis.
2. Where the vertical line crosses the waterlog threshold characteristic (B) draw a horizontal line.
3. Where the horizontal line crosses the threshold setting axis (C) the waterlog temperature setting can be used to set-up the R16C.

2.4.3 Thermodynamic and balanced pressure trap waterlog threshold setting



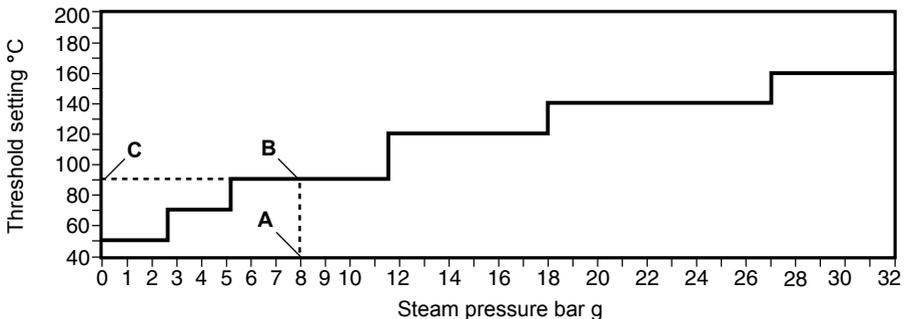
Example:

At 8 bar g a thermodynamic or Balanced pressure trap will have a threshold of 120°C.

Method:

1. Draw a vertical line from the 8 bar g point (A) on the steam pressure axis.
2. Where the vertical line crosses the waterlog threshold characteristic (B) draw a horizontal line.
3. Where the horizontal line crosses the threshold setting axis (C) the waterlog temperature setting can be used to set-up the R16C.

2.4.4 Bimetallic trap waterlog threshold setting



Example:

At 8 bar g a Bimetallic trap will have a threshold of 90°C.

Method:

1. Draw a vertical line from the 8 bar g point (A) on the steam pressure axis.
2. Where the vertical line crosses the waterlog threshold characteristic (B) draw a horizontal line.
3. Where the horizontal line crosses the threshold setting axis (C) the waterlog temperature setting can be used to set-up the R16C.

3. Installation

3.1 Mechanical installation

The mechanical installation is covered in two parts, the sensor chamber (Section 3.1.1) and the R16C monitor (Section 3.1.2).

If the R16C is to be installed in a harsh environment (conductive dust and/or wet conditions), extra protection is required.

During installation or maintenance, the rear of the product must be protected from environmental pollutants entering the product. Alternatively, the tasks can be performed in a dry clean environment.

3.1.1 Sensor chamber - installation

Spiratec sensor chambers are available with screwed, pipe socket weld or flanged connections. In all cases, installation should be as shown below. Specific installation instructions are given with each type of sensor chamber.

Sensor chambers are supplied with an SS1 Spiratec sensor already installed for steam leak only applications. For applications where the waterlogging facility is required, sensor chambers are available without a sensor and a WLS1 waterlogging sensor assembly must be fitted after installing the sensor chamber in the line.

The sensor chamber should be installed immediately upstream of the trap in a horizontal position, with the direction of flow according to the arrow on the body.

Where a steam trap with integral sensor is to be used, a separate sensor chamber is not required. An SS1 or WLS1 sensor assembly needs to be fitted after installing the trap in the pipeline.

Note: Screwed pipe connections shown. Steam traps with integral sensors do not require separate sensor chambers.

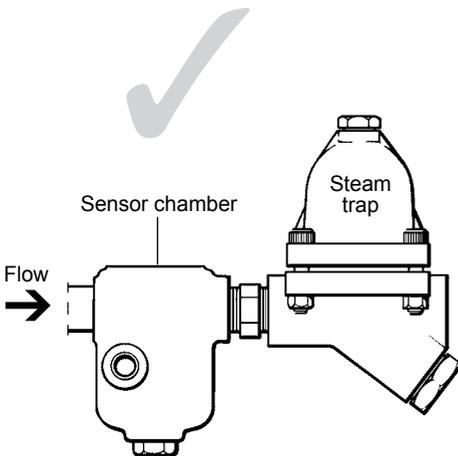


Fig. 1
Sensor chamber correct installation

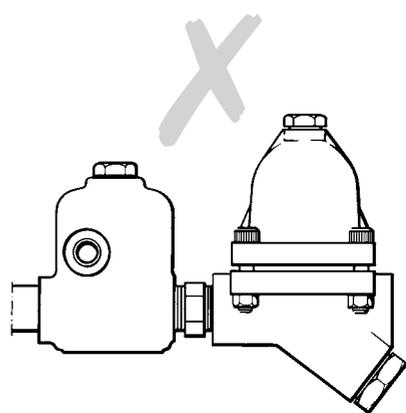


Fig. 2
Sensor chamber incorrect installation

3.1.2 R16C monitor - installation

The R16C monitor is available in wall mounted (Section 3.1.2.1) or panel-mounted (Section 3.1.2.2) versions.

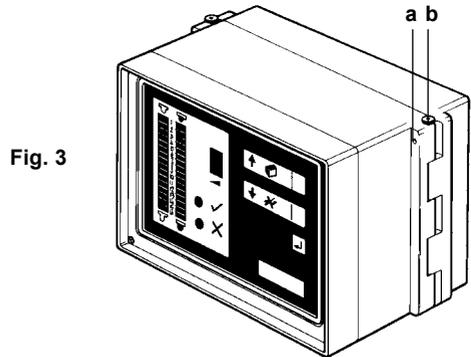


Fig. 3

3.1.2.1 Wall-mounted version

Note: The R16C must be fitted to a vertical wall and away from sources of excessive heat, electrical interference and from areas liable to flooding.

1. Loosen the grub screws 'a' (Figure 3).
2. Remove the right hand hinge pin 'b' (Figure 3).
3. Swing the front section 'c' open (Figure 4).
4. Unplug the ribbon cable plug 'd' (note the plug orientation).
5. Support the front section 'c' and remove hinge pin 'e'.
6. Store the front section 'c' in a safe place.
7. The rear section 'f' is attached to the wall using the four knock-out keyholes 'g' and suitable fastenings.
8. Reassembly is the reverse of the above sequence.

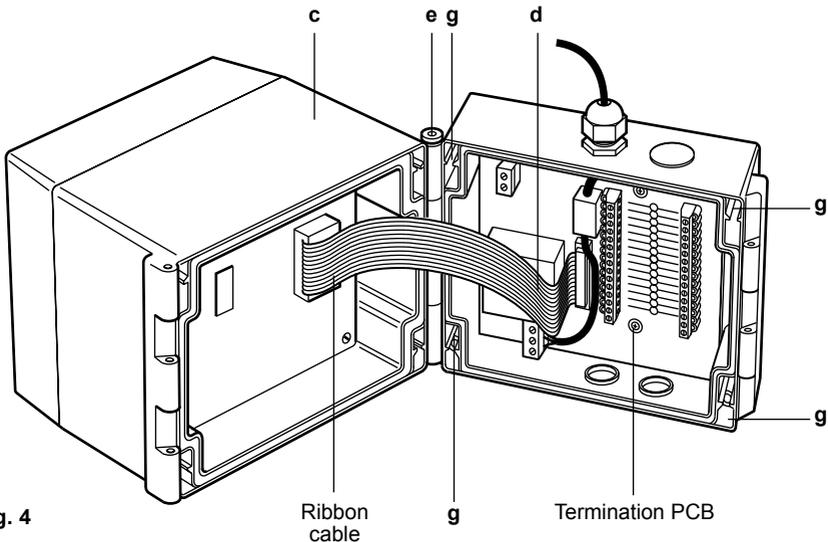


Fig. 4

Ribbon
cable

Termination PCB

3.1.2.2 Panel-mounted version (Figure 5)

These units have a bezel 'a' on the front section of the enclosure 'b'. Special clamps 'c' allow easy fixing to panels up to 20 mm thick.

1. Ensure that there is adequate clearance behind the panel where the R16C monitor is to be mounted (140 mm minimum). Room should be left for wiring to connect into the rear of the unit.
2. Cut an aperture in the panel 186 mm wide x 140 mm high.
3. Slide the R16C through the aperture until bezel 'a' butts up against the panel front.
4. Extend the clamping legs 'e' (Figure 6, page 11) to engage with the back of the panel. Tighten the four clamping screws 'd' (Figure 6, page 11) through the access holes in the R16C front panel bezel.

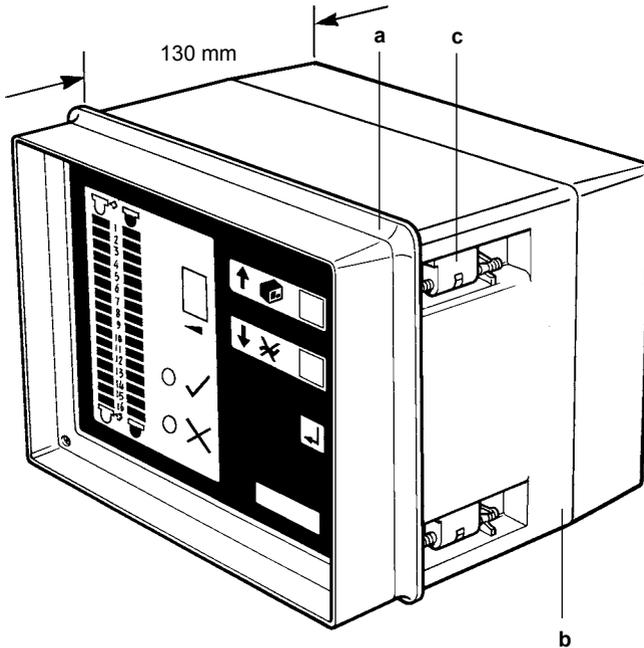


Fig. 5

3.2 Electrical installation

3.2.1 Important wiring notes that must be read:

Cabling should be installed in accordance with BS 6739 - Instrumentation in process control systems: Installation design and practice or local equivalent.

Every effort has been made during the design of the R16C monitor to ensure the safety of the user but the following precautions must be followed:

1. Service personnel must be suitably qualified to work with equipment containing hazardous voltages.
2. Ensure correct installation. Safety may be compromised if the installation of the product is not carried out as specified in this manual.
3. Isolate the R16C from the mains supply before opening the unit.
4. The design of the R16C relies on the building installation for overcurrent protection and primary isolation.
5. Fuse(s) rated at 1 ampere must be included in the installation wiring. If two fuses are used (see wiring diagram) they must be fitted next to each other and be of the same type and rating.
6. The R16C is designed as an installation category I product.
7. All external circuits must meet the requirements of double insulation as stated in IEC 60364 or equivalent.
8. Wiring should be carried out in accordance with IEC 60364.
9. Regardless of whether the R16C is installed as a wall or panel mounted unit, the mains cable must be securely clamped to the termination PCB using the cable tie and base provided - Located next to the mains connector and marked 'CLAMP'.
10. A disconnecting device (switch or circuit breaker) must be included in the building installation. This must be in close proximity to the equipment and within easy reach of the operator. It must be marked as the disconnecting device for the R16C. It must not interrupt the protective earth conductor. It must not be incorporated into a mains supply cord. The requirements for the disconnecting device are specified in IEC 60947-1 and IEC 60947-3.
11. The R16C must not be located in such a way that the disconnecting device is made difficult to operate.

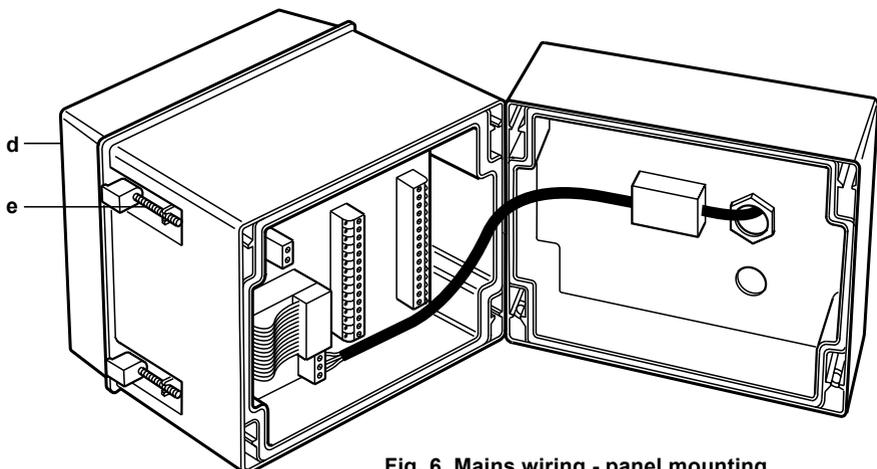


Fig. 6 Mains wiring - panel mounting

3.2.2 General wiring diagram

The general wiring diagram in Figure 7 below shows the connection of the sensors to the R16C monitor.

Wiring notes:

Cabling should be installed in accordance with BS 6739 - Instrumentation in process control systems: Installation design and practice or local equivalent.

Caution: The mains cable must be threaded through the Ferrite block. This is found on the PCB of the wall-mounted version, and on the inside of the back enclosure for panel mounted units.

1. The sensor cable type used is not critical but 7-strand 0.2 mm² wire is recommended.
2. Screening is not normally required but avoid running wires adjacent to mains cables or any possible source of electrical noise. Following BS 6739 Code of Practice for separation of cables is recommended.
3. Recommended maximum cable length between the R16C monitor and the sensor is 500 m.
4. The resistance between conductors of any pair of wires must be at least 2.2 MΩ.
5. It is important that the polarity of the sensor wiring is correct as shown in Figure 8, (PL5 on the R16C is connected to the red wire of the sensor and the PL4 on the R16C is connected to the sensors blue wire). If this wiring is reversed the unit will appear to operate but will give confusing results.

The connection to the mains is as shown in Figure 8.

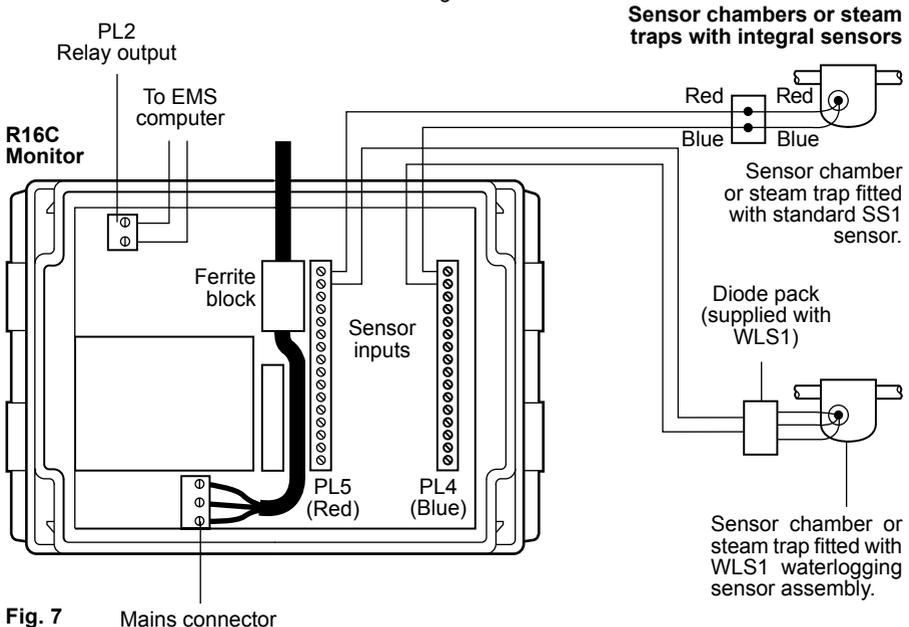


Fig. 7 Mains connector

Note 1

For use in hazardous area applications, the WLS1 diode pack must be located outside the hazardous area. In addition zener barriers must also be used.

Note 2

Fit cable glands at all cable entry points on wall-mount units.

Important:

Cabling should be installed in accordance with BS 6739 – Instrumentation in process control systems: Installation design and practise or local equivalent.

1. Read Section 3.2.1 before attempting to wire the supply to the R16C.
2. Fuses should be fitted in both supply conductors but not in the protective earth conductor.
3. The protective earth terminal must be connected to the installation protective earth system. The integrity of the installation protective earth system must not be compromised by the disconnection or removal of other equipment.

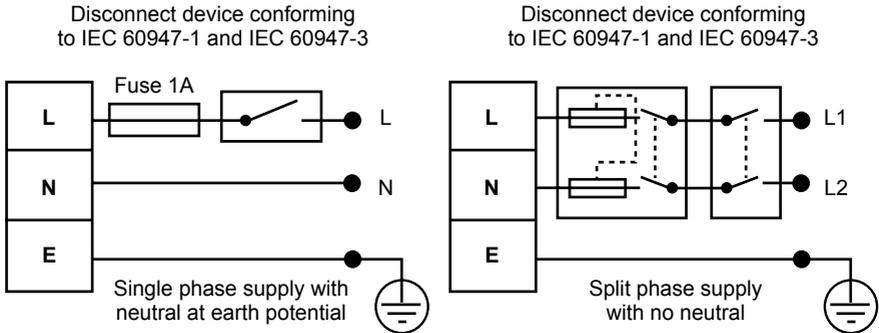


Fig. 8

3.2.3 Wiring for cascaded systems

Where more than 16 sensors are to be monitored, multiple R16C monitors will be required. Each 16 steam traps are monitored by a local R16C unit. The relay outputs of the local R16C can then be connected to the input of a master R16C unit.

In this mode the master R16C can centrally monitor the local R16C units, highlighting which local unit is failing, thus saving time and effort.

Note:

1. Refer to Section 4.5 for set-up details of master unit.
2. Slave units operate as normal.

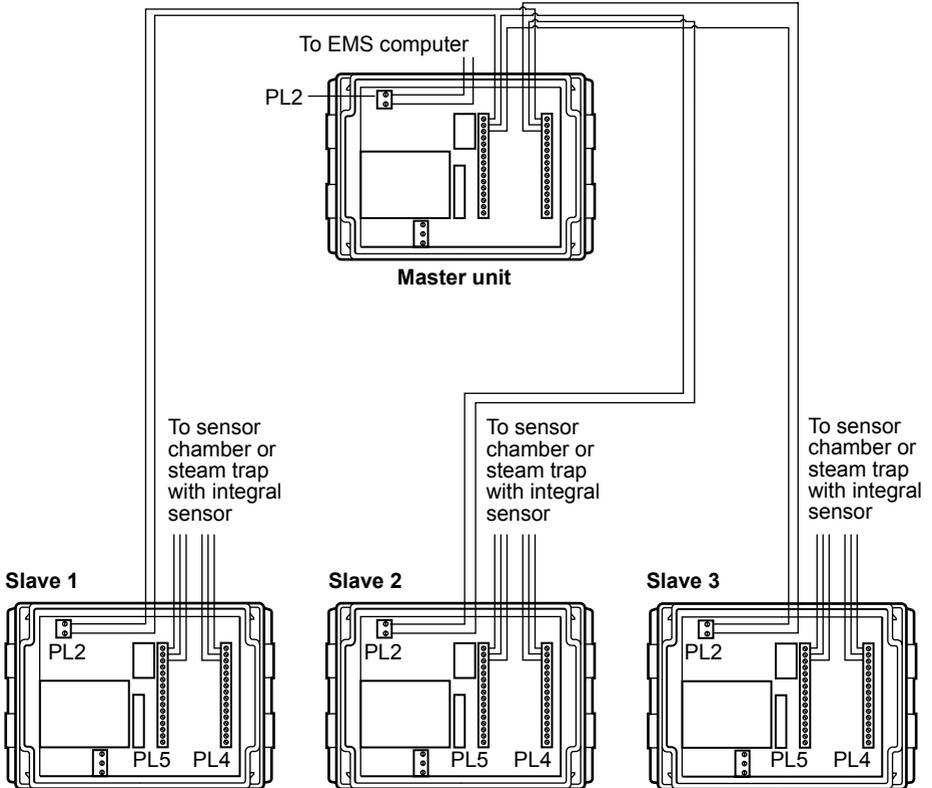


Fig. 9

4. Commissioning

The R16C monitor has switches fitted inside the unit which set the mode of operation. Once these switches have been set, the remainder of the set-up operation is conducted using the keypad.

4.1 Setting the mode of operation

There are three modes of operation which can be set using the switches housed inside the R16C monitor (see Figure 10).

The balloon below shows the switches in their default position.

Note:

1. On the panel mounted version, the switches are accessed via the four screws on the front panel.

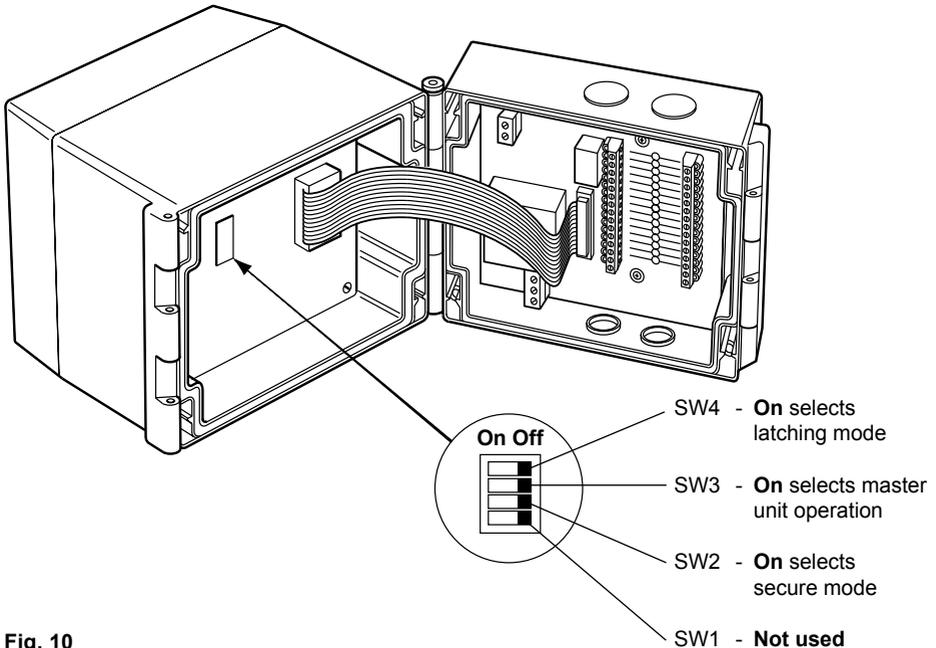


Fig. 10

4.2 Description of keypad

Note: If at any time during normal operation or set-up an incorrect key sequence is pressed, the **Secure model light (J)** will flash for 5 seconds.

Lights:

- **Steam leak trap fail lights (A).** This column of **Trap fail lights** indicates which trap is leaking steam.
- **Waterlog trap fail lights (B).** This column of **Trap fail lights** indicates which trap is waterlogged.
- The **7 Segment display (C)** decimal point will pulse on and off slowly during Normal operation acting as a Status Indicator. The **7 Segment display** displays data relevant to the mode of operation.
- **Down and Up lights (D and E respectively).** These **Lights** illuminate to indicate that the keys **1** and **2** can be used to scroll up or down the **Trap fail lights (A and B)** to select a channel for adjustment. Once a channel has been selected the **Lights (D and E)** indicate that the steam leakage and/or waterlogging levels can be increased using the keys **(1 and 2)**.
- **Test unit light (F).**
- **Latching light (G).**
- **Pass light (H).** When illuminated this **light** indicates that all traps are operating correctly.
- **Trap failed now light (I).** When illuminated this **light** indicates that one or more trap(s) is failing.
- **Secure mode light (J).** This symbol illuminates when the unit is in secure mode and indicates that the keypad is locked against tampering.
- **Communications light (K).** This symbol relates to communications which will be available in the future. For the moment this is not used.

BUTTONS:

- **Keys 1 and 2** have functions which vary depending on which **Light** is illuminated.
- **Enter key 3.**
- **Hidden key 4** (under Spirax Sarco logo).

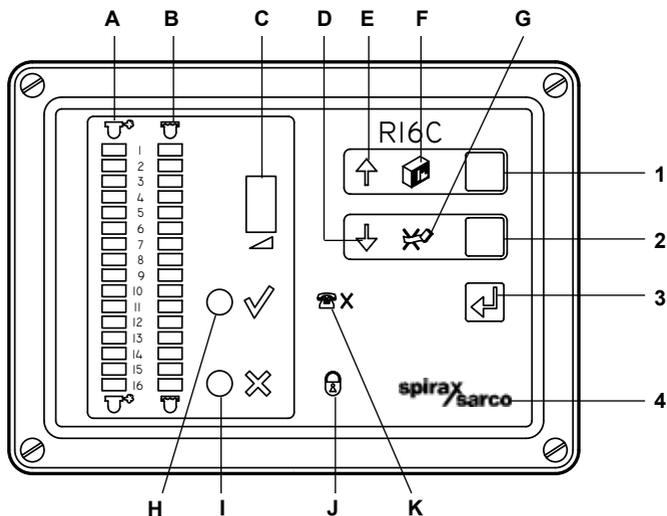


Fig. 11

4.3 Latching mode

The R16C is supplied with the Latching Mode disabled. When a trap fails, the R16C monitor indicates which trap has failed (and the type of failure) on the **Trap fail lights (A and B)**.

If the trap returns to correct operation, the **Trap fail light (A or B)** disappear and there is no record that the trap has previously failed. In some applications this is unacceptable and so a Latching Mode is available.

The Latching Mode is selected by moving switch SW4 to the **'On'** position (see Section 4.1, Figure 10). When the R16C monitor is operating in Latching Mode the **Latching light (G)** is illuminated.

In Latching Mode, when a trap fails temporarily and then returns to correct operation, the **Latching light (G)** and the **Trap fail light (A or B)** of the previously failed trap will start flashing. By pressing **key 2**, the temporary failure of the trap will be acknowledged. In this way a record can be kept of any intermittent trap failures.

4.4 Secure mode

In normal operation the R16C monitor can be set up via the keypad. In some applications, once the unit is set up, it is necessary to secure the R16C from unauthorised changes and so a Secure Mode is available.

The Secure Mode is selected by moving switch SW2 to the **'On'** position (see Section 4.1, Figure 10). In the Secure Mode the operation of the unit is unaltered. **Key 1** can be pressed to test the R16C and **key 2** can be pressed (if Latching Mode has been set) to acknowledge a previously failed trap. However, any attempt at setting up via the keypad (see Section 4.6) will be ignored and the **Secure mode light (J)** will illuminate.

4.5 Master unit mode

If more than 16 traps are being sampled, it is necessary to use multiple R16C monitors. To allow a central place for monitoring traps, an R16C operating in Master Unit Mode can be used to create a cascaded system (see Section 3.2.3, Figure 9).

The Master Unit Mode is selected by moving switch SW3 to the **'On'** position (see Section 4.1, Figure 10). In Master Unit Mode the R16C monitors the relay output (PL2) of a number of R16C slave units.

Note: The master unit will highlight the failure of a trap on a particular slave unit by the illumination of a **Steam leak fail light (A)**. The slave unit must then be checked to see the number and type of trap failures.

When using the R16C in Master Unit Mode, the sensor inputs must be set to the default configuration (see Section 4.6.2).

4.6 Setting up via the keypad

Once the mode of operation has been set (see Section 4.1), the R16C must be configured to accept the type and number of sensors to be monitored.

If all 16 channels of the R16C are to be connected for monitoring steam leakage, it is unlikely that any changes to the default set-up will be required. If the condensate collecting in the sensor chambers is particularly pure, then it will be necessary to adjust the steam leakage threshold as described in Section 4.6.1.

If only a small number of channels on the R16C are to be connected for monitoring steam leakage and/or waterlogging, it is more practical to clear all of the sensor input channels as described in Section 4.6.2. This will disable the unused inputs and allow the channels being connected to sensor chambers to be set-up as described in Section 4.6.1.

If the majority, or all 16 channels are to be used for both steam leak and waterlog detection then all 16 channels must be set-up as described in Section 4.6.1.

The instructions in Section 4.6.1. and 4.6.2. are highlighted as follows to make the text clearer:

- Each instruction in a sequence is given a small letter to uniquely identify it, e.g. **a.**, **b.**, etc...
- Display lights are labelled with capital letters, e.g. **A.**, **B.**, etc..
- Keys are labelled with numbers, e.g. **1.**, **2.**, etc...
- Where it is necessary in a sequence to press a key, the text is boxed and shaded, e.g.

a. Press **key 1** to test the R16C.

4.6.1 Setting the sensor inputs

The R16C monitor is supplied with default levels set and ready for operation. The default levels are specified clearly in Section 2.4. It is not normally necessary to alter any of the R16C settings after installation but where a change is required to suit a particular type of trap the levels can be determined from the information in Section 2.4.

The changes which may be needed after installation are as follows:

- Setting of the level at which a steam trap is shown to be failing open and leaking steam.
- Enabling R16C sensor channels for waterlog detection and setting the level at which a trap is shown to be failing closed and waterlogging.
- Disabling R16C sensor channels which are not being connected to a sensor chamber.

If any of the above changes are required, then use the following procedure for setting the sensor inputs of the R16C.

- a. Press and hold the **Hidden key 4**.
- b. Press and release **key 1**.
- c. Release the **Hidden key 4**.

- d. Both **Trap fail lights (A and B)**.
- e. The **Down** and **Up arrow** symbols (**D and E** respectively) will also be illuminated.
- f. The **7 Segment display (C)** will be illuminated with one of the following symbols which will indicate the status of the selected sensor channel:
 - └ Indicates that steam leak detection is set.
 - ┘ Indicates that waterlog detection is set.
 - └┘ Indicates that both steam leak and waterlog detection are set.
 - Indicates that the channel is disabled.

- g. Press **keys 1 or 2** to scroll the selected sensor channel.
- h. Press the **Enter key 3** to select the desired channel.

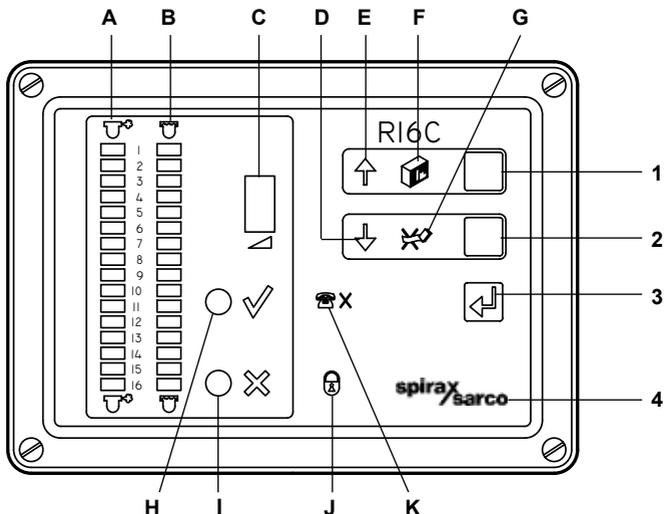


Fig. 12

-
- i. The selected sensor channel **Steam leak trap failed light (A)** will now be illuminated.
 - j. The **7 segment display (C)** will be indicating the steam leak level for the selected sensor channel.

k. Press **keys 1 or 2** to increase or decrease the steam leak level.

Notes:

- The defaults levels and other steam leak values are shown in Section 2.4.
- The sensor default level should be acceptable for the majority of installations.
- A steam leak level of '0' on the **7 segment display (C)** shows that the input is disabled for steam leak detection.
- Where the sensor default level is not acceptable, the level should be increased or decreased using **keys 1 or 2** respectively to the point where the **Pass light (H)** has just toggled **'On'**. In this way the system is set for the actual steam line conditions.

Important: this particular method of set-up is only possible with the steam turned on and when the system has settle down into normal operation. The system can initially be commissioned with the steam turned off. This set-up procedure can then be returned to when the steam is on and the system operating normally.

l. Press the **Enter key 3** to accept the selected sensor level.

- m. The selected sensor channel **Waterlog trap fail light** will now be illuminated.
- n. The **7 segment display** will be indicating the waterlog level for the selected sensor channel.

o. Press **keys 1 or 2** to increase or decrease the waterlog level.

Notes:

- The defaults levels and other waterlog values are shown in Section 2.4.
- A waterlog level of '0' on the **7 Segment display (C)** shows that the input is disabled for waterlog detection.
- To set waterlog detection, the level should be increased or decreased using **keys 1 or 2** respectively to the point where the **Pass light (H)** has just toggled **On**. In this way the system is set for the actual steam line conditions.

p. Press the **Enter key 3** to accept the selected sensor level.

- q. The next sensor channel **Trap fail lights (A and B)** will now both be illuminated.
- r. Return to step 'd' and follow the sequence to set up another sensor channel or move to step 's' to **Exit** the set-up sequence.

s. To **Exit** the set-up sequence, press and hold the **Hidden key 4**.

t. Press and release **Enter key 3**.

u. Release the **Hidden key 4**.

v. The R16C is now operating normally.

Note: The R16C will revert to normal operation if no key is pressed for 5 minutes.

4.6.2 Setting all sensor inputs to a default level or clearing all sensor inputs

The R16C monitor is supplied with default levels pre-set to the values shown in Section 2.4. If only a small number of input channels in the R16C are being connected to sensor chambers, then it is easier to clear all sensor inputs to disable them and then follow the procedure in Section 4.6.1.

Where a number of channels have been adjusted and changes have been made to the plant and installation, it may be useful to set all sensor inputs back to the factory level to give a known set of conditions for the R16C. The procedure in Section 4.6.1. can then be followed to set-up the R16C.

- a. Press and hold the **Hidden key 4**.
- b. Press and release **key 1**.
- c. Release the **Hidden key 4**.

- d. Press and hold the **Hidden key 4**.
- e. Press and release **key 1**.
- f. Release the **Hidden key 4**.

- g. All of the **Trap fail lights (A and B)** will be illuminated.
- h. The **Down and Up arrow symbols (D and E respectively)** will also be illuminated.
- i. The **7 segment display (C)** will be displaying a = symbol.

- j. Press **key 1** or **key 2** until the correct symbol (see step k.) is displayed on the **7 segment display (C)**.

- k. The **7 segment display (C)** will now be displaying one of three symbols.
 - = symbol - no change
 - d symbol - set all sensor inputs to default levels (see Section 2.4)
 - c symbol - clear all sensor inputs

Note: This is useful when only a small number of channels are to be used for monitoring steam traps. In this instance it is easier to clear all of the sensor channels and then set the channels to be used as described in Section 4.6.1.

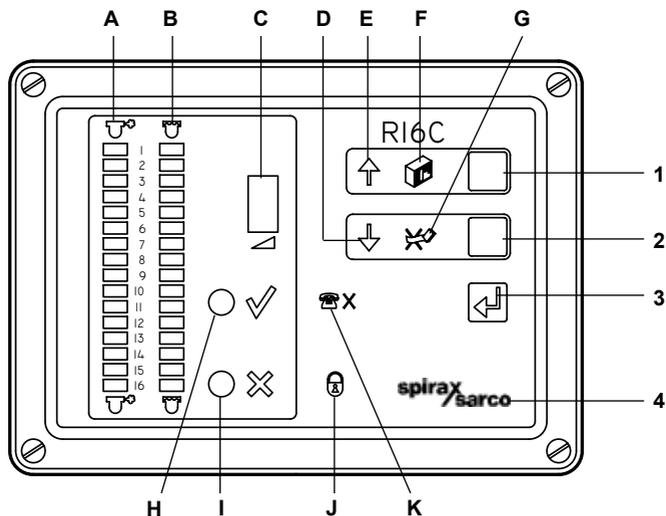


Fig. 13

- l.** Press the **Enter key 3**.
- m.** To **Exit** the set-up sequence, press and hold the **Hidden key 4**.
- n.** Press and release the **Enter key 3**.
- o.** Release the **Hidden key 4**.

p. The R16C is now operating normally.

Note: The R16C will revert to normal operation if no key is pressed for 5 minutes.

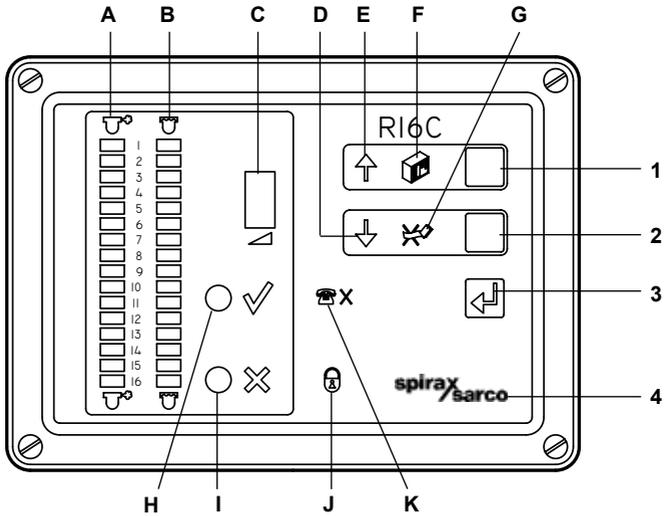


Fig. 14

4.7 Normal operation

Once installation and commissioning are complete, the R16C monitor will revert to normal operation. Full details are given in the accompanying Operators Instructions, but the following points should be noted:

1. If the system has been installed and initially commissioned with the steam turned off, then the R16C unit may display failures on a number of channels. These will not be genuine failures and will be caused by one of the following reasons:
 - a. **Steam leak trap failure(s) indicated.** Caused because the sensor is not submerged in hot condensate. This is because the steam has not been/is not turned on and there has not been enough time for condensate to be produced.
 - b. **Waterlog trap failure(s) indicated.** Caused because there is no steam warming the cold condensate that is covering the sensor. This is because the steam is not turned on or the steam has not been running long enough to warm the condensate to full operating temperature.
 - c. **Both steam leak and waterlog trap failure(s) indicated.** Caused when both conditions 'a' and 'b' above, occur at the same time. This is typical of a steam system which has just been installed or has been shut down for maintenance or repair work. The solution for all three of the above conditions is to allow the steam system time to settle down into normal operation.
2. Where the conditions listed above are occurring and a suitable settling time has been allowed, but the conditions still persist, the following points should be noted:
 - a. The R16C may need setting to operate on the actual steam line conditions present. The procedure in Section 4.6 should be followed and each channel showing a failure should be set to suit the conditions present in the steam line.
 - b. If the conditions listed in '1' above still persist, then refer to the fault finding section of this manual for further help.
3. Note that when setting the R16C to suit the actual line conditions as described in Section 4.6, that the steam traps must be in good working order. This will avoid the situation where the R16C is showing that a trap is operating correctly when it is actually failing.
 - a. If the traps are new and have been installed with the R16C and sensor chambers, then there will not be a problem.
 - b. If the R16C is being installed on a steam system which has been running for some time, it is strongly recommended that the traps are inspected and serviced as necessary to ensure correct operation.

5. Remote facilities

5.1 Alarm output

The R16C monitor is fitted with a volt-free relay contact which switches open in the event of any trap failure (steam leaking or waterlog) or if power to the R16C is removed.

The diagrams below clearly show the operating states.

See Technical information, Section 2.3 for relay contact rating

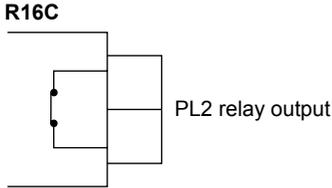


Fig. 15 All traps working correctly

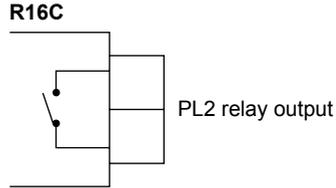


Fig. 16 One or more traps failing or power to the unit has been removed.

USE:

1. For connection of the Spiraxtec system into Energy Management Systems (EMS's)
2. For connection to an alarm.
3. For connection to a Master Unit (cascading).

6. Maintenance

Maintenance

There are no special maintenance procedures required.

The return of equipment for repair

Please provide the following information with any equipment being returned:

1. Your name, company name, address and telephone number, order number and invoice and return delivery address.
2. Description and serial number of equipment being returned.
3. Description of the fault or repair required.

If the equipment is being returned under warranty, please indicate:

1. Date of purchase.
2. Original order number.

Please return all items to your local Spirax Sarco office.

Please ensure that all items are suitably packed for transit (preferably in the original cartons).

7. Fault finding

Important note:

Operations included in the fault-finding section should only be carried out by personnel suitably qualified in dealing with hazardous voltages.

If for any reason an error occurs on the R16C monitor, the simple and easy-to-follow instructions in this section will allow the fault to be isolated and corrected.

The most likely time for faults to occur is during installation and commissioning. The most common type of fault is incorrect wiring. Before commencing fault finding read Section 3.2.1.

7.1 Thermal/over current trip

If the **Lights** on the R16C monitor display are not illuminated, it is likely that the unit has tripped. This means that there is a fault somewhere which must be corrected.

- (a) Remove power from the R16C monitor.
- (b) Locate and rectify fault (see Section 7.3).
- (c) Reapply power to unit.

Note: Power must remain off for at least 30 seconds to allow the unit to reset.

- (d) The R16C monitor should now be illuminated. If the unit does not illuminate then it may have a fault as listed in Section 7.3 or an internal fault which will require the R16C to be returned for investigation and repair.

7.2 Testing the R16C

If the R16C display is illuminated and functioning in its normal operating mode, then a self-test can be carried out to prove the operation of the unit.

- a. Ensure the decimal point on the **7 segment display (C)** is flashing. This is a **Status** symbol showing that the R16C monitor is running.
- b. The **Test unit light (F)** is illuminated showing that the unit may be tested.

c. Press and hold **key 1** to test the R16C.

d. All **Lights** will illuminate. Those relating to de-selected channels will flash. This test is also a quick means of determining which channels have been selected.

e. Testing will continue until **key 1** is released. If a fault has been found refer to Section 7.3.

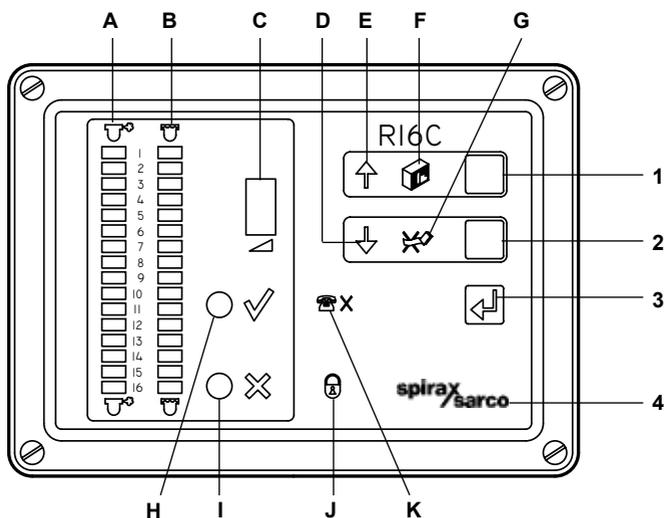


Fig. 17

7.3 Failure symptoms

Symptoms	Cause
No indications at all	Ensure mains power is on. Ensure the ambient temperature is not too high (see Technical Information Sheet).
A Light does not illuminate when the Test unit key 1 is pressed	The Light is faulty. Return the unit for repair.
The Secure mode light (J) flashes for 5 seconds	The key sequence used was incorrect.
The Secure mode light (J) illuminates for 5 seconds	The R16C monitor is in the secure mode with switch SW2 in the 'on' position.
No response to any key press	Faulty keypad. Return the unit for repair.
No response to keys other than key 1 (to test the R16C)	Incorrect key or sequence of keys pressed. Consult the instruction manuals.
Status indicator on the 7 segment display (C) not pulsing	The R16C monitor has stopped running. Return the unit for repair.
Trap fail lights showing either steam leak or waterlog failure(s)	<ol style="list-style-type: none"> 1. Ensure this is not a true alarm. 2. Check the steam leak and waterlog levels for the trap(s). 3. Check the wiring to the trap(s) for continuity and short circuit. 4. Check that a sensor of the correct type is used. 5. Replace the sensor.
Trap fail lights showing both a steam leak and waterlog failure	<ol style="list-style-type: none"> 1. Check that the channel is connected to a sensor. 2. Check that the sensor chamber is not full of cold air. 3. Increase the steam leak threshold level (Section 4.6). <p>If the Pass light (H) does not illuminate, the sensor is either dry or the wiring is open circuit. Short circuit the wiring at the unit terminals and the Pass light (H) will illuminate if the unit is functioning correctly. If not, check that the ribbon cable (Section 3.1.2, Fig. 4) is plugged in properly at both ends. If this does not make the Pass light (H) illuminate, then return the unit for repair. Short circuit the wiring at the trap end, the Pass light (H) will illuminate if the wiring is correct. Finally, if the problem persists, change the sensor.</p>
'F' displayed on the 7 segment display (C) , pressing key 1 to test the R16C does not work.	The unit has failed. Return the unit for repair.
'd' displayed on the 7 segment display (C) , during normal operation.	The trap set-up information has been corrupted. Press key 3 to reset the unit with default levels (see Section 2.4).

For technical assistance

Contact your local Spirax Sarco representative. Details can be found on the order/delivery documentation or on our website www.spiraxsarco.com

