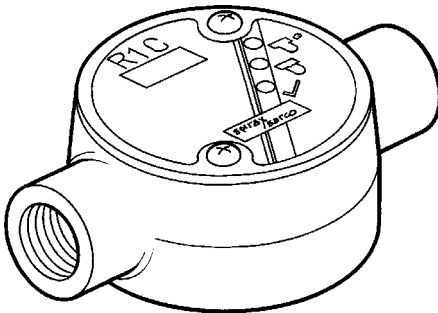


**R1C**  
**Steam Trap Failure Monitor**  
**Installation and Maintenance Instructions**

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1. *General safety information*
2. *General product information*
3. *Installation*
4. *R1C commissioning*
5. *BEMS/EMS commissioning*
6. *Normal operation*

# — 1. *General safety information* —

Your attention is drawn to Safety Information Leaflet IM-GCM-10.

## **WARNING**

This product complies with the requirements of the Electromagnetic Compatibility Directive 89/336/EEC by meeting the standards of:-

EN 61326: 1997 A1 + A2 Emmissions - Class B Equipment Table 4.

EN 61326: 1997 A1 + A2 Immunity for Industrial Locations Annex A.

The product may be exposed to interference above the limits of EN 61326 if:

- The product or its wiring is located near a radio transmitter.

Cellular telephones and mobile radios may cause interference if used within approximately one metre 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.

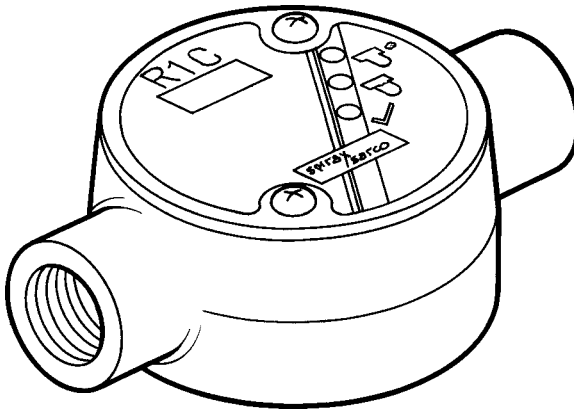
## — 2. General product information —

### 2.1 Introduction

The R1C steam trap failure monitor will continually monitor the performance of a steam trap when used in conjunction with a Spiratec sensor chamber and sensor or a steam trap with integral sensor. It will indicate whether a trap is operating correctly, passing live steam or has failed closed by means of coloured trap status lights on the unit. Analogue and digital outputs allow it to be connected directly to BEMS/EMS to indicate steam trap status remotely.

To detect a steam trap that is leaking steam, the R1C is used in conjunction with a Spiratec sensor chamber or steam trap fitted with a standard SS1 Spiratec sensor.

To detect a steam trap that is leaking steam or is waterlogged, the R1C is used in conjunction with a Spiratec sensor chamber or steam trap fitted with a WLS1 waterlogging sensor assembly.



### 2.2 General description

The R1C steam trap failure monitor constantly measures the conditions in the steam line through a Spiratec sensor fitted in the sensor chamber or steam trap.

If a steam trap is operating correctly, condensate will collect and submerge the sensor. The R1C monitor measures the resistance at the SS1 sensor, detecting whether the sensor is submerged in condensate or surrounded by steam. In the case of steam leakage (i.e. the trap has failed open), steam will blast through the line clearing the condensate and exposing the SS1 sensor to steam. The R1C monitor detects the high resistance due to the presence of steam and shows a fail open signal.

The WLS1 combined steam leak and waterlogging sensor monitors steam leakage in the same way as above, but also has a built in temperature sensor. When a trap fails closed, the condensate which backs up will start to cool. The R1C monitor detects this drop in temperature and shows a fail closed signal.

The R1C is supplied with steam leak and waterlogging values set ready for use. These values may be changed using internal switches if required (see Section 4, Commissioning, for details).

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# 3. Installation

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## 3.1 Mechanical installation

### 3.1.1 Sensor chamber installation

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

Sensor chambers are available 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.

Note that the R1C will only work with Spiratec WLS1 sensors which do not have built in diode packs. WLS1 waterlogging sensor assembly with integral diode packs should **not** be used.

The sensor chamber should be installed horizontally immediately upstream of the trap with the direction of flow according to the arrow found on the body of the sensor. The correct orientation is shown in Figure 1.

### 3.1.2 Steam trap installation

See installation details supplied with the steam trap.

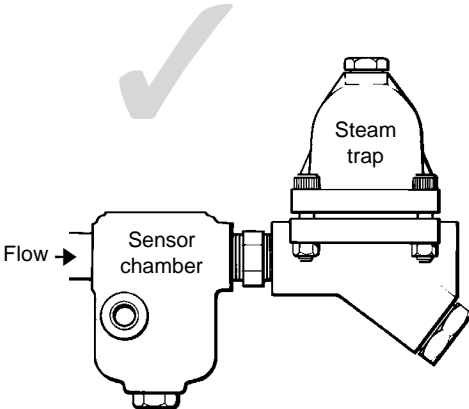
### 3.1.3 R1C installation

The R1C enclosure is a circular conduit box with 20 mm threaded entry holes. To maintain resistance to moisture, use a suitable cable gland between the R1C and the Spiratec sensor. If the cable to the BEMS/EMS passes through a conduit, make sure that the threaded connection to the R1C is water-tight.

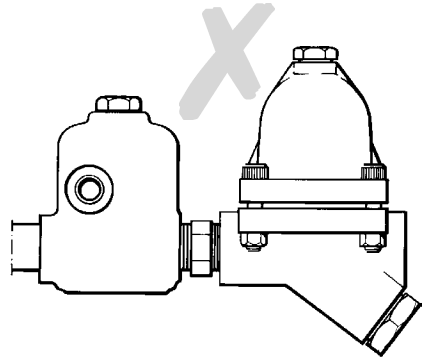
The R1C can be supported by the conduit or mounted on any convenient flat surface using suitable bulkhead mounting clamps.

The maximum distance between the sensor and the R1C is 10 metres.

### 3.1.4 Operating temperature range -20°C to +55°C



**Fig. 1 Sensor chamber correct installation**



**Fig. 2 Sensor chamber incorrect installation**

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

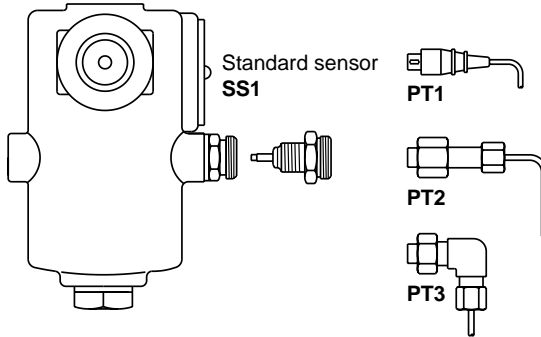
## 3.2 Electrical installation

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

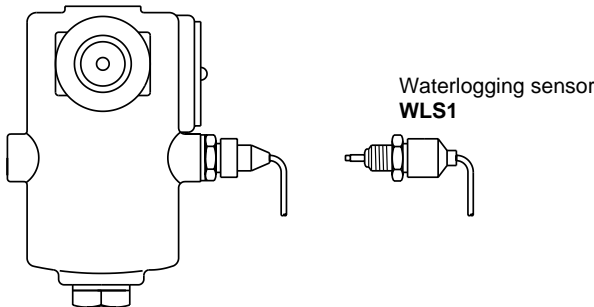
Before wiring, make sure that power to the BEMS / EMS is OFF, then remove the cover of the R1C to expose its connectors. Figure 5 shows the internal layout of the R1C.

### 3.2.1 Sensor wiring to R1C

The R1C can be used with either a standard SS1 sensor or a WLS1 waterlogging sensor assembly. These are shown below:



**Fig. 3**  
Sensor chamber (or steam trap, not shown) with SS1 standard sensor



**Fig. 4** Sensor chamber (or steam trap, not shown) with WLS1 waterlogging sensor

**Note:** Ensure that the resistance from the body of the sensor to the pipework is less than  $1\Omega$ . Wire the R1C to the Spiratec sensor as shown in Tables 1 and 2 below.

**Table 1**

SS1 standard sensor fitted with PT2 or PT3 plugtail	R1C
Blue	PL2 pin 1
Red	PL2 pin 3

**Table 2**

WLS1 waterlogging sensor assembly	R1C
Black	PL2 pin 1
Red	PL2 pin 2
White	PL2 pin 3

### 3.2.2 BEMS/EMS to R1C Wiring

We recommend that the R1C is connected to the BEMS/EMS via a 6 core 7/0.2 mm cable. The cable must be installed in steel conduit. **Note:** To ensure no loss in performance of the R1C, other power cables should not share the same conduit.

To remain compliant the R1C needs to be connected to a **CE** marked BEMS/EMS system or power supply and must be earthed.

Table 3 describes the R1C's power and failure signals. Refer to the BEMS/EMS manual for connection details.

**Note that the 0 V signal from the R1C is connected through the sensor to the grounded pipework.** Galvanic isolation between widely separated units should be used to prevent ground loops.

**Table 3**

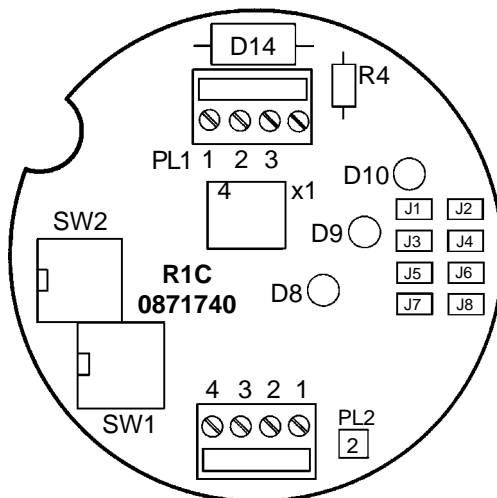
R1C	Signal	Notes
PL1 pin 1	Power supply 0 V input	Power return and signal reference
PL1 pin 2	Power supply +ve input	+24 Vdc power (I < 35 mA) See note A below.
PL1 pin 3	Failure output: Trap waterlogged	Digital signal - open collector transistor
PL1 pin 4	Failure output: Trap leaking	Digital signal - open collector transistor
PL2 pin 4	4 - 20 mA +ve output	Current source

**Note A: R1C supply voltage:**

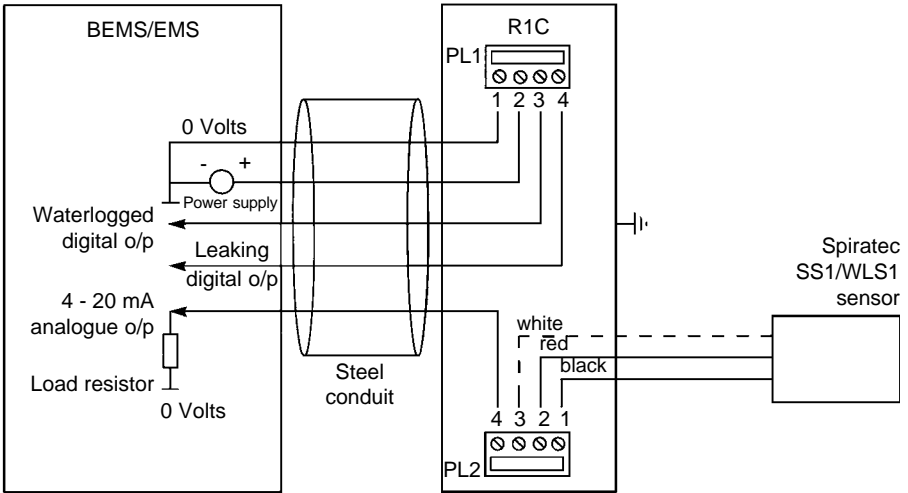
The required supply voltage for the R1C depends on the output signal configuration as shown below.

**Table 4**

R1C configuration	Supply voltage required
4-20 mA output <b>not used</b>	Separate 9-30 Vdc, <35 mA
4-20 mA output <b>used</b>	Separate 22-30 Vdc, <35 mA



**Fig. 5**



**Fig. 6** Wiring diagram

**Note:** Ensure that the resistance from the body of the sensor to the pipework is less than  $1\Omega$ .

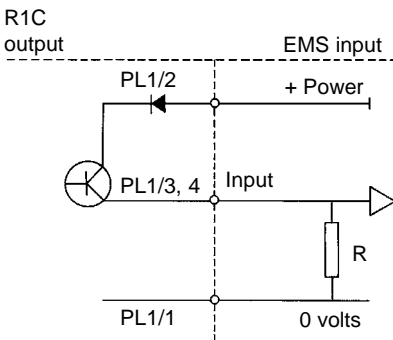
### 3.2.3 R1C output options:

#### PNP open collector outputs.

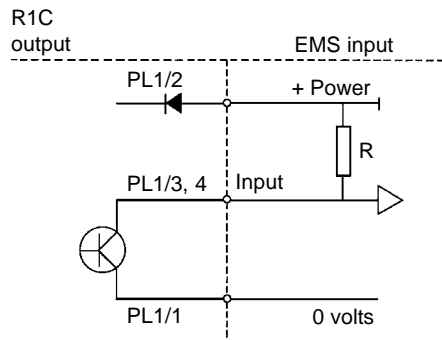
Use this output option to connect the R1C to a BEMS / EMS whose digital inputs are pulled-down to 0 volts. The pnp outputs act like switches connected to the R1C's power supply. During normal trap operation, the pnp outputs will switch **On** and give out a voltage equal to the R1C's power supply minus 0.4 V. Their output resistance in this state is 220 ohms. If the trap fails, one of the pnp digital outputs will switch **Off**.

#### NPN open collector outputs.

Use this output option to connect the R1C to a B/EMS whose digital inputs are pulled-up to a positive voltage: The npn outputs act like switches connected to 0 volts. During normal trap operation, the npn outputs will switch **On**, giving out 0 volts with an output resistance of 220 ohms. If the trap fails, one of the npn digital outputs will switch **Off**.



**Fig. 7** R1C with PNP outputs



**Fig. 8** R1C with NPN outputs

## 4. R1C commissioning

The R1C has internal switches which allow the following parameters to be adjusted:

1. Trap leaking detection period. This is the delay between a trap failing open (i.e. starting to leak steam) and a warning being given by the R1C
2. Trap leaking detection levels. This is the conductivity threshold of the condensate required for correct operation.
3. Trap waterlogging detection level. This is the condensate temperature at the sensor that will trigger a waterlogging warning.

As supplied, the R1C is set as described in Table 5:

**Table 5 R1C settings (as supplied)**

Channel	Setting	Notes
Leak detection period	22 minutes	The trap must leak for 22 minutes before the R1C signals a fault. See Table 6.
Leak detection level	4.8 $\mu$ S	The conductivity of the condensate at the sensor must be greater than 4.8 microsiemens for correct operation. See Table 7.
Waterlogging detection temperature	85°C	The condensate at the sensor must cool below this temperature before the R1C signals a waterlogging fault. See Table 9.

The R1C's modes of operation are configured with the DIL switches on the PCB.

**Please note:** the SW1 DIL switch 1 is the test switch which should be OFF for all normal trap monitoring modes except the test modes described in Table 9.

**Table 6 Trap leaking detection period:**

	1	2	3	4	Trap leaking detection period
SW2	OFF	OFF	-	-	2 minutes
	OFF	ON	-	-	22 minutes
	ON	ON	-	-	44 minutes
	ON	OFF	-	-	88 minutes

**Table 7 Trap leaking detection levels:**

	1	2	3	4	Trap leaking detection level
SW2	-	-	OFF	OFF	Disabled
	-	-	OFF	ON	17 $\mu$ S
	-	-	ON	ON	4.8 $\mu$ S
	-	-	ON	OFF	1.2 $\mu$ S

**Table 8 Trap waterlogging detection levels:**

	1	2	3	4	Trap waterlogged detection level
SW1	-	OFF	OFF	OFF	Disabled
	-	OFF	OFF	ON	48°C
	-	OFF	ON	ON	63°C
	-	OFF	ON	OFF	85°C
	-	ON	ON	OFF	111°C
	-	ON	ON	ON	140°C
	-	ON	OFF	ON	169°C
	-	ON	OFF	OFF	191°C



## Table 9 R1C test modes

(in test mode the green LED flashes every half a second):

SW1 1	SW2		Mode
	1	2	
ON	OFF	OFF	Trap monitor mode - the R1C's trap leaking steam detection period filters turns off and the outputs show if there is steam or condensate present in the trap. In this mode, the switches controlling the temperature and conductivity thresholds still operate as described in the Tables on pages 8 and 9.
ON	OFF	ON	BEMS/EMS set-up mode - the R1C will cyclically change it's outputs, one step every 8 seconds.

## 5. BEMS/EMS commissioning

An analogue output is available from the R1C as standard for use with BEMS/EMS's that operate on an analogue input signal. Recommended BEMS/EMS setting details are given below:

### Table 10 BEMS / EMS recommended analogue settings

Trap status	Nominal output current from R1C	Recommended BEMS/EMS alarm threshold settings
Trap operating correctly	20 mA	23.0 mA > setpoint > 17.5 mA
Trap leaking steam	15 mA	17.5 mA > setpoint > 12.5 mA
Trap blocked or waterlogged	10 mA	12.5 mA > setpoint > 7.5 mA
Trap cold, but free of condensate (or R1C failure)	4 mA	7.5 mA > setpoint > 0 mA

Two digital outputs are also available from the R1C as standard.

- a. PNP open collector outputs
- b. NPN open collector outputs

Trap status	R1C digital outputs	
	Waterlogged	Leaking steam
Trap operating correctly	ON	ON
Trap leaking steam	ON	OFF
Trap blocked or waterlogged	OFF	ON
Trap cold, but free of condensate (or R1C failure)	OFF	OFF

## 6. Normal operation

**Table 11 R1C normal operation**

Trap status	Status lights
Trap operating correctly	Red and orange lights <b>Off</b> Green light <b>Flashing</b>
Trap leaking steam	Red light <b>On</b> Green light <b>Flashing</b>
Trap blocked or waterlogged	Orange light <b>On</b> Green light <b>Flashing</b>
Trap cold but free of condensate (this is a common state during system start-up or when the system is shut-down) or sensor wires disconnected.	Red and Orange lights <b>On</b> Green light <b>Flashing</b>

During normal operation, the green light flashes **On** every second to show that electrical power is connected to the R1C and that it is operating correctly.

If the green light is not flashing, there may be a problem with the R1C.

The R1C will show a failure for as long as the fault is present. If the R1C detects a transient fault, it will show the failure for at least one minute.



