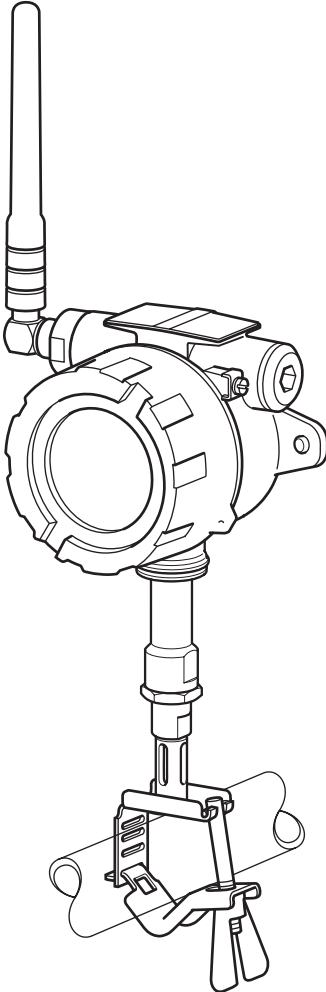# spirax sarco

STAPS
Wireless Head Unit
for ISA100.11a applications
Configuration

1. Safety information

2. General product information

3. Battery, LED and button operation

4. Provisioning and configuration

5. Diagnostics

1. Safety information

1.1 Battery
The Head unit is powered by a Lithium battery (Tadiran SL-2880).

Handling considerations:

- Do not crush, pierce, short (+) and (-) battery terminals with conductive (i.e. metal) goods.

- Do not mix batteries of different types and brands.

- Do not mix new and used batteries.

- Do not directly heat or solder.

- Do not throw into a fire.

- Keep batteries in non-conductive (i.e. plastic) trays.

- Do not subject the battery to temperatures above 100 °C.

Storage
Store in a cool (preferably below 30 °C), dry, clean and well-ventilated area.

Environmental consideration
As with any battery, local environmental regulations must be adhered to with regard to disposal of spent batteries. Special attention must be paid not to mix with other types of batteries. Battery hazards remain even when the cells are discharged.

Shipping considerations
Transport of Lithium batteries is regulated by many authorities:

- ADR (European Ground Transportation).

- IATA (International Air Transport Association).

- ICAO (International Civil Aviation Organisation) and the Regulations concerning the International Carriage of Dangerous Goods by Rail (Intergovernmental Organisation for International Carriage by Rail).

It is the responsibility of the shipper to ensure that these regulations are followed.

1.2 Use of non genuine components or spare parts
This product is certified by a number of health and safety regulatory bodies for health and safety and environmental purposes. To maintain the approvals only genuine components and spare parts must be used. This includes consumable items such as the Tadiran battery.

1.3 Warning

⚠	1. The equipment must be inspected and cleaned regularly to prevent the build-up of dust on the product.
	2. Electrostatic Hazard – Wipe only with a damp cloth.
	3. Only Tadiran SL2880 3.6 V Lithium Thionyl Chloride batteries are permitted to be used within the STAPS wireless steam trap monitor.

Note: The certification and approvals are only valid if the product is installed using the genuine supplied component parts and accessories, including consumable items such as batteries. Please refer to relevant IM for certification and approval information.

2. General product information

2.1 General description

The STAPS wireless steam trap monitoring system has been designed to efficiently monitor and evaluate steam trap operation. It surveys the operation of the steam trap at regular intervals and identifies poor performance that can cause reduced plant efficiency and increased energy consumption. It can diagnose both failed-open steam traps that leak live steam, and those that have failed-closed or are blocked, resulting in waterlogging, leading to plant damage, product spoilage and health and safety concerns.

Using non-intrusive installation technology combined with an ISA100.11a 2.4 GHz wireless network, it is an ideal solution for steam trap monitoring. It is suitable for use with all types of steam trap and can be connected to pipework up to 100 mm (4"), via an adjustable clamp.

How does it work?
A head unit assembly mounted on the pipe upstream of the trap to be monitored 'listens' to the sound signature of the trap in operation. This sound signature is categorised and the trap condition and steam loss are transmitted via a 2.4 GHz (ISA100.11a) wireless network. The trap condition and steam loss data is available via the ISA100.11a network.

Each STAPS head unit assembly is powered by a long life Lithium battery (typical battery life of over 3 years). The device is ISA100.11a compliant, and is capable of seamlessly joining and being part of existing and new ISA100.11a compliant networks. It is capable of acting as an ISA100.11a routing device if and when required to extend the radius of the network, but this will have an effect on the expected lifetime of the battery. To maximise battery lifetime, the device should be set to act as an ISA100.11a end node only device with the routing functionality turned off.

The steam trap data of each device is passed over to the ISA100.11a network Manager via a backbone router (Access Point), and is made available to the backbone network via interface(s) of the ISA100.11a network gateway.

2.2 STAPS head unit assembly

The STAPS head unit includes the head unit and the sensor and clamp that must be connected to the steam pipe upstream of the steam trap that it is monitoring. The pipe clamp is available in four sizes to suit: ½" - 1¼", 1½", 2" - 2½" and 3" - 4".

Please note that this document covers the integration of the STAPS head onto an ISA100.11a network, for further mechanical installation detail please refer to the IMI supplied with the product.
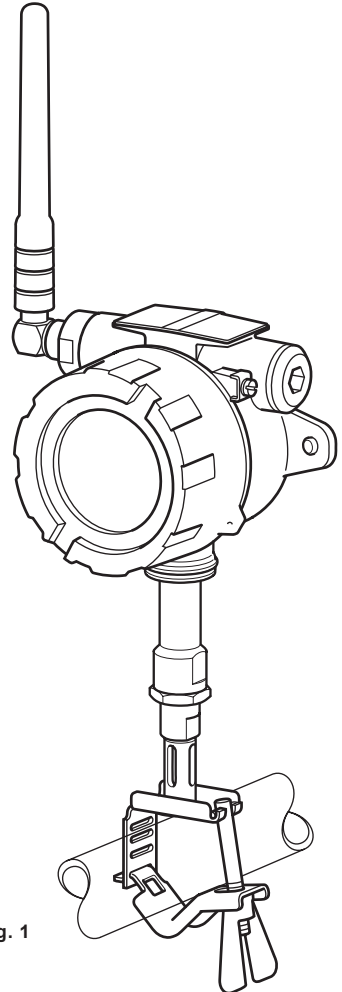

Fig. 1

STAPS Wireless Head Unit for ISA100.11a applications

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3. Battery, LED and button operation

3.1 Reference documents

Note: Before actioning any installation observe the 'Safety information' in Section 1 of IM-P014-23.

For Information on:	Installation considerations	see Sections 3 and 4 of IM-P014-23
	Mounting the head unit	
	Antenna fitting	
	Fitting heat shields	
	Parts and spare parts	

3.2 Fitting the battery to the sensor head

The head unit assembly requires a Tadiran SL-2880 3.6 V battery to function.

Note: The head unit needs to be powered to be commissioned. However if the complete 'system' (access point and wireless system manager) is not in service, the battery should be removed until required. Failure to do so will considerably reduce battery life. Once the battery is fitted to a unit it will attempt to contact an ISA100.11a wireless access point. If no access point is found within one hour the unit will enter a sleep mode, waking for six minutes every hour to attempt to connect to an access point. Removing and replacing the battery will cause the unit to recommence this cycle with the one hour search.

Please see IM-P014-23 for the fitting of the battery and refer to Section 1.1 of this document before handling or disposing of batteries.

Fig. 2

3.3 Button and LED function

The button (see below) will perform a number of functions dependent on the length of time it is held and whether it is pressed before the battery is inserted.

LED

Button

Infrared provisioning port

Fig. 3

STAPS Wireless Head Unit for ISA100.11a applications

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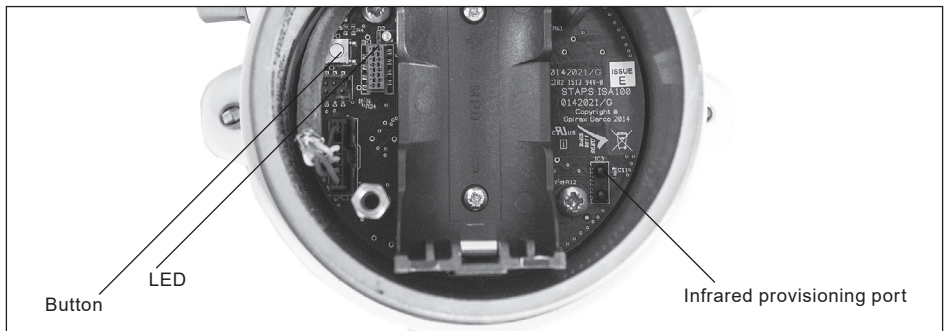
The LED response - number of flashes, follows the following pattern for each status that it is reporting; 1 flash is bad, 3 flashes are good.

Reporting of the trap condition is only available once the Head unit has fully joined a network and published trap data.

Time pressed	Function	Action
< 0.2 s	None	

0.2 - 5 s	Display status	The LED flashes green rapidly whilst the button is pressed.
		
		When the button is released the LED flashes red in sequence to indicate trap condition, battery status and RSSI.
		
		Trap condition 1 flash: Leak
		                                 2 flashes: Warning
		                                 3 flashes: Good
		
		Battery Status 1 flash: Replace
		                                 2 flashes: Warning
		                                 3 flashes: Good
		
		RSSI 1 flash: <=-80 dBm
		                                 2 flashes: >-80, <=-60 dBm
		                                 3 flashes: >-60 dBm

If the button is pressed and held before fitting the battery. Note: There will be a small delay before the LED begins to flash green.	
Timings shown below are from when the LED begins to flash green.	
5 - 10 s	Remove provisioning	If the button continues to be pressed the LED continues to flash green. The erase occurs after the button is released. The LED flashes red whilst the provisioning is being removed.
15 - 20 s	Reset to factory default	If the button continues to be pressed the LED continues to flash green. The reset occurs after the button is released. The LED flashes red whilst the reset to factory defaults is being applied.
> 20 s	None	

4. Provisioning and configuration

4.1 Reference documents and equipment

Reference documents and equipment for provisioning and configuring the STAPS Wireless Head Unit on an ISA100.11a Field Wireless Network.

4.1.1 Reference documents

Honeywell One Wireless

    Getting Started with Honeywell One Wireless

    Wireless Device Manager (WDM)

    Field Device Access Point (FDAP)

    User guides

Yokogawa field wireless network

    Field wireless system overview

    Field wireless management station

    Field wireless access point

    User guides

4.1.2 Equipment

The Honeywell One Wireless Network typically consists of the following components:

    Wireless Device Manager (WDM)

    Field Device Access Point (FDAP)

    Provisioning Device handheld (or PDA), must include Infrared (IR) port and run Windows Mobile 5.0 or Windows Mobile 6.5

The Yokogawa Field Wireless Network typically consists of the following components:

    Field Wireless Management Station (410)

    Field Wireless Access Point (510)

    or

    Field Wireless Integrated Gateway (710)

    PC including FieldMate and infrared adaptor

Please note other ISA100.11a Field Wireless Network infrastructure equipment vendors are available, please refer to their equivalent documentation. A list of vendors can be found on the ISA100 Wireless Compliance Institute web site (www.isa100wci.org).

Host system

Management PC

—— Ethernet

))) ISA100.11a

))) Infra-red

WDM
Wireless device manager

FDAP
Field device access point

STAPS devices

STAPS devices

Provisioning device handheld
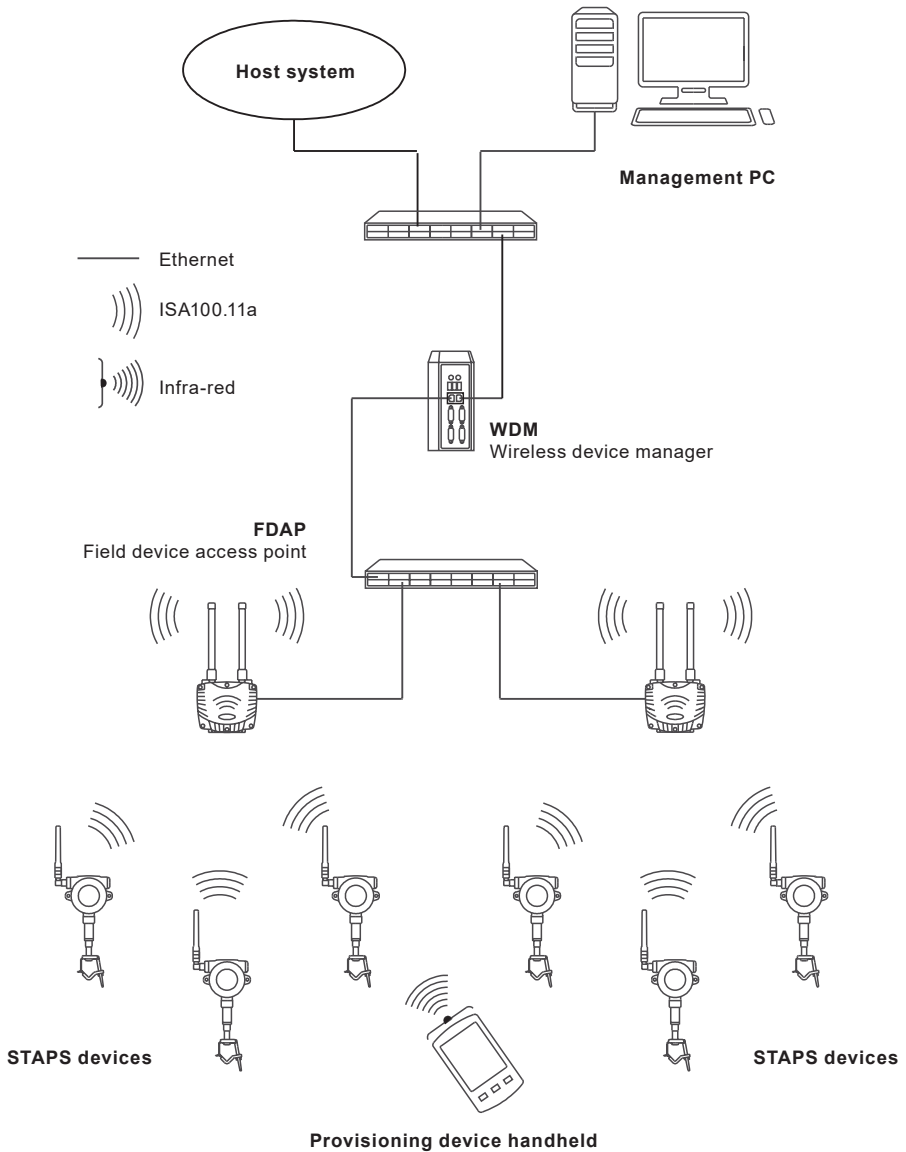
Fig. 4 - Typical Honeywell System

STAPS Wireless Head Unit for ISA100.11a applications

IM-P014-32 EMM Issue 3

Host system

Management PC

Ethernet

ISA100.11a

Infra-red

Field wireless management station

Field wireless access point

STAPS devices

STAPS devices

PC with FieldMate software

Fig. 5 - Typical Yokogawa System

STAPS Wireless Head Unit for ISA100.11a applications

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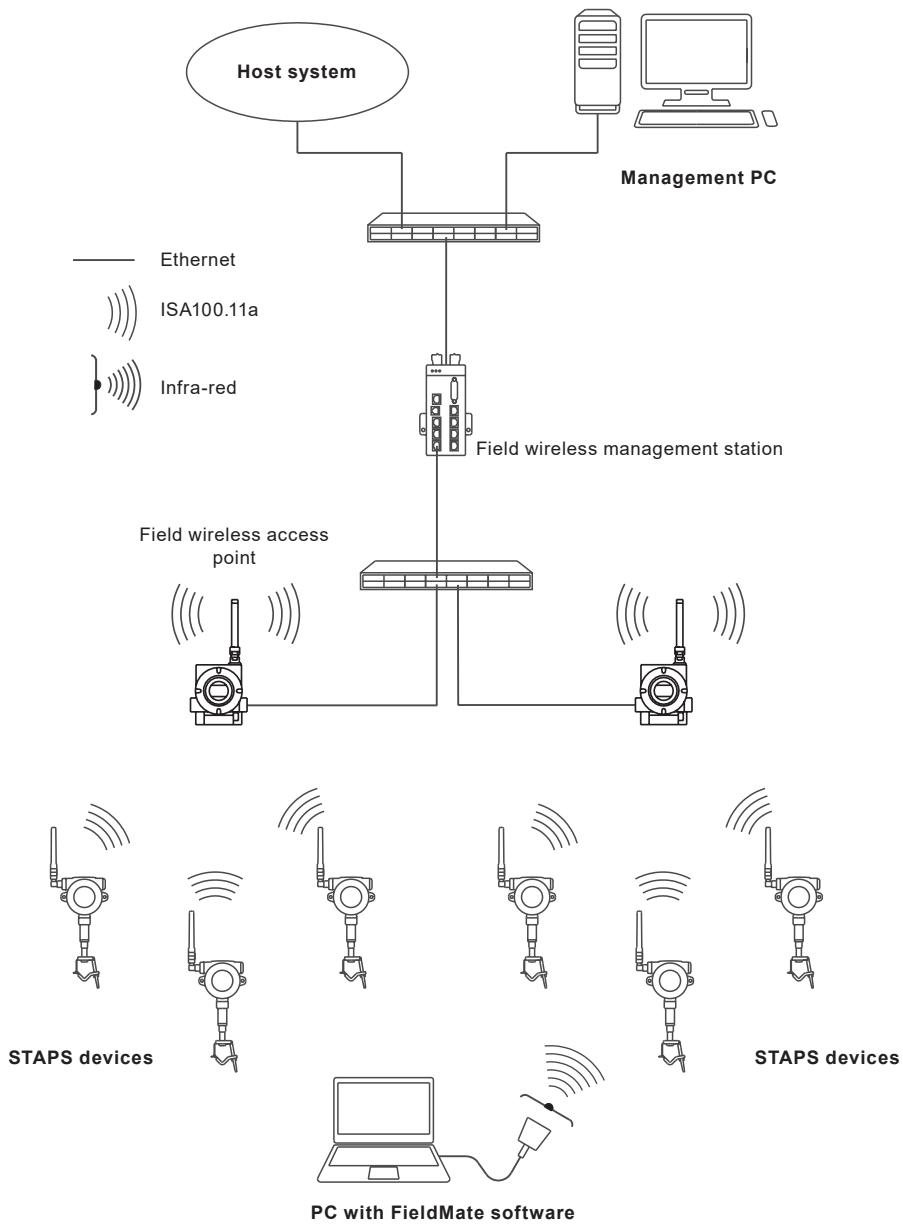
4.2 Provisioning-
Connecting to an ISA100.11a field wireless network.

The STAPS Wireless Head Unit needs to be provisioned to be able to join an ISA100.11a network. The device is capable of being provisioned by either its infrared interface or over the air (OTA).

The relevant tools and procedures as recommended from the ISA100.11a wireless system manager provider must be used to provision the STAPS Wireless Head Unit to an ISA100.11a wireless network.

The Honeywell One Wireless system supports provisioning using either a PDA or a handheld tool with an infrared interface running the dedicated "Provisioning Device" software or Over the Air (OTA).

The Yokogawa Field Wireless Network uses FieldMate software installed onto an appropriate PC with a USB to infrared adapter (ACTiSYS part number ACT-IR224UN-LN96-LE 9600bps).

Other ISA100.11a Field Wireless Network infrastructure equipment vendors are available.

4.3 Configuration

In order for the Device to be fully configured to read steam loss the following trap information is required:

- Location reference or trap tag, see note below.
- Type of trap.
- Size of trap orifice.
- Steam line pressure at the trap that the head is fitted to.
- Open or Closed return line.

Users can alter the 'Device Tag' and 'Description' ISA100.11a attributes to help them identify the devices in the field. The default 'Device Tag' value is actually the MAC (EUI-64) ID for each device so it is essential that the MAC (EUI-64) ID is noted against the 'Device Tag' for each device.

NB the 'Device Tag' attribute will get reset to its default value after a 'Reset Device to Factory' operation.

The MAC (EUI-64) ID is a unique number to the piece of equipment it is attached to. This cannot be changed and will remain with the product for its lifetime.

Fig. 6

STAPS Wireless Head Unit for ISA100.11a applications

4.3.1 About Device Descriptor (DD) files

The Spirax Sarco provided DD files are available on the Spirax Sarco website or from your local representative. The Device Decriptor must contain these files:

> *.ff5 - DD binary
>
> *.sy5 - device symbol file
>
> *.cff - device capability file

Files are available zipped or unzipped specific to your provider.

4.3.2 Method

The configuration of the STAPS Wireless Head Unit can be actioned using the supplied Device Descriptor (DD) with a relevant DD Host like Honeywell's WDM webserver or Yokogawa's FieldMate, either by using the infra red interface or Over the Air (OTA).

The procedure for configuration and provisioning will depend on the wireless infrastructure. Please see the relevant vendor documentation.

Once the STAPS Wireless Head Unit is configured there will be a 2 minute delay before the new settings are accepted and the evaluation of the trap starts or restarts.

If further changes to the configuration are made the evaluation of the trap will be delayed by a further 2 minutes, this will be repeated until there has been 2 minutes of inactivity.

4.3.3 Attributes

The STAPS Wireless Head Unit has 5 application specific attributes that require configuration.

Configuration Attributes.

Attribute	Available Options		Default
Time interval* **(How often the evaluation of the traps is performed)**	15 mins 30 mins 1 hour 8 hours	12 hours 24 hours Out of service	1 hour
Trap type	FT IB BP SM TD		TD
Orifice size	Range	1.0 to 25.4 mm	3.0 mm
		0.04 to 1.00"	0.12"
Pressure	Range	0.5 to 60.0 bar g	25.0 bar g
		7 to 870 psi	360 psi
Line type	Return Open		Return

* Faster Intervals can impact on the battery life.

Setting the trap to Time interval "Out of service" prevents the trap algorithm from running and returns the trap condition as 7, "Out of service"

In addition to the Spirax Sarco specific attributes the STAPS Wireless Head Unit supports the standard ISA100.11a device management attributes e.g. tag name, description, routing etc.

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4.3.4 Battery

When a new battery is inserted into the STAPS Wireless Head Unit there is a requirement to reset the life time prediction counter. This configuration varies from system to system.

If you are configuring for use on a Honeywell One Wireless system this is carried out on the WDM. Select the STAPS Wireless Head Unit's tag name on the selection panel and then select the battery drop down on the property panel. Select "Reset (New Battery)" from the status drop down menu and click apply.

If you are using a Yokogawa Field Wireless System, this can be carried out in the FieldMate software application. Select the UAPMO object from Menu->Device Configuration->UAPMO, and then select the 'Reset' option from the Status dropdown menu in the Battery tab. Click 'Download to device' to complete the operation.

Note: the battery life counter should be reset as soon as possible after fitting a new battery. Failure to do this will result in an inaccurate battery life prediction.

4.3.5 Other

The STAPS Wireless Head Unit is capable of being a routing device and/or an end node.

4.3.6 Outputs

Output		Units	Channel	Notes
Trap condition		0,1 = Good 2,3,4 = Leak 5 = Cold 6 = Unknown 7 = Out of Service	12	AI*
Steam leakage		Kg/h	11	AI*
		lb/hr		
Temperature	Piezo	°C	10	AI*
		°F		
	Pipe	°C	9	AI*
		°F		
Battery	%left	%		MO.attr.102
	Days left	days		MO.attr.103

* AI - ISA100.11a Analogue Inputs, see the Implemented Objects Table in Section 4.3.3

Table 1 - Application output description

If value –nan is displayed in the channel it is possible that the channel/s may need activation.

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5. Diagnostics

Diagnostic status is available as standard attribute 67 of the baseline profile of the User Application Management Object. It is a 32-bit number, each bit from 31 to 0 represents either a specific failure/non-conformance or one of a group of failures/ non-conformances.

With reference to ISA100.11a Profile UAPMO Extension v1.2 Section 5.2.4 DIAG_STATUS;

Bit	Description	Category
31	Failure status	
30	Function check status	
29	Out of Specification status	
28	Maintenance Required status	
27	Fault in electronics	F
26	Fault in sensor or actuator element	F
25	Installation or calibration problem	C
24	Out of service	C
23	Outside sensor limits	O
22	Environmental conditions out of device specification	O
21	Fault prediction: Maintenance required	M
20	Power is Critically Low: Maintenance need Short-term	M
19	Power is low: maintenance need mid-term	M
18	Software update incomplete	C
17	Simulation is active	C
16	Fault due to process influence	F
15	Fault due to non-compliance with specified operation conditions	F
14	Other faults	F
13	WCI reserved.	
12	WCI reserved.	
11	WCI reserved.	
10	WCI reserved.	

Bit	Description	Category
9	WCI reserved.	
8	Device reset: watchdog error	C
7	Vendor specific configuration active	C
6	Cold trap detected	C
5	Firmware not compatible	C
4	High battery use detected	M
3	Internal communications error	C
2	Leaking trap	C
1	Not Used.	
0	Detail information available.	

bits 31-28
denote the overall status of the device. If one or more of these bits is set it may mean that the device is not functioning normally.

bits 27-15
are specific types of failure or non-conformance that contribute to the overall device status.

bits 13-9
are reserved.

bits 8-1
are for vendor specific errors.

bit 0
indicated detailed information available.

Category codes:
F: Failure,
C: Function check,
O: Out of specification,
M: Maintenance required

Bit 31 - Failure status

NAMUR NE107 terminology: Output signal invalid due to malfunction in the field device or peripherals. This will be set by one or more of the following faults;

- Fault in electronics

- Fault in sensor or actuator element fault due to process influence

- Fault due to non-compliance with specified operation conditions

- Other faults

Once set the failure status will only be cleared when all of the above faults are clear.

Bit 30 - Function check status

NAMUR NE107 terminology: Output signal temporarily invalid (e.g. frozen) due to ongoing work on the device. This will be set by one or more of the following faults;

- Installation or calibration problem

- Out of service

- Software update incomplete

- Simulation is active

- Device reset: watchdog error

- Vendor specific configuration active

- Cold trap detected

- Firmware not compatible

- Internal communications error

- Leaking trap

Once set the function check status will only be cleared when all of the above faults are clear.

Bit 29 - Out of specification status

NAMUR NE107 terminology: Deviations from the permissible ambient or process conditions determined by the device itself through self-monitoring or faults in the device itself indicate that the measuring uncertainty of sensors or deviations from the set value in actuators is probably greater than expected under operating conditions.

This will be set by one or more of the following faults;

- Outside sensor limits

- Environmental conditions out of device specification

Once set the out of specification status will only be cleared when all of the above faults are clear.

STAPS Wireless Head Unit for ISA100.11a applications

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Bit 28 - Maintenance required status

NAMUR NE107 terminology: Although the output signal is valid, the wear reserve is nearly exhausted or a function will soon be restricted due to operational conditions.
This will be set by one or more of the following faults;

- Fault prediction: Maintenance required

- Power is critically low: Maintenance need Short-term

- Power is low: maintenance need mid-term

- High battery use detected

Once set the maintenance required status will only be cleared when all of the above faults are clear.

Bit 27 - Fault in electronics

Cause: Read or write to/from the Non Volatile memory failure.
This bit will get set when a single failure has been detected.

Action: No action applicable, the bit will stay set for the duration of the power cycle.

Bit 26 - Fault in sensor or actuator element

This will be set for the following reasons;

Cause: The sensor cable is not connected to the device.

Action: Ensure the connection between the sensor and device is secure, this is an internal fault and may need servicing by a Spirax Representative.

Bit 25 - Installation or calibration problem

This will will not be set as this diagnostic is not implemented at this time.

Bit 24 - Out of service

This will not be set as this diagnostic is not implemented at this time.

Bit 23 - Outside sensor limits

Cause: Either or both of the pipe and piezo temperature readings is(are) outside of the PT100 range. In our case we use class A PT100s and the range for these is -40 to +425 °C

Action: None required, this bit will clear automatically when both pipe and piezo temperature readings return to within range values. This could be either the good range or the disconnected range.

Bit 22 - Environmental conditions out of device specification

Cause: If the internal temperature is read to be

a) Greater than +80 °C or

b) Less than -29 °C

Action: None required, this bit will clear automatically when internal temperature is read to be within the limits mentioned above.

Bit 21 - Fault prediction: Maintenance required

This will not be set as this diagnostic is not implemented at this time.

Bit 20 - Power is critically low: Maintenance need short-term

Cause: The device battery has less than 25% remaining capacity.

Action: Monitor the device and replace the battery when you see fit. This error is only cleared by applying "Reset (New Battery)" in the user interface battery menu.

Bit 19 - Power is low: maintenance need mid-term

Cause: The device battery has between 25% and 75% remaining capacity.

Action: No action is required unless an opportunity to replace the battery early arises or if the battery use is too high.

Bit 18 - Software update incomplete

This will be set if an application upgrade fails.

Cause 1: The application image file supplied is not correct.

Action 1: Ensure the correct application image has been selected.

Cause 2: The upgrade has taken too long.

Action 2: Ensure the link quality is good.

Cause 3: The application image could not be stored correctly in the device.

Action 3: Try again. If bit 27 is also set this may indicate a problem with the device memory.

Bit 17 - Simulation is active

This will not be set as this diagnostic is not implemented at this time.

STAPS Wireless Head Unit for ISA100.11a applications

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Bit 16 - Fault due to process influence

This will not be set as this diagnostic is not implemented at this time.

Bit 15 - Fault due to non-compliance with specified operation conditions

This will not be set as this diagnostic is not implemented at this time.

Bit 14 - Other faults

This will not be set as this diagnostic is not implemented at this time.

Bit 13

WCI reserved.

Bit 12

WCI reserved.

Bit 11

WCI reserved.

Bit 10

WCI reserved.

Bit 9

WCI reserved.

Bit 8 - Device reset: watchdog error

Cause: The device software or hardware has become unresponsive and the device has restarted.

Action: This warning can only be cleared by restarting the device.

Bit 7 - Vendor specific configuration active

Cause 1: Access has been gained to the proprietary vendor access port.

Action 1: The warning will clear automatically after 5 minutes of no activity on the access port.

Cause 2: The device has been configured for non-standard behaviour.

Action 2: This can only be cleared by Spirax Sarco personnel.

Bit 6 - Cold trap detected

Cause: This bit is set when any STAPS algorithm run calculates the trap condition to be cold.

Action: None required, this bit will clear automatically when a STAPS algorithm run calculates the trap condition NOT to be cold. This bit will not be set if the trap is set to "Out of Service" (Section 4.3.3.)

Bit 5 - Firmware not compatible

Cause: The specific configuration of application firmware and radio firmware has not been tested or is known to be incompatible.

Action: Ensure the application firmware and radio firmware match the release notes or IMI.

Bit 4 - High battery use detected

Cause: The radio power consumption is higher than expected. This may impact battery life.

Action 1: Analyse the transmit power required by the location of the device in the mesh network, message rate and IO mode.

Action 2: Improve reception as poor reception may decrease battery life.

Bit 3 - Internal communications error

Cause: The communication link between the application processor and radio processor is not reliable.

Action: This is an internal fault and if it persists, may need servicing by a Spirax Representative.

Bit 2 - Leaking trap

Cause: Trap appears to be leaking.

Action 1: None required, this bit will clear automatically when the trap is detected as functioning again or the trap is detected as cold.

Action 2: Investigate trap - may require replacing.

Bit 1 - Not used

Not used

Bit 0 Detailed information available.

Detailed information available.

Enable DIAG_STATUS configuration

Ensure the DIAG SWITCH for each alarm that is required is enabled and then enable the DIAG_STATUS configuration tab.

STAPS Wireless Head Unit for ISA100.11a applications

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