# AIM<sup>®</sup> Model: ST6700 Armstrong Intelligent Monitoring Installation, Operation and Maintenance Manual





Please read and save these instructions



# **Table of Contents**

# **Safety**

**Icon Legend:** 

- DANGER! ... Injury or death and property damage are *imminent*.
- $\bigwedge$  WARNING! ... Injury or death and property damage are *possible*.
- CAUTION! ... Potential property damage, expensive repairs, and/or voiding the equipment warranty <u>may result</u>.
- BURN HAZARD! ... BURN HAZARD! Direct exposure to steam, hot water, or hot metal surfaces can cause severe skin burns. Skin contact with 140°F (60°C) water or metal for only five (5) seconds may cause a second-degree burn.

Failure to comply with instructions following a safety icon may result in adverse consequences including, property damage, personal injury, or, in extreme cases, death.

### **General Safety Guidelines:**

- 1. Inappropriate use of this product (beyond typical, intended use) could cause damage to the product and other property. It may also result in personal injury or, in extreme cases, death.
- 2. Only designated, qualified, and competent personnel should conduct installation, maintenance, and service in accordance with the directions in this product instruction manual.
- 3. Installation shall comply with all applicable federal, state, and local, electrical and construction, regulatory codes.
- 4. Improper installation, start-up, operation, maintenance, or service may void the product warranty.
- 5. When installing, commissioning or servicing this product:
  - a. ALWAYS select and wear appropriate personal protective equipment (PPE) <u>before</u> carrying out any physical work at the job site. Appropriate PPE may include hard hats, safety glasses, gloves, boots or shoes w/ non-slip soles and toe guards, and protective overalls.
  - b. ALWAYS scan the work area and take note of potential hazards <u>before</u> entering. Adjust your travel path or work position to avoid hazards and personal injury.
  - c. ALWAYS observe designated safety procedures when working in <u>hazardous locations</u> (areas containing explosive and combustible gases, vapors, and dusts) and <u>confined spaces</u> (locations where the breathable air supply may be limited or variable or where entrapment could occur).
  - d. ALWAYS use appropriate lockout-tagout procedures to disconnect power sources and de-energize machinery <u>before</u> conducting installation, service, and repair.
  - e. ALWAYS use great care and appropriate safety gear when working above ground level, especially on ladders and platforms or in the presence of overhead, electrical power lines.
  - f. ALWAYS ensure that all "live" steam, water supply, and condensate return lines are isolated before breaking or loosening any plumbing joints.
  - g. ALWAYS carefully relieve any residual internal pressure in the system or connecting pipe work before breaking or loosening any plumbing joints.
  - h. ALWAYS allow hot parts to cool before commencing work to avoid the risk of skin burns.

# Warnings and Cautions



### 🔼 Warning! Explosion Hazard

Please review product design certifications when installing transmitter in explosive or potentially explosive atmospheres. This transmitter must be installed in accordance with appropriate local, national and international standards, codes and practices.

### A Warning! Sparking Hazard

Risk of electrostatic sparking when installed in explosive atmosphere, clean the outside surface of the monitor with a damp cloth before servicing.

#### Warning! Maintenance Safety

Use industrial standard safety protocol when installing, removing, or performing authorized maintenance procedures on Armstrong Intelligent Monitoring™ transmitter on, or near, process equipment (This includes, but is not limited to, steam traps, relief valves, hot pipes, and equipment).

### A Caution: Lithium Batteries and Shipping

Armstrong Intelligent Monitoring™ products use lithium batteries as power source. Lithium batteries are regulated in transportation by the U.S. Department of Transportation and are also covered by IATA (International Air Transportation Association), ICAO (International Civil Aviation Organization), and ADR (2009 European agreement concerning International Carriage of Dangerous Goods). Confirm transmitters are packaged and shipped in accordance with all shipping regulations.

### A Caution: Damaged Transmitter

If the transmitter becomes damaged, immediately remove from service. Do not attempt repair or maintenance. Contact Armstrong Smart Services Group at:

+12692731415 Armstrong International, Inc. 816 Maple St. Three Rivers, MI 49093



### A Caution: Environment

It is the responsibility of the end user to verify that the process and environment that the transmitter is placed in is free of hazards that will damage the transmitter. Proper conditions are outlined in this document and should be followed to ensure the transmitter does not sustain damage.

#### **Notice: Compliance**

- This transmitter complies with electromagnetic emissions and immunity requirements. Operation is subject to the following condition:
- This transmitter may not cause harmful interference.
- This transmitter must accept any interference received, including interference that may cause undesired operations.

#### Notice: Usage

This manual should be used by experienced personnel as a guide to the installation of the Model ST6700 Armstrong Intelligent Monitoring™ System. Selection or installation of equipment should always be accompanied by competent technical assistance. You are encouraged to contact Armstrong International or its local sales representative for additional information.

#### Notice: Maintenance (Battery)

Authorized maintenance to the transmitter(s) is limited to replacing the battery. All other maintenance should be performed only by Armstrong Smart Services Group, Do not attempt any other maintenance aside from changing the battery and contact Armstrong Smart Services Group for repair:

+12692731415 Armstrong International, Inc. 816 Maple St. Three Rivers, MI 49093

## **Warnings and Cautions – continued**

**Notice:** Do not exceed 360° of rotation. Rotating the antenna more than 360° can cause the antenna to become disconnected internally.



**Notice:** Do not lay the monitor flat on a table or bench without the front cover. Contact with a hard surface can cause damage to internal components.



## Introduction

Armstrong Intelligent Monitoring Model ST6700 is wireless monitoring technology that efficiently monitors and evaluates steam trap operation. The AIM<sup>®</sup> ST6700 identifies the conditions of a steam trap to determine significant problems that could put your operation at risk. The AIM<sup>®</sup> ST6700 can accurately detect potential issues such as plugged and blow-through steam traps, which can cause a range of issues including, but not limited to failed equipment, loss of product, and safety concerns. Immediate failure notification from the AIM<sup>®</sup> ST6700 helps identify the root cause while minimizing production losses and reducing energy consumption. Using nonintrusive technology combined with ISA100, the AIM<sup>®</sup> ST6700 is the ideal solution for any temporary or permanent 24/7 steam trap monitoring.



# **Theory of Operation**

The Armstrong ST6700 AIM<sup>®</sup> transmitter is designed to continuously monitor any type of steam trap. It utilizes a combination of hardware and integrated algorithms to accurately detect steam trap conditions. The hardware consists of an acoustic sensor (Piezo) and a temperature sensor (Thermistor). The integrated algorithms are patented, proprietary code designed by Armstrong to provide actual steam trap conditions based on inputs from the hardware. When applied to a steam trap, the device wirelessly transmits the current condition of the steam trap.

#### **Armstrong ST6700 Measurements**

	Honeywell	Yokogawa	Nivis/Nexcom
Trap Condition	Channel_9	Piezo Status	Channel_9
Stem Temperature	Channel_10	Temperature	Channel_10
Temperature Set Point	Channel_11	Temperature Setpoint	Channel_11

The ST6700 has built-in algorithms, which perform a series of diagnostic checks in order to determine the condition of the steam trap.

The first stage validates the surface temperature of the steam line and compares it with the configurable temperature set point. The temperature sensor located in the stem of the monitor detects the skin temperature at the inlet of the steam trap. The Stem Temperature is compared to the Temperature Set Point.

If Stem Temperature is less than the Temperature Set Point, then the steam trap is cold/plugged. This could be due to a failed plugged steam trap, or there is no steam distributed to the steam trap. If the steam trap is cold/ plugged, the transmitter will return a Trap Condition value 2. A Trap Condition of "2" means the steam trap is in a cold/plugged condition.

If the Stem Temperature is greater than the Temperature Set Point, the monitor assumes there is steam being distributed to the trap causing the device to go into the second stage of diagnostics.

In the second stage, the ST6700 listens to the operation of the trap to determine if there is steam loss through the steam trap's internal orifice. The Piezo sensor has been tuned to detect a trap passing live steam while filtering out background noise. This acoustic signature is analyzed by Armstrong's patented algorithm to determine if the steam trap is in a blow-thru condition (i.e. - losing live steam).

If the algorithm determines that the trap is in normal operation, then the ST6700 will publish a Trap Condition value of 1. A Trap Condition value of "1" means the trap is in a good condition.

If the algorithm determines that the trap is losing live steam, the ST6700 will publish a Trap Condition value of 3. A Trap Condition value of "3" means the trap is in a blow-thru condition.

Trap Condition	Definition
1	OK Steam Trap
2	Cold/Plugged Steam Trap
3	Blow Through Steam Trap

## **Communication Overview**

Armstrong offers a variety of tools to help manage steam trap populations. A primary tool offered by Armstrong is SAGE<sup>®</sup>. SAGE<sup>®</sup> is an online trap management tool that lets you keep all you trap information in one place. The data in SAGE<sup>®</sup> is accessible through a standard computer with a web browser, or it can be accessed with a mobile device like a phone or tablet.

The AIM<sup>®</sup> system is compatible with the SAGE<sup>®</sup> system and the data it collects can be sent to SAGE<sup>®</sup> for real time reporting. Note: SAGE<sup>®</sup> is not required for your AIM<sup>®</sup> system to function properly. It is merely an option to take trap management to the next level. If you are interested in learning more about SAGE<sup>®</sup> go to <u>https://www.armstronginternational.com/sage</u>. Below are communication options for setting up SAGE<sup>®</sup> to communicate with the AIM<sup>®</sup> system.

## Communication Map – SAGE® Proxy in the Cloud



### **Communication Overview - continued**

## Communication Map – On Site SAGE® Proxy



## **ST6700 Overview**



## **ST6700 Overview – continued**



## **Install Steam Trap Transmitter**

## **Preparation**

#### Clearance

Make sure Waveguide is oriented so that enough clearance is available to install transmitter.

**Note:** Install antenna in vertical position for optimal performance.

**Important:** To prevent damage, do not rotate antenna more than 180 degrees.

**Recommendation:** Install transmitter at least 3 ft. (1 m) from any large structure for optimal performance.

**Note:** Install the transmitter so that hazards do not interfere with or damage the transmitter. Examples of physical hazards include, but are not limited to: blowing steam or condensate directly onto the transmitter, high temperature pipes, installation in pathways where the transmitter could be struck by personnel or vehicles, etc.



## **Install Steam Trap Transmitter – continued**



# **Proper Transmitter Positioning**

Pipe application temperature determines the correct transmitter mounting configuration. The transmitter may have angular mounting restrictions on horizontally running pipe.

There are no angular mounting restrictions on vertical piping.

YES YES \
PIPE
YES YES
<b>`</b> 360°

Pipe Temperature	0-160 °C / 32-320 °F
Corresponding Saturated Steam Pressure	5.2 barg/75psig

Pipe Temperature	160-195 °C / 320-383 °F
Corresponding Saturated Steam Pressure	5.2-13 barg / 75-188 psig



## **Proper Transmitter Positioning – continued**

Pipe Temperature	195-255 °C / 383-491 °F
Corresponding Saturated Steam Pressure	13- 42.2 barg / 188-612 psig

**Note:** A single heat sink is required.



Pipe Temperature	255-440 °C / 491-824 °F
Corresponding Saturated Steam Pressure	42.2-* barg / 612-* psig

\*Steam is superheated at this temperature.

Note: Dual heat sinks and a stem extension are required.



Designs, materials, weights and performance ratings are approximate and subject to change without notice. Visit armstronginternational.com for up-to-date information.

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# **Battery Installation and Replacement**



#### Warning: Sparking Hazard

If replacing a battery in the field, especially in areas where explosive or potentially explosive atmospheres may exist, wipe down the exterior of the monitor enclosure and antenna with a damp cloth to remove dust and debris to help prevent static electricity discharge.

**Recommendation:** When initially installing or replacing batteries, first install or replace the battery in the monitor that is locate closest to the access point (or gateway, as the case may be). Then install or replace the battery in the next closest monitor to the access point. Continue this process of working outward from the access point. This battery replacement technique will help the monitors in the system to learn the existence of network neighbors more quickly.



#### **Rules and Regulations:**

This transmitter is designed for live maintenance in hazardous environments. All maintenance should be performed by experienced personnel in accordance with local, national, and international standards and codes.





Orient red arrow on battery label to point towards red slot in enclosure. Insert battery pack into housing until it makes a firm connection with the housing.

**Note:** Use only Armstrong Model D64519 lithium metal battery pack. Use caution when installing battery not to damage or bend any components.



5

If the monitor is new or has been out of service for awhile, confirm that the sliding DIP switch, located on the main printed circuit board (PCB), is set in the "ON" position. (Note: The main PCB can only be viewed from the opposite side of the monitor w/ the short housing cap removed.)

Reset the Battery Life (when Installing a Replacement Battery ONLY)

- Remove short cover
- Press and hold the provisioning button for 10 15 seconds to reset the battery life
- When resetting battery in the gateway, see gateway specific battery reset instructions in the Gateway Appendix



Reinstall all housing caps - torque 25 ft-lb (34 N-m).

Note: Properly tighten caps to avoid water leakage into housing. Water leakage will cause electronic failure. Improper tightening of the caps will void the warranty.



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## **Maintenance and Service**



### **ON/OFF Switch Functions**

The power switch is a small white toggle on the left side of the internal board. It controls the unit's power and must be toggled to "on" or up for the unit to operate and function. Shown in "off" position below.



#### **Provisioning Button**

The provisioning button is located on the bottom of the board inside the ST6700. It has multiple functions based on how many times it is pressed or held. The button is highlighted to the right.



30 s hold = Clear Provisioning 5x = Initiate Publishing

### • Resetting Battery Life

One function of the provisioning button is resetting battery life after changing the battery. Press and hold the provisioning button for 10-15 seconds and battery life will be reset in the unit.

### • Resetting Provisioning

To clear all provisioning, press and hold the provisioning button for 30-35 seconds.

### Initiate Publishing

To allow broadcasting on all channels during setup press and release the provisioning button 5 times. It is important not to press and release it too fast or too slow. The procedure should be completed in a timeframe of approximately 2-4 seconds.

# **Dip Switch Mode Selection**





	Swi	tch	Device Operation Mode		
	1 2		Code 1.0C and Older	1.13 or Newer	
	Up	Up	Normal Operation	Normal Operation / Units - Imperial	
Switch	Up	Down	Burst	Burst / Units - Imperial	
Position	Down	Up	Burst	Normal Operation / Units - Metric	
	Down	Down	Test (Factory use only)	Test (Factory use only)	

The ST6700 performs a series of diagnostic checks to determine the condition of the steam trap. The position of the dip switches pictured above determine how often the standard diagnostics are performed.

1. Normal Operation Mode – Use this mode in the field to maximize battery life while maintaining accuracy. Normal Operation mode is programmed to sample the trap condition every 60 minutes.

**Burst Mode** – Samples the trap condition at the same rate as the Update Rate (See device details for Update Rate values). Notice: Using the device in this mode will cause decreased battery life and in some situations decreased steam trap testing accuracy.

**Test Mode** – Samples the trap condition every 2 seconds. Notice: Test Mode is used only in the factory for functionality testing and should never be used in the field. Test mode will cause significantly reduced battery life and decreased trap testing accuracy.

# **Product Specifications**

## ST6700 Specifications

Weight	1.9 Kg (4.1 lbs)
Ingress Protection Rating	IP66
Output Signal	ISA 100.00a 2.4 GHz
Operating Temperature	-40 °C to 70 °C (-40 °F to 158 °F)
Materials of Construction	Housing - Aluminum (<0.4% copper) Paint - Powder Coat O-ring - EPDM Stem - 304 Stainless Steel Antenna - Nylon 6,6 Nameplate - 316 Stainless Steel
Battery	Type - Encapsulated, Lithium Metal Cells Battery Life - 3 Years* Part Number - D64519 Capacity - 19 Ah Voltage - 7.2 V
Update Rate	Honeywell - Configurable (Default 60 seconds) Yokogawa - Fixed (60 seconds) Nivis/Nexcom - Configurable (Default 300 seconds)
Radio Power	15 (adjustable 1-15)
Default Role	Honeywell - Non-routing Yokogawa - Non-routing Nivis/Nexcom - Routing

- \* Assumptions of typical operating conditions (see variables impacting battery life)
  - · Non-routing device with good signal status with access point
  - 5-minute Update Rate
  - 21 °C (70 °F) Ambient Temperature
  - 10 years is shelf life of lithium cell
  - +/- 10% capacity for temperature and network variation

Variables impacting battery life include:

- Initialization connects and re-connects to the system (i.e., system shutdowns, power outages, maintenance disconnect, etc.)
- · Communications transmission retries due to poor RF connectivity
- Device radio power level
- Data transmission update rate frequency
- System requested polling of dynamic parameters (i.e., radio diagnostics, counters, etc.)
- · System activity rate related to operator configuration changes or manual device parameter data requests
- · Routing of information from other downstream field devices
- · Environmental effects such as operating temperature and humidity

NOTE: Extreme temperatures are detrimental to battery life and can cause as much as a 30% reduction in life for units at -30 °C (-22 ° F) or at 70 °C (158 °F) ambient temperatures, compared to those at a nominal 25 °C (77 °F). Installers should protect transmitters from very hot or very cold processes and consider shading them from direct sunlight.

· Battery construction quality, born-on date/shelf time, and storage temperature

## **Product Specifications - continued**

## **Battery Specifications**

## Part Number: D64519

Performance Specifications	Operating Temperature -40 °C to 70 °C (-40 °F to 158 °F) Humidity Limits - 0-100% non-condensing Output voltage - 7.2 VDC Capacity - 19 Ah
Physical Specifications	Weight - 0.32 kg (0.71 lb) Type - dry cell, lithium-thionyl chloride (LI-SOCL2) with integrated power control circuitry Material - Electrical-grade epoxy resin polymer compound
Storage Information	Storage Life - 10 years (1) Storage Temperature Limits - 5 °C to 30 °C (41 °F to 86 °F)
Approved Devices	AIM® ST6700
Design Certifications for Ordinary (non-hazardous) and Hazardous Locations:	The Armstrong battery pack P/N D64519 is designed and approved only for use within the AIM-ISA Model ST6700 steam trap monitor. The ST6700 steam trap monitor carries limited design certifications for specific hazardous locations under UL (US and Canada), ATEX, and IECEx (refer to the instruction manual 261-EN for a complete listing of the standards and conditions to which the monitor design conforms.) By extension, the ST6700 steam trap monitor is also suitable for use in most ordinary locations wherein the environment is satisfactory, i.e. the operating temperature falls within the limits listed above and moisture exposure does not exceed the monitor enclosure rating of IP66.

Notes: Estimate based on date of manufacturing and storage following recommended conditions

# **Product Certifications**

Underwriters	Laboratories (UL) Approval
United States	Intrinsic Safe for Class I/II/III, Division 1, Groups A, B, C, D, E, F, and G Zone 0, for Class I, Group IIC Temperature Code: T4 [275°F (135°C)] Ambient Temperature Range: T <sub>amb</sub> -40°C to 70°C (-40°F to 158°F) For use with Armstrong model D64519 lithium ion battery only Standards used for Certification: UL 913, Ed. 8; UL 60079-0, Ed. 6; UL 60079-11, Ed. 6
Canada	Intrinsic Safe for Class I/II/III, Division 1, Groups A, B, C, D, E, F, and G Zone 0, for Class I, Group IIC Temperature Code: T4 [275°F (135°C)] Ambient Temperature Range: T <sub>amb</sub> -40°C to 70°C (-40°F to 158°F) For use with Armstrong model D64519 lithium ion battery only Standards used for Certification: CAN/CSA C22.2 No. 157-92, Ed. 3; CAN/CSA C22.2 No. 60079-0:11, Issue date: 2011/12/01; CAN/CSA C22.2 No. 60079-11:14, Ed. 2
European Certification	ATEX Intrinsic Safety Zone 0, Group IIC Temperature Code: T4 [275°F (135°C)] Ambient Temperature Range: T <sub>amb</sub> -40°C to 70°C (-40°F to 158°F) For use with Armstrong model D64519 lithium ion battery only Standards used for Certification: CENELEC EN60079-0, Issue date: 2013/01/01; CENELEC EN60079-11, Issue date: 2012/01/01; CENELEC EN60079-26, Issue date: 2007/03/01
IECEx Certification	Equipment Protection Level: Ga Zone 0, Group IIC Temperature Code: T4 [275°F (135°C)] Ambient Temperature Range: T <sub>amb</sub> -40°C to 70°C (-40°F to 158°F) For use with Armstrong model D64519 lithium ion battery only Standards used for Certification: IEC 60079-0, Ed. 6; IEC 60079-11, Ed. 6; IEC 60079-26, Ed. 2

### **EMC Compliance**

FCC Part 15 Subpart B, Class A; EN55011 Group 1, Class A; EN61000-6.2 Immunity.

CE Mark CE					
EU Directives	Test Standards				
ATEX 2014/34/EU	CENELEC EN60079-0 (2013/01/01) CENELEC EN60079-11 (2012/01/01) CENELEC EN60079-26 (2007/03/01)				
EMC 2004/108/EC	IEC 61326-1 2012				
LVD 2006/95/EC	IEC 60950-1 2015 (2nd Ed.) + AM 1: 2009 + AM 2: 2013				
R & TTE 1999/5/EC	(ETSI) EN 300 328 V1.9.1 (2015-02) (ETSI) EN 301 489-1 V1.9.2 (2011-09) (ETSI) EN 301 489-17 V2.2.1 (2012-09)				

## **Product Certifications - Continued**

### **North American**

Hazardous Location / Explosive Atmosphere

Ratings Class I, II, III; Division 1; Group A,B,C,D,E,F,G

### Zone 0; Group IIC, IIB, IIA

T4 at T ambient =  $-40^{\circ}$ C to  $70^{\circ}$ C ( $-40^{\circ}$ F to  $158^{\circ}$ F)



**Notes:** Install per the National Electrical Code, ANSI/ISA-RP12.06.01, the Canadian Electrical Code, and applicable European or other international installation codes, including BS EN / IEC 60079-14, as applicable.

## **Product Labels**



# **Connecting the Armstrong ST6700 to the Honeywell WDM - Table of Contents**

.0 Over The Air (OTA) Armstrong ST6700 Provisioning and Joining 25						
.0 Infrared (IR) Armstrong ST6700 Provisioning and Joining						
3.0 Checking ST6700 Software Revision	34-35					
4.0 Checking ST6700 Battery Life	36-37					
4.1 Resetting Battery Life Through WDM						
4.2 Resetting Battery Life From the Monitor						
5.0 Modbus Register Content	39-44					
5.1 Translating ("STEAMTRAP_UAPMO').DIAG_STATUS						
5.2 Translating ("TEMPERATURE AIO").PV and ("TEMPERATURE SETPOINT AIO").PV	40					
5.3 Device Self-Diagnosis Status Flags						

This document does not contain information about how to configure the WDM. See WDM literature for configuration procedure.

# **1.0 Over The Air (OTA) Armstrong ST6700 Provisioning and Joining**

OneWireless (includes the Configurator tool) is the software used to configure the WDM and FDAP. To configure the network please use the following steps:

1. Start Internet Explorer, navigate and login to OneWireless via assigned IP address.

weighter to OneWireless <sup>14</sup> R220.2		فتعالم مترجية بالمارية فالتقاص والترك
	User Login	
	User ID Enter user ID	
	Password	
	Login	
the second se		

2. In the device list, click to select FDAP. Next, expand the Property Panel on the right.



## 1.0 Over The Air (OTA) Armstrong ST6700 Provisioning and Joining - continued

3. In the FDAP Property Panel, click to select/expand Device Management. Next, scroll down to locate Over The Air Provisioning and click Enable for 60 Minutes . Ensure FDAP in the device list now has key icon.



4. If ST6700 isn't already powered on, power it on. The power switch is a small white toggle on the left side of the internal board. It controls the unit's power and must be toggled to "on" or up for the unit to operate and function. Shown in "off" position below. Next, clear any previous provisioning by pressing & holding the provisioning button for 35 seconds.



## 1.0 Over The Air (OTA) Armstrong ST6700 Provisioning and Joining - continued

5. Shortly, the ST6700 should appear on the device list with a icon. Click to select the ST6700 and on the top menu bar on the Provisioning tab click Accept



6. Next the "Accept Over the Air Devices" window appears, click and the ST6700 provisioning will process. If successful, a Progress status of Completed will appear. Click when completed.

	Accept Over the Air Devices							
	Tag Name	Location	Vendor	Model	Revision	Progress	1	
	T022FF0000029467	Unplaced				Completed		
						÷		
		The accept using over	ot command allows you to r the air provisioning.	provision a device to you		Accept Close		
L								

7. The ST6700 should now appear on the device list with a icon. Shortly, a + will appear next to the ST6700. Click the icon + to expand the ST6700's Channels list. Next, quickly press and release the Provisioning button 5 times consecutively, within 2-4 seconds. This will initiate publishing of data on all channels.

	4
	4
— 🔘 CH09_AI_0	
— 🔘 CH10_AITEMP	
CH11_AITEMP	

## **1.0 Over The Air (OTA) Armstrong ST6700 Provisioning and** Joining - continued

- 8. The ST6700's channels will cycle from a icon to a icon. Once all 3 channels have a icon, drag & drop the ST6700 onto the map. Clicking on the ST6700's map icon will expand its window showing:
  - CH09 = Trap Status
  - CH10 = Temperature
  - CH11 = Temperature Set Point





9. The ST6700 Monitor has been added the list of Field Devices.

# 2.0 Infrared (IR) Armstrong ST6700 Provisioning and Joining

1. Start Internet Explorer, navigate and login to OneWireless via assigned IP address.



2. Connect the Provisioning Device handheld's power supply, and its docking station to the USB port on the WDM.



3. In the device list, click to select WDM. Next, expand the Property Panel on the right.



4. On the Property Panel, expand Provisioning. Check Transfer to PDA, and complete the following information under Settings. Name=handheld name, Number of Keys=100 max, Expiration (days)=31 max. When completed, Click Transfer Settings to transfer the security keys to the Provisioning Device handheld, then remove it from the docking station.



5. If ST6700 isn't already powered on, power it on. Next, clear any previous provisioning by pressing & holding the provisioning button for 35 seconds.



6. On the Provisioning Device handheld, select Start > Provisioning Device > Provisioning, the Provisioning screen appears.



7. Hold the Provisioning Device's IR sensor in line with the IR sensor of the ST6700 and tap "Provision A Device". If successful, the device provisioned successfully message appears, tap Ok.



8. The ST6700 should now appear on the device list with a  $\bigcirc$  icon. Shortly, a + will appear next to the ST6700. Click the Graphic icon to expand the channels list. Next, quickly press and release the Provisioning button 5 times consecutively, within 2-4 seconds. This will initiate publishing of data on all channels.



9. The ST6700's channels will cycle from a  $\bigcirc$  icon to a  $\bigcirc$  icon. Once all 3 channels have a  $\bigcirc$  icon, drag and drop the ST6700 onto the map. Clicking on the ST6700's map icon will expand its window window showing:

- CH09 = Trap Status
- CH10 = Temperature
- CH11 = Temperature Set Point

# **3.0 Checking ST6700 Software Revision**

1. One way to determine a ST6700's software revision is to click the device list icon, expanding the list. Once expanded, scroll through the list and locate the desired ST6700's row. Determine its software revision in the Revision column.



	I	•	Filter: All Devi	ces 🔹	🖉 Accept	- 🌰 🔺	ctivate	🇯 Templates	Application	📇 Manage Users	🔏 Manage Roles	-		OneWireless™ 📥 🌰
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🗩 🔿 JS	0-SP-128	4	Device	Joined	0041524D	0001	H01.4,S01.	0402.09 5022FF	000002946I FE80::	0022:FF00:0002:946E Hi	igh		Neighbor Diagnostics	
🗩 🔵 J5	0-SP-129	- 4	Device	Joined	0041524D	0001	H01.4,S01.	0402.09 5022FF	000002947 FE80::	0022:FF00:0002:9471 Hi	igh	12163	Channel Diagnostics	
🗩 🔵 J5	0-SP-130	4	Device	Joined	0041524D	0001	H01.4,S01.	0402.09 5022FF	000002947: FE80::	0022:FF00:0002:9473 Hi	igh	×	<ul> <li>Statistics (DMAP)</li> </ul>	
🗩 🗩 J5	0-SP-131	- 4	Device	Joined	0041524D	0001	H01.4,S01.	0402.09 5022FF	000002947 FE80::	0022:FF00:0002:9474 Hi	igh		<ul> <li>Statistics (UAP)</li> </ul>	
🗩 🗩 J5	0-SP-132	4	Device	Joined	0041524D	0001	H01.4,S01.	0402.09 5022FF	000002947! FE80::	0022:FF00:0002:9475 Hi	igh		Application Management	
🗩 J5	0-SP-133	4	Device	Joined	0041524D	0001	H01.4,S01.	0402.09 5022FF	000002947! FE80::	0022:FF00:0002:9479 Hi	igh		Input Publication	
	0-SP-134	4	Device	Joined	0041524D	0001	H01.4,S01.	0502.09 5022FF	000002947( FE80::	0022:FF00:0002:947C Hi	igh		Notes	
🗩 🔿 JS	0-SP-135	4	Device	Joined	0041524D	0001	H01.4,S01.	0402.09 5022FF	0000029B3 FE80::	0022:FF00:0002:9B36 Hi	igh			
🔵 J5	0-SP-137	4	Device	Joined	0041524D	0001	H01.4,S01.	0402.09 502 FE	0000029B3 FE80::	0022:FF00:0002:9B3E Hi	igh			
	0-SP-138	4	Device	Joined	0041524D	0001	H01.4,S01.	0402.09 5022FF	000029B4 FE80::	0022:FF00:0002:9B4E Hi	igh			
🔿 35	0-SP-139	4	Device	Joined	0041524D	0001	H01.4,S01.	0402.09 5022FF	0000029C9 FE80::	0022:FF00:0002:9C91 Hi	igh			
🔴 то	22FF00000293EB	4	Device	Offline	0041524D	0001	H01.4,S01.	0502.09 5022FF	00000238EI FE80::	0022:FF00:0002:93EB U	nknown			
— 🔵 то	22FF0000029467	4	Device	Joined	0041524D	0001	H01.4,S01.	0302.09 5022FF	000002946 FE80::	0022:FF00:0002:9467 Hi	igh			
Nar	me	Char	nnel Mode	Value		Status								Į I
•	CH09_AI_0	9	Auto	2.00 Unitle	ess	Good								
•	CH10_AITEMP	10	Auto	21.00 °C		Good				$\mathbf{N}$			Priority Start Time	Description
•	CH11_AITEMP	11	Man	52.00 °C		Good					Ļ		Urgent 12/30/2015 11:14:35 A	M Non-Redundar
4-							_							
R.										🗖 ek unstar	* 4 + 10 + 1			
•														

#### ST6700 software revision

### 3.0 Checking ST6700 Software Revision - continued

 Another way to determine a ST6700's software revision is to select the desired ST6700 from the device list. Once selected, expand the Property Panel and click Field Device Summary in the Identification section will be Sensor Revision: H01.S01.0302.09



T022FF	000002946	7		
▼ Field D	evice Summa	агу		
	Tag Name:	T022FF00000	29467	1
	Status:	Joined		ш
	Description:			ш
C C	Default Map:	Location 2	•	ш
	ication			
	Vendor:	0041524D		
	Model:	0001		
Se	rial Number:	S022FF00000	29467	
Ra	dio Revision:	V304.11.02		
Sens	sor Revision:	H01.4,S01.03	02.09	
Ter	nplate Type:	Installed		
Templa	ate Revision:	2		
-ISA100	) Network Ad	dress		
IF	v6 Address:	FE80::0022:F	F00:	
	EUI64:	0022FF000002	29467	
Netw	ork Address:	11		
Prir	mary Parent:	J40-SP-FDAP1		
Prim	ary Address:	3		
Secon	dary Parent:	0		
Second	ary Address:	1		
	buting Level.	1		1
ISA100	) Time Synch	ronization —		
Time Ma	aster Tag:	J40-SP-FDAP1		
Time Ma	ster Addr:	3		
Prir	mary Parent:	J40-SP-FDAP1		Ļ
• Aidiffis	s (1)			
Priority	Start Time		Description	-
Urgent	12/30/2015	11:14:35 AM	Non-Redun	dar
				J

# 4.0 Checking ST6700 Battery Life

1. To determine a ST6700's remaining battery life, select the desired ST6700 from the device list. Once selected, expand the Property Panel and click **Device Vendor Parameters**. Scroll down and locate **Remaining Battery**.



6022FF0000026A1		
Field Device Summa	агу	Â
Channel Configurati		
Device Profile Paran		
<ul> <li>Device Vendor Para</li> </ul>	meters	
AP Firmware Versi:	2817	
AP Hardware Vers:	1025	11 M
Country Code:	840	
Radio Output Power:	15	
Remaining Batter:	89 d	
Device rag		28
Devic	e Tag	
5	4	1
4	8	-110
5	0	- 118
5	0	
7	0	
7	0	
4	8	
4	8	
4	8	
4	8	-ţ
Primary Neighbor EUI64		
Primary N	eighbor EUI64	
	0	÷
## 4.1 Resetting Battery Life Through WDM

After installing a new battery the battery life indicator needs to be reset. Follow the instructions below to reset the battery life. Note: resetting the battery life when the battery is not new or isn't replaced with a new battery will cause the remaining battery life to display incorrectly. ONLY RESET THE BATTERY LIFE WHEN INSTALLING A NEW BATTERY.

1. Select the desired ST6700 from the device list. Once selected, expand the Property Panel and click **Device Vendor Parameters**. Scroll down and locate **Battery Reset Trig...**: as highlighted below

8 6022FF0000026A1	E 🕨
Field Device Summa	ary 🔒
Channel Configurati	on
Dovice Profile Doron	ostoro
AP Firmware Versi:	2817
AP Hardware Vers:	1025
Batery Reset Trig:	840
Dadia Output Pawaru	15
Remaining Batter	89 d
Device Tag	
Devic	ce Tag
5	i4 1
4	8
5	i0
9	50
7	0
7	0
4	18
	18
Primary Neighbor FUI64	•••••
Primary Neighbor E0104	eighbor EUI64
	0

2. Set the value to 1 and click the save button. The unit will reboot and reset the counter for the battery life.

3. To perform a battery reset on the device consult the battery reset section of general IOM on page 16.

### **4.2 Resetting Battery Life From the Monitor**

- 1. To reset the battery life, remove the short cover to reveal the "Provision/Display Select" button.
- 2. Press and hold the "Provision/Display Select" button for 10-15 seconds.

# NOTE: To avoid inaccurate battery life readings, DO NOT reset the battery life unless a new a new/undegraded battery is installed.



# **5.0 Modbus Register Content**

No.	Description	Name	Data format		Details			
0		Data Status	Unsigned 16	0x0	)080: Good \$	Status		
1			Unsigned 16	Status of (0: conne	the field wir ected, 2: not	eless device connected)		
2	VEGWA10 GW STATUS		Integer 16	Battery I 0x7FFF:	ife (0>: days external pov	, <0: hours, ver source)		
3 4 5 6 7		Device Status	Unsigned 16	Unsigned 16 0 (Reserved bits				
8		Data Status	Unsigned 16	0x(		Status		
10			Unsigned 16	Status of (0: conne	the field wir ected, 2: not	eless device connected)		
11	T022FF000002A532.DEV_STATUS	Device	Integer 16	Battery life (0x05B4 (1460 d days - normal starting poi				
12 13 14 15 16 17		Status	Unsigned 16	Usua	lly 0 (Reserv	ved bits)		
18		Data Status	Unsigned 16	0x0	)080: Good \$	Status		
19 20	T022FF000002A532.UAP02.UAPMO("STEAMTRAP_UAPMO').DIAG_STATUS	Diagnostic Status	Bit String	Bina	ry (See exan	nple #1)		
21		Data Status	Unsigned 16	0x0	)080: Good \$	Status		
22	T022FF000002A532.UAP02.AI_01("PIEZO STATUS AIO").PV	Piezo Status	Floating	Good Trap 3F80	Cold Trap 4000	Blow Through 4040		
23				0000	0000	0000		
24		Data Status	Unsigned 16	0x(	080: Good 9	Status		
25 26	T022FF000002A532.UAP02.AI_02("TEMPERATURE AIO").PV	Temperature	Floating	32 bit hex (	kadecimal re See example	presentation #2)		
27		Data Status	Unsigned 16	0x0	)080: Good \$	Status		
28 29	T022FF000002A532.UAP02.AI_03("TEMPERATURE SETPOINT AIO").PV	Temperature Set Point	Floating	32 bit hex (;	adecimal re See example	presentation #3)		

# 5.1 Translating ("STEAMTRAP\_UAPMO').DIAG\_STATUS

Active Bit	Diagnostic Status
31	Failure Status
30	Function Check Status
29	Out of Specification Status
28	Maintenance Required Status
27	Fault In Electronics
26	Faults in sensor or actuator element
25	Installation, calibration problem
24	Out of service
23	Outside sensor limits
22	Environmental conditions out of devices specifications
21	Fault prediction: Maintenance required
20	Power is critical low: maintenance need short term
19	Power is low: maintenance need mid-term
18	Software update incomplete
17	Simulation is active
16	Faults due to process influence
15	Faults due to non-complainant operating conditions
14	Other faults
13	WCI reserved 13
12	WCI reserved 12
11	WCI reserved 11
10	WCI reserved 10
9	WCI reserved 9
8	Watchdog reset
7	Vendor configuration active
6	Cold Trap
5	Incompatible firmware
4	High battery use
3	Communication error
2	Trap Blow Thru
1	Vendor Defined 1
0	Detailed information available

Examples																																
Register								19	9															20								
Bit	31	30	29	28	27	26	25	24	26	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Result #1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Result #2	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Result #1 "Function Check Status" & "Cold Trap"

Result #2 "Maintenance Required Status" & "Power is critical low: maintenance need short term"

## 5.2 Translating ("TEMPERATURE AIO").PV and ("TEMPERATURE SETPOINT AIO").PV

		Exar	nple #2				
Register	Result	Combine	Convert 32 HEX to Floating Point				
25	41C8	44000000	05 00000				
26	0000	41080000	25.00000				
		Exar	nple #3				
Register	Result	Combine	Convert 32 HEX to Floating Point				
28	428C	12800000	70,00000				
29	0000	4200000	70.00000				

# **5.3 Device Self-Diagnosis Status Flags**

### **Category 1: Failure Diagnostics**

### **Diagnostic: Fault in Electronics**

Functional Behavior:

The following diagnostic flags are set: "Failure Status" and "Fault in Electronics" (Bit 31 and Bit 27 are set to 1).

### Causes and Triggers:

Critical memory failure, security violations, WDT password violation, Flash password violation, PMM password violation, Peripheral area fetch (stack overflow, pointer access or other logical problem in the code.

### **Diagnostic: Faults In Sensor Or Actuator Element**

Functional Behavior:

The following diagnostic flags are set: "Failure Status" and "Faults in sensor or actuator element" (Bit 31 and Bit 26 are set to 1).

Causes and Triggers: Damaged (open or shorted) thermistor resulting in 0.1 Ohm > R or R > 1M Ohm. Damaged (open or shorted) piezo-electric transducer resulting in 0.1 Ohm > R or R > 1M Ohm.

### **Diagnostic: Faults Due To Process Influence**

Functional Behavior:

The following diagnostic flags are set: "Failure Status" and "Faults due to process influence" (Bit 31 and Bit 16 are set to 1).

Causes and Triggers: Excessively high process temp is detected can detect resulting in 290 deg C < Temp < 350 deg C.

### Diagnostic: Faults Due To Non-Compliance With Specified Operating Conditions

Functional Behavior:

The following diagnostic flags are set: "Failure Status" and "Faults due to non- compliant operating conditions" (Bit 31 and Bit 15 are set to 1).

Causes and Triggers:

This diagnostics flag will be set when the on-board oscillator experiences a fault frequency, namely when the frequencies generated drops below the minimum allowed specification.

### **Diagnostic: Other Faults**

Functional Behavior:

The following diagnostic flags are set: "Failure Status" and "Watchdog Reset" (Bit 31 and Bit 8 are set to 1).

Causes and Triggers:

The diagnostic flag is set if the result of ProbeTempReadObjId, ProbeTempSetObjId, PiezoStatusUAPObjId registration not successful. This is more like an extra software validation method to assure that all the channels have a right object attached to it and there is no duplicate registration.

### Diagnostic: Watchdog triggered device reset

Functional Behavior:

The following diagnostic flags are set: "Failure Status" and "Faults due to non- compliant operating conditions" (Bit 31 and Bit 15 are set to 1).

Causes and Triggers:

The diagnostic flag is set if the application processor was reset due to a watchdog expiration. This can be detected based on SYSRSTIV Register of the MSP430F5438A micro-controller.

### **Category 2: Functional Check**

### Diagnostic: Installation, Calibration Problem

Functional Behavior:

The following diagnostic flags are set: "Function Check Status" and "Installation, calibration problem" (Bit 30 and Bit 25 are set to 1).

Causes and Triggers:

The diagnostic flag is set if one of the following conditions has been met.

- Low output from thermistor where T < -40 $^{\circ}$
- High output from thermistor where T > 200°
- Low output from piezo-electric transducer where there is no voltage output or Vout-piezo <= 1 mV
- RSQI with primary neighbor is low RSQI < 63.
- High PER (Packet Error Rate) where PER > 50%.

### **Diagnostic: Out of Service**

Functional Behavior:

The following diagnostic flags are set: "Function Check Status" and "Out of service" (Bit 30 and Bit 24 are set to 1).

Causes and Triggers:

The diagnostic flag is set if actual mode of AI Objects is Out Of Service.

### Diagnostic: Software Update Incomplete

Functional Behavior:

The following diagnostic flags are set: "Function Check Status" and "Software Update Incomplete" (Bit 30 and Bit 18 are set to 1).

Causes and Triggers:

The diagnostic flag is set when the remote OTA upgrade process of the application processor (through UD mechanism) fails due to any reasons (ex. invalid image firmware, RF connection lost etc).

#### **Diagnostic: Simulation is Active**

Functional Behavior:

The following diagnostic flags are set: "Function Check Status" and "Simulation is active" (Bit 30 and Bit 17 are set to 1).

Causes and Triggers:

The diagnostic flag is set when the simulation mode /function of any process channel (AI object) is active.

### Diagnostic: Cold Trap Detected (Armstrong specific)

Functional Behavior:

The following diagnostic flags are set: "Function Check Status" and "Cold trap" (Bit 30 and Bit 6 are set to 1).

Causes and Triggers:

The diagnostic flag is set if the average output from thermistor is approximately equal to the ambient temp over a period of time of 10 minutes.

#### Diagnostic: Firmware incompatible (Armstrong specific)

Functional Behavior:

The following diagnostic flags are set: "Function Check Status" and "Incompatible Firmware (Bit 30 and Bit 5 are set to 1).

Causes and Triggers:

The diagnostic flag is set when after a remote firmware upgrade, the new application processor firmware version (reflected by UPAMO's VersionRevision attribute) is older than or equal with the previous one.

### Diagnostic: High-Battery Use Detected (Armstrong specific)

Functional Behavior:

The following diagnostic flags are set: "Function Check Status" and "High battery use" (Bit 31 and Bit 8 are set to 1).

Causes and Triggers:

The diagnostic flag is set when the rate of change of battery life prediction exceeds discharge rate threshold specified value over a time period.

### Diagnostic: Trap "Blow-Through" (Armstrong specific)

Functional Behavior:

The following diagnostic flags are set: "Failure Status" and "Faults due to non- compliant operating conditions"

(Bit 30 and Bit 2 are set to 1).

Causes and Triggers:

The diagnostic flag is set if the Analog Input PV (process value) reflecting the piezo-electric transducer becomes equals 3 (CH09\_AI\_0's PV = 3). The status flag will be cleared as soon as the Analog Input PV attribute value changes to 1 or 2.

### **Category 3: Out of Specification**

### **Diagnostic: Outside Sensor Limits**

Functional Behavior:

The following diagnostic flags are set: "Out of Specification Status" and "Environmental Conditions Out of Device Specification" (Bit 29 and Bit 23 are set to 1).

Causes and Triggers:

The diagnostic flag is set if the internal reading of the A/D converter present in the application processor is out of range. This indicates that the internal temperature sensor present in the application processor cannot be read, and there is no way of knowing if the instruments is operating within the advertised environmental specifications (temperature). If the value read is within 200 mV below or 200 mV above the lowest/highest possible ADC reading value this flag will be set.

#### Diagnostic: Environmental conditions out of device specification

Functional Behavior:

The following diagnostic flags are set: "Out of Specification Status" and "Outside Sensor Limits" (Bit 29 and Bit 22 are set to 1).

Causes and Triggers:

The diagnostic flag is set if the internal reading of the A/D converter present in the application processor indicates that the instrument is operating in temperatures that are below -40° or above 85°.

### **Category 4: Maintenance Required**

### **Diagnostic: Fault Prediction**

#### Functional Behavior:

The following diagnostic flags are set: "Maintenance Required Status" and "Fault Prediction Maintenance Required" (Bit 28 and Bit 21 are set to 1).

#### Causes and Triggers:

The diagnostic flag is set if the device resets due to a brownout. Since the device is battery powered, this indicates a drop in voltage, meaning that somethings is wrong with the power supply system.

### **Diagnostic: Power Is Critical Low**

Functional Behavior:

The following diagnostic flags are set: "Maintenance Required Status" and "Power Is Critical Low: Maintenance is needed short-term" (Bit 28 and Bit 20 are set to 1).

Causes and Triggers:

The diagnostic flag is set if the remaining battery capacity (DLMO.PowerSupplyStatus = 3) is less than 25% and battery life (DLMO.EnergyLeft) is less than 10 days.

### **Diagnostic: Power Is Low**

Functional Behavior:

The following diagnostic flags are set: "Maintenance Required Status" and "Power Is Low: Maintenance is needed mid-term" (Bit 28 and Bit 19 are set to 1).

Causes and Triggers:

The diagnostic flag is set if the remaining battery capacity (DLMO.PowerSupplyStatus = 3) is less than 25% and battery life (DLMO.EnergyLeft) is more than 10 days.

### Diagnostic: Communication Error (Armstrong specific)

Functional Behavior:

Diagnostic: Communication error (Armstrong specific) (Bit 28 and Bit 3 are set to 1).

Causes and Triggers:

The diagnostic flag is set if the API communication between application processor and stack radio module is not working. If no Radio API Request/Response will be received by the application processor during last 5 minutes the flag is set. If an API Request/Response is received the Communication error flag remains active for 5 minutes, but the internal counter will be reset for the next 5 minutes.

# **Connecting the Armstrong ST6700 to the Yokogawa YFGW410 - Table of Contents**

1.0 Required Software	46
1.2 Required Hardware	
2.0 Wireless System Configuration	47-82
2.1 OTA Armstrong ST6700 Provisioning and Joining	58
2.2 IR Armstrong ST6700 Provisioning and Joining	
2.3 Viewing Device Data – Field Wireless Management Console	
3.0 DTM Tool: Configuring Yokogawa FieldMate Tool	83-90
3.1 DTM Tool: Viewing Device Data in the DTM Tool	
4.0 Device Configuration	
4.1 Changing the Temperature Setpoint	
4.2 Simulation the Piezo Status (PV_Value)	
4.3 Device Vendor Parameters	
4.4 Restarting the Monitor	
4.5 Attributes List	
4.6 Armstrong Specific Attributes	
5.0 Viewing the Modbus Registers of the Monitor	106-107
6.0 Modbus Register Content	108-114
6.1 Translating ("STEAMTRAP_UAPMO').DIAG_STATUS	
6.2 Translating ("TEMPERATURE AIO").PV and ("TEMPERATURE SETPOINT AIO").PV	
6.3 Device Self-Diagnosis Status Flags	

This document does not contain information about how to configure the YFGW510 AP. See YFGW510 AP literature for configuration procedure.

# **1.0 Required Software**

The following table lists the required software for ST6700 device integration with the Yokogawa environment:

No.	Software	Scope	Required steps
1	Internet Explorer	Communication with the YFGW410	Included with all Windows based machine
2	Field Wireless Management Console	Wireless Network Configuration and monitoring	Web based application integral to the YFGW410. Available via the YFGW410 assigned IP address.
3	FieldMate (Lite/ Advanced)	Wireless Field Device configuration, data display	Install the software from the Field Mate DVD, or download from Yokogawa website.
4	CF/DD file	Field Wireless Device Registration	The DD files should be saved to the recommended folder below: C:\Program Files (x86)\Yokogawa\DTM\DTMev\EV\ISA100\ 0041524D\ https://www.armstronginternational.com/sites/default/files/resources/ files/Yogogawa%20YFGW410%20CF%2BDD%20Files.zip

## **1.2 Required Hardware**

For IR Provisioning the following infrared adapter is required and must be purchased separately:

Vendor Name	ACTISYS
Model Name	IR224UN
Model No.	ACT-IR224UN-LN96-LE
Baud Rate	9600bps

# **2.0 Wireless System Configuration**

Field Wireless Management Console (includes the Configurator tool) is the software used to configure the Field Wireless System. To configure the network please use the following steps:

- 1. Start Internet Explorer and enter assigned IP (Default http://192.168.0.101:8080) in the web browser navigation field.
- 2. Click "Configurator" and the login dialog will appear.



3. Follow the login steps (if it is the first time, the default login user is "admin" and password "admin").

🛃 Login		×
User Name	admin	
Password	•••••	
ОК	Cancel	

4. A valid login opens the configurator tool.

M Configurator					_		×
Eile Tools blate						0	^
Ph. La							_
File Tools Help	VFGW410 Settings	Device Tag  Enable redundancy Use external	VFGW410	Required to restart all Backbone Devices			

5. Select "Network ID" in the navigation pane on the left side of the screen (example Network ID: 204).

Configurator										-	×
File Tools Hele											
E M											
VFGW410 Settings     VFGW410 Settings     Access Control Lists     Time Source     Operation Mode     Hopping Patterns     VFGW410 Settings     Sampling Data     Moduus Settings     Resource	Network Information Backbone Routers Field Devi Network ID Description	204									
	Hopping Pattern	A		~		Require	d to restart	Subnet			
	Enable Channels	11	2 12	13	14	15	16	17	18		
		19	20	21	22	23	24	25	26		

6. Select the "Field Devices" tab.

File Tools Help							
© <b>₩</b>							
YFGW410 Settings     Interfaces     Access Control Lists     Time Source     Operation Mode     Hopping Patterns     Field Wireless Networks     Network ID: 204	Network Information B	ackbone Routers Field	dit Delete	Import Provis	ioning File		
– Graphic Editor – Alert Settings – Sampling Data – Modbus Settings – Resource	Devic	• Tag EUI-	64 Join Key		Device Role	Primary Router	Secondary Router

7. Click "Add" to prepare connection for a Field Wireless Device.

🛃 Configurator						-	×
File Tools Help							
R +1							
YFGW410 Settings     Interfaces     Access Control Lists     Time Source     Operation Mode     Hopping Patterns     Field Wireless Networks     Network ID: 204	Network Information Backbone Rou	Edit	Delete Impo	ort Provisioning File			
– Graphic Editor – Alert Settings – Sampling Data – Modbus Settings – Resource	Device Tag	EUI-64	Join Key	Device Role	Primary Router	Secondary Router	

- 8. Obtain the Device Tag from the ST6700.
  - · Remove the front cover
  - · Record the last 4 characters on the device ID tag (highlighted below)
  - In this example they are "A532"



- 9. Fill out the "Device Tag" field with T022FF000002 followed by the recorded 4 characters.
  - In this example the Device Tag will be T022FF000002A532

Field Device Settings		×
General Settings		
Properties Network ID:	204 ~	Alert Imable Diagnostic Alert Process Alert
Device Tag:	T022FF000002A532	- Device Group
OTA Provisioning: EUI-64:		Group ID:
Join Key:		Primary Router:
Device Role: Provisioner Name:	IO(Auto) ~	Secondary Router: 🗸 🗸 🗸 🗸
Provisioning Time:		
Primary Router:	$\sim$	
Secondary Router:	~	
Not online: Device Group:		
	ОК	Cancel

- 10. Verify the following and select OK.
  - The "OTA Provisioning" check box is selected (for both OTA and IR Provisioning methods)
  - The device role is selected in the desired function (Default: "IO(Auto)")
  - The "Enable Diagnostic Alert\_Process Alert" check box is selected

roperties		Alert
Network ID:	204 🗸	Enable Diagnostic Alert_Process Alert
Device Tag:	T022FF000002A532	
OTA Provisioning:		– Device Group –
EUI-64:		Group ID: V
Join Key:		Direct Darter
Device Role:	IO(Auto) $\checkmark$	Primary Kouter:
Provisioner Name:		Secondary Router: 🗸 🗸 🗸
Provisioning Time:		
Primary Router:	$\sim$	
Secondary Router:	$\sim$	
Not online:		
Device Group:		

11. The ST6700 Monitor has been added to the list of Field Devices.

Configurator File Tools Help								-	×
VFGW410 Settings  VFGW410 Settings  - Interfaces - Access Control Lists - Time Source - Operation Mode - Hopping Patterns - Field Wireless Networks - Network ID: 204	Network Info	rmation	Backbone Routers	Edit	Delete Import Prov	visioning File			
- Graphic Editor - Alert Settings - Sampling Data - Modbus Settings - Resource		1 10	vioo Tog 22FF000002A532		Join Key	Dovice Role IO(Auto)	Primery Router	Cessendery Rester	

12. Select "Sampling Data" in the navigation pane on the left side of the screen.

🛃 Configurator										-		×
File Tools Help												
i 🕞 🖬												
	Sampling Data	Add	Edit	Delete								
- Alert Settings - Sampling Data		Sampling Data		Read / Write	Period	Stale Limit	Retry	Vendor ID	Model ID	DEV_REV	CFREV	
Resource												_
												_
												_

13. Click "Add" to configure Sampling Data.

🛃 Configurator										-		×
File Tools Help												
B ••												
	Sampling Data											
Interfaces     Access Control Lists     Time Source     Operation Mode     Hopping Patterns     Field Wireless Networks     Network ID: 204     Graphic Editor		Add	Edit	Delete								
– Alert Settings – <b>Sampling Data</b> – Modbus Settings – Resource		Sampling Data		Read / Write	Period	Stale Limit	Retry	Vendor ID	Model ID	DEV_REV	CFREV	

- 14. Select the device to configure
  - Click the \_\_\_\_\_ button

Sampling Settings		
Device Tag:		CF / DD           CF File:         ~           DEV_REV:         CFREV:           DD File:
Available Parameters:		Read Parameters:
	>>	
	<	

15. Select the check box of the device to be configured and click OK.

Field	Device List Inform	ation	Network ID	All
9	Device Tag T022FF000002	EUI-64	Network ID 204	Device Role IO(Auto)

16. Select "Load CF/DD" from the CF File dropdown.

Sampling Settings			×
Device Tag: T022FF000002A532	CF / DD CF File: DEV REV:	Load CF/DD	
Read Parameters Write Parameters	DD File:	YOKOGAWA FN310 HART 1.1 YOKOGAWA FN510 DIDOAI 1.1 YOKOGAWA YTMX580 1.1 YOKOGAWA YTA510 1.2	
Available Parameters: Re	ad Parameters:		
>			

- 17. Navigate to folder containing the Armstrong \*.cff file and open the file (The device driver package is available at <u>www.armstronginternational.com</u>).
- 18. Select the "ARMSTRONG 0001 1.3" from the CF File Dropdown.

Sampling Settings			×
	CF / DD		
Device Terr T022EE000002A532	CF File:	ARMSTRONG 0001 1.3	
Pood Deventers	DEV_REV: DD File:	Load CF/DD Delete CF/DD YOKOGAWA FN310 HART 1.1 YOKOGAWA FN510 DIDOAI 1.1 YOKOGAWA YTMX580 1.1	
Write Parameters		YOKOGAWA YTA510 1.2	
Available Parameters:	Read Parameters:	ARMSTRONG 0001 1.3	1

19. If a warning for register device definitions appears, select OK to close the window.



20. Click OK to confirm the Sampling Data configuration.

Sampling Settings	×
Device Tag: T022FF000002A532	CF / DD CF File: ARMSTRONG 0001 1.3 ~ DEV_REV: 1 CFREV: 3 DD File:
Read Parameters Write Parameters	
Available Parameters:	Read Parameters:
<ul> <li>□ UAPMO("STEAMTRAP_UAPMO")</li> <li>□ DIAG_STATUS</li> <li>□ AI_01("PIEZO STATUS AIO")</li> <li>□ PV</li> <li>□ AI_02("TEMPERATURE AIO")</li> <li>□ PV</li> <li>□ AI_03("TEMPERATURE SETPOINT AIO</li> <li>□ PV</li> </ul>	UAP02 
ОК	Cancel

21. After clicking OK sampling data table will be displayed.

22. Select Modbus settings and verify "Normal Mapping" is selected.

Configurator		-	×
File Tools Help			
R +1			
File       Tools       Help         Image: Settings       Modbus Settings         Image: Image: Image: Source       Access Control Lists         Image: Operation Mode       Hopping Patterns         Field Wireless Networks       Image: Networks         Image: Image: Image: Network ID: 204       Sompting Patterns         Sompting Patterns       Image:	Input Registers Holding Registers          Modbus Mapping Type <ul> <li>Normal Mapping</li> <li>Jointly maps the status and value parameters</li> <li>Data Type Mapping</li> <li>Separately maps the status and value parameters</li> <li>Start of status registers</li> <li>20000</li> </ul> Read Parameter Assignment <ul> <li>Input Registers</li> <li>Holding Registers</li> </ul>		

23. Select "Input Register" tab and drag and drop the device parameters desired to the "Input Registers".

File Tools Help					
→ ₩3					
- VFGW410 Settings  - Interfaces - Access Control Lists - Time Source - Operation Mode - Hopping Patterns  - Field Wireless Networks - Network ID: 204 - Graphic Editor - Alert Settings - Sampling Data - Modbus Settings - Resource	Modbus Settings       Input Registers       Holding Registers         Available Parameters <ul> <li>GW, STATUS[i:0-8]</li> <li>BBR001</li> <li>BBR_STATUS</li> <li>T022FF00002A532</li> <li>OEV_STATUS[i:0-17]</li> <li>UAPMO("STEAMTRAP_UAPMO"),DIAG_STATUS[i:18 - 20]</li> <li>AL_01("PIEZO STATUS AIO"),PV[i:21 - 23]</li> <li>AL_02("TEMPERATURE AIO"),PV[i:24 - 26]</li> <li>AI_03("TEMPERATURE SETPOINT AIO"),PV[i:27 - 29]</li> </ul> <li>Batch operation</li> <li>Auto Mapping</li> <li>Clear All</li> <li>Start Address</li>	Input No. 8 9 10 11 12 13 14 15 16 17 16 17 18 19 20 21 23 24 23 24 25 23 24 25 26 27 28 29 30 <	ut Registers       Input Registers         Input Registers       T022FF000002A532.DEV_STATUS         T022FF000002A532.UAP02.UAPMO("STEAMTRAP_UAPMO").DIAG_STATU         T022FF000002A532.UAP02.AL_01("PIEZO STATUS AIO").PV         T022FF000002A532.UAP02.AL_01("PIEZO STATUS AIO").PV         T022FF000002A532.UAP02.AL_03("TEMPERATURE AIO").PV         T022FF000002A532.UAP02.AL_03("TEMPERATURE SETPOINT AIO").PV	IS er	

24. Repeats steps 6 – 23 for multiple devices, if all devices have been configured select the download buttor

🛃 Configurator	- 0
File Tools Help	
E 🖬	
File Tools Help File Tools Help File Tools Help File We File Version Sector Sec	Modbus Settings       Input Registers       Holding Registers         Available Parameters       Input Registers       Input Registers            • VFGW410         • GW_STATUS(i:0-8)         • BBR_STATUS         • T022FF000002A532.DEV_STATUS         • T022FF000002A532.DEV_STATUS         • T022FF000002A532.DEV_STATUS         • UAPNO("STEAMTRAP_UAPMO").DIAG_STATUS[i:18 - 20]         • AL_01("PIEZO STATUS AIO").PV[i:21 - 23]         • AL_02("TEMPERATURE AIO").PV[i:22 - 20]         • IG       16
	27 T022FF000002A532.UAP02.AI_03("TEMPERATURE SETPOINT AIO").PV 28 29 30 <
	Batch operation     Filter settings       Auto Mapping     Clear All       Start Address     0       End Address     65535       Enable Filter

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25. Confirm that Total Errors and Warnings are 0. Click "OK" to start the download process.

Error Check			$\times$
1. Device Tag Check : OK 2. EUI-64 Check : OK 3. IP Network Check : OK 4. Time Source : OK 5. Hopping Patterns : OK 6. Network/D : OK 7. Backbone Routers : OK 9. Graphic Editor : OK 10. Sampling Data : OK 11. Publications /second : OK 13. Modbus Settings : OK 14. Pressure Check : OK Total Errors:0, Warnings:0			
	ОК	Stop	

26. Click "Start Download".

Download Configuration	×
Restart Items	
Image: Second	
Current Configuration :10/31/2017 2:29:10 PM	
Start download Cancel	

27. Confirm and close the dialog boxes.

	Download Result	×
Download Progress	Stage 1 : OK!	
Download of configuration has been completed.If there are any unconnected devices, the YFGW410 will download a configuration to them when they are connected to the YFGW410.	Stage 2 : OKI Stage 3 : OKI Stage 4 : OKI Stage 5 : OKI Stage 5 : OKI Stage 7 : OKI	
		_
	Close	

28. Configure additional devices.

# 2.1 OTA Armstrong ST6700 Provisioning and Joining

The Yokokawa environment supports two methods of provisioning and joining. The first one is out of band provisioning that requires an infrared adaptor and the second method is the over the air provisioning.

Below are the steps required for over the air provisioning:

- 1. Start Internet Explorer and enter assigned IP (Default http://192.168.0.101:8080) in the web browser navigation field.
- 2. Click "Monitor" and the login dialog will appear.



3. Follow the login steps (if it is the first time, the default login user is "admin" and password "admin").

ka Login	×
User Name	admin
Password	•••••
ок	Cancel

4. After a successful login the following window will become available:

Monitor		-	×
File Tools Help			
2 4 d b B	YFGW410[Online] 2018/02/02 20:14:46		

5. From tab menu select "Tools -> OTA Provisioning Manager":

H 5 - O - Working Document Centero, Yokogawa (2-2-1	18) - Word Picture To			• - • ×	
m Monitor			-		
Help					
Change Password		YFI	3W410[Online]		
Cove User Account Manager		20	18/02/02 20:18:46	nbed	
Calual During				lash 🔨	
L OTA Provisioning Manager		1	Useradmin		
Firmware Download Manager	<ul> <li>OTA Provisioning Manager</li> </ul>				×
Upload Technical Information	Target Network ID 204	V Enable Provisi	oning Network		
	Provisioning Network				
	EUI-64	Current Device Tag	Target Device Tag	Last Detected	Provisioning Status
	20101	concile tog	larger beriet lag	con o ciccico	The factor of th
	Short Descriptioning				
	Start Provisioning				
	Operating Network				
	Device Tag	EUI-64	Device Role	Join Status	Provisioning Information
	Command Reset Provisioning Ir	nformation V Ap			
	· · · · · · · · · · · · · · · · · · ·				
					Close

6. Turn on the ST6700 and clear provisioning.



7. Select the checkbox for "Enable Provisioning Network" and "EUI-64".

OTA Provisioning Manager					×
Target Network ID 204	V Enable Provisio	ning Network			
EUI-64	Current Device Tag	Target Device Tag	Last Detected	Provisioning Status	
Start Provisioning					
Operating Network					
Device Tag	EUI-64	Device Role	Join Status	Provisioning Information	-11
Command Reset Provisioning Inf	formation V App				
				Close	

8. Wait until the "Provisioning Network" window is populated.

OTA Provisioning Manager					
Target Network ID Provisioning Network	V Enable Provisioni	ng Network			
EUI-64	Current Device Tag	Target Device Tag	Last Detected	Provisioning Status	
0022:FF00:0002:A532	T022FF000002A532		2018/02/02 20:28:08(1)	Not provision	

 Under "Provisioning Network" select the device, then in "Target Device Tag" dropdown select the tag being provisioned.

OTA Provisioning Manager					×
Target Network ID Provisioning Network	V Enable Provisioning No	etwork			
EUI-64	Current Device Tag	Target Device Tag	Last Detected	Provisioning Status	
0022:FF00:0002:A532	T022FF000002A532	~	2018/02/02 20:28:08(1)	Not provision	
		T022FF000002A532			
Start Provisioning					
Operating Network					

10. Click "Start Provisioning" button to initiate OTA provisioning mechanism. The "Provisioning Status" indication to monitor will update based on the current stage of the provisioning process (Expected steps: not provision -> waiting-> now provisioning -> provisioned).

OTA Provisioning Manager				
Target Network ID Provisioning Network	Enable Provisioning Net	twork		
EUI-64	Current Device Tag	Target Device Tag	Last Detected	Provisioning Status
0022:FF00:0002:A532	T022FF000002A532	T022FF000002A532	2018/02/02 20:28:08(1)	Not provision
Start Provisioning Operating Network			Note: The time require to detect an OTA provis complete the provisior environment depender 30 minutes for each st considered a normal b	ed for the system sioning target and ning process is radio nt. A time greater than ep (detect/provision) is ehavior.
Device Tag	EUI-64	Device Role	Join Status	Provisioning Information

11. The procedure is considered completed, when the device is removed from the "Provisioning Network" window and the status in the "Operation Network" window is set to "Full Join". Click "Close" when complete.

от	OTA Provisioning Manager								
T	Target Network ID 204 C Enable Provisioning Network								
[	UI-64	Current Device Tag Ta	rget Device Tag	Last Detected	Provisioning Status	1			
	Start Provisioning								
-0	perating Network								
	perating Network	EUI-64	Device Role	Join Status	Provisioning Information	1			
	Derating Network Device Tag T022FF000002A532	EUI-64 0022:FF00:0002:A532	Device Role	Join Status Full join	Provisioning Information				
	Dperating Network Device Tag T022FF000002A532	EUI-64 0022:FF00:0002:A532	Device Role IO	Join Status Full join	Provisioning Information				
	Dperating Network Device Tag T022FF000002A532	EUI-64 0022:FF00:0002:A532	Device Role IO	Join Status Full join	Provisioning Information	]			
- 0	Dperating Network Device Tag T022FF000002A532	EUI-64 0022:FF00:0002:A532	Device Role	Join Status Full join	Provisioning Information				
	Dperating Network Device Tag T022FF000002A532	EUI-64 0022:FF00:0002:A532	Device Role IO	Join Status Full join	Provisioning Information				
	Derating Network Device Tag T022FF000002A532	EUI-64 0022:FF00:0002:A532	Device Role IO	Join Status Full join	Provisioning Information				
	Dperating Network Device Tag T022FF000002A532 Command Reset Provisioning Inform	EUI-64 0022:FF00:0002:A532 nation V Apply	Device Role IO	Join Status Full join	Provisioning Information				
	Dperating Network Device Tag T022FF000002A532 Command Reset Provisioning Inform	EUI-64 0022:FF00:0002:A532	Device Role IO	Join Status Full join	Provisioning Information				

- 12. On the ST6700 quickly press and release the Provisioning button 5 times consecutively, within 2-4 seconds. This will initiate publishing of data on all channels.
- **Note:** (1) The Device will disconnect from the system momentarily.
  - (2) Once the device is disconnected, initiate a power cycle of the device and it will rejoin faster than waiting through the normal process.



## 2.2 IR Armstrong ST6700 Provisioning and Joining

The Yokokawa environment supports two methods of provisioning and joining. Section 2.1 above covered one method using over the air provisioning. The second method is out of band provisioning (IR Provisioning) that requires an infrared adaptor. This manual assumes the configuration of the infrared adapter (ACTiSYS IR224UN) has been completed. If not, please refer to Yokogawa manual IM 01R01A01-01E 16th Edition, section N.

Below are the steps required for out of band (IR) provisioning:

1. Device Check

Open "Device Manager" on the PC to determine the COM port of the installed infrared adapter, in the below example the COM port is set to COM9.



2. Start the FieldMate software and follow the login steps (if it is the first time, the default login user is "DefaultUser" and Default password is auto filled ).

FM Login		×
FieldMate		
User ID	DefaultUser	~
Password	•••••	
	Login	Cancel

3. Select Tool -> select ISA100 (Infrared) Interface Configuration.



4. Verify the COM Port has been selected with "Prolific USB-to Serial Comm Port" has been selected and press "OK"

ISA100(Infrared) In	_		×	
COM Port	COM9 Prolific USB-to-Serial Comm Port			v
		ок	Clo	se

5. Verify that FieldMate is set to use Provisioning Information file Select Tool --> Options --> ISA100 Provisioning Setting

FM FieldMat	e				
File View	Action	Tool	Help		
e	' Upda		User Manager	nten	ance Info Records : 3 (Max on Lite edition: 7)
Commu	unicati		Options +		Display parameters on Segment Viewer
HART	HART		HART Modem Configuration		DTM startup path from Device Maintenance Info
<b>2</b> - 1	OUNDA		FOUNDATION fieldbus Interface Configuration		ISA100 Provisioning Setting
P <sub>e</sub> r	PROFIBL		PROFIBUS Interface Configuration		
B	BRAIN		BRAIN Modem Configuration		
<u> </u>	SA100(I		ISA100 (Infrared) Interface Configuration		
⊿ 🦳 ।	SA100(C		ISA100 (Gateway) Interface Configuration		
HAR	HART		Modbus Interface Configuration		
M	Modt		HART(YOKOGAWA N-IO) Interface Configuration		
M	Modbus		FDT Project		
	Hart (YC	OKOG	SAWA N-IO)		

The following settings page will open, verify check box is NOT selected as shown below, select "OK".



6. Turn on the ST6700 and clear provisioning.



### 7. Start Provisioning Function

Holding the IR adapter close to the IR port on the ST6700 device select ISA100(Infrared) in the segment viewer, select Update, while reading do not remove the adapter from the device.



8. Reading" will be displayed near the bottom of the page while discovering the ST6700 device.



9. The device information for the ST6700 being configured will be displayed once the "Reading" process has completed.

Fill FieldMate					- a ×		
File View Action Tool Help							
€ Update X Cancel	Enabled Device Maintenance Info Records : 4 (Max on Lit	e edition: 7)					
Communication Path <	Segment Viewer > ISA100(Infrared)				⊖, ⊕,		
HART FOUNDATION fieldbus PROFIBUS BRAIN FOUNDATION fieldbus BRAIN FOUNDATION fieldbus BRAIN FAITOO(Infrared) FAITOO(Infrared) FAITOO(Infrared) FAITOO(Infrared) Modbus Modbus HART (YOKOGAWA N-HO)	Segment Viewer > ISAIU0(Infrared)	Metwork ID 1 Join Status	Attach Message.	No Image	Action		
					User ID :DefaultUser		

10. Select the "Provisioning" button, the "Provisioning" configuration pop up will display, verify the proper device tag is entered and update to the proper Network ID from step 5 of section 2.0, select "OK"

fW FieldMate				– a ×
File View Action Tool Help				
♦ Update X Cancel	Enabled Device Maintenance Info Records : 4 (Max on Lit	e edition: 7)		
Communication Path	Segment Viewer > ISA100(Infrared)			→ ⊕
VUpdate     Connel     Communication Path     HART     FOUNDATION fieldbus     FOUNDATION fieldbus     FOUNDATION fieldbus     SAUDO(Infrared)     SAUDO(Infrared)     Modbus     HART (Adapter)     Modbus     HART (COEDGAWA N-HO)	Segment Viewer > ISA100(Infrared)	III 100-75% Network ID 1 Join Status Device Tag T022FF0000029E5E Network ID 204 OK C	Attach Message.	Action Provisioning
				User ID :DefaultUse

11. A pop up dialog box will appear, select "Yes".



12. A pop up dialog box will appear when the provisioning process has been completed stating "Provisioning Completely Successfully", select "OK" to continue.



13. Note the Network ID has updated for the device.



14. Once all the devices have been provisioned, the Provisioning Device Information file needs to be exported.

15. Select File -> Export Provisioning Device Information File.

FM F	FieldMate					- a ×
File	View Action Tool Help					
Ð	Import Device Maintenance Info	Enabled Device Maintenance Info Records : 4 (Max on Lite	e edition: 7)			
∍	Export Device Maintenance Info	Segment Viewer > ISA100(Infrared)				⊖, ⊕,
	Export History	<b>1</b>		Attach Message.		Action -
	Export Serial No	T022FF0000029E5E	100-75%			
	Export Provisioning Device Information File	(0x0041524D) (0x0001)	Network ID 204		No Image	Provisioning
	Exit	Rev 1 ID(EUI-64) 0022FF0000029E5E	Join Status			
-	HART HART(Adapter)					
	Modbus(Adapter)					
	Modbus					
	HART (YOKOGAWA N-IO)					
	<u></u>					
1	<b>44 Pa Pa</b>					User ID :DefaultUser
16. The Save As window will be displayed, the default save location will be: FieldMate installed drive:\FM\Export\PD File name: PC computer name\_FieldMate user name.ypif

In this example we are saving to C:\ FM\Export\PD with file name UserPC\_DefaultUser.ypif

EM Save As						×
$\leftarrow$ $\rightarrow$ $\checkmark$ $\bigstar$ This PC $\Rightarrow$ Local Disk (C:) $\Rightarrow$ FM $\Rightarrow$ Export $\Rightarrow$ PD			v Ö	Search PD		0
Organize 🔻 New folder						?
Expense Report ^ Name	Date modified	Туре	Size			
Videos	No items mate	ch your search.				
🐉 Dropbox						
🐔 OneDrive						
🐔 OneDrive - Armsti						
💻 This PC						
🗊 3D Objects						
Desktop						
Documents     Documents						
Music						
Pictures						
Videos						
Local Disk (C:)						
						~
Save as type: Provisioning Device Infomation File						× ×
∧ Hide Folders				Save	Cancel	

17. Following steps 1-6 under section 2.0 System Configuration, navigate to the Field devices tab under Network ID and select the Import Provisioning File button.

🖾 Configurator							-
File Tools Help							
8 4		_					
YFGW410 Settings	Network Informa	tion Backbone Routers	Field Devices				
- Access Control Lists							
Time Source							
Operation Mode							
Hopping Patterns		bbA	Edit	Delete Import Pr	ovisioning File		
E Field Wireless Networks					, and the second se		
Network ID: 204							
- oropine canor		Device Tag	EUI-64	Join Key	Device Role	Primary Router	Secondary Router
Alert Settings	1	T022FF0000029E5E			IO(Auto)		
Sampling Data	2	T022FF000002A532	0022:FF00:0002:A532	******	IO(Auto)		
- Modbus Settings							
····· Kesource							

18. The Open ypif File dialog window will open, navigate to the location where the file was saved in step In this example C:\ FM\Export\PD with file name UserPC\_DefaultUser.ypif. Select the file name and select Open.

	🛃 Open ypif File			<u> </u>				×
	← → ∽ ↑  → This PC → Local Disk (C:)	> F	M > Export > PD	~ (	Search PD			Q
	Organize 🔻 New folder							?
		^	Name	Date modified	Туре	Size		
	📑 Videos	J.	UserPC_DefaultUser.ypif	3/10/2018 1:47 PM	YPIF File		1 KB	
	😻 Dropbox							
	痜 OneDrive							
	🐔 OneDrive - Armstrong International, Inc.							
	🛄 This PC							
	 ] 3D Objects							
ſ	📃 Desktop							
	Documents							
	👆 Downloads							
	👌 Music							
	Pictures							
	Videos							
	🏪 Local Disk (C:)							
	SDXC (E:)							
	🐋 IT (\\SHRSVR01) (O:)	~						
	File name: UserPC Defau	tUse	r.voif		<ul> <li>✓ .ypif</li> </ul>			$\sim$
					Open		Cancel	
			0					

19. The Import Provisioning File dialog window will open showing the list of new devices to be imported into the YFGW410. Verify all new devices are listed, then select Ok

mport i	Provisioning File		×
	The following devices are available. Do you wish to impo	int them?	
[	Older Devices	Newer Devices	
		✓ T022FF0000029E5E	
L	ОК	Cancel	

The Import Result dialog will be displayed showing the number of devices loaded successfully, select OK.



20. Verify the Join Key is displayed for the newly added devices in the Configurator Field Devices page. Select the Download button to send the information to the YFGW410 Gateway

🛃 Configurator							_		×
ols Help									
8 <b>6 40</b>									
VICUU 0 Settings     Interfaces     Access Control Lists     Time Source     Operation Mode     Hopping Patterns     Field Wireless Networks	Network Inform	Add	rs Field Devices	Delete Imp	ort Provisioning File				
- Graphic Editor		Device Tag	EUI-64	Join Key	Device Role	Primary Router	Secondary Router		
Alert Settings	1	T022FF0000029E5E	0022:FF00:0002:9E5E	*******	IO(Auto)	,	,	1	
Sampling Data	2	T022FF000002A532	0022:FF00:0002:A532	******	IO(Auto)			1	
Resource									
								1	
								1	
								1	
								1	
								1	
								l I	
								1	
								l l	
								l l	
								l I	
								1	
								1	
								j	

The Download Configuration dialog window will appear, select "Start Download"

Download Configuration	×
Restart Items	
VFGW410     VetworkID: 204     BBR001     T022FF000002A532     T022FF000002A532	
Current Configuration :3/10/2018 1:09:26 PM	
Start download Cancel	

The Download Progress dialog window will display and state completed, select the OK button.

6 Configurator							_	×
File Tools Help								
B 💀 🖬								
YFGW410 Settings     Interfaces     Access Control Lists     Time Source     Operation Mode     Hopping Patterns     FoldWaterns	Network Informa	Add	Edit	Delete Impo	rt Provisioning File			
Network ID: 204								
Graphic Editor     Alert Settings     Sampling Data     Modbus Settings     Resource	1	Device Tag T022FF0000029E5E T022FF000002A532	EUI-64 0022:FF00:0002:9E5E 0022:FF00:0002:A532	Join Key ********	Device Role IO(Auto) IO(Auto)	Primary Router	Secondary Router	
		Download Progress Download of conf	iguration has been compl	eted.If there are any unconnecte	⊧d			
		devices, the YFGV connected to the	V410 will download a conf YFGW410.	iguration to them when they an	e			

- 21. On the ST6700 quickly press and release the Provisioning button 5 times consecutively, within 2-4 seconds. This will initiate publishing of data on all channels.
  - Note: (1) The Device will disconnect from the system momentarily
    - (2) Once the device is disconnected, initiate a power cycle of the device and it will rejoin faster than waiting through the normal process.



22. Allow up to 30 minutes for the devices to fully join the network and begin publishing. Following steps 1-4 under Section 2.1, log onto the "Monitor" option of the Field Wireless Management Console. Select the Field Device List and verify the added devices show a Join Status of "Full Join" and an Operation Status of "Published".

												-	
e Tools Help													
\$	Ø		Ò						YFGW4 2018/03	10[Online] /10 19:21: User:ad	18 Imin		
d Device List	Network IE	) filter All	~										<b>•</b>
Device Tag T022FF0000029E5E T022FF000002A532	Network ID 204 204	Vendor/Model ARMSTRONG ARMSTRONG	Device Role IO IO	Join Status Full join(3) Full join(1)	Operation Status Published Published	Primary Router BBR001 BBR001	RSSI(P) -41dBm -46dBm	PER(P) - 3%	Secondary Router	RSSI(S) - -	PER(S) - -	Battery Life 1460 1460	Powe 100-7 100-7

#### 2.3 Viewing Device Data – Field Wireless Management Console

The Monitor tool enables the monitoring and operation status of Field Wireless System. In addition to the provisioning method, three other essential functions are available:



Topology Viewer - displays the field wireless network topology.



Field Device List – provides communication health reports such as RSSI (Received Signal Strength Indicator) and PER (Packet Error Rate).

Other proprieties of the devices can be selected by right-clicking a device icon. The following functions will be available:

Device proprieties - display device detail information;

Candidate neighbors - display neighbor devices;

Restart device - two options: Warm restart and Restart as provisioned based on the ISA 100 specification;

Read object attribute - read out device parameters

TSAP ID	Object ID	Attribute ID	Description ACTiSYS
2	1 (UAPMO)	102	Software Version
		103	Hardware Version
		104	Battery Energy Reset
		105	Country Code
		106	Radio Output Power
		107	Remaining Battery Life
		108	Device Tag
		109	Primary Neighbor Address EU164
		110	Primary Neighbor RSQI
		111	Primary Neighbor TX SUCCESS
		112	Primary Neighbor TX FAIL
		113	Secondary Neighbor Address EU164
		114	Secondary Neighbor RSQI
		115	Secondary Neighbor TX SUCCESS
		116	Secondary Neighbor TX FAIL
		117	Total Radio Charge
		118	Last Hour Radio Charge
		119	Battery Used Duration
		120	Total Device Charge
		121	Remaining Battery Life Percentage
		122	Radio Reset Command

#### 2.3 Viewing Device Data – Field Wireless Management Console – continued

Tools -> Firmware Download Manager – used for over the air upgrade.

Monitor File Tools Help		- 🗆 X
Change Password User Account Manager Select Retart Devices OTA Provisioning Manager Prohibit Badin Transmission		YFGW410[Online] 2018/02/05 21:36:20
Firmware Download Manager Maintenance Mode Upload Technical Information		A hide Tags Hide Paths
VFGW410 BBRD01 T022FF000002A532	Addressed Marger         X           Ref Innear Terrif France Robert Societ France         Innear Terrif France Robert Societ France           Big Topic Robert Societ Robert Societ France         Name Robert Societ Robert Societ France           Big Topic Robert Societ Robert Societ Robert Societ Robert Rob	
Last update:2018/02/05 21:36:20		



Monitor tool. Over the air sensor firmware update.

#### 2.3 Viewing Device Data – Field Wireless Management Console – continued

Topology Viewer       Network ID     204	YFGW4 2018/0	110[Online] 2/05 21:43:20 User.admin			
Topology Viewer Network (D 204 ~			_		-
	Hide Tags	Hide Paths			
VFGW410 BBR001					
1022FF OF Device Properties Candidate Neighbors Restant Device Read Object Attribute					
C			>		

Monitor tool. Other Functions.

The function "Read object attribute" allows to read a specified ISA100.11a standard parameter or other vendor attributes. It requires three Ids to read the data: TSAP Id, Object Id and Attribute Id.

Monitor	– 🗆 X
	YFGW410[Online] 2019/02/05 21:50:20
Topology Viewer       Network ID       204       Read Object Attribute	EZ fide Tags Hide Paths
VFGW410 BBR001 TSAP ID(port) 2 TO22FF000002A532 OK Cancel	Command Result         X           Status         Responded           Response         ASCII           48 30 31 2E 34 2C 53 30 31 2E 30 43 30 32 2E 30 39 00 00 00 00 00 00 00 00 00 00 00 00 00
C Lest update:2018/02/05 21:50:20	Close

Monitor tool. Read Software version.

(TSAP Id = 2, Object Id = 1 (UAPMO), Attribute Id = 1).

#### 2.3 Viewing Device Data – Field Wireless Management Console – continued



Read Battery used duration attribute.

(TSAP Id = 2, Object Id = 1 (UAPMO), Attribute Id = 119).

### **3.0 DTM Tool: Configuring Yokogawa** FieldMate Tool

The Yokogawa FieldMate is a tool used for monitoring, configuring and adjusting field wireless devices according to the ISA100.11a standard. The version of the tool referred in this document is the FieldMate Lite Edition, version R3.02.

The tool supports infrared communication and communication via gateways.

Below are the steps required to get the information from a Field Wireless Device (ST6700 Armstrong monitor) via gateway. The setup used is the same one, presented in figure 2.

- 1. Launch FieldMate tool and login.
- 2. Setup "ISA100 (Gateway) Interface Configuration".
  - From the menu bar select "Tool" -> "ISA100 (Gateway) Interface Configuration"
  - A new window will become available. Complete the IP address of the Gateway and press OK button.

FN <sub>3</sub>	FieldMate														-	o ×
File	e View Actic	Tool Help														
	User Manage	er		Enabled Device Maintenan	e Info Records : 0 (M	ax on Lite ed	lition: 7)						[			
	Options			ice List > All (0)							Filter	*	> Device	e Maintenanc	e Info	
	HART Moder	m Configuration		Device Tag	Device ID	Protocol	Vendor	Model	Device Revision	Last Update			Device Information	n Sticky Note	Images	History
	FOUNDATIO	N fieldbus Interface	Configuration										Parameter	Attachment		
	PROFIBUS In	terface Configuratio	in													
	BRAIN Mode	em Configuration														
	ISA100 (Infra	ared) Interface Confi	guration	_												
	ISA100 (Gate	eway) Interface Con	iguration			E	ISA100(0	Gateway)	Interface Config	uration			-			
	Modbus Inte	erface Configuration					Comment		t/Llast Name a		\ \					
	HART(YOKO	GAWA N-IO) Interfa	e Configuration				Connect	ion Hos	t(Host Name c	or IP Address,	)			_		
	FDT Project						172.16.	.31.220						~		
	Favorites												Connection	Test		
							🕑 Ad	lvanced	Setup							
												OK		laca		
														lose		
	<u>44</u>														User ID :	DefaultUser
			40													

3. Select the "Communication Path" pane by selecting the button in the lower left corner

FieldMate		- a ×
Eile View Action Iool Help		
	Enabled Device Maintenance Info Records : 2 (Max on Lite edition: 7)	
Communication Path	Segment Viewer > HART	$\odot$ $\oplus$
HART		
FOUNDATION fieldbus		
P PROFIBUS		
B BRAIN		
ISA100(Infrared)		
4 ISA100(Gateway)		
HART (Adapter)		
Modbus(Adapter)		
Modbus		
HART (YOKOGAWA N-IO)		
		User ID :DefaultUser

- 4. To obtain the field device list associated to the configured gateway
  - Click "ISA100(Gateway)
  - · Click "Update"



- 5. Select the ST6700 monitor and install DD file.
  - In the Instrumentation List, select the target device and click the dropdown arrow next to the "Device Tag".

FieldMate		- 5 ×
File View Action Tool Help		
Update X Cancel     Enabled Device Maintenance Info Records : 2 (Max on Lite edition: 7)		
Communication Path 🕻 ISA100(Gateway) : 172.16.31.220 (1)	Filter	- O, O,
HART Device Tag Device ID(EUI-64) Vendor Model Device Revision Comm Status Network ID R	Remainir Device	Role Address
FOUNDATION fieldbus	Ш) Ю	FD000393E01E00
Pe PROFIBUS		
BRAIN		
ISA100(Infrared) Open Device Maintenance Info		
Assigned DTM		
HART(Adapter) Select DTM		
Modbus(Adapter)		
M Modbus Install DD File		
HART (YOKOGAWA N-IO) Device Icon Setting		
<		>
		User ID :DefaultUser

• If "Install DD File..." is gray and un-selectable as in the example above then click "Assigned DTM..."



• Reselect the dropdown arrow and "Install DD File..." should now be selectable. Select "Install DD File..."

FieldMate						- 0 ×
File View Action Tool Help						
✓Update X Cancel	Enabled Device Maintenance Info Records : 3 (	(Max on Lite edition: 7)				
Communication Path	ISA100(Gateway) : 172.16.31.220 (	1)			Filter	- O . O
HART	Device Tag	Device ID(EUI-64)	Vendor Model	Device Revision Comm Stat	us Network ID Remainin	Device Role Addres
FOUNDATION fieldbus	Open Device Maintenance Info	0022FF000002A532	(0x0041524D) (0x0001)	1 Active	204	IO FD000
PROFIBUS BRAIN	Assigned DTM					
ISA100(Infrared)	Select DTM					
ISA100(Gateway)	Export Device Maintenance Info					
HART (Adapter)	Install DD File					
Modbus(Adapter)	Device Icon Setting					
Modbus						
HART HART (YOKOGAWA N-IO)						
1007						
	<					>
						Jser ID :DefaultUser

• Select "Install the EDD file for this device, specifying the location and select the location on the PC of the EDD file.



· Confirm the installation of the EDD by selecting "OK".

_		$\times$
	Cancel	
	curicer	
		- □

- 6. Install the DTM file for the selected ST6700 monitor.
  - In the Instrumentation List click the dropdown of the device and select "Select DTM..."

File View Action Tool Help         Enabled Device Maintenance Info Records : 3 (Max on Lite edition: 7)         Communication Path         ISA100(Gateway) : 172.16.31.220 (1)         Filter       © ©         Mark       Device ID(EUI-64)       Vendor       Model       Device Revision       Communication Path         ISA100(Gateway) : 172.16.31.220 (1)       Filter       © ©         Device Tag       Device ID(EUI-64)       Vendor       Model       Device Revision       Comm Status       Network ID       Remainir       Device Revision         COMUNICATION & ELIBRIN
Enabled Device Maintenance Info Records : 3 (Max on Lite edition: 7)       Image: Intermediate Cancel         Communication Path       ISA100(Gateway) : 172.16.31.220 (1)       Filter       Filter       O         HART       Device Tag       Device ID(EUI-64)       Vendor       Model       Device Revision       Comm Status       Network ID       Remainir       Device Revision         FOUNDATION 6 Lifting       Image: Intermediate Colspan="2">O       0.022EE000002A532       (0x0041524D)       (0x0001)       1       Active       204       Image: ID       EDD00
Communication Path       ISA100(Gateway) : 172.16.31.220 (1)       Filter       Image: Communication Path         HART       Device Tag       Device ID(EUI-64)       Vendor       Model       Device Revision       Comm Status       Network ID       Remainir       Device Revision         FOUNDATION 6 Lifer       Optice Tag       0022EE000002A532       0022EE000002A532       (0x0041524D)       (0x0001)       1       Active       204       Tag       EDD00
HART Device Tag Device ID(EUI-64) Vendor Model Device Revision Comm Status Network ID Remainir Device Rol Addre
Open Device Maintenance Info
BRAIN Assigned DTM
ISA100(Infrared) Select DTM
ISA100(Gateway)
HART HART(Adapter) Install DD File
Modbus(Adapter) Device Icon Setting
Modbus
THE HAR (YORUGAWA N-IO)
User ID:DefaultUser

• Select the "ISA100 Built-in DTM" and select the check box to "Assign selected DTM to this device model" and select "OK".

FN910 ISA100 DTM (DIDOAI) FN910 ISA100 DTM	3.6.0.21	YOKOGAWA
YTA ISA100 DTM	3.6.0.21	YOKOGAWA
YTMX ISA100 DTM	3.6.0.21	YOKOGAWA
FN310 DTM (HART)	1.01.01	YOKOGAWA
FN310 DTM (SENCOM)	1.01.00	YOKOGAWA
OWA100	1.02.02	YOKOGAWA
ISA100 Built-in DTM	3.6.0.21	YOKOGAWA
Assign selected DTM to th	nis device model.	

- "DTM Works" will launch automatically.
- In DTM Works select "Load Default Data" and select "OK".

Load options for DTM data		
○ Load from Database		
○ Load from File		
Icoad Default Data		
	ОК	Cancel

• The DTM Works screen will be display

20 DTM Works - [T022FF000002A532 ISA100 Built-in DTM]	- 🗇 ×
File View Device Tool Window Help	
Device Information Online Parameter X	
Device 0001 (0x0001) Device T022FF000002A532	
Device Rev: 1	
*- ♥ Menu (Online)	
	vigilantplant <sup>®</sup> . The clear path to operational excellence

#### 3.1 DTM Tool: Viewing Device Data in the DTM Tool

Manage the ST6700 Monitor.

• The following selections are available in the menu screen.



Device Configuration

- Steam Trap\_UAPMO contains the device profile parameters and device vendor parameters; According to the device implementation some parameters are read only.
- Piezo Status AIO used to display/modify Piezo Status attributes: process value, mode, transducer scale, simulation info.
- Temperature AIO used to display/modify Temperature object attributes: process value, mode, transducer scale, simulation info.
- Temperature Setpoint AIO used to display/modify Temperature SetPoint object attributes: process value, mode, transducer scale, simulation info.
- Process Variables
  - Piezo Status AIO used to display process value for Piezo status object.
  - Temperature AIO used to display process value for Temperature object.
  - Temperature Setpoint AIO used to display process value for Temperature Set Point object.

### 4.0 Device Configuration

#### 4.1 Changing the Temperature Setpoint

The AIM<sup>®</sup> device has built-in algorithms, which perform a series of diagnostic checks to determine the condition of the steam trap.

The first diagnostic validates the surface temperature of the steam line and compares it with the configurable temperature set point.

The temperature sensor detects the skin temperature at the inlet of the steam trap. That value is compared to the configurable **temperature set point**.

The **temperature set point** is the temperature below which the steam trap is considered COLD. By default, Armstrong uses 160°F or 70°C but it can be changed by the user. Best practice recommendation is to be at least 40°F (22°C) above the highest ambient temperature.

Highest Ambient T	emperature	Set Temperature			
104°F	40°C	144°F	62°C		
122°F	50°C	162°F	72°C		

#### Overview:

Step 1 – Change Mode – Target – from Man to Auto

Step 2 - Change Simulation Switch from 00 to 01

Step 3 - Change Simulation Value - Update to desired Set value

- Step 4 Change Mode Target from Auto to Man
- Step 5 Change Simulation Switch from 01 to 00
- Note: "Download to device" after every step

See next page for full details to change the temperature set point.

Detailed Instructions to Change the Temperature Setpoint:

- 1. Open FieldMate
- 2. Open DTM Works (See DTM Tool Viewing Device Data in DTM Tool)
- 3. From the menu select "Menu/Device Configuration/Temperature SetPoint AIO/TemperatureSetpointAIO

2 DTM Works - [T022FF000002A532 ISA100 Built-in DTM]							
File View Device Tool Window Help							
Device Information Online Parameter X	7 🔪 🌽						
Device information							
Device 0001 (0x0001) [ Device Rev: 1	Device T022FF000002A	.532					
<ul> <li>Top</li> <li>Menu (Online)</li> <li>Device Configuration</li> <li>SteamTrap_UAPMO</li> <li>Pizo Status AIO</li> <li>Temperature SetPoint AIO</li> <li>TemperatureSetpointAIO</li> <li>Diagnostic</li> <li>Process Variable</li> <li>Pizo Status AIO</li> <li>Temperature AIO</li> <li>Temperature AIO</li> <li>Temperature SetPoint AIO</li> </ul>	Process Value STATUS VALUE Mode TARGET ACTUAL PERMITTED NORMAL Transducer Scale EU_100 EU_0 UNITS_INDEX DECIMAL Simulation Switch Transducer Value PV_STATUS PV_VALUE Simulation Value PV_STATUS PV_VALUE	Good_NonCascade::N         70.00000         Man         Man         Man         O/S+Man+Auto         Auto         200.000000         40.00000         degC         2         0         Good_NonCascade::N         12.500000         Good_NonCascade::NonSpecific:NotLimited         0.000000					

4. Change Mode - Target - from Man to Auto and select "Download to device".

M DTM Works - (T022FF000002A532 ISA100	uilt-in DTMJ – 🖯	×
Eile View Device Tool Window He		
Device Information Online Parameter		
Device 0001 (0x0001) Device Rev: 1	Device T022FF000002A532	Wireless
■ ■ Top ■ ■ Menu (Online) ■ ■ Device Configuration ■ ■ Piezo Status AIO ■ ■ Piezo Status AIO ■ ■ Temperature Report AIO ■ ■ Temperature School AIO ■ □ Temperature		
< >	V Uplead from dewise Sto Downlead to device	Option
Error Log		
DefaultUser Engineer BIC	🚰 Connected 🜔 🚺 Dataset	

5. Change Simulation Switch from 00 to 01.

DTM Works - [T022FF000002A532 ISA10	0 Built-in DTM)						- 8 ×	
Eile View Device Tool Window H	elp							
	- • • • • • • • • • • • • • • • • • • •							
Device Information Online Parameter	x							
Device 0001 (0x0001) Device Rev: 1	Device T022FF000002	2A532					👘 🖬 ISA 100 Wireless	
	Process Value STATUS VALUE VALUE 9 Mode TARGET A ACTUAL A CTUAL A Transducer Scale EU 100 2 EU 0 0 DECIMAL 2 Simulation Mathe PV_STATUS 6 PV_VALUE 0	005Specific Not imited 90.000000 Auto 100.00000 40.000000 40.000000 40.000000 40.000000 500d_NonCascade=NonSpecific Net 0.000000	Limited					
٢ >	Upload from device	Download to device					Option	
📑 Error Log								
DefaultUser Engineer BIC			Con	rected 🔇	Dataset	=		

- 6. Change Simulation Value Update to desired Set value.
  - a. Identify the new temperature set point and apply it to the following formula

$$\left(\frac{x+40}{240}\right) \approx 100 = \text{Sp}$$

X = Desired temperature setting

Sp = Set point value to be entered into DTW

Example:

X = 50 C = Desired Setpoint

$$\left(\frac{50+40}{240}\right)$$
 \* 100=37.5

b. Enter the formula result into the PV\_VALUE in the "Simulation Value" section and select "Download to device"

W DTM Works - [T022FF000002A532 ISA10	0 Built-in DTM]					
<u>F</u> ile <u>V</u> iew <u>D</u> evice T <u>o</u> ol <u>W</u> indow <u>H</u>	lelp					
Device Information Online Parameter	^					
Device 0001 (0x0001) Device Rev: 1	Device T022FF00	0002A532				
■ Top         ■ Menu (Online)         ■ Device Configuration         ■ SteamTrap_UAPMO         ■ Piezo Status AIO         ■ Temperature AIO         ■ Temperature SetPoint AIO	Process Value STATUS VALUE Mode TARGET ACTUAL PERMITTED NORMAL Transducer Scale EU_100 EU_0 UNITS_INDEX DECIMAL Simulation Switch Transducer Value PV_STATUS PV_VALUE Simulation Value PV_STATUS PV_VALUE	Good_NonCascade::N         -40.00000         Auto         Auto         O/S+Man+Auto         Auto         Cool_NONCascade::N         -33.33332	:fic:NotLimited			
< >>	Upload from device	5 Download to device				

Designs, materials, weights and performance ratings are approximate and subject to change without notice. Visit armstronginternational.com for up-to-date information.

c. Verify the Temperature Setpoint Value updated.

2 DTM Works - [T022FF000002A532 ISA100 Built-in DTM]							
<u>File View Device Tool Window H</u>	<u>Eile V</u> iew <u>D</u> evice T <u>o</u> ol <u>W</u> indow <u>H</u> elp						
● 🔧 😤 🔮 🕑 🎦 📡 🦾- 💷-							
Device Information Online Parameter X							
Device 0001 (0x0001)	Device T022FF000	002A532					
Device Rev: 1							
□ 🖉 Top □ 💯 Menu (Online)	Process Value STATUS	Good NonCascade;:N					
e 🗊 Device Configuration	VALUE	50.000000					
	Mode TARGET ACTUAL PERMITTED NORMAL Transducer Scale EU_100 EU_0 UNITS_INDEX DECIMAL	Auto        Auto        O/S+Man+Auto        Auto        200.000000       40.000000       degC       2					
	Simulation Switch	1					
	PV_STATUS	Good_NonCascade::N					
	PV_VALUE	4.166667					
	Simulation Value PV_STATUS	Good_NonCascade::NonSpecific:NotLimited					
	PV VALUE	37.500000					

7. Change Mode - Target - from Auto to Man and select "Download to device".

DTM Works - [T022FF000002A532 ISA10	0 Built-in DTM] — G	×
Eile View Device Tool Window H	elp	
Device Information Online Parameter	X	
Device 0001 (0x0001) Device Rev: 1	Device T022FF00002A532	Vireless
a - ♥ Top	Norder   Moder   Moder<	
< >>	🖉 Uplaad from device 🕫 Download to device 00	tion
🛃 Error Log		
DefaultUser Engineer BIC	🚰 Connected 🔹 🚺 Dataset 😑 📰	

8. Change Simulation Switch from 01 to 00 and select "Download to device".

📴 DTM Works - [T022FF000002A532 ISA100 Built-in DTM]								
Eile View Device Tool Window Help								
		(in the second s						
	×							
Device 0001 (0x0001)	Device T022FF0	00002A532						
Device Rev: 1								
a 🖉 Top	Deserves Malers							
E	STATUS	Uncertain::NonSpecific						
R-Ⅲ Device Configuration	VALUE	50.000000						
🖲 – 📽 SteamTrap_UAPMO	Mode							
Piezo Status AIO	TARGET	Man						
□ Temperature AIO	ACTUAL	Man						
■ - ● Temperature SetPoint AIO	PERMITTED	O/S+Man+Auto						
TI Diagnostic	NORMAL	Auto						
	Transducer Scale	200 000000						
	EU_100	200.000000						
	LINITS INDEX	-40.00000						
	DECIMAL	2						
	Simulation Switch	00						
	PV_STATUS	Uncertain::NonSpecific						
	PV_VALUE	4.166667						
	Simulation Value							
	PV_STATUS	Good_NonCascade::Non	Specific:NotLimited					
	PV_VALUE	37.500000						
< >	🖉 Upload from devio	Download to device						
		· · · · ·						

9. Verify the Value is the desired setpoint. Verify the Mode is in "Man" for both TARGET and ACTUAL. Verify the Simulation Switch is "00".

rice 000	01 (0x0001)	Device T022FF0000	002A532
vice Rev: 1			
Top Menu (O Device St St St St St St St St St St	Online) ce Configuration teamTrap_UAPMO iezo Status AIO emperature AIO emperature SetPoint AIO TemperatureSetpointA nostic ess Variable	Process Value STATUS VALUE Mode TARGET ACTUAL PERMITTED NORMAL Transducer Scale EU_100 EU_0 UNITS_INDEX DECIMAL	Uncertain::NonSpecific 50.000000 Man Man O/S+Man+Auto Auto 200.000000 40.000000 degC v
		Simulation Switch Transducer Value PV_STATUS PV_VALUE Simulation Value PV_STATUS PV_VALUE	00 Uncertain::NonSpecific 4.166667 Good_NonCascade::NonSpecific:NotLimited 37.500000

### **4.2 Simulation the Piezo Status (PV\_Value)**

The purpose of Simulation Mode is to push steam trap state changes through to DCS or SAGE<sup>®</sup> software, for loop testing.

#### Overview:

- Step 1 Change Simulation Switch from 00 to 01
- Step 2 Change Simulation Value Update the Piezo Status to the desired simulation value (see table below)
- Step 3 Change Simulation Switch from 01 to 00
- Note: "Download to device" after every step

Simulation Value							
Steam Trap Status	Process Value	PV_Value					
Good	1	0					
Cold	2	50					
Blow Thru	3	100					

Detailed Instructions to change the operation mode of the device to "Simulation Mode"

- 1. Open FieldMate
- 2. Open DTM Works (See DTM Tool Viewing Device Data in DTM Tool)
- 3. From the menu select Menu/Device Configuration/Piezo Status AIO/PiezoStatusAIO

W DTM Works - [T022FF000002A532 ISA100 Built-in DTM]

<u>F</u> ile <u>V</u> iew <u>D</u> evice T <u>o</u> ol <u>W</u> indow <u>H</u> elp									
Device Information Online Parameter X									
Device 0001 (0x0001)	Device T022FF0	00002A532							
Device Rev: 1									
e—望 Top ⊨—愛 Menu (Online)	Process Value STATUS	Good_NonCascade::N	Monitor is shown here.						
Device Configuration	VALUE	2.000000	Confirm that simulating a						
e—≝ SteamTrap_UAPMO e—≝ Pi <mark>ezo Status AlO</mark>	Mode TARGET	Auto	value will result in a different						
PiezoStatusAIO	ACTUAL	Auto	value than currently shown.						
🖲 🛥 Temperature AlO	PERMITTED	O/S+Man+Auto	If the desired value is shown,						
Temperature SetPoint AIO	NORMAL	Auto	then it is not necessary to						
Diagnostic	Transducer Scale Simul								
Process variable	EU_100	3.000000							
	EU_0	1.000000							
	UNITS_INDEX	Unitless							
	DECIMAL	2							
	Simulation Switch	0							
	Transducer Value								
	PV_STATUS	Good_NonCascade::N							
	PV_VALUE	50.00000							
	Simulation Value								
	PV_STATUS								
	PV_VALUE	0.00000							

### 4.2 Simulation the Piezo Status (PV\_Value) - continued

4. Change Simulation Switch from 00 to 01 and select "Download to device".

DTM Works - (T022FF000002A532 ISA10	0 Built-in DTM] eln						- a ×
	······································						
Device Information Online Parameter	x						
Device 0001 (0x0001) Device Rev: 1	Device T022FF00000	12A532					10-333 🖬 ISA <b>100</b> Wireless
a - ♥ Top • ♥ Wenu (Online) • = ♡ Toevice Configuration • = ® Steam Trap, UAPMO • = Prices Status AIO • = 0 Temperature AIO • = 0 Temperature AIO • = © Temperature SetPoint AIO • = ♡ Temperature SetPoint AIO • = ♡ Process Variable	Process Value         STATUS         N           STATUS         Value         F           Value         F         F           AcTUAL         P         F           ACTUAL         P         F           ACTUAL         P         F           Composition         F         F           Composition         S         F           EU_10         T         F           DECIMAL         F         F           Simulation Value         P         S           PV_VALUE         S         F           PV_VALUE         S         S	VonSpecific NotLimited 200000 Auto OIS=Man+Auto OIS=Man+Auto III 000000 Unitess 2 1 50.00000 Good_NonCascade:NonSpecific:NotLimited 0.000000					
< >	Upload from device	Download to device					Option
Error Log			FE comoto		Detect		-
DefaultOser Engineer BIC			Connecte	. (2	Uataset	-	-

Note: When the device is in Simulation Mode, the Piezo Status AIO will default to 1 (OK trap condition).

#### 4.2 Simulation the Piezo Status (PV\_Value) - continued

5. Change Simulation Value – Update the Piezo Status to the desired simulation value (see table at the beginning of this section).

In this example the desired Simulation Value is Blow Through. From the Simulation Value table on page 38, the PV\_Value column should be 100.



6. Verify the Process Value is displaying the desired value. In this example 3 = Blow Through.

File View Device Tool Window H	aln	
	x	ž. <b>I.</b>
Device 0001 (0x0001) Device Rev: 1	Device T022FF0	000002A532
	Process Value STATUS VALUE Mode TARGET ACTUAL PERMITTED NORMAL Transducer Scale EU_100 EU_0 UNITS_INDEX DECIMAL Simulation Switch Transducer Value PV_STATUS PV_VALUE	Good_NonCascade::N           3.000000           Auto           J.000000           Unitiess           2           1           Good_NonCascade::N           Good_NonCascade::NoSpecific:NotLimited           100.00000

### 4.2 Simulation the Piezo Status (PV\_Value) - continued

7. Return the Monitor to Standard Operation - Change Simulation Switch from 01 to 00 and select "Download to device".



8. Confirm the device is back in Standard operation mode

💯 DTM Works - [T022FF000002A532 ISA100 Built-in DTM]						
<u>File View Device Tool Window H</u>	lelp					
Device Information         Online Parameter	×	<b>2</b> - <u>-</u>				
Device 0001 (0x0001) Device Rev: 1	Device T022FF000	J002A532				
■	Process Value STATUS VALUE	NonSpecific:NotLimitec 2.000000				
Steam Trap_UAPMO     Seteam Trap_UAPMO     Seteam Trap_UAPMO     Seteam Trap_UAPMO     Seteam Trap_UaPmo     Piezo Status AIO     Seteam Trap_Uapmo     Seteam Trap_Uapmo	Mode TARGET ACTUAL PERMITTED NORMAL Transducer Scale EU_100 EU_0 UNITS_INDEX DECIMAL	Auto        Auto        O/S+Man+Auto        Auto        3.000000        1.000000     Unitless       2     2				
	Simulation Switch Transducer Value PV_STATUS PV_VALUE Simulation Value PV_STATUS PV_VALUE	0       Good_NonCascade::N       50.00000       Good_NonCascade::NonSpecific:NotLimited       100.000000				

#### 4.3 Device Vendor Parameters

- 1. Open FieldMate.
- 2. Open DTM Works (See DTM Tool Viewing Device Data in DTM Tool).
- 3. From the menu select Menu/Device Configuration/Steam Trap\_UAPMO/UAPMOEX.
- 4. Select the "Device Vendor Parameters" Tab.



- · AP Firmware Version Current Firmware installed in the monitor
- AP Hardware Version Version of the monitor hardware
- Battery Reset Trigger Enables user to reset battery life after a battery change (See Battery Life Reset for battery resetting instructions)
- · Country Code Enables the user to define the country the monitor is installed

A list of current country codes can be found at https://en.wikipedia.org/wiki/ISO\_3166-1

- · Radio Output Power Transmission power of the radio transmitter
  - 0 Minimum power
  - 15 or 17 Maximum Power (Firmware/Hardware dependent)
- · Remaining Battery Life Estimated number of days remaining before the battery is depleted
- · Radio Total Charge Total Energy consumed by the radio since battery reset
- · Radio Last Hour Charge Energy consumed by the radio in the last hour
- Battery Use Duration Device up time in seconds
- · Device Total Charge Total energy consumed by the monitor since battery reset

#### 4.3 Device Vendor Parameters – continued

- · Percent Battery Life Remaining Remaining battery life in percent
- · RadioReset Allows the user to remotely restart the monitor
- Device Tag Hexadecimal representation of the device tag ASCII characters
- Primary Neighbor EUI64 MAC address of the primary source clock neighbor
- · Primary Neighbor RSQI The Received Signal Quality Indicator of the Primary Neighbor
- Primary Neighbor Tx Success Number of successful transmissions with the Primary Neighbor since last device restart
- Primary Neighbor Tx Fail Number of failed transmissions with the Primary Neighbor since the last device restart
- Secondary Neighbor EUI64 MAC address of the Secondary source clock neighbor
- · Secondary Neighbor RSQI The Received Signal Quality Indicator of the Secondary Neighbor
- Secondary Neighbor Tx Success Number of successful transmissions with the Secondary Neighbor since last device restart
- Secondary Neighbor Tx Fail Number of failed transmissions with the Secondary Neighbor since the last device restart

#### 4.4 Restarting the Monitor

- 1. Open FieldMate
- 2. Open DTM Works (See DTM Tool Viewing Device Data in DTM Tool)
- 3. From the menu select Menu/Device Configuration/Steam Trap\_UAPMO/UAPMOEX
- 4. Select the "Device Vendor Parameters" Tab
- 5. Select dropdown of "RadioReset"



	Device Management Application Process (DMAP) Attributes	User-Application Process (UAP) Attributes	Device Provisioning Object (DPO) Attributes
Warm Restart	Кеер	Keep	Keep
Restart As Provisioned	Clear	Кеер	Кеер
Reset to Factory Defaults	Clear	Кеер	Кеер
Hardware Reset	Clear	Clear	Clear

### 4.5 Attributes List

TSAP ID	Object ID	Attribute ID	Description	Туре	Comments:
2	3	64	Device Identification Number	Array of Unsigned8 (8 Bytes – Byte 03 – Vendor ID, Byte 45 Model ID, Byte 67 Device Revision)	
		67	DIAG_STATUS	Unit32	See Diag_Status decoding
		102	Software Version	Uint16	
		103	Hardware Version	Uint16	
		104	Battery Energy Reset	Uint8	
		105	Country Code	Uint16	
		106	Radio Output Power	Uint8	
		107	Remaining Battery Life	Uint16	
		108	Device Tag	Uint8[16]	
		109	Primary Neighbor EUI64 Address	Uint8[8]	
		110	Primary Neighbor RSQI	Uint8	
		111	Primary Neighbor TX SUCCESS	Uint32	
		112	Primary Neighbor TX FAIL	Uint32	
		113	Secondary Neighbor EUI64 Address	Uint8[8]	
		114	Secondary Neighbor RSQI	Uint8	
		115	Secondary Neighbor TX SUCCESS	Uint32	
		116	Secondary Neighbor TX FAIL	Uint32	
		117	Total Radio Charge	Uint32	Units are Coulombs.
		118	Last Hour Radio Charge	Uint32	Units are Coulombs.
		119	Battery Used Duration	Uint32	Units are seconds.
		120	Total Device Charge	Uint32	Units are Coulombs.
		121	Remaining Battery Life Percentage	Uint8	Units are percentage of battery energy left.
					0X00 – None
					0X01 – Warm Restart
122 Radio Reset Command Uin		Uint8	0X02 – Restart As Provisioned		
		0X03 – Reset To Factory Defaults			
			0X04 – Hardware Reset		

#### 4.6 Armstrong Specific Attributes

The following table contains a vendor specific attribute list for Armstrong ST 6700 instrument. Each of them could be displayed based on the "Read Object attribute" function.

TSAP ID	Object ID	Attribute ID	Description
2	1 (UAPMO)	102	Software version
		103	Hardware version
		104	Battery Energy Reset
		105	Country Code
		106	Radio Output Power
		107	Remaining Battery Life
		108	Device Tag
		109	Primary Neighbor EUI64 Address
		110	Primary Neighbor RSQI
		111	Primary Neighbor TX SUCCESS
		112	Primary Neighbor TX FAIL
		113	Secondary Neighbor EUI64 Address
		114	Secondary Neighbor RSQI
		115	Secondary Neighbor TX SUCCESS
		116	Secondary Neighbor TX FAIL
		117	Total Radio Charge
		118	Last Hour Radio Charge
		119	Battery Used Duration
		120	Total Device Charge
		121	Remaining Battery Life Percentage
		122	Radio Reset Command

### 5.0 Viewing the Modbus Registers of the Monitor

- 1. Start Internet Explorer and enter assigned IP (Default http://192.168.0.101:8080) in the web browser navigation field.
- 2. Click "Configurator" and the login dialog will appear.

<b>Field Wireless</b> Management Console	
Configurator Monitor YOKOGAWA vigilantplant: Copyright © 2012-2016 Yokogawa Electric Corporation All Rights Reserved.	

3. Follow the login steps (if it is the first time, the default login user is "admin" and password "admin").

Login		Х
User Name	admin	
Password	•••••	
ОК	Cancel	

4. A valid login opens the configurator tool.

File Tools Help				
D +0				
☐ YFGW410 Settings — Interfaces — Access Control Lists — Time Source — Operation Mode	VFGW410 Settings		Required to restart all Backbone Devices	
Hopping Petterns Field Wireless Networks 		Device Tag	VFGW410	
Sampling Data Modbus Settings Resource		Enable redundancy		
		Use external L	Layer 2 switch for Field Wireless Backbone Interface	

#### 5.0 Viewing the Modbus Registers of the Monitor - continued

5. Select "Modbus Settings" and the "Input Registers" tab.

Configurator			- 0	×
File Tools Help				
B 🖬				
VFGW410 Settings     Interfaces     Access Control Lists     Time Source     Operation Mode     Hopping Patterns     Field Wireless Networks     Intervork ID: 204     Graphic Editor     Alert Settings     Sampling Data     Modbus Settings     Resource	Modbus Setting Input Registers Holding Registers Available Parameters	Input No. 8 9 10 11 12 13 14 15 16 17 18 15 16 17 18 19 20 21 22 23 22 23 24 23 24 25 26 27 22 28 29 30 < <	1 Registers Input Registers 1022FF000002A532.DEV_STATUS 1022FF000002A532.UAP02.UAPMO("STEAMTRAP_UAPMO").DIAG_STATUS 1022FF000002A532.UAP02.AI_01("PIEZO STATUS AIO").PV 1022FF000002A532.UAP02.AI_02("TEMPERATURE AIO").PV 1022FF000002A532.UAP02.AI_03("TEMPERATURE SETPOINT AIO").PV 1022FF000002A532.UAP02.AI_03("TEMPERATURE SETPOINT AIO").PV	
	Batch operation Filter settings Auto Mapping Clear All Start Address	0	End Address 65535 Enable Filter Disable Filter	

### **6.0 Modbus Register Content**

No.	Description	Name	Data format	Details			
0		Data Status	Unsigned 16	0x0	)080: Good \$	Status	
1			Unsigned 16	Status of (0: conne	the field wir ected, 2: not	eless device connected)	
2	VEGW410 GW STATUS	Device Status	Integer 16	Battery life (0>: days, <0: hours 0x7FFF: external power source)			
3							
4			Unsigned 16				
6				0 (Reserved bits)			
7 8							
9		Data Status	Unsigned 16	0x0080: Good Status			
10			Unsigned 16	Status of the field wireless device (0: connected, 2: not connected)			
11	T022FF000002A532.DEV_STATUS	Daviaa	Integer 16	Battery life (0x05B4 (1460 dec)) days - normal starting point			
12		Status		Usually 0 (Reserved bits)			
13			Unsigned 16				
14							
16							
1/ 18		Data Status	Unsigned 16	0x0080: Good Status			
10							
20		Diagnostic Status	Bit String	Binary (See example #1)		nple #1)	
21		Data Status	Unsigned 16	0x0080: Good Status		Status	
22	T022FF000002A532.UAP02.AI_01("PIEZO STATUS AIO").PV	Diaza Statua	Floating	Good Trap	Cold Trap	Blow Through	
			rioating	3F80	4000	4040	
23				0000	0000	0000	
24		Data Status	Unsigned 16	6 0x0080: Good Status			
25 26	T022FF000002A532.UAP02.AI_02("TEMPERATURE AIO").PV	Temperature	Floating	32 bit hexadecimal representa (See example #2)		presentation #2)	
27		Data Status	Unsigned 16	0x0080: Good Status		Status	
28 29	T022FF000002A532.UAP02.AI_03("TEMPERATURE SETPOINT AIO").PV	Temperature Set Point	Floating	32 bit hexadecimal representation (See example #3)			
### 6.1 Translating ("STEAMTRAP\_UAPMO').DIAG\_STATUS

Active Bit	Diagnostic Status									
31	Failure Status									
30	Function Check Status									
29	Out Of Specification Status									
28	Maintenance Required Status									
27	Fault In Electronics									
26	Faults in sensor or actuator element									
25	Installation, calibration problem									
24	Out of service									
23	Outside sensor limits									
22	Environmental conditions out of devices specifications									
21	Fault prediction: Maintenance required									
20	Power is critical low: maintenance need short term									
19	Power is low: maintenance need mid-term									
18	Software update incomplete									
17	Simulation is active									
16	Faults due to process influence									
15	Faults due to non-complainant operating conditions									
14	Other faults									
13	WCI reserved 13									
12	WCI reserved 12									
11	WCI reserved 11									
10	WCI reserved 10									
9	WCI reserved 9									
8	Watchdog reset									
7	Vendor configuration active									
6	Cold Trap									
5	Incompatible firmware									
4	High battery use									
3	Communication error									
2	Trap Blow Thru									
1	Vendor Defined 1									
0	Detailed information available									

Examples																																
Register	ster 19											20																				
Bit	31	30	29	26	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Result #1	0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0									0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0						
Result #2	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Result #1 "Function Check Status" & "Cold Trap"

Result #2 "Maintenance Required Status" & "Power is critical low: maintenance need short term"

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# 6.2 Translating ("TEMPERATURE AIO").PV and ("TEMPERATURE SETPOINT AIO").PV

Example #2										
Register	Result	Combine	Convert 32 HEX to Floating Point							
25	41C8	44000000	05 00000							
26	0000	41080000	25.00000							

Example #3										
Register	Result	Combine	Convert 32 HEX to Floating Point							
28	428C	1200000	70 00000							
29	0000	4200000	70.00000							

### **6.3 Device Self-Diagnosis Status Flags**

### **Category 1: Failure Diagnostics**

### **Diagnostic: Fault in Electronics**

Functional Behavior:

The following diagnostic flags are set: "Failure Status" and "Fault in Electronics" (Bit 31 and Bit 27 are set to 1).

Causes and Triggers:

Critical memory failure, security violations, WDT password violation, Flash password violation, PMM password violation, Peripheral area fetch (stack overflow, pointer access or other logical problem in the code.

### **Diagnostic: Faults In Sensor Or Actuator Element**

Functional Behavior:

The following diagnostic flags are set: "Failure Status" and "Faults in sensor or actuator element" (Bit 31 and Bit 26 are set to 1).

Causes and Triggers:

Damaged (open or shorted) thermistor resulting in 0.1 Ohm > R or R > 1M Ohm. Damaged (open or shorted) piezo-electric transducer resulting in 0.1 Ohm > R or R > 1M Ohm.

### **Diagnostic: Faults Due To Process Influence**

Functional Behavior:

The following diagnostic flags are set: "Failure Status" and "Faults due to process influence" (Bit 31 and Bit 16 are set to 1).

Causes and Triggers:

Excessively high process temp is detected can detect resulting in 290 deg C < Temp < 350 deg C.

### Diagnostic: Faults Due To Non-Compliance With Specified Operating Conditions

Functional Behavior:

The following diagnostic flags are set: "Failure Status" and "Faults due to non- compliant operating conditions" (Bit 31 and Bit 15 are set to 1).

Causes and Triggers:

This diagnostics flag will be set when the on-board oscillator experiences a fault frequency, namely when the frequenciesgenerated drops below the minimum allowed specification.

### **Diagnostic: Other Faults**

Functional Behavior:

The following diagnostic flags are set: "Failure Status" and "Watchdog Reset" (Bit 31 and Bit 8 are set to 1).

Causes and Triggers:

The diagnostic flag is set if the result of ProbeTempReadObjId, ProbeTempSetObjId, PiezoStatusUAPObj Id registration not successful. This is more like an extra software validation method to assure that all the channels have a right object attached to it and there is no duplicate registration.

#### **Diagnostic: Watchdog Triggered Device Reset**

Functional Behavior:

The following diagnostic flags are set: "Failure Status" and "Faults due to non- compliant operating conditions"

(Bit 31 and Bit 15 are set to 1).

Causes and Triggers:

The diagnostic flag is set if the application processor was reset due to a watchdog expiration. This can be detected based on SYSRSTIV Register of the MSP430F5438A micro-controller.

### **Category 2: Functional Check**

#### **Diagnostic: Installation, Calibration Problem**

Functional Behavior:

The following diagnostic flags are set: "Function Check Status" and "Installation, calibration problem" (Bit 30 and Bit 25 are set to 1).

Causes and Triggers:

The diagnostic flag is set if one of the following conditions has been met.

- Low output from thermistor where T < -40°
- High output from thermistor where T  $> 200^{\circ}$
- Low output from piezo-electric transducer where there is no voltage output or Vout-piezo <= 1 mV
- RSQI with primary neighbor is low RSQI < 63.
- High PER (Packet Error Rate) where PER > 50%.

### **Diagnostic: Out Of Service**

Functional Behavior:

The following diagnostic flags are set: "Function Check Status" and "Out of service" (Bit 30 and Bit 24 are set to 1).

Causes and Triggers: The diagnostic flag is set if actual mode of AI Objects is Out Of Service.

#### **Diagnostic: Software Update Incomplete**

Functional Behavior:

The following diagnostic flags are set: "Function Check Status" and "Software Update Incomplete" (Bit 30 and Bit 18 are set to 1).

Causes and Triggers:

The diagnostic flag is set when the remote OTA upgrade process of the application processor (through UDO mechanism) fails due to any reasons (ex. invalid image firmware, RF connection lost etc).

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#### **Diagnostic: Simulation Is Active**

Functional Behavior:

The following diagnostic flags are set: "Function Check Status" and "Simulation is active" (Bit 30 and Bit 17 are set to 1).

Causes and Triggers:

The diagnostic flag is set when the simulation mode/function of any process channel (AI object) is active.

### Diagnostic: Cold Trap Detected (Armstrong Specific)

Functional Behavior:

The following diagnostic flags are set: "Function Check Status" and "Cold trap" (Bit 30 and Bit 6 are set to 1).

Causes and Triggers:

The diagnostic flag is set if the average output from thermistor is approximately equal to the ambient temp over a period of time of 10 minutes.

### Diagnostic: Firmware Incompatible (Armstrong Specific)

Functional Behavior:

The following diagnostic flags are set: "Function Check Status" and "Incompatible Firmware (Bit 30 and Bit 5 are set to 1).

Causes and Triggers:

The diagnostic flag is set when after a remote firmware upgrade, the new application processor firmware version (reflected by UPAMO's VersionRevision attribute) is older than or equal with the previous one.

### Diagnostic: High-Battery Use Detected (Armstrong Specific)

Functional Behavior:

The following diagnostic flags are set: "Function Check Status" and "High battery use" (Bit 31 and Bit 8 are set to 1).

Causes and Triggers:

The diagnostic flag is set when the rate of change of battery life prediction exceeds discharge rate threshold specified value over a time period.

### Diagnostic: Trap "Blow-Through" (Armstrong Specific)

Functional Behavior:

The following diagnostic flags are set: "Failure Status" and "Faults due to non- compliant operating conditions" (Bit 30 and Bit 2 are set to 1).

Causes and Triggers:

The diagnostic flag is set if the Analog Input PV (process value) reflecting the piezo-electric transducer becomes equals 3 (CH09\_AI\_0's PV = 3). The status flag will be cleared as soon as the Analog Input PV attribute value changes to 1 or 2.

### **Category 3: Out of Specification**

### **Diagnostic: Outside Sensor Limits**

Functional Behavior:

The following diagnostic flags are set: "Out of Specification Status" and "Environmental Conditions Out of Device Specification" (Bit 29 and Bit 23 are set to 1).

### Causes and Triggers:

The diagnostic flag is set if the internal reading of the A/D converter present in the application processor is out of range. This indicates that the internal temperature sensor present in the application processor cannot be read, and there is no way of knowing if the instruments is operating within the advertised environmental specifications (temperature). If the value read is within 200 mV below or 200 mV above the lowest/highest possible ADC reading value this flag will be set.

### **Diagnostic: Environmental Conditions Out Of Device Specification**

Functional Behavior:

The following diagnostic flags are set: "Out of Specification Status" and "Outside Sensor Limits" (Bit 29 and Bit 22 are set to 1).

### Causes and Triggers:

The diagnostic flag is set if the internal reading of the A/D converter present in the application processor indicates that the instrument is operating in temperatures that are below -40° or above 85°.

### **Category 4: Maintenance Required**

### **Diagnostic: Fault Prediction**

#### Functional Behavior:

The following diagnostic flags are set: "Maintenance Required Status" and "Fault Prediction Maintenance Required" (Bit 28 and Bit 21 are set to 1).

### Causes and Triggers:

The diagnostic flag is set if the device resets due to a brownout. Since the device is battery powered, this indicates a drop in voltage, meaning that somethings is wrong with the power supply system.

### Diagnostic: Power Is Critical Low

Functional Behavior:

The following diagnostic flags are set: "Maintenance Required Status" and "Power Is Critical Low: Maintenance is needed short-term" (Bit 28 and Bit 20 are set to 1).

### Causes and Triggers:

The diagnostic flag is set if the remaining battery capacity (DLMO.PowerSupplyStatus = 3) is less than 25% and battery life (DLMO.EnergyLeft) is less than 10 days.

### **Diagnostic: Power Is Low**

Functional Behavior:

The following diagnostic flags are set: "Maintenance Required Status" and "Power Is Low: Maintenance is needed mid-term" (Bit 28 and Bit 19 are set to 1).

### Causes and Triggers:

The diagnostic flag is set if the remaining battery capacity (DLMO.PowerSupplyStatus = 3) is less than 25% and battery life (DLMO.EnergyLeft) is more than 10 days.

#### Diagnostic: Communication Error (Armstrong Specific)

Functional Behavior: Diagnostic: Communication error (Armstrong specific) (Bit 28 and Bit 3 are set to 1).

#### Causes and Triggers:

The diagnostic flag is set if the API communication between application processor and stack radio module is not working. If no Radio API Request/Response will be received by the application processor during last 5 minutes the flag is set. If an API Request/Response is received the Communication error flag remains active for 5 minutes, but the internal counter will be reset for the next 5 minutes.

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