SteamEye®
All Models
Installation and Operation Manual

SteamEye®

Please read and save these instructions

Armstrong®

199-EN

Contents

General Safety Information

This document should be used by experienced personnel as a guide to the installation of the Armstrong SteamEye® monitoring System. Selection or installation of equipment should always be accompanied by qualified technical assistance. You are encouraged to contact Armstrong International, Inc. or its local sales representative for additional information.

Product Information

Tracking and monitoring systems allows for ongoing troubleshooting and optimization. It also allows you to know exactly where your savings are – and how to find more. Introducing SteamEye®, Armstrong's best practice system to constantly monitor and instantly report your steam system's condition for optimum energy system management and savings.

Section 1 Introduction

The SteamEye® system is designed to monitor and detect instant failure of steam traps and other steam equipment in real-time.

Using a patented Armstrong International technology, SteamEye® transmitters continuously monitor the steam equipment. Once a failure is detected, the transmitter wirelessly sends the current operating condition of the steam trap, or other steam equipment, to a gateway (wireless receiver). SteamEye® can also be integrated into your existing Building Automation System (BAS) or Digital Control System (DCS) using Modbus or BACnet™ communication protocols.

In applications where the transmitter has line of sight to the gateway, the range is approximately 1500 feet. In facilities where the signal must travel through walls, floors and other obstructions the range is 300 to 500 feet. If the receiver is out of the range of a transmitter, wireless repeaters can be placed to "repeat" the signal back to the gateway. A radio frequency signal strength survey is recommended to determine if repeaters are needed, where they will be located and how many will be required.

SteamEye® can be linked to SteamStar® for real time steam loss and CO_2 emissions information. SteamStar® will calculate and quantify accumulated steam and dollar losses until action is taken. SteamStar® can also send alerts immediately when a failure occurs, helping reduce cost and/or catastrophic damages due to steam trap failure. Advanced reporting tools such as Benchmarking, Trending and Work Orders are also available. All of this will help prioritize busy work schedules in today's "do more with less" workplace and ultimately help you achieve energy efficiency and reliability goals.

The gateway is connected to your company's network where the information can be viewed through any computer on campus.

SteamStar®:

The SteamEye® Gateway M has the capability to integrate into Armstrong's web-hosted steam trap management program called SteamStar®. SteamStar® allows users to calculate losses in real time and create reports that can be shared among colleagues. See Figure 1.1 for potential set up options.

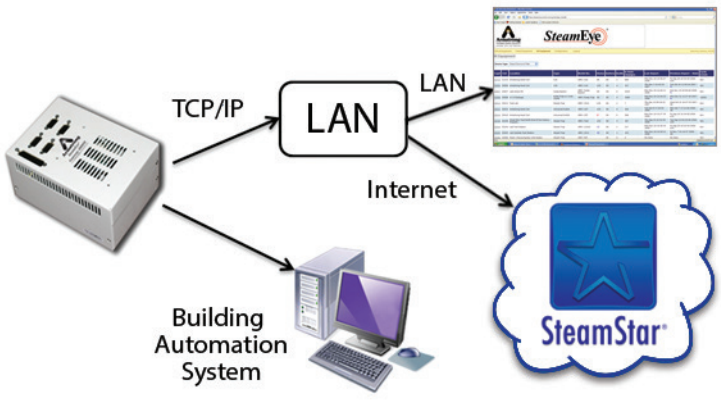


Figure 1.1 – Gateway Communication Options

Section 2 SteamEye® Gateway

The Armstrong SteamEye® Gateway M is a receiver and data collection center for the SteamEye® system. The Gateway runs on a Linux based LightTPD SSL web server and is capable of collecting data from up to 2000 SteamEye® transmitters. The Gateway can be installed on a LAN where data can be accessed through the built-in webserver and/or the information can be integrated into a control system via the built-in Modbus table.

Section 2.1 Connections

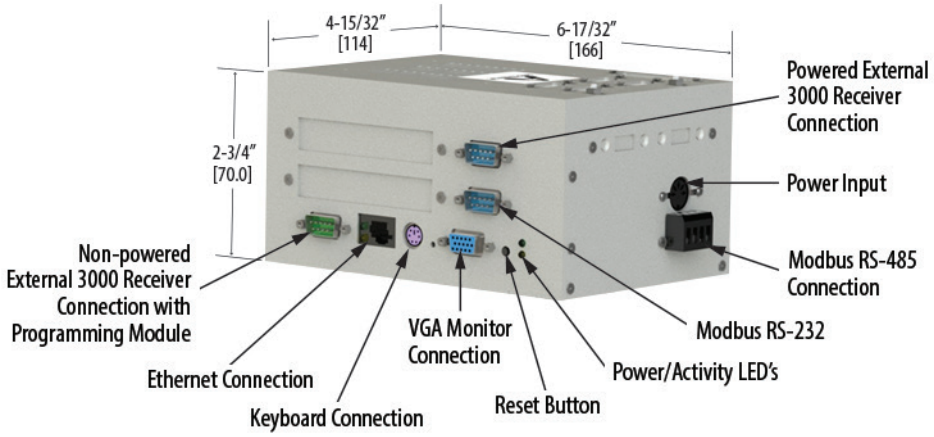


Figure 2.1

- Powered External 3000 Receiver Connection – This port can be used to add on an external 3000 series receiver (no programming/power module is needed to power the receiver when connected to this port)
- Power Input – DC power input from the power cord (included)
- Modbus RS-485 Connection – Used to connect SteamEye® system to a control system
- Modbus RS-232 Connection – Used to connect SteamEye® system to a control system
- Reset Button – Depressing this button with power cycle the Gateway
- VGA monitor Connection (used for programming and troubleshooting purposes only) – The Gateway can be connected directly to a monitor through this port
- Key Board Connection (used for programming and troubleshooting purposes only) – The Gateway can be connected directly to a keyboard through this port
- Ethernet Connection – Local Area Network (LAN) or crossover cable connection
- Non-Powered External 3000 Receiver Connection - This port can be used to add on an external 3000 series receiver (a programming/power module is needed to power the receiver when connected to this port)

Section 2.2 System Requirements

The following requirements apply to the laptop/PC that will be used to set up and or view the information on the SteamEye® Gateway.

Ethernet

- 10/100 base-TX Ethernet communication

Web Browser Application

- Mozilla Firefox 12 or higher
- Microsoft Internet Explorer 7.0 or higher
- Safari 3.0 or higher
- Google Chrome 20 or higher

Section 2.3 Initial Gateway Set-Up

The gateway is set up at the factory with DHCP network settings. If the Gateway is started up and it does not detect a DHCP server within approximately 60 seconds it will default to a static IP of 10.0.2.41.

Section 2.3.1 Prepare Laptop/PC

The Gateway settings can be changed as needed by connecting directly to the Gateway using an Ethernet crossover cable. Before connecting to the Gateway, the computer must be set up to communicate on a "private network" (the crossover cable). Follow the steps below to configure the computer settings:

1. Find the Control Panel (Usually found in the "Start" menu)
2. Open the Network Connections (usually called "Network and Sharing")
3. Select "Change Adapter Setting"
4. Select "Local Area Connection" - Figure 2.2
5. Select "Internet Protocol (TCP/IP)" Or "Internet Protocol Version 4 (TCP/IPv4)"
6. Click the "Properties" button
7. In the General tab select "Use the following IP address" - Figure 2.3
8. Enter an IP address of 10.0.2.10
9. Enter a subnet mask of 255.255.255.0
10. Click OK to close the Internet Protocols (TCP/IP) Properties window
11. Click OK to close the Local Area connection Properties window
12. Close the Network Connections window

Once the computer is set up, connect the Ethernet Crossover cable to the computer and to the Gateway. If the Gateway has not been started you can connect power. Note: Allow a minimum of 60 seconds for the Gateway to start-up. During this time you will not be able to access the Gateway.

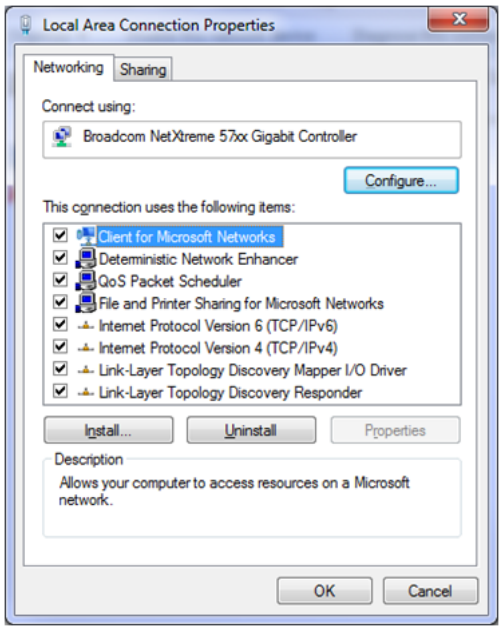


Figure 2.2

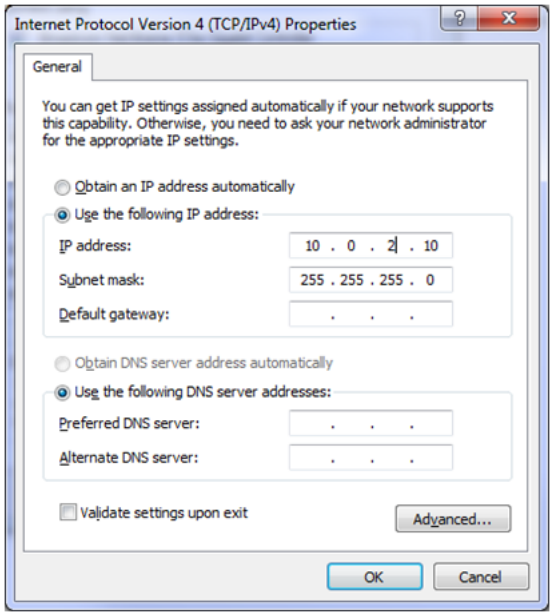


Figure 2.3

Section 2.3.2 Configuring the Gateway

The Configuration screen has several functions that allow you to customize your gateway.

Note: Requires administrative access.

Warning: Any changes should be made by a qualified IT professional.
Improper changes to the configuration could cause the gateway to become unresponsive.

Login with administrator access (default username: admin | password: admin).

Log into the Gateway and edit configuration settings for installation on a “live network”.
Properties that may need to be changed are:

- TCP/IP Network Settings
- Usernames and Passwords
- Time and Time Zone settings
- SteamStar® Configuration
- Outbound email notification

Logging into the Gateway:

1. Connect power to the gateway and allow it to start up (about 60 seconds)
2. Connect an Ethernet crossover cable to the laptop/pc and the Gateway (see Section 2.3.1 for computer setup instructions)
3. Start the web browser on the laptop/PC
4. Enter https://10.0.2.41 into the address bar and click enter
5. A warning stating that there is a problem with the website’s security certificate may be displayed. This is normal, acknowledge the security and proceed.
6. Once the login page has loaded you can login by entering:
   - Username: admin
   - Password: admin

   You will be directed to the home page
7. Click on “Configuration” to make changes to the Gateway

SteamEye®

Section 2.3.2 Configuring the Gateway - Edit Configuration

Click "Edit Configuration" to change the following

TCP/IP Configuration:

Set TCP/IP Configuration:

- "Yes" – allows for Static IP Configuration
  - Fill in remaining fields in this section
- "No" – Device will default to DHCP

Click "Save Changes" and restart the device for the changes to become effective.

Date and Time Configuration:

1. Select the appropriate time zone
2. Enter the current time and date – format: hr:min Month/Day/Year
   a. Example: 17:07 09/14/2014
3. Check the "Set Date and Time" box
4. Click "Save Changes" and restart the device for the changes to become effective.

SteamEye® Receiver Configuration:

Receiver Hostname

This will change the name of the Gateway

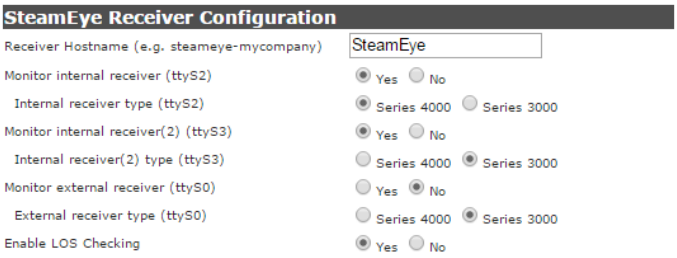
- Limited to alpha numeric characters only
- Maximum number of characters 29

Monitor Internal and External: receivers should not by modified without direct supervision of Armstrong International

Enable LOS Checking:

- "Yes" will allow the Gateway to mark a device as "LOS" or "Lost" is a transmission from a device has not been received in a 24 hour period
- "No" will prevent the gateway from marking any device as "LOS" or "Lost" This may be used if the gateway is installed in a mobile receiver kit

Click "Save Changes" and restart the device for the changes to become effective.

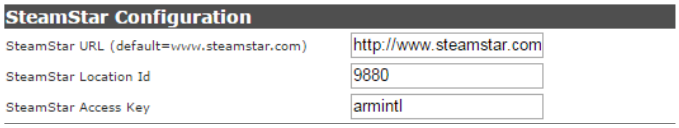


Section 2.3.2 Configuring the Gateway - Edit Configuration - *continued*

SteamStar® Configuration:

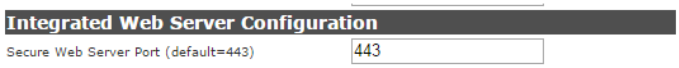
SteamStar® Configuration settings control the communication link between the SteamEye® Gateway and SteamStar® (see Section 2 overview). Changing these settings may prevent SteamEye® from sending updates to SteamStar®.

Please consult Armstrong prior to making any changes to the SteamStar® Configuration avoid any loss of communication.



Integrated Web Server Configuration:

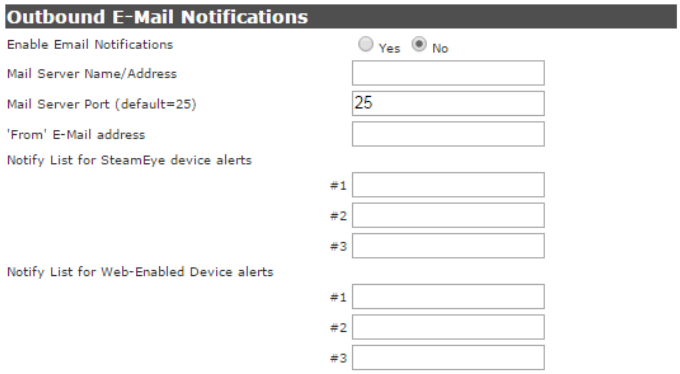
This section allows you to configure the HTTPS port (Default 443)



Outbound E-mail Notifications:

If this section is set up the SteamEye® Gateway will send out email notifications to up to 3 email addresses when there is a state change of a SteamEye® transmitter.

- Mail Server Name/Address – Enter the email server name or address here
- Mail Server Port – Enter the email server port
- 'From' E-Mail address – List the address that will be listed in the "from" address when an email is sent
  - **Note** – the email addresses in the "Notify List for SteamEye® device alerts" and "Notify List for Web-Enabled alerts" must match exactly or emails may not be sent out



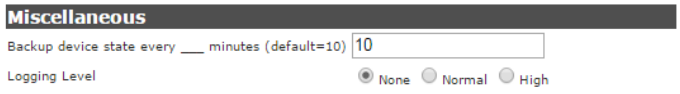
Miscellaneous:

Backup device state every ___ minutes (default 10) – This marks the frequency at which the gateway will write the existing data to the database.

Logging Level – Default = None

Note – Changing the logging level can cause the gateway to become very slow due to the additional load on the processor and memory. The logging level should only be activated in a troubleshooting situation.

Click "Save" when complete. Note: the Gateway must be rebooted for these changes to take effect.



Section 2.3.2 Configuring the Gateway - Edit User Access

Click “Edit User Access” to change Usernames and Passwords.

The default Username and Passwords are listed below.

Access Level	Username	Password	Privileges
Administrator	admin	admin	Edit Configuration Information Edit User Access Update to and from SteamStar® View and Edit Trap Data
Full	user	user	View and Edit Trap Data Update to and from SteamStar®
Guest	read	read	View Trap Data

Restart Device - Clicking the “Restart Device” button will cause the Gateway to shutdown and restart.

Note: communication to control system and network will be interrupted during a restart.

Shutdown Device – Clicking the “Shutdown Device” button will power down the gateway.

Note: communication to control system and network will stop when the Gateway is shutdown.

Update from SteamStar® – Clicking the “Update from SteamStar®” button will update the trap database with the information contained in the SteamStar® site the Gateway is programmed to communicate with.

Warning: Selecting “Update from SteamStar®” will overwrite the existing database on the Gateway. Any changes that may have been made on the gateway and not on SteamStar® will be permanently lost.

Upload to SteamStar® – Clicking the “Upload to SteamStar®” button will send condition updates of all the monitored points in the gateway to SteamStar®.

Note: only condition information will be sent to SteamStar®. Changes to other fields should be made directly in SteamStar®.

Section 2.4 Gateway Common Functions

Logging into the Gateway

1. Open web browser (i.e. Internet Explorer, Mozilla Firefox, etc.).
2. Enter IP address of the Gateway into the address bar (i.e. https://10.0.2.41).
3. A warning stating that there is a problem with the website's security certificate may be displayed. This is normal, acknowledge the security and proceed.
4. Enter username and password (see Section 2.3.2 for default passwords) and click "Submit".
5. The "All Equipment" screen will be the first page displayed. See "All Equipment Tab" of this section for more details.

Navigation Tabs:

Critical Equipment Tab:

If devices are marked as critical they will be listed under this tab.

Mark device as Critical Equipment Tab:

1. Under the "All Equipment" tab click on the tab number of the item to be marked critical
2. Select "Yes" next to Critical
3. Click Save

Failed Equipment Tab:

If a device is reading a failed condition it will be listed under this tab. This is exceptionally useful when there are several pages worth of data and you are only interested in the failed equipment.

All Equipment Tab:

Everything on the Gateway will be listed under this tab.

Configuration Tab:

See Section 2.3.2

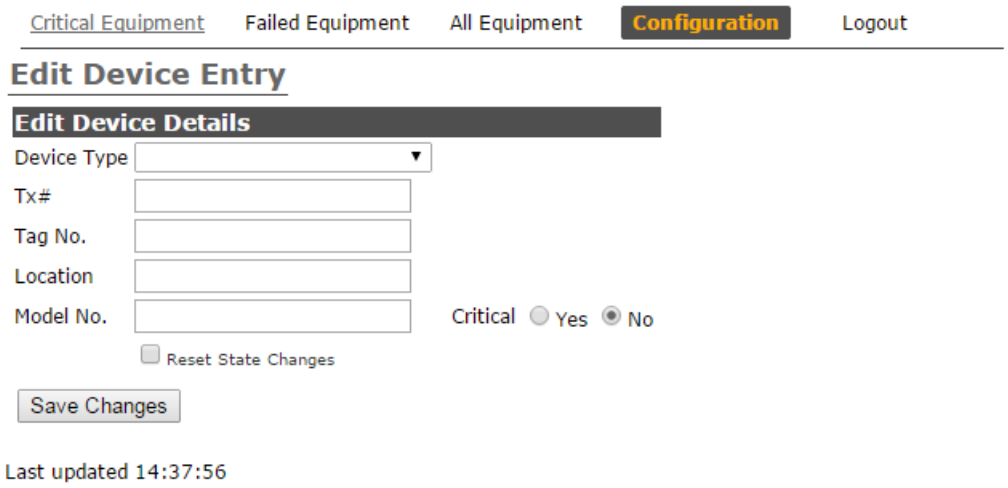
Logout Tab:

Click this to log off the Gateway.

Section 2.4 Gateway Common Functions - *continued*

Adding new equipment:

1. Locate and click the “Add New Equipment” button on the bottom left of the “All Equipment”, “Failed Equipment”, or the “Critical Equipment” page.
2. Select the correct device type.
3. Enter the unique transmitter signature number found on the transmitter cover.
4. Enter tag number (do not duplicate tags).
5. Enter a description of the location as you want it displayed on the equipment screens.
6. Enter the Manufacturer and Model of the equipment monitored in the “Model No.” field. This will be displayed on the equipment screens (example ARM / 811).
7. Mark the trap as critical if you would like the trap to be displayed on the “Critical Equipment” page and send email alerts to acknowledge state changes (see configuration for email settings).
8. Click “Save Changes”



Editing Data and adding points

1. Click on tag number of the desired device for the “Critical Equipment”, “Failed Equipment” or “All Equipment” tabs.
2. All fields can be edited at this point however if the transmitter number is changed a new entry will be created.

Change your Password:

1. Click on the “Configuration” tab
2. Click “Edit User Access”
3. From this screen you can change your Username, Full Name (how it is displayed) and password
4. Click “Save”

Device Type Filters

SteamEye® has the capability to monitor several different types of equipment (i.e. steam traps, coils, pump traps etc.). The device filter will display only the device type selected. Select from the pull down the device type you would like to see.

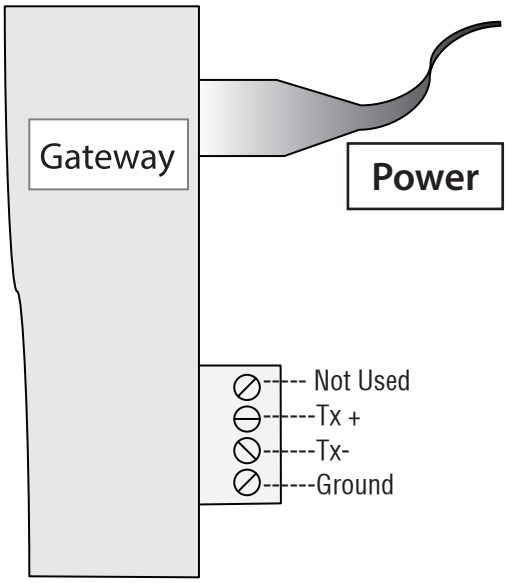
Section 2.5 Gateway Specifications

Specifications	Armstrong SteamEye® Gateway GW4000M
Operating System	Linux based Cherokee SSL web server
Processor	AMD low power LX800 500MHz, Fanless
Memory	128MB RAM 4GB Internal Flash
Input Power	120v AC Power Supply
Power Consumption	400mA
Ethernet Interface	1 x 10/100 Mbps
Supported Communication Protocols	IPv4, SMTP, FTP, Telnet, SSH, HTTP, HTTPS, Modbus RTU
Inbound TC/IP ports: - Embedded web server with Remote configuration	80 standard (redirected to 443) 23 Telnet 21 FTP 443 HTTPS configurable 22 SSH configurable
Outbound TC/IP ports: - For e-mail/text message notification - For SteamStar® updates	25 (Mail to SMTP server) 80 HTTP 443 HTTPS configurable
RF Receiver	1 Internal RF Receiver 1 External Receiver Port
Operating Frequency	902-928 MHz
Dimensions (H x W x D)	2-3/4" x 6-1/2" x 4-1/2" (70mm x 166mm x 114mm)
Weight	3.5 lb (1.6 kg)
Operation Temperature Range	32-140°F (0-60°C)
Operating Humidity	10% - 70% Relative humidity, non-condensing
Modbus Connection	RS-485 (Standard) or RS-232 (Optional)

Section 2.6 Modbus Configuration

The SteamEye® Gateway M comes standard with Modbus 485 connections (see Section 2.1 Connections) Using an RS-485 interface, the server can be accessed over a network of Modbus devices.

Section 2.6.1 Modbus Connections



Section 2.6.2 Modbus Settings

Slave Device ID 2

Baud..... 9600

Data Bits..... 8

Parity..... Even

Stop Bits 1

Section 2.6.3 Modbus Register Table

The information is accessed via the holding register (40,000) and input register (30,000) space. To refresh the input register table, write a 1 or 0 to holding register 40,000.

Please note: This manual assumes a 0 based system. If the system being used is a 1 based system, add 1 to all locations.

The SteamEye® system is a wireless system with the potential for 2000 monitoring points communicating with a single receiver. With such a large amount of information available from a single point the Modbus table is constructed differently than may be customary for single point monitoring. The Modbus table on the SteamEye® gateway is a single table that contains information for all points monitored by the gateway. The information available for each monitoring point is extensive and may or may not be needed so it is important to plan what data is necessary from the Modbus table to minimize programming and hardware cost.

Holding Registers (Table 2.6.1)

Register Name	Add	Write	Read
devicenum	0	update input registers array	number of devices
base	1	device index offset	device index offset
indexed device	2-5	change index/delete	device transmitter number
device fields	6-97	modify/create indexed device	read indexed device fields

Input Registers (Table 2.6.2)

Register Name	Add	Write
device[base]	0-90	1st monitor point listed in the table
device[base+1]	91-181	2nd monitor point listed in the table
etc....	etc…	etc…
device[base+108]	9828-9918	109th monitor point listed in the table. End of offset.

Each monitoring point uses 91 registers in the table and they are stacked for additional monitoring points. For example in a 10 point monitoring system the first monitoring point would take up registers 0-90, the second point 91-181, the third 182-272… the tenth point 819-909.

If the population of traps is great enough that it exhausts the 10,000 available registers (109 monitor points) it will be necessary to adjust the base to offset the index of monitoring points.

When the base is adjusted, the register table will adjust to make the base number the first monitoring point listed. For example, if the base is changed to 10, the first 90 registers would be for monitoring point number 10. In the case where the first register table is exhausted (109 monitor points) the base could be adjusted to 110 and the register table would build from monitoring point 110.

Section 2.6.3 Modbus Register Table - *continued*

The Modbus table contains all the information available for each point in the system. Below is a table that describes where to find the information for each point in the gateway. It is worth noting that if the information is not something that needs to be entered into the control system then it is not required to read the data. This can help save significant cost when setting up a system.

Device Fields (Table 2.6.3)

Field	Reg. Offset	Type	Description
transmitter	0-3	decimal	device index and RF transmitter #
tag	4-14	string	tag number or device name
location	15-40	string	physical location of the transmitter
model	41-51	string	equipment make / model
status	52-62	string	current status of equipment (see table 2.6.4)
state_changes	63	decimal	number of state changes of equipment
low_battery	64	decimal	low battery alarm (0/1)
last_update	65-68	date & time	last update (time from Epoch)
signal_margin	69	decimal	transmitter signal level
failed	70	decimal	is the equipment in a failed state (0/1)
critical	71	decimal	is the equipment marked as critical (0/1)
for future use	72	decimal	(0/1) alarm bit not currently used
for future use	73	decimal	(0/1) alarm bit not currently used
last_alarm_changed_status	74-84	String	status of equipment at last state change
type	85	decimal	device type number (see Table 4)
last_alarm_changed_time	86-89	date & time	last state change (time from Epoch)
cycle_count	90	decimal	cycle count (pump trap equipment type)

The Modbus table will provide data in Decimal, String, or Date and Time. The information in these fields can be converted into something a human can read using the translation information below:

Translating a decimal field (the transmitter number is used in this example):

Example: Transmitter number 986792:

[30000] = 0

[30001] = 0

[30002] = 15

[30003] = 3752

Translate the Decimal fields into hex first:

Register	Decimal	Hex
[30000]	= 0	= 0
[30001]	= 0	= 0
[30002]	= 15	= 0F
[30003]	= 3752	= 0EA8

Combine the hex information together so it = 0F0EA8

Covert the combined hex information to decimal. In this example 0F0EA8 converts to 986792

Section 2.6.3 Modbus Register Table - *continued*

Translating a string (the current status is used in this example):

The current condition is populated in registers 30052-30062

Start by converting the value to Hex, break the Hex up and then convert from ASCII to letters.

Example: decimal response of 17220 from register 30052, convert it to HEX. 17220 = 4344.

Register	Decimal	Hex
[30052]	17220	4344

Break the hex up into 43 and 44 and look them up in an ASCII table. See table below.

43 = ASCII “C”

44 = ASCII “D”

Combine the two and you get CD, cold status.

If the steam trap was OK, you would get a response of decimal 20299 = 4F4B,

4F = ASCII “O”

4B = ASCII “K”

For Blowthru, response = 16980 = 4254

42 = ASCII “B”

54 = ASCII “T”

Translating date & time (the last update field is used in this example)

Date and time fields are listed in 2 registers. Start by converting each register to hex. Then combine the 2 hex strings. Convert the combined field to a decimal to get the Epoch time. Convert the Epoch time to “human time” to finish.

Example:

Register	Decimal	Hex
[30067]	21373	537D
[30068]	02985	0BA9

Combine the 2 hex fields to get 537D0BA9.

Hex	Dec	
537D0BA9 =	1400703913 =	Wed, 21 May 2014 20:25:13 GMT
	Epoch time	Date “human time”

Section 2.6.3 Modbus Register Table - *continued*

Device Status Table (Table 2.6.4)

Steam Trap				
OK	CD	BT	FT	LOS
Pressure Reducing Valve				
OK		OP		LOS
Pressure Reducing Valve with Safety Relief Valve				
OK	OP	RA		LOS
Pump Trap				
OK	FL			LOS
Pump Trap with Cycle Count				
OK	FL	CC		LOS
Coil				
OK	FL			LOS
Sump Ejector (Flooded Detection Device)				
OK	FL			LOS
Universal Switch				
OK		ALR		LOS
Safety Relief Valve				
OK		RA		LOS
Repeater				
OK				LOS
Safety Relief Valve with Temperature				
OK	OT	RA		LOS

Device Type
Possible Conditions

OK = OK
CD = COLD
BT = BLOWTHRU
FT = FAULT
LOS = LOSS OF SIGNAL
OP = OVER PRESSURE
RA = RELIEF ALARM
FL = FLOODED
CC = CYCLE COUNT
ALR = ALARM
OT = OVER TEMPERATURE

Device Type Table (2.6.5)

Type #	Equipment Type
1	Steam Trap
2	Pressure Reducing Valve
3	Pressure Reducing Valve with Safety Relief Valve
4	Pump Trap
5	Pump Trap with Cycle Count
6	Coil
8	Sump Ejector (Flooded Detection Device)
9	Universal Switch
10	Safety Relief Valve
11	Repeater
12	Safety Relief Valve with Temperature

Section 2.6.3 Modbus Register Table - *continued*

ASCII Table (2.6.6)

Hex	Char	Hex	Char	Hex	Char	Hex	Char
00	Null	20	Space	40	@	60	`
01	Start of heading	21	!	41	A	61	a
02	Start of text	22	"	42	B	62	b
03	End of text	23	#	43	C	63	c
04	End of transmit	24	$	44	D	64	d
05	Enquiry	25	%	45	E	65	e
06	Acknowledge	26	&	46	F	66	f
07	Audible bell	27	'	47	G	67	g
08	Backspace	28	(	48	H	68	h
09	Horizontal tab	29	)	49	I	69	i
0A	Line feed	2A	*	4A	J	6A	j
0B	Vertical tab	2B	+	4B	K	6B	k
0C	Form Feed	2C	‘	4C	L	6C	l
0D	Carriage return	2D	-	4D	M	6D	m
0E	Shift out	2E	.	4E	N	6E	n
0F	Shift in	2F	/	4F	O	6F	o
10	Data link escape	30	0	50	P	70	p
11	Device control 1	31	1	51	Q	71	q
12	Device control 2	32	2	52	R	72	r
13	Device control 3	33	3	53	S	73	s
14	Device control 4	34	4	54	T	74	t
15	Neg. acknowledge	35	5	55	U	75	u
16	Synchronous idle	36	6	56	V	76	v
17	End trans. block	37	7	57	W	77	w
18	Cancel	38	8	58	X	78	x
19	End of medium	39	9	59	Y	79	y
1A	Substitution	3A	:	5A	Z	7A	z
1B	Escape	3B	;	5B	[	7B	}
1C	File separator	3C	<	5C	\	7C	|
1D	Group separator	3D	=	5D	]	7D	{
1E	Record separator	3E	>	5E	^	7E	~
1F	Unit separator	3F	?	5F	_	7F	¨

Example Table 2.6.7

Field Description	Priority	Register #	Result	Type	Translation					Notes
					Convert to Hex	Combine the cells		Convert back to Dec		
Transmitter Number		30000	0	Decimal						Register typically not used
		30001	0							Register typically not used
	2	30002	31		1F	1F4FC8		2052040		
		30003	20424		4FC8					Decimal fields end at the last Register
					Convert to Hex	Split numbers		Look Up in Ascii table		
Tag Number	1*	30004	21297	String	5331	53	31	S	1	String fields start at the first register
		30005	13109		3335	33	35	3	5	
		30006	25088		6200	62	00	b	null	
		30007	0							Registers used in longer Tag numbers
		30008	0		Result = S135b					Registers used in longer Tag numbers
		30009	0							Registers used in longer Tag numbers
		30010	0							Registers used in longer Tag numbers
		30011	0							Registers used in longer Tag numbers
		30012	0							Registers used in longer Tag numbers
		30013	0							Registers used in longer Tag numbers
		30014	0							Registers used in longer Tag numbers
					Convert to Hex	Split numbers		Look Up in Ascii table		
Location	2*	30015	18798	String	496E	49	6E	I	n	Reference ASCII Table 2.6.6
		30016	8258		2042	20	42		B	
		30017	24947		6173	61	73	a	s	
		30018	25965		656D	65	6D	e	m	
		30019	25966		656E	65	6E	e	n	
		30020	29728		7420	74	20	t		
		30021	24930		6162	61	62	a	b	
		30022	28534		6F76	6F	76	o	v	
		30023	25888		6520	65	20	e		
		30024	18520		4858	48	58	H	X	
		30025	9011		2333	23	33	#	3	
		30026	0							Register used in longer descriptions
		30027	0			Result = In basement above HX #3				Register used in longer descriptions
		30028	0							Register used in longer descriptions
		30029	0							Register used in longer descriptions
		30030	0							Register used in longer descriptions
		30031	0							Register used in longer descriptions
		30032	0							Register used in longer descriptions
		30033	0							Register used in longer descriptions
		30034	0							Register used in longer descriptions
		30035	0							Register used in longer descriptions
		30036	0							Register used in longer descriptions
		30037	0							Register used in longer descriptions
		30038	0							Register used in longer descriptions
		30039	0							Register used in longer descriptions
		30040	0							Register used in longer descriptions
					Convert to Hex	Split numbers		Look Up in Ascii table		
Model Number	2*	30041	16722	String	4152	41	52	A	R	
		30042	19759		4D2F	4D	2F	M	/	
		30043	14385		3831	38	31	8	1	
		30044	12544		3100	31	00	1	null	
		30045	0							Register used in long model numbers
		30046	0			Result = ARM/811				Register used in long model numbers
		30047	0							Register used in long model numbers
		30048	0							Register used in long model numbers
		30049	0							Register used in long model numbers
		30050	0							Register used in long model numbers
		30051	0							Register used in long model numbers

Example Table 2.6.7 - *continued*

Field Description	Priority	Register #	Result	Type	Translation					Notes
					Convert to Hex	Split numbers		Look Up in Ascii table		
Status	1	30052	20299	String	4F4B	4F	4B	O	K	See Table 2.6.4 for list of statuses
	2	30053	0							Register only for "ALM" and "LOS"
		30054	0							Register typically not used
		30055	0							Register typically not used
		30056	0							Register typically not used
		30057	0							Register typically not used
		30058	0							Register typically not used
		30059	0							Register typically not used
		30060	0							Register typically not used
		30061	0							Register typically not used
		30062	0							Register typically not used
					This is a single register decimal field, no conversion needed					
State changes	2	30063	28	Decimal	Result = 28					
					Status Bit					
Low Battery	1	30064	0	Decimal	1 = Yes, 0 = No ------- Result = No					Status bit (1=Yes, 0=No)
					Convert to Hex	Combine Cells	Convert to Dec	Convert from Epoch time to human time		
Last Update	1	30065	0	Time and Date						Register typically not used
		30066	0							Register typically not used
		30067	21373		537D	537D0BA9	1400703913	Wed, 21 May 2014 20:25:13 GMT		
		30068	02985		0BA9					
					This is a single register decimal field, no conversion needed					
Signal Margin	3	30069	51	Decimal	Result = 51					
					Status Bit					
Failed	3	30070	0	Decimal	1 = Failed, 0 = Okay ------- Result = Ok					Status bit (1 = Failed, 0 = Okay)
					Status Bit					
Critical	3	30071	0	Decimal	1 = Critical, 0 = Non-critical ------- Result = Non-critical					Status bit (1 = Critical, 0 = Non-critical)
					Not used					
For Future Use		30072	0	Decimal						
		30073	0							
					Convert to Hex	Split numbers		Look Up in Ascii table		
Last Alarm Changed Status	2	30074	16980	String	4254	42	54	B	T	
		30075	0							Register only for "ALM" and "LOS"
		30076	0							Register typically not used
		30077	0							Register typically not used
		30078	0							Register typically not used
		30079	0							Register typically not used
		30080	0							Register typically not used
		30081	0							Register typically not used
		30082	0							Register typically not used
		30083	0							Register typically not used
		30084	0							Register typically not used
					This is a single register decimal field, no conversion needed					
Device Type	3	30085	1	Decimal	Result = Steam Trap					Reference device type table 2.6.5
					Convert to Hex	Combine Cells	Convert to Dec	Convert from Epoch time to human time		
Last Alarm Changed Time	2	30086	0	Time and Date						Register typically not used
		30087	0							Register typically not used
		30088	21372		537C	537C13CB	1400640459	Wed, 21 May 2014 02:47:39 GMT		
		30089	02985		13CB					
					This is a single register decimal field, no conversion needed					
Cycle Count	**	30090	0	Decimal	Result = 0					

Priority - At Armstrong we recognize that it can be cost prohibitive to read all registers for every point in the system. The priority level is the level at which it is recommended the register is read from the table. For example, the location field is unlikely to change over time so it is listed as a priority level of 2 because this information can be written into the control system. Whereas the condition is 1 because that will change if the trap condition changes.

Priority Level: 1 = High
2 = Medium
3 = Low

* Only need to read enough registers to get information. The rest are blank and it is not necessary to read them

** This field is 1 priority if monitoring pump traps with cycle count otherwise the field is unused

SteamEye®

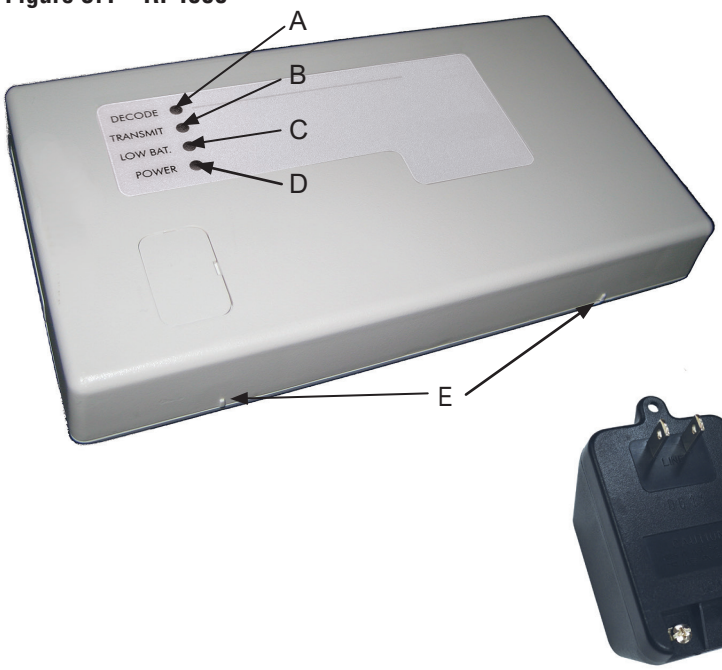
Section 3 SteamEye® Repeater (RP4000)

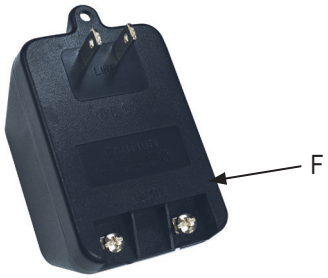
RP4000 high-power repeaters receive, decode, amplify and retransmit signals from SteamEye® transmitters. The RP4000 expands the range for any SteamEye® 4000 series transmitters, and can be used to amplify signals from other RP4000's. The RP4000 can be used to expand the SteamEye® system to scale from small sites to complete campuses consisting of several buildings.

Section 3.1 Operating Information

The RP4000 Repeater is designed to operate without any need for interaction. Once the Repeater is powered it will receive and send signals from all series 4000 Armstrong SteamEye® devices automatically.

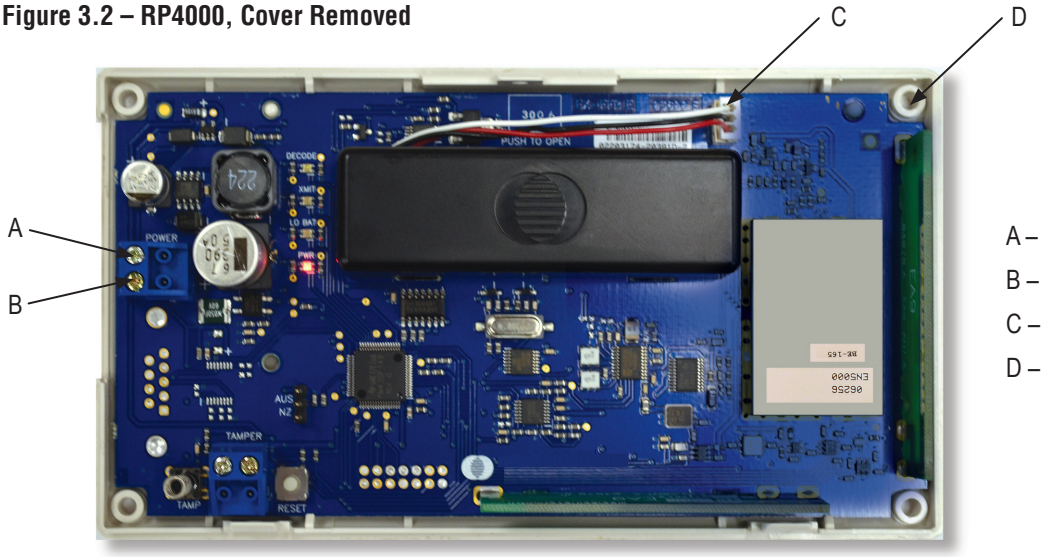
Figure 3.1 – RP4000





A – DECODE
Processing a received wireless signal
B – TRANSMIT
Transmitting a wireless signal that was received
C – LOW BAT.
Backup battery voltage is low
D – POWER
Power indicator light
E – HOUSING RELEASE TABS
F – POWER TRANSFORMER

Figure 3.2 – RP4000, Cover Removed



A – POWER CONNECTION
B – POWER CONNECTION
C – BATTERY CONNECTOR
D – ANCHOR LOCATION (4 Corners)

Section 3.2 Installation Information

Prior to installation of the RP4000 SteamEye® Repeater an RF survey should have been performed to identify Repeater installation locations. Install the RP4000 in the locations specified by the RF Survey. For maximum performance, mount the RP4000 in an area removed from metal (metal objects such as duct work and wire mesh will reduce RF range). All installation locations should be dry and maintain a temperature between 32°F - 140°F (0°C - 60°C). If installing in an outside location or location where water splash maybe present, install the RP4000 in a non-metallic enclosure. See installation example, Figure 3.6

Section 3.2.1 RP4000 Power Cable Installation

The RP4000 is supplied with a transformer allowing it to be powered from any standard 120 VAC outlet.
120 VAC power is required.

1. Remove Cover – Remove RP4000 cover by inserting a flat screwdriver in the seam of the front and back cover at the housing release tabs and gently pry down. Repeat this step at all retainer marks.

2. Cut Power Cable – Cut the necessary length of cable to run from the repeater location to the power source.

Note: Wire should be two-conductor 20 AWG (or larger) stranded-tinned copper with PVC insulation rated to 300 volts at 80 °F (26 °C). Wire length should not exceed 328 ft (100 Meters).

Figure 3.3 – Removing Cover

3. Install Power Cable – Terminate the cable on the transformer connection screws and on the RP4000 power and ground connections. Note: the RP4000 uses 14 VAC and there are no concerns with polarity for the wire termination locations.

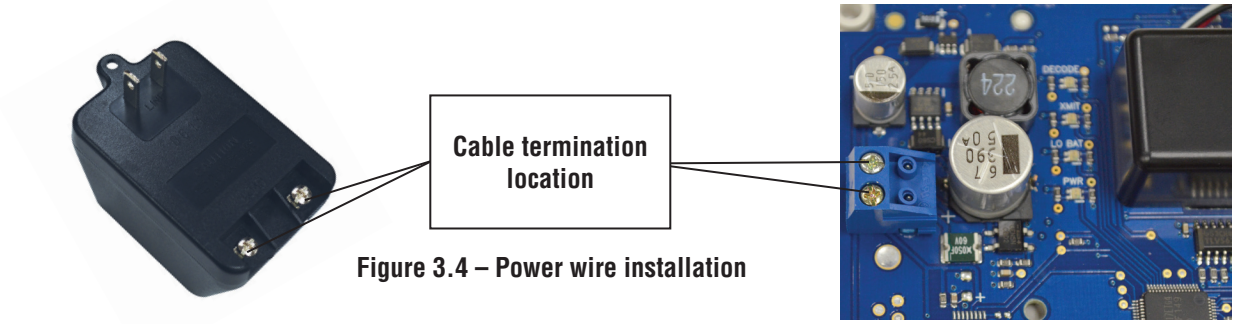


Figure 3.4 – Power wire installation

4. Connect Battery Power – The RP4000 is shipped with a fully charged backup battery. Connect the battery before re-installing the cover.
5. Reinstall the cover.

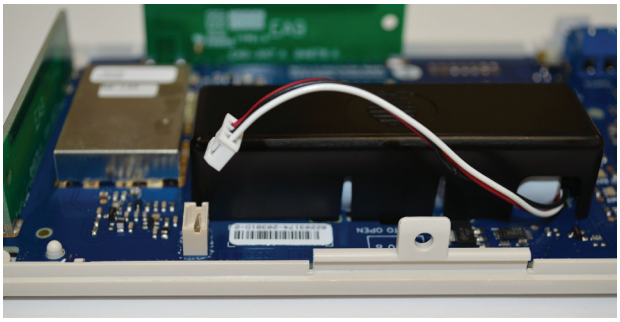


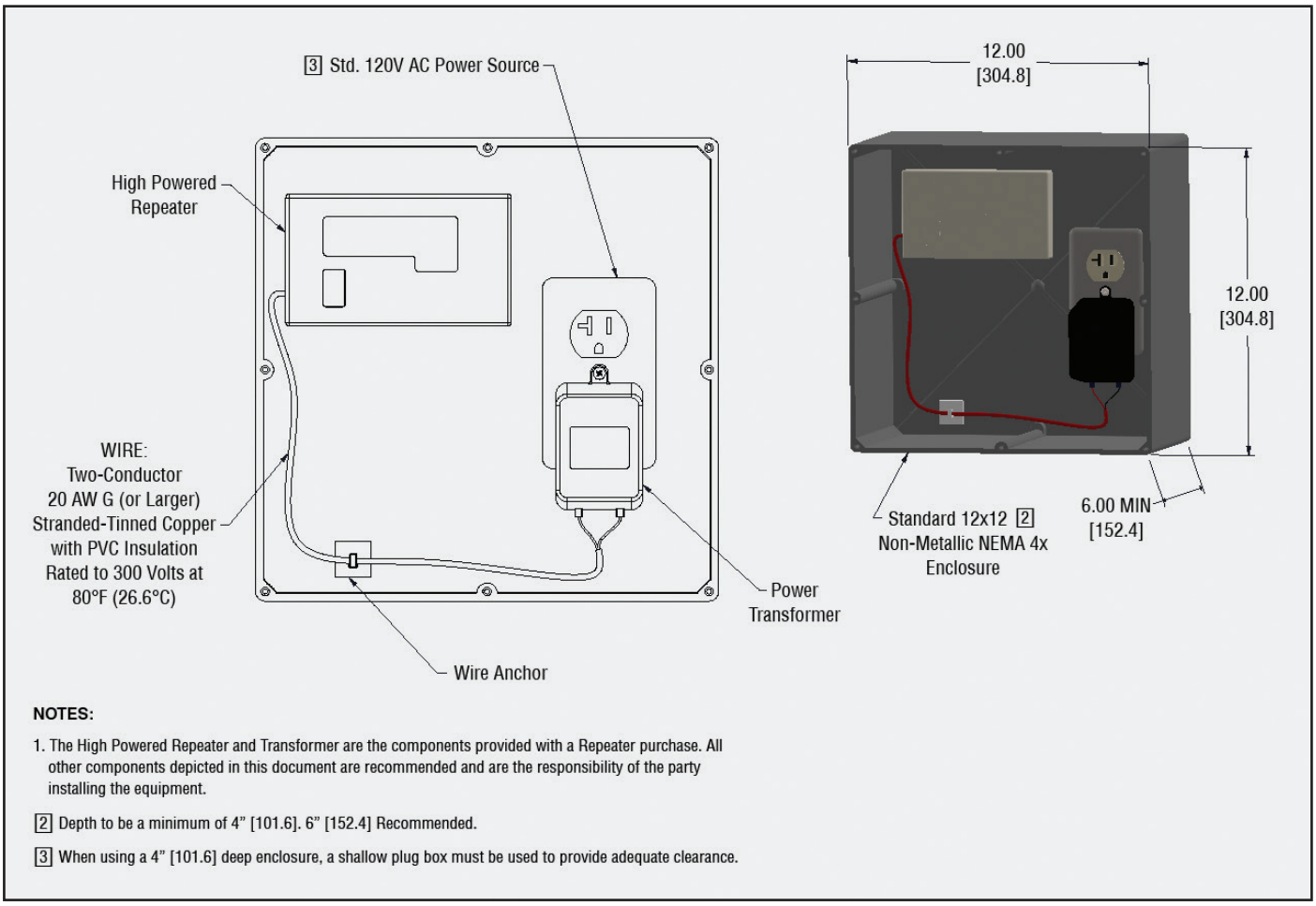
Figure 3.5 – Connect Battery Power

See the next page for an example of an installation with enclosure.

Section 3.2.2 RP4000 Mounting Installation Example

The RP4000 can be mounted to a non-metallic panel or wall using the 4 provided screws (see figure 3.2 for Anchor locations). Please note that metallic enclosures will significantly impede on the signal transmission and should not be used for SteamEye® repeaters.

RP4000 Installation Example



NOTES:

1. The High Powered Repeater and Transformer are the components provided with a Repeater purchase. All other components depicted in this document are recommended and are the responsibility of the party installing the equipment.

[2] Depth to be a minimum of 4" [101.6]. 6" [152.4] Recommended.

[3] When using a 4" [101.6] deep enclosure, a shallow plug box must be used to provide adequate clearance.

Figure 3.6

Section 4 SteamEye® Transmitter Applications

The SteamEye® system has various monitoring options for steam traps to match the requirements of different demanding locations. In addition to steam trap monitoring, the system is capable of monitoring additional equipment described below.

Model: URFC4700

The URFC4700 steam trap transmitter can be installed on any style trap operating under constant pressure.

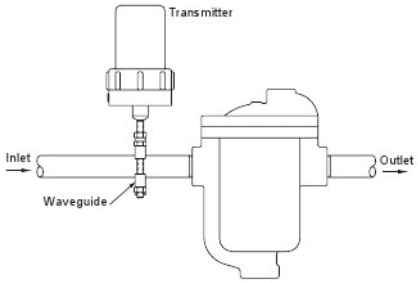
Monitors: Steam Trap Constant Pressure Applications

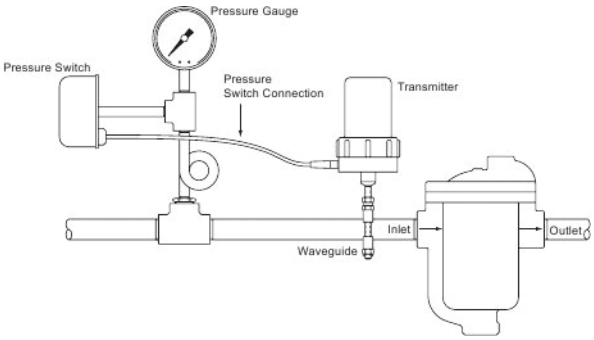
Operating Conditions: Non-submersible

Ambient Temperatures: -40°F – 125°F (-40°C – 52°C)

Pressure Range: 15 – 1500 psig (1 – 100 Bar)

Note: Heat sync is required on installations above 200 psig (14 Bar)





Model: URFM4700

The URFM4700 steam trap transmitter can be installed on any style trap operating on modulating pressure.

Monitors: Steam Trap Modulating Pressure (On/Off)

Operating Conditions: Non-submersible

Ambient Temperatures: -40°F – 125°F (-40°C – 52°C)

Pressure Range: 15 – 1500 psig (1 – 100 Bar)

Note: Heat sync is required on installations above 200 psig (14 Bar)

Note: Pressure switch not included.

Model: URFC4700R

The URFC4700R steam trap transmitter can be installed on any style trap operating on constant pressure. The remote transmitter can be installed away from the trap making it ideal for use in situations where communication is difficult.

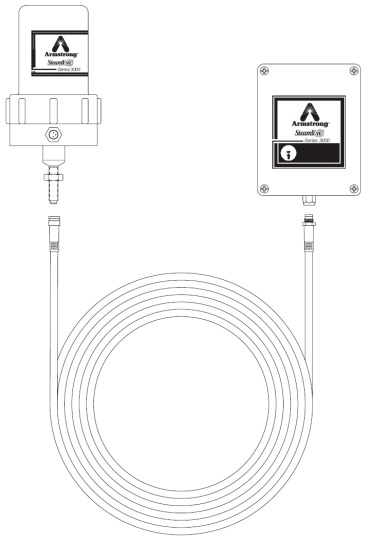
Monitors: Steam Trap Constant Pressure Applications

Operating Conditions: Non-submersible

Ambient Temperatures: -40°F – 125°F (-40°C – 52°C)

Pressure Range: 15 – 1500 psig (1 – 100 Bar)

Note: Heat sync is required on installations above 200 psig (14 Bar)



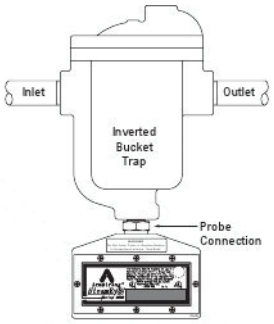
Model: RFC4300
The RFC4300 steam trap transmitter can be installed on any probe ready Armstrong inverted bucket steam trap.

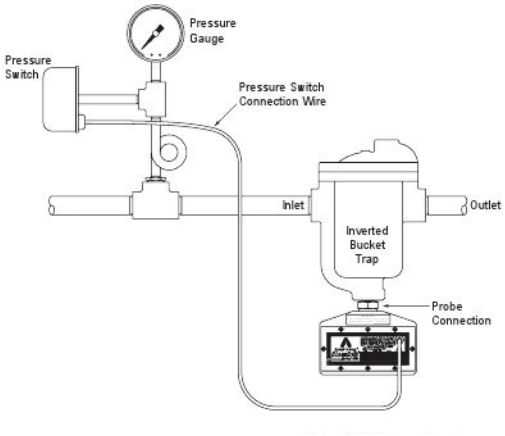
Monitors: Steam Trap Constant Pressure Applications

Operating Conditions: Non-submersible

Ambient Temperatures: -40°F – 125°F (-40°C – 52°C)

Pressure Range: 0 – 600 psig (0 – 41 Bar)





Model: RFM4300
The RFM4300 steam trap transmitter can be installed in any probe ready Armstrong inverted bucket trap.

Monitors: Steam Trap Modulating (On/Off Applications)

Operating Conditions: Non-submersible

Ambient Temperatures: -40°F – 125°F (-40°C – 52°C)

Pressure Range: 0 – 600 psig (0 – 41 Bar)

Note: Pressure switch not included.

Model: URFC4700-SRV
The URFC4700-SRV Safety Relief Valve (SRV) transmitter can be installed on a SRV for notification of a leaking or discharging SRV.

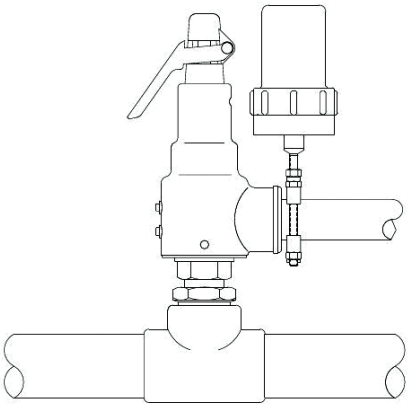
Monitors: Safety Relief Valves

Operating Conditions: Non-submersible

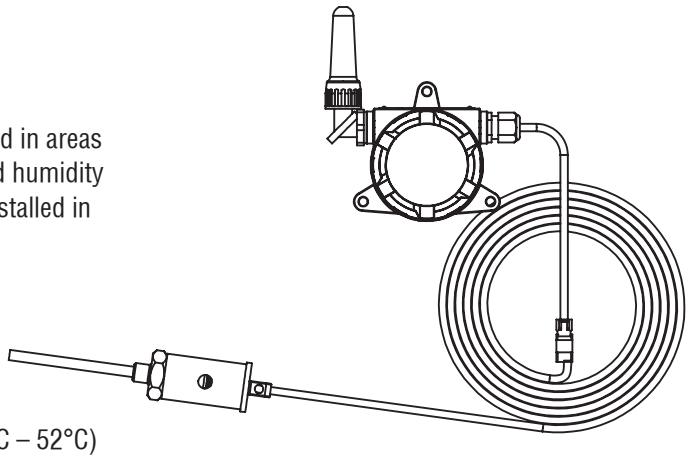
Ambient Temperatures Probe: -40°F – 125°F (-40°C – 52°C)

Maximum Pipe Temperature: 600°F

Note: A heat sync is required on installations with pipe temperatures greater than 385°F.



Model: RFC4310PR
The RFC4310PR steam trap transmitter is typically installed in areas where there is a potential for flooding and/or high heat and humidity are present (steam vaults/pits). The RFC4310PR can be installed in any probe ready Armstrong Inverted bucket trap.



Monitors: Steam Trap, Constant Pressure Applications

Ambient Temperature (Probe): 250°F (121°C)

Max Pressure (Probe): 600 psig (41 Bar)

Ambient Temperature (Transmitter): -40°F – 194°F (-40°C – 52°C)

Section 5 SteamEye® Transmitter Installation Guidlines

Model: URFC4700/URFM

Transmitter	
Physical Dimensions	dia - 3" (76 mm) h - 6.75" (171 mm)
Monitoring Type	Ultrasonic and Temp
Material	Glass Filled Nylon
Power Supply	Duracell 123A 3 Volt Lithium Battery
Typical Battery Life	3-5 years*
Transmission	902 to 928 MHz
Power	60 mW
Transmission Bandwidth	200 KHz
Communications	Proprietary spread spectrum format
Temperature Range	-40°F to 115°F (-40°C to 46°C)
Max Operating Pressure	1500 psi (104 bar)**
Intrinsic Safety	Class I, Groups C, D Class II, Groups F, G Div. 1, 2

*Operating at the upper or lower end of the temperature range may decrease battery life

**Heat sink may be required (see page 31 for orientation and heat sink requirement)

Preparation

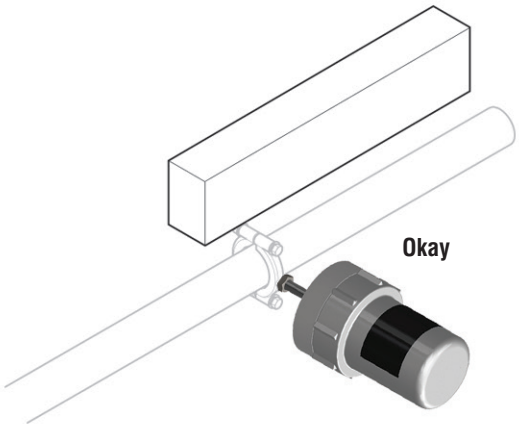
Clearance

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

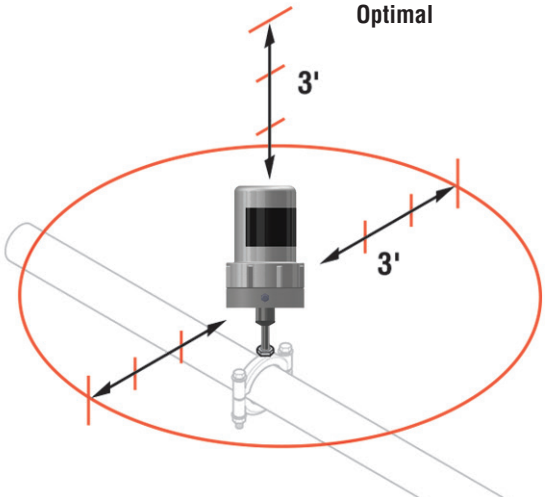
Recommendation: Install transmitter at least 3 ft. (1 m) from any large structure for optimal performance.

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

Obstruction



Optimal



Installing Battery

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.

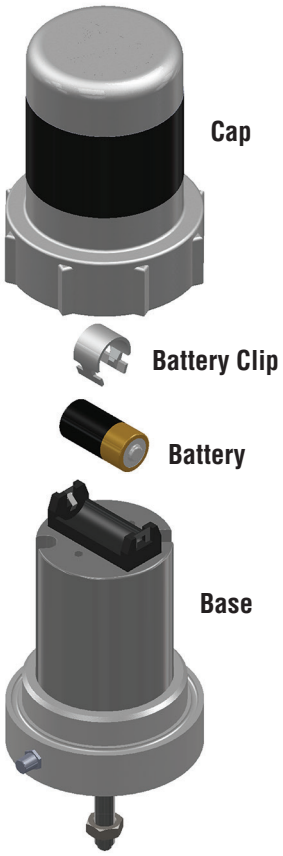
Warning: Explosion Hazard
Do not place conductive objects or materials within battery compartment.

Warning: Explosion Hazard
Do not open when dust atmosphere is present.

1. Remove cap by unscrewing from base.
2. Inspect O Rings for cracks or damage, replace if necessary.
3. Install battery.

Note: Use only Duracell® model 123A 3 Volt Lithium Battery. Use caution when installing battery not to damage or bend any components.

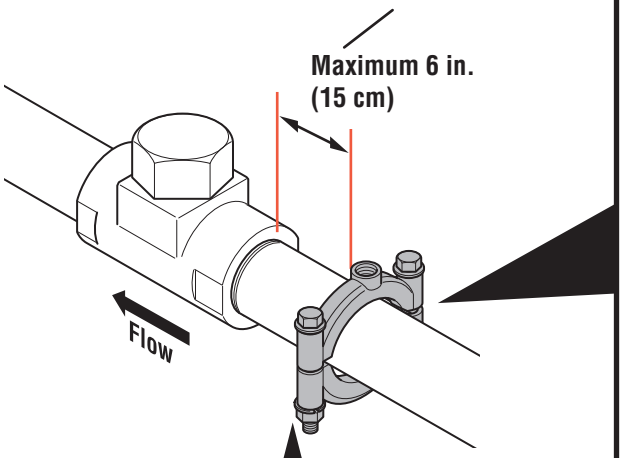
4. Reinstall cap.

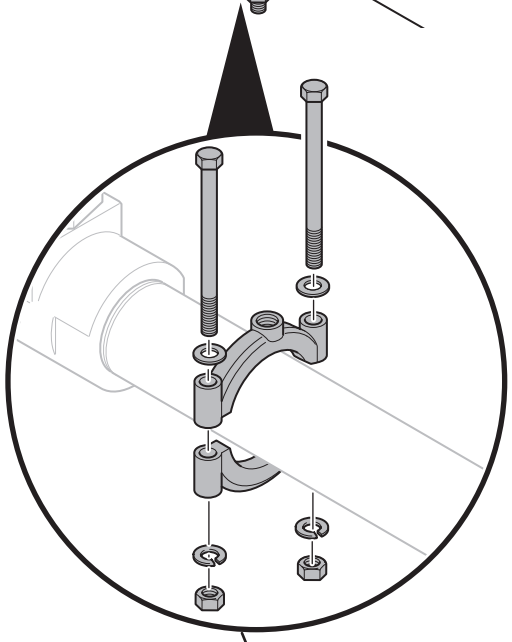


SteamEye®

Transmitter Installation

1 Position Waveguide no greater than 6 in. (15 cm) from inlet.



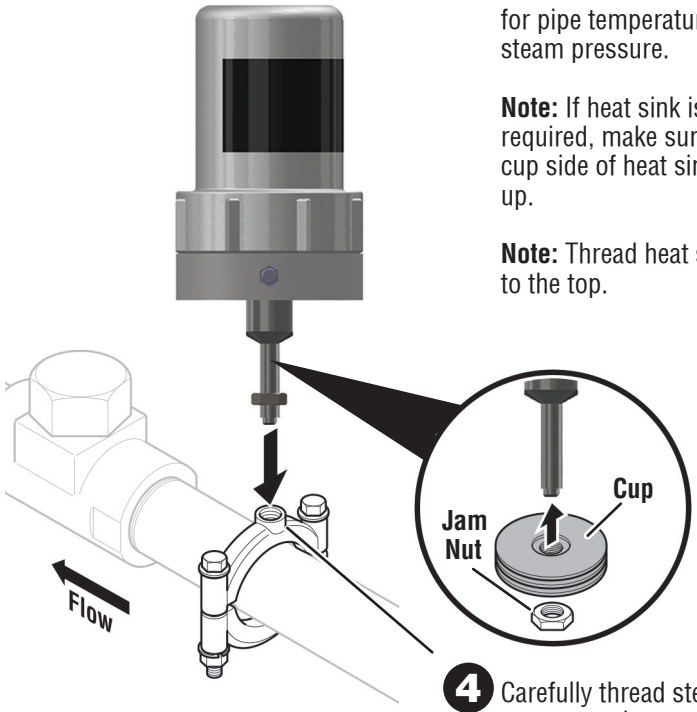


2 Install Waveguide:
- Assemble Waveguide around pipe.
- Torque Waveguide bolts to 25 ft-lb (34 N-m).

3 Refer to page 31 to determine the proper installation orientation for pipe temperature/ steam pressure.

Note: If heat sink is required, make sure cup side of heat sink is up.

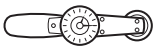
Note: Thread heat sink to the top.

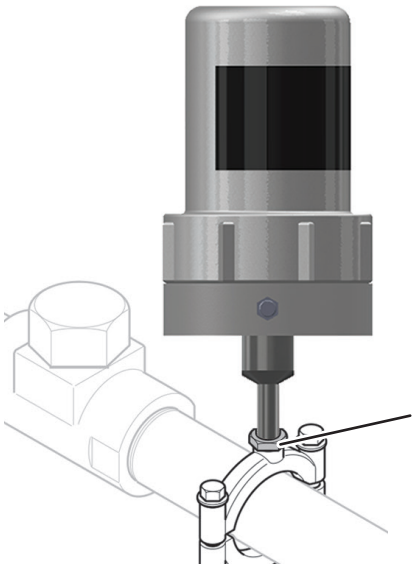


4 Carefully thread steam trap transmitter stem into Waveguide.

Note: Do not cross-thread stem.

5 Torque transmitter to 20 ft-lb (27 N-m).





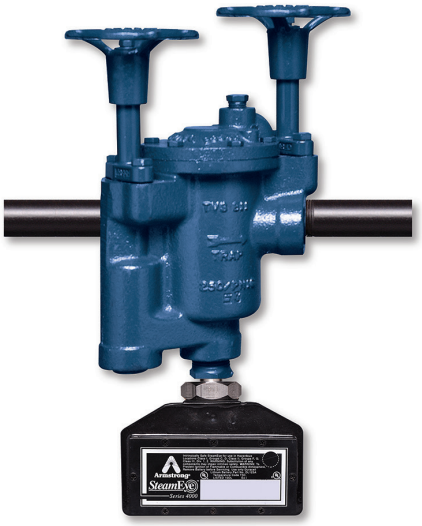
6 Tighten jam nut to 20 ft-lb (27 N-m).

7 Confirm cap is tightened to 25 ft-lb (34 N-m).

8 Install Pressure Switch (If needed) Refer to pressure switch installation on page 32

Model: RFC4300/RFM4300

Technical Specification



Transmitter	
Physical Dimensions	W - 5.25” (134 mm) H – 4.5” (115 mm) D - 2.75” (70 mm)
Monitoring Type	Conductivity & Temperature
Material	Thermoset Resin; EL Cast Black
Power Supply	Duracell 123A 3 Volt Lithium Battery
Typical Battery Life	3-5 years*
Transmission	902 to 928 MHz
Power	60 mW
Transmission Bandwidth	200 KHz
Communications	Proprietary spread spectrum format
Temperature Range	-40°F to 115°F (-40°C to 46°C)
Max Operating Pressure	600 psi (42 bar)

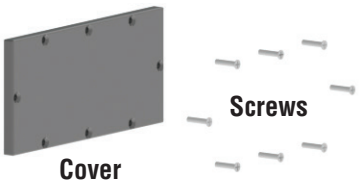
*Operating at the upper or lower end of the temperature range may decrease battery life

Installing Battery

1. Remove cover by unscrewing screws
2. Install battery

Note: Use only Duracell® model 123A 3 Volt Lithium Battery. Use caution when installing battery not to damage or bend any components

3. Reinstall cover



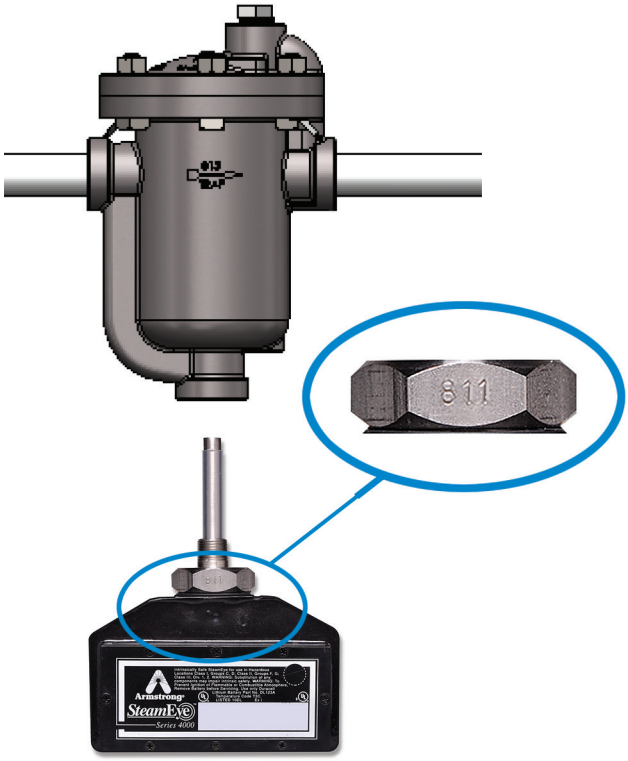
SteamEye®

Transmitter Installation

Use caution when handling the transmitter not to strike or put force on the end of the probe. This could cause damage to the ceramic core.

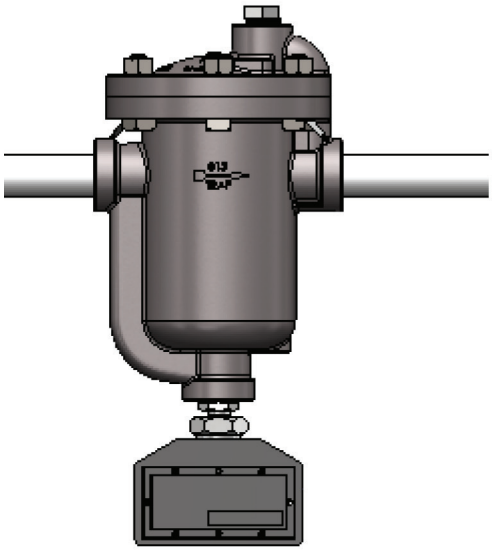
1. Remove Plug from the bottom of the Armstrong probe connection steam trap

2. Confirm the probe is cut for the trap (this is done by looking at the trap model on the transmitter as shown on the picture)



3. Install Transmitter with the probe in the probe connection

Note: Use proper piping practices for sealing connections



4. Install Pressure Switch (If needed) Refer to pressure switch installation on page 32

Model: URFC4700 Remote

Technical Specification

Transmitter	
Physical Dimensions	h - 4.53” (115 mm) w - 3.54” (90 mm) d - 2.17” (55 mm)
Enclosure Environmental Rating	NEMA 4X
Enclosure Material	Polycarbonate, UV Stabilized
Enclosure Flammability Rating	UL94V-2
Power Supply	Duracell 123A 3 Volt Lithium Battery
Typical Battery Life	3-5 years*
Transmission	902 to 928 MHz
Power	60 mW
Temperature Range	-40°F to 115°F (-40°C to 46°C)

*Operating at the upper or lower end of the temperature range may decrease battery life

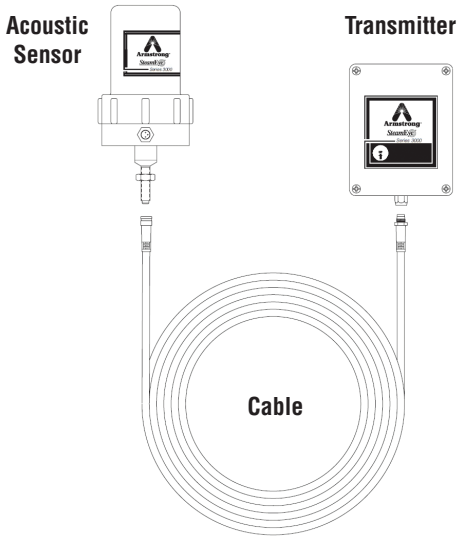
Sensor	
Physical Dimensions	dia - 3” (76 mm) h - 6.75” (171 mm)
Max Ambient Temperature	180°F (82°C)
Monitoring Type	Ultrasonic and Temp
Material	Glass Filled Nylon

Cable	
Length	16.4 ft (5 m)
Size	4-Pole, 22 AWG
Temperature Range	-40°F to 115°F (-40°C to 46°C)
Insulation Material	PVC
Degree of Protection	IP 67 / NEMA 6P
Contact	Brass, pre-nickeled and 0.8 microns gold plated
Coupling Nut	Brass, nickel-plated

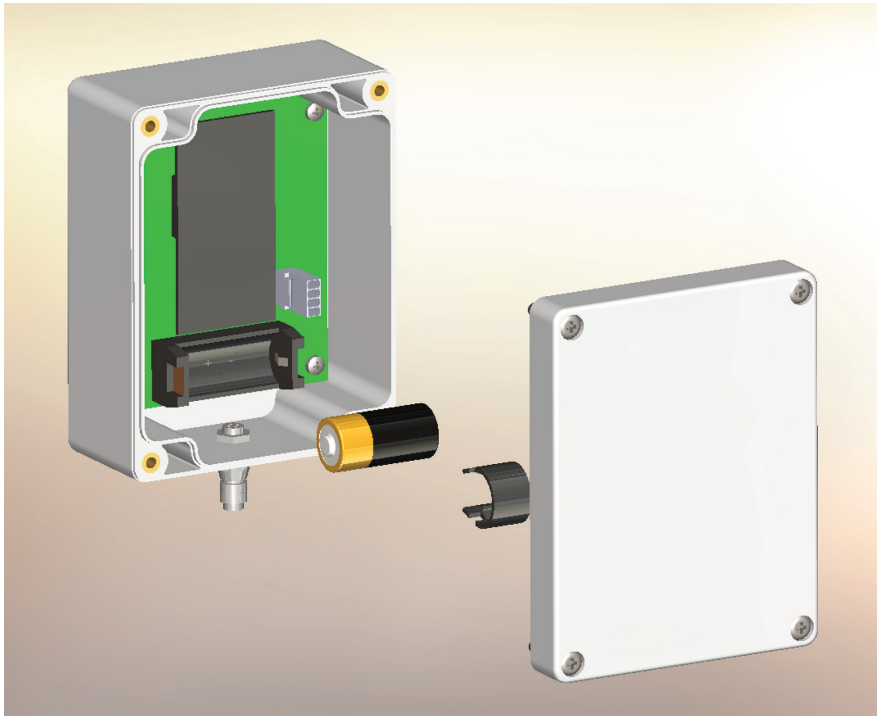
Make sure Waveguide is oriented so that enough clearance is available to install device.

Recommendation
Install Transmitter box at least 3 ft. (1 m) from any large structure for optimal performance.

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



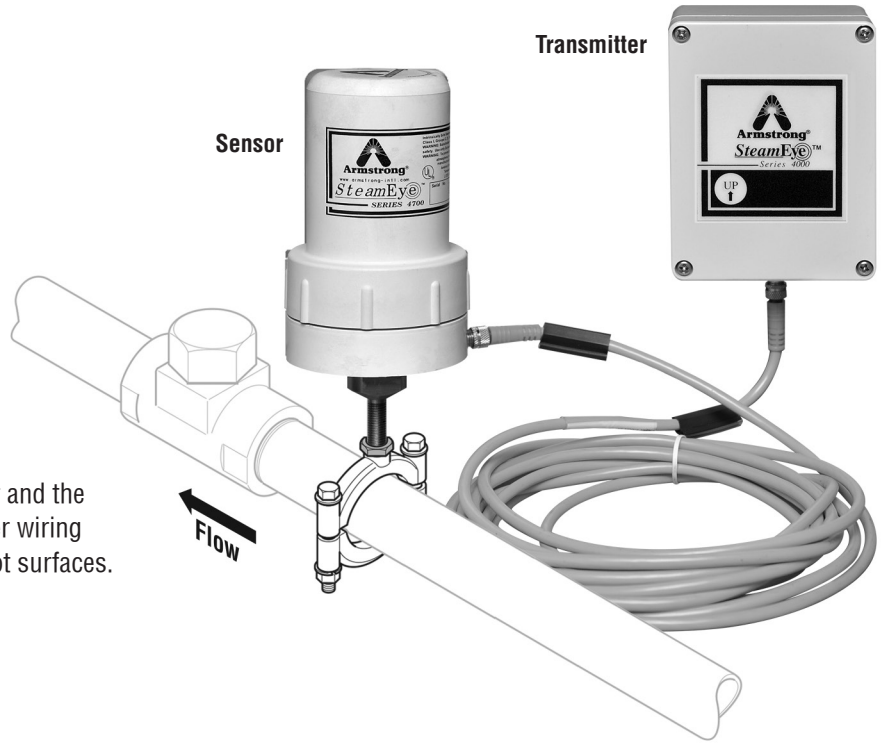
Installing Battery



1. Remove cover by unscrewing the screws.
2. Install battery.

Note: Use only Duracell® model 123A 3 Volt Lithium Battery. Use caution when installing battery not to damage or bend any components.

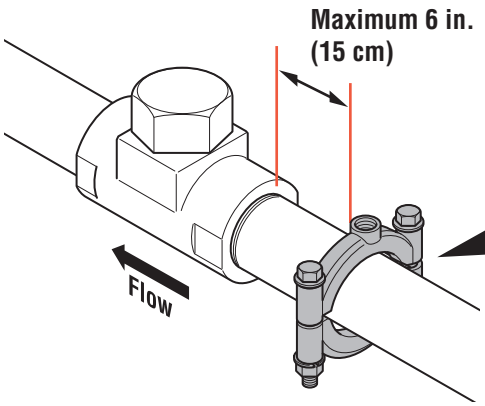
3. Reinstall housing cover.

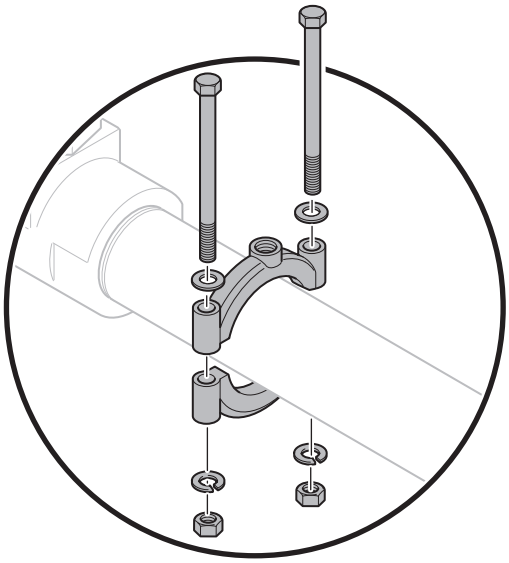


Install cable on the acoustic sensor and the transmitter route cable using proper wiring practices taking caution to avoid hot surfaces.

Acoustic Sensor Installation

1 Position Waveguide no greater than 6 in. (15 cm) from inlet.



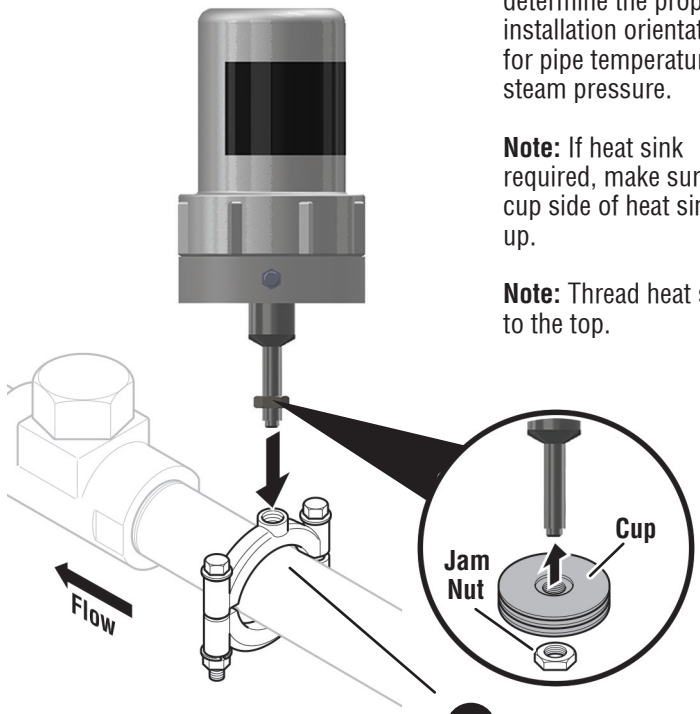


2 Install Waveguide:
- Assemble Waveguide around pipe.
- Torque Waveguide bolts to 25 ft-lb (34 N-m).

3 Refer to page 31 to determine the proper installation orientation for pipe temperature/ steam pressure.

Note: If heat sink required, make sure cup side of heat sink is up.

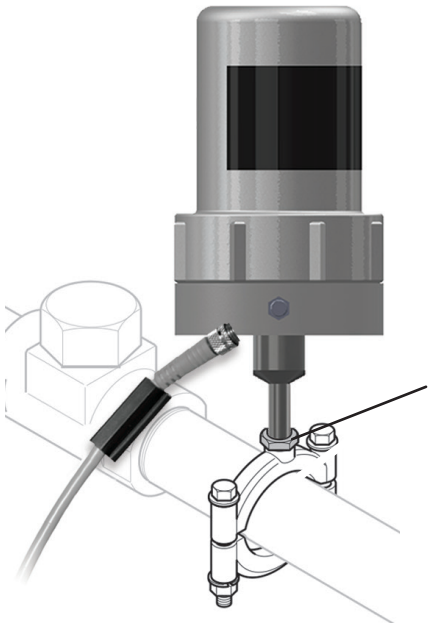
Note: Thread heat sink to the top.



4 Carefully thread steam trap transmitter stem into Waveguide.

Note: Do not cross-thread stem.

5 Torque transmitter to 20 ft-lb (27 N-m).



6 Tighten jam nut to 20 ft-lb (27 N-m).

7 Confirm caps are tightened to 25 ft-lb (34 N-m).

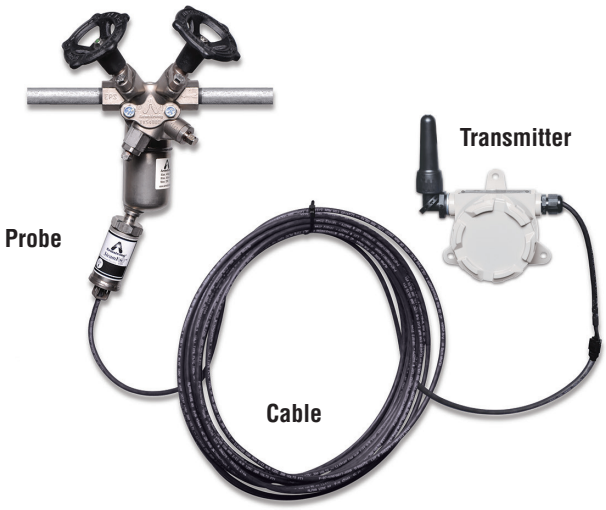
8 Attach cord connecting Sensor and Transmitter.

9 Install Transmitter box away from any obstructions.

SteamEye®

Model: Vault Transmitter

Technical Specification



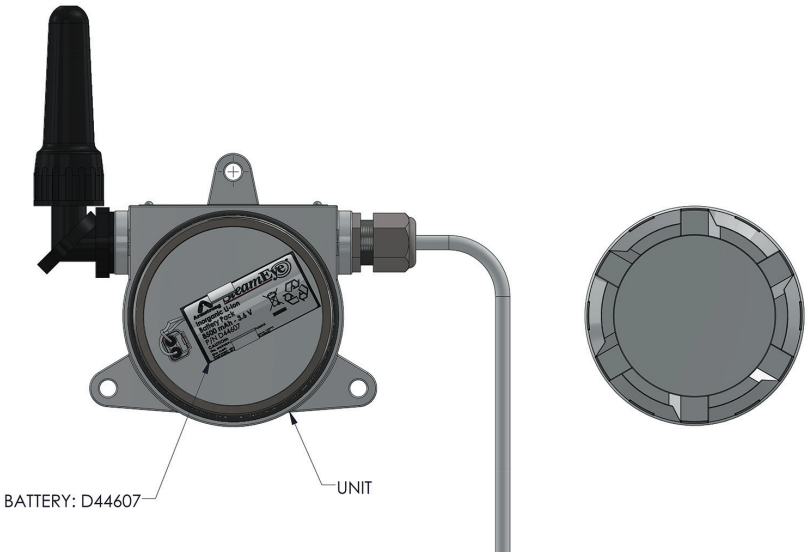
Transmitter	
Physical Dimensions:	h – 7.80" (198 mm) w – 7.09" (180 mm) d - 2.88" (73 mm)
Enclosure Environmental Rating	NEMA 4X
Enclosure Material	Aluminum
Antenna	Nylon 6,6
Power Supply	Lithium ION
Typical Battery Life	3-5 years*
Transmission	902 to 928 MHz
Power	60 mW
Temperature Range	-40°F to 194°F (-40°C to 90°C)

*Operating at the upper or lower end of the temperature range may decrease battery life

Probe	
Physical Dimensions	dia - 1.875" (48 mm) h - 5" (127 mm)
Max Temperature	250°F (121°C)
Max Pressure	600 psi (41 bar)
Monitoring Type	Conductivity and Temp
Material	304 Stainless steel

Cable and Connector	
Length	50 ft (15.24 m)
Size	4-Pole, 22 AWG
Temperature Range	-40°F to 221°F (-40°C to 105°C)
Insulation Material	Thermoplastic Elastomer
O-ring Material	Nitrile Rubber
Connector Contact Material	Brass, Gold plated over Nickel
Connector Material	Polyurethane and Stainless Steel

Installing Battery



1. Remove housing cover of the transmitter
2. Install battery

Note: Use only SteamEye® vault battery pack. Use caution when installing battery not to damage or bend any components

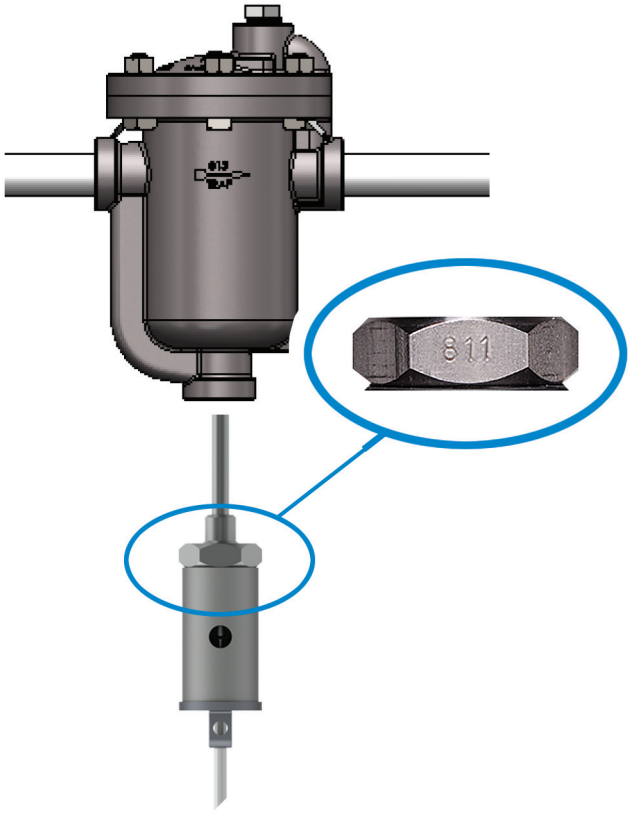
3. Reinstall housing cover

Probe Installation

Warning:

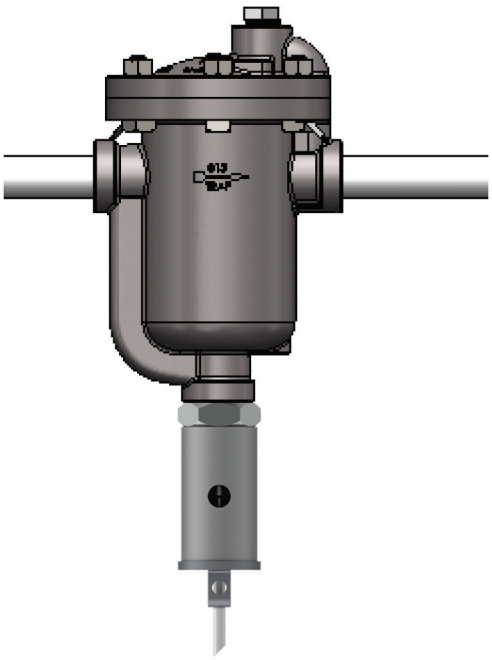
Vaults can be dangerous and entrance to them need to be performed by qualified personnel.

Use caution when handling the probe, not to strike or put force on the end of the probe. This could cause damage to the ceramic core.



1. Remove Plug from the bottom of the Armstrong probe connection steam trap

2. Confirm the probe is cut for the trap (this is done by looking at the trap model on the transmitter as shown on the picture)



3. Install Transmitter with the probe in the probe connection

Note: Use proper piping practices for sealing connections

4. Install Pressure Switch (If needed) Refer to pressure switch installation on page 32

SteamEye®

Transmitter Installation

There are many ways the transmitter can be installed. If the transmitter is being installed in a room or an enclosure, simply mount the transmitter to a wall or back plate in the enclosure.

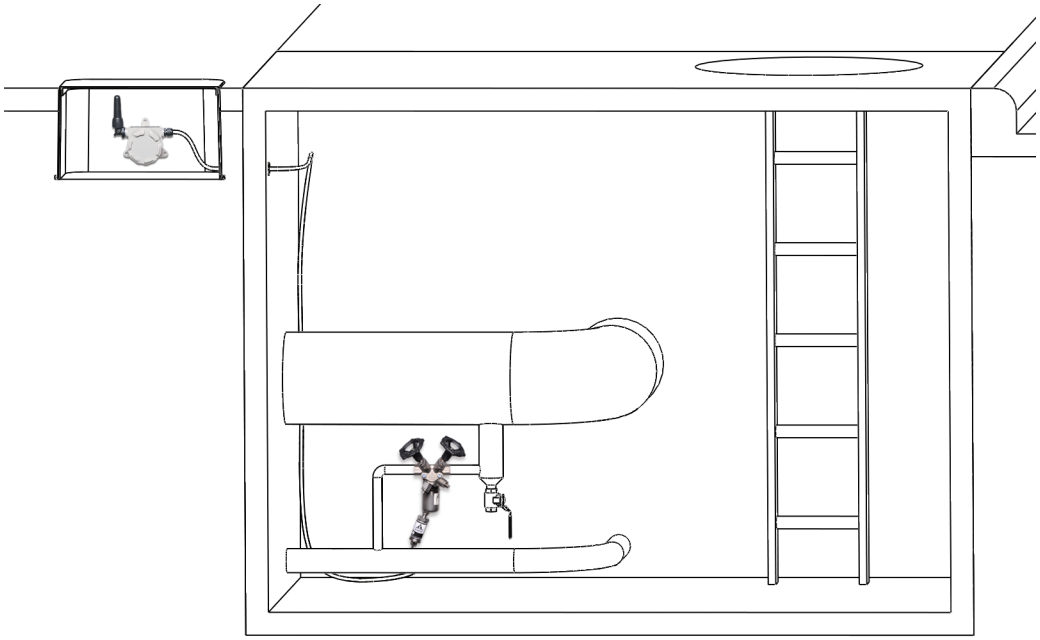
> **Note:** All enclosures must be non-metallic material.

Another popular method to install the transmitter is in an at grade enclosure.

When placing the transmitter in an at grade enclosure it should be placed such that water will not pool around or submerge the transmitter. Additionally water flowing directly over the transmitter (i.e. rain water runoff) should be avoided.

Place the transmitter no more than 2 feet below grade to promote maximum wireless transmission distance. The enclosure must be constructed of non-metallic materials.

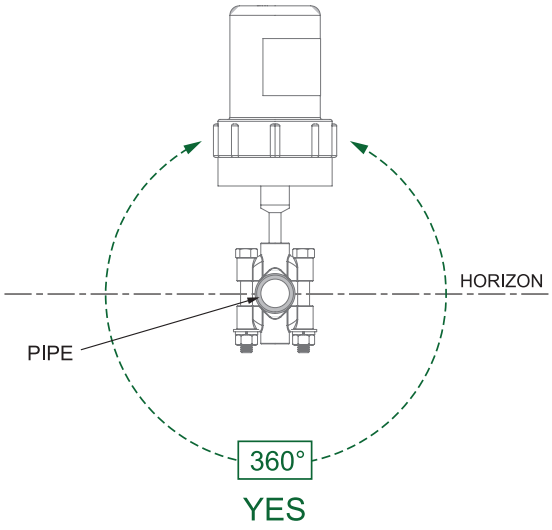
> **Note:** Install the device so that Hazards do not interfere with or damage the transmitter. Examples of physical damage include, but are not limited to: blowing steam or condensate directly onto the transmitter, installation in pathways where transmitter could be struck by personnel or vehicles,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



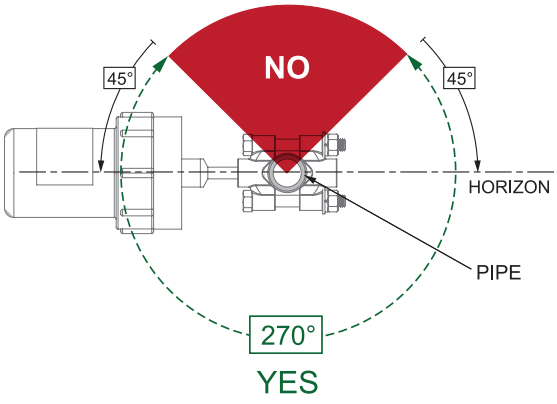
Proper Transmitter Positioning for SteamEye® Model URFC 4700

Transmitter should be mounted as depicted in the illustration based on the pipe temperature.

Pipe Temperature	0-185ºC / 32-365ºF
Saturated Steam Pressure	0-150 PSI

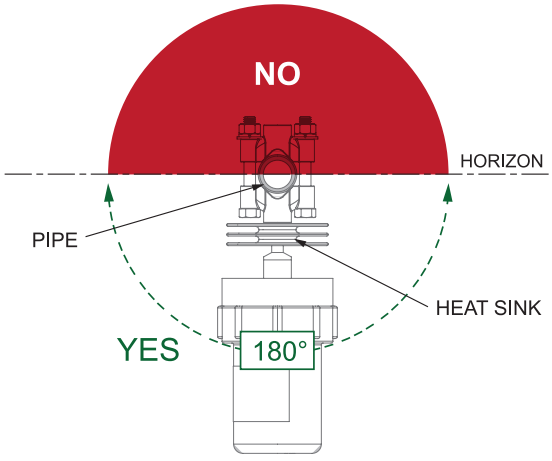


Pipe Temperature	186-231ºC / 366-448ºF
Saturated Steam Pressure	151-400 PSI



Pipe Temperature	232-313°C / 449-596°F
Saturated Steam Pressure	401-1500 PSI

Note: Heat Sink Required.



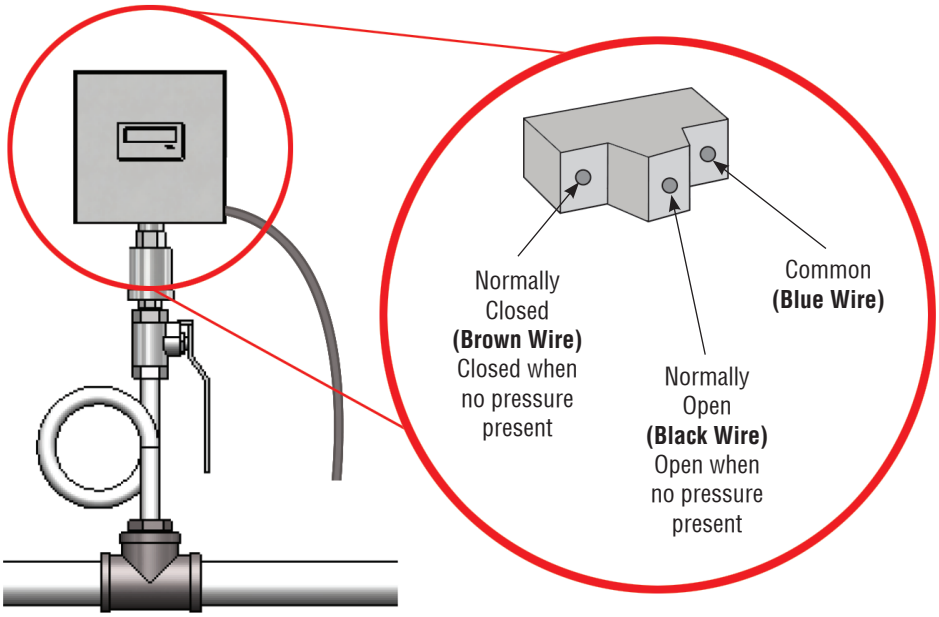
Pressure Switch Wiring and Installation

For modulating steam applications pressure switches are used to verify when there is pressure to the application. This is important as in modulating applications if there is not a pressure switch the trap would show cold when steam is not present. The pressure switch keeps the transmitter from showing a cold trap that is not in use.

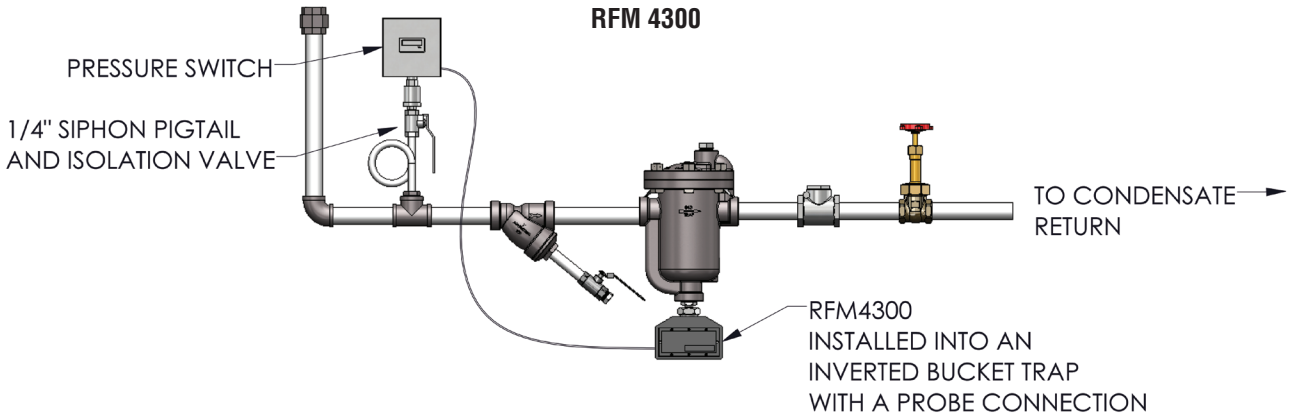
Important

Pressure Switch to be installed in the line where the pressure is the same as at in the trap. If it is installed before block valves the pressure reading will not be accurate.

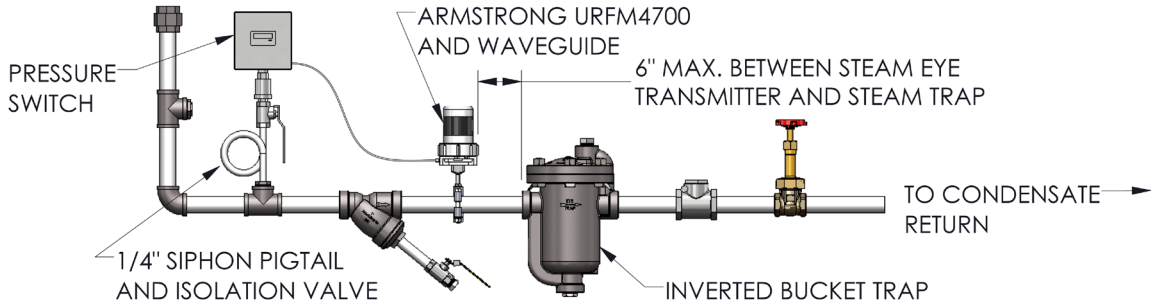
1. Connect the supplied wire to the pressure switch
2. Connect the connector of the pressure switch wire to the transmitter
3. Install the battery in the transmitter



RFM 4300



URFM 4700



Notes

Notes

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SteamEye®
All Models
Installation and Operation Manual

For more information, please contact the Smart Services Group at 269-273-1415
or at: smartservices@**armstrong**international.com

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IOM-199-EN
Printed in U.S.A. - 7/19/16