



# SPX Product Family Smart Melt Pressure Transmitters

Intrinsically safe and Explosion-proof  
Pressure transmitters with integrated amplifier  
For use in hazardous environments

# Operating Manual



## DYNISCO SPX QUICK START CARD

This Quick Start Setup guide can be used by experienced instrumentation technicians to configure the Transmitter using the Zero and Span actuators or via the optional HART Communications. For more detailed information please consult the complete manual before operating. The Quick Start procedure with HART is designed for users already familiar with the use of the HART Communicator and loop powered instrumentation.

### QUICK START Using Zero Actuator

1. Insure the mounting hole is clear of any frozen polymer or debris and is machined to the proper dimensions. Apply a quality high temperature Anti-Seize lubricant to the snout tip threads. For flanged configuration units, apply Anti-Seize to mounting bolt threads and use proper button seal gasket and install on transducer snout. Install unit into the process connection. (Do NOT torque transmitter into the hole at this time!) Allow time for the transmitter snout temperature to equalize to the process temperature. This will help eliminate thread galling and ease removal later. There should be NO pressure applied at this time.
2. Connect power to the transmitter. For conduit output configurations, Red wire is Sig+/Exc +, Black wire is Sig-/Exc-, Green wire is Ground. For a 6 or 8 pin connector version, Pin A is Sig+/Exc+ and pin B is Sig-/Exc-. Insure proper loop supply voltage is applied to transmitter.
3. After temperatures have equalized, apply proper torque as described in Section 5.2 of the Manual and tighten transmitter into mounting hole.
4. Perform Zero Function
  - a. SPX 2XXX/4XXX/5XXX (Pushbutton)

<b>ATTENTION</b>
------------------

- Do not remove seal screw when the circuit is live in a hazardous area
- Remove zero pushbutton seal screw
- Using a 2mm or smaller Allen key, depress the pushbutton for a ½ second
- Release pushbutton for a ½ second
- Depress the pushbutton again for a ½ second and release

- b. SPX 3XXX (Hall Effect Switch)

- Unthread Zero screw from endplate
- Depress screw
- Release screw
- Depress screw
- Release screw
- Restore screw in endplate

Note: The screw must be threaded into the endplate for normal operation. Failing to do so will cause the device to go into failsafe.



5. Verify loop output is zero (4 mA).

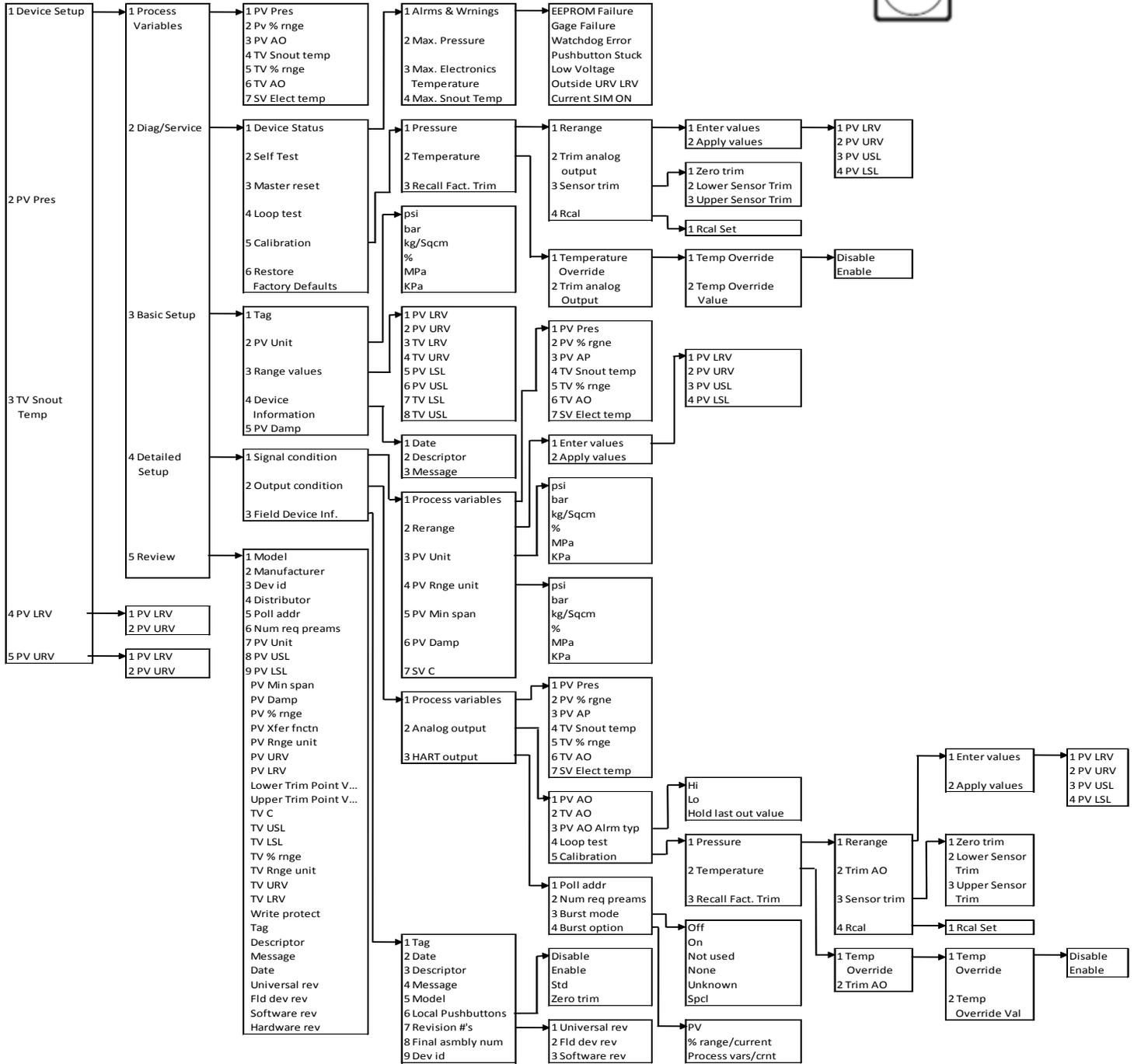


## QUICK START UTILIZING HART COMMUNICATOR

1. Follow Steps 1 through 3 from Quick Start Using Zero Actuator.
2. Connect Communicator to the loop. If unsure on how to do this, refer to “Connecting the HART Handheld Communicator” (Figure 6-1).
3. Power on HART Communicator. See HART Command tree on the following page for reference.
4. From the Main Menu:
  - a. Enter Tag (Quick Key 1, 3, 1)
  - b. Set Pressure Units (Quick Key 1, 3, 2), if required
  - c. Set URV (Quick Key 1, 3, 3, 2) if output turndown (rescaling), is required
  - d. Perform Zero Trim (Quick Key 1, 2, 5, 1, 3, 1)
5. Verify loop output is zero (4mA).
6. Remove HART Communicator from loop.



Menu Tree



NOTE: Above is the Menu Tree for the latest Device Descriptor. For units with software revision < 100 refer to Appendix 2 for appropriate Menu Tree.



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## 1 GENERAL

### 1.1 IMPORTANT INFORMATION

This manual applies to the SPX melt pressure product family. The SPX industrial pressure family is covered in a separate manual. This manual must be kept near the equipment in a readily and immediately accessible location at all times. The content of this manual must be read, understood and followed in its entirety. This applies in particular to the notes on safety. Following the safety instructions will help to prevent accidents, defects and malfunctions.

DYNISCO will not be held liable for any injury, loss or damage resulting from failure to follow the instructions in this manual.

If the product malfunctions, in spite of having followed the operating instructions, please contact customer service from our website:

***[www.dynisco.com/contact](http://www.dynisco.com/contact)***

### 1.2 COPYRIGHT

Copyright law requires that this manual be used for intended purposes only.

It is strictly forbidden to allow reproduction of any kind “in whole or in part” to persons outside of Dynisco, without approval from Dynisco.

HART is a registered trademark of HART Communication Foundation.



### 1.3 EXPLANATION OF ICONS

The manual uses icons to indicate information pertaining to safety:

ATTENTION	Risk of destruction or damage to equipment, machines or installations
	General danger to life or limb
	Specific danger to life or limb
	CE EMC specific requirements
	ATEX Intrinsic Safety specific requirements
	FM Approvals Explosion proof specific requirements
	CSA Explosion proof specific requirements
	NEPSI Intrinsic Safety or Explosion proof specific requirements
 <div style="display: inline-block; vertical-align: middle; margin-left: 10px;"> <p>Product Safety Functional Safety</p> <p>www.tuv.com ID 0600000000</p> </div>	Related to Safety Integrity and Performance Level Applications

The safety instructions are provided again in the individual sections of the manual.



## 1.4 ABBREVIATIONS

The following abbreviations are used:

BSL	Best Straight Line
DD	Device Descriptor
EEPROM	Electrically Erasable Programmable Read Only Memory
FS	Full Scale
HART	Highway Addressable Remote Transducer
LRV	Lower Range Value
PT	Pressure Transmitter
PV	Primary Variable (Pressure)
RTD	Resistance Temperature Detector (A very accurate temperature sensor)
SV	Secondary Variable (Electronics Temperature)
TV	Tertiary Variable (Snout Temperature)
URV	Upper Range Value
Watchdog	An internal monitor for the electronics

## 1.5 NAMING CONVENTION

SPX	Melt Smart Pressure Transmitters (SPX 2xxx/3xxx/4xxx/5xxx Series)
SPX-L	Melt Smart Pressure Transmitters with Linearity Correction (SPX 5xxx series)
SPX-T	Melt Smart Pressure Transmitters with Linearity Correction and Process Temperature Compensation (SPX 3xxx series)

## 1.6 TRANSMITTER PRINCIPLES OF OPERATION

The mechanical system (filled assembly) consists of a lower diaphragm, a filled capillary tube, and an upper diaphragm with a strain gage. The filled assembly transmits pressure from the process to the strain gage diaphragm where it is converted to an electrical signal. The filled assembly isolates the electronics from the high process temperatures.

The lower diaphragm is the surface in contact with the media being measured. This diaphragm can be made from a choice of materials. The standard material is heat-treated 15-5 stainless steel with Dymax™ coating. This has average corrosion and abrasion resistance and is similar to 17-4 stainless steel. Other materials are also available including Hastelloy C-276 which has excellent corrosion resistant properties (but is not good for abrasion). For other materials please consult the factory.

Behind the lower diaphragm is a capillary tube filled with a liquid (typically Hg, mercury) to the upper diaphragm. As the process pressure deflects the lower diaphragm, the fill is displaced through the capillary tube to deflect the upper diaphragm. Other fill liquids are available, please consult the factory.

The upper diaphragm has a strain gage element in the configuration of a Wheatstone Bridge. The deflection of the upper diaphragm causes a change in the resistance of the strain gage and hence a change in the balance of the bridge. The amount of imbalance is directly proportional to the applied pressure. This completes the translation of pressure applied to the lower diaphragm into a usable electrical signal.

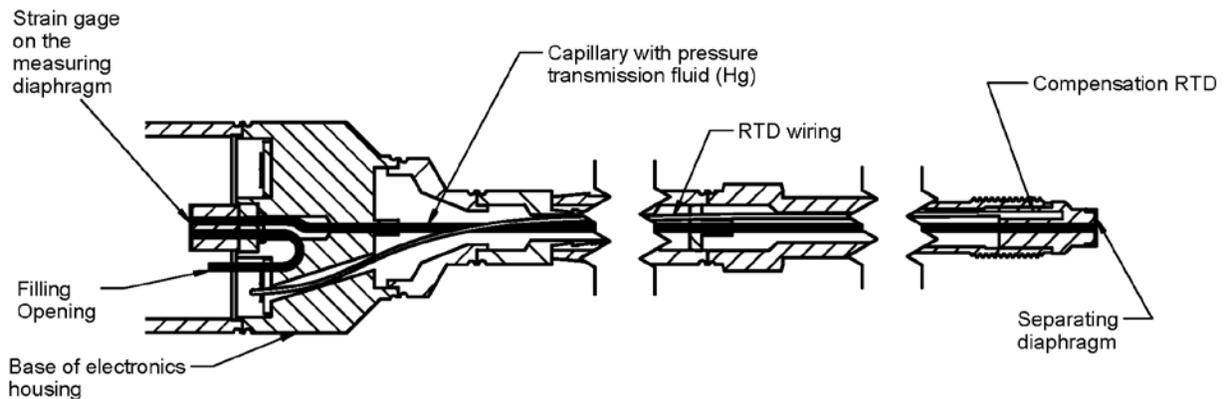


Figure 1-1 Functioning Principle of the SPX 3xxx Filled Assembly



The low level output signal from the bridge is amplified via an instrumentation amp circuit. The amplified signal then goes to the input of the analog-to-digital (A/D) converter.

Once the microprocessor has the converted voltage input from the A/D converter, the digital signal is sent to a digital-to-analog (D/A) converter which modulates the current of the unit's power supply between 4 and 20 mA for an output current proportional to the applied pressure.

There is also a resistance temperature detector (RTD) in the tip of the sensor (SPX 3XXX Models only). This sensor is used to measure the temperature of the snout tip to improve accuracy by compensating for snout temperature effects on the pressure measurement. The temperature sensed by this RTD can be accessed digitally via HART or via an optional 4-20 mA temperature output. 4 mA and 20 mA correspond to 0 and 400 Celsius, respectively.

An alternative 3 wire RTD temperature output option is available. The 3 wire RTD temperature output comes from a second RTD located in the snout tip (SPX 3XXX Models only, not available with 4-20 mA temperature output). The RTD is a 100 ohm RTD with an alpha of 0.00385 ohms/°C.

## 1.7 CORRECT USE



When using an SPX as a safety component in accordance with the EC Machine Directive, Annex IIc, the equipment manufacturer must take any necessary precautions to ensure that malfunction of the PT cannot cause damage or injury.



For installation in explosive gas atmospheres the device must be installed in accordance with European installation guidelines EN 60079-14. For category 1 (zone 0) installations, over voltage protection of the electrical connections shall be in accordance to EN 60079-14.

When planning machinery and using one of the units from the SPX Family, follow the safety and accident prevention regulations that apply to your application, such as:

- EN 60204, Electrical equipment in machines
- EN 12100, Machine safety, general design guidelines
- DIN 57 100 Part 410, Protection against electric shock
- EN 60079-0 Explosive atmospheres - General Requirements
- EN 60079-11 Explosive atmospheres - Intrinsically Safe Apparatus
- EN 60079-26 Special Requirements for EPL Ga

## 1.8 USER'S OBLIGATIONS

The operator or owner of the larger overall system, e.g. a machine, is responsible for following the safety and accident prevention regulations that apply to the specific application.



## 2 NOTES ON SAFETY



### 2.1 GENERAL DANGER TO LIFE OR LIMB

The operator or owner of the larger overall system is responsible for following the safety and accident prevention regulations that apply to the specific application.

**DYNISCO** will not be held liable for any injury, loss or damage resulting from failure to follow the instructions in this manual.

The SPX is an ESD sensitive component. Electrostatic discharge may damage the SPX. Take ESD precautions.

Electrical shock can result in death or serious injury. Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

Mounting and electrical connection of the PT must be done by specialists with EMC training, following all applicable regulations, and in **pressure-less, voltage-free, intrinsically safe** condition with the **machine switched off. The machine must be secured against being switched back on!**

Deviation of the supply voltage from the value given in the technical specifications, or reverse polarity, can damage the pressure transmitter and cause malfunctions that can pose a risk of explosion.

Several configurations of the SPX are designed and approved for use in hazardous classified areas. **Units intended for installation in these areas must bear the applicable approval agency label.**

The SPX can be used in media temperatures up to +400°C (based on configuration). If the pressure transmitter is used in other applications, the safety and accident prevention regulations specific to that application must be followed. Ambient temperature for the electronics housing is +85°C maximum in areas that are not classified as hazardous.

Higher temperatures can result in damage and malfunction. Do not install the pressure transmitter in places where these temperatures are exceeded.

Before connecting a HART handheld communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.



## 2.2 SPECIFIC DANGER TO LIFE OR LIMB

### Toxic Hazard!

The SPX typically contains a very small amount of mercury, Hg (approx. 0.00322 in<sup>3</sup> for a 6/18 configuration), as its transmission medium. If the diaphragm is damaged, mercury may escape. Never transport or store the SPX without the protective cap. Remove the cap shortly before installation.

**If mercury is inhaled or swallowed, seek medical attention immediately!**

Mercury is hazardous waste and must be disposed of in accordance with applicable laws. **DYNISCO** will accept defective PT's. If mercury escapes, use airtight packaging!



## 2.3 CE EMC SPECIFIC REQUIREMENTS

Connect the shield of the connecting cable on both sides, making sure it conducts with full and continuous contact.

When introducing the connecting cable into an EMC compliant switch cabinet, for example, connect the shield correctly (cable gland, conducting, full contact, and continuous) to the conductive housing or route it via a built-in cable connector that is also connected to the conductive housing. Connect unused cable cores or free cable ends correctly to the cable shield on both sides.



## 2.4 ATEX INTRINSIC SAFETY APPROVAL SPECIFIC REQUIREMENTS

The housing of the SPX shall be connected reliably to the local equipotential bonding system. The housing is electrically bonded to the process equipment through the process connection.

The installation of the SPX must be in accordance with European installation guidelines EN 60079-10.

For category 1 (zone 0) installations, over voltage protection of the electrical connections shall be in accordance to EN 60079-14.

For category 1 (Zone 0) installations, care must be taken to avoid the danger of ignition due to electrostatic discharges (ESD). The chance for static build up on the cable surface during normal conditions of use, maintenance and cleaning must be eliminated. Install the cable in an appropriate conduit or use some other cable reliable installation technique to avoid static electricity at the cable surface.

The free length of the cable must be below 5 cm. If metallic conduits are used they need to be grounded. If nonmetallic conduits are used they need to be antistatic ( $< 1G \text{ Ohm/cm}^2$ ).

For application as category-1-equipment the connecting cable shall be equipped with a suitable conductive coating ( $R_{\text{surface}} < 10^9 \text{ ohms}$ ) to avoid possible electrostatic charge.

Those variants of the SPX that include the material aluminum shall be installed in such a way that sparking as a result of impact or friction between aluminum and steel is excluded. Impact or friction between aluminum and stainless steel is allowed if the existence of rust particles can be excluded.

After installation before operating the device the user must check that the complete installation and wiring is intrinsically safe. Special care must be taken to insure that the power source is a certified apparatus.

If the transmitter is installed in hazardous areas, only passive devices like switches or resistors may be connected between the RCAL+ and RCAL- signals. Connection of any active electronic circuits or voltage or current sources is not allowed.

In non-conduit units with the secondary 4-20mA option proper creepage and clearance distances must be maintained between the mating connector and cabling per EN/IEC 60079-11. Proper creepage and clearance distances are maintained using Dynisco SPX-T ATEX Intrinsically Safe mating connector cable assemblies;

PT style connector cable assys - 50 ft cable - p/n 641002, 100 ft cable - 641004

PC style connector cable assys - 50 ft cable - p/n 641012, 100 ft cable - 641014

**Additional ATEX Intrinsically Safe approval specific requirements are provided on the EC Type Examination certificate, Dynisco drawing number 975161, located in section 10.2 of this manual. The**



medium temperature ( $T_{med}$ ) listed in the EC Type Examination certificate is defined as the temperature of the pressure transmission fluid below the measuring diaphragm (See Figure 1-1). This temperature can be verified by measuring the surface temperature at the base of the electronics housing.

Maximum allowed pressure range of each SPX by pressure range model code:

Pressure Range					
XX					
Code	PSI	Bar	Kgf/cm <sup>2</sup>	MPa	KPa
01	1	0.07	0.07	0.007	7
02	2	0.14	0.14	0.014	14
03	3	0.2	0.2	0.02	20
04	4	0.27	0.27	0.027	27
05	5	0.35	0.35	0.035	35
06	10	0.7	0.7	0.07	70
07	15	1	1	0.1	100
08	25	1.75	1.75	0.175	175
09	50	3.5	3.5	0.35	350
10	75	5	5	0.5	500
11	100	7	7	0.7	700
12	150	10	10	1	1000
13	250	17.5	17.5	1.75	1750
14	500	35	35	3.5	3500
15	750	50	50	5	5000
16	1000	70	70	7	7000
17	1500	100	100	10	10000
18	2000	140	140	14	14000
19	2500	175	175	17.5	17500
20	3000	200	200	20	20000
21	5000	350	350	35	35000
22	7500	500	500	50	50000
23	10000	700	700	70	70000
24	15000	1000	1000	100	100000
25	20000	1400	1400	140	140000
26	25000	1750	1750	175	175000
27	30000	2000	2000	200	200000
33	200	14	14	1.4	1400



## 2.5 FM EXPLOSIONPROOF APPROVAL SPECIFIC REQUIREMENTS

Installation shall comply with the relevant requirements of the National Electrical Code (ANSI/NFPA 70)

Installation shall comply with the latest edition of the instruction manual. The latest edition of the instruction manual is available for download from the Dynisco website:

**[www.dynisco.com](http://www.dynisco.com)**

Replacement with non-factory components may adversely affect the safe use of the systems.

**Additional SPX-T FM Explosionproof Approval specific installation requirements are provided on the SPX-T FM Explosionproof Control drawing, Dynisco drawing number 000610, Figure 5-1 of this manual.**

Also see section 10 of this manual ([Approvals and Certificates](#)) for FM certificates of compliances that list hazardous location limitations and approved model code configurations.

For SPX units that are explosion-proof approved the power supply rating is 13-30 Vdc.

- 1) Do not remove the transmitter push-button seal screws in explosive environments when the circuit is live (applicable to all models except SPX-T).
- 2) Transmitter push-button seal screws must be fully engaged to meet Explosion-proof requirements (applicable to all models except SPX-T).



## 2.6 CSA EXPLOSIONPROOF APPROVAL SPECIFIC REQUIREMENTS

SPX-T CSA Explosionproof Approval specific installation requirements are provided on the SPX-T CSA Explosionproof Control drawing, Dynisco drawing number 000611, Figure 5-2 of this manual.

Contact factory for CSA certificates of compliances that list hazardous location limitations and approved model code configurations.

SPX-T units are Explosionproof with Intrinsically Safe Output, Exia

Maximum non-hazardous voltage not to exceed 250V.

For SPX units the power supply rating is 13-30 Vdc.

- 1) Do not remove the transmitter push-button seal screws in explosive environments when the circuit is live (applicable to all models except SPX-T).
- 2) Transmitter push-button seal screws must be fully engaged to meet Explosion-proof requirements (applicable to all models except SPX-T).

See pressure range table in section 2.4 for maximum allowed pressure range of each SPX by pressure range model code:

## 2.7 NEPSI INTRINSIC SAFETY REQUIREMENTS



### 一、产品安全使用特殊条件

产品防爆合格证号后缀“X”代表产品安全使用有特殊条件：

1. 产品外壳含有轻金属，用于0区时需注意防止由于冲击或摩擦产生的点燃危险。
2. 产品外壳含非金属，使用时须防止产生静电火花，只能用湿布清理。

### 二、产品使用注意事项

1. 产品温度组别与使用环境温度范围和介质温度范围之间关系为：

温度组别	T6	T4
使用环境温度范围	-20°C~+50°C	-20°C~+85°C
介质温度范围	-20°C~+60°C	-20°C~+85°C

2. 本安电气参数：

最高输入电压 $U_i$ (V)	最大输入电流 $I_i$ (mA)	最大输入功率 $P_i$ (W)	最大内部等效参数	
			$C_i$ (nF)	$L_i$ ( $\mu$ H)
30	100	0.75	4.5	40

3. 该产品必须与已通过防爆认证的关联设备配套共同组成本安防爆系统方可使用于爆炸性气体环境。其系统接线必须同时遵守本产品 and 所配关联设备的使用说明书要求，接线端子不得接错。

4. 用户不得自行更换该产品的零部件，应会同产品制造商共同解决运行中出现的故障，以杜绝损坏现象的发生。

5. 产品的安装、使用和维护应同时遵守产品使用说明书、GB3836.13-2013“爆炸性环境第13部分：设备的修理、检修、修复和改造”、GB3836.15-2000“爆炸性气体环境用电气设备第15部分：危险场所电气安装（煤矿除外）”、GB3836.16-2006“爆炸性气体环境用电气设备第16部分：电气装置的检查和维护（煤矿除外）”、GB3836.18-2010“爆炸性环境第18部分：本质安全系统”和GB50257-1996

“电气装置安装工程爆炸和火灾危险环境电力装置施工及验收规范”的有关规定。



## 2.8 NEPSI EXPLOSIONPROOF SPECIFIC REQUIREMENTS

### 二、产品安全使用特殊条件

产品防爆合格证号后缀“X”代表产品安全使用有特殊条件：

1. 产品外壳含非金属，使用时须防止产生静电火花，只能用湿布清理。
2. 涉及隔爆结合面的维修须联系产品制造商。

### 二、产品使用注意事项

1. 产品温度组别与使用环境温度范围和介质温度范围之间关系为：

温度组别	使用环境温度
T6	-20℃ ~ +60℃
T5	-20℃ ~ +85℃

2. 用户在使用时应将产品外壳可靠接地。
3. 安装现场应不存在对产品外壳有腐蚀作用的有害气体。
4. 用户不得自行更换该产品的零部件，应会同产品制造商共同解决运行中出现的故障，以杜绝损坏现象的发生。
5. 产品的安装、使用和维护应同时遵守产品使用说明书、GB3836.13-2013“爆炸性环境第13部分：设备的修理、检修、修复和改造”、GB3836.15-2000“爆炸性气体环境用电气设备第15部分：危险场所电气安装（煤矿除外）”、GB3836.16-2006“爆炸性气体环境用电气设备第16部分：电气装置的检查和维护（煤矿除外）”和GB50257-1996“电气装置安装工程爆炸和火灾危险环境电力装置施工及验收规范”的有关规定。



## 2.9 SAFETY INTEGRITY AND PERFORMANCE LEVEL APPLICATIONS



Product Safety  
Functional  
Safety

www.tuv.com  
ID 0600000000

### User's obligations

The operator or owner of the larger overall system, e.g. a machine, is responsible for following the safety and accident prevention regulations that apply to the specific application.

### Intended Use

[See Certificate in section 10.5](#)

### Safety Function

[See Certificate in section 10.5](#)

### For units with the optional monitoring channel (Guardian Series, Option Code = GCxxx):

Under normal operating conditions the relay contacts are closed. In the event that a failure is detected the relay contacts open. Detectable failures include:

- 1) Loss of Power
- 2) Open Gage
- 3) Input over a predefined (customer selectable at time of order) threshold

The Guardian Series transducer has been designed to provide a protective measure. This has been done by the avoidance and control of systematic and random failures.

This product will:

Measure the pressure and provide a safety relay output. Since this is being used to perform a protective measure, this sensor should only be used for monitoring the pressure and not controlling the process. Best practices declare that safety and control must be independent from each other.

The Guardian Series transducer detects many hardware failures including an open or short in the measuring gage and if there is an overpressure condition. If any of these failures occur, the output relay will open. It is the user's responsibility to connect this relay to the system in such a way that when this relay opens, it brings the system to a safe state.

This fault state is not latched. It is up to the user to latch this error if desired.

### Recommended practices



This Guardian Series transducer must be installed in such a way that the opening of the output relay will bring the system to a safe state. In this safe state the instrument that is monitoring the pressure should be left operational.

This error indication is not latched. If it is necessary to latch the error until it is manually reset, this is the user's responsibility.

At startup and on a periodic basis the safety system should be tested to ensure proper operation. This will require applying a pressure to the Guardian Series transducer that is over the safe level but less than the maximum pressure. Verify that the protective measure is initiated to take the machine to a safe operating condition.

**Use of qualified personnel**

The product may only be assembled, installed, configured, commissioned, operated and maintained by persons with proven skills. Persons with proven skills are suitably experienced to operate devices, systems, plant and machinery in accordance with the general standards and guidelines for safety technology.

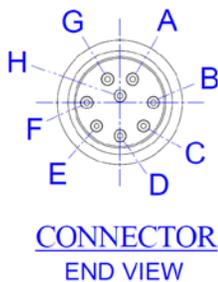
It is the user's responsibility only to employ personnel who:

- Are familiar with the basic regulations concerning health and safety and accident prevention
- Have read and understood the safety guidelines given in this description
- Have a good knowledge of the generic and specialist standards applicable to the specific application

**Connecting Safety Relay**

Relay specs: Maximum switching voltage: 200Vdc; Maximum switching current: 0.5A

**Device pinout**



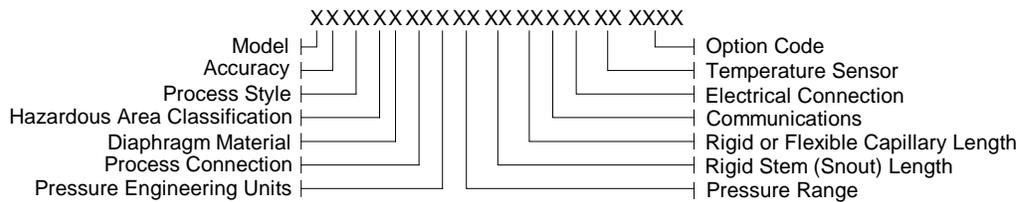
CONNECTOR WIRING mA-HART	
PIN	FUNCTION
A	POWER +
B	SIGNAL -
C	POWER -
D	N/C
E	RCAL +
F	RCAL -
G	RELAY CONTACT
H	RELAY CONTACT



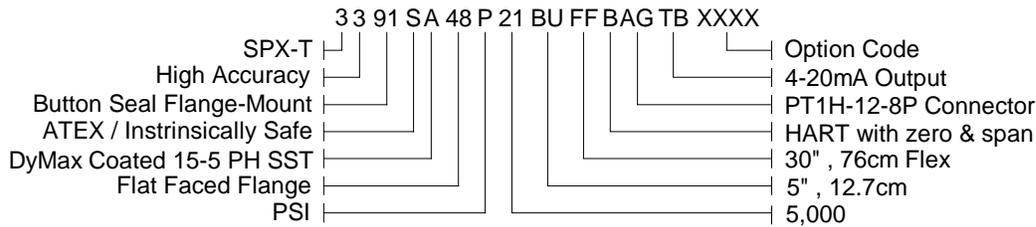
### 3 TECHNICAL DATA

#### 3.1 MODEL CODE BREAKDOWN

The exact meanings of the letter/digit combinations are given in the corresponding sections of this Chapter.



#### 3.2 ORDERING EXAMPLE



Note(s):

- 1) Review section 3.4 Performance Characteristics for accuracy definition and details.
- 2) Review “Notes on Safety” (Chapter 2) before installation in Hazardous locations.
- 3) Accuracy can be affected with choice of diaphragm and coating.
- 4) Certain models are not available in some configurations.
- 5) For other process connections please consult factory.
- 6) Please see the appropriate figure in section 5.8 for dimensions of your specific flange.
- 7) For other mounting flanges/process connections not listed please consult factory.
- 8) Other approved ranges may exist, please consult factory.
- 9) Other lengths available, please consult factory.
- 10) Transmitters are available with certain approved option codes. Please consult factory for list of approved options.

#### 3.3 SAFETY SPECIFICATIONS

Please see “Notes on Safety” (Chapter 2.)



### 3.4 PERFORMANCE CHARACTERISTICS

#### 3.15.1 ACCURACY

Accuracy is defined as combined error expressed as a percentage of full scale (% F.S.) output based on the following standard configurations/conditions:

- 1) Mercury Filled Capillary  $\leq 36''$
- 2) Dymax Coated 15-5 SST Process Diaphragm
- 3) Best Straight Line % F.S. as per ISA-37.3
- 4) +20°C ambient electronics

\*Consult factory for availability of NaK filled units or other non-standard configurations.

Model	Snout Temp	Range	Accuracy (% of FS)
SPX 32XX	20°C - 300°C	< 1500 PSI	+/- 0.75
		1500 PSI	+/- 0.50
		$\geq 1500$ PSI	+/- 0.25
SPX 33XX	20°C - 300°C	< 1500 PSI	+/- 0.50
		1500 PSI	+/- 0.25
		$\geq 1500$ PSI	+/- 0.15
SPX 2242/2243	20°C	< 1500 PSI	+/- 0.50
		$\geq 1500$ PSI	+/- 0.25
SPX 2241	20°C	Entire Range	+/- 1.0
SPX 2244	20°C	< 500 PSI	+/- 0.50
		$\geq 500$ PSI	+/- 0.25
SPX 229X	20°C	Entire Range	+/- 0.50
SPX 4222/4232/4352	20°C	< 1500 PSI	+/- 0.50
		$\geq 1500$ PSI	+/- 0.25
SPX 4622/4672/4502	20°C	Entire Range	+/- 0.50
SPX 5342	20°C	Entire Range	+/- 0.20
SPX 5343	20°C	Entire Range	+/- 0.20
SPX5344	20°C	Entire Range	+/- 0.20
SPX5390	20°C	Entire Range	+/- 0.20
SPX5391	20°C	Entire Range	+/- 0.20
SPX5392	20°C	Entire Range	+/- 0.20

#### 3.15.2 RESOLUTION

$\pm 0.035\%$  full scale or better



### 3.15.3 REPEATABILITY

± 0.10% of full scale

### 3.15.4 OVERLOAD PRESSURE (MAX PRESSURE WITHOUT INVALIDATING SPECIFIED ACCURACY)

Model	Pressure
SPX 2242/2243/5342/5343	2 X FSP or 35,000 PSI, whichever is less
SPX 2241/2244/5344	2 X FSP or 15,000 PSI, whichever is less
SPX 229X/539X	2 x FSP
SPX 4222/4232/4352/4622/4672	2 x FSP or 35,000 PSI, whichever is less
SPX 4502	3 x FSP
SPX 3X42/3X43/3X9X	1.5 x FSP

### 3.15.5 BURST PRESSURE

Model	Pressure
SPX 2XXX/4XXX/5XXX	6 x FSP or 45,000 PSI, whichever is less
SPX 3XXX	Greater than 2 x FSP

### 3.15.6 FREQUENCY RESONSE

20 Hz [-3db]

### 3.15.7 RESPONSE TIME

50 mS

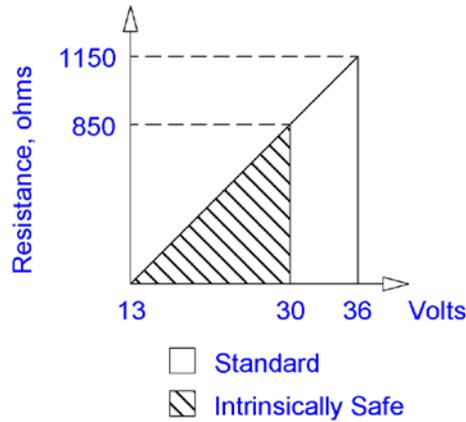
## 3.5 ELECTRICAL DATA

Configuration	4-arm Wheatstone bridge strain gauge with internal amplifier
Output Signal	2-wire 4 - 20 mA
Saturation Levels	3.8 mA and 20.5 mA
Fail Safe Levels	3.6 mA for Low Level > 21mA for High Level
Current Consumption	< 25 mA
Supply Voltage	13 - 30 VDC for PTB ATEX IS and FM XP approved models 13 - 32 VDC for non-approved models



Note: Transmitter incorporates overvoltage protection and reverse polarity protection and will not operate if inputs are reversed.

Sense Resistor Load Line



250 ohms minimum for HART communication

### 3.6 TEMPERATURE INFLUENCE

#### ELECTRONICS HOUSING

Operating Temperature Range	-29°C to +85°C
Compensated Temperature Range (SPX 2XXX/4XXX/5XXX)	-20°C to +65°C
Compensated Temperature Range (SPX 3XXX)	20°C to +85°C
Zero Shift due to temperature change on electronics housing	
SPX 2XXX/4XXX/5XXX	0.01% FS/°F max. (0.02% FS/°C max.)
SPX 3XXX	Included in accuracy specification
Span shift due to temperature change on electronics housing	
SPX 2XXX/4XXX/5XXX	0.01% FS/°F max. (0.02% FS/°C max.)
SPX 3XXX	Included in accuracy specification



## PROCESS CONNECTION

Zero shift due to temperature change on the diaphragm

SPX 2242/2243/4xxx/5xxx (except SPX 4502)	15 PSI/100°F typical 2 BAR/100°C typical
SPX 2241/2244/229X/4502	1 PSI/100°F typical (from 75°F to 450°F) 2 PSI/100°F typical (from 450°F to 600°F) 0.07 BAR/38°C typical (from 24°C to 232°C) 0.14 BAR/38°C typical (from 232°C to 315°C)
SPX 3XXX	Included in accuracy specification

## 3.7 EMC REQUIREMENTS

The SPX Conforms to CE in accordance with EMC directive. See Declaration of Conformity for more details.

## 3.8 MATERIALS

Standard Diaphragm	15-5PH Mat. No. 1.4545 Various proprietary coatings
Standard Stem (Snout)	17-4PH Mat. No. 517400

Please note other diaphragm and stem materials may be substituted.

## 3.9 TORQUE

[See section 5.2](#)

## 3.10 ENVIRONMENTAL PROTECTION TO ANSI/IEC-60529 & ANSI/NEMA-250

SPX with sealed conduit to IP67, NEMA 4X

## 3.11 WEIGHT

The weight varies depending on product configuration. Average weight range is 1 to 5 pounds.

## 3.12 DIMENSIONS

The dimensions vary based on product configuration. Contact Dynisco if product dimensions are required.



## 4 TRANSPORT/DELIVERY



### Toxic hazard!

The SPX contains a small amount of mercury (Hg) as its standard transmission medium. If the diaphragm is damaged, mercury may escape. For alternate (non-Hg) transmission mediums please consult factory.

Never transport or store the SPX without the protective cap in place. Remove the cap shortly before installation.



**If mercury is inhaled or swallowed, seek medical attention immediately.**

Mercury is hazardous waste and must be disposed of in accordance with applicable laws. **DYNISCO** will accept defective SPXs.

If mercury escapes, use airtight packaging!

### ATTENTION

The SPX is an ESD sensitive component. Electrostatic discharge may damage the SPX. Take ESD precautions.

### 4.1 TRANSPORT/PACKING/TRANSPORT DAMAGE

- Do not let the SPX be damaged by other items during transit
- Use only the original packaging
- Report transport damage to **DYNISCO** immediately in writing

### 4.2 STORAGE

- Store the SPX in original packaging only
- Protect against dust and moisture

### 4.3 SCORPE OF DELIVERY

- SPX with diaphragm protection cap
- Fastening clip (transmitter with flexible stem only)
- Calibration sheet
- Operating manual with declaration of conformity



## INSTALLATION

### NOTES:

**2. Follow all Notes on Safety in Section 2 during installation.**

### 5.1 GENERAL MOUNTING INFORMATION

Do not remove the protective cap on the SPX until ready to install.

Before mounting the SPX, check mounting hole carefully. The SPX must only be mounted in holes that satisfy the requirements below. A hole that does not satisfy these requirements can damage the Transmitter.

Insure the mounting hole is clear of any frozen polymer or debris and is machined to the proper dimensions.

For threaded SPX transmitters coat the threads with a high temperature anti-seize grease or a suitable parting agent, this will help prevent the SPX snout from sticking permanently in the mounting hole. For flanged configuration units, apply Anti-Seize to mounting bolt threads. Use proper Buttonseal gasket and install on transducer tip.

Install unit into the process connection (Do NOT torque transmitter into the hole at this time!). Allow time for the transmitter snout temperature to equalize to the process temperature. This will help eliminate thread galling and ease removal later. There should be NO pressure applied at this time.

Always use a torque wrench applied to the designated hexagon collar or mounting bolts while screwing the transmitter in and out. Do not apply the tool to the housing or housing/sensor connection.

After temperatures have equalized, apply proper torque as described in Section 5.2 of the Manual and tighten transmitter into mounting hole.

After the correct torque has been applied units with flexible capillary require the electronics to be mounted away from the process heat using mounting hardware, P/N 200941.

Connect power to the transmitter. For conduit output configuration, Red wire is Sig+/Exc +, Black wire is Sig-/Exc-, Green wire is Ground. For a 6 or 8 pin connector version, Pin A is Sig+/Exc+ and pin B is Sig-/Exc-. Insure proper loop supply voltage is applied to transmitter.

Make sure that the medium is in molten condition during transmitter removal. Removing the transmitter while the medium is in solidified condition can damage the sensor diaphragm.



When removing the SPX, carefully clean the diaphragm of the transmitter with a soft cloth while the medium is still malleable.

Always remove the SPX prior to cleaning the machine with abrasives or steel wire brushes. Also, do not clean the SPX with hard objects, such as a screwdriver, a wire brush, etc. This will possibly damage the transmitter.

Before reinstalling the SPX, ensure that the mounting hole is free from hardened plastic. A mounting hole cleaning tool kit is available to aid in removing of the material. (Dynisco Part Number 200100 for ½-20, 200101 for M18 and 200102 for M10 ports.) A gauge plug to check the hole is included in this kit.

**ATTENTION**

The SPX is an ESD sensitive component. Electrostatic discharge may damage the PT. Take ESD precautions.



Mounting and electrical connection of the SPX must be done by specialists with EMC training, following all applicable regulations, and in **pressure less, voltage-free, intrinsically safe condition with the machine switched off.**



**The machine must be secured against being switched back on!**

**ATTENTION**

The most common causes of transducer damage are: installation in improperly machined or plugged mounting holes and cold starts. The tip of the transducer consists of a stainless steel diaphragm that must be protected from severe abrasives, dents and scores.



**Burn Hazard!** The SPX must be removed with the melt in the molten condition. The SPX can be very hot when removed. **WEAR PROTECTIVE GLOVES!**



Careful attention should be paid to correctly machine the mounting port. Failure to use the recommended mounting port may result in erroneous pressure measurement, difficult transducer removal, premature sensor failure, process fluid leaks, and personnel hazard. In applications involving high temperature operation and/or repeated thermal cycling a good high quality anti-seize compound should be applied to the threaded surfaces.

**5.2 MOUNTING HOLE TORQUE**

Model	SPX 2242 SPX 3X42 SPX 4222/4622/4352/4672 SPX 5342	SPX 2243 SPX 3X43 SPX 4232 SPX 5343	SPX 2241/2244/2290/2291 SPX 3X9X SPX 4502 SPX 539X/5344	SPX2292
Torque Spec	Max. 56.5 Nm (500 inch-lbf.)	Max. 5.6 Nm (50 inch-lbf.)	Max. 39.5 Nm (350 inch-lbf.)	Max. 108.5Nm (80 ft-lbf.)



### 5.3 MOUNTING HOLE DIMENSIONS

Please contact Dynisco if mounting hole dimensions are required.

### 5.4 MOUNTING HOLE PRESSURE TRANSMITTER

Dynisco offers a set of mounting hole-machining tools with all the necessary drills, taps, and reamers for the Dynisco standard ½-20 UNF-2A and M18 and M10 mounting holes used in high temperature and plastics processing applications (Dynisco Part Numbers 200925, 200105 and 901949 respectively). Detailed instructions are sent with the machining kits. Copies of the instructions are available from Dynisco upon request.

When machining the hole pay careful attention to the concentricity between the threads and the 0.312/ 0.314 diameter. Since the pressure seal is on the 45° seating surface, this surface should be examined for good finish, free from burrs, etc.

It is general good practice to check the mounting hole before installing the transducer. One procedure is to coat a gauge plug (Dynisco Part Number 200908 for the 1/2 –20 standard port, 435901 for the short tip ½ – 20 version, 200960 for the M18), with Dykem machine bluing on surfaces below the thread. Insert the gauge plug into the mounting hole and rotate until surface binding is encountered. Remove and inspect. Bluing should only be scraped off of the 45° sealing chamfer. If bluing has been removed from other surfaces, the mounting hole has not been machined properly.



## 5.5 INSTALLING THE FLANGED PRESSURE TRANSMITTER

Note that the pressure seal on flange mounted units is made at the lower o-ring or gasket, not the flange.

[See section 5.2](#) for recommended mounting torques.

Recommended mounting torques to crush appropriate gasket material:

Pressure Range	Gasket	Part Number	Torque
3,000 psi	Aluminum	494602	15 ft/lbs
10,000 psi	Parkerized Carbon Steel	634001	60 ft/lbs
10,000 psi	Hastelloy	634002	60 ft/lbs
10,000 psi	303 Stainless Steel	634004	60 ft/lbs

## 5.6 ELECTRICAL CONNECTION

The SPX has 4-20 mA output. The transmitter power supply and output are supplied over the same pair of wires.

It is recommended that you use twisted, shielded cables as connecting wires.

Observe National Electric Code and national regulations for applications in hazardous areas.

Do not lay connecting cables in the direct vicinity of cables carrying higher voltage or used to switch inductive or capacitive loads.



**For FM approved SPX 3XXX Explosionproof installations, install in accordance with controlled drawing 000610 (Figure 5-1).**



**For CSA approved SPX 3XXX Explosionproof installations, install in accordance with controlled drawing 000611 (Figure 5-2).**

## 5.7 CONNECTION ASSIGNMENTS

The device must be connected to a certified power supply. Each unit will include a primary 4-20mA output. The unit may also have one of the options listed in the table below. [See section 2.9](#) for wiring details of units with GCxxx option code.

Signal	Terminal Description	Connection Type		
		Conduit-Lead Wire Color	6-Pin	8-Pin
Primary 4-20mA	PWR+/SIG+	Red	A	A
	PWR-/SIG-	Black	B	B
	CASE	Green	-	-
Options				
Optional RCAL Only	RCAL+	Orange	F	E
	RCAL-	Blue	E	D
SPX 3XXX Only Options				
Optional RCAL with Secondary 4-20mA only	RCAL+	Orange	-	E
	RCAL-	Blue	-	D
	2nd PWR+/SIG+	Violet	-	G
	2nd PWR-/SIG-	Yellow	-	H
Optional Secondary 4-20mA only	2nd PWR+/SIG+	Violet	-	G
	2nd PWR-/SIG-	Yellow	-	H
Optional Dual RTD only	RTD (-)	White	-	D
	RTD (+)	Grey	-	E
	RTD (+)	Brown	-	F
Color Code				
SPX				
SPX 3XXX ONLY				

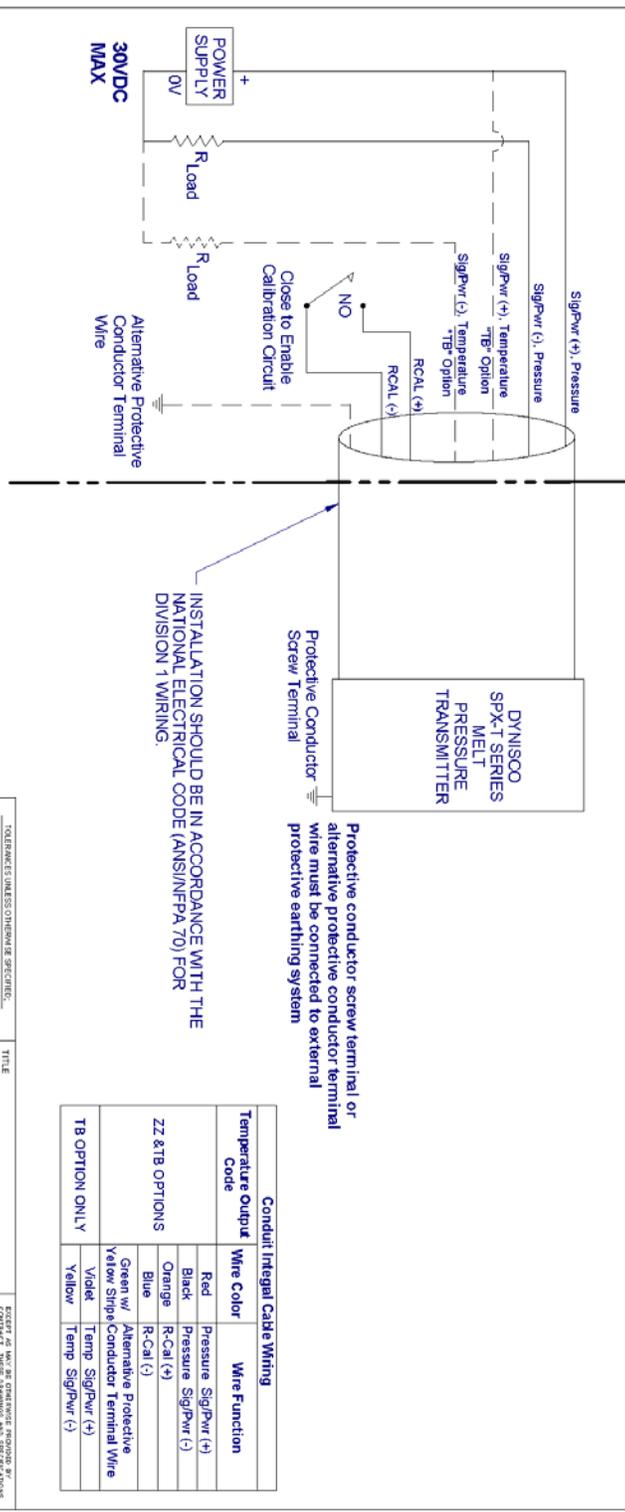
**Note:** The Optional Dual RTD option (TA) is a second RTD in the snout tip that is brought to the connector. The RTD is a 100 Ohm RTD with an alpha of 0.00385 Ohms/°C.



If the transmitter is installed in hazardous areas, only passive devices like switches or resistors may be connected between the RCAL+ and RCAL- signals. Connection of any active electronic circuits or voltage or current source is not allowed.



REV	ECO	BY	APP	DATE	EXPLOSIONPROOF INSTALLATION	HAZARDOUS (CLASSIFIED) LOCATIONS CLASS I, DIVISION 1, GROUPS A, B, C AND D CLASS II, III, DIVISION 1, GROUPS E, F AND G
C	35413	MLL	MLL	6/19/09		



**WARNING - EXPLOSION HAZARD. DO NOT DISCONNECT EQUIPMENT WHEN A FLAMMABLE OR COMBUSTIBLE ATMOSPHERE IS PRESENT.**

This installation is for Electrical Settings Option Model Code: Ce only, where e = variable cable length (permanently attached cable).

**NOTES:**  
 1. CIRCUIT BOARD MATERIAL IS CE 94V-0 FLAMMABILITY RATED (EQUIVALENT TO FV-0).  
 2. EQUIPMENT CONNECTED TO POWER SUPPLY CANNOT USE OR GENERATE IN EXCESS OF 250 VOLTS.

INSTALLATION SHOULD BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (ANSI/NFPA 70) FOR DIVISION 1 WIRING.

Protective conductor screw terminal or alternative protective conductor terminal wire must be connected to external protective earthing system

DO NOT SCALE DRAWING	DATE	2003/09
DATE	DATE	DATE

MODEL NO.	SPX-T
DATE	2003/09

DATE	DATE	DATE
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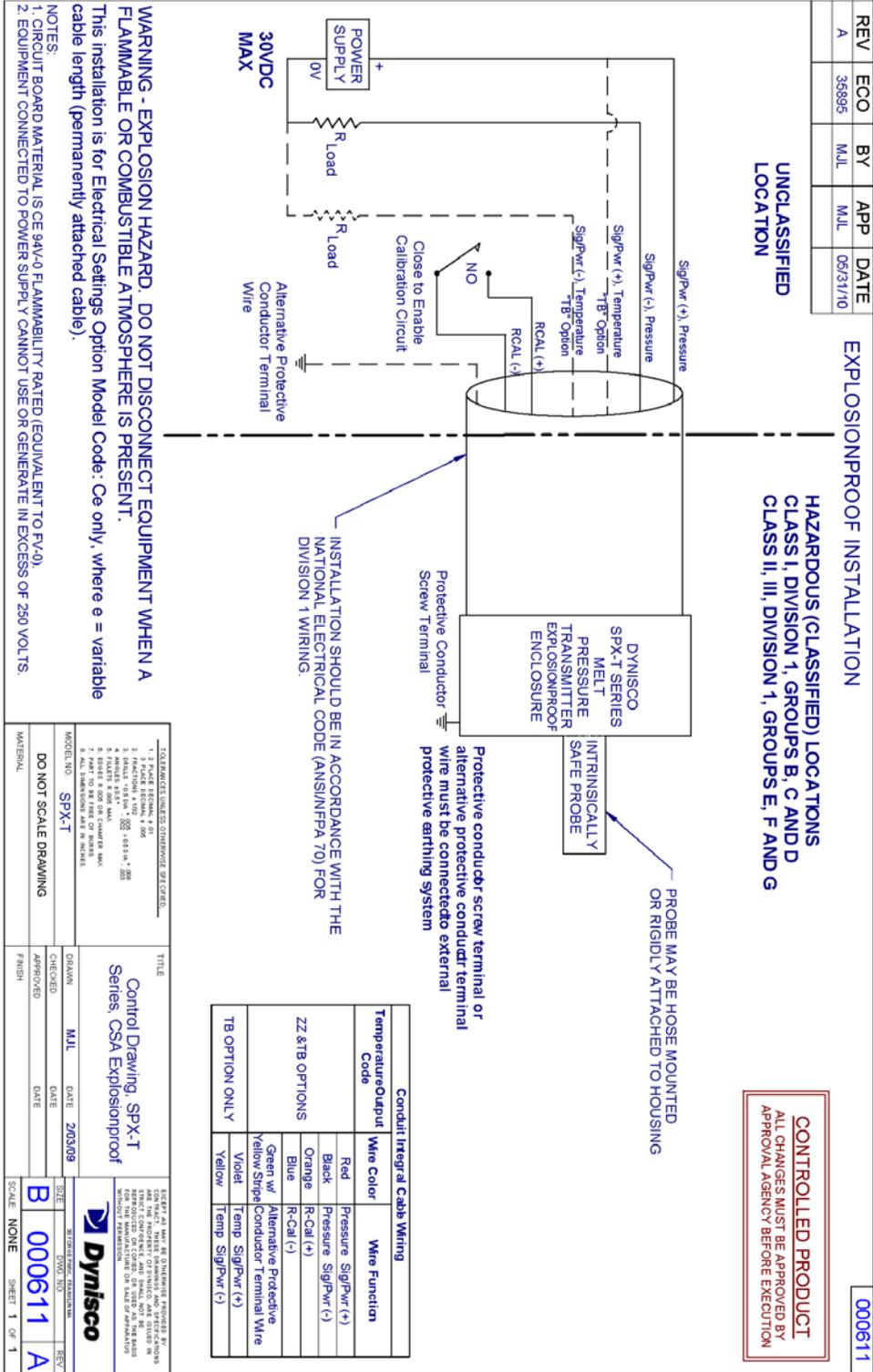
SCALE	NONE
SHEET	1 of 1

EXCEPT AS NOTED OR OTHERWISE INDICATED, ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.

1. 2 RACE CORNERS 4.00  
 2. RACE CORNERS 4.00  
 3. RACE CORNERS 4.00  
 4. RACE CORNERS 4.00  
 5. RACE CORNERS 4.00  
 6. RACE CORNERS 4.00  
 7. RACE CORNERS 4.00  
 8. ALL DIMENSIONS ARE IN INCHES



Figure 5-1 Electrical Configuration for FM Approved Explosionproof SPX 3XXX Installations





**Figure 5-2 Electrical Configuration for CSA Approved Explosionproof SPX 3XXX Installations**

### 5.8 FLANGE CONFIGURATIONS

Please contact Dynisco if flange configurations are required.



## 6 COMMISSIONING

There are two ways of commissioning the SPX transmitters. This can be done by utilizing the ZERO and SPAN actuators or by HART Communications via a communicator connected to the pressure loop.

If the SPX is equipped with the optional HART communications, it is not necessary to access the zero/span actuators on the sensor.

If the transmitter is not equipped with HART then the zero/span actuators must be utilized. However, Sections 6.3 through 6.8 and 6.11 may be skipped.

### 6.1 WHY A TRANSMITTER MUST BE REZEROED

The transmitter output must be nulled at zero pressure after installation when the machine has stabilized at operating temperature. This is easy to understand why when considering the mechanical properties of the sensor.

As described in section 1.5, a fill fluid transmits the process pressure from the sensor tip of the transmitter (at process temperature) to the electronics housing (at ambient temperature). As the transmitter sensing tip is brought from ambient to process temperature, the fill fluid expands and increases the amount of deflection on the sensing diaphragm. This creates a positive pressure reading, as if a small pressure was actually applied, even with zero pressure on the system. Even with the advanced temperature correction performed by the SPX 3XXX, there is a slight residual temperature offset so rezero may be beneficial.



Also, depending on the orientation of the sensor, the weight of the fluid will have an effect on the sensing diaphragm. The weight of the fluid will either increase the deflection of the diaphragm as if a small pressure is applied or may pull on the diaphragm as if pressure was pulling away from the sensor (a negative reading).

There are some other effects that may affect the zero as well, such as torque, side loading, etc. For more information contact Dynisco.

All of these effects can be compensated for by setting the transmitter zero after the machine has stabilized at operating temperature.

## 6.2 UTILIZING THE ZERO AND SPAN ACTUATORS

When the transmitter output needs to be corrected due to mounting location and temperature shift the zero actuator can be used (if a HART Communicator is not available.) Please wait until the process has been brought to operating temperature before zeroing. The zero procedure is only recommended after the process temperature has stabilized and the SPX electronics housing has been permanently installed.

When the actuator is depressed in a certain sequence, the output will be corrected to reflect 4 mA. This is done by the transmitter electronics automatically by adjusting the LRV and URV settings simultaneously to the offset required to obtain 4 mA. Normally a Zero calibration is all that is required after installation since the Transmitter span has been calibrated at the factory. In the event the Full Scale output is not correct when checked against a calibrated pressure source or dead weight tester, the transmitter span can be adjusted via the Span actuator. This is performed by applying a known calibrated full scale pressure to the transmitter and depressing the Span actuator in a certain sequence. When complete, the transmitter electronics will have adjusted the URV to correct to output to equal 20 mA.

### ATTENTION

The span actuator should never be used to set the URV without zeroing the PT with the zero actuator first.

If for some reason the calibration is incorrect and the user wishes to revert back to the Factory Calibration, a procedure can be performed to revert the calibration back to factory state. Refer to “Resetting to Factory Default Settings” in this Chapter.

### 6.2.1 ZERO AND SPAN PROCEDURE

1. Connect Power Supply to SPX signal leads with 250 ohm load and milliamp meter in series with loop.
2. If commissioning on the bench with a dead weight tester or calibrated pressure source, ensure pressure connection is free of leaks.
3. Apply power to the SPX transmitter and observe loop current with zero pressure applied. It should be 4 mA. If other than 4 mA proceed to step 4.
4. Perform Zero Function



- a. SPX 2XXX/4XXX/5XXX (Pushbutton)
  - i. Do not remove seal screw when the circuit is live in a hazardous area.
  - ii. Remove zero pushbutton seal screw.
  - iii. Using a 2mm or smaller Allen key, depress the pushbutton for a ½ second.
  - iv. Release pushbutton for a ½ second.
  - v. Depress the pushbutton again for a ½ second and release.
  
- b. SPX 3XXX (Hall Effect Switch)
  - i. Unthread Zero screw from endplate
  - ii. Depress screw
  - iii. Release screw
  - iv. Depress screw
  - v. Release screw
  - vi. Restore screw in endplate

Note: The screw must be threaded into the endplate for normal operation. Failing to do so will cause the device to go into failsafe.

The available pressure is now adopted as the new lower range value

Steps past this point are not part of a normal bench setup and should only be performed by qualified individuals, as the SPX is highly stable and has been factory calibrated with highly accurate pressure generators. This function should only be performed on such equipment.

5. Apply Full Scale pressure and verify output is 20 mA. If output is other than 20 mA, perform Local Span adjustment:
  - a. SPX 2XXX/4XXX/5XXX (Pushbutton)
    - i. Do not remove seal screw when the circuit is live in a hazardous area.
    - ii. Remove span pushbutton seal screw.
    - iii. Using a 2mm or smaller Allen key, depress the pushbutton for a ½ second.
    - iv. Release pushbutton for a ½ second.
    - v. Depress the pushbutton again for a ½ second and release.
  
  - b. SPX 3XXX (Hall Effect Switch)
    - i. Unthread Span screw from endplate
    - ii. Depress screw
    - iii. Release screw
    - iv. Depress screw
    - v. Release screw
    - vi. Restore screw in endplate

Note: The screw must be threaded into the endplate for normal operation. Failing to do so will cause the device to go into failsafe.



The available pressure is now adopted as the new upper range value.

### 6.3 UTILIZING THE HART COMMUNICATIONS

The zero procedure is only recommended after the process temperature has stabilized and the SPX electronics housing has been permanently installed. When the zero trim function is selected (HART Quick key 1,2,5,1,3,1) the output will be corrected to reflect zero pressure. This is done by the transmitter electronics automatically by adjusting digital PV to zero and analog output will be 4 mA. Normally a Zero Trim is all that is required after installation since the Transmitter span has been calibrated at the factory.

In the event the Full Scale output is not correct when checked against a calibrated pressure source or dead weight tester, the Transmitter span can be adjusted by performing the Sensor Trim function. This is performed by first applying Zero Pressure and selecting Lower Sensor Trim (HART Quick Key 1, 2, 5, 1, 3, 2) and following the prompts on the HART Communicator. When complete, apply a known calibrated full scale pressure to the Transmitter and selecting Upper Sensor Trim (HART Quick Key 1, 2, 5, 1, 3, 3) and follow the prompts on the HART Communicator. When complete, the transmitter electronics will have adjusted the digital PV to correct to full scale output.

**ATTENTION** Never perform upper sensor trim without performing lower sensor trim first.

### 6.3.2 CONNECTING THE HART HANDHELD COMMUNICATOR



In hazardous areas, refer to the handheld communicator instruction manual for instructions for HART Communicator to function properly.

**ATTENTION**

A minimum of 250 Ohms resistance must be present in the loop.

The HART Communicator does not measure loop current directly.

The HART Communicator can interface with the SPX anywhere along the 4 - 20 mA cable as shown in the following figure.

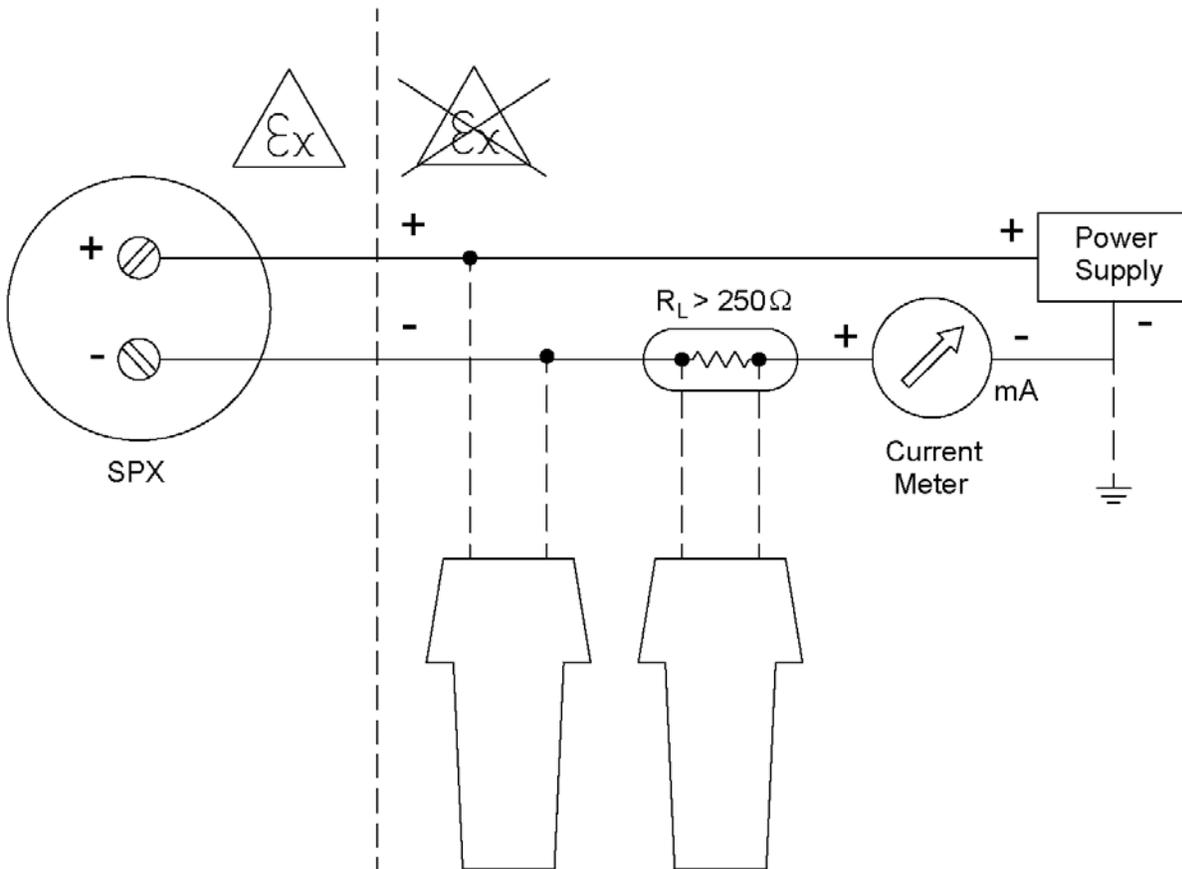


Figure 6-1 HART Communicator Interface

### 6.3.3 PROCEDURE

1. Connect Power Supply and HART Communicator per the above diagram.



2. If commissioning on the bench with a dead weight tester or calibrated pressure source, insure pressure connection is free of leaks.
3. Apply power to the SPX transmitter and turn on the HART Communicator by pressing the ON/OFF key. The LCD display should show [SPX-T or SPX depending on model] in the upper left corner. If this is not present, consult the Troubleshooting section of this manual.
4. Set PV Units (Fast Key 1,3,2) to appropriate pressure unit. (e.g. psi, Bar, kgf/cm<sup>2</sup>, MPa)
5. Set Tag (Fast Key 1,3,1).
6. If transmitter output needs to be re-ranged, set the appropriate LRV (Fast Key 4,1) and URV (Fast Key 4,2)
  - Note: URV cannot be turned down below the PV Minimum span (Fast Key 1,4,1,5)
7. Set Lower Trim (Fast Key 1,2,5,1,3,1)
8. Verify SPX transmitter output. Zero pressure output should read 4 mA.

ATTENTION

Steps past this point are not part of a normal bench setup and should only be performed by qualified individuals, as the SPX is highly stable and has been factory calibrated with highly accurate pressure generators. This function should only be performed on such equipment.

9. Next, using calibrated pressure source, apply pressure equal to value set in URV in step 6. Output should equal 20 mA. If output does not equal 20 mA proceed to step 10.
10. To calibrate full scale output, first apply pressure equal to full scale pressure of unit. Next perform Upper Sensor Trim (Fast Key 1,2,5,1,3,2). Output should now equal full scale pressure.
11. If Transmitter Output Damping is required, set PV Damping (Fast Key 1,3,5) to the appropriate value.
12. Press the left arrow key until the HART Communicator is off-line then turn the power off.

The SPX pressure transmitter is now ready to be installed in the process.

#### 6.4 SPX ANALOG OUTPUT

The SPX has a 4-20 mA output proportional to pressure for normal operating conditions. However, unlike a traditional sensor, the SPX performs self-diagnostic routines continually during operation. If a special condition is detected, the transmitter drives its analog output outside the normal saturation values to indicate that investigation is necessary. (This condition is called fail-safe mode alarm.) The conditions detected by the self-diagnostic routines (and the corresponding effect on the analog output) are listed later in this section.

When a special condition is detected, the SPX goes into fail-safe mode and the transmitter output goes high, by default. However, using a HART communicator, the transmitter can also be configured to drive its output low or to freeze the output where it was just before the fail-safe was detected. The actual analog output levels are indicated below.

A low alarm (3.6 mA) is possible but not recommended because HART communications are not guaranteed until the cause of the alarm is removed.



Using the HART communicator, the specific condition that triggered the fail-safe mode alarm can be read for diagnostic purposes. (See Status in the HART menu tree.)

In a fail-safe condition the PV is not affected and can still be read using the handheld HART communicator. For process related fail-safe conditions, the transmitter will remain in the alarm state until the source of error disappears. If certain electronics errors are detected, the fail-safe condition will latch until a reset is performed by either cycling the power or through a software command.

#### NAMUR Compliant Saturation and Alarm Values

	<u>4 - 20 mA Saturation</u>	<u>4 - 20 mA Alarm</u>
Low	3.8 mA	3.6 mA
High	20.5 mA	>21 mA

You can alter the actual transmitter mA output values by performing an analog output trim using the HART Communicator.

When a transmitter is in an alarm condition, the analog output displayed by the handheld indicates the alarm value of the analog output – NOT the value the transmitter would have, if the sensor had not detected the failure.

#### Special Conditions and the Corresponding Analog Output

<u>Condition</u>	<u>Alarm Value (fail safe)</u>
EEPROM failure detected	Set to configured fail safe mode
Cold start	Set to fail safe mode low
Pressure above upper limit	Unchanged
Pressure below lower limit	Unchanged
Electronics temp above upper limit	Unchanged
Electronics temp above lower limit	Unchanged
Strain gage open detected	Set to configured fail safe mode
Analog output saturated	Unchanged
Watchdog error detected	Unchanged
Zero/Span Actuator stuck	Set to configured fail safe mode
Low voltage detected	Unchanged
Outside URV or LRV	Unchanged
Rcal simulation on	Unchanged

#### 6.5 ALARM & SATURATION VALVES BURST MODE

No special requirements are defined for the burst mode.

#### 6.6 ALARM & SATURATION VALUES IN MULTIDROP MODE

If the device is in multidrop mode, the NAMUR levels are no longer achievable. Instead the fail safe condition is indicated by the field device status and the additional diagnostics.



## 6.7 SPX TRANSMITTER FUNCTIONS VIA HART

### Zero Trim (1,2,5,1,3,1)

Digital Correction to zero which affects the digital output. This differs from Lower Sensor Trim in that zero trim is ONLY performed at zero pressure.

### Lower Sensor Trim (1,2,5,1,3,2)

Digital Correction to zero which affects the digital output. This differs from Zero Trim in that Lower Sensor Trim can be performed at pressures above zero.

Note: This must be performed before Upper Sensor Trim. Only perform this function with a known calibrated pressure source.

### Upper Sensor Trim (1,2,5,1,3,3)

Digital correction to Full Scale which affect digital output.

Note: Lower Sensor Trim must be performed before Upper Sensor Trim. Only perform this function with a known calibrated pressure source.

### Digital to Analog trim (1,2,5,1,2)

This is used to match the digital representation of the analog output with its actual analog loop current.

Note: This should only be performed with a known Calibrated Current (mA) meter.

### Reranging

The SPX allows for the 4 mA and 20 mA points (LRV and URV respectively) to be adjusted so that output resolution can be improved. A Re-range or “Turndown” ratio of 6:1 is possible. Accuracy specifications remain dependent upon the Full Sensor Range without any turndown applied. Three methods of Reranging the SPX Transmitter are outlined below.

Note: If pressure applied to the transmitter is not in the range of the 6:1 turndown ratio, the transmitter will reject the Span attempt. This will be indicated by the output not adjusting to 20 mA after a few attempts using the Span Actuator.

### Reranging TV (SPX 3XXX) with “TB” option only

On a SPX 3XXX with the TB option, there is a second 4-20mA output that is proportional to the snout temperature. By default the TV LRV and TV URV are set to 0 and 400C respectively. The secondary 4-20mA output can be reranged by changing TV LRV and TV URV.

### Reranging via Zero/Span Actuators

When HART Communication is not used, LRV and URV values are entered by applying zero pressure to the SPX 3XXX and “Rezeroing” by:

- a. SPX 2XXX/4XXX/5XXX (Pushbutton)
  - i. Do not remove seal screw when the circuit is live in a hazardous area.
  - ii. Remove zero pushbutton seal screw.
  - iii. Using a 2mm or smaller Allen key, depress the pushbutton for a ½ second.
  - iv. Release pushbutton for a ½ second.

ATTENTION



- v. Depress the pushbutton again for a ½ second and release.
- b. SPX 3XXX (Hall Effect Switch)
  - i. Unthread Zero screw from endplate
  - ii. Depress screw
  - iii. Release screw
  - iv. Depress screw
  - v. Release screw
  - vi. Restore screw in endplate

Note: The screw must be threaded into the endplate for normal operation. Failing to do so will cause the device to go into failsafe.

The LRV and URV have now been adjusted to zero the device without affecting the span.

After Rezeroing, it is possible to set the span by adjusting the URV with the span actuator. The span actuator should never be used to adjust the URV without using the zero actuator to set the LRV first.

URV or Full Scale Turndown is performed by applying any pressure, within the 6:1 ratio of the transmitter that you want to be the 20 mA point. When the pressure is held steady:

- a. SPX 2XXX/4XXX/5XXX (Pushbutton)
  - i. Do not remove seal screw when the circuit is live in a hazardous area.
  - ii. Remove span pushbutton seal screw.
  - iii. Using a 2mm or smaller Allen key, depress the pushbutton for a ½ second.
  - iv. Release pushbutton for a ½ second.
  - v. Depress the pushbutton again for a ½ second and release.
- b. SPX 3XXX (Hall Effect Switch)
  - i. Unthread Span screw from endplate
  - ii. Depress screw
  - iii. Release screw
  - iv. Depress screw
  - v. Release screw
  - vi. Restore screw in endplate

Note: The screw must be threaded into the endplate for normal operation. Failing to do so will cause the device to go into failsafe.

The SPX has now adjusted the URV 20 mA point to match the pressure applied.

## 6.8 RERANGING VIA HART

### Rerange LRV (4)

This is the pressure at which the transmitter will output 4 mA as entered directly by the user. Changing the LRV affects the transmitter span so the is range is limited by the minimum span value found in Fast Key (1,4,1,5)



### **Rerange URV (5)**

This is the pressure at which the transmitter will output 20 mA as entered directly by the user. This range is limited by the minimum span value found in Fast Key (1,4,1,5)

### **Rerange TV LRV (1,3,3,3) SPX 3XXX “TB” option only**

This is the temperature at which the transmitter will output 4 mA on the secondary mA output as entered directly by the user.

### **Rerange TV URV (1,3,3,4) SPX 3XXX “TB” option only**

This is the temperature at which the transmitter will output 20 mA on the secondary mA output as entered directly by the user.

### **Rerange LRV By Applying Pressure (1,2,5,1,1,1,1)**

This is done by applying a known pressure and initiating the procedure so that the transmitter adopts the pressure as the 4 mA point.

Note: This should only be performed with a Calibrated Pressure Source.

### **Rerange URV By Applying Pressure (1,2,5,1,1,1,2)**

This is done by applying a known pressure and initiating the procedure so that the transmitter adopts the pressure as the 20 mA point.

Note: This should only be performed with a Calibrated Pressure Source.

### **Recall Factory Trim (1,2,5,3)**

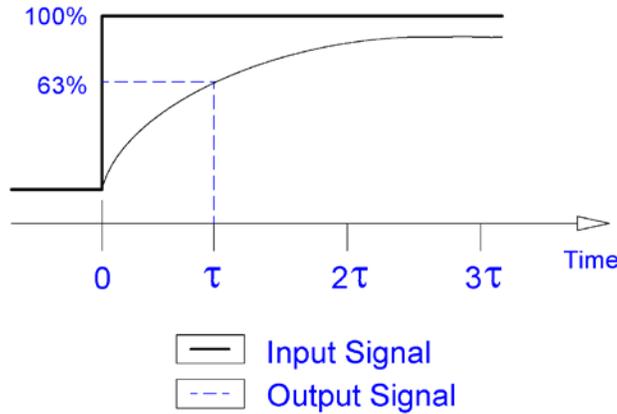
This is used to restore the Zero, Lower, and Upper Trim to the Values as set from the Factory.

### **R-Cal Set % (1,2,5,1,4,1)**

This is used on versions with a Rcal. By activating R-Cal, the output will be set to the percentage of span set by this function. Default is 80%. Setting Rcal to 0%, disables the Rcal function.

### **Damping (1,3,5)**

The damping time constant affects the speed with which the primary output signal reacts to changes in pressure as shown in the figure on the following page. Damping is off by default but values between 0 and 30 seconds can be set using the handheld communicator. The damping value must be entered in integers. If non-integers are entered, the system rounds to the next integer.



**Local Actuator Disable (1,4,3,6)**

Local zero and span actuators can be disabled using the HART handheld communicator function “Local Push-buttons.” When turned off, the software Lock Out prevents changes to transmitter range points via the local zero and span actuators. With local Push-buttons disabled, changes to configuration are still possible via HART.

**Status (1,2,1,2)**

Reads Device Status from SPX.

**PV Unit (1,3,2)**

The pressure unit defines the unit of measure that the pressure-specific parameters are transmitted in. The SPX can be configured in the engineering units of psi, Bar, MPa, and kgf/cm<sup>2</sup> or as a percentage of Full Scale (FS). After selecting a new pressure unit, all entries for pressure are recalculated to the new unit, using the following conversion rules:

$$1 \text{ psi} = 0.068947 \text{ Bar} = 0.0068947 \text{ MPa} = 0.070309 \text{ kgf/cm}^2$$

**Tag (1,3,1)**

An inventory “Tag” identification number may be stored in transmitter memory (8 characters maximum). Software tag is a single question mark by default.

**Descriptor (1,3,4,2)**

A 16 character text can be entered for further description of transmitter e.g. location, function, position, etc.

**Message (1,3,4,3)**

A 20 character message can be set and displayed on the HART Communicator.

**SV Electronics Temperature (1,1,7)**

Temperature measured on the Electronics Assembly is used for reference and factory diagnostics only.

**TV Snout Temperature (1,1,4)**



Temperature measured at the snout tip (SPX 3XXX only).

### Poll Address (1,4,3,3,3)

Use in Multidrop mode allows more than one transmitter (up to 15) on a single loop. If this value is other than zero, the transmitter is in Multidrop mode. An example of Multidrop mode would be a group of HART devices wired in parallel on a single powered loop and each device being assigned a unique Poll address (1-15). The HART communicator would prompt for the individual address of the transmitter to communicate with and would only poll that specific device. All others would remain unchanged. Note: Analog output is set to 4mA when in multi-drop mode.

### Burst Mode (1,4,2,3,1)

When the SPX 3XXX is used in Burst Mode, the transmitter outputs one-way digital communications from the transmitter to the Host. Communication rate is faster since the transmitter does not have to be polled to send data. Information transmitted in Burst Mode includes Pressure Variable, Analog Output value, Pressure in % of range. Access to other information can still be obtained through normal HART Comms.

## 6.9 RESETTING TO FACTORY DEFAULT SETTINGS

The factory settings for the sensor (including zero and span) can be restored if they are changed inadvertently using the Zero/Span Actuators or the HART communicator. The list of parameters restored is shown below.

Make sure Control System is in Manual mode. Temporary loss of Loop Output during Electronics Re-boot may occur.

To reset the sensor using the actuators, use the following procedure:

- a. SPX 2XXX/4XXX/5XXX (Pushbutton)
  - i. Do not remove seal screw when the circuit is live in a hazardous area.
  - ii. Remove zero and span pushbutton seal screws.
  - iii. Using a 2mm or smaller Allen key, depress the pushbuttons for a ½ second.
  - iv. Release pushbuttons for a ½ second.
  - v. Depress the pushbuttons again for a ½ second and release.
  
- b. SPX 3XXX (Hall Effect Switch)
  - i. Unthread Zero and Span screws from endplate
  - ii. Depress screws
  - iii. Release screws
  - iv. Depress screws
  - v. Release screws
  - vi. Restore screws in endplate

ATTENTION



Note: The screws must be threaded into the endplate for normal operation. Failing to do so will cause the device to go into failsafe.

At this point, the LRV and URV will be set to factory defaults.

#### 6.10 DEFINITION OF “RESTORE FACTORY DEFAULTS”

1. Restore LRV and URV to their values at shipment.
2. Restore the Pressure Unit (psi, Bar, etc.) to its value at shipment.
3. Set the Analog Output Alarm Level to its value at shipment.
4. Remove all Pressure Damping
5. Clear all Sensor and Analog Output Trim values.
6. Clear Burst Mode.
7. Restore the Address to Zero.
8. Restore the Rcal option to its value at shipment. (Enable or Disable the Rcal option.)
9. Set actuators to the settings they were when shipped from DYNISCO.

#### 6.11 HART COMMUNICATOR FAST KEY SEQUENCES

Below defines the HART Communicator Fast Key sequences. Fast Keys are a means of supplying a shortcut to navigate through the menu tree.



### HART Communicator Fast Key sequences

Function	Fast Key Sequence
Read PV Pressure	2
Read % of Full Scale	1,1,2
Read Analog Output (PV)	1,1,3
Read SV Electronics Temperature	1,1,7
Read Peak Pressure Value	1,2,1,2
Read Peak Electronic Temp Value (SV)	1,2,1,3
Read Sensor Diagnostic Status	1,2,1,1
Read PV Minimum Span	1,4,1,5
Perform Sensor Self-Test	1,2,2
Perform Sensor Master Reset	1,2,3
Perform Loop Test	1,2,4
Perform D/A Trim (PV)	1,2,5,1,2
Perform Zero Trim	1,2,1,3,1
Perform Lower Sensor Trim	1,2,5,1,3,2
Perform Upper Sensor Trim	1,2,5,1,3,3
Recall Factory Trim	1,2,5,3
Set Rcal %	1,2,5,1,4,1
Set Tag	1,3,1
Set PV Unit	1,3,2
Set Lower Range Value (LRV) (PV)	1,3,3,1
Set Upper Range Value (URV) (PV)	1,3,3,2
Display Lower Set Limit (LSL) (PV)	1,3,3,5
Display Upper Set Limit (USL) (PV)	1,3,3,6
Set Date	1,3,4,1
Set Descriptor	1,3,4,2
Set Message	1,3,4,3
Set PV Damping	1,3,5
Set SV Temperature Unit	1,4,1,7
Set PV Analog Output Alarm Type	1,4,2,2,3
Set Poll Address	1,4,2,3,1
Set # of Request Preambles	1,4,2,3,2
Set Burst Mode	1,4,2,3,3
Set Burst Option	1,4,2,3,4
Read Analog Output (TV)	1,1,6
Read Peak Temp Value (TV)	1,2,3,4
Perform D/A Trim (TV)	1,2,5,2,2
Set Lower Range Value (LRV) (TV)	1,3,3,3
Set Upper Range Value (URV) (TV)	1,3,3,4
Temperature Override	1,2,5,2,1,1
Temperature Override Value	1,2,5,2,1,2

## 7 MAINTENANCE

### 7.1 MAINTENANCE

Mounting and electrical connection of the SPX must be done by specialists with EMC training, following all applicable regulations, and in **pressureless, voltage-free, intrinsically safe condition with the machine switched off.**



**The machine must be secured against being switched back on!**

The most common causes of transducer damage are: installation in improperly machined or plugged mounting holes and cold starts. The tip of the transducer consists of a stainless steel diaphragm that must be protected from severe abrasives, dents and scores.

ATTENTION



**Burn Hazard!** The SPX must be removed with the melt in the molten condition. The SPX can be very hot when removed. WEAR PROTECTIVE GLOVES!



**Wear protective gloves!**

Installation and Removal Instructions

- DO NOT REMOVE PROTECTIVE CAP UNTIL READY TO INSTALL.
- PRIOR TO INITIAL INSTALLATION, VERIFY CORRECT MACHINING OF MOUNTING HOLE.
- WHEN REINSTALLING, MAKE SURE MOUNTING HOLE IS CLEAR OF DEBRIS OR HARDENED PLASTIC.
- THE MEDIUM MUST BE IN MOLTEN CONDITION DURING TRANSDUCER REMOVAL.
- (Removing the transducer with the medium in a solidified condition can damage the sensor diaphragm.)
- ALWAYS REMOVE THE SPX BEFORE CLEANING THE MACHINE WITH ABRASIVES OR STEEL WIRE BRUSHES, ETC.
- DO NOT CLEAN THE “SCREWED-IN” SECTION OF THE SPX WITH HARD OBJECTS – THIS WILL DAMAGE THE SPX.
- ALWAYS USE A TORQUE WRENCH APPLIED TO THE DESIGNATED HEXAGONAL COLLAR WHEN SCREWING THE PT IN AND OUT. DO NOT APPLY THE TOOL TO THE HOUSING OR HOUSING/SENSOR CONNECTION.
- ELECTROSTATIC DISCHARGE MAY DAMAGE THE SPX – TAKE ESD PRECAUTIONS.



## 7.2 REPAIR/DISPOSAL 7.3 WARRANTY



### Toxic hazard!

The SPX contains a small amount of mercury (Hg) as its standard transmission medium. If the diaphragm is damaged, mercury may escape. For alternate (non-Hg) transmission mediums please consult factory.

Never transport or store the SPX without the protective cap in place. Remove the cap shortly before installation.

**If mercury is inhaled or swallowed, seek medical attention immediately!**

Mercury is hazardous waste and must be disposed of in accordance with applicable laws. **DYNISCO** will accept defective SPXs.

If mercury escapes, use airtight packaging!

Please send defective SPX units back to your **DYNISCO** representative. For **DYNISCO** addresses, see the back cover of the operating manual.

## 7.3 WARRANTY

The SPX Series Dynisco Pressure transmitters will provide excellent service and superior performance if proper care is taken during handling, installation, and use. This **DYNISCO** product is warranted under terms and conditions set forth in the **DYNISCO** web pages. Go to [www.dynisco.com](http://www.dynisco.com) and click on the "warranty" link under the "Post-Sales Support" tab at the top of the web page for complete details.



## 8 TROUBLESHOOTING

Symptom	Corrective Actions
Milliamp Reading is Zero	<ol style="list-style-type: none"> <li>1) Check if Power Polarity is Reversed</li> <li>2) Verify Voltage Across Transmitter Pins</li> </ol>
Large Zero Shift when Screwing In	<ol style="list-style-type: none"> <li>1) Check Hole with Gage Plug and Rework Hole as Required</li> <li>2) Check Mounting Torque</li> </ol>
Primary Milliamp Reading is Low or High	<ol style="list-style-type: none"> <li>1) Check Pressure Variable Reading for Saturation</li> <li>2) Check if Output in Alarm Condition</li> <li>3) Verify 4 and 20 mA Range Points or Simply Reset</li> <li>4) Perform 4 - 20 mA Output Trim with HART Communicator</li> </ol>
No Response to Changes in Applied Pressure	<ol style="list-style-type: none"> <li>1) Check Test Equipment</li> <li>2) Check Port/Pipe for Blockage or Solidified Plastic</li> <li>3) Check if Output in Alarm Condition</li> <li>4) Check if in multi-drop mode</li> </ol>
Pressure Variable Reading is Low or High	<ol style="list-style-type: none"> <li>1) Check Test Equipment</li> <li>2) Check Port/Pipe for Blockage or Solidified Plastic</li> <li>3) Perform Full Sensor Trim</li> </ol>
Pressure Variable Reading is Erratic	<ol style="list-style-type: none"> <li>1) Check Port/Pipe for Blockage or Solidified Plastic</li> <li>2) Check Damping</li> <li>3) Check for EMI</li> </ol>
Transmitter Not Communicating with HART Communicator	<ol style="list-style-type: none"> <li>1) Check Power Supply Voltage at Transmitter</li> <li>2) Check Load Resistance (250 Ohm minimum)</li> <li>3) Check Communicator Connection Across Power Supply</li> <li>4) Check if Unit is Addressed Properly</li> <li>5) Confirm HART communicator is connected to primary (Pressure) output 4-20mA</li> </ol>
HART Communicator missing SPX Features Described in Manual	From the Communicator's Main Menu, Access the On-Line Menu. The Name SPX Should be Displayed on the Top Line of the LCD. If the Name is not Present, Contact Dynisco to Arrange for DD Upgrade
Secondary output at or below 3.6mA (Failsafe low)	<ol style="list-style-type: none"> <li>1) Confirm output option is specified in Model configuration</li> <li>2) Confirm that primary output is properly powered</li> </ol>
Primary output =3.6mA or > 21mA	<ol style="list-style-type: none"> <li>1) Unit is in fail safe, consult fail safe section</li> </ol>



## 9 ACCESSORIES

- Machining tool kit 1/2"-20UNF-2A P/N 200295
- Cleaning tool kit 1/2"-20UNF-2A P/N 200100
- Machining tool kit M18 x1.5 P/N 200105
- Cleaning tool kit M18 x1.5 P/N 200100
- Mounting Bracket P/N 190925



## 10 APPROVALS/CERTIFICATES

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**Note additional approvals available; please consult factory.**



## 10.1 CE DECLARATION OF CONFORMITY



### EC Declaration of Conformity

We, **Dynisco LLC**  
**38 Forge Parkway**  
**Franklin, MA 02038**  
**USA**

declare under our sole responsibility that the products,  
**Model SPX2 GEN2 Pressure Transmitters**  
**Model SPX3 Pressure Transmitters (SPX-T 3xxx)**  
**Model SPX4 GEN2 Pressure Transmitters**  
**Model SPX5 GEN2 Pressure Transmitters (SPX-L 5xxx)**

to which this declaration relates, are in conformity with the standards or other normative documents following the provisions of the respective Council Directives listed below:

**EMC Directive 2004/108/EC – Electromagnetic Compatibility**

EN 61326-1:2006 (IEC 61326-1:2005)  
CISPR 11:2003 Radiated Electromagnetic Emissions  
IEC 61000-4-2:2001 Electrostatic Discharge Immunity  
IEC 61000-4-3:2002 Radiated Electromagnetic Field Immunity  
IEC 61000-4-4:2004 Electric Fast Transient Burst Immunity  
IEC 61000-4-5:2001 Surge Immunity  
IEC 61000-4-6:2003 Radio Frequency Common Mode Immunity  
IEC 61000-4-8:1994 Power Frequency Magnetic Field Immunity  
IEC 61326-2-3:2006

**PED Directive 97/23/EC – Pressure Equipment**

Sound Engineering Practice (SEP) applies to all models except the SPX228 and the SPX538 with a maximum pressure of 200 bar (3000 psi) or greater.

Conformity Assessment Module "A" applies to models SPX228 and the SPX538 with a maximum pressure of 200 bar (3000 psi) or greater.

**ATEX Directive 94/9/EC – Potentially Explosive Atmospheres**

EN 60079-0:2009 General requirements  
EN 60079-11:2007 Intrinsic safety "i"  
EN 60079-26:2007 Equipment with equipment protection level (EPL) Ga  
EN 1127-1:2007 Explosion prevention and protection. Basic concepts and methodology

Equipment Group II, Category 1 G Ex ia IIC T6/T4 or Category 2 G Ex ia IIC T4/T6

EC-type-examination Certificate Number.: PTB 09 ATEX 2038 X

ATEX Notified Body for EC Type Examination Certificate:  
Physikalisch-Technische Bundesanstalt (PTB)  
Bundesallee 100  
D-38116 Braunschweig, Germany  
Notified Body Number: 0102

P/N 973002  
ECO# 44422  
Rev. D

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ATEX Notified Body involved in the Production Control Stage:  
Sira Test and Certification Ltd (SIRA)  
Rake Lane, Eccleston  
Chester, Cheshire  
CH4 9JN, England  
Notified Body Number: 0518

The authorized representative located within the Community is:  
**Dynisco Europe GmbH**  
Pfaffenstr. 21  
74078 Heilbronn Germany

Other information:

1. Device testing per normative standards following the EMC Directive (2004/108/EC) was conducted by: Chomerics Test Services, Woburn, Massachusetts, USA / 7-8 April 2009 / American Association for Laboratory Accreditation (A2LA) accredited facility, Certificate Number 1980-01.
2. Safety Description per normative standards following the ATEX Directive (94/9/EC) was prepared by: MESCO Engineering GmbH, Wiesentalstrasse 74 D-79539 Lorrach, Germany

Date of issue: 20 November 2014

Place of issue: Franklin, MA USA

  
John Czazasty  
Director of Engineering

P/N 973002  
ECO# 44422  
Rev. D

10.2 EC-TYPE EXAMINATION CERTIFICATE

**Physikalisch-Technische Bundesanstalt**  
Braunschweig und Berlin





**EC-TYPE-EXAMINATION CERTIFICATE**  
(Translation)

(1) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(2) EC-type-examination Certificate Number:  
**PTB 09 ATEX 2038 X**

(3) Equipment: Pressure transmitter, type series SPX-T and SPXGEN2

(4) Manufacturer: Dynisco Instruments

(5) Address: 38 Forge Parkway, Franklin, MA 02038, USA

(6) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(7) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential assessment and test report PTB Ex 09-29142 .

(8) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:  
**EN 60079-0:2006    EN 60079-11:2007    EN 60079-26:2007    EN 1127-1:2007**

(9) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(10) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(11) The marking of the equipment shall include the following:



 **II 1 G Ex ia IIC T6 / T4**

Zertifizierungssektor Explosionschutz  
By order:

*U. Gerlach*  
Dr.-Ing. U. Gerlach  
Oberregierungsrat



or

 **II 2 G Ex ia IIC T4 / T6**

Braunschweig, October 20, 2009

ZSEx10100e.dot

sheet 1/4

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

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Dynisco  
P/N 975161  
ECO 35645  
Rev. A

P/N: 974149 | Rev: 112016 | ECO: 47068  
[www.dynisco.com](http://www.dynisco.com)

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# Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin



(13)

## SCHEDULE

(14)

### EC-TYPE-EXAMINATION CERTIFICATE PTB 09 ATEX 2038 X

(15) Description of equipment

The pressure transmitters of type series SPX-T and SPXGEN2 are used to convert a mechanical quantity (pressure) into a proportional electrical quantity in the field of process control. Both type series are supplied by an intrinsically safe 4...20 mA current loop with superimposed digital data communication in accordance with the HART-protocol. The conditioned measured value is available as an analog 4...20 mA current signal. Type series SPX-T is optionally provided with an additional intrinsically safe 4...20 mA current loop which is used to display temperature, however, without digital data communication, as well as an optionally available secondary resistive temperature detector (RTD). HALL-switches (SPX-T) or pushbuttons (SPXGEN2) enable adjustments of Zero and Span. These are installed inside the enclosure. The transmitters may be operated as category-1- or category-2-equipment according to the specifications listed below.

#### Category-1-equipment:

For application as category-1-equipment the following marking and ambient temperatures apply:

Marking:  II 1 G Ex ia IIC T6 / T4

For relationship between maximum permissible ambient temperature, maximum permissible medium temperature and temperature class reference is made to the following table:

temperature class	T6	T4
max. permissible ambient temperature	50 °C	85 °C
max. permissible medium temperature	60 °C	85 °C

The minimum permissible ambient and medium temperature is: -20 °C.

#### Category-2-equipment:

For application as category-2-equipment the following marking and ambient temperatures apply:

Marking:  II 2 G Ex ia IIC T6 / T4

For relationship between maximum permissible ambient temperature, maximum permissible medium temperature and temperature class reference is made to the following table:

temperature class	T6	T4
max. permissible ambient temperature	60 °C	85 °C
max. permissible medium temperature	60 °C	85 °C

The minimum permissible ambient and medium temperature is: -20 °C.

sheet 2/4

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

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Dynisco  
P/N 975161  
ECO 35645  
Rev. A



# Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 09 ATEX 2038 X

Electrical data:

**SPX-T and SPXGEN2**

Supply and evaluation circuit  
(plug connector or open ended cable,  
terminals: PWR+/SIG+, PWR-/SIG- ,  
RCAL+, RCAL-)

type of protection Intrinsic Safety Ex ia IIC  
only for connection to a certified intrinsically safe  
circuit

Maximum values:

$U_i = 30 \text{ V}$   
 $I_i = 100 \text{ mA}$   
 $P_i = 750 \text{ mW}$   
 $C_i \leq 4.5 \text{ nF}$   
 $L_i \leq 40 \text{ } \mu\text{H}$

only passive components without internal power  
source and without external circuits shall be  
connected to the terminals RCAL+ / RCAL-

Sensor circuit

internal, in type of protection Intrinsic Safety

**SPX-T**

Supply and evaluation circuit  
(plug connector or open ended cable,  
terminals: PWR+/SIG+, PWR-/SIG-, RCAL+,  
RCAL-, RTD-, RTD+, RTD+  
2<sup>nd</sup> PWR+/SIG+, 2<sup>nd</sup> PWR-/SIG-)

type of protection Intrinsic Safety Ex ia IIC  
only for connection to a certified intrinsically safe  
circuit

Maximum values per circuit:

$U_i = 30 \text{ V}$   
 $I_i = 100 \text{ mA}$   
 $P_i = 750 \text{ mW}$   
 $C_i \leq 4.5 \text{ nF}$   
 $L_i \leq 40 \text{ } \mu\text{H}$

only passive components without internal power  
source and without external circuits shall be  
connected to the terminals RCAL+ / RCAL-

Sensor circuit

internal, in type of protection Intrinsic Safety

(16) Assessment and test report PTB Ex 09-29142

sheet 3/4

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • 38116 Braunschweig • GERMANY

Dynisco  
P/N 975161  
ECO 35645  
Rev. A



# Physikalisch-Technische Bundesanstalt



Braunschweig und Berlin

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 09 ATEX 2038 X

(17) Special conditions for safe use

1. The housing of the pressure transmitters, type series SPX-T and SPXGEN2 shall be connected reliably to the local equipotential bonding system.
2. Those variants of the pressure transmitters, type series SPX-T and SPXGEN2 which include the material aluminium, shall be installed in such a way that sparking as a result of impact or friction between aluminium and steel is excluded. Impact or friction between aluminium and stainless steel is allowed if the existence of rust particles can be excluded.
3. For application as category-1-equipment the connecting cable shall be equipped with a suitable conductive coating ( $R_{\text{surface}} < 10^9 \Omega$ ) to avoid possible electrostatic charge.

(18) Essential health and safety requirements

met by compliance with the standards mentioned above

Zertifizierungssektor Explosionschutz  
By order:

Braunschweig, October 20, 2009

  
Dr.-Ing. U. Gerlach  
Oberregierungsrat



sheet 4/4

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • 38116 Braunschweig • GERMANY

Dynisco  
P/N 975161  
ECO 35645  
Rev. A



### 10.3 EXFM CERTIFICATE OF COMPLIANCE – SPX2XXX/5XXX



FM Approvals  
1151 Boston Providence Turnpike  
P.O. Box 9102 Norwood, MA 02062 USA  
T: 781 762 4300 F: 781-762-9375 www.fmapprovals.com  
Member of the FM Global Group

## CERTIFICATE OF COMPLIANCE

### HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT

This certificate is issued for the following equipment:

**228aEbcDefghi. SPX Smart Pressure Transmitter**

XP/II/1/ABCD/T5 Ta=85C, T6 Ta=60C  
DIP/II,III/1/EFG/T5 Ta=85C, T6 Ta=60C; Type 4X\*, IP67\*  
a = Accuracy 0, 1, or 2.  
b = Pressure reference E, N, H, R, A, B, K, C, M, G, D, L, F, P, or S.  
c = Process connection A, B, C, D, E, F, G, H, K, L, M, N, P, R, or S.  
d = Cable length code (one digit alpha-numeric)  
e = Wiring Connections 4 or 9.  
f = Pressure units B, C, K, M, or P.  
g = Pressure range code 10 through 32.  
h = Hart communications A, B or C.  
i = Option code (four digits alpha-numeric)  
\*If Pressure Range code is less than 14 and Pressure Reference Code (b = B, K, C, M or G) then Type 4X and IP67 ratings are not included.

**229aEbcdefghCiZzj. SPX Smart Pressure Transmitter**

XP/II/1/ABCD/T5 Ta=85C, T6 Ta=60C  
DIP/II,III/1/EFG/T5 Ta=85C, T6 Ta=60C; Type 4X, IP67  
a = Mounting configuration 0, 1, or 2.  
b = Process diaphragm material (one digit alpha-numeric).  
c = Process connection code (two digits alpha-numeric).  
d = Pressure units B, C, K, M, or P.  
e = Pressure range 08 through 23.  
f = Rigid snout length code (two digits alpha-numeric).  
g = Flex length code (two digits alpha-numeric).  
h = Hart communications A, B or C.  
i = Cable length code (one digit alpha-numeric).  
j = Option codes (four digits alpha-numeric).



**2241EabcdefgChZZi. SPX Smart Pressure Transmitter**

XP/II/1/ABCD/T5 Ta=85C, T6 Ta=60C  
DIP/II,III/1/EFG/T5 Ta=85C, T6 Ta=60C; Type 4X, IP67  
a = Process diaphragm material (one digit alpha-numeric).  
b = Process connection code (two digits alpha-numeric).  
c = Pressure units B, C, K, M, or P.  
d = Pressure range 08 through 23  
e = Rigid snout length code (two digits alpha-numeric).  
f = Flex length code (two digits alpha-numeric).  
g = Hart communications A, B or C.  
h = Cable length code (one digit alpha-numeric).  
i = Option codes (four digits alpha-numeric).

**2242EabcdefgChZZi. SPX Smart Pressure Transmitter**

XP/II/1/ABCD/T5 Ta=85C, T6 Ta=60C  
DIP/II,III/1/EFG/T5 Ta=85C, T6 Ta=60C; Type 4X, IP67  
a = Process diaphragm material (one digit alpha-numeric).  
b = Process connection code (two digits alpha-numeric).  
c = Pressure units B, C, K, M, or P.  
d = Pressure range 08 through 27  
e = Rigid snout length code (two digits alpha-numeric).  
f = Flex length code (two digits alpha-numeric).  
g = Hart communications A, B or C.  
h = Cable length code (one digit alpha-numeric).  
i = Option codes (four digits alpha-numeric).

**2243EabcdefgChZZi. SPX Smart Pressure Transmitter**

XP/II/1/ABCD/T5 Ta=85C, T6 Ta=60C  
DIP/II,III/1/EFG/T5 Ta=85C, T6 Ta=60C; Type 4X, IP67  
a = Process diaphragm material (one digit alpha-numeric).  
b = Process connection code (two digits alpha-numeric).  
c = Pressure units B, C, K, M, or P.  
d = Pressure range 08 through 27  
e = Rigid snout length code (two digits alpha-numeric).  
f = Flex length code (two digits alpha-numeric).  
g = Hart communications A, B or C.  
h = Cable length code (one digit alpha-numeric).  
i = Option codes (four digits alpha-numeric).

**2244EabcdefgChZZi. SPX Smart Pressure Transmitter**

XP/II/1/ABCD/T5 Ta=85C, T6 Ta=60C  
DIP/II,III/1/EFG/T5 Ta=85C, T6 Ta=60C; Type 4X, IP67  
a = Process diaphragm material (one digit alpha-numeric).  
b = Process connection code (two digits alpha-numeric).  
c = Pressure units B, C, K, M, or P.  
d = Pressure range 08 through 23  
e = Rigid snout length code (two digits alpha-numeric).  
f = Flex length code (two digits alpha-numeric).  
g = Hart communications A, B or C.  
h = Cable length code (one digit alpha-numeric).  
i = Option codes (four digits alpha-numeric).



**538aEbcCdefghi. SPX Smart Pressure Transmitter**

XP/II/1/ABCD/T5 Ta=85C, T6 Ta=60C  
DIP/II,III/1/EFG/T5 Ta=85C, T6 Ta=60C; Type 4X\*, IP67\*

- a = Accuracy 0, 1, or 2.
- b = Pressure reference E, N, H, R, A, B, K, C, M, G, D, L, F, P, or S.
- c = Process connection A, B, C, D, E, F, G, H, K, L, M, N, P, R, or S.
- d = Cable length code (one digit alpha-numeric)
- e = Wiring Connections 4 or 9.
- f = Pressure units B, C, K, M, or P.
- g = Pressure range code 10 through 32.
- h = Hart communications A, B or C.
- i = Option code (four digits alpha-numeric)

\*If Pressure Range code is less than 14 and Pressure Reference Code (b = B, K, C, M or G) then Type 4X and IP67 ratings are not included.

**539aEbcdefghCiZZj. SPX Smart Pressure Transmitter**

XP/II/1/ABCD/T5 Ta=85C, T6 Ta=60C  
DIP/II,III/1/EFG/T5 Ta=85C, T6 Ta=60C; Type 4X, IP67

- a = Mounting configuration 0, 1, or 2.
- b = Process diaphragm material (one digit alpha-numeric).
- c = Process connection code (two digits alpha-numeric).
- d = Pressure units B, C, K, M, or P.
- e = Pressure range 08 through 23.
- f = Rigid snout length code (two digits alpha-numeric).
- g = Flex length code (two digits alpha-numeric).
- h = Hart communications A, B or C.
- i = Cable length code (one digit alpha-numeric).
- j = Option codes (four digits alpha-numeric).

**5341EabdefgChZZi. SPX Smart Pressure Transmitter**

XP/II/1/ABCD/T5 Ta=85C, T6 Ta=60C  
DIP/II,III/1/EFG/T5 Ta=85C, T6 Ta=60C; Type 4X, IP67

- a = Process diaphragm material (one digit alpha-numeric).
- b = Process connection code (two digits alpha-numeric).
- c = Pressure units B, C, K, M, or P.
- d = Pressure range 08 through 23
- e = Rigid snout length code (two digits alpha-numeric).
- f = Flex length code (two digits alpha-numeric).
- g = Hart communications A, B or C.
- h = Cable length code (one digit alpha-numeric).
- i = Option codes (four digits alpha-numeric).



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**5342EabcdcfgChZZi. SPX Smart Pressure Transmitter**

XP/II/1/ABCD/T5 Ta=85C, T6 Ta=60C  
DIP/II,III/1/EFG/T5 Ta=85C, T6 Ta=60C; Type 4X, IP67  
a = Process diaphragm material (one digit alpha-numeric).  
b = Process connection code (two digits alpha-numeric).  
c = Pressure units B, C, K, M, or P.  
d = Pressure range 08 through 27  
e = Rigid snout length code (two digits alpha-numeric).  
f = Flex length code (two digits alpha-numeric).  
g = Hart communications A, B or C.  
h = Cable length code (one digit alpha-numeric).  
i = Option codes (four digits alpha-numeric).

**5343EabcdcfgChZZi. SPX Smart Pressure Transmitter**

XP/II/1/ABCD/T5 Ta=85C, T6 Ta=60C  
DIP/II,III/1/EFG/T5 Ta=85C, T6 Ta=60C; Type 4X, IP67  
a = Process diaphragm material (one digit alpha-numeric).  
b = Process connection code (two digits alpha-numeric).  
c = Pressure units B, C, K, M, or P.  
d = Pressure range 08 through 27  
e = Rigid snout length code (two digits alpha-numeric).  
f = Flex length code (two digits alpha-numeric).  
g = Hart communications A, B or C.  
h = Cable length code (one digit alpha-numeric).  
i = Option codes (four digits alpha-numeric).

**5344EabcdcfgChZZi. SPX Smart Pressure Transmitter**

XP/II/1/ABCD/T5 Ta=85C, T6 Ta=60C  
DIP/II,III/1/EFG/T5 Ta=85C, T6 Ta=60C; Type 4X, IP67  
a = Process diaphragm material (one digit alpha-numeric).  
b = Process connection code (two digits alpha-numeric).  
c = Pressure units B, C, K, M, or P.  
d = Pressure range 08 through 23  
e = Rigid snout length code (two digits alpha-numeric).  
f = Flex length code (two digits alpha-numeric).  
g = Hart communications A, B or C.  
h = Cable length code (one digit alpha-numeric).  
i = Option codes (four digits alpha-numeric).

**Equipment Ratings:**

Explosionproof for Class I, Division 1, Groups A, B, C and D; dust-ignitionproof for Class II/III, Division 1, Groups E, F and G hazardous (classified) locations; indoor/outdoor (Type 4X, IP67).

**FM Approved for:**

Dynisco Inc.  
38 Forge Parkway, Franklin, MA 02038



This certifies that the equipment described has been found to comply with the following Approval Standards and other documents:

Class 3600	1998
Class 3615	2006
Class 3810	2005
IEC 60529	2004
ANSI/NEMA 250	1991

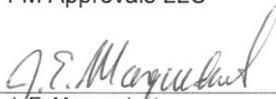
Original Project ID: 3018521

Approval Granted: July 22, 2004

Subsequent Revision Reports / Date Approval Amended

Report Number	Date	Report Number	Date
081218	January 20, 2009		
3039264	September 29, 2010		

FM Approvals LLC

  
\_\_\_\_\_  
J.E. Marquedaht  
Group Manager, Electrical

29 September 2010  
Date



## 10.4 EXFM CERTIFICATE OF COMPLIANCE – SPX 3XXX



FM Approvals  
1151 Boston Providence Turnpike  
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T: 781 762 4300 F: 781-762-9375 www.fmapprovals.com

Member of the FM Global Group

# CERTIFICATE OF COMPLIANCE

## HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT

This certificate is issued for the following equipment:

**3a42Ebcdefghijk. SPX-T Smart Pressure Transmitter.**

XP-IS / I / I / ABCD / T5 Ta=85°C, T6 Ta=60°C; - 000610  
DIP-IS / II, III / I / EFG / T5 Ta=85°C, T6 Ta=60°C; - 000610  
Type 4X, IP67

a = Accuracy Code: 2 or 3.

b = Process Diaphragm Material Code: A, B, C, D, E, F, G, H, J, K, L, M, N, P, R, S, T, U, V, W, X, or Y.

c = Process Connection Code: 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, or 15.

d = Engineering Units Code: B, C, K, M, or P.

e = Pressure Range Code: 08 to 27.

f = Rigid Snout Length Code: representing 1.19" to 36.5".

g = Flex Length Code: representing 0" to 35.3".

h = Hart Communications Code: A, B, or C.

i = Electrical Connections Code: CA, CB, CC, CD, CE, CF, CG, CW, CX, or CY.

j = Temperature Sensors Code: ZZ or TB.

k = Option Code: B106, B116, B300, B636, B676, B941, M493, M625, M640, M654, M792, M950, M998, and Zxxx (where xxx = any three digit code pertaining to output calibration settings).

**3a43Ebcdefghijk. SPX-T Smart Pressure Transmitter.**

XP-IS / I / I / ABCD / T5 Ta=85°C, T6 Ta=60°C - 000610  
DIP-IS / II, III / I / EFG / T5 Ta=85°C, T6 Ta=60°C; - 000610  
Type 4X, IP67

a = Accuracy Code: 2 or 3.

b = Process Diaphragm Material Code: A, B, C, D, E, F, G, H, J, K, L, M, N, P, R, S, T, U, V, W, X, or Y.

c = Process Connection Code: 25 to 46.

d = Engineering Units Code: B, C, K, M, or P.

e = Pressure Range Code: 08 to 27.

f = Rigid Snout Length Code: representing 1.19" to 36.5".

g = Flex Length Code: representing 0" to 35.3".



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h = Hart Communications Code: A, B, or C.  
i = Electrical Connections Code: CA, CB, CC, CD, CE, CF, CG, CW, CX, or CY.  
j = Temperature Sensors Code: ZZ or TB.  
k = Option Code: B106, B300, B676, M498, M625, M634, and Zxxx (where xxx = any three digit code pertaining to output calibration settings).

**3a9bEcd efghijkl. SPX-T Smart Pressure Transmitter.**

XP-IS / I / 1 / ABCD / T5 Ta=85°C, T6 Ta=60°C - 000610  
DIP-IS / II, III / 1 / EFG / T5 Ta=85°C, T6 Ta=60°C; - 000610  
Type 4X, IP67

a = Accuracy Code: 2 or 3.  
b = Mounting Configuration Code: 0 or 1.  
c = Process Diaphragm Material Code: A, B, C, D, E, F, G, H, J, K, L, M, N, P, R, S, T, U, V, W, X, or Y.  
d = Process Connection Code: 24, 48-68, 70-79.  
e = Engineering Units Code: B, C, K, M, or P.  
f = Pressure Range Code: 08 to 23.  
g = Rigid Snout Length Code: representing 1.19" to 18".  
h = Flex Length Code: representing 0" to 35.3".  
i = Hart Communications Code: A, B, or C.  
j = Electrical Connections Code: CA, CB, CC, CD, CE, CF, CG, CW, CX, or CY.  
k = Temperature Sensors Code: ZZ or TB.  
l = Option Code: B106, B300, B676, M625, and Zxxx (where xxx = any three digit code pertaining to output calibration settings).

**Equipment Ratings:**

Explosionproof with Intrinsically Safe probe for use in Class I, Division 1, Groups A, B, C and D;  
Dust-Ignitionproof with Intrinsically Safe probe for use in Class II, III, Division 1, Groups E, F and G Hazardous (Classified) Locations; in accordance with Control Drawing No. 000610;  
indoor/outdoor type 4X and Ingress Protection IP67.

**FM Approved for:**

Dynisco Incorporated  
Franklin, MA, 02038, USA



This certifies that the equipment described has been found to comply with the following Approval Standards and other documents:

Class 3600	1998
Class 3615	2006
Class 3610	2007
Class 3810	2005
ANSI/NEMA 250	1991
ANSI/IEC-60529	2004

Original Project ID: 3035512

Approval Granted: June 24, 2009

Subsequent Revision Reports / Date Approval Amended

Report Number	Date	Report Number	Date
090701	July 8, 2009		

FM Approvals LLC

  
Robert L. Martell, Jr.  
Director

  
Date

## 10.5 Safety Integrity and Performance Level Applications

# Certificate

Product: Safety  
Functional  
Safety  
  
www.tuv.com  
ID: 360000000

### No.: 968/FSP 1205.01/16

<b>Product tested</b>	Pressure Transmitter and Transducer	<b>Certificate holder</b>	Dynisco 38 Forge Parkway Franklin, MA 02038 USA
<b>Type designation</b>	SPX 2xxx-..., SPX 3xxx-... (with linearity correction and process temperature compensation) (SPX-T 3xxx), SPX 4xxx-..., SPX 5xxx-... (with linearity correction) (SPX-L 5xxx), each optionally with separate monitoring channel for over-pressure (Guardian series, option code at the end of the model code: GCxxx)		
<b>Codes and standards</b>	IEC 61508 Parts 1-7:2010 IEC 61511-1:2016	IEC 62061:2015 ISO 13849-1:2015	
<b>Intended application</b>	Pressure measurement and monitoring, 4 - 20mA output proportional to the pressure. The transmitters meet the requirements for SIL 1 and SIL 2 (low demand mode of operation) in HFT=0 architecture and SIL 2 (any mode of operation) in HFT=1 architecture acc. to IEC 61508 and IEC 61511-1 (Route 2) and may be used accordingly. They further meet in a HFT=0 architecture SIL 1 and in HFT=1 SIL 2 requirements of IEC 62061. The monitoring channel in the Guardian Series Transducers meets Cat. 1 / PL c acc. to ISO 13849-1 and may be used accordingly in safety functions up to PL c and SIL 1 acc. to IEC 62061/IEC 61508/IEC 61511-1. If 2 monitoring channels are used (HFT = 1 architecture), they may be used in safety functions up to PL d and SIL 2.		
<b>Specific requirements</b>	The instructions of the associated Operating Manual and the Datasheets shall be considered. Further information see page 2 of this certificate.		
<b>Valid until</b>	2021-06-20		

The issue of this certificate is based upon an examination, whose results are documented in Report No. 968/FSP 1205.01/16 dated 2016-06-20.  
This certificate is valid only for products which are identical with the product tested. It becomes invalid at any change of the codes and standards forming the basis of testing for the intended application.

**TÜV Rheinland Industrie Service GmbH**  
Bereich Automation  
Funktionale Sicherheit  
Am Grauen Stein, 51105 Köln

Köln, 2016-06-20

Dipl.-Ing. Heinz Gall

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www.tuv.com

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TÜV Rheinland Industrie Service GmbH, Am Grauen Stein, 51105 Köln / Germany  
Tel.: +49 221 806-0190, Fax: +49 221 806-1008, E-Mail: industrie@tuv.com



**Safety function:** Measuring of pressure and output of an analogue signal 4 – 20mA proportional to the volume pressure applied to the sensor. The total valid range of the output signal shall be configured to a minimum of 3.8 mA and a maximum of 20.5 mA (Factory Default).

The safety related function of the transmitter is the safe measurement of the pressure with a tolerance of  $\pm 0.5\%$  of the span (worst-case). Monitoring for an excessive pressure condition has to be performed in the downstream safety device, the transmitter is connected to. This safety device has to treat output currents lower than 3.6 mA or greater than 21 mA as failure conditions. It must be configured to recognize the configured pressure range for the high alarms or low alarms as a safety trip and secondary alarms as defined by NAMUR are diagnostic failure.

The transmitters of the Guardian Series contain a separate HW monitoring channel for excessive pressure. In case the configured over-pressure value is exceeded the contact of the output relay opens. It has to be considered, that it is not allowed to use the analogue output of a combi-transmitter for the control of a pressure and the monitoring output of the same transmitter for monitoring of an over-pressure condition at the same machine. In this case 2 different devices have to be used (see EN 1114-1, cl. 5.2.5).

Characteristics as per IEC 61508	Value	
SIL	SIL 2 (HFT = 0 architecture, 1oo1)	
Device Type	B	
Mode of operation	Low demand mode	
SFF	SPX Series 2	78 %
	SPX Series 3	79 %
	SPX Series 4	78 %
	SPX Series 5	78 %
	SPX Series Industrial	78 %
	Guardian	71 %
Recommended time interval for proof-testing T1	1 year	
PFD <sub>avg</sub> for T1 = 1 year	SPX Series 2	4.8x10 <sup>-6</sup>
	SPX Series 3	2.1x10 <sup>-6</sup>
	SPX Series 4	4.8x10 <sup>-6</sup>
	SPX Series 5	4.8x10 <sup>-6</sup>
	SPX Series Industrial	4.8x10 <sup>-6</sup>
	Guardian	4.8x10 <sup>-6</sup>
PFH	SPX Series 2	2.2x10 <sup>-8</sup> 1/h
	SPX Series 3	9.4x10 <sup>-9</sup> 1/h
	SPX Series 4	2.2x10 <sup>-8</sup> 1/h
	SPX Series 5	2.2x10 <sup>-8</sup> 1/h
	SPX Series Industrial	2.2x10 <sup>-8</sup> 1/h
	Guardian	2.3x10 <sup>-8</sup> 1/h
$\lambda_{tot}$	SPX Series 2	99.2 FIT
	SPX Series 3	44.6 FIT
	SPX Series 4	99.2 FIT
	SPX Series 5	99.2 FIT
	SPX Series Industrial	99.2 FIT
	Guardian	79.6 FIT
$\lambda_a$	SPX Series 2	77.2 FIT
	SPX Series 3	35.1 FIT
	SPX Series 4	77.2 FIT
	SPX Series 5	77.2 FIT
	SPX Series Industrial	77.2 FIT
	Guardian	56.5 FIT
$\lambda_d$	SPX Series 2	22.0 FIT
	SPX Series 3	9.4 FIT
	SPX Series 4	22.0 FIT
	SPX Series 5	22.0 FIT
	SPX Series Industrial	22.0 FIT
	Guardian	23.2 FIT
$\lambda_{du}$	SPX Series 2	22.0 FIT
	SPX Series 3	9.4 FIT
	SPX Series 4	22.0 FIT
	SPX Series 5	22.0 FIT
	SPX Series Industrial	22.0 FIT
	Guardian	23.2 FIT

1 FIT = 1 E-09 1/h

**Remark:** Failure rates of the electronic components as per Siemens SN 29500, calculated based upon an ambient temperature of 85 °C.

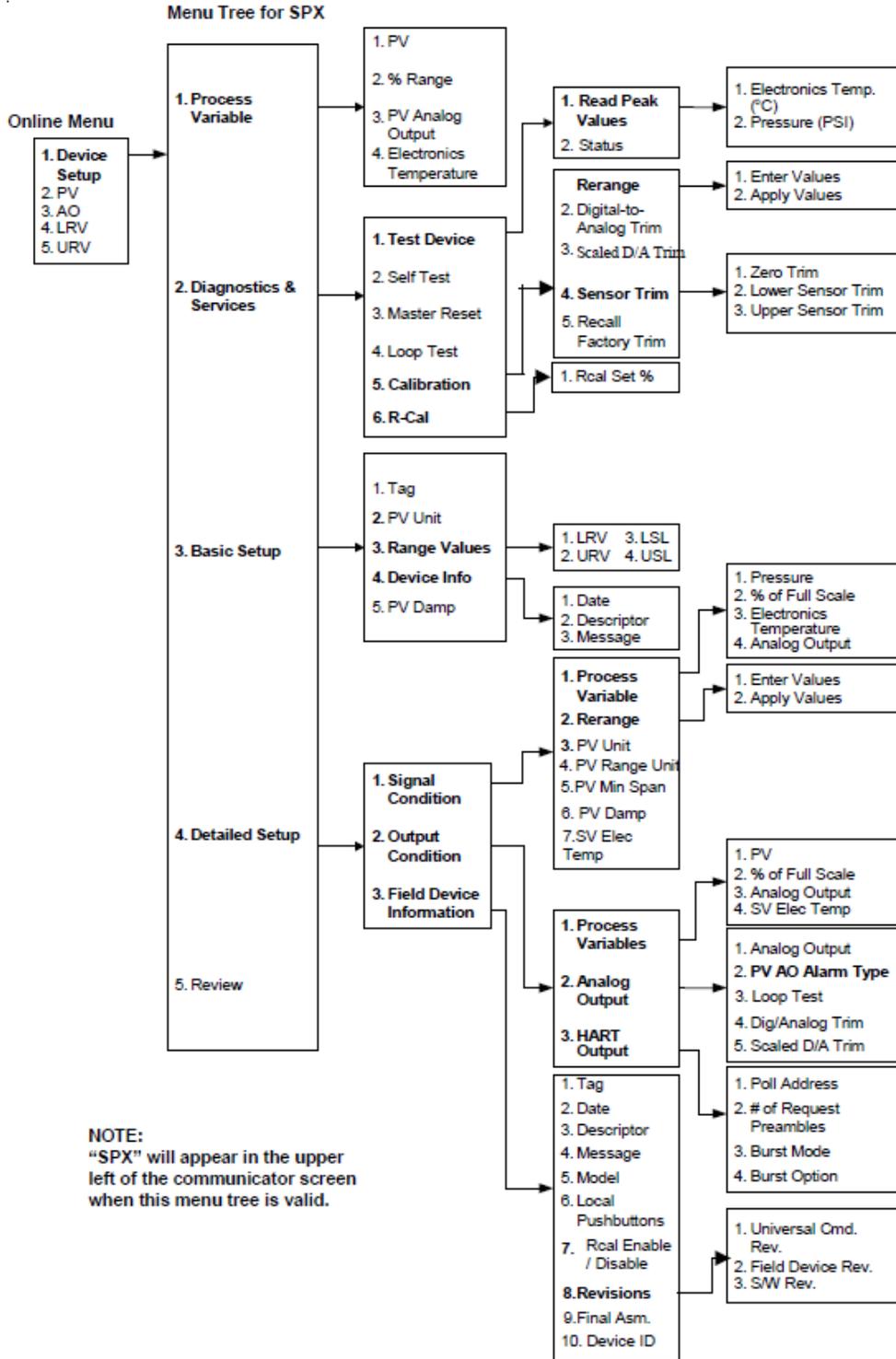


## 11 APPENDIX 1 - DEFAULT VALUES

Variable	Default Value	Access	Options
Analog Output Alarm Flag	High	RW	High Low Hold Last
Burst Command Enable	Off	RW	
Burst Option Variable	PV	RW	
Date of Last Factory Calibration	Date of Calibration	RO	
User Selectable Date	Date of Calibration	RW	
Manufacturer Identification Code	0 x 72	RO	
Dev ID (Device Identifier)	Unique number set by Factory	RO	
Final Assembly Number	<BLANK>	RW	
Local Push-button Enable	Enable	RW	Enabled Disabled
Factory Default LRV	0	RO	
Lower Sensor Limit	-0.04 * full scale of SPX 3XXX	RO	
Message Text	HTTP://WWW.DYNISCO.COM/	RW	
PV Minimum Span Value	Factory Default PV_URV divided by 5	RO	
Number of Request Preambles	5	RW	
PV Damping Constant Value	0 Seconds	RW	0-30
PV Lower Range Value	0	RW	0-30
PV Engineering Unit Code	Per Customer Order	RW	0 x 06 – PSI 0 x 07 – Bar 0 x 0A – kg/cm <sup>2</sup> 0 x 39 – % of FS 0 x ED – MPa
PV Upper Range Value	Full scale (same as on label)	RW	
PV Transfer Function Code	Linear	RO	
Rcal Calibration Percentage	80%	RW	20 - 100%
Field Device Serial Number	As Set at Factory	RO	
Tag	?	RW	
Transmit Address	0	RW	0 - 15
Factory Default URV	Per Customer Order	RO	
Upper Sensor Limit	1.5 * full scale of SPX	RO	



## 12 APPENDIX 2 – Menu Tree (Software Revision < 100)



Menu

Tree for software revision < 100



### 13 APPENDIX 3 – Oil Fill Offset

An oil-filled sensor has the advantage of being non-toxic and therefore compliant for many food, medical or other critical applications. A disadvantage of an oil-filled system is that the organic oil fill can degrade over time at high temperatures. Over a period of months and continuously operating at elevated temperatures (>275°C / 525°F), some long chain molecules in the oil can degrade and generate gas molecules. While in continued operation, these gases remain in solution in the oil and have no effect on the performance of the sensor. However, if/when the sensor is returned to room temperature and zero pressure, the gas may come out of the solution (outgas) over a short period of time (minutes to hours), creating a bubble(s) in a closed fill system. At non-operating room temperature and zero pressure, the gas exerts a small additional pressure (on the order of 50-100 psi) and results in an apparent increase in the Zero Output. Therefore, the gas offset error represents a higher percentage effect in lower versus higher pressure range systems. The actual magnitude will depend on the percentage of oil which has degraded over time at temperature.

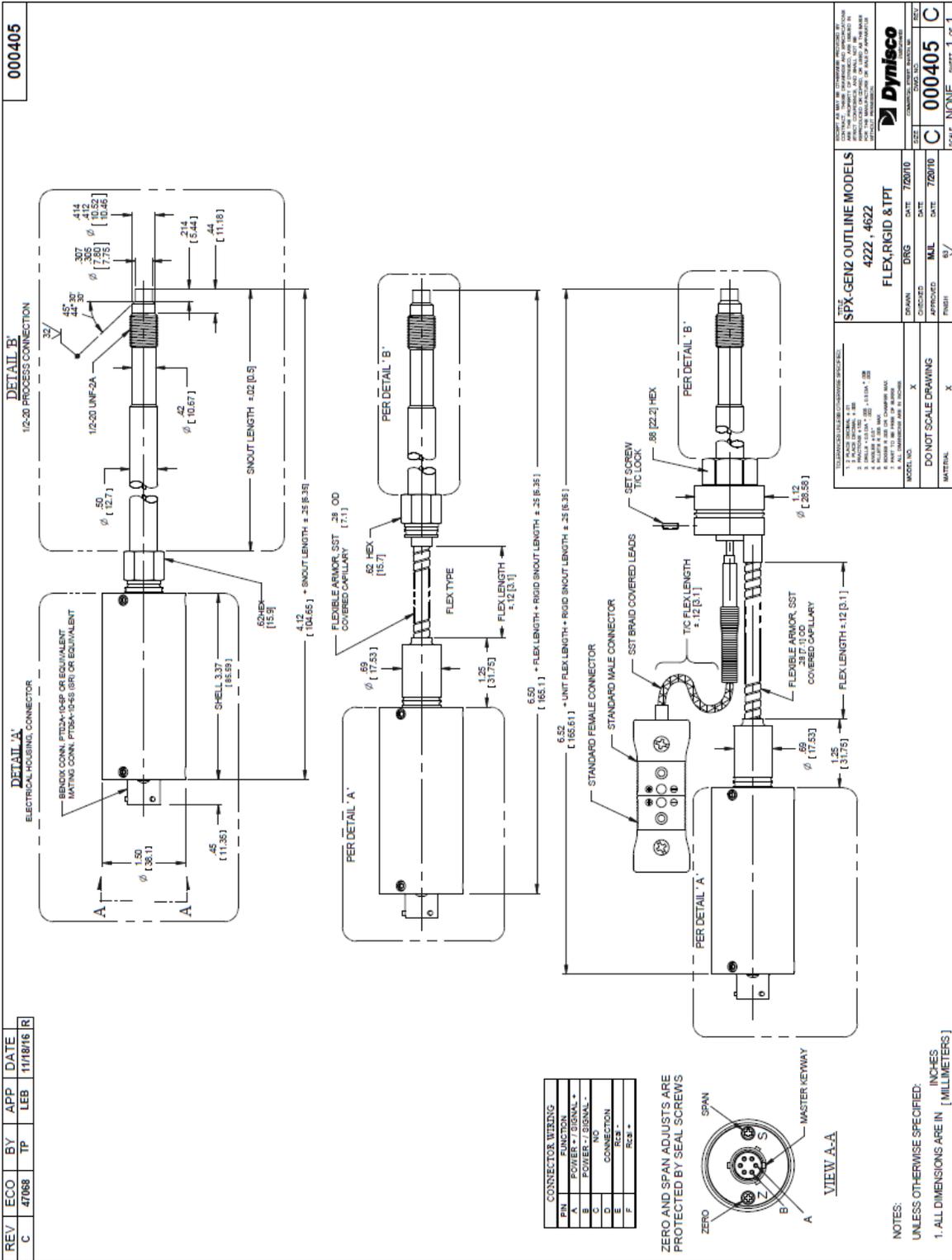
When the sensor is returned to operation with increased pressure and temperature, the gas bubble(s) will go back into solution. Testing has shown that the gas is typically reabsorbed with temperatures exceeding 100°C / 212°F. With the gas reabsorbed, the sensor is reading the true pressure at specified accuracies. When the sensor is installed and brought to operating temperature and before applying pressure, it can then be re-zeroed without any impact on the calibration accuracy.

#### Recommended Zero Adjustment

Prior to performing a zero adjustment, it is recommended that the system is installed and the equipment brought to process temperature (<100°C) at or near zero pressure. This will allow any gas to be absorbed into the oil and eliminate offset effects.

If a zero adjustment is conducted at less than 100°C (e.g., bench calibration test port), briefly pressurize to >/=150 psi/10 bar, then depressurize the system prior to performing the zero adjustment.

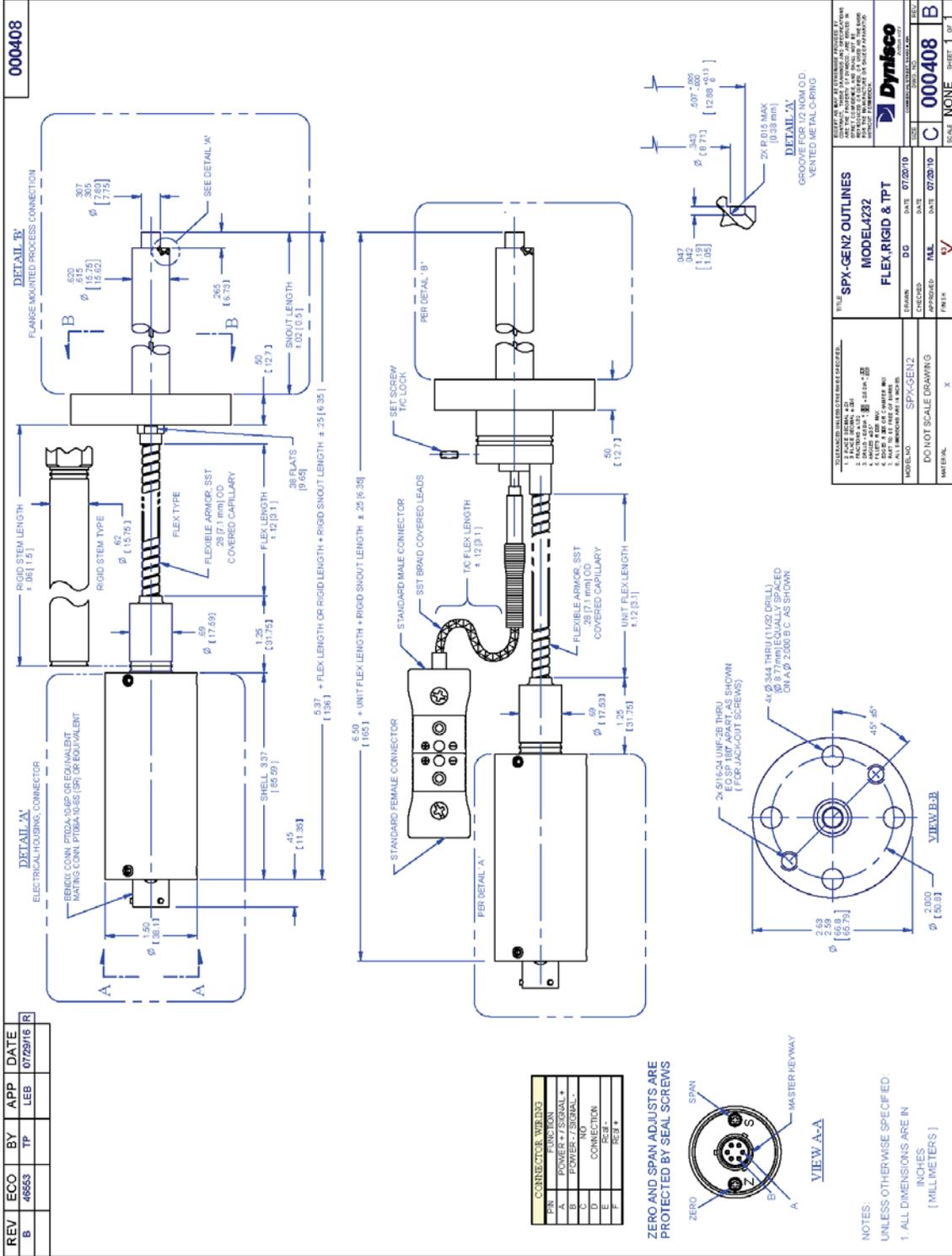
Pressurizing following by depressurizing will temporarily allow any gas to be absorbed into the oil and eliminate offset effects. Verify that the zero output value will be repeated by reapplying pressure to >/=150 psi/10 bar followed by depressurizing.



REV ECO BY APP DATE 000405  
C 47068 TP LEB 11/18/16 R

TIC SPA-GEN2 OUTLINE MODELS 4222, 4622 FLEX, RIGID & TPT		DATE: 7/20/10
DESIGNED	DATE: 7/20/10	REV: C
APPROVED	M.L.	SCALE: NONE
DO NOT SCALE DRAWING		SHEET 1 OF 1
MATERIAL		

**Dynisco**  
DYNISCO, INC.  
10000 W. 11TH AVENUE, SUITE 100  
DENVER, CO 80231  
TEL: 303.440.1000  
WWW.DYNISCO.COM





REV	ECO	BY	APP	DATE		000411
B	46653	TP	LEB	07/29/16		

ZERO AND SPAN ADJUSTS ARE PROTECTED BY SEAL SCREWS

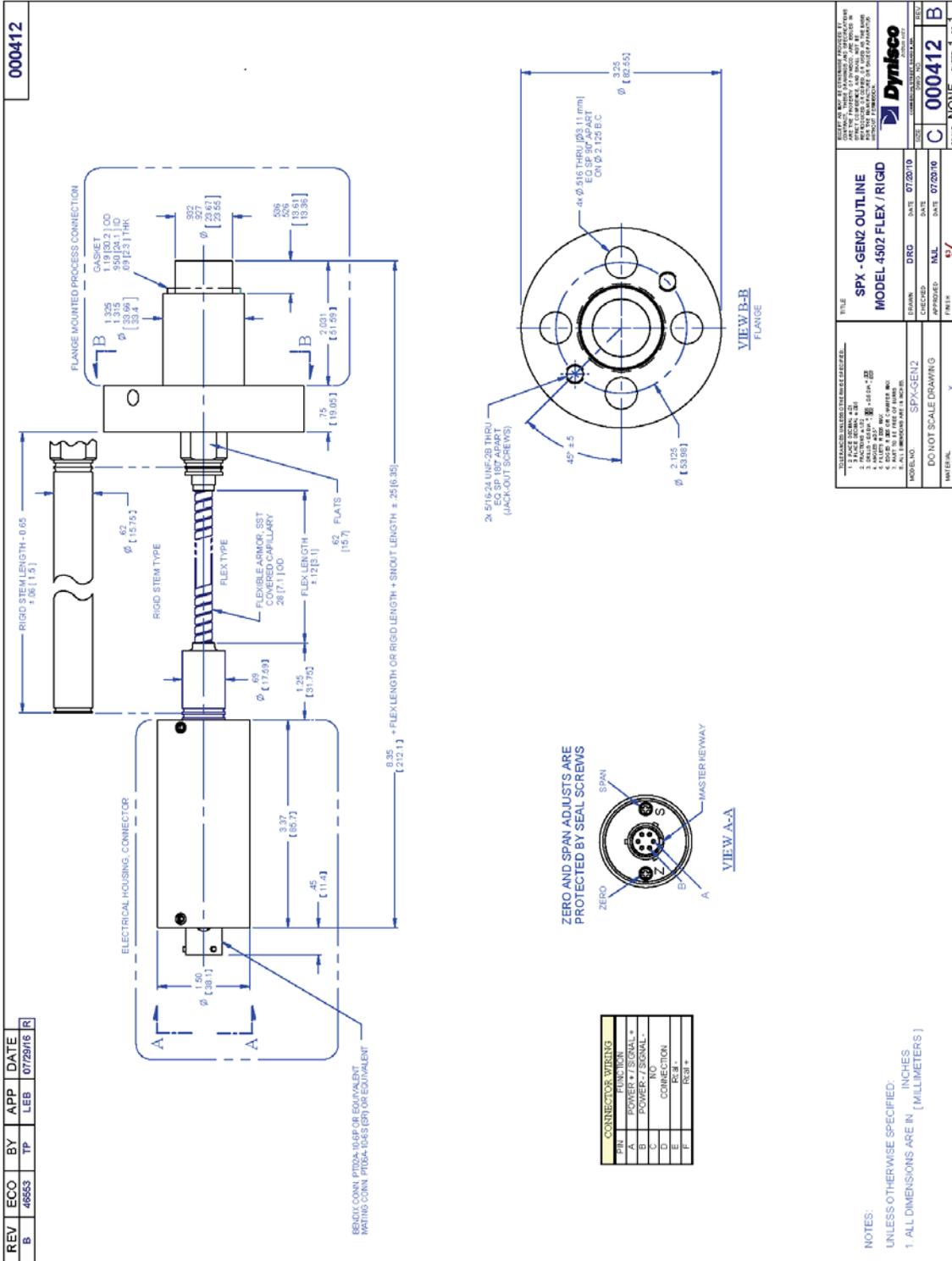
CONNECTOR WIRING	
PIN	FUNC. I/O
A	POWER + / SIGNAL +
B	POWER - / SIGNAL -
C	NO CONNECTION
D	NO CONNECTION
E	RES +
F	RES -

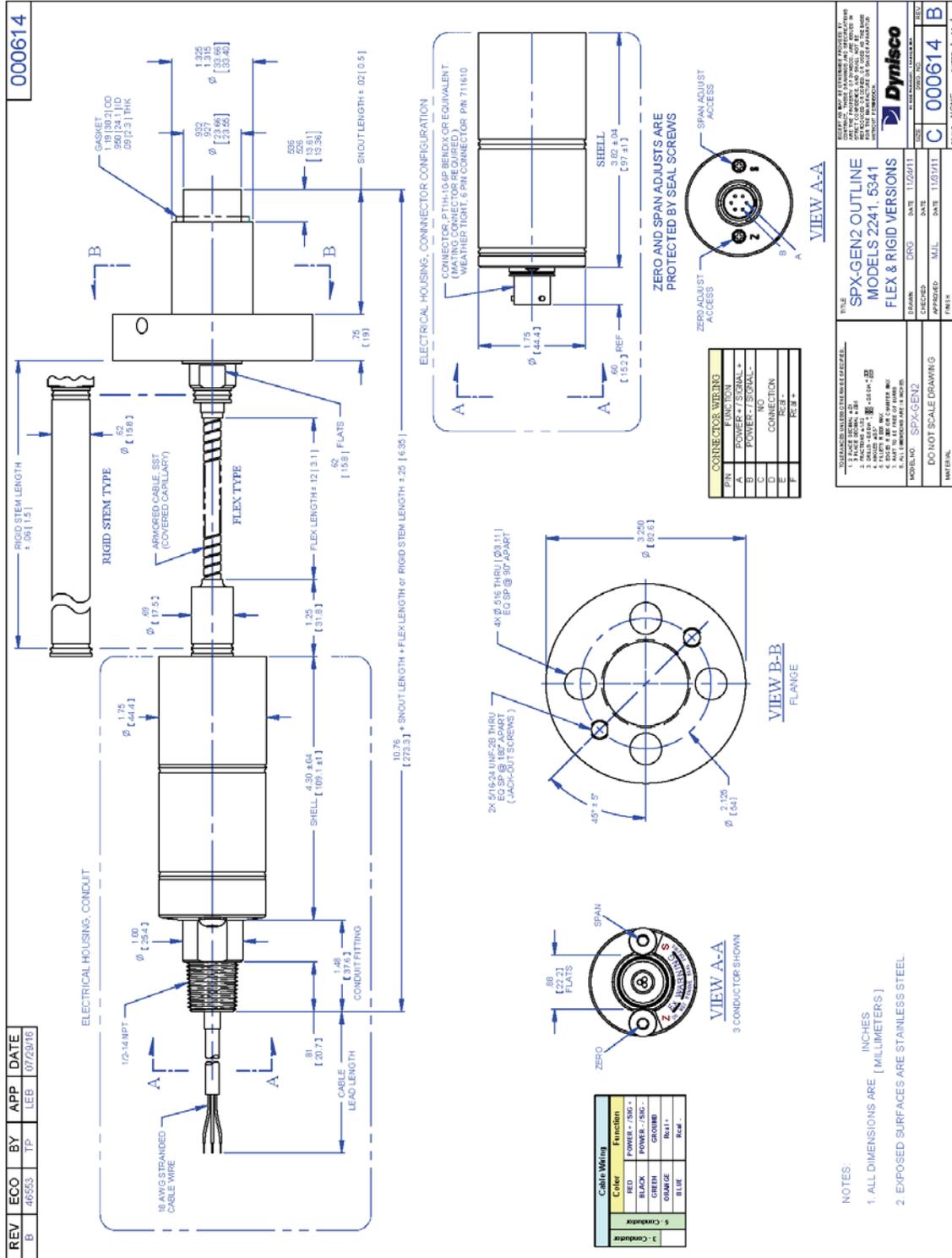
  

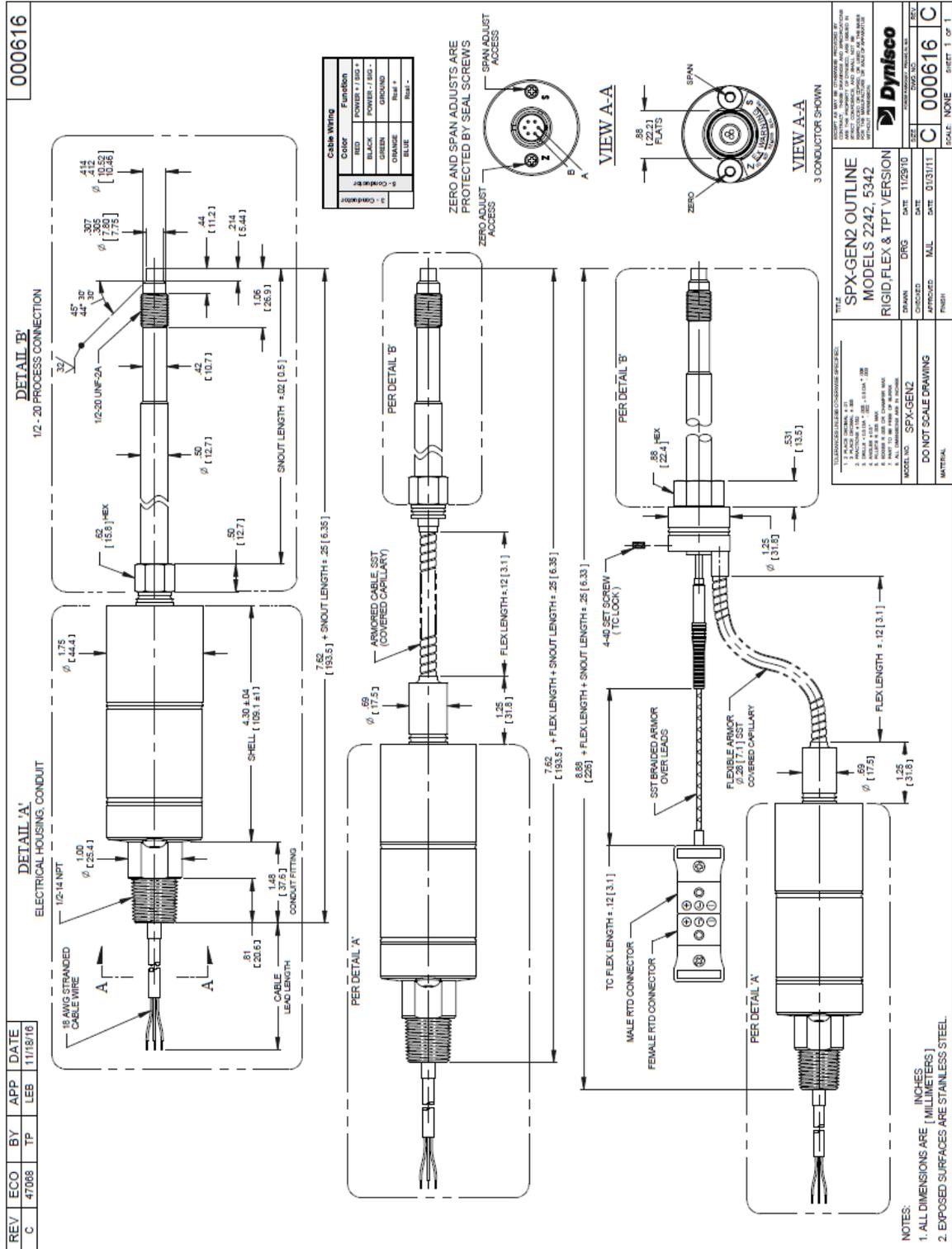
<p>NOTES:</p> <p>UNLESS OTHERWISE SPECIFIED, INCHES [ MILLIMETERS ]</p> <p>1. ALL DIMENSIONS ARE IN [ MILLIMETERS ]</p>	
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<p>FILE: OUTLINE DRAWING</p> <p>SPX4352-GEN2</p> <p>SPX4672-GEN2</p>	
<p>DESIGNED BY: [REDACTED]</p> <p>DATE: 06/15/10</p>	<p>DRG: [REDACTED]</p> <p>DATE: 06/15/10</p>
<p>CHECKED BY: [REDACTED]</p> <p>DATE: 08/12/10</p>	<p>APPROVED BY: [REDACTED]</p> <p>DATE: 08/12/10</p>
<p>FINISH: [REDACTED]</p> <p>SCALE: NONE</p>	<p>SHEET: 1 OF 1</p>





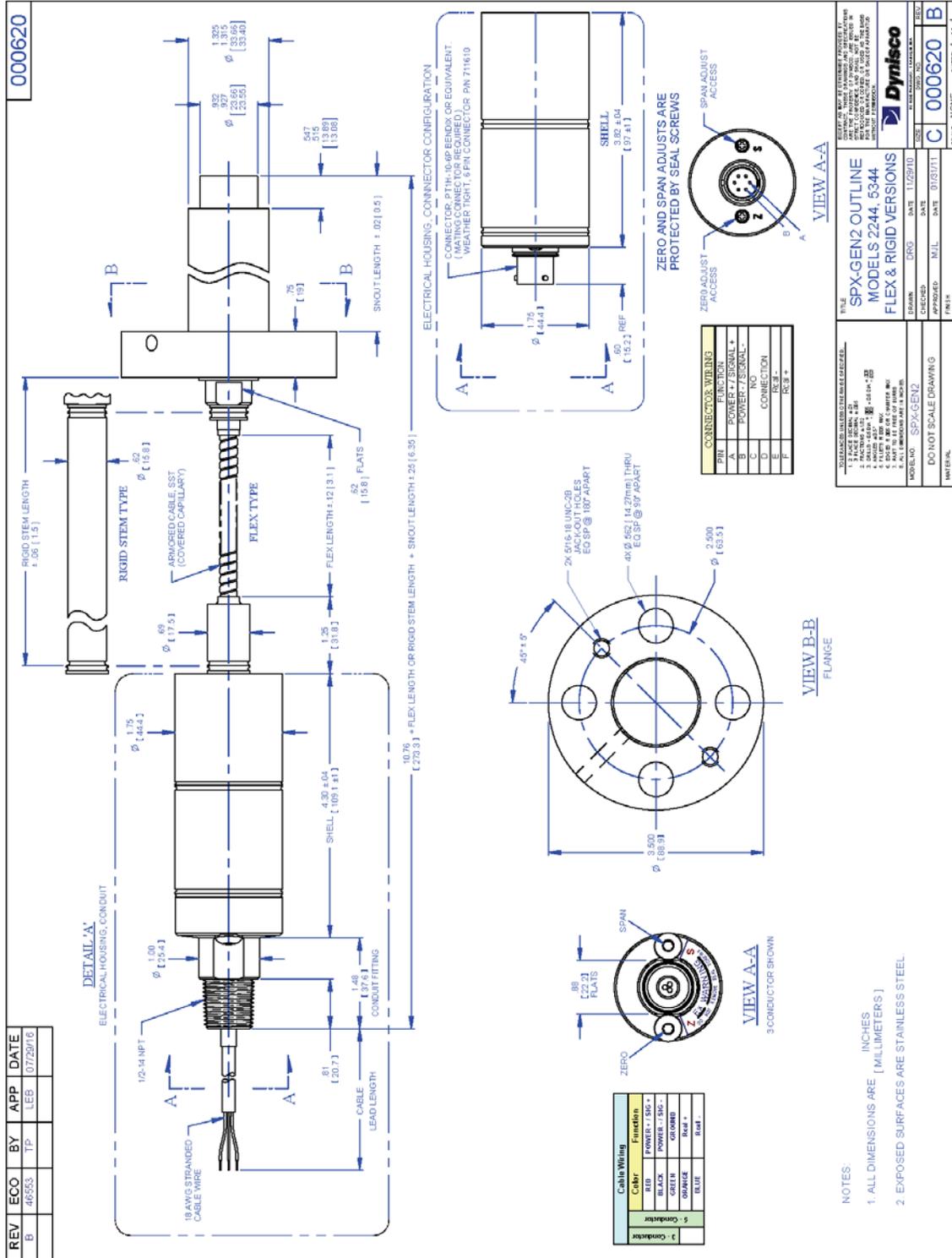


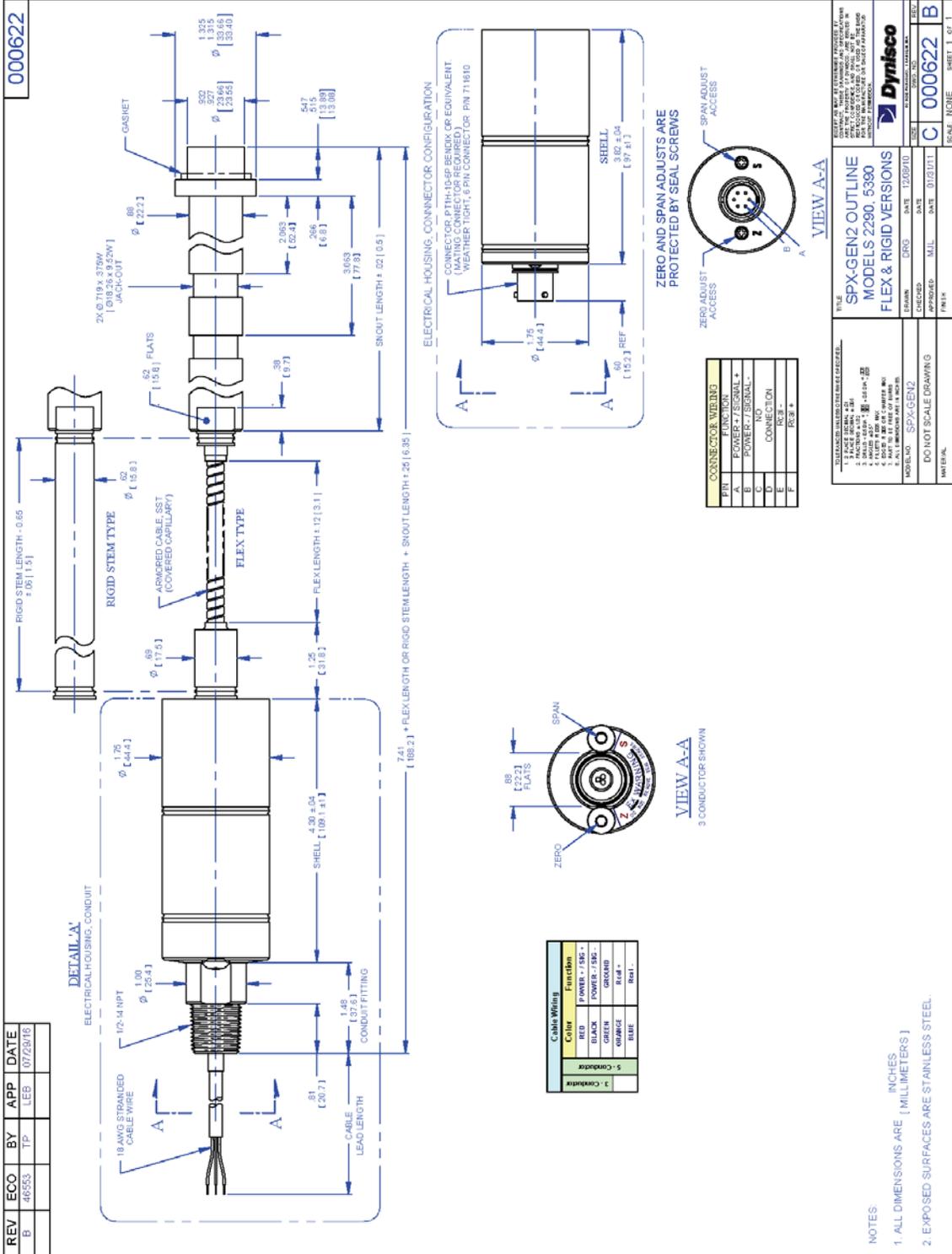
000616

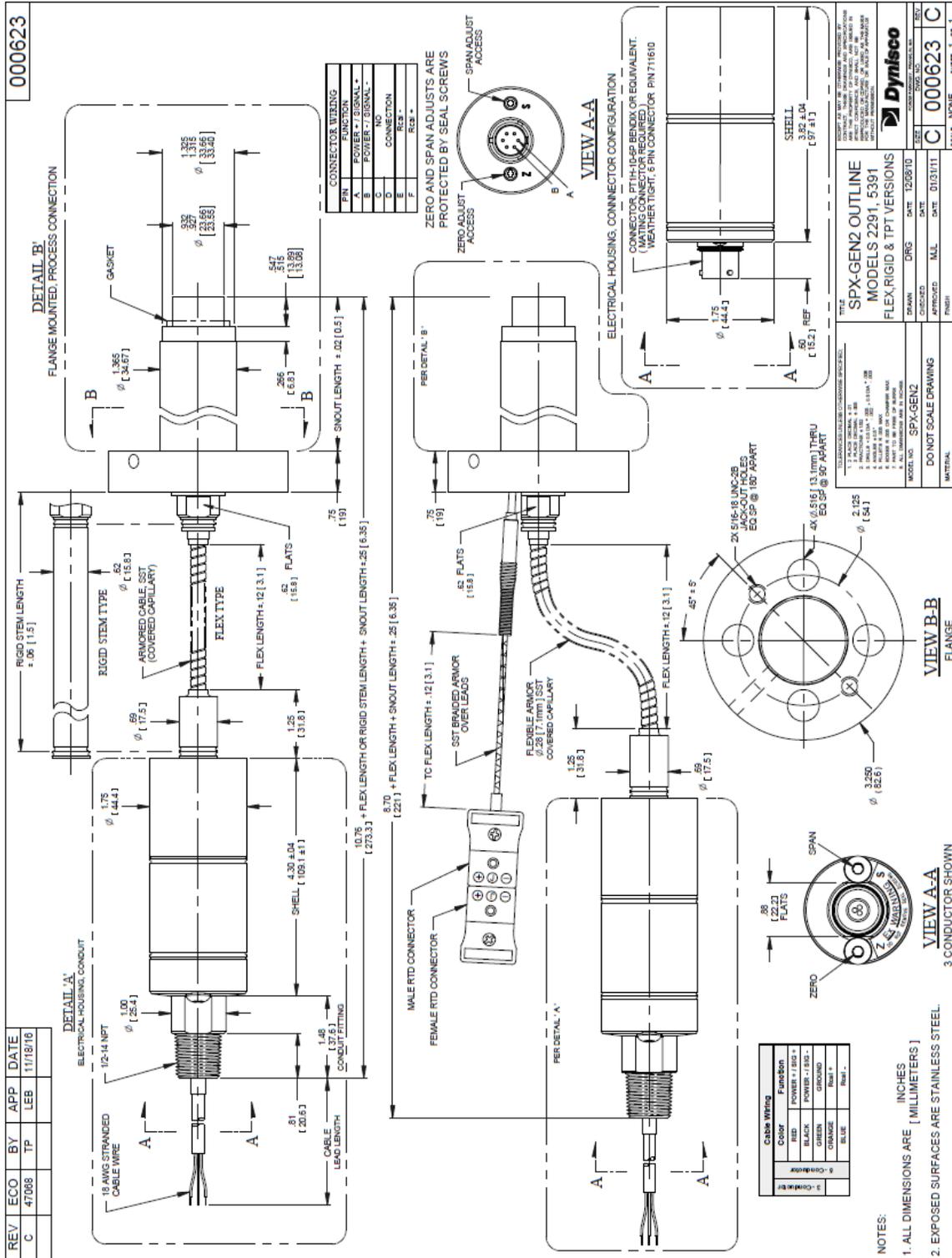
REV	ECO	BY	APP	DATE
C	47068	TP	LEB	11/18/16

TITLE		SPX-GEN2 OUTLINE	
MODEL NO.		MODELS 2242, 5342	
REV.		RIGID/FLEX & TPT VERSION	
DRWN	DRG	DATE	11/28/10
ISSUED	MAL	DATE	01/31/11
FINISH			
MATERIAL		DO NOT SCALE DRAWING	
SCALE		NONE	
SHEET		1 OF 1	







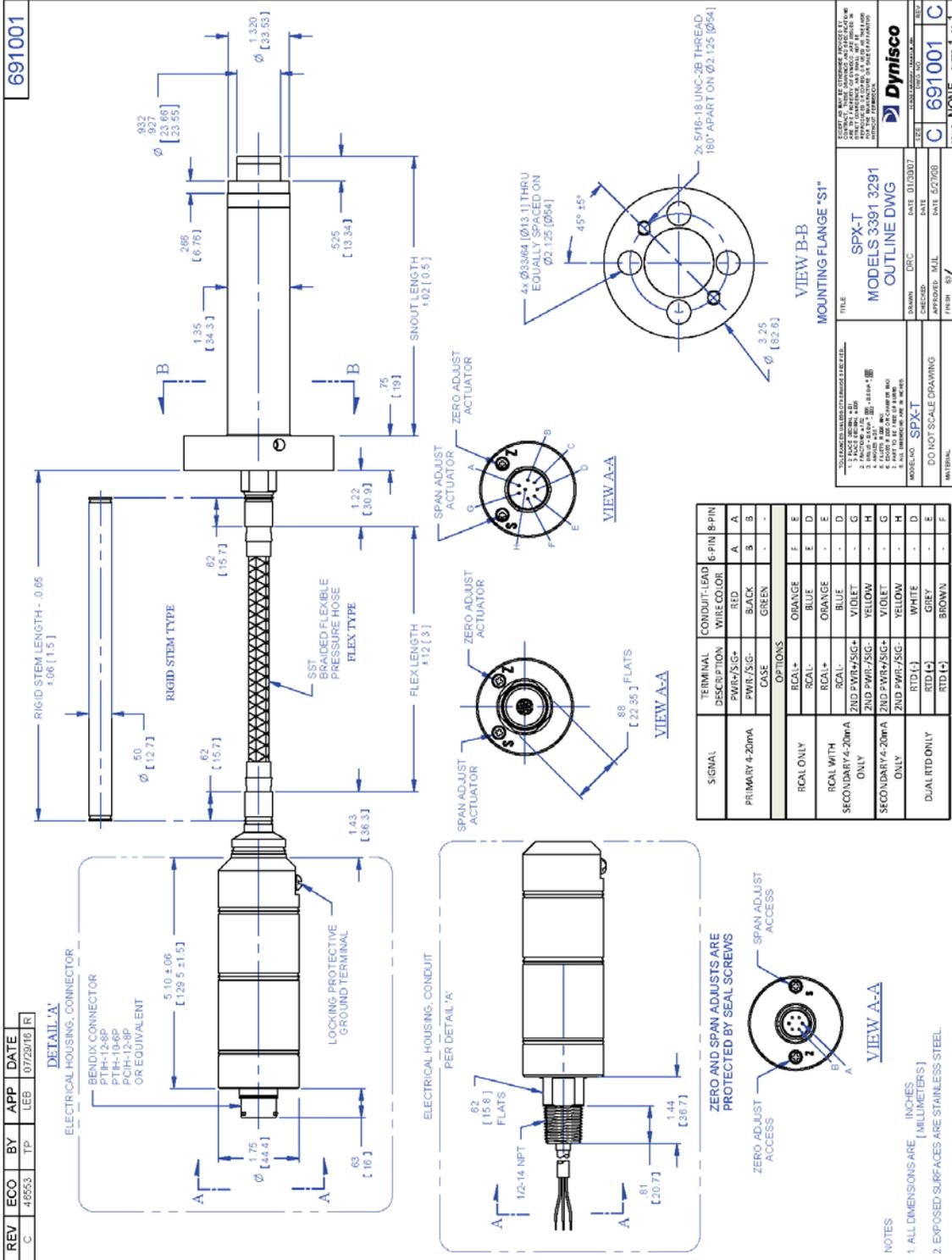












REV A	ECO 46553	BY TP	APP LEB	DATE 07/29/16	R	000652																																																		
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<p><small>EXCEPT AS MAY BE OTHERWISE INDICATED BY NOTES, ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.</small></p> <ol style="list-style-type: none"> <li>1. 2 PLACE DECIMAL &amp; 05</li> <li>2. FRACTIONS 1/32, 1/16, 1/8, 3/16, 1/4, 5/16, 3/8, 7/16, 1/2, 5/8, 3/4, 7/8</li> <li>3. DIMENSIONS IN PARENTHESIS ARE FOR REFERENCE ONLY</li> <li>4. DIMENSIONS IN PARENTHESIS ARE FOR REFERENCE ONLY</li> <li>5. FILLETS R .006 MAX.</li> <li>6. ALL DIMENSIONS ARE IN INCHES</li> <li>7. PART TO BE FREE OF BURRS</li> <li>8. ALL DIMENSIONS ARE IN INCHES</li> </ol>																																																								
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*From lab to production,  
providing a window into the process*



## DYNISCO CONTACT INFORMATION

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