

# Overcoming the challenge of obsolete pressure transmitters in aging nuclear power plants

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## Ultra Energy

We understand the challenge of operating an aging nuclear plant, including the issues that obsolescence creates. You're under political and financial pressure to generate power with minimum interruption so you need a reliable supply of easy-to-install replacement parts. Yet some of the parts you rely on were designed decades ago and are no longer manufactured.

Ultra Energy's strength in nuclear qualified pressure and temperature products emanates from our 2008 acquisition of Weed Instrument, one of the original specialists in that field. Our combined organization retains a focus on high-integrity instrumentation. We know product safety and reliability are paramount, while also understanding the importance of continuous supply.

A great example of how we help the nuclear industry overcome the challenges associated with aging and obsolescence is our DTC3 pressure transmitter. Designed as a drop-in replacement for the almost ubiquitous but now discontinued Rosemount™ 1151. In this white paper, we explore the issues created when critical parts, such as the 1151, are no longer available and offer reasons to use Ultra Energy as a supplier, including for the DTC3.

## America's nuclear plant obsolescence challenge

The US has the largest fleet of nuclear plants in the world. With most of our fleet having been built in the 1960s and 1970s, we are now experiencing a growing obsolescence problem, including with installed pressure transmitters.

Pressure transmitters are critical to the operation of nuclear plants because they provide pressure, level and flow measurements for a variety of applications in the steam plant, turbine island and balance of plant areas. A nuclear power plant typically needs 400 to 600 precision pressure and differential transmitters to function properly. They deliver operational performance and efficiency, reduce downtime, and, most importantly, support safety within power plants. However, obsolete pressure transmitters – discontinued from manufacture and no longer supported – are in use throughout our aging fleet today.

The Rosemount 1151 pressure transmitter made its debut in 1969, the same year Neil Armstrong walked on the moon. At that time, the Rosemount pressure transmitter offered an unprecedented degree of stability, reliability, and accuracy and served as a replacement for older pneumatic and electric transmitters that were subject to early degradation, which compromised response time and accuracy.

The Rosemount 1150 series (1151, 1152, 1153, and 1154) captured a majority market share in the US nuclear industry, becoming the de facto industry standard for nuclear pressure measurement. However, after 40 years in manufacture, the Rosemount 1151 pressure transmitter was discontinued.

The loss of supply resulted in the industry taking a 'wait and see' stance, which translates into continued use of aging and obsolete pressure transmitters. In a representative sample of the industry we researched in 2020, the Rosemount 1151 pressure transmitter still comprised 52% of in-use equipment in both boiling water reactors (BWR) and pressurized water reactors (PWR).



# Overcoming the challenge of obsolete pressure transmitters in aging nuclear power plants

## Why analog pressure transmitters remain the best choice

We know that nuclear operators want a cost effective obsolescence solution that reduces station risk and vulnerabilities associated with equipment reliability, at the same time as minimizing implementation and servicing hassle. Analog transmitters remain a great technology because they fulfill functional requirements, are simple to use and have proven to be very reliable.

Of course, there are modern alternatives to analog, but as we say in this industry, 'friends don't let friends go digital'. While using digital pressure transmitters for mild environments or non-safety applications is certainly an option, the resources required to deal with the complexities of such a change, like the significant training time and drastically different calibration procedures, don't exist. The reality is that the nuclear industry is under pressure to remain economically viable while competing with natural gas and subsidized renewable energy sources, and the cost of changing to digital is simply too high.

In short, operators appreciate the benefits of analog transmitters and want to continue using them. With that being the case, they have three

options:

- High cost, nuclear-qualified Class 1E analog pressure transmitter for non-safety or Risk 3 applications
- Continue to refurbish aging 1151 transmitters
- Find an equivalent new analog pressure transmitter

To stay with analog electronics, some operators have invested in premium nuclear grade transmitters, each of which costs tens of thousands of dollars, even for non-safety applications. These high-cost options are not sustainable. In many cases, the total cost of the engineering change outweighs the procurement cost of the basic components. Rosemount introduced a new line of analog pressure transmitters in the 3150 Series but the range codes changed. Plants were forced to do an equivalency evaluation to specify a replacement transmitter. In one case, a contractor charged a utility over \$100k for an equivalency evaluation.

More commonly, we have found that plant engineers are continuing to attempt to replace discontinued Rosemount transmitters. In December 2019, there were fewer than 700 such transmitters available in the secondary market. The available supply is already low so will disappear altogether soon. This approach has not much road left to run. For example, operators of the Point Lepreau Nuclear Generating Station in Canada tried to use the Rosemount 1151 transmitters as long as possible. The plant opened in 1982 and has 182 operational pressure transmitters. Eventually, plant managers had increasing difficulty trying to refurbish the 1151 transmitters, so they embarked on a very costly upgrade that most operators today simply can't afford.

## Selecting an equivalent new analog pressure transmitter

Selecting an equivalent new analog pressure transmitter is theoretically a better option than changing up to a high-cost premium nuclear-qualified analog transmitter or continuously attempting to find parts that are no longer made. Equivalent transmitters will retain the advantages of the Rosemount 1151 product, such as being robust and simple to use, while avoiding

## Overcoming the challenge of obsolete pressure transmitters in aging nuclear power plants

costly engineering change work packages. The major benefit of course is availability.



Most nuclear power plants need to replace aging pressure transmitters, while being under pressure to improve performance improvement and facing an unavoidable requirement to replace major systems to extend plant life. Finding the best replacement pressure transmitter has a role in each of these issues so require operators to discover:

- The functional characteristics of the existing transmitter, such as the type, e.g. differential, gauge or absolute pressure ranges
- Its performance in relation to environmental, regulatory and quality requirements
- Operating experiences with the transmitter in use in similar environments to your plant
- A trusted supplier with industry experience, a solid reputation, and a strong supply chain
- The total lifetime cost of using the new transmitter

### Ultra Energy DTC3 Pressure Transmitter

Ultra Energy saw the need to address the significant pain point of obsolete pressure transmitters in the nuclear industry. Through collaborations with major utilities, user groups and industry experts, we designed a direct replacement for the Rosemount 1151, an analog pressure transmitter that brings the technology into the modern age.

With its precise controls and reliability, the Ultra Energy DTC3 is a great option for deployment within nuclear plants. It has a true analog design with no microprocessors, firmware or required software and was developed to offer differential, gauge and absolute pressure measurement. With reduced calibration times, the DTC3 offers significantly reduced installation times.

Our industry assessment showed that most aging nuclear power plants still use the Rosemount 1151 so we developed the DTC3 to have a universal mounting bracket that is forward and backwards compatible with the Rosemount 1150 series brackets.

### Key features of the DTC3

- Easier than switching to smart transmitters
- Non-interacting zero and span
- Coarse and fine, non-interacting, span and zero adjustments
- Local test points for field adjustability
- Adjustable damping
- Operating regions:
  - 4-20 ma: 12-45 Volts DC (0Ω-1333 Ω)
  - 10-50 ma: 30-85 Volts DC (0 Ω -1100 Ω), not offered by most manufacturers



# Overcoming the challenge of obsolete pressure transmitters in aging nuclear power plants

## Key DTC3 features (continued)

- Simple modular architecture with common components
  - Electronics
  - Housing
  - Adaptor plate
  - Flanges/bolts/O-Rings
  - Universal mounting bracket

The DTC3 is far less complicated to calibrate since it does not have zero/span interaction, which occurs when the zero pressure output (4mA) changes when the span is adjusted. The DTC3 has two simple calibration steps compared to six steps for the 1151. This saves technicians time in the field and on the bench.

### DTC3 calibration steps:

- Apply your 4 mA pressure and adjust the output for 4 mA
- Apply your 20 mA pressure and adjust the output for 20 mA

### Rosemount 1151 calibration steps:

- Apply your 4 mA pressure and adjust the output for 4 mA
- Apply your 20 mA pressure and adjust the output for 20 mA
- Apply your 4 mA pressure and adjust the output for 4 mA again
- Apply your 20 mA pressure and adjust the output for 20 mA again

- Apply your 4 mA pressure and adjust the output for 4 mA again
- Apply your 20 mA pressure and adjust the output for 20 mA again

Furthermore, the DTC3 pressure transmitter ranges are a one-to-one match to the Rosemount 1151. Ranges and limits can be easily changed, making the ordering process very simple.

## Why to select the DTC3 as your pressure transmitter obsolescence solution

In the nuclear industry, an analog replacement option is valued. Regarding price, the DTC3 offers a lower cost-of-change, saving money and operational time compared to other alternatives.

The DTC3 pressure transmitter is a true analog replacement specifically designed for mild environment applications to provide precision pressure measurements in non-safety nuclear applications with reliable performance.

Ultra Energy has talented engineers, ready to provide stellar technical support to solve any issue your plant has while transitioning to the DTC3 pressure transmitters. Our technicians can provide onsite and remote assistance with calibration, environmental condition advice, equivalency analysis and more.

In addition to the DTC3, Ultra Energy supplies a broad range of pressure transmitters for nuclear-qualified applications. Most instruments are qualified to IEEE-323/344 and versions are offered for virtually every installation, from inside containment/harsh environment to applications requiring only seismic qualification or commercial grade. Models are available for the measurement of gauge, absolute or differential pressure and output signals including 4-20 mA, 10-50mA, HART, FOUNDATION Fieldbus, Profibus, and FoxCom.

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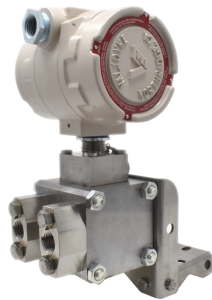
### DTC3 differential, gauge and absolute pressure transmitter

- 1151 replacement
- Fully analog, loop powered
- 4-20 mA or 10-50 mA
- Industrial grade
- Mild environment
- EMC per NRC RG1.180



### N-DR800 series draft range differential pressure transmitter

- Fully analog, loop powered
- 4-20 mA
- Nuclear grade (CGD/OEM)
- IEEE 344 seismic/mild
- EMC per NRC RG1.180
- Wetted parts traceability



### N-I/A series by Schneider Electric "Foxboro" IDP10S, IAP10S & IGP10S

- New generation of advanced pressure transmitters
- Nuclear qualified
- IEEE 344 Seismic/mild
- Smart/Hart and Square Root Functions



### DTN2070 series DP and AP/sealed gauge pressure transmitter

- 1152, 1153, 1154 replacement
- Full analog, 4-20 mA
- IEEE 323/344 Class 1E
- Harsh environment
- EMC per NRC RG1.180
- Seismic, LOCA/PAM EQ levels nearly equal to Rosemount™ 3155N
- Full traceability



### Foxboro N-E series N-E11 high/wide pressure ranges and N-E13 low/narrow pressure ranges

- IEEE 323/344 Class 1E
- Harsh environment (200Mrad)
- Fully analog, loop powered
- 4-20 mA or 10-50 mA
- Electro-mechanical force balance technology



Ultra Energy can create a customized solution for any aging nuclear power plant. Analog pressure transmitters will always have a place in nuclear plants, and we understand the value that transmitters bring to nuclear energy. Contact us to learn how our team can help you find a solution for aging and obsolete pressure transmitters.



## About Ultra Energy

Organizations working with nuclear and industrial technologies have a responsibility to safeguard people, the environment and infrastructure. We provide solutions that give our customers complete, long-term protection and control of safety critical systems, while helping them increase the net value derived from investments over their total lifespan.

Part of Ultra Group, Ultra Energy has worked with nuclear and industrial customers for over 60 years. We're embedded in strategic national infrastructure and helping organizations develop future applications. We support continuous operation of industrial sites with protection and control solutions that monitor and manage factors such as radiation, neutrons, temperature and pressure within safety critical systems.

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