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DART re-defines intrinsic safety:

Power shutdown instead of power limits

Until now, avoiding sparks meant either costly installation efforts or limiting the available power. Dynamic Arc Recognition and Termination (DART) represents a completely new approach to explosion protection. Pepperl+Fuchs was the driving force in the development of DART. The company wants to actively promote the development of applications using this new technology and is interested in a dialogue with interested users.

Until now, preventing the development of sparks hot enough to cause an ignition was primarily achieved by limiting the effective power to less than 2 watts. For many field devices, this power level is simply too low, limiting applications with intrinsic safety to the use of sensors and actors with low power requirements.

DART puts an end to such power limitations, allowing the use of field devices with power requirements of up to 50 watts within explosion hazardous areas. Key to this breakthrough technology is a completely new approach to preventing sparks. While intrinsic safety is presently achieved by simply limiting the available power to a safe level, DART approaches the actual problem by preventing the development of a spark right in its initial phase.

To achieve this goal, DART uses the fact that any spark results in a sharp increase of the current within the respective electric circuit which follows specific characteristics and can therefore be recognized dependably. DART detects this effect and is able to react within a few micro seconds by switching off the circuit before the current reaches a level sufficient to create a spark hot enough to cause an ignition.

From idea to solution within eight years

Immediately after publication of the Fieldbus Intrinsically Safe Concept (FISCO), some eight years ago, specialists at Pepperl+Fuchs started thinking of ways and means to increase the usable electrical power of intrinsically safe applications without compromising safety within the Ex zone.

The initial step consisted of modeling the exact electrical behavior of the cable, in order to gain detailed insight into the development of voltage and current of a fault. At this early stage already, the basic idea was to create a dynamically reacting system to shut off power, which would be able to react considerably faster and precise enough to surpass the threshold values according to FISCO.

However, the research team quickly discovered that individual field devices are characterized by anything but uniform electrical behavior. Yet, this is a vital factor if one wants to reliably detect a spark from the dynamics of voltage and current. The solution to this problem was a split of the safety-related circuits between the power source and a de-coupling module embedded in the field device.

In 2004, it was time to legally protect the new technology by means of respective patents and take specific steps in order to prepare its presentation on the market.

New technology, new test procedures

Pepperl+Fuchs experts got into an interesting dialogue with the Physikalisch Technische Bundesanstalt (PTB) in Braunschweig, a renowned technical research institute in Germany. PTB started a comprehensive research project and came to the result that the present testing methods employed to verify intrinsic safety are not sufficient in combination with dynamically acting power sources, such as DART.

Established test procedures proved to simply fail in combination with DART. They are based upon a spark testing device, which generates opening and closing sparks at short, statistically determined intervals. With this procedure, it is not possible to determine, whether the DART power source is in its safe or feeding mode. In the worst case, it simply resides in safe mode and does not react at all.

The solution resulted in development of a new type of spark generator by the PTB, which can be used to dependably verify intrinsic safety. Corresponding test procedures are presently being developed and will soon be included into the respective standard.

Experts discussing about DART

DART was first mentioned in an article published in the P&A Compendium, which appeared in 2005. At the Hanover Fair in 2008, this new technology was presented to the industry scene for the first time, leading to considerable discussion.

Being the leading developer of DART technology, Pepperl+Fuchs is highly interested to focus the ongoing discussion and bring experts together, in order to drive the development of new products and solutions. One important step in this connection is a workshop hosted by PTB in Braunschweig, Germany, which will take place October 14-15, 2008. All interested users, device manufacturers and system integrators are invited to take part in this workshop and may register via the PTB website at www.ptb.de.

Key words: DART, intrinsic safety, fieldbus, explosion protection, installation, Ex-barrier

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Characters: 4,087, without space characters

Characters short text: 427, without space characters

Pictures: No. MC7522_080529_04, No. MC7522_080311_04

September 2008



Fig. 1: Entering into a new era of explosion protection with DART – the manufacturer seeks to make this idea a reality in cooperation with licensees.

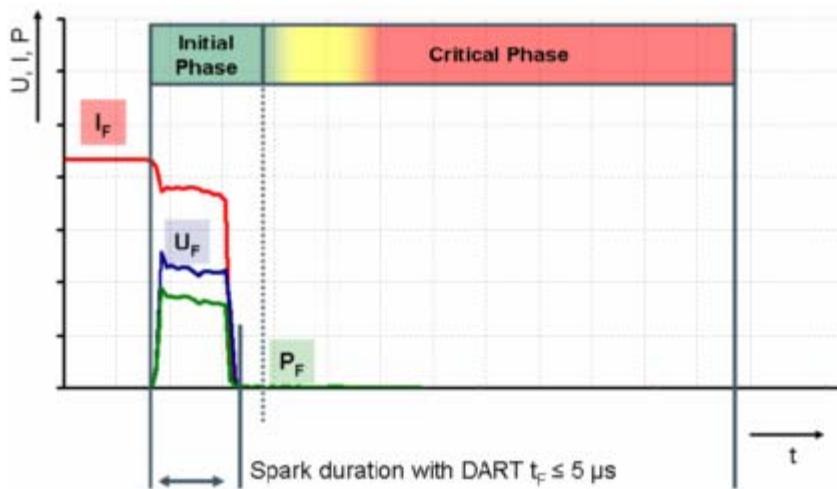


Fig. 2: Electric behavior of a spark turned off by a DART-Power Supply

Table: Possible process industry applications

	DART Fieldbus	DART Power
High-power field instrumentation		
Solenoid valves	■	■
Magnetic flow measurement	■	■
Corriolis flow measurement	■	■
Gas detectors		■
Other applications		
Visual and audible warning devices		■
Servo motors		■
Illumination		■
Analysis devices	■	■
Scales		■
PCs and operating terminals		■

Table: Maximum intrinsically safe DART output values for typical cable lengths

	Voltage V_{out}	Effective power P_{out}	Cable length
DART Power	50 VDC	approx. 50 W	for 100 m
	24 VDC	approx. 22 W	for 100 m
	50 VDC	approx. 8 W	for 1000 m
DART Fieldbus	24 VDC	approx. 8 W	for 1000 m