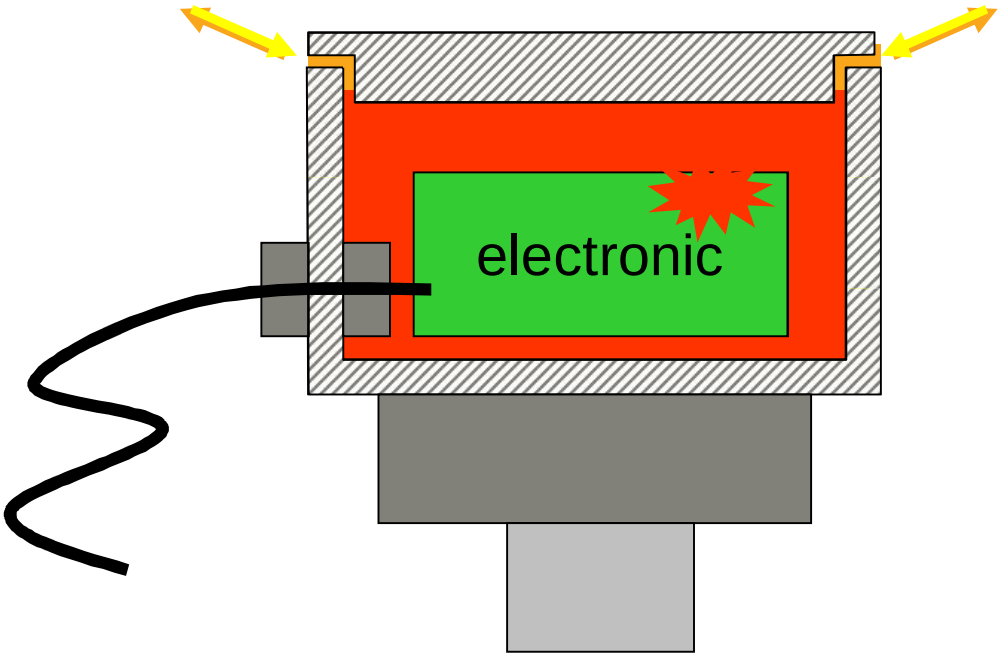
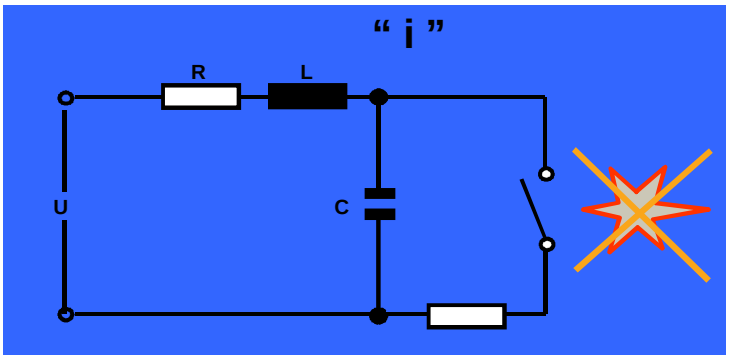
Flame proof Ex-d housing



Principle of Intrinsic Safety



The energy in an intrinsically safe system is limited to a value that is not capable of causing ignition in normal operation and fault condition in the surrounding hazardous atmospheres by sparks (opening, closing, short circuit, short circuit to earth)

Principle of Intrinsic Safety

The classic protection method is to limit voltage, current, power, inductance and capacity in an intrinsically safe system to a constant value.

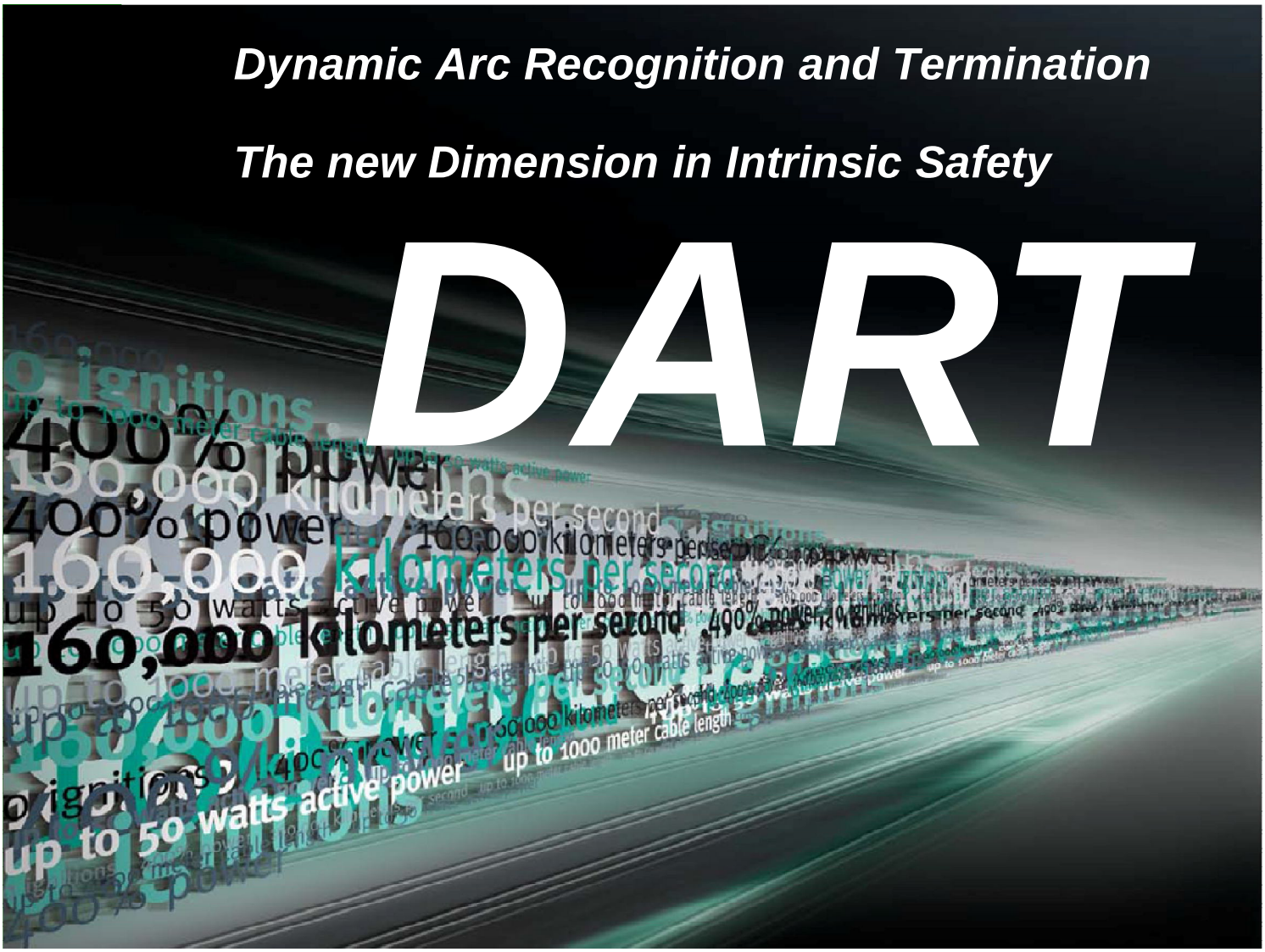
Biggest Problem is Limited Power

-> The results are documented in "Ignition curves"

Dynamic Arc Recognition and Termination

The new Dimension in Intrinsic Safety

DART



History of DART

- **1991: Patent GB2253956**
  - A fast acting protection device for use with a power supply
- **1994: Begin of Research – ES-Bus by PTB**
  - AC fieldbus power supply
- **2002: Patent GB2368206B**
  - Fast acting switch of a load during under voltage condition
- **2003: CIS-concept of PTB**
  - Continuous Interrupted Supply

Pepperl+Fuchs DART History

- **2001: First idea “DART” – Basic concepts**
- **2003: Begin basic research**
- **2004: Patent filed: “Electrical Circuit with incendive arc prevention means”**
- **2004: Cooperation between PTB and Pepperl+Fuchs**
- **2009: Cooperation between PTB and 15 companies to introduce DART into IEC-standards**
- **2011: Introduction of DART - Fieldbus**

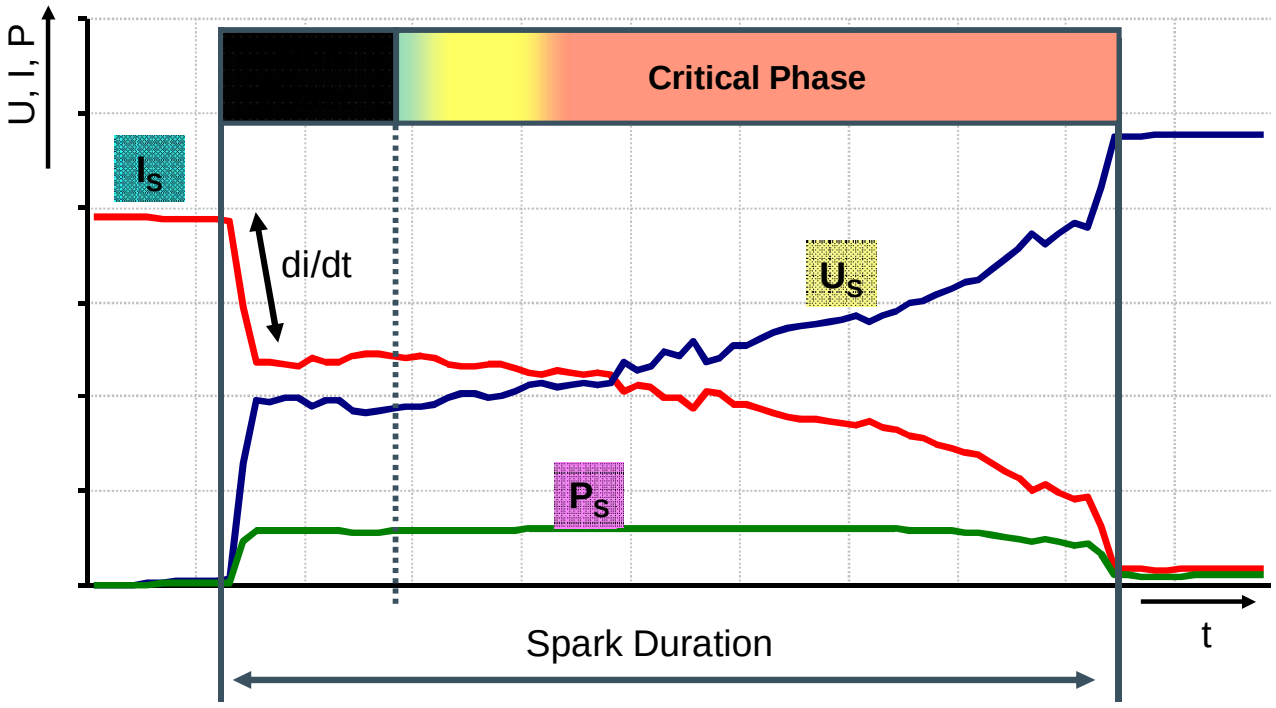
Basic Operating Principles

Detecting the Ignition

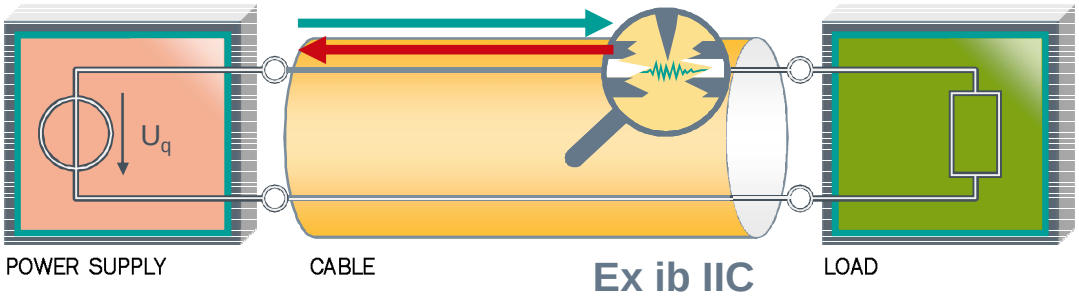
Basic Operating Principles

- **Provides 8…50 W, intrinsically safe**
- **Detects sparks as they occur**
- **Limits the energy during a fault**

A typical Spark – Electrical Behavior

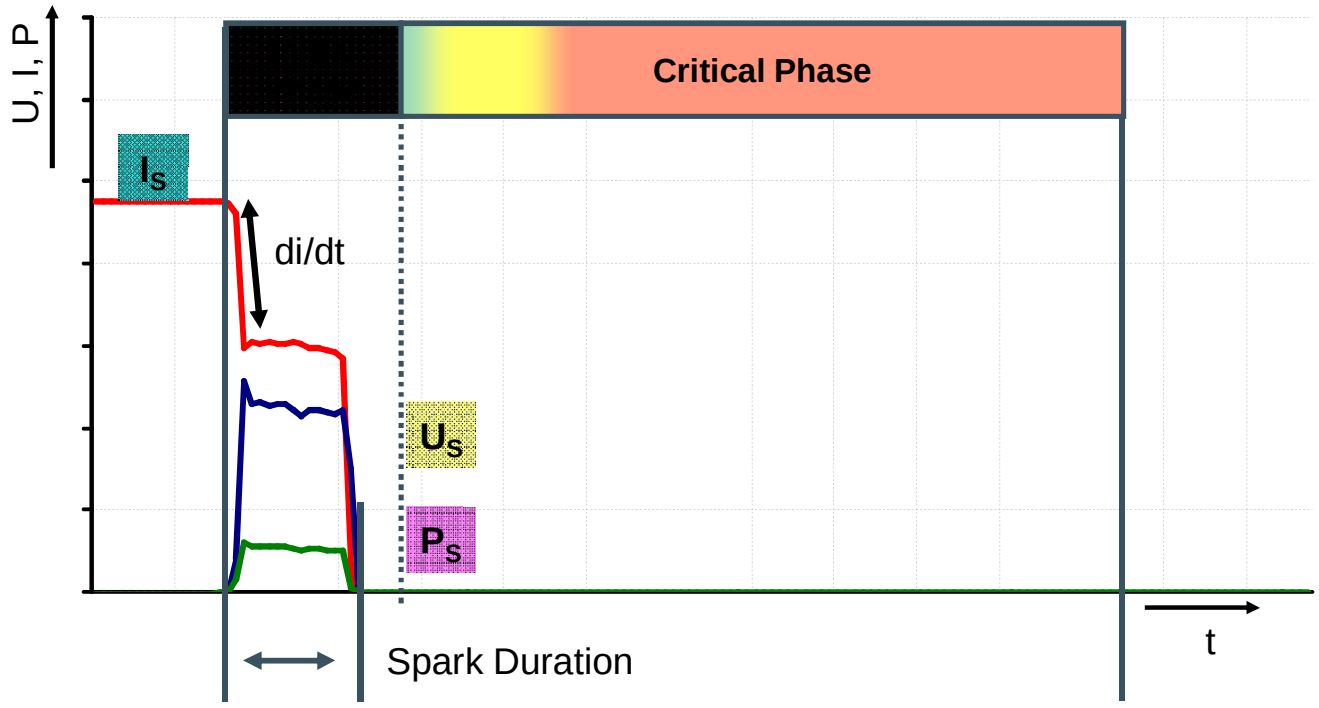


Dynamically detecting an ignition



Turn Off the Power before the Spark ignites

A typical Spark – Extinguished by DART

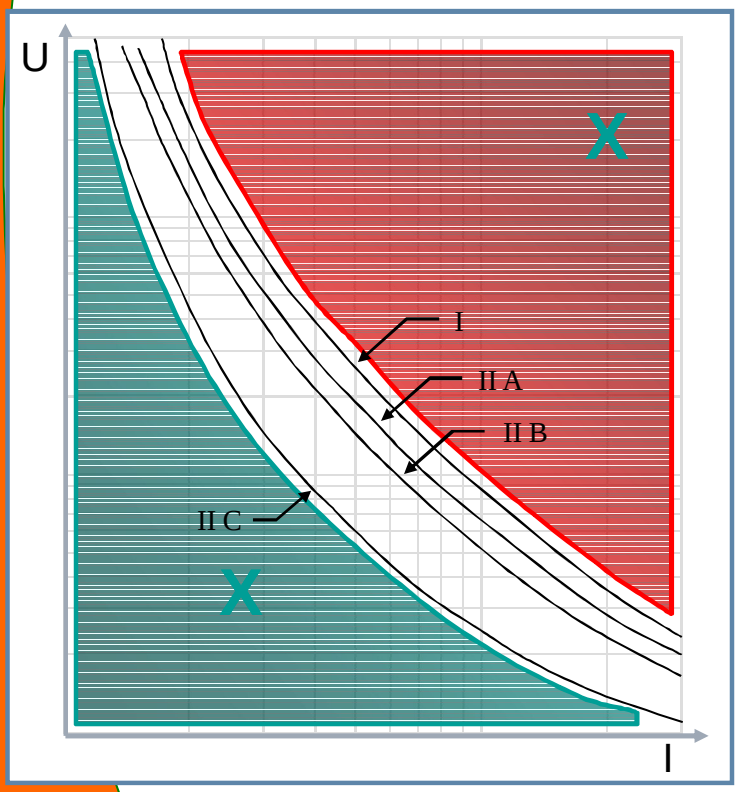


DART is:

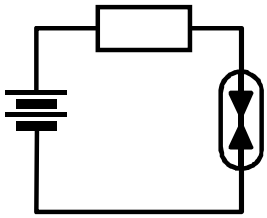
Re-thinking how to limit energy

With Unlimited Power

DART – Safe beyond traditional limits

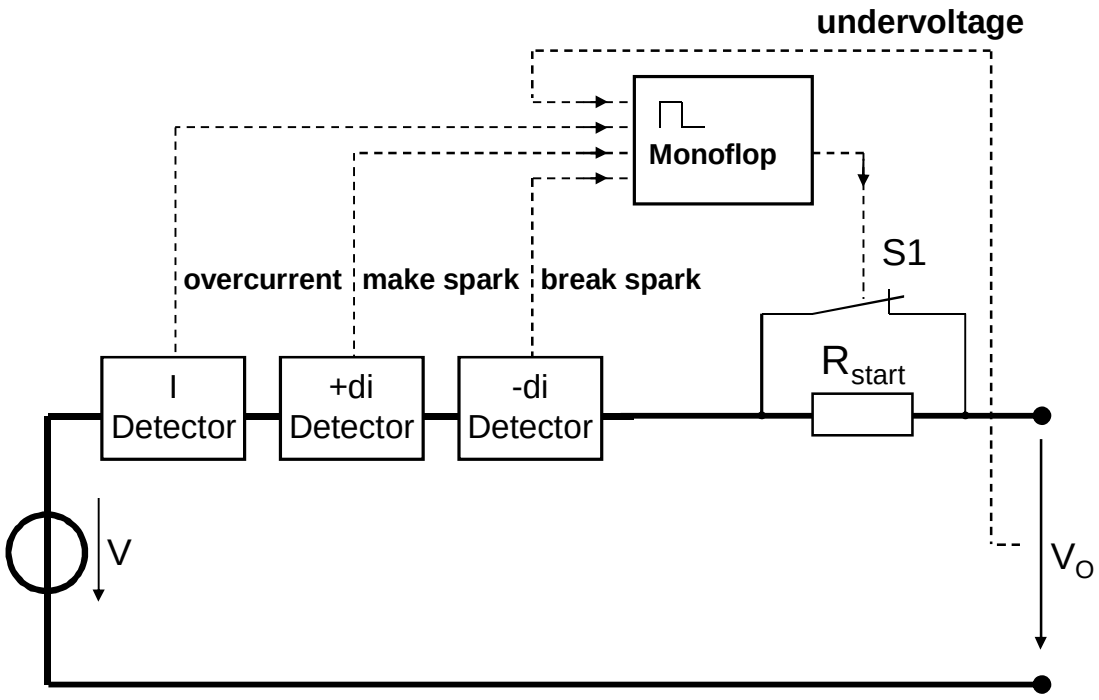


Ignition curves acc. to IEC 60079-11

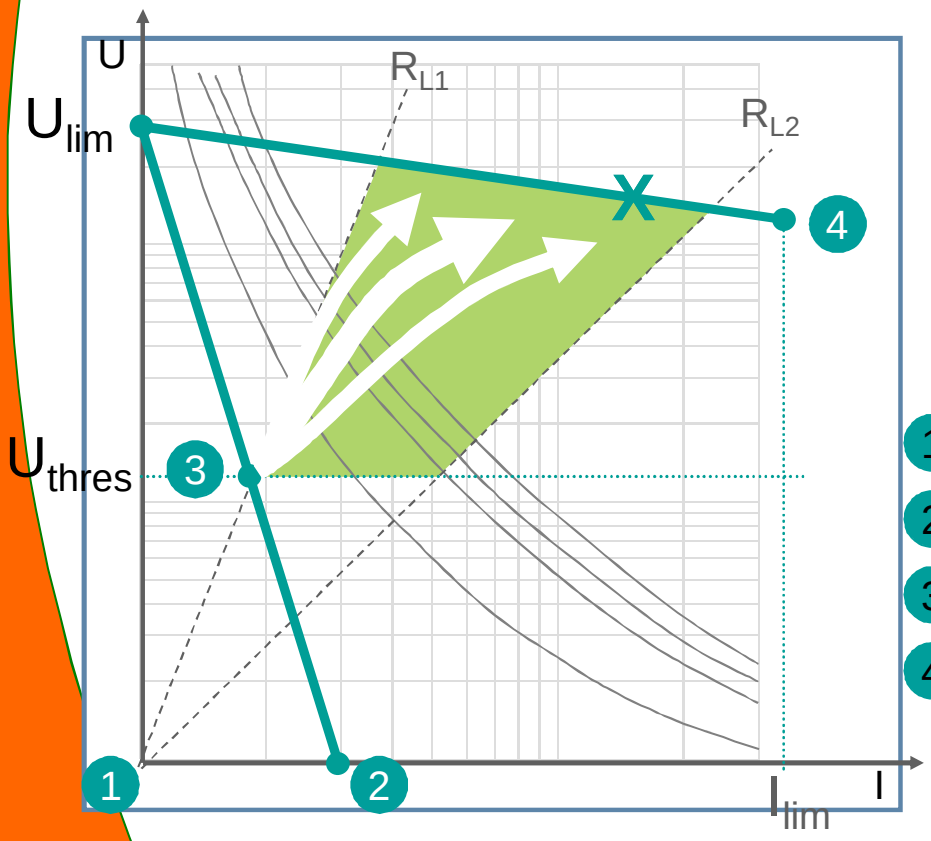


Circuit diagram for determining ignition curves

DART CONCEPT – Block Diagram



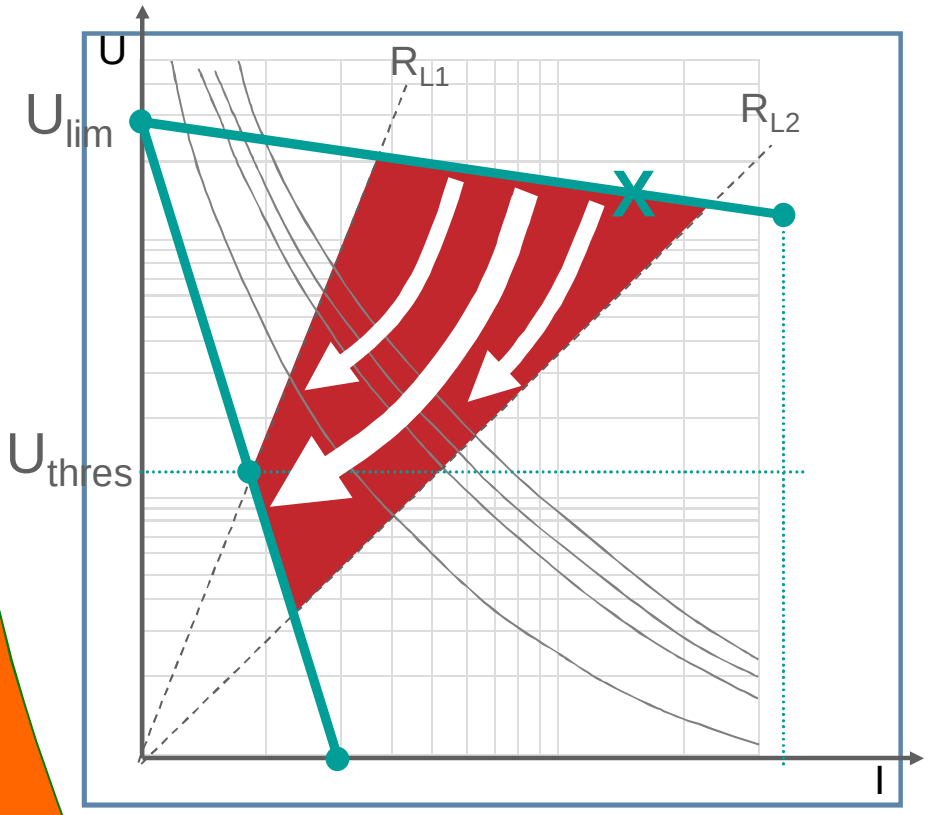
Output characteristic of DART



Turning On

1. Power Off
2. Initial On – S1 open
3. Threshold – S1 closes
4. Overload condition

Output characteristic DART



Turning Off

DART Technical Data

	U_{out}	P_{out}	Cable length
DART	24 VDC	ca. 22 W	100 m
	50 VDC	ca. 50 W	100 m
	24 VDC	ca. 8 W	1000 m
	50 VDC	ca. 8 W	1000 m
Transmitter Supply	16 VDC	ca. 320 mW	1000 m
FISCO Fieldbus	12,8 VDC	ca. 144 W	1000 m

- Cable length determines available power
- Values for today's I.S. products shown for reference

DART Verification and Approvals

- **DART has been reviewed by Dekra-Exam**
  - "The DART Fieldbus Concept is in conformance with the requirements of IEC60079-11"
- **DART-Products approved according to IEC 60079-11**
  - Intrinsically Safe Apparatus
  - PTB has developed the necessary test methods

DART Approvals and Standardization

- **DART will be added to IEC 60079-11, in the next revision**

- **DART will be standardized in an IEC technical specification**

Advantages

- **Single Ex-i hazardous area protection concept, no Ex-e wiring.**
- **High Power Trunk offers more cable length through accepting bigger voltage drops along the trunk cable.**
- **Simplified Active Junction Box (compared to Fieldbus Barrier).**
- **Spurs remain FISCO protected.**
- **No change in Field Device certifications**
- **Live maintenance is permitted in the field**

DART: Award-Wining Technology

HERMES AWARD 2008

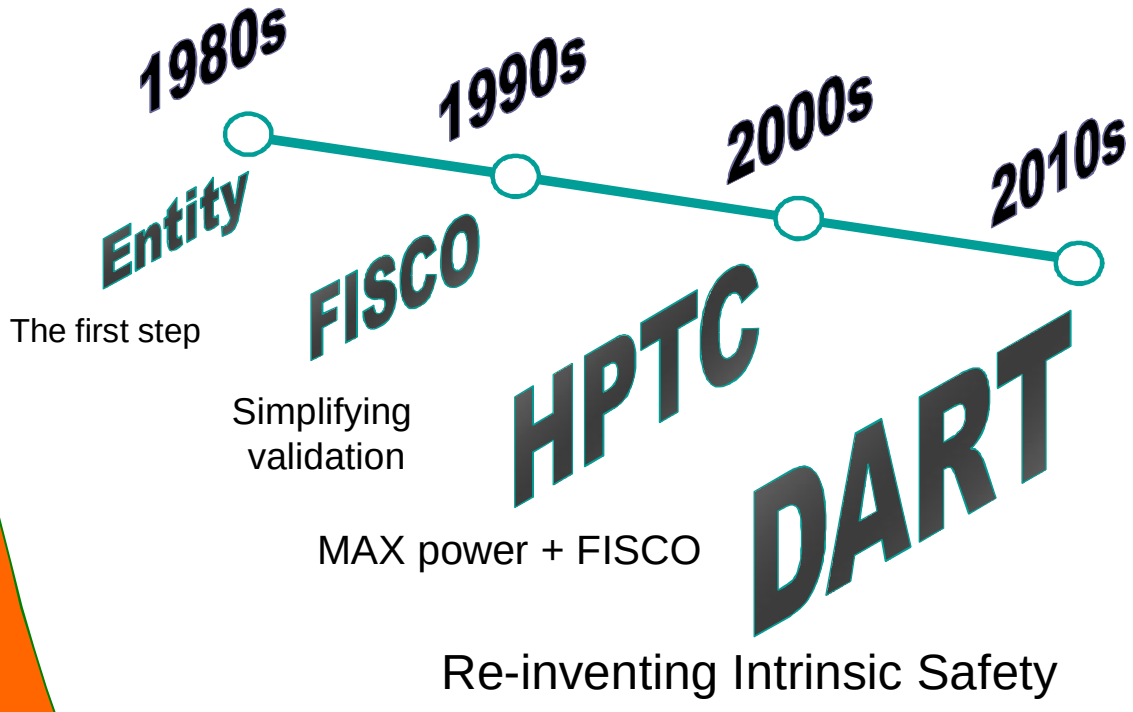
IHK Braunschweig

TECHNOLOGIE TRANSFERPREIS

DART Fieldbus

Product Line

DART Application in Fieldbus



DART Fieldbus
The Simplicity of Intrinsic Safety

DART fieldbus provides:

A completely intrinsically safe fieldbus segment in
gas groups IIB and IIC with real power redundancy and advanced diagnostics.

For existing intrinsically safe field instrumentation,
Protects your investment

The Intrinsically Safe High-Power Trunk

DART Fieldbus

The Simplicity of Intrinsic Safety

Main Attributes

- Trunk cable up to 1000 m
- Built-in power redundancy
- Same topology as a general purpose high-power trunk
- For FOUNDATION fieldbus H1 and PROFIBUS PA

DART Fieldbus is certified according to the international I.S. standard IEC 60079-11