DIEHL & EAGLE PICHER
Batterie-Systeme

„State of the Art Fuze Batteries and their Performance“

61th Annual Fuze Conference
May 15th - 17th, 2018
Roland Hein
Diehl & Eagle Picher GmbH

Overview

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- Introduction of the Design Features of Reserve Batteries
- Reserve Battery - Versions
- Reserve Battery - Versions Overview
- Reserve Battery - Application
- Reserve Battery - Testing
- Reserve Battery - Versions Summary
- Recommendations for Fuze Electronic Design
- Future developments

Introduction of the Design Features of Reserve Batteries

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- *Primary Design Features of all Reserve Batteries*
  - *Lithium Metal Battery*
  - *Lithium Thionylchloride electrolyte ($LiSOCl_2$)*
  - *glass ampoule*
  - *release mechanism/activation mechanism*
  - *metal to glass seal*
  - *hermetically sealed stainless steel case*
  - *100 % helium leak test*

Reserve Battery - Versions

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Battery Parameter

Diameter max. : 18,2 mm (0.72 in)
Height : 13,7 mm (0.54 in)
Electrode Area : 1,4 cm² (0.22 in²)
Volume : 1,8 cm³ (0.11 in³)

DEP14202

Diameter max. : 32,2 mm (1.27 in)
Height : 25,5 mm (1.0 in)
Electrode Area : 3,5 cm² (0.54 in²)
Volume : 15 cm³ (0.92 in³)

DEP140xx

Diameter : 11 mm (0.43 in)
Height : 11 mm (0.43 in)
Electrode Area : 0,4 cm² (0.06 in²)
Volume : 1,0 cm³ (0.06 in³)

DEP14103

Reserve Battery - Versions Overview

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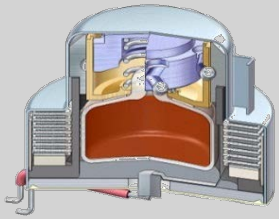
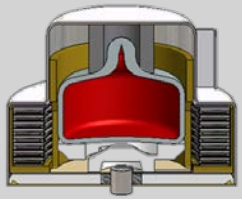
“Large”	“Large”	“Midi”	“Mini”	“Ultra Mini”
DEP14001	DEP14007/17/12	DEP14020/21	DEP14202	DEP14103
5 – 10 cells	5 – 10 cells	1 – 4 cells	1 – 2 cells	1 cell
7 cells	8 cells	2 cells	2 cells	1 cell
25.2 V	28.8 V	7.2 V	7.2 V	3.6 V


Reserve Battery - Application

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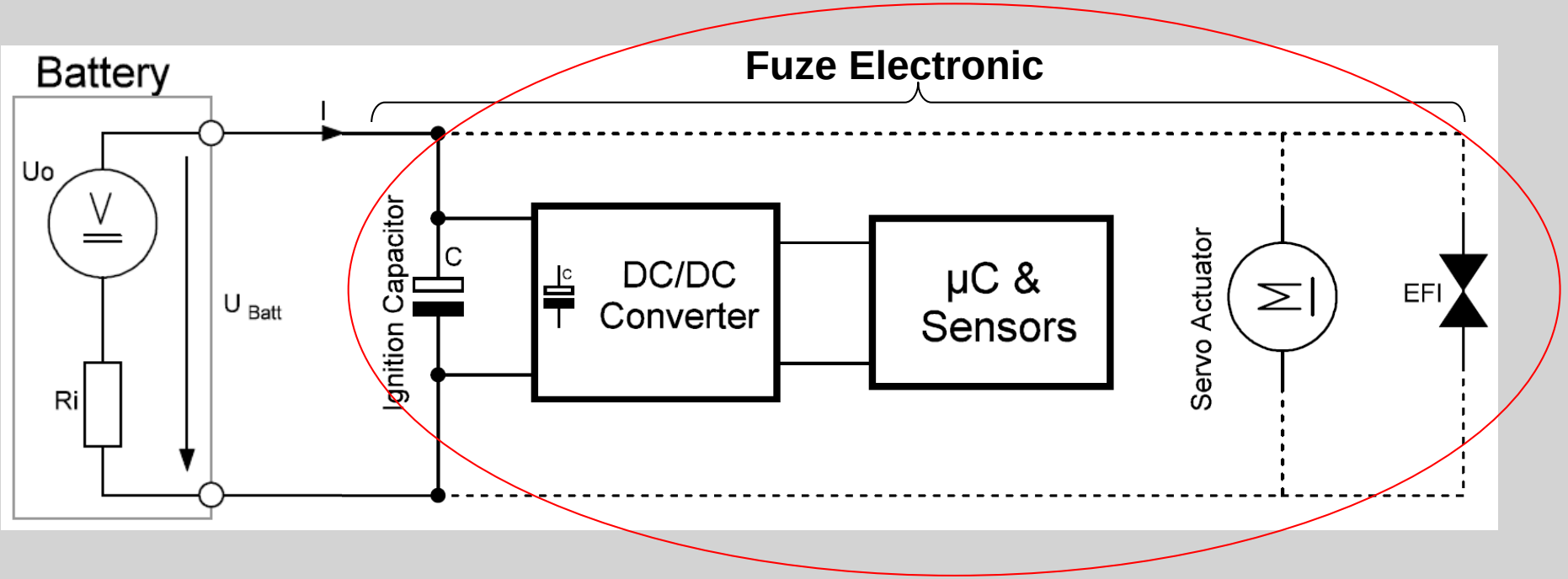
Reserve Battery in a typical application



1. How much Power does the Fuze Electronic need ?

Reserve Battery - Application

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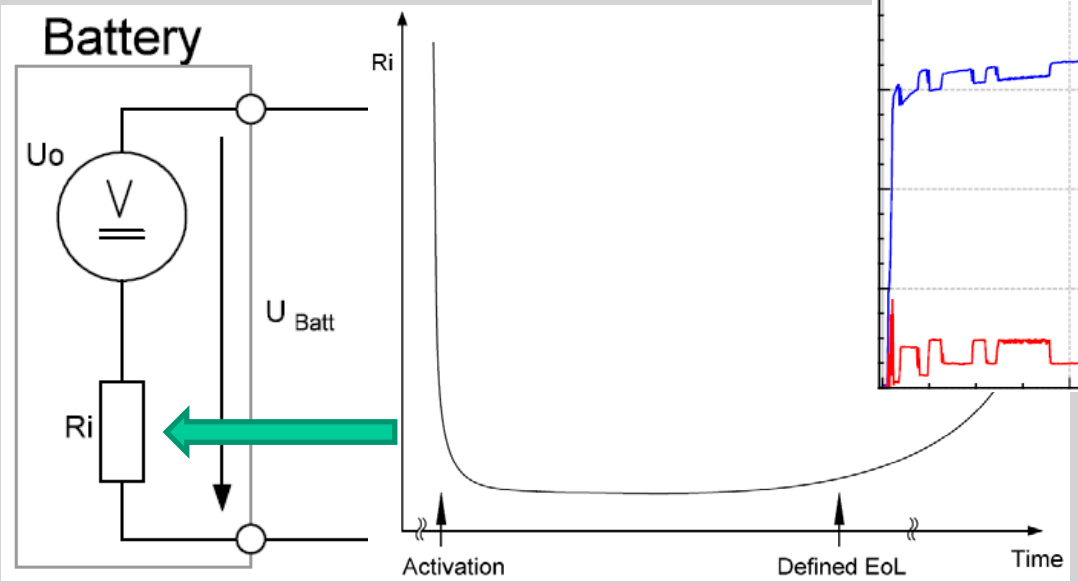
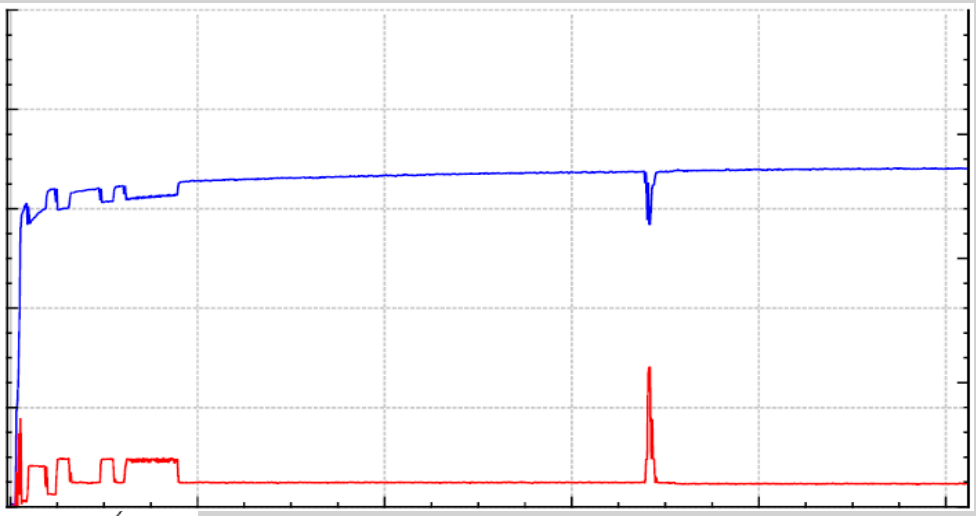
Reserve Battery – Internal Resistance





1. How much Power does the Fuze Electronic need ?

2. What is the minimum Voltage for operating a Fuze Electronic ?

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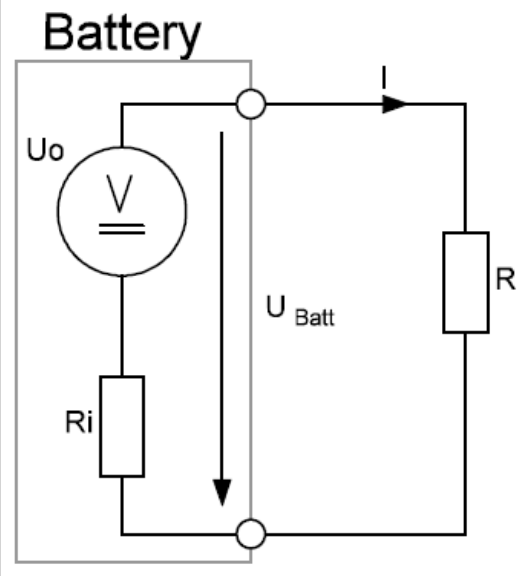
Reserve Battery – Equivalent Circuit Diagram



Some Equations of Electrical Power

$P = U_{Batt} \times I$ *or*

$$P = \frac{U_{Batt}^2}{R}$$

Fuze Electronic

$U_{Batt} = U_o - (R_i \times I)$

$$P = \frac{[Uo - (Ri \times I)]^2}{R}$$

Battery State

Reserve Battery - Testing

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Reserve Battery – Battery-Test-System

Flexibel Configuration of

- ***Acceleration Pulse***
- ***Rotation***
- ***Electrical Load***

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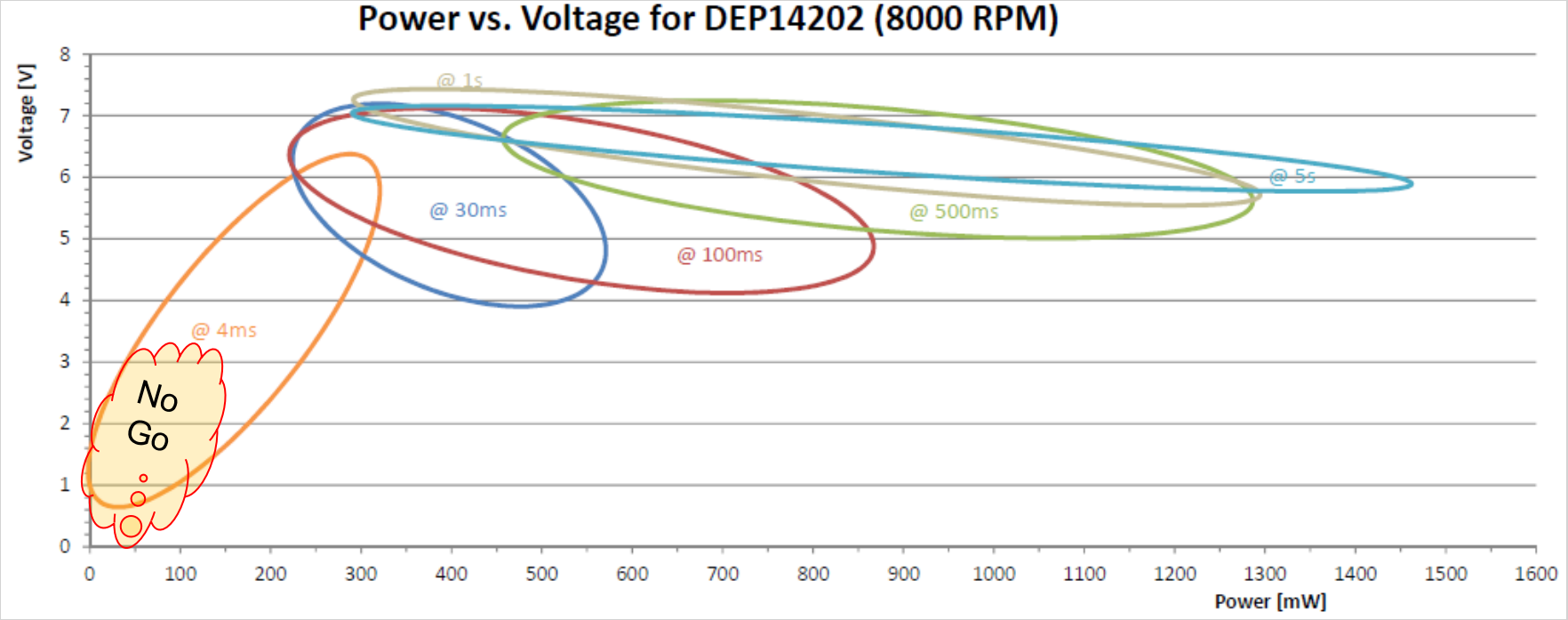
Reserve Battery – Test Results (Example)



1. How much Power may a Fuze Electronic require at what time ?

2. What is then the minimum Voltage for operating a Fuze Electronic ?

Reserve Battery - Versions Summary

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“Large”	“Large”	“Midi”	“Mini”	“Ultra Mini”
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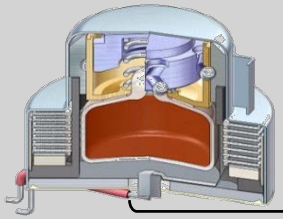	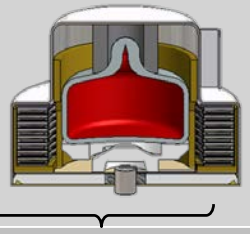			
Volume	15 cm³	11,7 cm³	1,8 cm³	1,0 cm³
Cell Area (ea.)	3,5 cm²	3,5 cm²	1,4 cm²	0,4 cm²
Spec. Current	235 mA/cm²	187 mA/cm²	150 mA/cm²	80 mA/cm²
Rec. Max. Power	3100 mW	2800 mW	1400 mW	140 mW

Recommendations for Fuze Electronic Design

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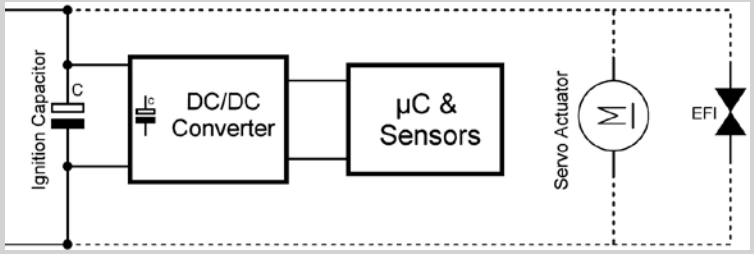
- Timing of Power Electronic Fuze Parts
  - Controlled Charge of Ignition Capacitors
  - Start Up of µController (delayed)
  - Switched Sensor Start



- No “Big” Capacitors on Power Inlet (DC/DC-Converter)
- Small Power Buffer (Capacitors) for Actuators
- Moderate Power Consumption can lead to Standard Fuze Battery
- Involve D&EP early in Power Consumption of your Fuze Electronic

Future developments

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- 1 & 2 cell batteries for high spin and high acceleration application
- Development on super quick in barrel activation batteries for artillery and naval versions
- Development of new electrode material for higher current / power application

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Thank you for your attention!

Questions?

Diehl & Eagle Picher Contact

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