

ORDNANCE SAFETY AND ARMING

e2v technologies has been active in the Ordnance Safety and Arming (OS&A) technology arena since 1984. The activity began with e2v technologies funding Exploding Foil Initiator (EFI) technology in conjunction with RARDE (now QinetiQ and Dstl).

Through the late 1980s and early 1990s, work was concentrated on EFI initiator research and characterisation, explosive material characterisation and firing circuit development.

e2v technologies secured its first product contract for an electronic safety and arming unit (ESAU), including EFI detonator, in 1994. This contract resulted in qualification of a basic firing system in 1996 and delivery of approximately 1,000 production devices.

Since the mid-1990's, the activity has grown and is now a key part of e2v technologies' future business strategy. Today, e2v technologies is supplying electronic safety and arming units and firing systems containing EFI detonators to more than ten weapon systems.

These include torpedoes, sea mines, missiles, explosive ordnance disposal systems and rocket motor igniters.

Ongoing technology research into low energy EFIs and next generation electronic safety and arming systems is securing the e2v technologies portfolio for the future.

Key system parameters for the devices are as follows:

Exploding Foil Initiators

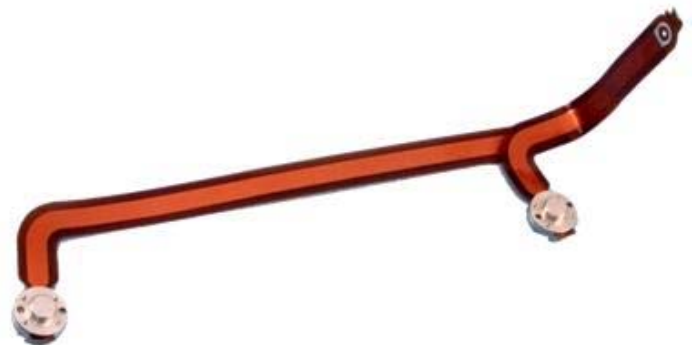
- HNS explosive fill
- Flexi-circuit or rigid board construction
- Threshold energy 0.2 J
- Explosive take-over proven into various warhead and explosive chain materials
- 99.9% @ 95% confidence all fire energy: 0.29 J
- Characterised against STANAG 4560
- Material compatibility tested against STANAG 4147



Example of e2v Exploding Foil Initiator



Example of Removable e2v EFI detonator



Example of Removable e2v Twin EFI detonator

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Firing Unit (FU) Systems

- Low inductance firing capacitor
- 3-electrode triggered vacuum switch
- Flexi-circuit or rigid board interconnect
- 0.45 J typical storage energy
- DC-DC converter to provide high voltage for firing capacitor
- <100 ms capacitor charge time
- 9 V to 40 V dc input
- <2 μ s trigger input to explosive output delay time



ESAU Electronics Assembly with removable EFI detonator for missile application

Electronic Safety and Arming Units (ESAU)

- Solid-state sensors and electronics detect independent environmental events, e.g.
 - Acceleration/ Time (launch and / or flight)
 - Distance (launch and / or flight)
 - Gas pressure (rocket motor)
 - Water pressure (underwater weapons)
 - Umbilical break (from various platforms)
- Safety switching and logic realised in discrete circuitry to maximise safety
- Electrical, mechanical and explosive interfaces designed to meet specific weapon application
- Designed to meet UK PP101 and PP102 and STANAG 4187



ESAUID with integral detonator for missile application

Ruggedised Electronic Safety and Arming Units

- Solid-state sensors and electronics detect independent environmental events
- Safety switching and logic realised in discrete circuitry to maximise safety
- Electrical, mechanical and explosive interfaces designed to meet specific weapon application and environment
- ESAU demonstrated to survive and operate during and following the mechanical shock event associated with target penetration
- EFI Detonator demonstrated to survive and operate following the mechanical shock event associated with target penetration
- Variable charge delay after penetration up to ~100 ms.
- Designed to meet UK PP101 and PP102 and STANAG 4187



Electronic Safety and Arming Unit with removable EFI Detonator for missile warhead application (target penetrating)

Motor Ignition Units

- Based on e2v proven safety and arming technology
- Safety switching and logic realised in discrete circuitry to maximise safety
- Electrical, mechanical and explosive interfaces designed to meet specific weapon application and environment
- Designed to meet STANAG 4368



Electronic Motor Ignition Unit with removable EFI Detonator for ignition of Through Bulkhead Initiator

Tandem Electronic Safety and Arming Units

- Based on e2v proven safety and arming technology
- Solid-state sensors and electronics detect independent environmental events
- Safety switching and logic realised in discrete circuitry to maximise safety
- Electrical, mechanical and explosive interfaces designed to meet specific weapon application and environment
- ESAU demonstrated to survive and operate following the precursor charge detonation
- EFI Detonator demonstrated to survive and operate following the precursor charge detonation
- Variable charge delay after precursor charge up to ~100 ms
- Designed to meet UK PP101 and PP102 and STANAG 4187

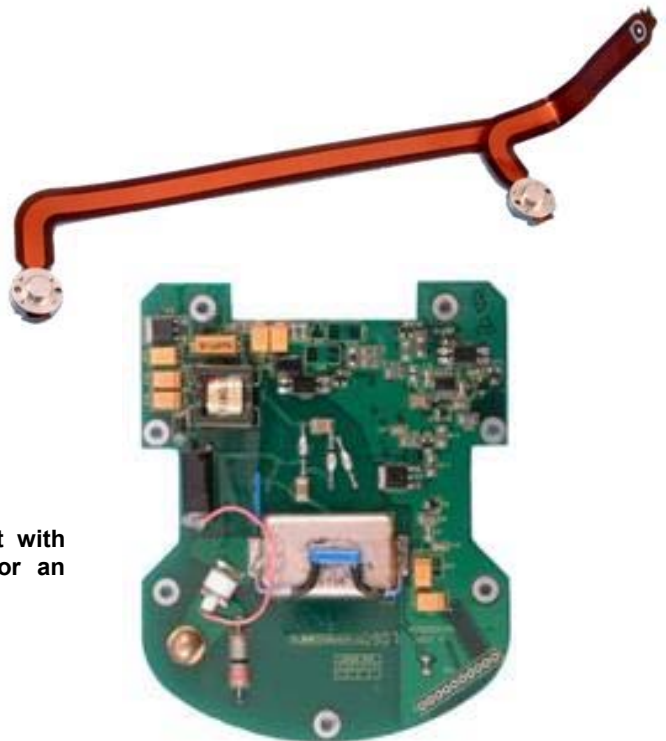
Electronic Safety and Arming Unit with removable EFI Detonators for tandem missile warhead application



Multipoint Safety and Arming Units

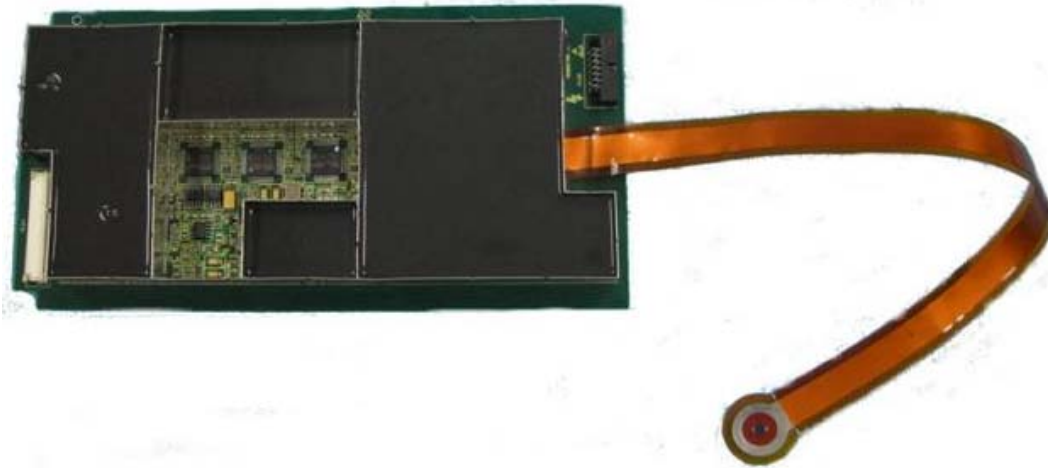
- Based on e2v proven safety and arming technology
- Solid-state sensors and electronics detect independent environmental events
- Safety switching and logic realised in discrete circuitry to maximise safety
- Electrical, mechanical and explosive interfaces designed to meet specific weapon application and environment
- Fully characterised twin output detonator
- Designed to meet UK PP101 and PP102 and STANAG 4187

Electronic Arming and Firing Unit with removable twin EFI Detonators for an EOD application



Safety and Arming Units incorporating Firmware

- Based on e2v proven safety and arming technology
- Solid-state sensors and electronics detect independent environmental events
- Safety switching and logic realised in firmware using FPGAs with anti-fuse technology to maintain safety
- Electrical, mechanical and explosive interfaces designed to meet specific weapon application and environment
- Designed to meet MIL-STD-1316



Electronic Arming and Firing Unit incorporating firmware with lid and potting removed to show FPGAs

e2v Ordnance Safety and Arming (OS&A) Product Overview

ESAU Type	Application	Environments Sensed	Operating Voltage	Arm Time	Explosive Interface
EIS1061	Underwater grenade	Electrical Inputs	12 V	80 ms	Removable Detonator
EIS1161	Underwater EOD	Electrical Inputs	24 V	100 ms	Removable Detonator
EIS1171	Sea Mine	Electrical Inputs	30 V	40 s	Removable Detonator
EIS1211	Surface - Air Missile	Acceleration / Electrical Input	28 V	100 ms	Removable Detonator (EIS2041)
EIS1221	Surface - Air Missile	Acceleration / Umbilical Break and Impact Sensor for initiation	28 V	75 ms	Integral Detonator
EIS1241	Underwater EOD	Electrical Inputs	12 V	5 mins.	Integral Detonator
EIS1251	EOD	Electrical Input	12 V	500 ms arm & fire	Removable Detonator
EIS1291	Torpedo	Lanyard Pull Water Pressure	33 V	400 ms	Removable Detonator (EIS2071)
EIS1401	Air – Air Missile	Electrical Inputs	44 V	100 ms	Removable Detonator (EIS2091)
EIS1421	Surface–Air / Surface–Surface Missile	Gas pressure Optical Fibre break	28 V	5 s	Removable Detonator (EIS2111)
EIS1451	EOD	Electrical Inputs	3 V	10 s	Removable Detonator (EIS2101)
EIS1491	Rocket Motor Igniter	Electrical Inputs	28 V	400ms	Removable Detonator (EIS2121)
EIS1501	Air to Surface Tandem Missile	Distance/ electrical input	28 V	400 ms	Removable Detonators (EIS2111 and EIS2141)
EIS1521	Air – Air Missile	Acceleration / Electrical Input	56 V	200 ms	Removable Detonator (EIS2151)
EIS1541	Surface – Air Missile	Acceleration/ electrical input	28 V	200 ms	Removable Detonator (EIS2221)