

Case Study: TomoTherapy Inc.

TomoTherapy Inc. was founded in 1997 by two members of the University of Wisconsin's intensity – modulated radiotherapy (IMRT) research group. Cancer hospitals across the globe are today using the progressive TomoTherapy® Hi-Art® treatment system in the fight against cancer. This equipment integrates the treatment planning, on-board computed tomography for patient positioning and the delivery of IMRT – a key recent advance in radiation therapy – from the same system. Patients with tumours that are untreatable with conventional systems can now receive radiotherapy treatments from the Hi-Art® treatment system.

In order to generate the prime energy required by the system's accelerator, which delivers the X-rays used in the imaging and treatment of tumours, US-based TomoTherapy needed help from a global supplier. TomoTherapy required an advanced RF power system capable of delivering 3MW of peak microwave power to fit within the confined space of their system, which uses a patented and unique rotating gantry concept to deliver complex treatments. The potential to offer remote diagnostics and system management in the future was also a requirement of TomoTherapy.

e2v's magnetron and high power electronics groups worked closely with TomoTherapy to provide them with a solution that suited their specific needs. e2v's advanced RF system consists of a solid-state compact modulator, a magnetron with electro-magnet and a microwave launching section, and provides the high energy, pulsed microwave source required to drive the accelerator, which in turn provides the life saving X-rays used in tumour imaging and treatment.



Bob Evensen, Director of Manufacturing at TomoTherapy, comments: "We selected e2v on the merits of its forward thinking technology. e2v's modulator is highly compact in design, making it ideal for our system. Early results showed the solid-state modulator to be more stable than line-type modulators. Furthermore, its computer-controlled and detailed diagnostics capability is a significant advantage for rapid diagnostics, something that could potentially be managed remotely in the future. It fits our requirements precisely."

Today, TomoTherapy has over 130 "clinical sites", meaning they have been fully tested and are currently being used for patient treatment. As a result, over 2,500 patients each day are currently treated using a TomoTherapy® Hi-Art® treatment system, and this figure is increasing daily. Bob Evensen reflects: "Being able to provide so many patients with highly conformal, image-guided IMRT radiotherapy treatment truly reflects the progress that TomoTherapy and e2v have made to date. Our relationship is truly a partnership in all aspects of reliability, quality, features, and cost."

Sales and support offices

Europe: Regional sales office

e2v
106 Waterhouse Lane
Chelmsford
Essex, CM1 2QU
England
T +44 (0)1245 493493
F +44 (0)1245 492492
E-Mail: enquiries@e2v.com

Europe: Regional sales office

e2v
16 Burospace
91572 Bièvres
Cedex
France
T +33 (0) 16019 5500
F +33 (0) 16019 5529
E-Mail: enquiries-fr@e2v.com

Europe: Regional sales office

e2v
Industriestraße 29
82194 Gröbenzell
Germany
T +49 (0) 8142 41057-0
F +49 (0) 8142 284547
E-Mail: enquiries-de@e2v.com

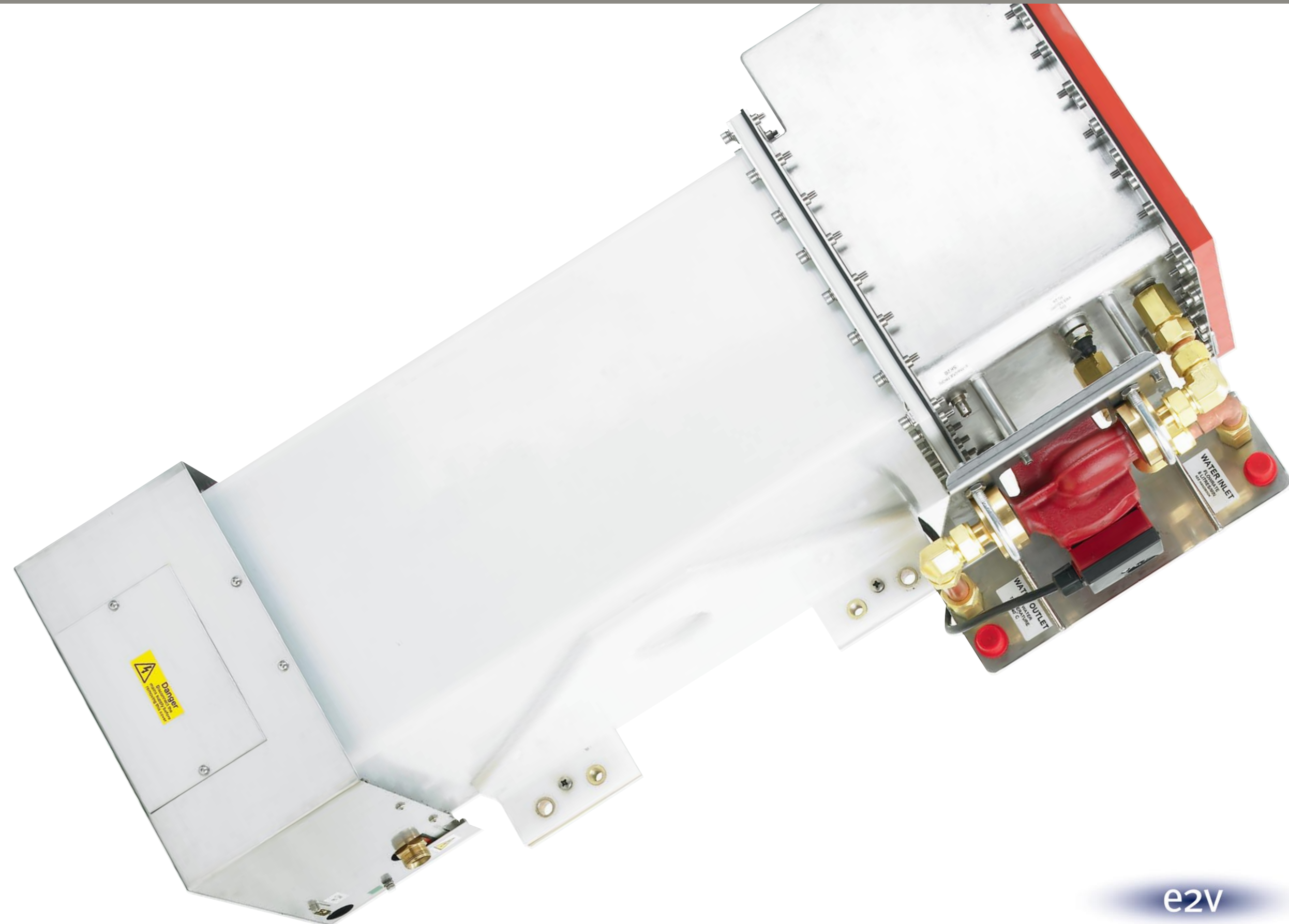
Asia Pacific

e2v
11th floor
Onfem Tower
29 Wyndham Street
Central, Hong Kong
T +852 3679 364 8/9
F +852 3583 1084
E-Mail: enquiries-ap@e2v.com

Americas

e2v
4 Westchester Plaza
Elmsford
NY 10523-1482
USA
T +1 (914) 592 6050 or 1-800-342-5338
F +1 (914) 592-5148
E-Mail: enquiries-na@e2v.com

www.e2v.com



Introduction

e2v has a long history of manufacturing components for high-voltage modulator systems. We now offer a range of compact modulators based around our patented solid-state switching technology.

e2v has a very strong high-voltage electronic engineering pedigree which has successfully been used to supply enabling technology to its customers, allowing them to maintain leading positions in the markets in which they operate. Over the last decade e2v has designed and developed a range of high power pulsed systems for radar and for linear accelerators used in industrial, scientific and medical applications, to complement its range of electronic vacuum tubes.

These high-voltage modulators and semiconductor switches provide a real proven alternative to conventional “line and hard valve type” modulator technology. Using innovative assemblies of solid-state switches, together with compatible power supplies and energy storage units gives a significant improvement in pulse shape and quality. A flexible control system gives the ability to remotely vary the pulse parameters on a pulse-to-pulse basis. These features make the units ideal for systems where precise energy control is essential.

Bespoke Requirements

e2v's strategy is to work closely with customers to provide either generic or bespoke solutions as required. Furthermore, these modulators can be designed to drive either e2v's range of microwave tubes, thereby simplifying integration with the modulator, or those from other manufacturers. The broad technical expertise at e2v provides scope for consultation and complex design work, fulfilling your specific requirements.

e2v prides itself on its exceptional technical support; both during the initial product selection and once products are in service.

Pulsed Power for Radar Applications

Radar is an essential part of modern life, whether it be for air traffic control, predicting the weather or some defence application, the principle requirements are the same - performance and reliability.

With increasing cost pressures, many radar systems around the world are now expected to operate well beyond their intended service life. System performance can be severely degraded due to obsolescence, poor reliability and the ability to maintain the original operating specification.

Do you need to upgrade?

Whether you are replacing a few obsolete components or comprehensively up-grading your transmitter, e2v can provide a cost effective solution offering improved performance and reliability, with reduced maintenance costs and downtime.

All radar systems require a high frequency pulsed RF transmitter. We have been supplying reliable RF components to the radar industry for many years. We now have the capability to design, manufacture and supply complete system transmitters, based around our advanced solid-state modulator and power supply technology.

e2v's compact solid-state modulator technology, when combined with its extensive range of magnetrons and travelling wave tubes, can be configured to satisfy even the most demanding radar transmitter system application.

Pulsed Power for Industrial and Scientific Applications

e2v has the technology to satisfy many of the emerging scientific and industrial applications for pulsed electric fields or pulsed microwave fields when combined with our magnetrons, TWTs (Travelling Wave Tubes), klystrons and IOTs (Induction Output Tubes).

The pulsed power capabilities developed by e2v can be employed to drive linear accelerators for cargo scanning, particle research, X-ray lithography and other applications. For example:

- Automotive – using pulsed magnetic energy for shaping and joining of metal
- Non-regular pulse repetition rate for dose control (i.e. pulse-to-pulse adjustment)
- Food – pulsed electric and microwave fields for sterilisation of food and liquids
- Industry – industrial processes, ion implantation, cleaning of flue gases, wastewater treatment and separation of rocks
- Homeland security – using pulsed power for biological screening, cargo screening and other processes requiring scanned radiation.



Pulsed Power for Medical Applications

A new fully integrated modulator system has been designed to complement and drive e2v's range of radiotherapy magnetrons. It is a solid-state direct switching unit, designed specifically for use in linear accelerator (LINAC) machines to provide users with a tailor-made solution for all modulator requirements. “Reliable” and “compact” are words that best describe the new high-voltage modulator, which, when combined with an e2v magnetron, will provide a very versatile, high-energy, pulsed microwave source from a prime three-phase power input.

e2v's direct switch technology is not restricted to use with magnetrons; when combined with a pulse transformer, it can provide the same level of versatility for klystron driven systems.

The e2v design, whilst satisfying the requirements of a typical radiotherapy specification, also provides added functionality. This direct switch approach offers the following benefits:

- Precise setting of pulse width for accurate dose delivery (electronic)
- Non-regular pulse repetition rate for dose control (i.e. pulse-to-pulse adjustment)
- Fast removal of pulse under fault conditions or patient movement
- Predictable pulse shape to allow active drive and phase compensation
- Compact size and the ability to be rotated allow new system layouts to be realised

Let e2v help you to realise your pulsed power applications

Other e2v product guides available:

- Switching (thyratrons and spark gaps)
- Heating (gridded tubes)
- Microwave
- Automotive
- L3Vision™ (high sensitivity CCD imagers)

Partnerships – Future Technology Innovation

e2v is constantly working on new applications; developing technology that will change the world. Strong links with universities, government establishments and other research organisations around the world ensure that e2v stays at the forefront of technology. e2v is a cost effective manufacturer working closely with customers to meet the challenges of new applications.

