



CAPABILITIES

LED BY INNOVATION



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MARL International Ltd has been adapting LED technology to provide innovative, attractive and functional solutions for over 50 years.

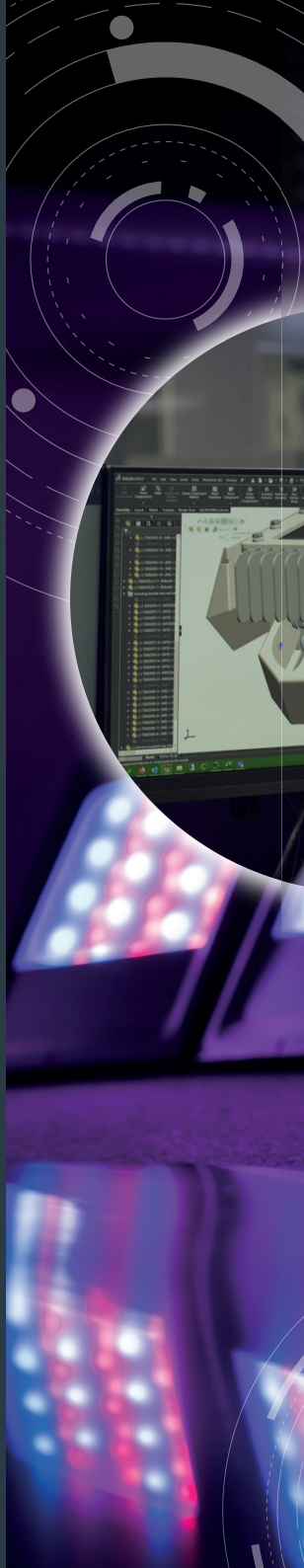
Backed by world class in-house design and manufacturing facilities, we are recognised internationally as experts in both the electronics and LED lighting industries. Our comprehensive design and manufacturing competences cover sectors that include defence, rail, marine, off-shore, industrial control, water treatment, film & photography and specialist lighting.

MARL is based in the historic market town of Ulverston, Cumbria, on the edge of the English Lake District. An area of outstanding natural beauty, it's home to a great number of tourist attractions and is a popular holiday destination.

We are a member of "Made in Britain", proudly manufacturing to the very high standards expected of the UK.



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SURFACE MOUNT TECHNOLOGY CENTRE (SMT)

MARL's SMT Centre has the capacity to process 80,000 components per hour, allowing fast turnaround, and is available to clients for a range of design and manufacturing services including build to print, complete PCB design, prototyping, design verification and volume manufacture.

As an LED specialist, our SMT facility and expertise are particularly suited to supporting professional luminaire manufacturers. The lines are equipped to handle board lengths of up to 1480mm; such lengths are commonly required for replacing conventional lighting products.

The SMT lines consist of two I-Pulse M20 high performance, high flexibility SMT placers, coupled with two Lemme Neo 20-stage convection reflow ovens, situated in a climatically-controlled environment.





The facility offers:

- 2 fully automated lines.

- Capability to place secondary optics.

- Capability to process FPCs (Flexible Printed Circuit Boards) with clamping / stable handling of long boards with narrow aspect ratio.

- Very high placement accuracy of $\pm 0.04\text{mm}$ for chips and $\pm 0.025\text{mm}$ for QFPs (Quad Flat Packages).

- Stable feeding, pickup and placement of LEDs and associated components.

- Multi-placement component heads for wide ranging component handling capability; rapid application of solder pastes and adhesives and high feeder capacity (maximum 144 feeder lanes).

- Stencil-less solder paste dispensing for reduced NRE costs and lead times for prototype development.

- Laser measurement to control board warp measurement.



PRECISION ENGINEERING

Our in-house precision engineering facilities include precision CNC machining centres and routers enabling the manufacture of bespoke fittings, heatsinks, lenses and diffusers.

2x 3-axis Hurco Vertical Milling Machining centres (VM20 and VM20i) are utilised to allow good capacity, offering a table size of 1160x508mm, spindle speed of up to 12000 rpm and spindle torque of up to 98.8Nm @ 1450rpm.

Routing capacity is provided by 2x Pegasus 1530 ATC CNC Routing machines, each with a bed size of 1525x3050mm and an Automatic Tool Change system.

For prototyping and other specialist parts, 3D printing is available using a Creality K1 Max. Boasting a 300x300x300mm large build volume and 600mm/s printing speed, it's great for rapid prototyping or design verification.

Our Tool Room Facilities also include manual Turning and Milling equipment.





IN-HOUSE DESIGN SERVICES

The MARL Design & Development Team has a broad range of experience and expertise in optoelectronic, hardware, software and mechanical design with specialist knowledge in LED technology integration. Services extend from concept development to end certification, allowing even the most complex LED indication and illumination projects to be guided with confidence.

Services include:

- Feasibility studies: examining the cost and timescale of your project and advising on the most appropriate approach in areas such as manufacturing methods.
- Technical documentation: testing products to relevant industry standards and helping to demonstrate your product's quality, safety, lifespan, technical specifications and warranty.
- Research & development: using the latest LED industry insights, we can help clients enhance existing products and find new routes to market.
- To help support these activities our design facilities include 3D printing, SMT, prototyping and a darkroom with a goniometer to produce IES files and detailed reports of luminous flux and lighting characteristics.

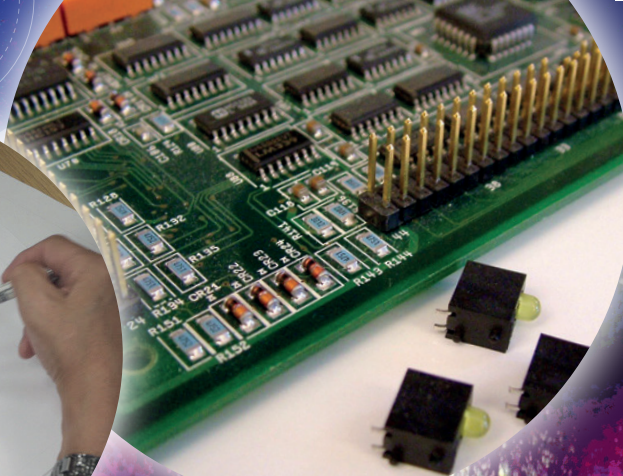
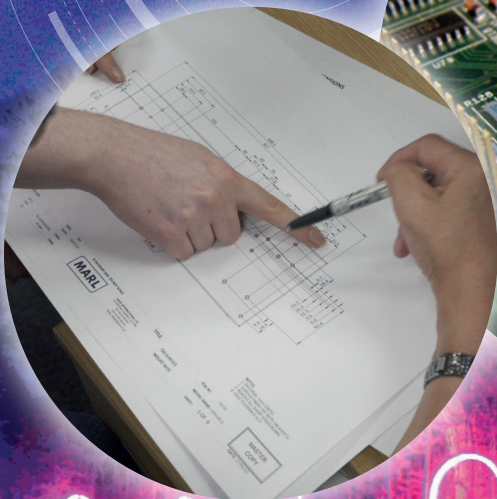
PRODUCTION & ELECTRO-MECHANICAL ASSEMBLY

Whilst we have automated SMT lines for sub-mm accuracy and rapid placement of surface mounted components, all MARL-manufactured products are ultimately hand assembled including placement of the resulting boards and components into housings, wiring, hand soldering of intricate components, potting, inspection and testing.

This approach allows real-time quality control as our technicians have precise attention to detail and can visually inspect each component, identify defects and make any necessary adjustments. It also allows better customisation and flexibility than automated assembly, being able to rapidly prototype and move between a wide variety of projects or adapt as requirements change, without long and costly setup of automated machinery.

A dedicated Quality team ensures all inspection processes are comprehensive, well documented and meet regulatory requirements, and that any defects are appropriately addressed with preventative measures wherever they're identified.





SUB-CONTRACT DESIGN & ASSEMBLY

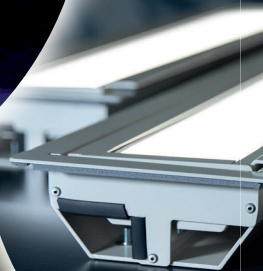
MARL can provide Box Build services. A relatively recent development in electronics manufacturing, Box Builds place all your assembled electronics in an enclosure – PCBs are internally mounted into place, cabling and wire harnesses are routed internally as well as backplane assembly, din rails etc. Pneumatics may also be included in the box build.

Box builds are used in several industries such as defence (communication devices, avionics systems etc), automotive (control units etc especially in electronic vehicles), medical (patient monitoring systems), industrial instrumentation etc.

Our Box Build and Sub-Contract Design and Assembly services integrate with our other design services such as prototyping and designing the build, and our hand-assembly, quality control and testing services.



LIGHTING THE WAY



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