

COMPANY PROFILE

Teknek Electronics Ltd, Quarriers Village, Bridge of Weir, Scotland

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FRIDAY, December 11, 1992 — While hordes of headline-seeking journalists at Holyrood Palace competed for the latest scoop on the Edinburgh Summit, it was pleasant to travel west to the calmer setting of Quarriers Village in Renfrewshire. Success was claimed as the outcome of the Summit. Another success story is reflected in the growth and performance of the still fairly young but thriving company Teknek Electronics Ltd. Success in a period of inescapable gloom for the electronics industry is all the more newsworthy. It should also offer a glimmer of optimism to an industry where hope and enthusiasm appear dampened, if not extinguished, by successive recession-related blows.

Housed uniquely in the Old Fire Station — dating from 1898 — which served the Orphan Homes of Quarriers Village*, Teknek must be one of the rare companies situated in a quiet residential area of a small village, overlooking peaceful countryside and accessed by virtually traffic-free roads. The main firestation building, its attached stabling and workshops are of red sandstone and have been renovated and equipped as appropriate for a modern technology company. Extensions carried out in 1990 to accommodate a new production and stores unit reproduced the traditional sandstone appearance so that the entire property retains its turn-of-the-century character.

From its modest beginnings in 1984, with four employees in a rented 100 ft² one-room office at the Old Fire Station, the company now employs 55 staff on site in premises occupying 10,000 ft². The physical expansion has — amazingly — in 1992 been accompanied by growth in business and also by the development of a new management tier comprising a Design Manager, a Quality Manager and a Sales & Marketing Manager. Such development is identified as part of the company's strategy of 'building for the future'. The present team of directors — Jonathan Kennett, Managing Director, and Technical Directors Stewart Robertson and Sheila Hamilton — is supported by the following departments: Design and Development, Quality, Production, Direct External Sales, Internal Sales, Technical and Customer Services, and Purchasing. In addition, the company engages 65 distributors worldwide in 30 countries including the Far East and Australia, as well as employing US and German nationals as full-time Sales Managers in their respective lands. The strong emphasis on export areas is reflected in the fact that 85% of business is for the export market, split almost equally among Europe, Asia and the USA. At present, trade with Eastern Europe is being investigated, and negotiations are under way for direct business with China.

For several years the name Teknek has been synonymous with the catchy product title, the 'Clean Machine'. Although this is still the major product line, in particular in a printed circuit industry context, during its recent visit *Circuit World* gained insight into what seemed like a treasure-trove of other interesting products. The package of product information sheets alone adds considerable weight to a briefcase!

But how did it all begin? Looking back, 1978 saw the start of trading when Jonathan Kennett began championing the use of protection film on phototools (Protek). In 1979, he was joined by Stewart Robertson and, ironically, triggered by the industry downturn of the early 1980s, business rapidly expanded into the export market, initially to Scandinavia and the USA.

A customer base was thus already established when in 1984 the company Teknek Electronics Ltd was formed to develop an idea for removing airborne contamination (dust, lint, hair, etc.) from sheet materials such as plastic films, polyester, copper panels, glass etc. A hand roller was first developed to address the needs of the printed circuit industry and was followed after a year by the prototype of a sheet cleaner, which after some refinement was launched at Productronica 1985 as the Clean Machine.

The justification for the concept behind this cleaning system is easy to grasp when one considers that, although the problems associated with particulate contamination had long been acknowledged, industry trends towards smaller printed circuit boards with greater packing density were leading to finer conductors and narrower spaces. This increased complexity and fineness meant that dirt and dust inclusion was becoming more problematic, more difficult to detect and more expensive to remedy.

In general, the most dust-sensitive processes encountered in PCB manufacture are in the following areas:

- dry film lamination, where panels must be cleaned before lamination to prevent pinholes or blistering of the resist;
- covercoat application to flexible circuits, where dust inclusions considerably reduce yields;
- exposure of photoresist, where dust on panel, phototool or exposure frame can cause open or short circuits;
- photography, where unexposed film can be contaminated with loose particles (from the slitting operation) which can cause pinholes;
- screen printing, where airborne dust can block open areas of the screen mesh or become encapsulated in the coating, causing subsequent delamination;
- multilayer build, in which case dust on the individual layers of a multilayer 'book' can be pressed into the copper tracks of inner layers or can cause voids;
- automatic optical inspection (AOI), where a false reading generated by a particle of dust can be difficult to differentiate from a genuine defect, wasting considerable inspection time.

The main sources of contamination occurring in these areas are airborne dust, dust on materials, on equipment and on people. Did you know that human beings are the greatest potential source of contamination and that a person walking can shed up to 10 million particles per minute? Airborne dust might appear to be the least noxious (is it not *airborne?*), but here the risk arises because the forces of static electricity can produce extremely high charges on plastic sheet or copper panels, attracting the dust to settle immediately on these charged surfaces.

The traditional methods used to remove such contamination before crucial processes in the PCB industry included wiping, brush and vacuum systems, with wet cleaning and air knife equipment also finding application. Cleanroom technology, so indispensable in the semiconductor industry, is expensive to install, especially for large areas, and is not necessarily the most appropriate solution to the PCB industry problem.

Each of the above methods exhibited shortcomings or drawbacks which the Clean Machine sought to tackle. The prototype featured four specially formulated elastomer rollers to remove contamination from both sides of the workpiece and static elimination bars to neutralise any static charge likely to cause its recontamination. To keep the cleaning rollers clean, two rolls of special adhesive paper were used, with the adhesive face on the outside, running in contact with the rubber rollers. Care was taken to avoid adhesive reaching the workpiece, which might introduce problematic chemical residues. Such refinements required attention to chemical structures and working temperatures.

After thorough tests in a genuine working environment with a major PCB manufacturer, the prototype machine achieved immediate acceptance. Without delay production began, sourced predominantly from local suppliers. At present, at least 80% of the parts are manufactured in the UK. Serious marketing led to widening distribution on a global scale. The UK was obviously the first market targeted and it is to Teknek's credit that virtually all UK PCB manufacturers, the majority of companies in mainland Europe, and many of the major players in the US have installed at least one Clean Machine. In the larger companies, 10 to 15 machines are located at every relevant stage of production. Such firms clearly recognise to the full the capability for 'Just in Time' cleaning offered by the Teknek system, which operates on the principle that a sensitive substrate can be allowed to gather dust, be quickly and efficiently cleaned, undergo a critical process (whether in the photographic or photomechanical areas, AOI, screenprinting, photoimageable resist, or multilayer build department) and then be allowed to recontaminate. The time delay between cleaning and processing is minimised, as is the operator involvement after cleaning.

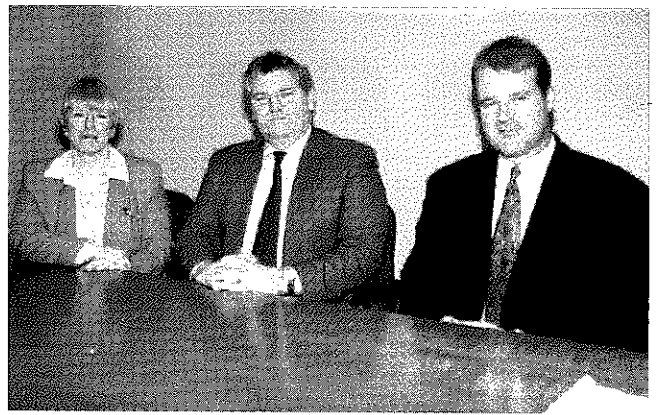
The JIT cleaning philosophy was carried a stage further by the development of a laminar flow ionising hood, the LFI, which provides a mini clean room around the chosen process. Designed for installation above an individual machine or process, this unit produces a localised static-free Class 100 clean room environment. The airflow pattern creates a barrier to the ingress of contaminated air from the surrounding area, augmented by transparent, permanently anti-static curtains which enclose the working area. Cost-effectiveness and efficiency are combined in this integrated equipment approach.

It should be mentioned that, in addition to the reduction in unnecessary

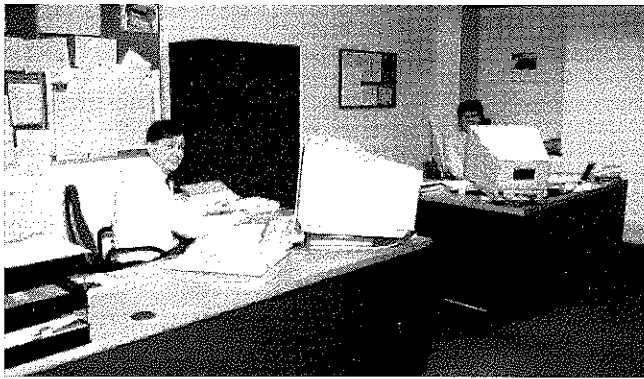
*William Quarrier founded the Orphan Homes of Scotland, with the first buildings opened in Glasgow in 1871 and later the 'model' village, Quarriers Village, at Bridge of Weir. His ideal was the provision of cottage homes for orphans and destitute children, and his original scheme of 10 cottages gradually expanded to 43 cottages in addition to homes for babies and toddlers, a hospital, a 'colony' for epileptics and a sanatorium.



The original Old Fire Station building in Quarriers Village, today housing just a few of Teknek Electronics' departments.



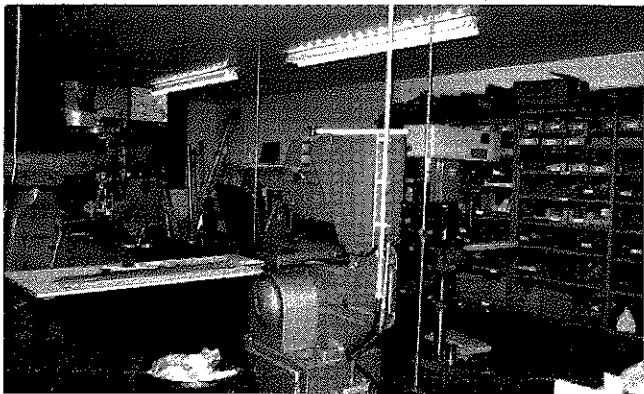
The team of directors: Jonathan Kennett, Managing Director (centre), with Technical Directors Sheila Hamilton and Stewart Robertson.



The design studio.



The production area in the new extension.



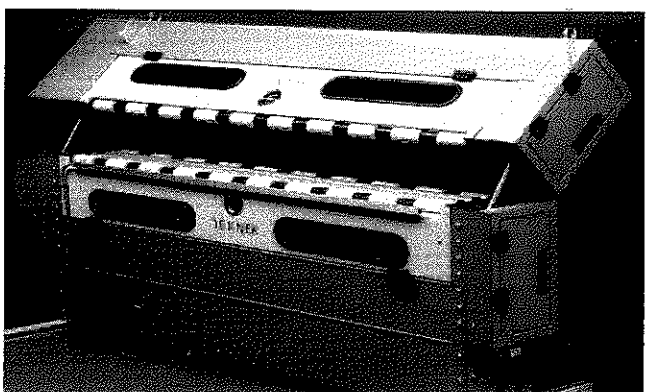
The in-house machine shop.



The CMIII production unit.



Final adjustments to an HDCM 1500 heavy duty cleaning unit for caul plate cleaning in the laminate industry.



XCM 1830 for caul plate cleaning — the newest machine in the range.

labour and time and the provision of dramatically increased board manufacturing yields achieved by using this system, other peripheral benefits for the PCB manufacturer accrue. One significant example is the case of the adhesive roll which acts as a 'contamination reservoir', permanently removing unwanted debris from the workpiece. When the contaminated sections of the roll are removed, these can be retained for analysis by the user, thus enabling determination of the sources of contamination and enhancing process control.

Following success in cleaning flat surfaces to a high standard in relation to the PCB manufacturer's requirements, Teknek then recognised the potential for use by laminate companies, especially at the lay-up stage. Many such companies have in fact been able to upgrade their product as a result of implementing Clean Machine technology. A natural progression was acknowledgement of the benefit to copper foil manufacturers, who are now successfully employing the system internationally.

After PCB manufacture, the equipment also finds use for cleaning surface mount panels/boards prior to solder paste application, thereby helping to reduce blow-outs.

The current model of the Clean Machine is available in two designs — the uni-directional, offering continuous feed forward, and the multi-mode style, with continuous feed forward and reverse, auto reverse and feed on demand. It was interesting to see the third-generation CMIII at various stages of modular construction. Sheet-metal work is sub-contracted out and assembly is carried out in-house by the flexible, multi-skilled workforce of the Production department. Build of the basic CMIII takes about 20 hours; delivery time is two weeks, and replacement adhesive rolls are available ex-stock. Customised models of the machine are constructed to suit varying specialised requirements.

It would have been shortsighted to assume that this 'workhorse' had potential only for the PCB industry. From the outset Teknek realised that there were other markets for the Clean Machine principle. Logically, the first one addressed was the screenprinting industry where an impressive 20% improvement on bottom line yields is now attributed to use of this technology. At present, the company's activity is divided almost evenly, with 50% of business in the printed circuit (and associated) industry and 50% in screenprint and other areas. The main cleaning unit for screenprinting applications is a single-sided cleaning head which works in conjunction with a screenprint machine. Operating on a transfer principle, the head permanently removes contamination down to particles of less than 2 microns.

Other diverse markets have included film converting, liquid crystal display, flat screen display, food packaging, adhesive coaters, and more recently automotive glass, security glass and the lithoprinting industry.

Space does not permit details on the company's entire range but it is certainly worth at least mentioning the existence of items such as the Clean Machine Web Cleaner, the Photo-Emulsion Protection Laminator with integral Pre-cleaner, and the Pre-cleaner for Dry Film Hot Roll Laminators (for retrofitting with Du Pont and Dynachem equipment). Smaller items such as the DCR Hand-held Cleaning Rollers, a Static Locator, Static Bar Checker, Dust Viewing Device and Clean Room Control Mat supplement the range appropriately.

With a strong foothold in the cleaning technology area of the PCB and screenprinting industries, Teknek has recently branched off in other directions. The earlier emphasis on equipment is now complemented by an increased level of activity in consumables/materials. An innovative early example of this diversification taken on board was an adhesive system for the bonding of heat sinks to printed circuit boards. Known as DMA, the system uses a specially formulated pressure-sensitive adhesive coated as a matrix of closely spaced discrete dots onto a release liner to form a transfer tape, and claims significant advantages over prepreg bonding.

A vast portfolio of other specialist adhesive products is now offered, meeting the requirements of the printed circuit and membrane switch industries and including adhesive tapes, optically clear transfer tapes,

conductive adhesives for component assembly on low temperature substrates (including a flexible adhesive), anisotropic adhesives providing conductivity in the Z-axis only, and high temperature adhesives. Detailed product information sheets as well as health and safety data sheets are available on the various products within these categories.

Teknek also sources a wide selection of inks and coatings to cater for these industries, including conductive, ultra-conductive, resistive and dielectric (also flexible dielectric) inks.

The product family further covers substrates such as sputtered ultra-thin copper on polyimide and polyester for fine-line flexible circuits; sputtered ITO (indium tin oxide), gold and silver for touchscreen and display manufacture and membrane switch shielding; and print-receptive polyester pre-coated with optically clear adhesive for membrane switch lamination.

Another different product area which for Teknek has proved particularly healthy during the recession has been that of EMI protection of PCBs at board level. EMIform is a three-layer thermoformable laminate meeting the stringent requirements of the electronics industry. It comprises a support film made from an electrically insulating polymer providing the structure of the shielding package, a middle layer or core made from an electrically conductive material which can be formed, and an inner layer made of an insulating polymer which offers improved thermal properties to aid heat transfer. This family of laminates helps solve the problems of intra-system coupling as well as providing excellent thermal management. Future development in this area by Teknek is foreseen.

This company has confronted a difficult period for the industry, and for the economy in general, in a very positive manner. Its record of having expanded during 1992 is remarkable and very welcome. The creation of a new management tier, attendance (as in previous years) at 10 exhibitions worldwide, and no reduction in the company's normal targeted advertising strategy throughout the year reflect Teknek's secure status. As a privately owned enterprise, it has fully exploited its flexibility and responsiveness to the world marketplace, whose trends have been monitored closely.

To the visitor, Teknek appears progressive and well organised. A management information system is in place with a computerised network of 24 terminals. There is an air of orderliness in the various clean and bright departments — through Sales and Administration offices, Consumables Development and Storage areas, Despatch, the Design Studio, Production, and the Development and Machine Shop. On a section of one wall in the entrance to the new building are displayed the various awards received, the most treasured being the Export and Enterprise Award 1990 and the Opportunity Japan Award 1991.

The downturn in the industry has given some less busy companies an opportunity to 'imitate' Clean Machine technology. However, without being complacent, Teknek is not too anxious, as, although the principle of the system is perhaps not difficult to emulate, the secret of its success lies also in the unique properties of both the elastomer rollers and the adhesive rolls, which can be reproduced much less readily.

For the future, growth is fuelled by industry's increasing recognition of the cleanliness issue. The move to fine-line technology, especially in Europe during the past five years, together with multinationals pushing board technology to ever tighter limits, has made efficient cleaning systems absolutely essential. This augurs well for future business. Teknek intends to address the coming years with greater emphasis on custom-built equipment, with specialisation in new market areas, and by combining its unique, patented Clean Machine technology and related equipment with an enhanced range of innovative consumable products.

In its first year of trading in 1984 the company turned over £25,000. Turnover for 1992 is approaching £5 million. With expansion into new territory — in geographical and technology areas — the Old Fire Station in Quarriers Village may not have seen the last of the *new* red sandstone façades!

Lorna Cullen