



GAUGE BLOCK GOOD PRACTICE GUIDE

FEATURES//

REMOTE OPERATING
SIMPLIFIES ASSETS

ENGAGING WITH
YOUNG ENGINEERS

SPECIAL INTERVIEW//

CHRISTOPHER SMEETH, AWE

OCTOBER_2017_ISSUE THREE

PRECISION

MAGAZINE



Servelec Controls is an
approved systems integration partner
for HIMA specialist safety platforms.



ICE OR NO ICE — THAT IS THE QUESTION



For good or bad we have been living with the ‘infernal’ combustion engine for over a hundred years now and it has changed our society, again for good and bad. It has transformed some countries such as the USA, but its time is coming to an end. The UK and French governments have both announced that the sale of new petrol

and diesel cars, including hybrids will be stopped from 2040 in an effort to combat pollution. How will that affect the automation and instrumentation industry?

This has been an ongoing effort since we saw the phasing out of 4-star petrol and introduction of lead free petrol and ‘clean’ diesel, which we are now told is not as clean as we thought. But electrically powered cars would be pollution free wouldn’t they? But what about the extra power stations, battery manufacture and disposal? Will we see ever cheaper and more efficient power storage that will not in itself harm the environment?

What other changes can we expect? There will no longer be a need for

filling stations as we will be able to charge up at home or at the office. In the USA there are already many charging stations at shopping malls. What about the oil majors – what will they do? How will refineries change? Will they move to producing aviation fuel as I don’t see electric planes even on the 2040 horizon?

One thing is for sure, it will need the help of the automation and instrumentation industry. Our industry has aided the move to today’s modern car, bristling with sensors and management systems and more efficient than ever. We have developed automation and instrumentation systems that enable refineries to produce far more products than ever before without harming the environment. It is in our nature to adapt and, once more, we will rise to this new challenge.

I plan to start a dialogue with you on this topic via correspondence and social media and will write a longer article in a future edition of Precision. Give me your comments and opinions please at engineering.director@instmc.org

Dr. Maurice J. Wilkins
C.Eng, FInstMC
Engineering Director

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PRECISION

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NEWS

NPL PARTNERS WITH NEXGEN NETWORKS TO EXPAND NPLTIME® PRECISE TIMING SERVICE ACROSS EUROPE

NPL is expanding its precise timing service, NPLTime®, across Europe through a strategic global partnership with NexGen Networks, the premier provider of tailored, high-capacity communications services to the financial industry

NPLTime® provides a precise time signal delivered over fibre, traceable to Coordinated Universal Time (UTC), accurate to within one microsecond. The agreement aims to provide the NPLTime® service to all major exchange proximity colocations in Europe and, in the future, around the world, through NexGen Networks' Certified UTC TaaS (Time as a Service). This will provide NexGen Networks' customers with the underpinning timing capability for traceable timestamping, latency monitoring and synchronisation.

The agreement comes ahead of the implementation of the European Securities and Markets Authority (ESMA) update to the Markets in Financial Instruments Directive (MiFID II), which will require financial organisations to achieve up to 100 microsecond level traceability of trading events by January 2018.

The NPLTime® service provides a certified precise time signal delivered over fibre, accurate to within one microsecond. This provides assurance to industry that they can become fully compliant with MiFID II timestamping requirements and eliminate their reliance on GPS, removing susceptibility to jamming, spoofing, urban canyon effects and space weather.

NPL is the home of atomic time, and operates one of the world's most accurate atomic clocks, NPL CsF2, which is accurate to one second every 158 million years. NPLTime® is an extension of many decades of time dissemination expertise, giving industry direct access to reliable timing straight from the source.

Leon Lobo, Strategic Business Development Manager, NPL, says:

"The magnitude of new regulation must not be underestimated. MiFID II will make having a highly accurate time standard all the more important, to ensure that transactions completed in microseconds are easily certified. But in addition to compliance, precise timing offers many competitive advantages, from enhanced algorithm optimisation to ease of audit. At NPL, the home of the UK's National Timescale, we provide the only precise time dissemination solution that is directly and physically connected to UTC. By partnering with NexGen Networks, which has expertise in rapidly delivering services to the financial industry, we are able to offer the benefits of NPLTime® to customers across Europe ahead of MiFID II implementation in January."

Janesh Mistry, Senior Sales Director, NexGen Networks, says:

"By forming this partnership with NPL to deliver NPLTime® over our network, we will not only enable financial enterprises and exchanges impacted by ESMA's ruling to de-risk all compliance ambiguity in technically addressing MiFID II RTS25, but also confidently present new creative market structure opportunities.

"For compliance, legal and technical authorities still working through possible solutions, the NexGen TaaS takes the guess work out of what to implement across your Europe-wide electronic trading real estate, as we fast approach 3 January 2018. Using our proven global experience and heritage in expertly delivering complex infrastructure solutions, we offer a European service for European regulations, understand the urgency and, in some cases, can even compliment your existing timing infrastructure without the need for further capital expenditure."

GOLD STATUS FOR ENDRESS+HAUSER



EcoVadis honours sustainable business processes

Endress+Hauser has received a Gold Recognition Level certificate in the EcoVadis audit, improving on the previous year's result with 66 points. The result illustrates the high importance Endress+Hauser places on its corporate social responsibility (CSR) and the structured, foresighted approach it takes.

"As a family business, the concept of sustainability is anchored firmly in our values," emphasizes Matthias Altendorf, CEO of the Endress+Hauser Group. "For this reason we have made the EcoVadis rating one of our strategic key figures. The gold certificate confirms that we are moving in the right direction. At the same time, it

serves as an objective evaluation of our social responsibility for our customers."

Broad audit

Twenty-one criteria were assessed in the audit, including environment, labor practices, fair business practices, and sustainable procurement. The company achieved an above average rating for all categories, receiving the gold certificate. Endress+Hauser is therefore among the leading two percent of all suppliers evaluated by EcoVadis.

Social responsibility at Endress+Hauser

The concept of responsibility is firmly anchored in the company values at Endress+Hauser. Since 2015, the Group has published a sustainability report that examines social, environmental and economic aspects of company management,

giving a holistic view of the Group's development.

The EcoVadis rating

EcoVadis runs a platform that allows companies to assess the environmental and social aspects of their suppliers. Structured scorecards make it simple to track and improve environmental, social and ethical performance worldwide. Over 20,000 companies use EcoVadis in order to reduce risks, improve innovation and create trust and transparency between business partners

ROYAL MAIL TRIALS ELECTRIC VEHICLES

The Royal Mail has started a one year trial of nine electric vehicles, which will be used to move post around London's mail distribution centres. Produced in partnership with Arrival, an Oxfordshire-based carmaker, the three 3.5 tonne, three 6 tonne and three 7.5 tonne trucks being tested have a zero-emission range of up to 100 miles. The vehicles have a dual power mode which can be used to top up the battery after the first 100 miles.

Paul Gatti, Royal Mail Fleet Director, said, "We will be putting them through their paces over the next several months to see how they cope with the mail collection demands from our larger sites. We have trialled electric trucks before but not of this innovative design and look forward to seeing what additional benefits they can bring to our existing fleet". Denis Sverdllov, chief executive of Arrival, said: "Cities like London will benefit hugely from a switch to electric, in terms of both pollution and noise."

These larger payload vehicles are intended to complement the 100 electric zero-emission Partner L2 vans, manufactured by Peugeot, which will come into full service from December 2017. The order follows extensive trials by Royal Mail and the vans will be used by delivery offices across the UK. The Partner L2 uses lithium-ion batteries with a range of up to 106 miles, which can be recharged to around 80% capacity in 30 minutes, when connected to a dedicated rapid charge point.

PSA Group Fleet Director Martin Gurney said "It's a tribute to their performance in the trials that Peugeot Electric vans will soon be helping Royal Mail to significantly reduce the environmental impact of its delivery fleet."

Partner Electric customers are eligible for the Plug in Van Grant (PIVG) from the Office for Low Emission Vehicles (OLEV), which covers 20% of the cost of the vehicle (including VAT but excluding on-the-road costs). These vehicle also receive the an

Ultra Low Emission Discount (ULED), which gives a 100% discount from the London Congestion Charge and some boroughs (including Hackney) also offer a 100% discount on parking permits for electric vehicles.

While this order and the vans being trialled represent a very small proportion of Royal Mail's 49,000 vehicle fleet, mobility experts suggest that European countries including the UK could convert a significant percentage of their vehicle fleet to electric over the next 10-15 years. In July, the Government announced plans to ban new petrol and diesel vehicles by 2040, which has increased development in the electric vehicles market – Volvo, BMW and Hyundai have all announced plans for electric commercial vehicles.

Source: Engineering Council
<https://www.engc.org.uk/news>

UPTURN IN STUDENT NUMBERS BODES WELL FOR ECONOMIC PROSPERITY

The number of students sitting A-levels in science, technology, engineering and maths-related (STEM) subjects rose in 2017, with 41% of A-level entries overall in STEM subjects, up from 40% in 2016.

School Standards Minister, Nick Gibb, said strong uptake in maths and further maths as well as "increasing entries to science, technology, engineering and maths subjects bodes well for the economic prosperity of our country. It will help to grow our workforce in these sectors, allowing young people to secure well-paid jobs and compete in the global jobs market of post Brexit Britain".

"Increasing the number of girls studying STEM subjects has been an important objective of the Government, so it is particularly

pleasing to see that more young women are taking STEM subjects."



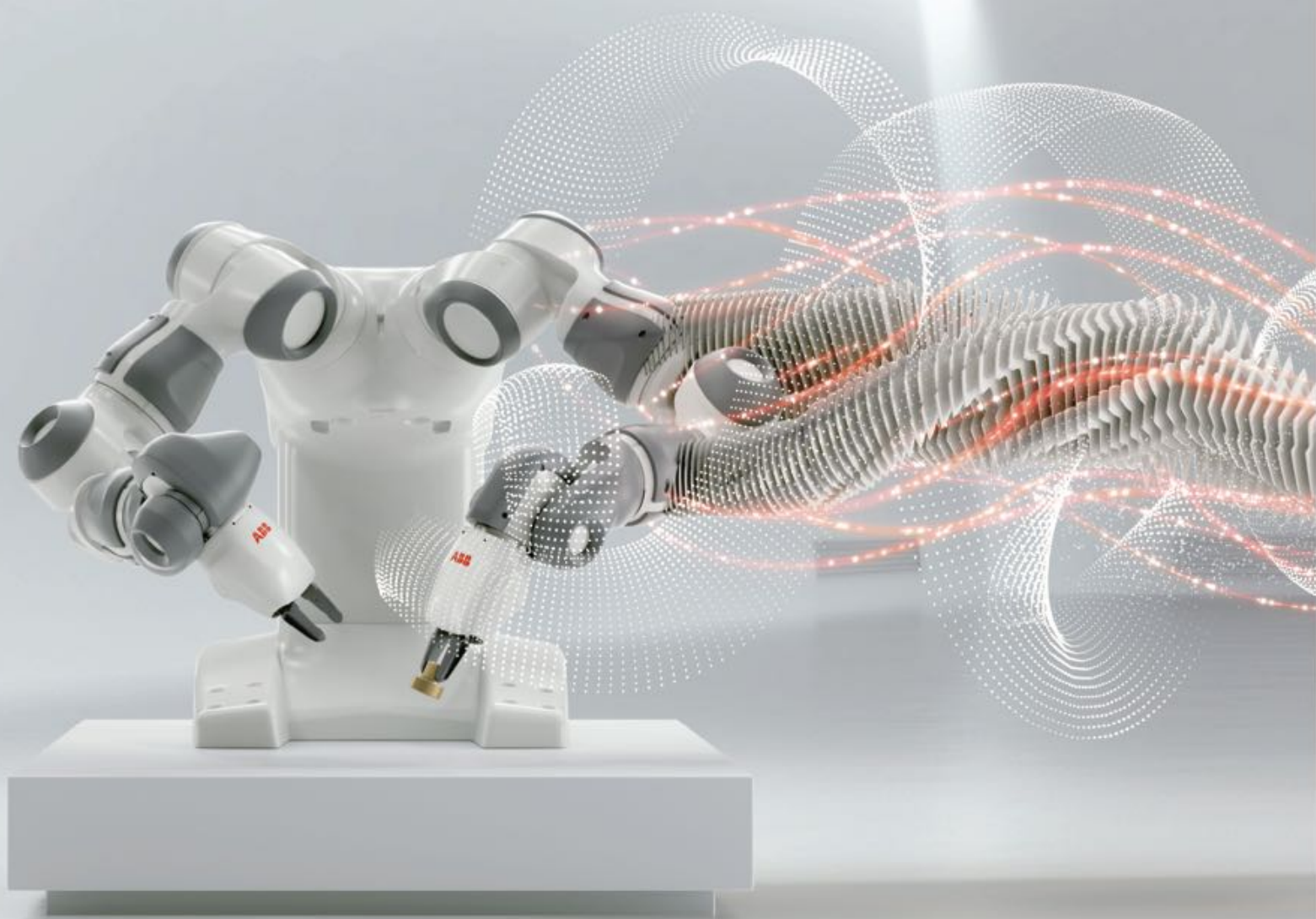
Overall entries for A-level Computing in particular have more than doubled in the past five years, with the number of female candidates on the increase. 2017 is also the first year since 2004 that more female students than male studied chemistry.

Peter Finegold, head of education and skills policy and research

at IMechE, told Professional Engineering that the upward trend in STEM numbers was "gratifying". He added that "translating this success and enthusiasm into engineering jobs will require a robust - and long-awaited - government career strategy that will help pupils, their parents and teachers to appreciate the breadth of opportunity on offer."

According to EngineeringUK, the annual shortfall of engineering graduates is at least 20,000. Their "The state of engineering" 2017 report also notes that the supply of postgraduate-level skills in engineering and computing is currently highly dependent on international graduates studying in the UK.

Source: Engineering Council
<https://www.engc.org.uk/news>



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ABB

ENGAGING WITH YOUNG ENGINEERS



InstMC's Patrick Finlay with Ellis Davies are looking to support the new professionals who will help shape the future

Earlier this year, the UK's 35 Professional Engineering Institutions (PEIs) came together at a single event for what is quite possibly the first time. As part of the 21st Century PEI project, a Young Members Workshop was held in London to gather feedback and hear from younger members from a range of institutes including InstMC. The day was taken up with a variety of activities, including group workshops, presentations and feedback sessions, designed to allow members to relay their needs and wants to the CEOs of the PEIs. The event also provided the opportunity for young professional engineers to network and exchange experiences with members of the other PEIs.

The attendees formed four workshop groups to carry out the morning's tasks. The first came in the form of a paint box. Each tube of 'paint' was labelled with an idea for improvement put forward by the CEOs of the PEIs, and the groups were tasked with arranging these tubes in order of priority. Each group was also given blank tubes of paint, with which they could add their own ideas to the list of priorities. These sessions were filled with discussion and debate concerning the future needs of PEIs, as well as frequent comparisons of young members' experiences in their respective institutes, some being very actively involved and holding positions on committees, whereas others were less so.

Once the paint box was full, the groups moved onto the second task,

ideas, and to continue to work with the CEOs to help 21st Century PEI progress.

The groups reunited to discuss priorities. All groups had placed an emphasis on communication and career development, grasping the opportunity to put forward their own ideas, which ranked high. The need for a common communication platform was raised, in which members could talk to each other and promote events across every institute. This tied in with a point put forward by the CEOs regarding a shared diary of events, enabling members who are interested in topics outside their institution to attend.

Continual professional development (CPD) also featured highly in the discussion, with members feeling

would be appropriate to switch to a different institution for this post – a process that could happen repeatedly during a career. Modern engineers have to be multi-disciplined and can expect to change their areas of work and update their skill base repeatedly over a working life time.



which involved placing all 35 PEIs into 'clusters' under a common term, such as energy. Many debates ensued over which PEIs belonged in each cluster. There was a desire by many to attempt to find cluster names that would encompass all 35 institutes, rather than fragment them into smaller segments.

Finally, members were asked what they would like the next step to be. Action was the word on most lips, with members asking for a follow-up event to see the results of their

that an online system for keeping track of CPD across all the PEIs would provide greater flexibility for members and an easy way of monitoring personal progression.

The over-arching conclusion from young members was that they did not want to feel placed in a silo at the start of their careers. Although they may choose to join the institute which is aligned with their current job, they would like access to the activities of all PEIs. Furthermore, their next job may be in a different area and it

Continued on next page...

More recently, in July, InstMC CEO Patrick Finlay and Mmarketing Mmanager Catalina Pascu held a focus evening with students and young engineers – some InstMC members, and some not - to learn how our institute could engage more positively with them. A number of ideas came forward. An important tip for involving new young members and students is to give them a specific responsibility – such as organising an event or running a Facebook page - that gives a sense of being valued and belonging. This is particularly true for involvement with Local Sections and university student groups.

Students and young members' expressed interest in attending local events, especially site visits, where they can network with their peers and with potential employers.

They also pointed to the value of social events for networking and relationship building. There is less interest in attending committee meetings and talks unless the speaker or subject is particularly exciting. Social media is a more practical way of keeping in touch and agreeing plans, and YouTube is a preferred medium for acquiring information.

The Institute is planning to appoint a Student and Young Members Officer who will be responsible for encouraging membership in these groups and helping to strengthen links between universities and local sections. The insights gained from these two sessions will be a key input into defining the job role and selecting a suitable candidate.

We also plan to set up two advisory

boards, one made up of students and the other of young engineers. These will help the Institute to remain on message in the services it provides to the up-coming generation of new professionals.

A job advertisement for a Student and Young Members' officer, and the opportunity for young members and student members to join our new advisory boards will both shortly be advertised on our website and elsewhere.



An important tip for involving new young members and students is to give them a specific responsibility – such as organising an event or running a Facebook page - that gives a sense of being valued and belonging.



COMPANION COMPANY SCHEME BENEFITS

Companies involved in measurement, instrumentation & process control are welcome to become members of our Companion Company Scheme. Over 100 leading businesses already benefit from CCS membership.

Over the past 70 years, the InstMC has become an established and recognised professional body in the Measurement, Control and Automation industry. InstMC is widely acclaimed for its continuous efforts to facilitate the exchange of information aimed to improve instrumentation and control industry standards. The Institute supports the development of our Member Companies through a wide range of business oriented benefits:

- ▶ Opportunity to organise networking events and services;
- ▶ Discounted advertising space on InstMC platforms;
- ▶ Introductory article in InstMC journal;
- ▶ Certificate acknowledging InstMC Corporate Membership (CCS) and status within the industry;
- ▶ Possibility to submit internal news articles and technical material on InstMC Website and Journal.
- ▶ Discounted Exhibitors and Conference fees.

GAUGE BLOCK GOOD PRACTICE GUIDE

Length measurements are central to almost all manufacturing industries. Good quality length measurements can be the difference between competitors and can demonstrate product quality in order to win that next big contract. No matter how large the manufactured part is, the "devil is always in the detail"!

A gauge block, or slip gauge, is a piece of wear-resistant material of rectangular cross-section which is used as a reference for performing length measurements. Gauge blocks are widely used to calibrate hand held engineering equipment (e.g. micrometers and Vernier calipers) and larger Coordinate Measuring Machines (CMMs). The best accuracy comes from using the best method. For this, appropriate care and maintenance is key.

There are several national and international specification standards that apply to gauge blocks. In several countries, which previously had their own national standards for gauge blocks, these have been superseded by the latest international standard.

Each standard gives tolerances for parallelism (or variation in length), central length deviation and face flatness. There are also tolerances on material properties such as hardness and length stability, as well as geometrical features such as squareness of side faces and surface roughness. These standards include BS EN ISO 3650:1999, ASME B89.1.9-2002 and JIS B 7506-2004.

What are gauge block grades?

Gauge blocks are manufactured to different accuracy levels, or grades, intended for different purposes. Generally the higher quality grades, which are more accurate and more expensive, are used as reference gauges to calibrate gauge blocks of lower quality grade.

The most commonly used grades in circulation are as follows:

Grade K, the highest grade, has the smallest tolerances and grade 2, the lowest grade, has the greatest tolerances. Grade K gauge blocks are mainly used to calibrate other gauge blocks via a comparator while grade 2 gauge blocks can be found in the workshop for checking various equipment.

The different grades can be used for calibration or verification on a variety of equipment, such as:

- Coordinate measuring machine (CMM)
- Microcoordinate measuring machine
- Micrometer (see Good Practice Guide No. 40)
- Callipers (see Good Practice Guide No. 40)
- Linear variable differential transformer (LVDT)
- Thread gauges



Sheryl Bailey,
NPL's gauge block
calibration expert
describes how to
get the best from
your gauge blocks



Image 2: Practising wringing

Care and Maintenance

The National Physical Laboratory's (NPL's) newly published Good Practice Guide on the "Care and Use of Gauge Blocks" (Guide No. 149) discusses the details of the best care and maintenance for your gauge blocks. Handling gauge blocks correctly helps keep them in optimal condition – for example, wearing gloves will help to avoid corrosion due to oils from your hands and thermal expansion due to heat from your hands. Before using any gauge block, a check should be made that it is free from any problems that would prevent a good wring or measurement. If a gauge block is damaged in any way, this damage could render the gauge unusable and it will need to be re-lapped or replaced.

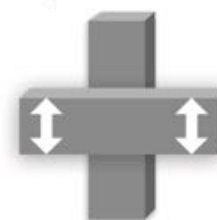
Wringing Gauge Blocks

It is common to need to combine gauge blocks in order to achieve your desired length. For this reason they come as a set (see Image 2). Gauge blocks stick to each other through a process called wringing –

a phenomenon occurring because of molecular attraction between the two lapped surfaces and a thin film of molecules trapped between the surfaces (which is known as the wringing film). This wringing film (when achieved correctly) is typically only a few nanometres thick, so it makes a negligible contribution to the overall size of the wrung gauge blocks. Through the process of wringing, gauge blocks can be combined to obtain a desired length.

There are a few ways gauge blocks can be wrung together. Here we discuss just one. With two gauge blocks, hold the faces firmly together in a cross shape (as shown in the figure). Slide the top gauge block up and down along the surface of the bottom gauge block until it no longer moves easily. Then, rotate the top gauge block until it is in line with the bottom gauge block. This is shown in Figure 1 and Image 1. This method works well for larger gauge blocks. Other methods are discussed in the full guide.

Step 1



Step 2



Figure 1 Hold the faces of the gauge block in a cross shape, then firmly slide up and down. Then twist the gauge block back into alignment.

Occasionally, you may have difficulty getting your gauge blocks to wring together correctly. Adding wringing fluid can help.

Wringing fluid is a mixture of liquid paraffin diluted 1:10 in a solvent. To use wringing fluid, add a small amount on the gauge block so that the wringing fluid is spread evenly on the measuring face (and wipe any excess away with a tissue). Try again to wring the gauge blocks together. If they still don't wring, check the gauge blocks under a microscope for any damage that might be interfering.

Gauge blocks can be damaged easily during wringing, so you may need to prepare your work surface to ensure it is very clean. When wringing more than two gauge blocks, lay them on a cloth resting on the work surface in case the stack falls over. Also, wring gauge blocks low above the bare work surface to minimise damage in case you drop them. For this reason, you should also not hold gauge blocks above the open box of gauge blocks, as a dropped gauge block could damage others in the case.

Do not leave the gauge blocks wrung together for more than 24 hours. If you leave gauge blocks wrung together for long periods, they can become very difficult to separate. If you find that you are having difficulty separating your gauge blocks, try gently twisting to loosen the wring or adding some solvent (e.g. ethanol) to the joins.

Calibrating Gauge Blocks

Calibration of gauge blocks is often advertised as being performed to an accuracy or uncertainty class. These classes describe the calibration process, indicate the likely uncertainty that can be achieved, as well as the relative pricing.

Calibration laboratories list their gauge block calibration services in a matrix format sorted by nominal length and uncertainty class. Uncertainty class A indicates the smallest uncertainty, and the uncertainty levels then increase as far as class D. Some laboratories also include a class E calibration for gauge blocks of particularly low accuracy grade.

Calibration can be performed by comparison – where the calibration laboratory would need to have a nominally identical set of gauge blocks – or by interferometry. Interferometry is a non-contact technique for measuring gauge blocks. The gauge block size is determined by interfering light reflected from the top surface of the gauge block and from a platen to which the gauge block is wrung with light reflected by a reference mirror.

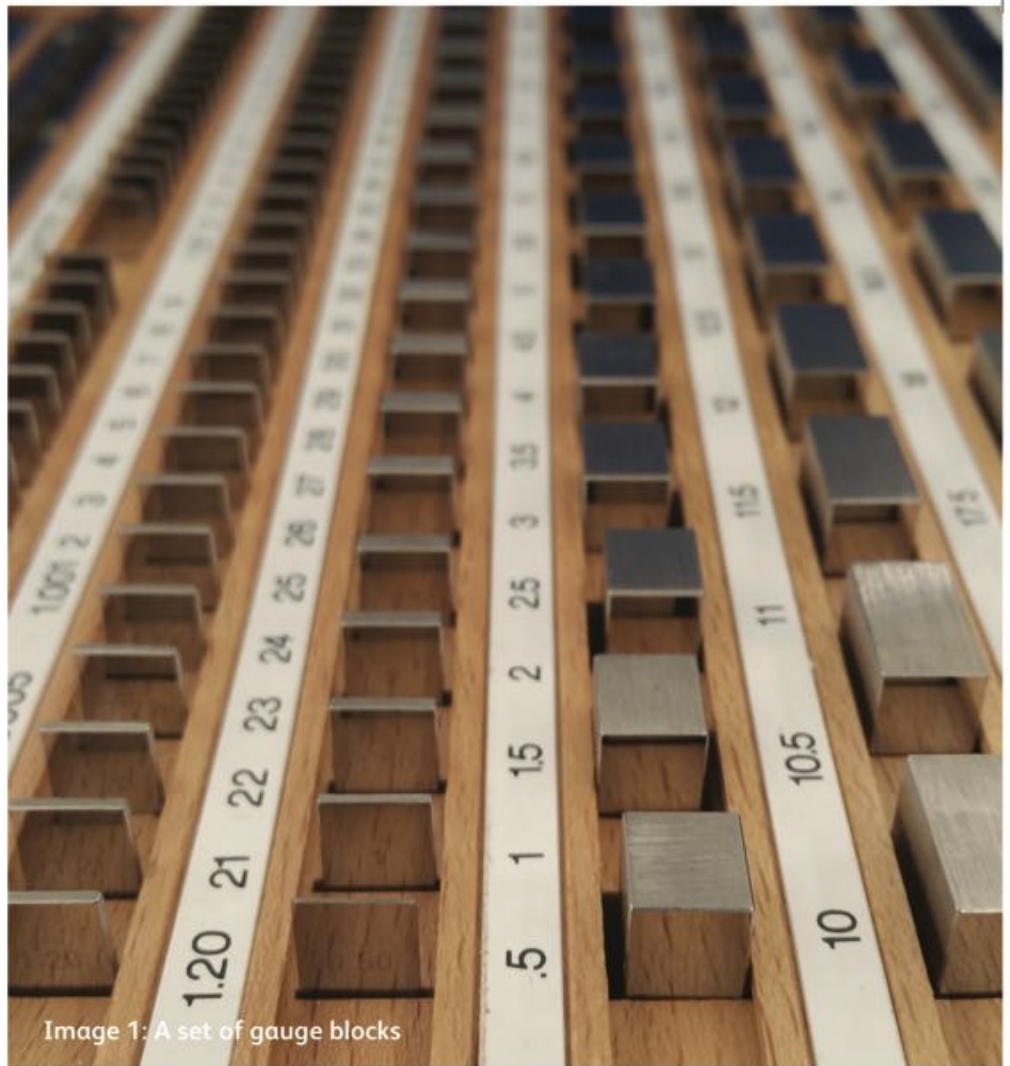
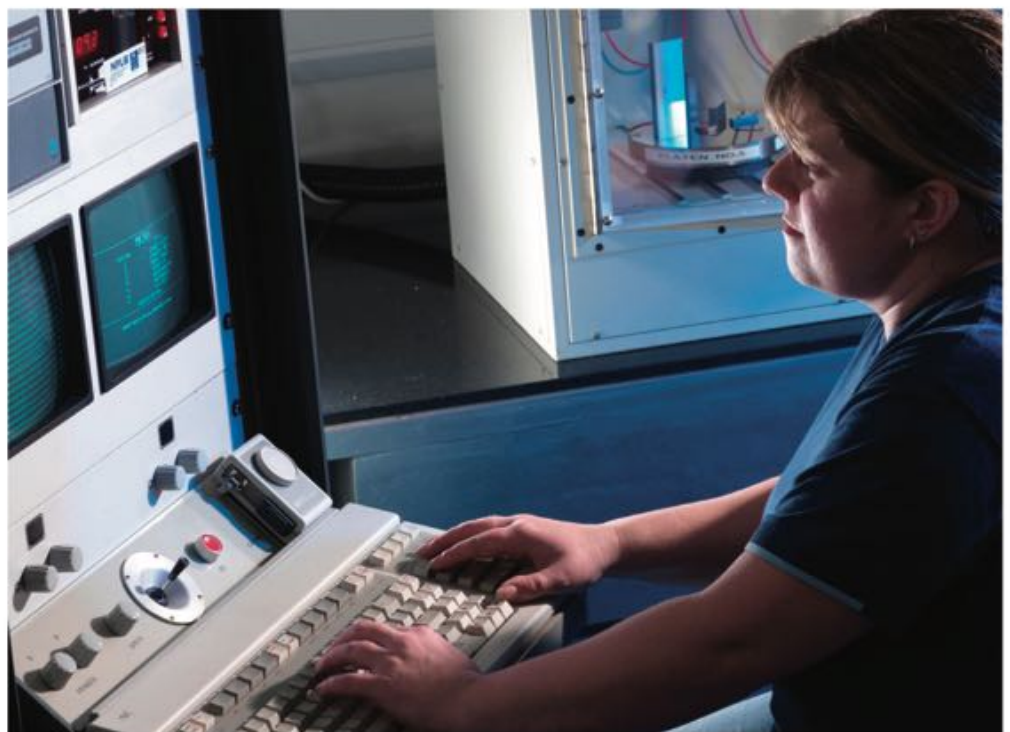


Image 1: A set of gauge blocks



The technique relies on a starting value obtained using a gauge block comparator.

The NPL "Care and Use of Gauge Blocks" Good Practice Guide (No. 149) is available to download in full, for free from: www.npl.co.uk/content/ConPublication/7538.

Biography

Sheryl Bailey MInstMC, has been providing gauge block calibration services at NPL for over 10 years.

www.npl.co.uk/news/gauge-block-guide-supports-dimensional-measurement-in-industry



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REMOTE OPERATING SIMPLIFIES ASSETS

Chris Stones, Sales Director, of Servelec Controls, explains how Centrica improved safety and minimized offshore manned interventions, extending oil and gas field viability, by applying new and emerging remote operation and maintenance technologies developed for the aerospace, naval and defence industries





This disruptive innovation decreases operations and maintenance costs, improves safety and ultimately maximises asset value. This is a game-changing idea for the oil and gas sector and an opportunity for oil companies across the world.

Stuart Broadley, CEO EIC



The history of Servelec Controls' Remote Operations solution spans more than ten years, from 2006, when a helicopter transporting seven support workers to an offshore gas platform crashed, tragically killing all those on board. This event was the trigger for the company to ask the question, 'how can we improve safety and minimise manned interventions?'

In the following years, in conjunction with our client Centrica, we started developing the blueprint of a solution to simplify the topside processes on several of Centrica's offshore platforms in the East Irish Sea. The main driver for this exercise was to improve the safety of their support staff by reducing the dependency upon helicopter-based manned interventions. As the investigations progressed, many potential ancillary benefits presented themselves, including a significant reduction in operating expenditure (OPEX) and extending the operating life of the gas field in question. Much

of the OPEX savings were realised by the removal of over 500 tonnes of redundant equipment and accommodation, which significantly cut the fabric maintenance requirements for the platforms.

At the end of 2012, the team began formally working on a FEED study to develop a solution allowing complete remote operation of several offshore assets. The scope included a replacement for the existing control, safety and electrical systems with new, state of the art equipment to be monitored and controlled in real-time from a control centre based safely onshore. The technical investigations covered existing, new and emerging technologies from industries outside of oil and gas as diverse as aerospace, naval and defence and included:

- Mission critical distributed control system technology
- Real-time information and asset monitoring system development

- Intelligent electrical componentry with diagnostic / control features
- Up-rated UPS systems significantly increasing power availability and stability
- Advanced optical and acoustic fire and gas detection / control systems
- Wireless instrumentation and detection devices to minimise cabling
- Use of drones for aerial surveying and remote access

Given the complexities and ever changing ideals, the concept and design phase took place over several years and in quarter four of 2016, Servelec Controls were formally awarded the contract to begin the design and implementation of the new distributed control system (DCS) for the first offshore platform (DP6.)

Continued on following page...

with commissioning underway during quarter one of 2017. In June 2017, Servelec Controls received the order to conduct the same scope of supply for the second platform, DP8.

In addition to safety improvements and efficiency gains, a Remote Operations solution presents various benefits for the industry. It enables significant OPEX savings, reduces downtime and minimises insurance as well as logistics costs. In addition, the overall cost reduction improves field viability and provides an opportunity for operators to delay abandonment, an activity which requires significant expenditure.

While de-manning platforms is an innovative opportunity, it also presents some issues. Making remote operations and maintenance possible in this instance involved the replacement of pneumatic valves with electric valves, which requires upfront investment (an unpopular proposition considering the current investment climate). These valves are controlled by the distributed control system, which decides whether the platform is still safe to operate following a spurious trip event and allows a remote restart.

Monitoring and assessing of restarts is a key aspect of Remote Operations and, as a maintenance concept, avoids having to mobilise support staff to the platforms at short notice, which ultimately invalidates the value proposition of the remote concept.

Drivers and benefits for Remote Operations

In addition to the desire to ensure the safety of their offshore workers, OPEX costs were forcing Centrica to consider early decommissioning of their assets in the East Irish Sea. Investigations proved that by investing in Remote Operations (or 'Simplification' as it is known by Centrica) of their assets, which included the removal of redundant topside plant and accommodation, maintenance costs would be reduced significantly. By Investing in a state of the art integrated control and

safety system (ICSS) and electrical control system, which could be operated from an onshore control room, a 60% reduction in manned interventions via helicopter could be achieved resulting in a dramatic improvement in safety, OPEX and 'end of life' forecasts for the ageing brownfield assets. Following completion of the DP6 project, Centrica expect to achieve:

- A 60% reduction in manned helicopter intervention
- Delayed asset end of Life by 15 years
- Return on £65m investment inside of 2 years due to remote operation capability
- Demonstrable improvement in safety of support staff by way of minimised intervention
- Significant reduction in OPEX
- Reduced risk profile and therefore reduced insurance costs
- State of the art ICSS and instrument technologies ensuring lifetime supportability

The Remote Operations solution

The Remote Operations solution is based on Emerson DeltaV technology to complement Centrica's legacy Rosemount DCS equipment and enables a more proven upgrade path.

For this solution, DeltaV offers all of the expandability required for remotely operating an offshore platform including:

- Alarm management
- Asset monitoring
- Integration of fire and gas detection and control
- Integration of emergency shutdown systems
- Electrical system monitoring and remote control

All of the above are remotely operable from the onshore control centre, including the ability to

come back online from a black-start situation.

This flexible and dynamic approach ensured an ambitious project timeline, from order placement to completed FAT in six months, was achieved.

The deceptively simple concept of remote operation has made a major contribution to the customer's offshore activities. Whilst safety was the principle driver, the resulting cost savings in maintenance and extended asset life have shown that the approach is cost effective with a payback of less than two years.

Stakeholder considerations

- Existing industry practices in offshore platform operations and maintenance have not changed for 40 years and are ripe for disruptive innovation.
- New technologies are enabling huge shifts to remote operations and maintenance.
- Policy-makers need to prepare for the implications of this type of disruptive innovation.
- The UKCS regulator (Oil & Gas Authority) and the Oil & Gas Technology Centre should have direct roles in encouraging industry to adopt these changes - in line with the MER strategy.



In addition to safety improvements and efficiency gains, a Remote Operations solution presents various benefits for the industry. It enables significant OPEX savings, reduces downtime and minimises insurance as well as logistics costs.



THE FUGITIVE

Rick Gould of Eudo sees a growing interest in fugitive emissions and looks at how innovative techniques are contributing to their measurement and control

According to statistics from the Department for Environment, Food and Rural Affairs (DEFRA), fugitive emissions (leaks) typically account for about 15% of the total, annual emissions of volatile organic compounds (VOCs). When sufficiently concentrated, VOCs can be explosive and hence a significant safety hazard. Additionally, these emissions are often harmful to human health and the environment. For example, VOCs react with nitrogen oxides to form secondary pollutants such as low level ozone, which is directly harmful to people and plants, as well as contributing to climate change. Lastly, fugitive emissions are typical losses of an industry's products, too – which means a slice off the bottom line. There is a risk of leaks of VOCs when these chemicals are processed, transported or stored under pressure, with potential escapes wherever there is a flange, pump, valve or tank-seal. Such leaks can occur in a wide variety of industries including chemicals, pharmaceuticals and oil and gas. Fixing leaks and even preventing them is relatively simple; the difficulty is locating them due to the huge number of potential sources. For example, an oil refinery can have several thousand flanges, pumps and valves, as well as multiple storage tanks. Unfortunately, any one of them can leak when a seal begins to fail.

Managing risk

In order to manage this risk, industrial operators employ a management tool known as Leak Detection and Repair (LDAR). LDAR consists of programmed inspections, preventative maintenance, leak detection and quantification, and repair. Traditionally, operators have used instruments known as Toxic Vapour Analysers, affectionately known as sniffers, to find leaks. These are portable instruments comprising a thin probe connected via a pump to a VOC sensor such as a flame ionisation detector or IR sensor. Although sniffing is a proven, reliable and effective technique, it is extremely time consuming; someone using a sniffer must probe every part of each seal of every component that could potentially leak. This means that individual components at a plant might be inspected annually or less – and a lot can happen between inspections. So ideally, managers of LDAR programmes need tools or techniques that can rapidly identify areas where leaks occur, in order



to focus their LDAR programmes. This is where the three types of innovative IR technology are making a significant difference. Differential Absorption Light Detection and Ranging (DIAL), Solar Occultation Flux (SOF) and Optical Gas Imaging (OGI).

IR Spectroscopy

Back in the early nineteenth century, at the beginning of the industrial revolution, scientists were pioneering embryonic forms of spectroscopy, and it is rather fitting that their discoveries should now be playing a crucial role in measuring and controlling the air-pollution that has dogged industrialisation. In 1800, William Herschel discovered infrared radiation (IR) and, like many other scientists at that time, was captivated by the properties of solar

radiation. One of his contemporaries, Joseph von Fraunhofer, used a diffraction grating to improve observations of the solar spectrum and so laid the foundations for modern IR- spectroscopy. Two centuries on, IR-spectroscopy is commonly employed to measure and therefore control pollution.

Remote-sensing and visualisation in the infrared

In the late 1980's, a team from the UK's National Physical Laboratory (NPL) and British Petroleum (BP) worked together to develop a new pollution-sensor using DIAL. This system projects an IR laser into the atmosphere; aerosols and particles in the air then reflect the beam back to a receiver, whilst the frequency of the beam is tuned to the chemicals that the DIAL users want to

Continued on following page...

measure. In effect, DIAL turns the atmosphere into an optical bench for measurements, and is termed as a long-path or remote sensing technique for gases. Conventional gas-analysers typically have an optical bench within them, drawing a sample of air into the analyser. At the time, BP owned and operated an oil refinery in Gothenburg and the team used the DIAL to scan the air above and around the refinery. When coupled with weather data, the engineers and scientists using the DIAL created site-wide profiles of VOCs in the air.

The measurements were groundbreaking; notably, the data showed that the fugitive emissions were up to 20 times higher than those expected when estimating leaks using emissions factors. DIAL showed that leaks could arise from unexpected sources, such as tank seals and a small number of leaks can make a substantial contribution to the total fugitive-emissions at a plant. DIAL measurements since then have produced very similar results worldwide and yet, despite its strengths, there are few commercial instruments and DIAL has had a stronger role in research than in routine monitoring. In simple terms, these systems are enormous, complex and expensive; a typical system is housed in an articulated truck and requires a highly-skilled and specialised team to operate it. These drawbacks triggered the need for a system with many of the benefits of DIAL but in a simpler, more compact package. The solution to this challenge came from the same city where DIAL first measured leaks from a refinery.

Enter astrophysics and Solar Occultation Flux (SOF)

The department of Earth and Space Science at Chalmers University in Gothenburg is a leading centre for research in developing and using remote-sensing techniques to measure airborne-chemicals. In the late 1990's, a team led by Bo Galle and Johan Mellqvist at

Chalmers combined a solar-tracker with a Fourier Transform IR (FTIR) spectrometer, and mounted the new system in a van. The FTIR can detect the same chemicals as DIAL, but instead of relying on a laser beam, it uses the sun as a source of electromagnetic radiation. The FTIR measures how much IR energy airborne chemicals absorb between the tracker and the sun – hence Solar Occultation Flux. As with DIAL, the results are combined with meteorological data to produce graphical images of site-wide leaks.



SOF has produced similar results to DIAL, but it is not as sensitive to some chemicals - such as methane - and has a shorter range of measurement. Like DIAL, SOF requires highly-trained operators and has had a stronger role in research, rather than routine measurements. Mellqvist reports that the response from operators has been fragmented: "Industry, which ultimately pays for the measurements, has defended the emissions-factors model and sniffer methods, whilst regulatory agencies have not taken any strong positions towards measurements SOF either". That said, recent legislation now strongly recommends the use of SOF and DIAL for detecting and measuring fugitive emissions. In contrast, LDAR programmes, emissions factors and sniffers are typically mandatory in legislation.

Both DIAL and SOF have been strong for identifying hotspots, so that operatives with sniffers can hone in on leaks. Yet even when a hotspot is known, using sniffers in an area can still be time consuming. This is where OGI has demonstrated its value as a tool that fits neatly between

remote-sensing techniques and the close-up, sniffer measurements.

Optical Gas Imaging to visualise emissions

OGI instruments evolved from Forward Looking Infrared (FLIR) thermal-imaging cameras and are typically housed in a device that resembles either a CCTV camera or camcorder. OGI gives gases the appearance of fog or smoke. "We developed the FLIR camera after industry asked for an instrument which could visualise gases", explains Steve Beynon from FLIR Systems, one of the handful of manufacturers that produces OGI cameras. "Industry initially wanted the cameras for hazard investigations, but they have found that OGI systems are beneficial for environmental reasons too, as well as for preventing losses of products," adds Beynon. OGI can be used independently, yet works synergistically with sniffers, slashing the time needed to locate leaks. Mellqvist's team from Chalmers uses OGI cameras alongside SOF, further decreasing the time to zoom in on leaks.

As with all forms of measurement, standardised and validated methods are essential for the reliable monitoring of fugitive emissions. Accordingly, the sniffer technique is underpinned by a United States Environmental Protection Agency procedure, called Method 21. This is now embodied within a European standard, EN 15446. Meanwhile, Mellqvist is active in a CEN working-group that is developing another EN standard for measurements of fugitive emissions using DIAL, SOF and OGI. National regulators, as well as NPL and representatives from industry are also in this working group. When completed, the new standard will provide a foundation for complementary and synergistic techniques for leak detection and control, improving not just the measurements, but also boosting safety and environmental protection.



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NEWS FROM THE INSTITUTE

NEW PRESIDENT IS WORLD EXPERT IN THERMOMETRY

The next President of The Institute of Measurement and Control will be Prof Graham Machin. Graham takes office in January 2018, succeeding Prof Sarah Spurgeon.

Graham is a Fellow of the Institute of Measurement and Control and a Chartered Engineer. He is a leading international expert in thermometry and is the science area leader of the NPL Temperature and Humidity Group. He currently holds visiting professorships at the University of Valladolid, University of South Wales and the University of Strathclyde. In October 2012, he was awarded the InstMC Callendar Medal award for improvements to the state of the art in temperature measurement. In 2017, Graham was awarded a Chinese Academy of Sciences Fellowship, in recognition of his world-leading position in and decadal contributions to the science of thermometry.

During Graham's term, the UK will host the World Congress in September 2018 and the redefined measurement units will be implemented. The Institute's core objectives and NPL's mission are very closely aligned and, during his presidency, Graham will seek to exploit that synergy to raise the profile of metrology throughout the UK.

Graham has a BSc and DSc from Birmingham University and a DPhil

from Oxford University. He has published more than 200 technical papers and given numerous talks on temperature related topics.



Graham Machin FInstMC works at the National Physical Laboratory where he is head of Temperature Standards. In fact, Graham is a world authority on temperature and he has a challenging job description: he writes

"Key aspects of my role are:

- 1) ensuring that the temperature standards of the UK are realised and disseminated with world leading uncertainties [errors]
- 2) ensuring that the temperature measurements standards at NPL are equivalent or better to those of other similar National Measurement Institutes
- 3) Contribute to the development of the implementation of the new kelvin through research (such as measuring the Boltzmann constant and T-T90)
- 4) work with industry, medical and research partners to address temperature measurement problems in a wide variety of contexts"

His current research interests include high temperature fixed-points, thermal imaging, primary thermometry (radiometry and acoustic thermometry), clinical thermometry (contact, non-contact and internal), thermocouple developments (including self-validation methods), reliable temperature measurements in hostile environments, especially space/aerospace and nuclear decommissioning, and metrology for wound management and prevention.

Having been involved with the Institute of Measurement and Control as both a Fellow and recipient of the InstMC Callendar Medal, it is an honour to be elected as the next President. The measurement community is entering a period of great change with the redefinition of the SI system and this presents fantastic opportunities to promote the work of the Institute and measurement in general.

GROWTH AND RESILIENCE FOR THE TEST & MEASUREMENT MARKET IN SECOND QUARTER OF 2017

The Test & Measurement market continues to deliver strong levels of deal activity with year-on-year deal volume growth up 18% in the second quarter of 2017.

US & Canada continued to see the largest deal volumes with 26 in Q2 2017 out of a total of 74 deals across the globe. Europe saw deal volumes up 38% in comparison to the same quarter in 2016 and continues to generate the most cross-border deals, with Germany and Sweden home to key bidders. In contrast, it is the UK, US and also Germany which have been home to most target businesses.

The UK continues to represent an attractive region for overseas buyers, particularly following the recent depreciation of sterling, which can give international acquirers an initial price advantage over domestic counterparts.

Domestic focus was a strong theme for the US & Canada region, with cross-border transactions only representing a quarter of all deals.

A notable transaction in Q2 2017 was Element Materials BV's acquisition of Exova Group plc, one of the world's leading providers of testing, calibration and advisory services, for £620m representing a 26% premium to Exova's average share price over the previous 12 months and implying an enterprise value of approximately 12.5x Exova's adjusted EBITDA. The combined group is majority owned

by Bridgepoint, an international private equity firm, and is expected to deliver annual revenues in excess of \$700m.

A further notable deal in the quarter was Ametek Inc's acquisition of Mocon Inc, a provider of products and services that detect, measure and monitor gases and other chemical compounds for £145m, implying an enterprise value of £141m at 17.8x historical EBITDA. Mocon joins Ametek as part of its Process & Analytical Instruments Division within Ametek's Electronic Instruments Group. Mocon had sales of approximately \$63 million in FY2016.

Attractive valuations in the sector persist, with BDO's T&M index revealing trading multiples of quoted businesses averaging 14.7x EBITDA, and growth of 95.1% in the share price index during the five years to June 2017.

Private equity has taken a backseat in 2017, with only 7% of deals involving a private equity backer in the first half of 2017, compared to 13% in 2016.

Roger Buckley, M&A Partner at accountancy and business advisory firm BDO LLP, commented: "The Test & Measurement market remains an exceptionally resilient sector, with M&A activity and multiples trending above average comparators. The Non-Destructive Testing sub-sector in particular is an area ripe for consolidation, with larger

players keen to acquire providers of innovative new techniques and technologies."

BDO LLP, which is the UK's No.1 M&A Adviser for deals valued between £1m - £50m*, produces quarterly reports highlighting the M&A trends, economic drivers and events impacting the Test & Measurement market. Each quarter highlights M&A updates in the market and shines a spotlight on a specific sub-sector. In the Q2 2017 edition, there is a focus on the Non-Destructive Testing Market.

A full report on Q2 2017 M&A Highlights can be downloaded from BDO's website:



Q&A

Christopher Smeeth

This month's interviewee is Christopher Smeeth, Control & Instrumentation Instructor, with AWE, a name synonymous with science, engineering & technology excellence, in support of the UK's nuclear deterrent and to inspire the great minds of the future.)

What was the root of your interest in Engineering?

As a child I was always interested in science and learning how things worked. As a die-hard science fiction fan I was fascinated by the imaginative technology of my favourite television shows. Seeing the amazing fictional things that the technology could do inspired me to learn more, and discover what could be truly possible with the use of technology. I think science fiction has inspired generations of engineers, with fictional devices such as communicators (mobile phones) and tricorders (medical scanners) becoming reality and commonly used in our society. Every person with access to the internet on their phone has "The Hitchhikers Guide to the Galaxy" in their pocket, with answers to almost any question, whenever they desire. Yet we often take these amazing advancements in technology for granted.

My interest in engineering was also influenced by my parents who were always keen to get me involved in DIY projects around the house as I was growing up. This has been incredibly useful to me since getting a home of my own, as there is always something to install or repair!

Once I left school, I completed an Advanced Apprenticeship in Electronics. This led to my role as a Control & Instrumentation Maintenance Practitioner and then to my current role as a Control & Instrumentation Instructor, teaching apprentices engineering. As an ex-apprentice, this role has been particularly enjoyable and rewarding.

What is your vision of Engineering in Britain in 2020?

I would like to see Britain with a more clearly defined path of

encouraging and promoting engineering to the next generation. We have some great engineers and institutions in this country, although we need to promote them more effectively and be proud of our country's engineering legacy and achievements.

I believe that engineering is such an important cornerstone in our modern lives, but is so often taken for granted or overlooked. As a child growing up in the 90's, the year 2020 sounded very futuristic and exciting. We now live in "the future" and don't truly appreciate the amazing technology and engineering that comes with living in our modern age. The engineering and technology around us is both fun and exciting, and this can be easily forgotten. I would like the people of Britain in 2020 to be increasingly aware of the technology they use in their daily lives and to consider the question "how does this work?" more frequently.



I believe that engineering is such an important cornerstone in our modern lives, but is so often taken for granted or overlooked.



What should the UK government do to address the shortage of UK engineers?

I believe the new apprenticeship levy is a great way to encourage companies to start their own engineering apprenticeship schemes. I believe the chance to gain knowledge and understanding alongside practical experience is an invaluable way of starting an engineering career.

The government needs to play a more active role in encouraging females into engineering roles. A large number of female pupils are interested and inspired by engineering, with many choosing to study an engineering subject whilst at school. However, for many this does not then develop into a career. Schools, engineering institutions and the government need to work more collaboratively in order to demonstrate the wide range of engineering opportunities available to pupils.

I have spoken to female pupils at numerous school events and many express their interest for learning engineering, but struggle to translate that enthusiasm into a clear career path once leaving school. Some of them believe this is due to lack of clear engineering roles for females and a lack of engineering female role models, whereas others feel a social pressure to attain non-engineering roles. This is a real shame, as there are talented people with the potential to become gifted engineers who feel there is no place for them in the world of engineering. This desperately needs to change if Britain wants to be at the forefront of engineering excellence.

Any specific areas?

I would like to see greater promotion of Control and Instrumentation to a wider audience, and for it to receive the recognition it deserves for the important role it plays in our society.

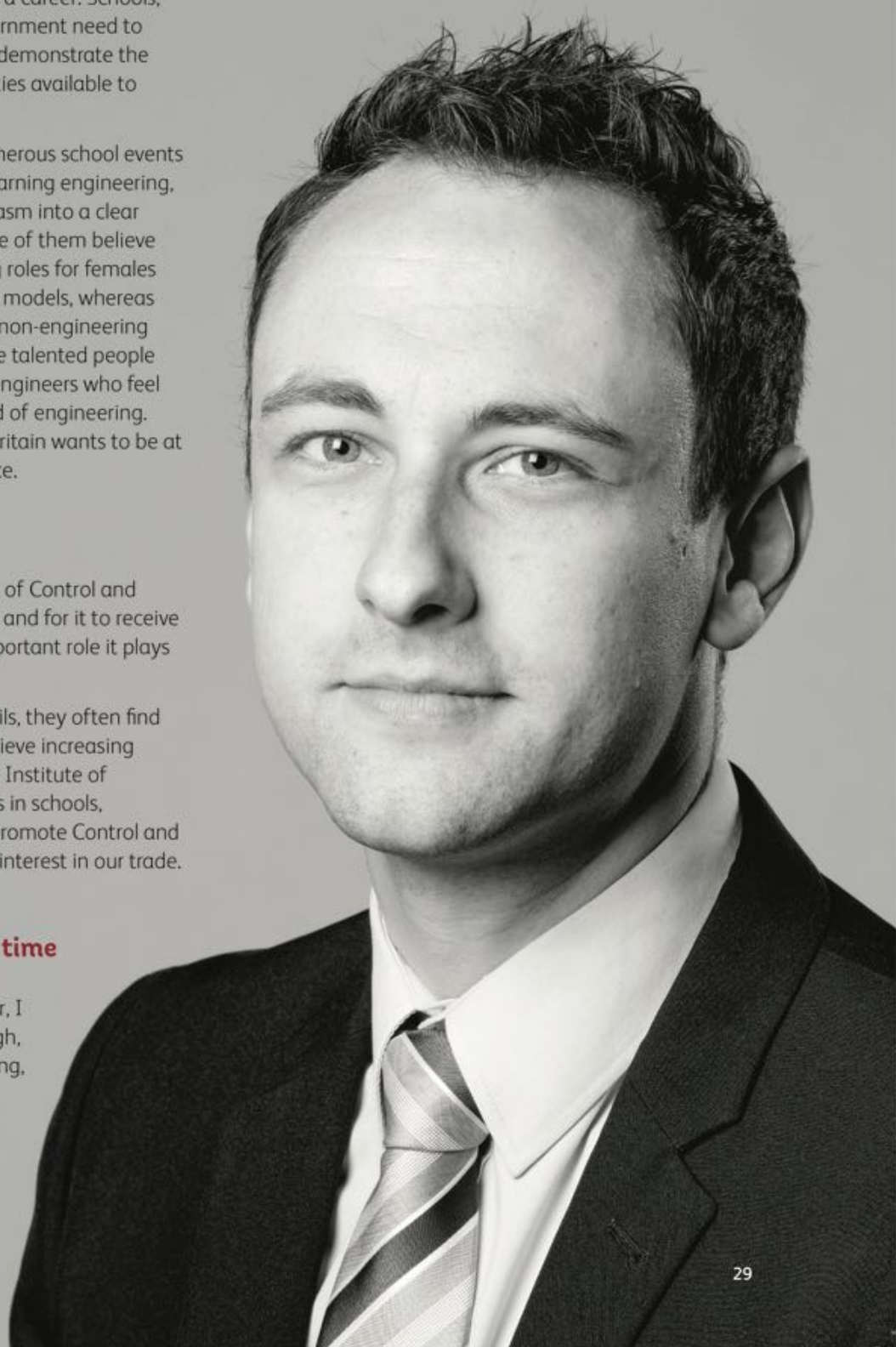
Once people understand what it entails, they often find it very engaging and interesting. I believe increasing the amount of outreach activities the Institute of Measurement and Control undertakes in schools, colleges and universities would help promote Control and Instrumentation and stimulate more interest in our trade.

What do you do in your free time to relax?

As a father of a two year old daughter, I don't get much time to relax! Although, when I do find the time, I enjoy reading, playing squash, catching up on my favourite comedy and science fiction shows, and going for days out with my wife and daughter.

What would your one wish be?

Honestly, I would like my daughter to grow up happy and healthy. However, it would be great if my little girl was to become inspired, and enjoy engineering and science as she grows up, especially if it led to her becoming an engineer who could change people's lives for the better.



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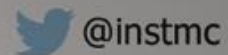
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