

LOW COST RADAR LEVEL SENSORS FOR FLOOD MONITORING AND MANAGEMENT



FEATURES//

RISK-BASED DECISION MAKING IN
CONFORMITY ASSESSMENT

HOW ENGINEERING HAS RESPONDED
TO THE COVID-19 PANDEMIC

HAZARDEX 2020, HARROGATE
26TH – 27TH FEBRUARY 2020

ELECTRICAL MATTERS
AT HOME FOR NEW
TECHNOLOGIES

A photograph of a large, multi-arched stone bridge spanning a river. The bridge has a decorative balustrade on top. In the background, a red brick building is visible through the arches. The water reflects the bridge and the sky. The sky is blue with some white clouds.

PRECISION

JUNE 2020_ISSUE SIXTEEN

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INSTMC WELCOMES NEW HONORARY SECRETARY BILLY MILLIGAN

From the day, and hour, I left secondary school I've been involved in industrial automation and control, but my involvement with the Institute wasn't until a very shy and retiring professor at Glasgow Caledonian University pulled me to the side as we were leaving an Applied Instrumentation and Control lecture one day and said, "Here you boy, are you a member of the InstMC?" I replied that I wasn't, and he handed me a bit of paper and said, "Better fill this out then". A brutal but effective recruitment model! I was an ordinary member for a number of years and occasionally attended some East of Scotland lectures and visits, but when Tom Ryan restarted the West of Scotland section I became more involved and eventually became Chair of the section. This has evolved from being a council member to joining the Board of Trustees and now to Honorary Secretary. It's been quite a journey and I've met some remarkable people along the way.

I think this is a truly exciting time to be involved in our profession. Martin Belshaw spoke of recent tribulations in this same column in the last issue of Precision. With the increased adoption of industrial digitisation, even more so with the acceleration of this adoption due to the current circumstances, we as a professional institution are in a position to be right at the forefront of these emerging technologies meaning we

can stay relevant and increase our status among the United Kingdom's professional institutions. The British government's 2017 Made Smarter review identified that the British manufacturing sector could unlock an additional £455 billion in revenue by adopting industrial digitisation, and we as a profession will be the practitioners to unlock and enable this. Having taken part in the recent InstMC strategy days and with Steff and the team tasked with delivering our model, this next two years are going to be incredibly busy.

I consider it a pleasure and a privilege to serve as Honorary Secretary of the Institute of Measurement and Control and

look forward to the next two years, especially to working alongside Steff and Martin, to deliver the next chapter of our Institute's history. I also recognise that I have some serious shoes to fill. The sterling leadership that my predecessor Graeme Philp displayed, alongside Colin Howard, during our very recent history, was inspirational.

The first couple of months of 2020 have been interesting and again referencing Martin's previous remarks we will act, adapt but instead of survive as in previous challenges I believe the Institute stands ready to thrive.

Billy Milligan
Honorary Secretary InstMC



CONTENTS

ARTICLES

INSTMC WELCOMES NEW HONORARY SECRETARY BILLY MILLIGAN

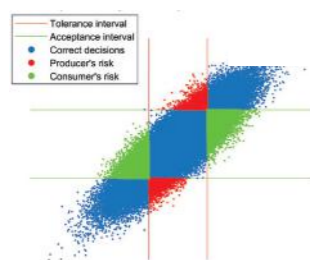
3



RISK-BASED DECISION MAKING IN CONFORMITY ASSESSMENT

New software, CASoft, which supports decision making in conformity assessment.

6-7



SPE ABERDEEN & INSTMC CONFERENCE: DIGITALISATION OF PROCESS CONTROL

Digitalisation of process control is extremely important in this current climate. The pace of change at which we have had to adapt in recent months has been unprecedented, with us relying more on digital technologies, remote working and remote access.

12

NEW FEATURE: FOCUS ON A SIG

InstMC SIGs provide an opportunity for like-minded engineers to network, share ideas and expertise, collaborate and learn, and keep updated on industry news and developments.

Focus this issue: Measurement



10-11

LOW COST RADAR LEVEL SENSORS FOR FLOOD MONITORING AND MANAGEMENT

The latest versions of level-detecting, radar sensors offer multi-capability and cost savings across the water industry.



8-9

INTERVIEW

IAN CRAIG ANSWERS

14-15

Sitting in the hot seat this issue is Ian Craig, Senior Operations Manager, KBR and the newly appointed InstMC Honorary Treasurer.



HAZARDEX 2020, HARROGATE

24-25

The Institute was invited to attend and host a two-day free-to-attend workshop at the Hazardex 2020 conference earlier this year.



HOW ENGINEERING HAS RESPONDED TO THE COVID-19 PANDEMIC

22-23

In this feature we provide a brief roundup of the various initiatives and efforts made by the engineering community in response to the COVID-19 crisis.



ELECTRICAL MATTERS AT HOME FOR NEW TECHNOLOGIES – PART 2

In an electric vehicle (EV) future there will be a huge demand for high-powered kW battery charging.



18-19

LOCAL SECTION NEWS



Keeping you up-to-date with local news including Teesside Annual Dinner and Reunion.

13-15

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RISK-BASED DECISION MAKING IN CONFORMITY ASSESSMENT

New software, CASoft, which supports decision making in conformity assessment outlined by Alexandre Allard, Laboratoire National De Métrologie et D'Essais, France (LNE), Ian Smith, National Physical Laboratory, UK (NPL) and Leslie Pendrill, Research Institutes of Sweden (RISE)

Requirements, decision rules and tolerance intervals in conformity assessment

The term conformity assessment applies to any activity undertaken to determine whether a property of a product satisfies a requirement, such as specified in a standard or agreed between a consumer and producer.

In particular, testing and calibration laboratories are expected to reach a decision regarding the conformity of a measuring instrument to a specified requirement. Conformity assessment comprises three steps. First, a measurement is made of the property. Next, the measured value is compared with the requirement. Finally, action is taken by applying a pre-determined decision rule that is based upon the consequences of an incorrect decision. For example, a decision could be made to accept and subsequently sell a product classified as conforming, or to reject and possibly scrap a product classified as non-conforming.

The most recent version of ISO/IEC 17025¹ states that testing and calibration laboratories must document the decision rule they employ in conformity assessment. For markets that are subject to regulation, a product must fulfil one or more requirement before it can be brought to market by a producer. The wellbeing of consumers could be placed at risk by a non-conforming product and, indeed, such a consideration is frequently cited as a key reason for a regulated economy.

In many cases, the requirement is defined by a tolerance interval, specified by a lower tolerance limit and/or an upper tolerance limit. A product is classified as conforming if the value of the property of interest lies within the tolerance interval. If the property could be measured exactly, it would be straightforward to state the conformance of the product – either it does or

doesn't conform. However, since the value of the property cannot generally be determined exactly due to measurement uncertainty, information regarding its possible values is typically encapsulated by a probability distribution. The distribution gives the probability that the value of the property lies within any stated interval.

How does uncertainty affect conformity assessment?

JCGM 100:2008, the Guide to the Expression of Uncertainty in Measurement (GUM)², provides guidance on how to evaluate measurement uncertainty and is well known and widely applied. One of its supporting documents, JCGM 106:2012³, describes calculations to implement conformity assessment taking measurement uncertainty into account. The main approach to uncertainty evaluation advocated by JCGM 100 involves the propagation of uncertainty through a measurement model to determine the standard uncertainty associated with the estimate of the quantity of interest. That standard uncertainty is multiplied by a coverage factor to determine an expanded uncertainty corresponding to a prescribed coverage probability, for example, 0.95. Although the coverage factor is based on the assignment of a Gaussian probability distribution to the quantity, this probabilistic aspect is frequently overlooked. In contrast, JCGM 106 explicitly relies on the assignment of a probability distribution to the quantity of interest.

The use of a probability distribution to summarise measurement uncertainty information means that conformance cannot be expressed by a decision rule involving the measured value alone. Instead, it is defined in JCGM 106 in terms of a probability, referred to as the conformance probability that takes a value between zero and one inclusive.

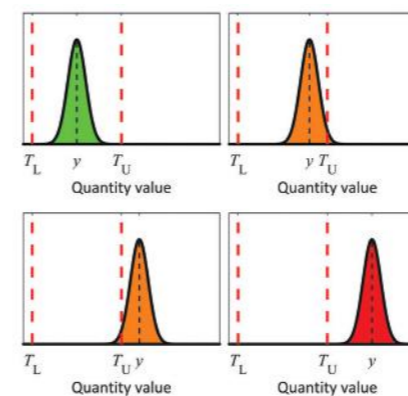


Figure 1: Examples of different levels of conformity assessment, taking measurement uncertainty into account.

Figure 1 illustrates knowledge of a property of a product (quantity) encapsulated by a Gaussian probability distribution with expectation and standard deviation given by, respectively, a measured value y of the quantity and its associated standard uncertainty $u(y)$, for four different values of y but the same standard uncertainty and tolerance interval $[T_L, T_U]$. The values give rise to cases where the product is almost certainly conforming (top left), “probably” conforming (top right), “probably” non-conforming (bottom left) and almost certainly non-conforming (bottom right).

The presence of measurement uncertainty also means that there are risks associated with making incorrect decisions as to whether a product conforms. There is the risk that an item that is classified as non-conforming actually conforms (this scenario is referred to as producer's risk), or, conversely, that an item that is classified as conforming is actually non-conforming (consumer's risk). In the first scenario, a product could be scrapped unnecessarily. In the second, there may be danger to

consumers arising from a non-conforming product being brought to market.

Two categories of risk are of interest. Specific risks relate to risks of incorrect decisions for a particular product. Global risks relate to risks of incorrect decisions for a product sampled from a population. Specific risks are easily calculated from the conformance probability. The calculation of global risks is more complicated as it involves a joint probability distribution that depends on knowledge of both the production process and of the measuring system.

JCGM 106 describes how to calculate the probability of each incorrect decision, and details how an acceptance interval can be used to balance the risks of incorrect decisions arising from measurement uncertainty to minimise the cost of those decisions.

New software for conformity assessment calculations

Until now, testing and calibration laboratories have largely been left to their own to implement calculations relating to conformity assessment. Some calculations are not straightforward, requiring mathematical and statistical knowledge, and it was felt that industry could benefit from the provision by National Metrology Institutes of generic software. To that end, the Laboratoire National De Métrologie et D'Essais (LNE) in France, the National Physical Laboratory (NPL) in the UK and the Research Institutes of Sweden (RISE) have collaborated to develop CASoft, a software package that allows users to undertake the main calculations relating to conformity assessment, that is, of conformance probability, global (consumer's and producer's) risks, and acceptance interval, with the availability of calculations dependent upon the number of properties of interest (one, two, or more than two).

The software, available as a standalone Microsoft Windows executable, is provided with a graphical user interface (GUI). Users

select the number of properties of interest, specify tolerance interval(s), select which calculation to undertake, and then assign probability distributions from a list of commonly encountered distributions. While the user may enter data into the GUI manually, the software provides users with the option to read in data from, and write results to, a Microsoft Excel workbook. This functionality is useful for those users who are required to undertake large numbers of calculations. In addition to providing numerical results of conformity assessment calculations, the software generates supporting plots. Figure 2 shows an example of a scatter plot generated by the software to accompany the calculation of global risks.

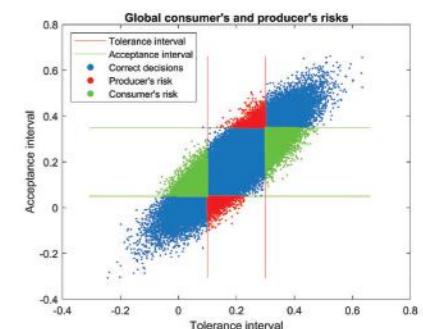


Figure 2: Scatter plot generated by the CASoft software package for the calculation of global risks

This work is part of the Support for Impact Project 17SIP05 of the European Metrology Programme for Innovation and Research (EMPIR). The EMPIR is jointly funded by the EMPIR participating countries within EURAMET and the European Union. CASoft can be downloaded via the LNE website (<https://www.lne.fr/en/software/CASoft>). For more information about the CASoft software package, contact Alexandre Allard, LNE alexandre.allard@lne.fr.

References

1. ISO/IEC 17025:2017, General requirements for the competence of testing and calibration laboratories.
2. BIPM, IEC, IFCC, ILAC, ISO, IUPAC, IUPAP and OIML. JCGM 100:2008, Guide to the expression of uncertainty in measurement.
3. BIPM, IEC, IFCC, ILAC, ISO, IUPAC, IUPAP and OIML. JCGM 106:2012, Evaluation of measurement data – The role of measurement uncertainty in conformity assessment.

LOW COST RADAR LEVEL SENSORS FOR FLOOD MONITORING AND MANAGEMENT

BY PETER NORMAN
IENG MINSTMC MIET

The latest versions of level-detecting, radar sensors offer multi-capability and cost savings across the water industry.

Applications can range from pump control to reservoir monitoring; open channel flow through to safe measurement of chemicals in plastic tanks (looking through the tank top); and, digester level control (measuring through isolation valves). It is an ideal sensor for pump control, with its excellent focusing to avoid obstructions. In many applications, radar transmitters can offer improved reliability, lower maintenance and easier installation over other level measurement technologies.

The typical radar device is an electronic, loop-powered, transmitter.

Its 4-20mA signal can be monitored on a localised electronic digital slave indicator, a laptop PC or mobile device such as a Tablet or Smartphone suitably enhanced by the installation of compatible interface software. Bluetooth wireless communications are also available for managing data using the range of mobile data devices.

Radar sensor technology can be a very useful tool for deployment across all water and environmental sectors, meeting commercial needs and providing superior performance. Radar is an interesting level technology. It combines excellent performance with immunity to conditions such as condensation or build-up on the sensor face, extreme weather, water surface and wind conditions, or solar gain/temperature influence. This means accurate measurement with little maintenance all year round. For remote monitoring sites, where reliability is essential, the device can even be battery or solar powered. It is both compact and loop-current-powered, which means it can directly input to pump control systems, with no intermediate wall mounted controller, so it's easier and cheaper to install.



Pipe installation with hidden radar device at the Welsh Bridge over the River Severn in Shrewsbury

The long-term use of radar technologies by environmental regulatory and monitoring agencies is a testament to its potential, performance and reliability for all sectors. A typical water level radar sensor offers good resolution performance, contained in a watertight IP68 (1 Bar) housing and ranges up to 8m (15m with sister electronic unit). The highlighted device being widely used has a plastic horn antenna (80mm diameter) which operates in the K-band (IEEE*) range of frequencies covering 18~27GHz. Communication protocols for the electronic data include: Profibus, Foundation Fieldbus and HART (Highway Addressable Remote Transducer) superimposed on the 4-20mA analogue transmission signal. It also has LPR EN 302729 - Level Probing Radar approval for use outside.

*Institute of Electrical and Electronics Engineers (USA)

Focus on Flood Water Level monitoring:

In terms of UK flood monitoring, many rural and urban locations have benefitted from the deployment of radar level transmitters suspended above rivers by the use of bespoke mounting brackets to fasten to the side of bridges, quaysides, or other suitable structures. Radar has proved to be unaffected by adverse weather conditions such as ice, silt, rain, mist and strong winds when compared to more traditional, submersible hydrostatic probes and ultrasonic level instruments which were additionally affected by strong sunlight.

UK regions currently using radar level technology include:

- River Humber Estuary and East Riding of Yorkshire Catchment Area
- River Thames Greater London including the Flood Barrier, Royal Docks, London (since 2010) which used a longer range model



80GHz radar transmitter being deployed as the future installations improvement in the flood defence service

- Hampshire, Dorset, Somerset regions
- Locations across Wales
- East Anglia, Surrey and Sussex regions
- Urban Surrey, and Urban Berkshire counties
- Shropshire including Shrewsbury's Welsh Bridge – neatly concealed within plastic pipe
- Rural Leicestershire and Rural Nottinghamshire locations
- Scottish Highlands in lochs, hydro-electric schemes and coastal areas
- Numerous inland waterways and harbours around the UK

Looking ahead to the future, many more installations are being planned by various environmental agencies and municipal authorities. One of the predominant manufacturers in this technology area has also recently released new models in the W Band Frequency range: 75–110 GHz, which are both physically smaller and cheaper to purchase and use considerably less power, with Modbus and SID-12 low-power serial communication options. This is good news for the various water authorities, drainage boards, trusts and local authorities who need to monitor water catchments for protection against flooding.



26GHz radar transmitter device used by the Water Industry in flood warning defence

The author gratefully acknowledges the kind assistance and permissions granted by VEGA Controls (UK) Ltd., a Companion Company of this Institute, to indirectly highlight their equipment. The focus here is purely to highlight the use of radar level detection technology which has now quite widely gained proven-in-use acceptance by UK environmental regulatory and monitoring agencies for the above-quoted areas. Hence, this provides a useful overview of radar instruments to aid the defence of some of the extreme weather events that seem to be exacerbated by the effects of global climate change phenomena.

INTRODUCTION TO INSTMC SIGS

InstMC Special Interest Groups provide an opportunity for like-minded engineers to network, share ideas and expertise, collaborate and learn, and keep updated on industry news and developments.

Our SIGs cover technical topics within the measurement and control fields and are driven by groups of volunteers who work, or have expertise, within the topic area. SIGs promote the sharing and advancement of knowledge through a range of activities including white papers, briefing notes, conferences, seminars and exhibitions.

Members can join any SIG through the members only area of the InstMC website. If you are interested in finding out more about a particular Special Interest Group visit <https://www.instmc.org/Special-Interest-Groups> or email the following relevant contact.

Cyber Security Cevn Vibert
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Digital Transformation
Maurice Wilkins
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Explosive Atmospheres
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Measurement Andy Morris
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Standards Maurice Wilkins
Maurice.Wilkins@instmc.org

In each issue of Precision we will take a more detailed look at the work and activities of an individual Special Interest Group. The focus for June 2020 is Measurement.



FOCUS ON A SIG: MEASUREMENT

Measurement pervades our lives. From the time we get up in the morning to the sound of an alarm clock (time) – breakfast (mass, volume), driving to work (distance/length, time, temperature) and so on.

In most cases it would appear that some of this is almost arbitrary – does it really matter if we arrive at work a few minutes late (well it might) or early? However, without standards and traceability to national and international standards of measurement we would all be working on different timescales, length and mass scales.

It's not surprising that early on in human existence standards were created to ensure that we started to align our ways of measuring. For example, the Egyptian cubit – look at how accurately the pyramids were made. Later on, measures for food and drink, and probably most importantly at the time, the weight of coins – coin clipping (silver and gold) was for a long time punishable by death in England.

Modern requirements for measurement constantly push the boundaries of science, with more and more need for even greater resolution and accuracy, for more critical measurement needs such as space exploration, radiation dosage and time stamping in financial transactions.

The InstMC has a Measurement Special Interest Group (M-SIG) that meets quarterly to identify ways in which the Institute can offer its wealth of knowledge and expertise to our membership (and beyond), and to share our belief that measurement is fundamental to our modern day lives.

To do this we have created a number of project themes of which we are currently working on three. For each theme we have a small working group which reports regularly to the M-SIG steering group. The steering group provides a critical appraisal of the progress of these groups and steers them towards agreed targets. The steering group also prioritises projects to ensure that those with the greatest potential impact are being followed first.

The three Working Groups (WGs) currently active are:

WG1 – Marketing of Measurement: This is all about how we tell everyone how important measurement is in their everyday lives and encourage people to think more about this. Targets include business, universities, schools and the general public.

WG2 – Training: The emphasis of this group is to provide input into schemes to ensure that measurement training is appropriate and that a structure is produced around measurement training to help people to identify their own training needs, those of their staff, and to help plan their careers.



WG3 – Technology Transfer: This group is seeking to ensure that measurement instrumentation is suitable for use by potential end users and that measurement instrument manufacturers are meeting the needs of these users.

Membership of these WGs is generally made up of members of the Steering Group, but not entirely, and we often co-opt experts from outside the group to offer advice and support. If you feel that you can help with any of these groups, then please don't hesitate to contact us.

Membership of the Steering Group is made up of representatives from a wide range of industries and is by invitation. Membership is reviewed regularly whilst we monitor how well represented we are in industry as a whole.

If you have any suggestions about how the M-SIG can help or you would like to contribute ideas, please feel free to send us a message at measurementsig@instmc.org

Andy Morris InstMC
Chair – InstMC M-SIG

SPE ABERDEEN & INSTMC CONFERENCE

THE PACE OF CHANGE - DIGITALISATION OF PROCESS CONTROL, WITH CYBER SECURITY IN MIND

Digitalisation of process control is extremely important in this current climate. The pace of change at which we have had to adapt in recent months has been unprecedented, with us relying more on digital technologies, remote working and remote access.

We know that data is a very valuable asset. Historically speaking instruments needed to be checked and monitored by people in the field and their results marked down. Now with smart devices we can have access to data at any time anywhere in the world. With restrictions on movement, this kind of remote access, to the extremely important

commodity that is data, is a huge benefit to our move towards the digitalisation of process control.

The InstMC and SPE Aberdeen are hosting their second annual conference on 11th November 2020. Building on the strength of last years' conference, we are following on with a similar theme. We will focus on cyber security which is one of the biggest areas that is a threat to digitalisation. Digitalisation cannot be ignored - it is hugely important to the continued improved efficiency of many industries.

Megan Hine, Chair of the 2020 Conference says:

"Companies should submit an abstract because this is their chance to stand out in the conversation around digitalisation especially in the current climate. We don't know when these restrictions will be lifted but our conference will be well timed and well placed to offer a commentary on how important digitalisation has become in recent months and will continue to be as the world develops and changes.

I'm very keen to see abstracts that bring forward innovations that have been practically implemented in process control. We want to see technology that is readily available and cost effective and



Megan Hine,
Conference Chair

easy to implement. These are real life barriers that can get in the way of what would be a nice to have, becoming a reality. We want to see innovative presentations that involves audience participation to embrace collaboration in our industry."

To submit your short 200 word abstract, email aberdeen.events@spe-uk.org by the 19th June or visit www.spe-aberdeen.org for more information on the Conference.

LOCAL SECTION NEWS

NORTH OF SCOTLAND

TAKING TECHNICAL EVENTS ONLINE

The current UK lockdown has us all working remotely, looking to technology more than ever to keep us connected with friends, family and work colleagues. It certainly poses a challenge for networking orientated organisations like local InstMC sections. However, even here, technology can assist.

The North of Scotland section has made certain events available online in the past, especially when we felt they would be in high demand. Events such as our technical talk hosted by the HSE back in April 2019, as well as other more inward-looking meetings, such as our CPD guidance events, were hosted online throughout 2019 to support members with the new Engineering Audit process.

This stance has served us well in relying solely on online events and maintaining our events calendar. Our first 'Lockdown' event was our "CPD, Joining and Switching" meeting where we had 17 participants all looking for guidance on how to maintain compliant CPD records, or generate compliant records to support an application to switch to the InstMC. We have always offered an online option to committee members when hosting meetings, we now simply extend this to all committee members for all committee meetings! This means we can keep the section running, and even continue to plan high profile events such as the Annual Dinner and Christmas party!

We held our first online only Technical Talk on 15th April with Micropack providing a comprehensive overview of the BS60080:2020 Guidelines for Explosive and Toxic Atmospheres:



Hazard Detection Mapping. The event was a great success with 40 people joining the call from across the UK and even Norway. We have asked for feedback from all attendees so that we can continue to evolve and give the membership what they require during the current situation.

We believe that almost all our speakers will have the ability to facilitate online Tech Talks. Most of these companies are global organisations experienced in bringing together remote employees, it makes sense, therefore, that they can do it to host our networking events. Indeed, these companies are only too glad to provide continued support to our events schedule as it offers them access to a potential customer base which at the moment is hard to reach. We also believe that now, more than ever, cementing the communities that the local sections have created, by maintaining event schedules, proves what a worthwhile organisation we are part of.

Some of the well-known platforms on which to host your events are Skype and Microsoft Teams, but there are a whole host of other options. We ask our members to RSVP by replying to the Programme Secretary who maintains the list of attendees. The event reminder clearly states when

they can expect to see the calendar invite pop in to their inbox, which will contain instructions for those who wish to join, either through their Skype for Business or Teams account or as a guest. Audio quality is often good, and provided that rules are laid out clearly in advance regarding questions from the audience (best left until the end, or requested directly by the speaker - jumping in can make things rowdy and hard to manage) then all seems to work well. You may need to coach your speaker a little on requesting audience participation at regular(ish) intervals to ensure the 'room' is engaged, but most speakers will be familiar with online conference calls and the challenges they present.

Ultimately, it is important to view this situation as an opportunity. A chance for sections with large geographic regions, such as North of Scotland (and others), to reach our wider audience who often cannot attend in person. In fact, we believe it would be a lost opportunity if offering an online or remote access option to the membership fell by the wayside once we return to 'normality'. Once "we are sure what is normal anyway", to quote the venerable Douglas Adams!

Megan Hine, InstMC North of Scotland Programme Secretary

LOCAL SECTION NEWS

HERTS

TECHNICAL LECTURE: THE FUTURE OF ROBOTICS FOR SOCIETAL CHANGE 26TH FEBRUARY 2020

Ocado's innovation journey has entailed developing some of the most advanced and disruptive robotic systems in the world.

The company's highly automated warehouses feature the densest storage and retrieval robotic system in the world where thousands of bots collaborate like a swarm to collect customer orders.

Two other grand challenges are developing robotic systems that can pick and pack 58,000 items in the warehouse and can also deliver the groceries from the kerb to the kitchen. Such robotic systems are beyond the state of the art today.

The use cases that are afforded by the grand challenges within grocery logistics act as an incredibly useful



analogue for some of the challenges facing society today.

Alex's talk explored how these pioneering technologies, competencies and know-how have the potential to positively disrupt many other sectors for wider societal

impact. In particular, Ocado's contribution to a H2020 project called SoMa, experimenting with three different types of robot gripper with subtly different parameters but all inherently torque controlled. Alex explained if Ocado can pick and pack its entire range then they have a generalised dextrous gripper that could be deployed in other domains such as agriculture.

Alex Harvey, Ocado

Alex Harvey is Head of Robotics and Autonomous Systems at Ocado, where his wide-ranging responsibilities include the technology development of Ocado's proprietary warehousing automation and overseeing teams of researchers in robotics, 3D vision, simulation and 3D visualisation.

CENTRAL NORTHWEST CHAIN:20

The section was invited to attend the CHAIN:20 event on 22nd February at Manchester Metropolitan University, having previously attended in 2019. The event aims to expose undergraduates to the benefits of institute membership. The day, which occurs on a Saturday within the February half-term, provides a full programme of lectures alongside an exhibition. The InstMC was among other esteemed professional bodies this year including NASA, IET, IMechE, ICE to name a few.

Phil Malpas, committee member, spoke about 'The Role of Measurement and Control in Modern Living' with a presentation showing how measurement and control is used everywhere. This year the section was supported by



Endress & Hauser and Tennants Fine Chemicals Limited to provide an interactive stand. It featured working equipment and demonstrations of pH measurement on everyday liquids and how technology for measuring different aspects is used to produce the aromas that Tennants Fine Chemicals provide each day of operation. The stand had an

interactive quiz with a prize donated by Endress & Hauser of a day in their Manchester training facility for up to eight students.

We spoke with more than 80 people on the day and the presentation and stand was very well received. The section would like to thank Endress & Hauser and Tennants Fine Chemicals Limited for their support at this event. This is one of the activities that the section is involved with in the aim of encouraging younger engineers to join the Institute.

For more information on the CHAIN programme of events then please see www.chainevents.org.uk.

David Green, Chair

TEESSIDE

ANNUAL DINNER & REUNION

Around 252 members and guests attended this year's Teesside Annual Dinner and Reunion on 12th March 2020 at Jurys Inn, Middlesbrough just prior to restrictions put in place in response to the Covid19 outbreak.

Attendees were well fed and watered, addressed by Section

Chairman, Richard Leng and InstMC President, Martin Belshaw followed by raconteur, Rudi West.

This year's Prize Draw raised in excess of £1,250 to be distributed to local charities. The event also enabled local hospitality apprentices from Middlesbrough College to gain

hands on experience by helping Jurys Inn staff, set up, welcome, prepare and serve at the event.

Mike Vowell, Hon. Sec. Teesside



Q&A

Ian Craig

Sitting in the hot seat this issue is Ian Craig, Senior Operations Manager, KBR and the newly appointed InstMC Honorary Treasurer.

What was the root of your interest in Engineering?

I was born in Motherwell and, as my father was in the steel industry, I grew up in the shadow of steelworks like Ravenscraig, Consett and Redcar on Teesside.

I was always happiest building objects with Lego and Meccano. I fondly remember when I was about 13 using every piece of my Meccano to build a drilling rig which I could not bring myself to dismantle.

I did not realise I had an interest in engineering as a career until I was in sixth form, when I talked to Jim Turbill the ICI Graduate recruitment manager and friend of my father. School had never mentioned engineering as a career but Jim pointed me towards the new degree in Instrumentation and Control Systems at Teesside Polytechnic. I completed a "thin" sandwich course and spent a seven-month period during the commissioning of Hunterston B nuclear power station working on the installation of instrumentation. This was followed a year later by six months on the oil rig modules for Chevron at the Dorman Long yards on the north bank of the river Tees.

Getting my hands dirty building instrumentation control loops and solving the initial glitches and setting them to work was so satisfying and enjoyable that I was sold on my future career of Engineering Procurement and Construction of projects around the world!

What is your vision of Engineering in Britain for the next ten years?

The next ten years are going to be challenging and exciting for all engineering disciplines but particularly for the instrumentation and control field. We will be seeing totally new infrastructures for the supply of energy not just in charging points for cars but in the distribution of hydrogen as a fuel and the safety challenge that brings; as well as increased remote operation of all industrial facilities.

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

As with most problems this needs to be addressed on a number of fronts simultaneously, some of which have already been focused on in many reports for the Government. In my view there are two areas that still require addressing further. Firstly, engineering should become an aspirational career for children (and their parents) along the lines that medicine and law, for example, are. Secondly at junior school the way we teach STEM subjects can be improved as demonstrated by an organisation called "Primary Engineer" which, I believe, is showing how we can engage children at an early age in the joy of solving problems in an engineering environment.

The government also needs to encourage the development of all the new technology related to the environment and AI to be based in the UK. I don't think we have scratched the surface at what can be done with the amount of data instrument systems are now capable of collecting for analysis.

What do you do in your free time to relax?

I have a wide set of interests. I

play tennis at weekends all year round, go skiing twice a year and I enjoy cooking. It was at a course at the Raymond Blanc Cookery School that made me realise that I have enough natural talent to reach a level of understanding of everything I do to see why I should stick to engineering. I also run a 1965 classic car which I maintain myself; but not the bodywork — that is art not science! I have been involved with the Institute since joining in 1976 and been an active member of the London section acting as Treasurer and Chairman. For the last ten years, with my friend and former President of the Institute John Morley, I have been able to put into use all the experience I have gained in 40 years of annual dinners and corporate hospitality and run our Christmas wine tasting lecture. With retirement approaching I have been voted into the role of Trustee and Hon Treasurer of the InstMC, which I am thoroughly looking forward to.

Given one wish what would that be?

Given one wish, I would wish for three more wishes but given that would be forbidden in the small print, I wish that the British Government would give a legal status to Chartered Engineer as it is in Germany and the US.

The next ten years are going to be challenging and exciting for all engineering disciplines but particularly for the instrumentation and control field.

COMPANION COMPANY SCHEME (CCS) SHOWCASE

The InstMC Companion Company Scheme has been running since 1992, enabling companies to raise their profile amongst our membership of 3,000 professional engineers in the measurement, automation and control sectors.

There are opportunities to network with other businesses, InstMC accredited universities and with individual members at local and regional level through Local Sections and Special Interest Groups. At present, we have 92 CCS members and would like to take this opportunity to introduce them to you here and in future issues of Precision.

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Fluidic have experience in a variety of applications such as the Nuclear Industry; Oil & Gas; Petrochemical; Refineries; Pharmaceutical and Food & Beverage (particularly the Whisky industry). Some team members hold sites passes at various nuclear sites across the country. We also have capacity for workshop and site calibration and onsite wireless installs.

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www.instmc.org

For further details and application forms please visit our website or contact the Director of Membership & Registration on +44 (0) 20 73878 4949 Ext 3 or email: membership@instmc.org

ACCREDITATION CORNER

Our resident expert, Trevor Thompson from bestmeasurement.com, is here to answer your questions on measurement, traceability and laboratory accreditation. If you have a question for Trevor, please email him at questions@bestmeasurement.com and we will publish the answer in a future issue.

In this issue, Trevor defines the meaning of words and terms used within the accreditation process to clear up any confusion.

Accreditation and Certification

These terms are often confused and used wrongly. Basically, Certification is about conformity of a process, product or person with a specification or requirement. Accreditation is about competence; in our case, competence to perform

certification. Calibration and Testing are taken to be a form of conformity assessment, so laboratories may be accredited as competent to make the necessary measurements, such that they may issue certification by certificates or reports.

In the UK, UKAS (The United Kingdom Accreditation Service) is the authoritative body appointed by Government to accredit conformity assessment bodies. These include laboratories making measurements, certification bodies and registrars certifying management systems of manufacturers and service providers.

Calibration and Testing

We can consider that calibration is a subset of testing; some will disagree, but this is an easy way to appreciate the situation. Testing is the act of establishing that a product, service or material meets a specification or requirement. Calibration is a type of test conducted on a measuring instrument or on equipment that is going to be used to make a further measurement or comparison. A calibration compares the performance of the measuring equipment with a known physical standard or a "better" piece of measuring equipment. The result of that comparison is the calibration.

Examples

We test a chair, car, engineering component or almost anything with a specification expressed in objective terms.

We calibrate a measuring meter, gauge block, ruler or anything that is going to be used to make a further measurement.

To recognise the difference, consider the use of the item:

- A calibration is made if the item is one that is used to make a further measurement. It is a measuring instrument or transfer standard that itself makes a measurement or assigns a value to another item.
- Calibrate a ruler, Test the height of a chair

Sometimes the items are similar but the use is different:

- Test a piece of metal for hardness: Calibrate a Hardness Reference Block
- Test tea for polyphenols: Calibrate a polyphenol in tea reference solution
- Test a 12v power supply (to be used to power something): Calibrate a 12v reference voltage source

So, it depends on the intended use of the item.

Testing and calibration always has some uncertainty of measurement, which we can examine more in a future issue of Accreditation Corner.

Trevor Thompson recently left UKAS having been assessing and accrediting measurement laboratories for over 40 years. He was also the British representative and one of the authors in the writing of ISO/IEC 17025:2017 and served on several EA and ILAC committees and working groups over many years. You can contact Trevor at www.bestmeasurement.com where he offers help with metrology and accreditation issues.

HOW ENGINEERING HAS RESPONDED TO THE COVID-19 PANDEMIC

In this feature we provide a brief roundup of the various initiatives and efforts made by the engineering community in response to the COVID-19 crisis.

Royal Academy of Engineering

Auxiliary Engineering Support for Field Hospitals: With a number of new medical facilities being built across the UK to treat patients with COVID-19, and existing facilities increasing capacity in specialist areas, RAEng were approached by NHS England to ask engineers to volunteer, with a range of engineering requirements, enabling them to continue to deliver frontline services.

They received over 1,000 applications and have stated that a representative from the NHS team will be in touch if

volunteers are needed in one of the Nightingale hospitals.

Supply Chains Call for Input:

The Royal Academy of Engineering and its partners across the National Engineering Policy Centre have been supporting government by helping to identify potential future shortages and bottlenecks across critical supply chains in the coming months. They recently put out a call to engineers from all sectors about supply chain issues they are currently having or anticipate having. This could include displacement effects created by the repurposing of production lines to manufacture coronavirus (COVID-19)-related products and shortages caused by reduced operation of factories.

Nightingale Hospitals: Skills & technology deployment:

An online Q&A event was held on 14th May exploring the different ways the engineering profession is contributing to the COVID-19 response. Interviews with engineers involved in innovative projects and multidisciplinary efforts, highlighted the ways in which the community has mobilised to rapidly add expertise to the ongoing battle against the virus and how lessons have been learned from innovating and scaling at pace.

Speakers at the event included, Dr Helen Meese, Founder and Managing Director of The Care Machine, who spoke about her involvement in the Nightingale Hospitals coordinating the engineering profession to volunteer as auxiliary engineers and Professor Richard Kitney who talked about deploying his healthcare technology (Visbion data cubes) in the Nightingale Hospitals.

A recording of the event is available to view on the Royal Academy of Engineering website. <https://www.raeng.org.uk/>

Funding Calls: The Academy are currently running and coordinating a number of funding opportunities including a grant for The Engineering X Pandemic Programme. This initiative is helping the UK and global engineering community to learn from the COVID-19 pandemic through global sharing of lessons on disruptive solutions and best practice approaches in the prevention, preparedness, response and recovery from pandemics.

Full details on all Royal Academy of Engineering initiatives can be found on their website at <https://www.raeng.org.uk/policy/engineering-response-covid-19-coronavirus>

Institution of Mechanical Engineers – IMechE

IMechE hosted a webinar in April covering the engineering efforts that have been made so far, as well as bringing together manufacturing experts from across the country, to discuss the best engineering response to the COVID-19 crisis. Speakers included Basit Abdul, Healthcare Science Fellow at NHS England, Alex Dickinson, Associate Professor in Engineering & Physical Sciences, University of Southampton and Sam Turner, Chief Technology Officer at High Value Manufacturing (HVM) Catapult. A wide range of topics were discussed including taking devices from design-to-prototype, navigating the medical device approval process, the clinical engineer perspective and finding synergies between traditional manufacturing and medical device manufacturing.

'Engineering Response to COVID-19' webinar is available to watch on YouTube at <https://youtu.be/Sux6krkvfQ>

InstMC Companion Company supplies flow control units to NHS Hospitals

The current Covid-19 pandemic has placed unprecedented demand upon UK hospital O2 delivery to critical care wards. The problem being, how to manage depletion of oxygen supplies, particularly with the increased use of high flow devices such as ventilators. Flexim UK Instruments, an InstMC Companion Company Scheme (CCS) member, have been able to retro-fit clamp-on O2 meters in more than 20 NHS hospitals throughout the current crisis. The flowmeters are clamped onto existing copper pipework and introduce no new leak paths. In combination with integration into local Medical Gas Pipeline Systems (MGPS) or Building Management Systems (BMS), the instantaneous O2 flow data from the FLEXIM meters allows remote access to live



The current Covid-19 pandemic has placed unprecedented demand upon UK hospital O2 delivery to critical care wards.



oxygen consumption data and alarming. Usage in each hospital ward, along with total site usage is now constantly available for local effective management of critical O2 demand. Data such as live, peak and average flows across various legs of the hospitals' O2 system can all be fed into the operational command to assist with proactively managing the O2 being proscribed to patients based on the known limits of the oxygen system.



HAZARDEX 2020, HARROGATE 26TH – 27TH FEBRUARY 2020

The Institute was invited to attend and host a two-day free-to-attend workshop at the Hazardex 2020 conference earlier this year.

Harvey Dearden (FS & EX-SIG Chair) presented 'Day One: Ex (Atex) Workshop: Non-certified i.s Junction Boxes Briefing Note' while Dil Wetherill (Method & FS-SIG member) presented 'Day Two: Functional Safety Workshop: What will be in 61511 Ed3 Briefing Note'. Staff from Head Office attended

an Exhibition stand to promote the benefits of InstMC membership. We are delighted to report that we also won an award at the prizegiving ceremony - 'Best User Application' for the Explosive Atmospheres Special Interest Group. Congratulations to all members of the group!



At the conference, the InstMC launched the first 'Briefing Note' from the Explosive Atmospheres Special Interest Group. These occasional notes, reviewed by the SIG steering committee, are intended to provide information on key topics; typically to dispel myths or clarify points of confusion. This first note explained the requirements for junction boxes containing multiple intrinsically safe circuits. Some parties assert that such junction boxes should be 'Ex' certified (which would have particularly profound implications if used to 'defect' legacy boxes), but this assertion is challenged in

the note and the actual provisions in the standard explored in some detail. The notes will be issued first to members of the SIG as a member benefit, via the associated LinkedIn group. This group is only available to InstMC members who have registered with the Ex-SIG (through 'Manage Personal Details' under 'My InstMC') through their website personal login.

There is a corresponding LinkedIn group for the Functional Safety Special Interest Group (FS-SIG) and the first FS-SIG briefing note has been issued to the group. Again, only available to InstMC members

registered with the SIG. This first briefing note considers the role of SIL certification and explains that certification is not in fact a requirement but may have a role in providing confidence in fitness-for-purpose.

Later the briefing notes may, at the discretion of the relevant steering committee, be released for publication as a service to the wider measurement and control community, but the initial release will be exclusive to SIG members.

Harvey Dearden,
FS & EX-SIG Chair

ELECTRICAL MATTERS AT HOME

FOR NEW TECHNOLOGIES PART 2

BY PETER NORMAN
IENG MINSTMC MIETC

Electric Vehicles – home charging considerations

In an electric vehicle (EV) future there will be a huge demand for high-powered kW battery charging.

This will require high current flow, towards the upper end of the domestic 13A-rated fittings, for a number of continuous hours of battery charging. That is, of course, subject to any smart control within the charging equipment to help avoid the broader peak electricity supply demands on the national grid supply infrastructure – an improvement to charging equipment which is already under development.

Sensible considerations for EV home charging are to install on to a dedicated spur circuit which supplies this high-current load. Also, it makes sense to use a standard industrial plug/socket outlet system to BS-EN-60309-2 for electrical durability in the service. This is designated 'Mode 3' charging – as opposed to 'Mode 2' charging where only a standard 13A plug/socket to BS 1363 is retained. Quite possibly, even the best-quality BS 1363 accessories, protected by a BS 1362 fuse, may not be sufficiently tolerant of regular EV charging demands.

Next, the main service supply fuse at the domestic property is usually rated 60A or 80A unless it has been upgraded to 100A. Older properties tend to be rated at 60A. Taking into account that a domestic house has numerous electric power demands during evening times, a fuse rating of 60–80A range is reckoned to be good for powering a 7.4kW (32A) EV charger, which should be adequate for fast-charging cycles of about three hours. It should be noted that normal home electrical components are only rated for a maximum of 13A and a ring-main protection component is only in the order of 30A.

Any upgrades to the main service supply fuse can only be carried out by the locally responsible electricity supplier, because only they possess the equipment to perform the change-out work safely and re-seal the fuse-holder box. Higher ampere fuse ratings are physically larger than lower fuse ratings so require a larger box to accommodate them. Another limitation to the ease of such a power upgrade, of course, is the physical size of the main, incoming electricity cable which may need increasing to cope with the increased electrical current. A conversion from single-phase to 3-phase supply can also, theoretically, be engineered. UK

Power Networks is one example of an infrastructure company that deliver these aspects for London, the South East, and East of England regions.

The next consideration in the EV charging safety scenario is the standard of electrical earthing system in place at the domestic property. Many non-industrial properties use protective multiple earthing (PME) where the electrical earth connection is only achieved by connecting the property's green/yellow-wired, equi-potential bonding cables to the incoming Neutral, single-phase conductor which is

Continued on page 29...



Digitalisation of Process Control

Delivering more data with cyber security in mind

11th November 2020, Aker Solutions, Dyce, Aberdeen



Digitalisation seems to be the new industry buzzword, but what does it actually mean for the process industry? A need to reduce costs drives our desire for increased efficiency and a new generation of digital technology claims to make this possible. Do the rewards of digitalisation outweigh both the risks and the expenditure? Digitalisation isn't just about introducing new technology, it often means that systems can be rendered more vulnerable, processes have to be updated, work forces have to be trained, systems have to be successfully integrated and the data captured has to be processed.

The second annual conference, jointly organised by InstMC and SPE Aberdeen, will provide a forum for discussing these issues with subject matter experts - leaving you with ideas to consider and workable solutions.

If you have experience, case histories or live demonstrations to share, then we invite you to submit a short 200 word abstract for formal 20 minute presentations or for the 5 minute "Techbyte" sessions, which are more sales-oriented presentations.

To submit your abstract, email aberdeen.events@spe-uk.org or call 01224 646311

earth-bonded at the local supply distribution 3-phase transformer's star point. This system therefore needs to carry the combined fault currents to earth for all the local properties utilising this common PME bonding.

Electrical Wiring Regulations (UK)

The 18th edition Wiring Regulations do not like this system when it comes to EV chargers and the electric vehicle itself is standing external to the property. A risk of electric shock is envisaged if the EV's chassis is able to witness a different earth potential to that of the main electric system earth. For this reason, the current recommendation is to separately bond the EV charging system's main earthing terminal to earth via a dedicated, earth electrode (copper rod) directly into the ground. This is known as the TT (terre-terre) system.

Specifically, Section 722 of BS 7671:2018 – dealing with EV charging installations – has been the focus of revision in relation to latest standards of EV charging equipment. This section comes under Part 7 of these Wiring Regulations which deals with 'special installations of locations'. The amended regulation has been labelled: BS7671:2018+A1:2020 and was issued on 1st February 2020 for immediate implementation. Compliance with the amendment, however, only becomes compulsory for in-scope, electrical installations commencing after 31st July 2020.

Within BS 7671:2018+A1:2020, earth resistance parameters are defined for installation quality. Protection against electric shock must be provided by an automatic, electrically-sensitive, disconnect device which may be incorporated within the charging equipment itself. Where the disconnect device is external to the equipment, specific RCD (Residual Current Device) types are defined and to comply with a number of relevant BS-EN standards. A touch voltage threshold is mentioned (70/71V)

considering ventricular fibrillation for 50/60Hz alternating current (ac) for both-hands-to-feet in water-wet conditions with medium contact area (12.5 cm²), in compliance with IEC 60479-5 (ed.1.0).

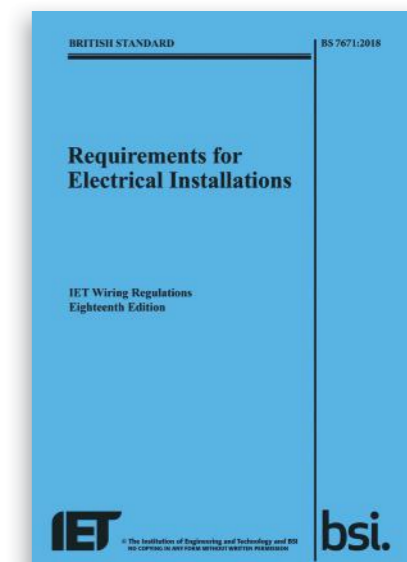
Conventional 3-pin, BS 1363 socket outlets are allowable for the relevant mode of charging but with suitable labelling; and, there appear to be accessory charging cables available on the market utilising the BS 1363 household plug but with an in-line, power-monitoring unit and finishing with the necessary final connector for plugging into the vehicle's electrical input socket.

Testing and Certification to European Standards

Where the EV charging equipment's manufacturer requires thorough product certification then the likes of TÜV-Rheinland can test to the applicable EU Directives (as most recently revised for 2014 implementation) and also apply numerous IEC (International Electrotechnical Commission) standards which embrace the various types and components of electrical equipment including wireless charging systems.

Established Technical Documentation

There appears to be a wealth of documented technical information covering what has been outlined here. Much comes from the Institution of Engineering and Technology (IET) and its sub-sources, when it comes to BS 7671 with its focus on protection against electric shock. The IET's Code of Practice for Electric Vehicles Charging Equipment Installation has been revised to its 4th edition to reflect changes within the BS 7671:2018+A1:2020 release. BEAMA – the UK trade association for manufacturers and providers of energy infrastructure, technologies and systems - has documentation covering the aspects of EV charging infrastructure. Numerous Residual Current Detector manufacturers detail the various types of device and their intended use.



Concluding Cautionary Note

It becomes clear that a home electrical conversion to embrace the growing number of modern technologies is not automatically straightforward and may well require technical inspection and modifications involving more than one layer of the electrical supply chain in order to manage the complete change effectively. That is to say that equipment installers may not be able to just come along and fit the new equipment without the involvement of other electrically-qualified bodies of professionals who need to be able to authorise/supervise conversion works at the higher levels so that all aspects of the installation are truly fit for the purpose of safe electrical installation for the ordinary consumer to use. Even the desired TT earthing system alternative to PME may not be practical at certain building properties as is covered by a Note 6 within the BS 7671:2018+A1:2020 document.

Finally

As mentioned in Part 1, members of the Institute should find themselves better placed than many people to be able to grasp the technical aspects and appreciate the safety concerns. Therefore, any efforts that the Institute can initiate for the greater public good would seem to be a very worthy endeavour to undertake.

SPOTLIGHT ON STAFF:

Q&A with InstMC Staff Member **Leila Atherton**, Director of Membership & Registration

There is no absolutely typical day. A day can involve anything from responding to emails, arranging Professional Review Interviews, liaising with our Professional Registration Committee, various panels, mentors and assessors, examining submitted paperwork for accuracy and corresponding with members.



How long have you been with InstMC?

12 years.

What is your background?

I have a degree in English Literature and Creative Writing. I've spent all my professional life at the Institute of Measurement and Control and have had a variety of roles in that time.

What is your role at InstMC?

I am in charge of all things membership and registration.

Can you describe a typical day in the office?

What do you bring to the team?

Diligence and attention to detail.

What do you like best about working for the InstMC?

I enjoy the variety of the role and the way in which our team works, interacts and works together to get things done.

What do you do to unwind, once your working day is over?

Reading is a particular love of mine and I can whittle away many an hour thinking about and planning where I will next travel to. A cup of tea also features highly in my unwinding.

Can you tell us a fun fact about yourself?

The scariest night I spent was camping in the open air in a remote part of Kenya without a tent or any other structure. The stars were very beautiful but I did not get to enjoy the sight of them as me and the people I was with were in utter terror as hyenas circled around us in the bushes and made their hideous howling laugh for most of the night. It made for a great 'fun' story.

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Martin Belshaw



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