



# WAY of life

exhibition edition



Edition

# 37

Sep 2014



# Internet of Things or industry 4.0



*Our neighbours to the East have had it on the agenda for quite some time: industry 4.0 and IoT, even right up to government level. It was then launched and supported by the Merkel cabinet and developed by German industry. Here in the Netherlands I have not really encountered this subject with government and trade associations. To sum it up it all comes down to the fact that everything will be connected to everything.*

*Naturally we have a great deal of experience in this area: tbp has already been working toward this for 15 years and we are now reaching the final phase! But we are only talking about tbp internally, let alone the fact that all external parties must also be connected. Although we are already some way there in terms of logistics and finance.*

*I am certainly not saying that it is impossible, but that it will require a lot of time*

*and energy. This is partly due to the fact that all of those involved must be fully transparent. As far as we are concerned it begins with early involvement which is also a high priority at tbp. We will roll our sleeves up and take on the challenges which this creates for us, whilst realising that we will all have to put in a great deal of effort to achieve it. That may be clear and in relation to this much will be spoken and written about IoT...*

*But if it works you will be able to control all of your production yourself at the push of a button.*

*Ton Plooy  
CEO*

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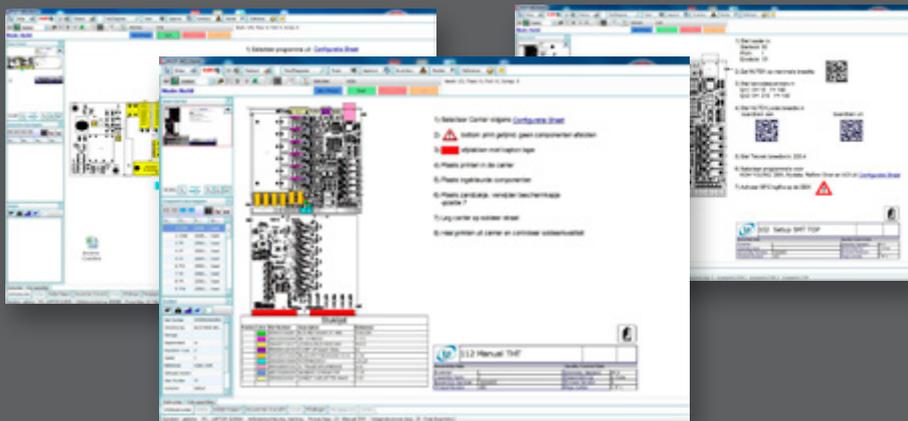
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one of the MES dashboards

# Finger on the pulse with MES

Under the title "nothing escapes MES" in the last *Way of Life* you read about the implementation of the Manufacturing Execution System. This is a system set up to monitor all process steps on the work floor and to create reports. Using MES we manage the production process optimally. By recording all individual pcb's\*) and their features at each production step the history of a particular product can be subsequently investigated in fine detail.



some examples of work instructions

## work instructions

One of the features of MES is the provision of work instructions (also called PIM - Product Instruction Manual) - for each process step depending on the requirements for each pcb - to the operators. Process steps which are laid down in the so-called Factory Model. At the end of last year an inventory and

standardisation of all process steps was begun. Ambitious as we are however it soon became evident that the proposed activities took longer than was initially calculated. In practice it appeared that more process steps occurred than was initially assumed. There was no uniformity in the presentation of the required work instructions. In other

words, there was a requirement for an (editorial) translation. The solution was found by creating work instructions in accordance with clear arrangements, which are controlled by a so-called *sign-off* group before a production order containing those work instructions is visible on the production floor. Some thousand or so instructions which are now in the old system must be converted in word and image, and to achieve that alongside regular activities is more difficult to schedule than was initially thought. To achieve uniformity, a set of templates was first developed with which the work planners could assign product-related information to a new work instruction. The *look and feel* of all of the pages will basically be identical. An additional benefit of the use of templates is that the time to carry out an instruction is reduced by about half. The intention is that each operator will soon see an action described in clear, understandable language which cannot lead to misunderstandings, aided by photographs where necessary.

## new release

The Aegis MES is not only a way to create work instructions - what an operator should do in a certain situation - but also a storage medium for what has been passed in review. Thus it is possible to create a large number of standard and tbp-specific reports. Some examples of those reports are the so-called First Pass Yield report (the percentage of well-assembled products), a DPMO report (Defects Per Million Opportunities) or a top 10 list of faults over a selected period.

At the Productronica fair Aegis announced a new release (FactoryLogix) as a replacement for the current version. But we are not there yet. Our focus remains on *fine tuning* the current version concerning the standard work instructions described above, process optimisation and the achievement of optimum communication between the various machines and the central database. Parallel to that we will enter a test phase with the new version in order to make a controlled transition halfway through next year and therefore make use of the announced improvements. We expect to be able to report more on these developments in a subsequent edition of *Way of Life*.

\*) printed circuit boards

# why early involvement?

*At first sight a strange title. Those who have known tbp for a while, know precisely what it means. What early involvement yields for a client and what this concept means in practice, we will explain here. We will do this on the basis of the life cycle of a product, in this case a pcba\*), seen through the spectacles of tbp.*

*\*) pcba = printed circuit board assembly, electronics consisting of a printed board containing all of the components*



From the beginning to the end we see the following stages:

- drafting of the block diagram
- design of the (electrical) diagram
- design of the print layout of the copper line plan (the electrical "wires")
- compilation of the list of components
- purchase of the board and components
- indication of where the components are to be placed
- assembly process (the placement and soldering of the components on the pcb)
- optical quality inspection
- quality testing
- transport and further processing
- operational use
- completion of any repairs or modifications
- decommissioning.

Everyone who uses electronics will have to take these aspects into consideration. All of these factors also have a direct effect on costs - including "hidden costs" - indicated by the term Total Cost of Ownership (TCO). Naturally the user wishes to keep this low.

## the EMS company

Just like the design of electronics, their assembly is a separate discipline. The assembly of modern electronics requires specialist machinery and qualified personnel. That's why in most cases designers outsource production to a specialised EMS company, Electronics Manufacturing Services. An obvious solution to keep the costs of this assembly as low as possible is to find an EMS partner which charges low prices. Do these companies exist? "Yes!", says tbp. There are various EMS companies which are able to assemble a pcb with the motto "you demand it, we'll supply it". Whether the client will achieve his objective, is doubtful. Very often no attention is paid to the question: "Will the product fulfil quality requirements over its expected lifecycle?".

## faults

The answer is easy; probably not. The cause can be traced to the existence of faults. Numerous fault-sources ensure that the slip through - the percentage of pcb's manufactured and delivered to the client which potentially still contain faults - is high. This is due in part to the lack of optimum test coverage. In fact: sometimes it appears impossible to produce a board due to faults. A client who subsequently uses assembled electronics in his product will then discover the consequences. Often with (high) extra repair costs (so-called "hidden costs"). Cheap suddenly becomes expensive! What faults are likely to occur? A summary:

- a fault in the diagram
- a fault in the area and connection of the components "shapes (footprints)"
- a fault in the line diagram
- a fault in the digital information for production
- a fault in the chain from manufacturer to EMS company, the *supply chain* (faulty, damaged components)

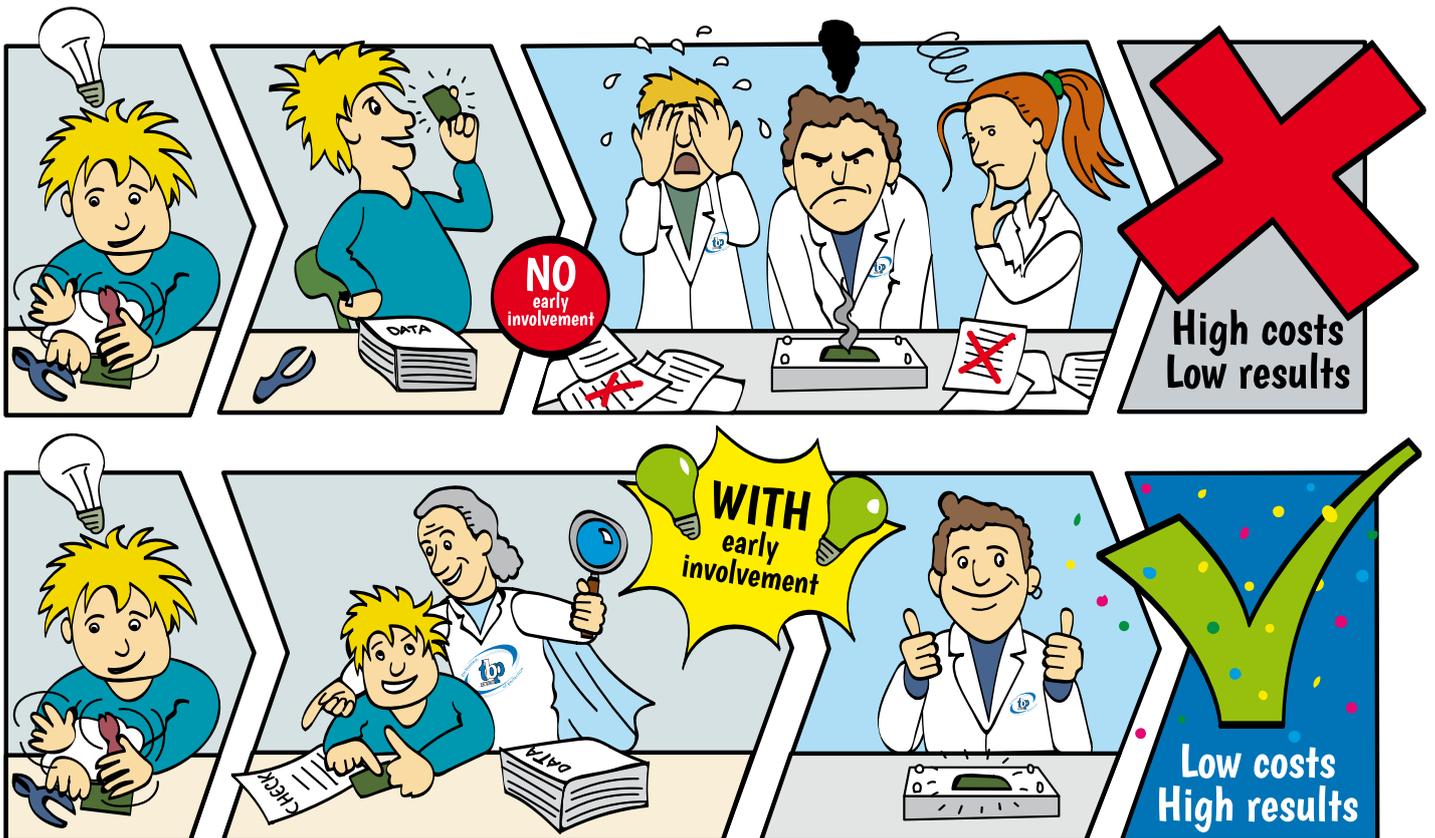
- a fault in production
- a fault in the distribution and handling of the product.

According to conventional opinion the role of the EMS company only begins with assembly. tbp's thinking on this is completely different. tbp is convinced that it is impossible to make a good product if the designer does not take assembly requirements into consideration (in accordance with IPC). A low slip through rate is inconceivable if there is no cooperation between designer and manufacturer at an early stage. Naturally an EMS company must have at its disposal state-of-the-art machinery and qualified personnel but this alone cannot prevent numerous potential faults. For reassurance: Not a single EMS company is in a position to make an absolutely perfect product in only one production run; the so-called Production Yield is always lower than 100%. The way in which a good EMS partner distinguishes itself is by keeping the slip through referred to as low as possible.

## DfX

All efforts to be able to make a good quality product are summarised by the term Design for eXcellence (DfX). It is the sum total of a number of methods which contribute to the quality of the product. DfL, Design for Logistics, considers the availability of components and at the same time the liabilities for residual values are minimised. DfM, Design for Manufacturing, considers to what extent the EMS company is able to manufacture a good quality product. DfT (Design for Test) determines the preferred test strategy to enable a product to be tested at the earliest possible stage during assembly in order to maximise the quality of the product and to minimise any repair costs. DfX only has a chance of success if the EMS company and the designer combine their efforts at an early stage with the aim of creating a high quality product. tbp refers to this by the term early involvement. Cooperating with the designer's thought processes on feasibility and testability

p6 >>>



p5 >>>

from the very start in order to enable the creation of a top product. That is tbp's main strength. On balance - and this can be supported based on calculation examples - this operating method also delivers a lower TCO ("the best buy"). The benefits are twofold! As far as we can judge the market, this service appears to be unique. Furthermore, we require our clients to cooperate with our DfX engineers to achieve a good result. That's why we have a team of DfX-engineers on standby to support clients when they start a project and when they have only the first idea (the block diagram) of the product to be designed.

#### DfM

We want to make it quite clear that early involvement is not a superfluous luxury by providing a brief insight into the many factors in designs which negatively affect feasibility. Issues which arise on the design bench and for whatever reason remain unnoticed. Such issues are uncovered during the analysis included in DfM. These examples are drawn directly from practical experience:

- weak solder joints. The strength of the solder joint is determined to a great extent by the flow of solder to the rear (heel) of the foot. Figure 1 shows on the left a faulty path design (paths too far from each other) as a result of which flow to the rear has not succeeded. The image on the right

shows the correct path design;

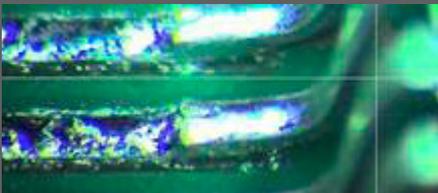
- component is too large for the footprint. The physical dimensions of the planned component (figure 2) differ from the component used. However certain types occur in different casing sizes;
- thermal imbalance. Because too great a thermal imbalance between the paths occurs, the solder paste melts more quickly on the right path than on the left path. As a result the likelihood that a component on one side of the path raises up and stands vertically on one side of the path (3: the tombstoning effect).

#### DfL

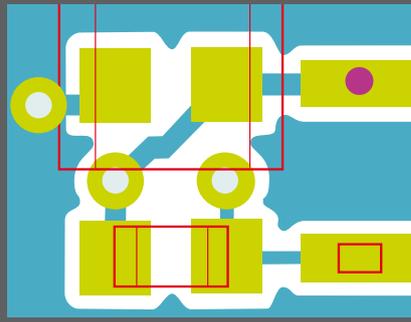
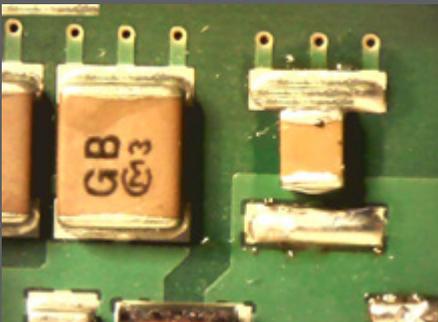
As stated previously an EMS company puts together or assembles. That assembly consists mainly of soldering parts or components on a printed circuit board. The designer who creates the electronic diagram and decides the layout on the pcb, determines which components are necessary. In principle every electronics designer can select from a huge market offering. The wise choice depends to a great extent on the logistics process. Imagine a designer makes use of components with which tbp is not familiar. The buyers must then check availability, perhaps contend with an MOQ (minimum order quantity), reserve space in the warehouse and hold stock according to the order size. The work planners must then provide instructions for all sorts of production processes, from pick-and-place through to testing. That is a time-consuming and expensive task. It is better for a designer to make use of the usual components which tbp stocks as standard. This prevents problems and yields financial benefits to the client. In this logistics process tbp uses three categories of components, indicated by the letters A, B and C:

- A. standard components which tbp keeps in stock itself
- B. specific components used by two or more clients. Agreements apply to these components regarding the stock to be held and the purchasing commitments for each client

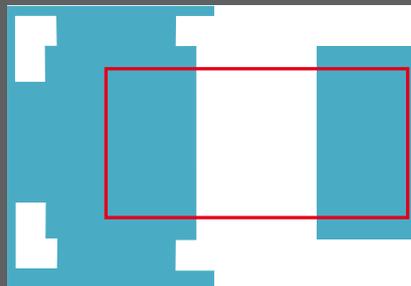
1. example of a weak (l) and good (r) solder joint



2. the area reserved on the printed circuit board does not match the selected component



3. due to thermal imbalance (difference in dimensions of the paths) there is a risk of tombstoning



C. specific components which are only used by one client. Conditions apply to these components for stockholding and purchase obligations.

And then there are the components which have not yet been classified. In contrast to the components in categories A, B or C these are components which are unknown to tbp which require further study before they can be used. It is no surprise that such activity increases cost.

Quite apart from the holding of stock there is another facet which plays an important role, that of traceability. It is a process which runs through all steps from the start of manufacture of a component right through to decommissioning. As is already customary in the food chain, the circumstances in which a product is handled are recorded. Traceability is important in order to discover the history in the event of a defect. And we are talking about all phases in the supply chain. Who made the product, when, how was it transported, when was it processed, what were the environmental conditions, using which machines? Only with reliable information about these sorts of things can conclusions be drawn if the life cycle of a product is not achieved.

#### DfT

In addition to issues in the design sphere, faults can arise in the production environment. The production machine may contain a faulty component, it may be installed incorrectly, damaged or not functioning properly, it has not been correctly soldered etc. Sometimes these faults can be detected visually (using the 3D AOI (Automatic Optical Inspection)), but often they are only discovered when the board undergoes an electrical test. Electrical tests give a better impression of whether the board is functioning. Various techniques are available for this purpose. At tbp we have at our disposal the most diverse inspection and testing methods: visual inspection, 3D AOI, flying probe, in-circuit testing, (extended) boundary scan, a generic (functional) test platform (GTP) and ESS (Environmental Stress



GTP: Generic Test Platform

Screening, or burn-in test). They all have their own specific features with advantages and disadvantages. The importance of testing is beyond doubt. But testing must be feasible. A designer must therefore take into account the testability of the product in his design. It is not without reason that as early as the design phase the DfX engineers at tbp advise which test facilities and test coverage are desirable and necessary. It is these people who propose the right combination of test techniques at this stage. The test strategy is determined by a mix of parameters, such as the (specific) costs of each test, the diagnosis time (the time required to track down a fault, the test time and last but not least, the test coverage (coverage: which components are tested and to what degree). Testing at an early stage of the assembly process exposes faults more quickly and allows them to be corrected more quickly than faults which are discovered at a later stage. In other words, the production process runs more efficiently and slip through is greatly improved.

#### not just a slogan

That the umbrella term DfX is inseparably linked to assembly stands to reason.

Each client naturally wants a product with a high level of reliability. Even in the longer term. A machine builder who takes several hours to track down a defective board during the production of a machine and has to go to the trouble of replacing that board, pays the bill indirectly. Replacing a pcba at a distance (for example offshore or overseas locations) is also a costly exercise. It is better to ensure that both the designer and the manufacturer work together to create a reliable product, thereby avoiding any hidden costs. Early involvement is not just a slogan, but a condition for creating a successful product!

# In other words, all pcba's are not created equal!

# will I see you at the WoTS and other fairs?

World of Technology & Science. This is the name of the fair conceived by FHI and FEDA as a combination of the traditional fairs organised by both institutions for many years. A melting pot where the world of electronics, industrial automation, motion and drives and laboratory come together and entertain lavishly. Together with VNU, the organiser of Macropak, Industrial European Dairy Show and Industrial Processing, the Jaarbeurs will soon



be buzzing with activity. It is unmissable for every right-minded worker in the above sectors: it is the place to be. It's already in your diary: from 30 September to 3 October 2014: Jaarbeurs, Utrecht. And is it also written that in **hall 9 on stand A050** you can visit the new *tbp* stand? And by the way: don't forget to register as a visitor to the WoTS. This is easy to do by registering via [www.tbp.nl](http://www.tbp.nl) and your entry will be free. A visit to the WoTS is very worthwhile.



### our stand

As usual we do our best to welcome you as a guest. We are happy to chat to you about the developments in our field, about current or future projects or other subjects we are involved in. In other words: a place for a good discussion about the business in pleasant ambience. We hope to create that partly by adapting the stand design to a more contemporary style. What remains is a cosy bar with - you will remember this from previous fairs we have attended - the beer tap from which wonderful Belgian beer flows. As stated our traditional decoration has made way for a more modern entourage, including an iPhone for custom demonstrations of the tbp order tracking app. The artist's impression here will give you a taster of what's to come. Perhaps our happy hour on Wednesday 1<sup>st</sup> October from 16.00 with live music is a date for your diary?

### racing car "around the corner"

The successful electric racing car which you can read more about on pages 14 & 15 is a short walk away from tbp on stand A100. Take the time to check out what this car looks like and ask one of the students about their experiences in developing the electronics. The approach to the electronics for the new DUT14 has changed compared to that of last year. According to the students their first experiences gave a great deal of insight into the right way to design and build electronics. Concepts such as early involvement and DfM/DfT/DfX have also become valued concepts in these circles.

### presentations

In addition to the activities in the exhibition hall you can also register for one or more presentations. WoTS has brought together four disciplines which are all organising their own conferences. Immerse yourself in the world of automation, laboratory, motion & drives and electronics. In this context we restrict ourselves to the last concept, not only because this is most closely linked to our field, but also because tbp is providing a contribution. On Tuesday 30 September, during the programme "successful electronics applications", Marcel Swinnen, test engineering team leader, will cover DfX in detail under the title "**all pcba's are not created equal**". He will cover Design for eXcellence (DfX) which ensures that an EMS company produces even better

pcba's. DfX not only delivers a reliable product, but also lowers the Total Cost of Ownership (TCO). How do you apply DfX? What do you achieve with Design for Manufacturing (DfM) and Design for Test (DfT)? It will be demonstrated that DfX delivers the lowest possible slip through (the percentage of pcba's containing potential faults). Please ensure you attend the presentation! You will certainly not regret it.

### gadget: the virtual memo

During WoTS attendees can collect the free gadget "virtual memo". The virtual memo is a smart item of electronics (with bluetooth 4) which can be attached with a magnet. Using a smartphone or tablet a message can be programmed via an app which can be received by one or more people on the smartphone at the desired time when he/she is in the vicinity of the virtual memo.



The gadget promotion was created several years ago with the aim of enhancing contacts between visitors to the fair and exhibitors. Because visitors had to collect their gadget from several stands, the exchange of ideas on business could take place whilst they picked up their little jewel.

Would you also like to be eligible for virtual memo? State this in your registration (this is quick and easy to do via [www.tbp.nl](http://www.tbp.nl)). A total of 2,000 gadgets have been produced, so there is limited availability.

Some twenty companies, including tbp, have contributed directly or indirectly via sponsorship.

### testing and metering

At the World of Technology & Science visitors will find a broad palette of testing and metering solutions in the testing & metering pavilion. In hall 9 there are at least 16 companies divided over two pavilions with the latest possibilities for the testing and metering of products and signals and the metering of installations and networks.

### development club

The invitation by the fair organisers to make a speed date appears titillating. This doesn't sound very business-like, however the intention is that in the Development Club Pavilion at least eight electronics developers are united to be of service to interested parties. These specialists are all quite at home in developing hardware, (embedded) software and mechatronics. In the centre of the pavilion is a large table which everyone who wants to brainstorm an idea or problem can simply approach. Participants are guaranteed to return home with new ideas and inspiration. According to the organisers you can't find this on the internet!

### exciting technology

Exciting, inspirational and innovative aspects of technology are assembled under the name 'Exciting Technology'. The fair organisation provides primarily non-commercial projects free exhibiting space to present themselves to the general public. For example a world champion from 2012: Students of the Tech United (TU Eindhoven, [www.techunited.nl](http://www.techunited.nl)) will give a dynamic demonstration with footballing robots. Other student projects are also on display, such as that of the TU Delft: the DUT Racing Team ([www.dutracing.nl](http://www.dutracing.nl)) and Forze Hydrogen Electric Racing ([www.formulazero.tudelft.nl](http://www.formulazero.tudelft.nl)). The organisation is also involved in a simulation of the Ministry of Defence and a New Control Room. In total around eighteen projects will show visitors the splendour of technology. Exciting Technology is emphatically included in the visitor recruitment programme.

More information will follow and will be communicated via social media, newsletters and the website.

You will find more useful information on the WoTs-website: [www.wots.nl](http://www.wots.nl)



## precision fair

The Precision Fair is a somewhat less exuberant fair than the WoTS, but no less interesting. Over time the fair has grown to become the meeting place for businesses and organisations involved in high and ultra-precision technology. With more than 250 exhibitors and some 3,500 visitors last year the organiser Mikrocentrum is showing that a great deal is happening in the sector. As you probably know, the event focuses on component and system suppliers, engineering firms, machinery and equipment manufacture, research institutes and universities in the high-tech systems sector. In addition to visitors and participants from this country many colleagues in the sector attend from Belgium and Germany.

The Precision Fair is a combination of a trade fair and a conference.

The conference programme at the Precision Fair has four keynote tracks. The first conference day

is devoted to CERN, ESS and the Advanced Instrumentation road map of the top sector High Tech Systems and Materials. Additive Manufacturing is central to the morning programme on the second conference day and the afternoon is taken up by euspen (European society for precision engineering and nanotechnology, [www.euspen.eu](http://www.euspen.eu)). In addition the exhibitors are providing over forty presentations in the lecture programme including subjects such as microprocessing, engineering, motion control and metering. In this context tbp will also make a contribution which - as you can probably gather - is about early involvement. The usefulness and need for DfX will be thoroughly explained and you will be able to discuss it at leisure during your visit to the tbp stand (stand 210).

More information is available via: [www.precisiebeurs.nl](http://www.precisiebeurs.nl)



## electronica 2014

Yes, tbp is returning to Munich. Not only to see what is going on in our sector, but also to focus on the service provision of our neighbours to the East. The 2014 electronics fair has built up a considerable reputation over the years (this is already the 26<sup>th</sup> edition!) in the world of components, systems and applications for electronics.

At the fair you will find everything to do with electronics, so you meet exhibitors from the automotive sector, industrial electronics, medical electronics and applied "embedded" electronics in the

form of MEMS (micro-electro-mechanical systems).

Are you also going to Munich? Call in to our stand 409 in hall A2. We will send you a registration number for free entry if you send an email with your request to [info@tbp.nl](mailto:info@tbp.nl). If you also attended the WoTS, you will recognise our stand from a distance. You will also be able to meet our new German representative, Fred van der Zwart.

The QR-code takes you to the website: [www.electronica.de](http://www.electronica.de)



## WoTS lecture programme

*Within the world of electronics conference segment daily seminars are held in which visitors can participate (free of charge). The following themes are on the programme in order:*

### successful electronics applications

*Tuesday morning 30 September, Progress hall*

What is a successful electronic product? It meets a demand, the application is reliable in use and the most important thing is that the product sells (internally). In order to achieve this multidisciplinary teams are increasingly formed with members from technical and commercial/marketing departments. The right approach to developing, testing and producing successful electronics applications is central to this seminar.

### tomorrow's electronics

*Wednesday morning 1 October, Quest hall*

The annual Tomorrow's Electronics Seminar is trendsetting and controversial. What is science currently involved in? Which new basic technology will the electronics industry soon be bringing to market? How do the latest new ventures make their business cases? Food for thought for technologists, investors and trendwatchers.

### PLOT reliability seminar

*Thursday afternoon 2 October, Quest hall*

This seminar was designed in association with PLOT (Platform OmgevingsTechnologie). During this seminar a response will be given to questions such as: how reliable is the electronics or the system, how can you test this and how can (accelerated) failure mechanisms be found in the design?

### electronics trends in industrial applications

*Friday morning 3 October, Expedition Hall*

*sensor data and remote control*

During this seminar a link will be formed between several important trends in the industry. What are the developments in the field of sensors? How can all of the data from the sensors be analysed smartly? How can real time (for example using own devices) be managed safely? Lectures by specialists and adopters give visitors a good oversight of the latest developments.

*In summary: this Autumn you can visit us at several trade fairs. An excellent opportunity to come and have a chat with us. We look forward to welcoming you and offering you our hospitality.*

our trade fair attend-  
ances in the Autumn  
of 2014 at a glance:



Jaarbeurs, Jaarbeursplein, 3521 AL Utrecht  
**HALL 9, STAND A050**  
30 September to 3 October 2014

Tuesday, Wednesday and Thursday:  
10.00 to 17.30  
Friday: 10.00 to 16.00  
[www.wots.nl](http://www.wots.nl)



## Precisiebeurs

NH Conference Centre Koningshof  
Beneluxhal entrance Locht 117, 5504 RM  
Veldhoven  
**STAND210**  
Wed. 12 & Thurs. 13 November 2014  
9.30 to 17.00  
[www.precisiebeurs.nl](http://www.precisiebeurs.nl)



Messegelände/ICM, An der Point, 81829  
Munich  
**HALL A2, STAND 409**  
11 to 14 November 2014

Tuesday, Wednesday and Thursday:  
09.00 to 18.00  
Friday: 09.00 to 17.00  
[www.electronica.de](http://www.electronica.de)

## and much more

*The next few months will see a variety of conferences, trade shows and events being held once more which might be important for you. Here are a few from the ample selection:*

9-11 September 2014, Santa Clara,  
California, USA  
**PCB WEST 2014**  
conference and trade fair for designers  
and manufacturers of electronics  
[www.pcbwest.com](http://www.pcbwest.com)

25 September 2014, Eindhoven, Netherlands  
**HIGH TECH MEETS HIGH TECH:  
RELIABILITY GROWTH ANALYSIS**  
[www.holland-innovative.nl/hightech](http://www.holland-innovative.nl/hightech)

30 September – 1 October 2014, Nuremberg,  
Germany  
**E | DPC**  
conference and trade fair on the pro-  
duction of electric propulsion systems  
[www.mesago.de/en/EDPC/home.htm](http://www.mesago.de/en/EDPC/home.htm)

6-8 October 2014, Eurogress Aachen,  
Monheimsallee 48, 52062 Aachen, Duitsland  
**AACHEN COLLOQUIUM AUTOMOBILE  
AND ENGINE TECHNOLOGY**  
international conference for the  
automotive industry and its suppliers  
[www.aachener-kolloquium.de/en](http://www.aachener-kolloquium.de/en)

14-15 October 2014, Sao Paulo, Brazil  
**PCIM**  
trade fair and conference on power  
electronics, intelligent propulsion  
systems, energy re-use and energy  
management  
[www.mesago.de/en/SAPCIM/home.htm](http://www.mesago.de/en/SAPCIM/home.htm)

22-23 October 2014, Munich, Germany  
and

3-4 December 2014, Stuttgart, Germany  
**EMV SEMINARE**  
seminars on electromagnetic tolerance  
<http://tinyurl.com/pu4l2o8>

28-30 October 2014, Shanghai (Pudong),  
China  
**CHINA ELECTRONICS FAIR (CEF) 2014**  
one of the most prestigious trade fairs  
on electronics and ICT in China  
[www.mesago.de/en/HCEF/home.htm](http://www.mesago.de/en/HCEF/home.htm)

6 November 2014, Sound & Vision,  
Mediapark Hilversum, Nederland  
**NATIONAL CONFERENCE BUILDING  
AUTOMATION 2014**  
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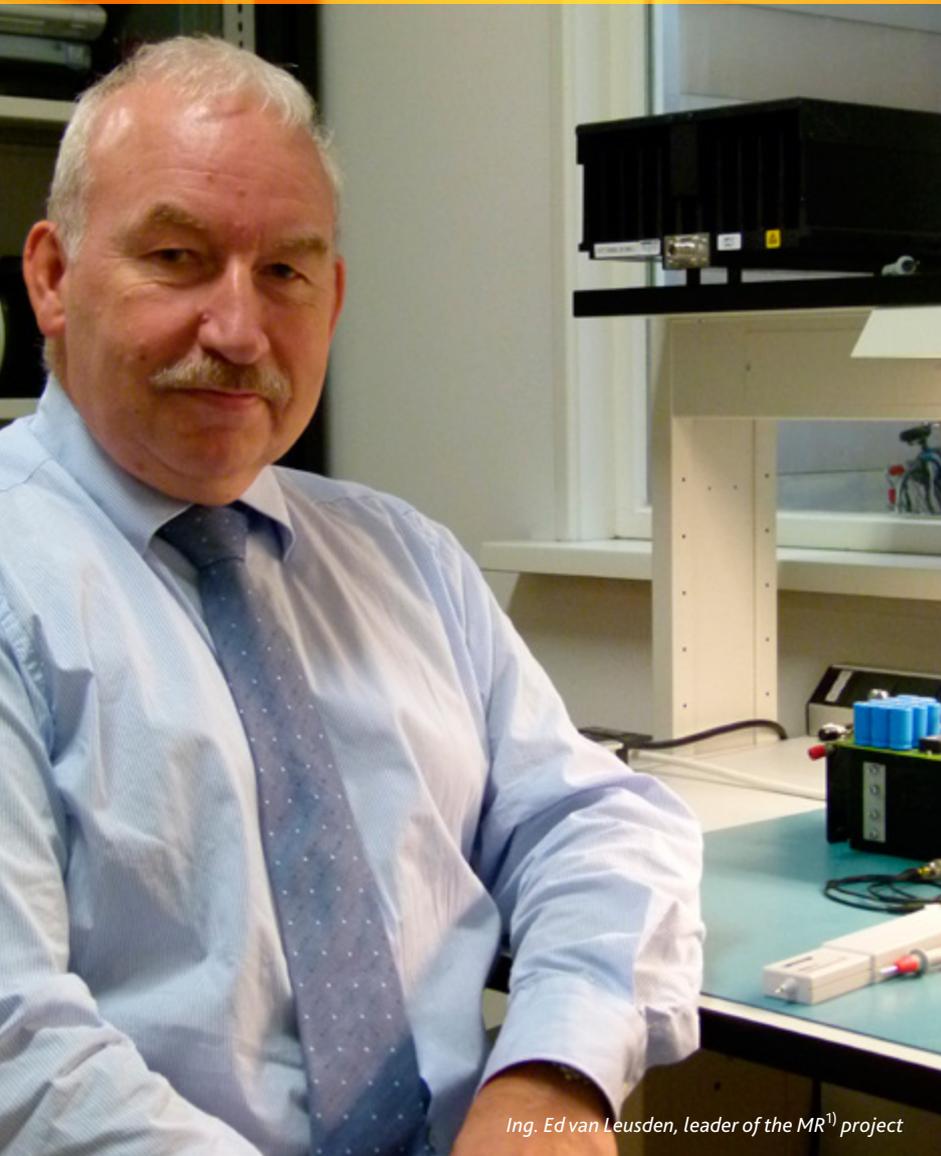
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# flow meters for the major work



Ing. Ed van Leusden, leader of the MR<sup>1</sup> project

*You come across them in many industries: the distinctive blue-rimmed flow meters from Krohne. This originally German manufacturer has been providing metering solutions for the industrial (process) world since 1921. The Dutch branch sells, produces and calibrates part of the broad supply programme and has recently developed a very special meter: the Multiphase Flowmeter.*

## novelty in the making

The metering of a liquid or gas is in itself a difficult task, but to then be able to say something about the medium passing over the sensors is a different story altogether. This question arose in the oil industry, where people wanted to know the ratio of water, oil and gas in the substance pumped out of the ground. The quantity of oil however is definitive in determining whether an oil well is still producing enough oil to remain viable.

Instruments which provide on the flow metering results have not existed until now. Attempts have been made to come up with a metering design, but these have never been developed into a usable product. A design has now been created which functions well and which Krohne is developing into a commercially viable industrial product.

Ing. Ed van Leusden, leader of the so-called MR<sup>1</sup>-project, is working on the creation of this entirely new product: the Multiphase Flowmeter. "It is based on the same technology which can be found in the MRI scanners used in hospitals. Briefly, this means that the behaviour of protons which are resonated at the metering point by an electromagnetic pulse in a powerful magnetic field is measured. The electronics we design must ensure the transmission of a well-defined pulse and a receiver which can process the data into usable information." Enthusiasts who wish to know more can easily google this. In any event, this principle also appears suitable for metering composite substances.

## focus on electronics

A team of six electronics designers racked their brains to develop a diagram which provided a usable metering result. Ed: "Unfortunately we couldn't make use of the technologies from the world of traditional MRI scanners which are to be found in hospitals. The main reason is that for the measurement of (human) tissue the body lies still, whereas for our measurements the substance is flowing through a pipe at considerable speed."

During development we allowed several concepts to pass review and built them. In the definitive project there were four different pcba's<sup>2</sup> excluding the pcba in the feed which measured the current to drive the transmitter and receiver and the display for the presentation of the metered values. "We created the design in-house, but we are seeking partners for production. So we will outsource the production of the layout to third parties. Before I joined Krohne, the company had carried out an extensive search for a good EMS<sup>3</sup> partner. From the research they did, tbp emerged as the best due to the high quality of their work. That meant a new supplier of electronics alongside the German parent company which controls everything for the standard products.

It is therefore a logical continuation to allow tbp to produce our new boards." Ed considers one of tbp's most striking plus points is the added value in the form of DfM<sup>4)</sup> and DfT<sup>5)</sup> at the moment you come forward with a new product. "Normally you use reports for the improvement of your print design before production. We are deviating from this rule and taking the risk if something goes wrong into the bargain. We are however still at the prototype phase and so the necessary modifications are still taking place. Naturally we take on board any advice during the next phase in order to arrive at a good product." It is not only the DfX<sup>6)</sup>-advice which Ed finds worthwhile, but also the involvement of the buyers at tbp. "As a designer you are not always aware of what's happening in the market and it's great to receive advice, for example on the availability of components in the (near) future."

#### please be patient

The concept has now been developed into a functioning prototype. A production-ready appliance is expected to be ready by the end of this year. In the meantime work is being done not only on the development of the appliance, but also on the setting up of a production location. The MR project appears to have a good future. Across the world there are some 800,000 oil wells. Although not all

oil wells will be equipped with such metering instruments, there appears to be sufficient potential for the entire oil industry. These companies are constantly active in exploration and the price of oil plays an extremely important role in this. When prices are high it is worth re-commissioning sources which have previously been declared unprofitable. When prices are low the pumps stop. The percentage of oil pumped in relation to the price is therefore the benchmark. Who knows, other types of application may come along later. Time will tell.

#### flow meters

Flow meters are Krohne's most important products. The company produces a wide range, from small examples with a diameter of 2.5 mm to large examples of over 3 meters. They not only produce, but can also calibrate. Thus Krohne possesses the largest calibration installation in the world.

Around 400 people work at the Dutch branch in Dordrecht, 70 of which work in research and development. The company sees innovation as a necessity in order to be able to continue to grow and to respond to customers' demands. That is the incentive for strong investment. At the Krohne branch in Dordrecht, meters for liquids or gas are reproduced, based on two different principles, namely with ultrasonic sensors and

with electromagnetic sensors. There are countless applications. They are often used to measure a specific quantity of liquid, for example. This might be a bottle-filling machine which has to fill a given quantity of liquid. Both principles have their specific features which we won't go into in this context. Suffice it to say that tbp has produced pcba's for one of those sensors for some time now.

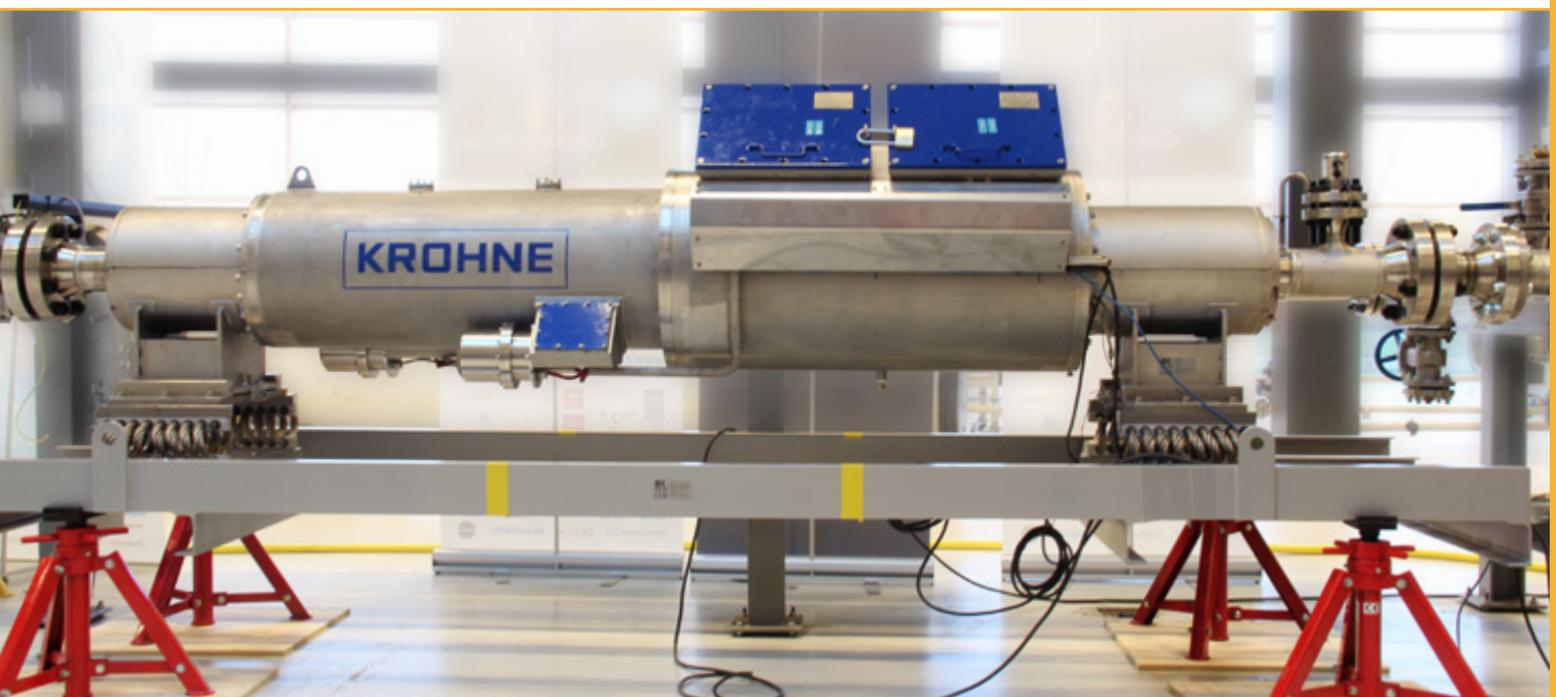
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*a trial design of the special flow meter which Krohne has developed for the petrochemical industry*



# DUT Racing Team: electrifying

*You will remember the great results achieved by the DUT13, the electric racing car with which the students of TU Delft became official world champion last year. A jewel in the crown of the 75 students who bundled their expertise in the development of this multi-disciplinary project. tbp also played its part in the form of the supply of the pcba's\* used and the provision of advice. This year the*

*expectations are high for the next generation of racing car: the DUT14. During the summer competitions took place in various locations at which participants from high schools and universities could show what they were capable of. The DUT Racing Team 2013/2014 once again scored an "electrifying" result, as you can see on the website and in the newsletters via [www.dutracing.nl](http://www.dutracing.nl).*



photo: Worcflow

## getting started

At the start of the 2013/2014 study season last September the new team was put together from some 90 students who wanted to work on this ambitious project. Spread over nine different disciplines there was a job to do. As "electronics chief" Marinus Geuze and his team members had to develop the necessary electronics. Based on the requirements and rules imposed on global competition by the SAE International, a concept was developed for the construction of a racing car. These rules were different to those of previous years in several areas. Only once the concept had been devised were comparisons made with previously produced models. Supplemented by the information gained from the students' practical experience from the previous round (in which the DUT13 participated) an action plan could

be further developed.

For example these changes in the specifications led to a different type of wheel and tyre. This combination made it possible for a more compact construction to be developed for even better grip with the additional benefit of weight saving. The gearbox, which connects to the motor, has no protruding axle upon which the rim is mounted, it itself acts as the rim. Also in the area of electronics, partly due to previous experience, radical changes have been introduced. Some parts have been developed from the basis, but what has remained is the central computer. Both the hardware and software appeared sufficiently robust and reliable for the next round.

The central computer has been slightly simplified and has become more compact, saving weight and increasing reliability.

It's not necessary to reinvent the wheel. Marinus talks enthusiastically about the first successes achieved in the initial phase. "An exciting change is the communication between the central computer and the outside world such as the sensors and actuators. In the new design we have extended the use of the CAN-bus as a result of which the number of wires in the wiring harness has been considerably reduced. There was another reason by the way: in the electronics in the DUT13 problems occasionally developed with EMC (Electro Magnetic Compatibility). Shortly after the first tests it became apparent that these types of problems no longer occurred with the current CAN-bus."

EMC is all about the effects caused by uncontrolled interference signals or simply the transmission of such signals. The old idea that protection with a metal

casing would be sufficient appeared not to work properly in practice. It is for precisely that reason that extra attention was paid to this issue during the design of the electronics diagram.

The solution lay in the decentralisation of electronic connections which were bundled together on a board in previous versions. By incorporating local functions on various pcba's close to the sensors, the signal integrity (commonly referred to as "clean signals") is greatly enhanced. Of course the omission of such a complex wiring harness also creates a significant weight saving for the DUT14!

#### the battery management system

A truly new development in the area of the electronics is the battery management system. Marinus explains: "Although the industry offers such systems, these do not appear to connect well to our systems. Every reason to roll up our sleeves and develop such a system. It's true we didn't expect this but we consider safety to be very high on the list of priorities, that's why." The lithium polymer batteries - two sets of 138 cells in series - have to supply energy to the four motors. And that power can increase considerably. When the motors are under maximum load, a total of 104 kW (!) of power are converted into rotation in the motors. This places high demands on the batteries, but also creates risks. The temperature can rise too high and there is a risk of explosion - certainly in the case of a short circuit in one or more cells. It is important therefore to continually monitor the temperature of the cells and the electrical currents and flows. The power supply consists of six blocks

of a low 100 volts per block. In total 23 sensors per block constantly monitor the voltage and current and transmit their data to a system bus which connects the blocks to each other. As soon as the controller records an impermissible value, action will be taken and if necessary the power supply to the motors is disconnected. Safety first!

#### it's becoming real

The first DUT 14 electronic diagrams were already on the computer screen quite early in the Autumn of 2013. The next phase was imminent: time to put in a call to the specialists at tbp. Marinus takes up the story: "Last year concepts such as DfM, DfT and early involvement were fairly unheard of, and everyone assumed that you could assemble a print by supplying a bare board and a handful of components. In the current design we noticed that it makes more sense to consult at an early stage." This is a strategy that the old-timers passed on to the newcomers. So the choice of components could immediately be fine-tuned to the library of components which tbp uses as standard. This is always preferable to the use of specials. At the same time contact was made with the team of DfX-engineers (Design for eXcellence) at tbp. They know better than anyone the demands which a print design must fulfil and make it feasible and testable. Feasible to prevent surprises during production and testable to ensure that there is a degree of certainty that the product will function after assembly.

The DfX-engineers carried out a thorough investigation and reported their findings to the designers. Shortly thereafter

this could be signed off and all digital information sent to tbp as the BOM (Bill of Materials) . In doing so the prototypes of seven different pcba's were available at the beginning of this year. The pcba for the sensors is universal in design, and in the end four identical examples of these were incorporated in the racing car. In total therefore this involves 10 pcba's. During the pcba production a video film was also made of the flying probe test. You can watch it via this link: <http://youtu.be/TSyeMmTRe38>.

#### and on to the racing

In May it got really exciting: the assembly of the complete vehicle and testing took place. This had to prove that theory and practice were one and the same and the team got the chance to steal the show. Impressions during the first testing laps were very promising. Just like last year the competition was held on the circuits of Silverstone in England, Hockenheim in Germany and Spielberg in Austria. At the first event the jury declared the Delft team the absolute winner of this Formula Student event. With 885.5 of the 1,000 points theoretically available, the team left the competition in its tracks. Literally a world class performance! With a nod in the direction of the tbp motto you could say: the TU Delft Formula Student Team is the Electrifying Team of Perfection.

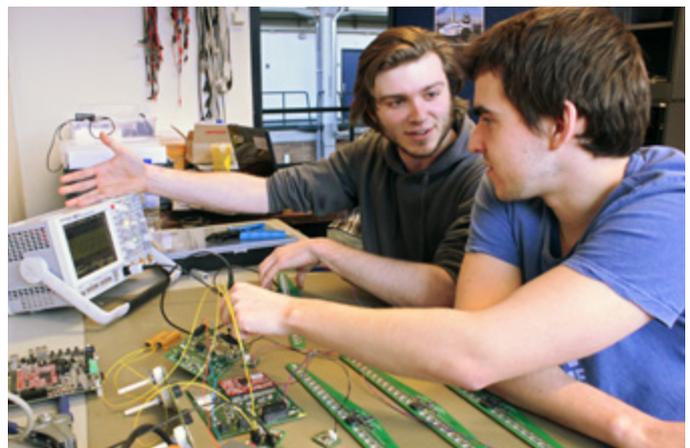
If you would like to know more about the results achieved by the DUT14 racing car: [www.dutracing.nl](http://www.dutracing.nl)



\*) printed circuit board assemblies



electronics chief Marinus Geuze on the left and on the right powertrain chief Maxim Sprey



# digital services



*Under the title "How can we be contacted digitally?" in the previous Way of Life we summarised the modern methods with which you can communicate with tbp. Smartphone users are*

*already familiar with the wide variety of apps available to them. Requesting an offer online has become a simple task. Thankfully so, as we are all working very efficiently on this.*

## our website

It is not surprising that everyone who has access to the internet can find the website [www.tbp.nl](http://www.tbp.nl). Yet there have been a few updates behind the screens to benefit the user. For example our website is now very responsive. This means a good picture is visible on the screen the surfer is using under all circumstances. Whether he or she is sitting at a pc or using a laptop, tablet or smartphone: the image is always complete and practical in use. Responsive means that the images on the monitor screen adapt to the dimensions, without hindering legibility. From a technical point of view this means that images and the like are not used at full resolution but are scaled according to requirements. A responsive website therefore adapts to the appliance which is requesting web information. This is an enjoyable feature.

## web problems solved

We also wanted to change the hosting provider. That's easier said than done as migrating from one to the other you accept unwanted risks. Thankfully the transfer went unnoticed in practice and we remained online without a hitch. Even the adaptation of the content with the tools available went flawlessly. This transfer will have hopefully gone completely unnoticed by our web visitors. And that is precisely what we intended.

## Way of Life also live

In addition to the paper version this (and previous issues of the tbp newsletter) Way of Life are also available on your iPad. You can even choose the language: Dutch, English or German. Always handy if you want to look something up or re-read it.

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# Girlsday 2014

*all of the girls who attended in ESD-safety clothing for the tour of tbp*

*Some 44 girls from the Prins Maurits Christian School visited tbp electronics in Dirksland as part of national Girls day 2014. Main objective: to bridge the gap between women and technology. Via a presentation in the auditorium tbp electronics demonstrated what it does and showed that many women are involved in technology. Excitement was raised by the showing of the company film, together with videos of the DUT Racing Team from TU Delft (see also pages 14 & 15). The ladies then got some hands-on experience with several amusing technical exercises. After the break there was a tour of the production area. An enlightening and worthwhile experience! At the end of the morning a few group photos were taken and the girls were given some nice gadgets to take home with them.*

**aim**  
Girls day is an initiative by the VHTO, the national knowledge bureau for girls/women and beta sciences/technology/ICT. The aim is to increase the participation of girls and women in this world. The VHTO also works towards maintaining women on the employment market in these sectors. During Girls day the VHTO cooperates with businesses and schools in order to interest young girls aged from 10 to 15 in these buoyant industrial sectors. Some 300 companies registered and therefore around 8,400 girls from 250 schools got the chance to get a glimpse of the diverse, fascinating worlds of (female) professionals!

**encouragement**  
Minister of Education, Culture and Science Jet Bussemaker wished all of the girls an enjoyable day in a special video message: "I hope that you enjoy yourselves, I hope that you dare to dream and perhaps some of you will choose to follow a technical education as a result. Because without women in technology we will get nowhere!"

The national kick-off of Girls day 2014 took place at ICT company IBM in Amsterdam. Mrs Andrée van Es, Councillor for Work, Income and Diversity, welcomed the 92 girls in attendance on behalf of the Borough of Amsterdam. Skating coach and champion Renate Groenewold explained to the girls how she uses technology to optimise her speed skating.

On behalf of the ladies - and certainly also the gentlemen - at tbp electronics: thank you CSG Prins Maurits for your interest during Girls day 2014!

[www.girlsday.nl](http://www.girlsday.nl)  
[www.vhto.nl](http://www.vhto.nl)



*Jet Bussemaker Minister of Education, Culture and Science*

# do we have a deal?

*As a consumer, do you think it's quite normal to go to the shop, select the product you wish to purchase at the desired/agreed time and then pay for it? That purchase and sale process takes place tacitly in accordance with logical steps. You buy something, receive it and pay for it. It would be absolutely crazy if you had to sign a contract with the shopkeeper before you bought the product. At least, as long as the price tag was not too high. Nevertheless you do enter into a tacit contract with your supplier. In many cases the implicit conditions are embedded in our legal system. What to do if the product is not satisfactory? What guarantees exist?*

The same rules apply to professionals in fact. You get your bread directly from the baker, but for an EMS company it's slightly different. How is it different? The client (customer), the EMS company (tbp) and suppliers agree this between each other.

How does such a contract come about? Just like if tbp wanted to re-invent the wheel, that also applies to the client. In by far the most cases an existing contract serves as the basis for a new one.

## establishing agreements

A client wants value for money. He wants products of the agreed quality at the agreed time at the market price, or, if possible, slightly cheaper. Both parties lay down what has been agreed in a contract. So they both know the obligations they have to each other.

A large part of the work involved in drawing a contract takes place in balancing the clients purchasing conditions on the one hand and tbp's sales conditions on the other. As a general guide tbp uses the terms & conditions drawn up and lodged by the Metals Union. This "standard" provides a good basis.

It is customary in the EMS sector to talk about medium and long term deals. This often involves products which are sold over a longer period. Other than consumer electronics which thinks in large quantities with changing products in a fairly short time window, tbp operates in the market for smaller volumes, but with greater diversity. It is customary for products to be produced for several years in small batches which are despatched to the client on a

monthly basis. In such cases tbp enters into a so-called framework agreement. This is the agreement with the client over a longer term. A contract like this consists partly of purchasing and sales conditions but these often differ from the regular format. Usually they relate to all sorts of logistical issues, such as stockholding of components or finished goods. To a client, this means that a way is found for the products to be used more flexibly. Naturally the other side to this is that tbp wants security that at a given moment the products or residual stocks will be purchased.

These agreements must of course be binding in nature. In the case of forecasting tbp is certainly prepared to hold stocks, but in so doing, it wishes to agree a sales forecast.

## supply problem

A problem can arise if a certain component is no longer available. This is then referred to as an obsolete component. The last-minute search for a suitable replacement can cause (serious) delays. It is also normal for component suppliers to communicate with designers regarding the availability of components, even in the long term. And when a factory stops, there is still the opportunity for a last time buy. But this is therefore a perfect example of an instance to ensure that there is sufficient for the future, but not too many components in tbp's warehouse. In other words, if all parties can make and fulfil the right agreements, everyone is better off and trouble is avoided.



# Electronics for industrial applications



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# the Royal Commissioner of the province of Zuid-Holland visits tbp



## **Silicon Flakkee**

A visible enthusiast was Dr. Jaap Smit, Royal commissioner of the province of Zuid-Holland, when in June he sat in the DUT13, the electric racing car which the students of TU Delft developed very successfully in 2013 and which even gained them a place in the Guinness Book of Records. The commissioner paid a visit to tbp as part of the Integrated Spatial Programme which is intended to strengthen the regional economy of Goeree-Overflakkee. "Perhaps tbp is the beginning of a Silicon Flakkee", he joked during the presentation of what the business has to offer.

*Dr. Jaap Smit with Mrs Ada Grootenboer, mayor of the borough of Goeree-Overflakkee immediately behind with architect Matthijs Zeelenberg alongside. On the left is councillor Arend-Jan van der Vlugt and on the right councillor Frans Tollenaar of the same borough. On the far left is Bas aan de Stegge of TU Delft and last but not least Ton Plooy on the right.*