Electrical Systems
Control & Automation Solutions

WORLD CLASS QUALITY
THROUGH WORLD CLASS CONNECTIVITY

PP case studies as featured in

THE Manufacturer

Manufacture of electrical control systems and assemblies

Featured ***Articles***

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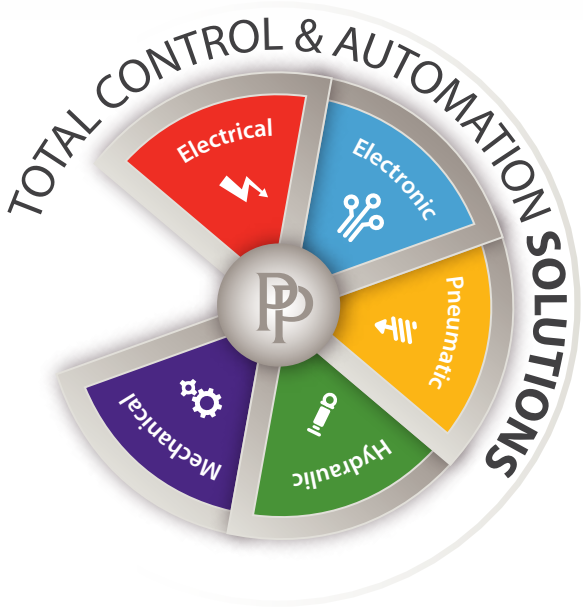
Introduction



As an acknowledged leader in the provision of control & automation solutions to some of the World's most successful machinery builders, we have had the opportunity to publish a number of articles in the UK's premier journal for The Manufacturing Industry. These case studies have been used to highlight and promote the very real business benefits that have been realised through us working in close partnership with our clients, customer benefits that have resulted in;

- **Increased sales**
- **Reduced manufacturing costs**
- **Improvements in quality**
- **Improved production throughput times**
- **Reductions in customer lead times**
- **Increased profitability**

"We look to adopt a consultative approach when engaging with our customers, looking to first fully understand and appreciate their areas of constraint and "business pain", before we look to design a manufacturing solution that will deliver specific remedies, based on their individual needs. The solutions we offer are able to deliver significant and measurable results for our customers."

case studies

Through the roof

A strategic decision to outsource part of its production has helped Ishida Europe double its capacity and achieve significant growth in the process.

The company, which has sites in the West Midlands and Poole, turned to PP Electrical Systems to help it ease capacity issues and improve lead times offered to its global customer base.

What started as the supply of electrical harnesses has now been transformed into a long-term partnership, which sees the Walsall-based control and automation specialist oversee the base build of the multi-head food weighers, including building and fitting all associated controls.

These are then delivered to Ishida on a just-in-time (JIT) schedule for the final fit and bespoke configuration before being sent to clients supplying some of the world's biggest supermarkets.

"We used to try to do as much of the assembly as possible in-house, but that was causing us issues with increased lead times and being able to keep up with demand," explained John Priest, operations director at Ishida Europe.

"This made us consider our approach to outsourcing and, after we saw what PP Electrical Systems was doing for some of its other customers, we invited the company in to see how it could work with us more strategically.

"Results have been emphatic. We proved the outsourcing arrangement worked with multi-head weighers and then adopted it for other product lines, such as our innovative tray sealing machines.

"The impact of strategic outsourcing and a number of additional activities has delivered growth of 20% year-on-year since 2012. This has enabled us to employ 75 more people, and, in recognition of this achievement, we were awarded the Queens Award for Enterprise – International Trade in 2014."

PP Electrical Systems is creating an enviable reputation for working with original equipment manufacturers (OEMs) looking to replace 100% vertical integration of production by sub-contracting out non-core competencies.

Tony Hague, MD of PP Electrical Systems, picked up the story: "Ishida Europe is a great example of how outsourcing can really make a difference to machinery manufacturers.

"We have been providing the high 'added value' machine base build solution for more than five years now, gradually working our way up so that we are now involved in numerous variations of multi-head weighers.

An Ishida multi-head weigher machine in production

"As well as the complex assembly and fit, we also look after the logistics and supply chain management, meaning our customer now deals with one strategic source directly rather than many individual component suppliers and the associated costs that go with managing them."

He went on to add: "Outsourcing -when the right partner is selected-offers many benefits. It can eliminate unnecessary stock and reduction in work in progress, improves cash flow and should improve production throughput times. The latter reduces customer lead times, which in turn can assist in securing new orders.

"Importantly, it can also give you flexibility in capacity and that works equally well when volumes are 'up' or 'down', reducing the need for costly sub-contract labour as a reaction to increased build requirements and, equally, the issue of managing short working hours or some form of 'lay offs' in quieter periods."

A recent example of the partnership evolving has been Ishida successfully securing an order for 40 customised multi-head food weighers into twelve different locations, including Europe, Japan and North America.

This involved ensuring each machine was certified to CE and UL508a standards, a challenge PP Electrical Systems played a major role in meeting.

John concluded: "Outsourcing non-core assembly has been a major success for us and we are keen to move forward with this approach. We're looking at introducing new model launches over the next twelve months and PP Electrical Systems will be instrumental in that process."

Understanding the true cost of poor quality

Ian Knight, Director of Operational Excellence at PP Electrical Systems, asks Machinery Manufacturers: "How much is downtime really costing you?"

Customers becoming more demanding, wanting more for less, pressure on lower prices, purchasing departments focused on cost down results, all of this sound familiar?

However, as important price may be, do you really appreciate the total manufacturing cost of your equipment and just as importantly, the lifetime cost?

More OEMs are now focused on true 'total' cost when they consider their manufacturing and supply chain options, using valuable information back from their sales, service and installation teams to help shape future design and cost analysis.

When you consider the electrical controls and automation field - speak to any machinery manufacturer, irrespective of industry or application - the biggest single contributor to field failure and resultant service visits is poor electrical connectivity. It's a fairly obvious point to make, but the weakest part of any electrical circuit is the connection between cables and components.

Traditional methods of manual cable preparation and crimping using hand tools are prone to error, irrespective of how tools are calibrated and maintained. This is because the error is usually with how they are used by the operator themselves.

Quite often such defects result in a crimp 'making' sufficiently well that when it is wired into a control panel or cable harness and then 'point-to-point' tested, it will pass. However once that machine has been transported and installed, you could have an immediate problem, or indeed you may find the problem occurs some weeks later following the install.

Having an intermittent fault caused by a poor electrical connection is a 'nightmare' for a service engineer. Such an issue can cause a host of problems for an automated machine and can be exceptionally difficult to locate. The result at best is an expensive service visit, but it could be far worse depending on the end customer, application and the associated costs of machine downtime.

These scenarios are exactly why PP Electrical Systems has invested over £1m in the best automated cable preparation machinery, much of it unique to us in the UK.

Crimp Force Monitoring

Features include crimp force monitoring (CFM) technology, where every single crimp going on to every cable, is 100% optimised by measuring the force applied to the crimp at the point of application.

The automated machinery can immediately sense a variance caused by over strip (copper conductors being removed when the outer jacket/sleeve is removed) or the crimp not being seated correctly on the stripped cable when crimped.

Either way the machine will recognise a potential issue, cut off the faulty crimp and re-crimp accordingly. This removes the need to batch test crimp quality through pull off tests or crimp height tests, you guarantee 100% quality – every time.

Our customers are OEMs with a reputation for optimum quality, technology and machine performance.

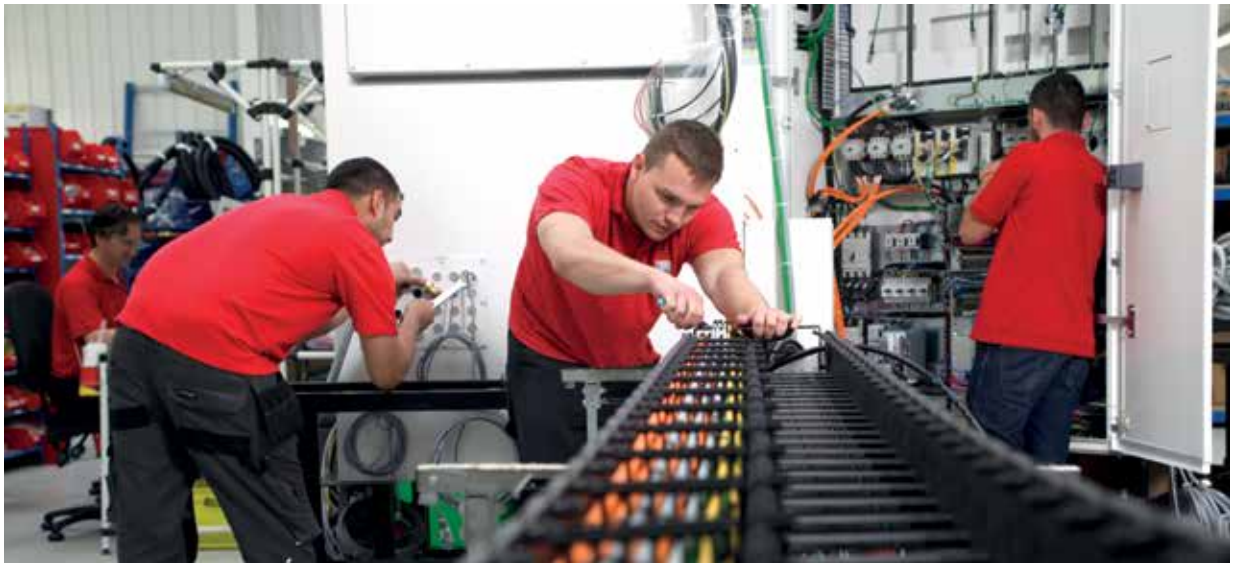
Many of them export equipment all over the globe and their clients are demanding and machine downtime is an absolute catastrophe for all parties concerned. A good example of this would be Mazak Machine Tools, with whom we have worked in partnership for 23 years.

Marcus Burton, European managing director, had this to say: *"The quality of our machine tools are recognised globally and everything we strive for with our partners is focused on maintaining those levels of performance."*

"PP Electrical Systems' investment in automated cable preparation and the associated levels of 6 sigma quality that is delivered, is a critically important factor in ensuring we take every possible step in offering our customers the most reliable product available."

Mazak supplies machine tools to many leading manufacturers in automotive, aerospace and medical Industry.

So in summary, when you consider machinery build costs, not only consider true total costs of manufacture, but also factor in lifetime costs associated with machine performance.



Time is of the essence

David Fox, Chairman & Tony Hague, Managing Director of PP Electrical Systems, explains why meeting reduced lead times is now one of the biggest challenges for machinery manufacturers across the world.

There's an old saying that "time is the most precious commodity" you can possess, a phrase that rings even truer in today's demanding industrial landscape.

The global recovery – although much cherished and needed – has brought with it a new trading environment that often puts "delivery lead time" at the top of the pecking order, along with cost and performance.

Machinery manufacturers have probably had to adapt to this change in focus more than most. A few years ago they could have specified how long it would take a model to be built and delivered to the customer, but now the power is very much with the purchaser and lead time can be the difference between an order won or lost.

So not only have firms had to contend with building machines quicker they've also had to come to terms with more complex requirements from the customer and a demand for each model to be customised to their exact requirements.

"We've been calling it the 'Perfect Storm'," explained David Fox, Chairman of control and automation specialist PP Electrical Systems.

"Machinery manufacturers have had to introduce a complete culture and process change and that change has had to happen swiftly. We're not talking small companies either, these are some of the biggest names in industry.

"They used to be able to set the timescales and there certainly wasn't the same appetite from clients to configure their machines as much as there is now."

He continued: "The recession changed all that and despite the recovery bringing much sunnier times, it also brought with it a more cautious and demanding approach to capital investment. "The point of order release for capex seems to get further delayed, but the delivery times requested do not reflect those delays.

"In order to meet these new requirements, our customers have had to revert to a more agile approach to manufacturing and this is where we often come into the equation."

PP Electrical Systems, which employs 185 people at its facility in the West Midlands, currently works with thirteen of the world's biggest machinery manufacturers.

It has become a close ally to the sector in recent years, with its ability to provide electrical, pneumatic, hydraulic and mechanical build capabilities making it one of only a few multi-disciplined system integrators in the UK.

Under the strong leadership of MD Tony Hague and Chairman David Fox, the company has been able to develop an outsourcing offer that helps its global client base reduce lead times, increase capacity and improve the total manufacturing cost.

"The first stage is to take a look at the overall build process of the machine and explore ways in which we can make the build flow more efficient…value engineering you could say," continued Tony Hague, who is also a member of The Manufacturer's Automation Advisory Board.

"This gives us the opportunity to examine where we can standardise some of the processes or components so that it is easier to configure later on in the build. Immediately, we are removing potential bottlenecks and reducing risk.

"In some cases we have even designed custom parts to be modular so they can be interchanged depending on the customer's wishes."

He continued: "Other elements include assessing the complete inter-connectivity associated with the machinery. This means auditing the current arrangement and identifying ways to improve quality, reliability, robustness and speed of assembly."

There are an increasing number of PP Electrical Systems' clients looking at strategic outsourcing, recognising that the only alternative available to them is trying to build more machines in advance. This can prove very risky as you would have to forecast likely demand – which can be problematic on heavily customised equipment, plus all the "buffer" being built, whether stock, work-in-progress or finished products, constitutes space and money.

Winner of numerous Best Factory and Manufacturing Excellence awards, the company estimates that its approach has reduced production lead times for its customers from between 20% and 50%.

One startling statistic is how one customer, supplying into the fast moving electronics sector, managed to reduce machine build time from 6 weeks to just fourteen days – all through strategic outsourcing and the associated benefits of value engineering. "There aren't any downsides that we can see from outsourcing. It gives you agile capability to ramp up production in a controlled manner and, likewise, can be equally effective when volumes are lower than expected as there's no sub-contract labour to manage or difficult workforce decisions to take," added Tony Hague.

He concluded: "We are always very careful to work in partnership with our customers, which allows them to evaluate their own core competences and the areas in which we can provide solutions of significant value."

Under the guidance of Tony Hague PP Electricals has developed an outsourcing offer that supports its global client base in reducing lead times

EXPORTING MACHINERY TO USA OR CANADA?

How aware are you of UL and CSA standards associated with electrical control systems that form part of your machinery, not to mention relevant NFPA70/79 standards concerning cabling and connectivity?

The level of confusion that we are seeing from machinery builders has never been greater, ironically at a time when the North American export market is actually growing for many of these companies.

With this growing opportunity comes greater risk if the appropriate standards and approvals are not either fully understood, misinterpreted or, worst still, ignored.

The UL 508A/cUL508A standards apply to electrical control panels and PP Electrical Systems has more than 15 years' experience in design, build and approval to these standards and can help machine builders avoid the very damaging and often costly exercise of getting it wrong.

Too many companies believe they will meet requirements by simply selecting UL approved components and putting them into a UL approved enclosure system. . . nothing could be further from the truth.

There are many influencing factors to take into consideration when designing and building a control system that will be UL 508A compliant and few companies have the level of experience that PP has developed over many years.

In addition to the complexities of UL, firms also have to consider the often application specific needs of US NFPA (National Fire Protection Association) standards number 70 & 79, national US electrical and safety codes. Non-compliance to these standards can cause a scenario where machinery cannot be installed and connected to the supply, resulting in major expense and inconvenience.

Enhanced global design acceptance - the prestigious UL Listed mark is sought after by end customers all over the world.

c UL US
508A

MEMBER OF NFPA®

Staying the right side of the UL standard in the US and North America. Sean Cayley, Operations Director of PP Electrical Systems, explains why compliance confusion can be costly for machinery manufacturers.

Standard Errors

As a manufacturer of machinery, how confident are you that you are meeting the legal and technical requirements of the US and North American markets? Confusion in respect to UL 508A and NFPA standards can be extremely costly.

As a specialist in electrical control systems and automation – with 15 years' experience of designing and building systems to meet (Underwriters Laboratory) UL 508A standards – at PP Electrical Systems we are amazed at the level of confusion that still shrouds what does and does not constitute a UL certified product. UL 508A certification is an industrial control panel standard, which is sought by electrical inspectors.

The UL 508A Listing Mark on an industrial control panel provides evidence of third party certification to the municipal inspection authority and to the purchaser of the panel. In essence, it shows that the panel complies with an acceptable safety standard.

This applies to any company that is supplying control panels or building machinery for export to the United States and North America. This could be firms involved in food processing or packaging equipment, machine tool manufacturers, pharmaceutical, scientific or semiconductor plant. It can carry a far reaching remit.

Vendor beware

Many companies believe that by simply selecting components that are UL listed and integrating them into a control panel that also carried a UL (NEMA) rating, that was the start and end of the exercise. In fact, a number of machinery manufacturers have adopted this approach and depending on which US states they have been exporting to, may have managed to escape any serious issues. But that is until they come across a more stringent inspection, whether state specific or just a more detailed and thorough site inspector. Then the problems can be huge.

There will be re-working, supplying new components and even the time and financial cost of dispatching engineers overseas to sort out the problem as quickly as they can. And this isn't even taking into consideration consequential penalties from the customer due to late installation of machinery and the impact this can have on future business relationships.

All of these issues can be easily avoided by taking a more proactive approach and working with companies that can offer a complete UL solution in line with specific needs.

Prior to manufacturing a UL approved electrical panel, we will first undertake crucial checks of customer's submitted designs. Some examples of checks and considerations and the common issues of non-compliance are described below.

It is very important that the design is checked for compliance with the UL 508A standard prior to manufacturing the panel, in order to ensure UL compliance and thus enable us to apply a UL mark to the electrical panel.

Defining the required SCCR (short circuit current rating)

Electrical panels must be designed to achieve a rated minimum short circuit current rating. A 5000 Amp prospective symmetrical fault current rating will be sufficient in many cases. Some applications require a much higher SCCR and these higher fault current withstand ratings can be achieved with the right design. The SCCR is one of the most important electrical panel design factors as AHJs (US Authorities Having Jurisdiction) can prevent connection and use of an electrical panel if its SCCR rating is not greater than the symmetrical fault current rating of the power supply that it will be connected to.

Voltage rating and end customer site electrical power network configuration

Electrical panels will normally either be connected to a single-phase 115V or three-phase 460/480Vac 60 Hz public power supply network in the USA. Sometimes system voltages of 575V or even 690Vac three phase may be seen. Power network connections may be star or delta configuration and the point of connection could, for example, be a 'grounded delta' supply. Further design considerations here will include adequacy of proposed transient voltage surge suppressor modules or components.

In the case of a grounded delta network configuration for example, prospective transient impulse voltages of 6 kV can appear between incoming phases and the panel's earth connection (perhaps due to a nearby lightning storm or switching on and off of large electrical loads on the local power network). The electrical panel rated impulse voltage withstand rating requirement will be agreed and the design checked to ensure it complies. Note that standard UL compliant electrical panels will be rated up to 600Vac maximum (normally 115Vac, 230Vac or 480Vac). Connection to a 690Vac power network requires special assessment and design. AHJ's can prevent connection of electrical panels that do not have suitable impulse voltage withstand rating.

Wire bending space

Electrical panels must be designed to provide the necessary minimum wire bending space in accordance with UL 508A requirements. The bending space is the distance between a field wiring termination point inside the panel and the directly opposite metal wall of the panel. The distance required depends on the 'ampacity' (current rating) of the field wiring cables. AHJ's will prevent connection of electrical panels that do not have sufficient wire bending space. Clearly, the cable size calculation is important and it can affect the dimensions of the panel in some cases.

US NFPA 70 NEC and NFPA 79 code compliance

The UL 508A standard incorporates many requirements that are derived from the US NFPA (US National Fire Prevention Association) standard no. 70 - the 'NEC' (US National Electrical code). An example is cable 'ampacities' (current ratings). Whilst checking an electrical panel design to the many clauses of the UL 508A standard, this does not guarantee that a design will be in accordance with the relevant NEC articles and many of these are application-specific.

This is yet another example of where electrical panels can be prevented from connection to an electrical supply by the authorities, if they are found to be non-compliant with the US NFPA 70 NEC or NFPA 79 machine safety codes. As you can start to see, there's a lot to take in when considering all of the implications associated with UL 508A and the potential significance of getting it wrong.

Some benefits of incorporating an electrical control panel carrying the UL 508A certification include:

- The UL 508A certification provides the inspection authority and your customer evidence that the control panel complies with nationally recognised safety standards, which ensure public safety and compliance with national and local electrical codes.
- Manufacturers that carry the UL 508A certification are subject to periodic unannounced inspections of their facilities by UL personnel. Through periodic audits, UL makes sure the manufacturer continues to meet the UL requirements for 508A certification.
- The UL mark on a component means that UL has evaluated and tested samples of this component and has concluded that they meet the necessary requirements, thus protecting the quality and integrity of the control panel.

Look West

Developing exports to the US and Canada could offer growth potential for machinery builders outside of traditional European markets explains PP Electrical Systems' Engineering Manager, Mark Johnson.

Engineering staff can take an EU specification industrial control panel design and convert it into a design to meet both US and Canadian regulations and standards

There has been a feeling for some time that the US and Canada offer significant opportunities for machinery manufacturers and we are starting to hear more and more success stories of UK companies gaining access to these lucrative markets, capitalising on demand for innovative systems and machine designs, some of which were only originally sold at home.

We have a host of helpful government schemes looking to assist businesses, often spearheaded by the likes of UK Trade & Investment.

However, life is never plain sailing and there are a number of issues associated with entering new markets, such as culture, administrative responsibilities, logistics and regulation. When doing business with the US and Canada, the focus should also be on securing compliance for the safety of industrial products and equipment.

Regulations across the pond are different in many ways to our EU "CE" marking approach, but they are not insurmountable.

At PP Electrical Systems we have 17 years' experience in successfully navigating and meeting regulatory requirements and we even have a US accredited factory here in the heart of the UK. This gives us the capability to manufacture industrial control panels that are fully certified to the necessary US and Canadian standards.

What are the key regulations affecting industrial control panels?

There are several organisations in the US and Canada that create safety standards and regulation. The key regulations and standards for industrial control panels are:

USA:

- US National Electrical Code - NFPA 70 (National Fire Prevention Association standard)
- UL (Underwriters Laboratories) UL 508A safety standard for Industrial Control Panels
- NFPA 79 - Electrical standard for industrial machinery

CANADA:

- Canadian Electrical Code
- CAN/CSA C22.2 No.14 Industrial Control Equipment

Typical things we need to understand include:

- Short circuit current rating for the panel. Often it may not be known what the requirement is, but we can advise.
- Enclosure type rating. A different categorisation system is used to that of the EU 'IP' codes.
- The terminals that will be wired to in the field have a bearing on the choice of approved terminals.
- The type of circuit protection devices. The right kind of approved component has to be used.
- Thermal overload protection scheme for electric motors, in accordance with the US National Electrical Code.

Safety related components are expected to hold UL or CSA (Canadian Standards Association) approval.

The safety standards have many requirements, but we have developed a process for meeting them in a timely, cost-effective way. Our engineering team will design your entire panel or convert an existing design into one that complies in both the US and Canada.

Getting to grips with UL

The Underwriters Laboratories of the USA (UL) develops safety standards and common test methods to reduce electrical fires and has produced hundreds of safety standards covering multiple sectors.

Our factory has been accredited by UL as an authorised panel builder and PP Electrical Systems is able to apply the much sought after UL safety mark to all of its work.

Engineering staff can take an EU specification industrial control panel design and convert it into a design which will meet US - and Canadian if required - regulations and standards.

An industrial control panel carrying the UL 'Listing' mark as applied by PP can be connected to the US power supply network without any further local inspection.

With us as your partner, the perceived hurdle of meeting US and Canadian safety regulations is no longer there and we can help you make the most of these lucrative markets.

"Engineering staff can take an EU specification industrial control panel design and convert it into a design which will meet US and Canadian regulations and standards."

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