London Electronics Limited

Handy Performance Monitoring Ideas

for the Busy Factory Manager

“ Everyone has two jobs ...

First, to do their job ...

Second, to find ways of doing their job better ”

John Towers, former MD of Rover Motor Company

london-electronics.com

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Performance measurement - the smart way

When you set out to measure your factory's performance, you may find yourself becoming overwhelmed by all the possible measurements you can make. Some of thes include ...

Actual vs. Target production rate now
Actual vs. Target production rate over the last hour
Actual vs. Target production rate over the last shift
Actual vs. Target production rate over the last week, etc...

Total achieved versus target since start of shift

Down Time since start of shift
Down Time this week
Down time this month, etc.
Down time on indvidual machines
Reasons for down time on each section of the line

Rejects versus Total produced this shift
Rejects versus Total produced this week
Rejects versus Total produced this month ...

OEE now
OEE over the last hour
OEE for the last shift
OEE over the last week ...

... and the list goes on.

Are they all appropriate to YOUR factory and YOUR processes? Some may be, but most are probably not.

Can you realistically handle all that data and make valid decisions from it? More data doesn't necessarily mean more value.

Quite the contrary, in many cases.

We will guide you, so that you end up with no more than 5 key measurements which will highlight the most important areas of improvement.

Keep it simple - that way you can deal effectively with the data and share it usefully with colleagues, so that improvements offering the best return can be planned and put into place.

Getting workforce and management on your side

" It's not what you do - it's the way that you do it! "

Beware ...

First, what not to do ...

Don't be tempted to unveil a grand plan of performance monitoring if you have devised it on your own, without consulting the teams at the sharp end. As soon as you begin putting it into action, you may find that performance drops, rather than improves.

Most people are demotivated by hints of 'big brother' scrutinising their every move.

We need to devise production monitoring methods which BOOST their morale and motivation, helping them to improve efficiency by guiding them with positive, timely, realistic and manageable recommendations which the understand and buy into.

Let's try this instead...

Many successful performance monitoring campaigns have something in common - they tend to be designed by the workforce - not management.

This makes perfect sense and is something to encourage. The teams on the production lines are the best people to ask about reasons for low efficiency and will have valuable ideas about how things can be improved.

If they see that you value their opinions and trust them enough to help design a plan of action, you are likely to have a team of enthusuastic followers on your hands - just what you need!

Be humble, listen to their ideas, but be realistic too, as some ideas may be impractical and may not have your interests at heart! On the whole, if done with sincerity and open mindedness, you can expect a positive experience from asking for guidance from the shop floor.

Many people don't like change, especially if there is little explanation of the reasoning behind it.

Having your team devise the change can bring about a refreshing tranformation in their enthusiasm for ideas which might otherwise have been reluctantly tolerated, at best. If they complain that coming up with ideas is not their job, they may be poorly motivated.

Some members will have some really great ideas, but may lack the confidence in expressing them in a group. You should find ways to encourage them to put their ideas forward in a relaxed, non judgemental way.

Your management skills will be vital in guiding the whole group to a workable solution, but you should make every effort to let the ideas come from the group.

You can then help them to distil the ideas into a few key ones which can be easily put in place and which you can all agree will have the most positive impact.

Now we need to focus on delivering the biggest improvements with the least complexity - remember - keep it simple !

What would YOU do, to work more effectively?

You do not need to have years of experience in your job to be able to offer suggestions on improvements.

The apprentice, even in his first week, may well spot ways in which the team could work more efficiently. Old habits die hard. Just because something has been done a certain way for as long as anyone can remember is no reason to reject fresh ideas which may be more efficient. Simple changes can have big effects.

The simpler ideas are the ones you want to encourage, as more people will find themselves able to contribute, which helps to develop a culture of idea flow. As people realise that their ideas are being considered, the number of sensible suggestions will grow.

You can guide suggestions by asking for ideas within a specific subject area, with a different **'subject of the week'**, for example.

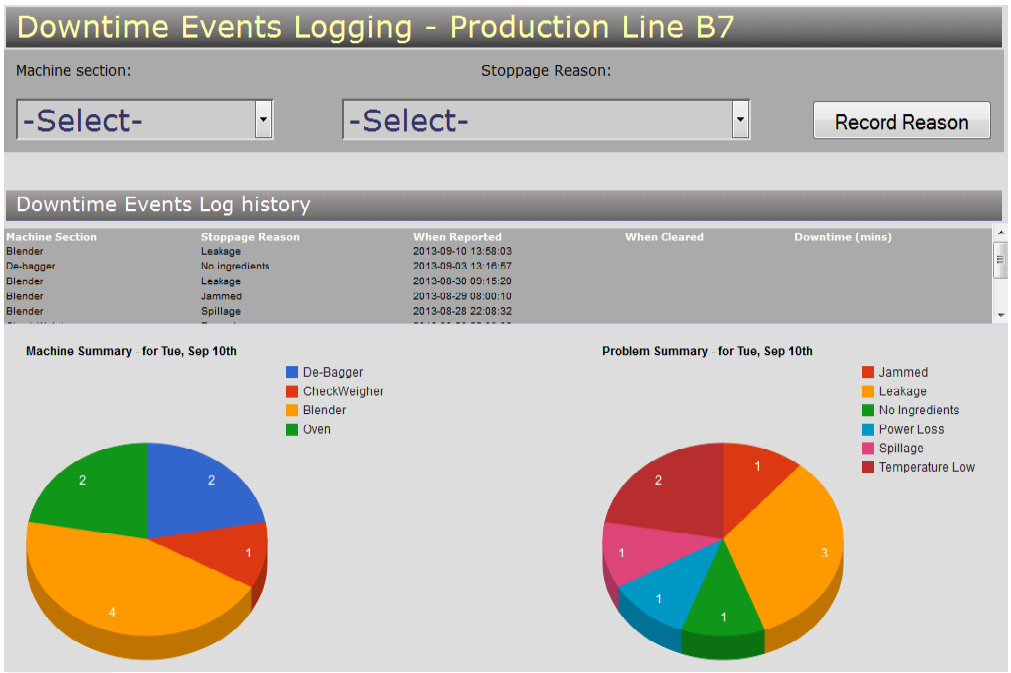
How do you choose a subject of the week, and how can you be confident that it is the most appropriate subject to tackle, over all the others?

Focus on the most pressing problems first, and then deal with others in order of urgency, once the more important ones have been solved.

A challenge in many manufacturing processes is identifying reasons for stoppages. It is often impractical to have someone write down stoppage reasons and durations and machine ID, and then collate the whole factory's history to come up with a statistical plan. Reasons can change with time, depending on temperature, materials variations, wear and tear, etc.
There is an easy solution...

Logging and analysing downtime reasons - the 'no stress' approach

A simple, reliable, method is to gather downtime reasons with the **London Electronics Downtime Analysis** system. This automatically timestamps reported stoppages, identifies machines, reasons, operators, trends etc. and can share the information in real time with you and your team in a cloud-based app.



The screenshot is of an imaginary production line, but you can try it for real online. Just google **London Electronics Downtime Analysis** and then click on the pie chart screen. Your own down time screen would have your machines and would only have failure reasons which you encounter. All our software is custom made to suit your needs exactly, without the clutter of unused features and terminology.

Once you have gathered some downtime history, you will soon be able to see which machines have the most downtime and you will be able to see the most common reasons for downtime.

This gives you your **'subject for the week'** to give to the teams. The team members can then offer you ideas on how they feel they can achieve a lower stoppage rate for that reason, on that machine or group of machines.

The summary pie chart shows that the blender has been responsible for most stoppages and that leakages have been the most common problem.

So, the initial ideas will focus on the blender.

Why is it the problem? What is the main cause for leakages?

Overfilling? If so - look at procedures to ensure that the safe filling limit is clearly defined and that the actual level is easy to determine. Get ideas for improving this, if needed.

Are the seals failing? If so, why?
Again, level may be an issue, causing over-pressure beyond the seals' ratings. What are the team's views on this?

The seal material may be degrading and require replacing. Are there alterna tive seal materials which would be more durable? Get the team on the case!

There is pleny of scope for discusson and investigation and solution searching. With a team ap-proach, a solution will be found, and then the next issue can be tackled.

Your teams will become far more in-tune with their line and develop a greater pride in ensuring that everything runs smoothly.

Many small ideas for improvement, each easily manageable, will soon add up to big improvements overall for your lines.

Summary:

Encourage the team to come up with ideas for improvement, no matter how small. Everyone can make valuable contributions.

Let them all see where the biggest downtime problems are, so they can offer ideas on how this can be improved.

Use the London Electronics Downtime Analysis tool to get up to date, accurate information on where your problems lie.

Things to measure and how to measure them.

The range of variables which could be measured in a production environment is enormous.

However, too much information becomes confusing and unmanageable, so your focus will be on deciding which measurements will give you the most valuable information.

Start with a few, easily manageable important measurements. These should be the ones which will deliver the the best improvements, and being few in number, can be more easily managed and analysed. Aim for no more than 5 key measurements to start with. Where do we focus?

Here are the most common manufacturing line measurements - Select up to 5 which are most appropriate to your operation...

Stoppage reasons

Any stoppage is expensive. You are not producing, so are not earning. Worse still, stoppages can result in scrapped material, if the materials are perishable or involved in a chemical reaction which cannot be halted. Stoppages can also require complete machine clean-outs, for example in some plastics manufacturing processes, a reaction will cause the material to solidify, and if it is not being moved through the machinery, the solidification could occur within the machine itself, rendering it useless.

Identifying stoppages, where they occur and under what conditions they occur is vital in understanding what to do , in order to reduce problems in the future.

Whenever we record textual reasons, it is important that the format is identical every time, to enable accurate matching to be made, for later statistical analysis.

> For example, a hose might develop a leak, requiring a section of machinery to be shut down while repairs are made.
>
> > One operator might record this as “Hose cut, needs repair”
> > Another might write “Leaking pipe stopped production”
> > Another might write “Fluid escape from feed line”

All these statements may be perfectly correct, but this ‘free-style’ approach to recording reasons will become a nightmare when you want to analyse how often this event has occurred. You need a single term for this failure, which will be recorded whether the operastor is Fred, Mary or Bert. How do we achieve that standardisation?

In the **London Electronics DowntimeAnalysis t**ool, operators do not need to type anything. Instead, they select from a standard list of reasons, created by an authorised user. The list contains only reasons which have happened in the past.

Next to the reasons list is a machine list, so that the list is populated only with reasons appropriate to that machine. The operator who logged on to report the reason has his name automatically attached to the report, so that he can be contacted if any further detail is needed. The whole record is date and time stamped as soon as it is made and a flag will appear on the production graph which anyone can click on to see the details of the report and the report updates live so you can spot trends early.

To see how often this problem has occurred in the past year, select that reason from the list, click ‘Show History’ and you can immediately see a graph of events over the past year, month, week or day. Very easy.

Quality percentage

Everything you make costs money, so you aim to keep rejects to a minimum. Reject percentage can involve counting items, boxes of items, weight, length or volume.

Two measurements are made, to find a quality percentage, with the aim of achieving 100%.

Count total made & total rejected.
Quality % = [(total made-total rejected)/total made] * 100

Count total made and total passed OK
Quality % = [total passed/total made] * 100

Count total passed OK and total rejected.
Quality % = [total passed/(total passed + total rejected)] * 100

However you count it, you will aim to increase your quality %.

Reject reasons

These gives you clues as to what must be done to improve quality. Whenever you record textual reasons, it is important that the format is identical every time, to enable accurate matching to be made, for later statistical analysis.

For example, a product may be under its specified weight

One operator might record this as “Under weight”
Another might write “Too light”
Another might write “Weight reject - too light”

All these statements may be perfectly correct, but this ‘free-style’ approach to recording reasons will present a nightmare when you want to analyse how often this event has occurred.

You need a single standardised term for this type of failure, which will be recorded whether the operastor is Fred, Mary or Bert.

How do we achieve that standardisation?

In the **London Electronics Reject Analysis t**ool, operators do not need to type anything. Instead, they select from a standard list of reasons, created by an authorised user. This means that the list contains only reasons which have happened in the past.

Next to the reasons list is a machine list, so that the list is populated only with resons appropriate to that machine. The operator who logged on to report the reason has his name automatically attached to the report, so that he can be contacted if any further detail is needed.

The whole record is date and time stamped as soon as it is made and a flag will immediately appear on the production graph , which anyone can click on to see the details of the report.

To see how often this problem has occurred in the past year, select that reason from the list, click ‘Show History’ and you can immediately view a graph of the reject reason occurrences over the past year, month, week or day.

Very easy.

Production rate vs Target rate

This shows the performance **at this time**, not necessarilly taking into account previous poor or good performance. The rate could be instantaneous, or it could be averaged over the past minute or hour, but it does not normally tell us if we are ahead of or behind our overall target production total.

It is most useful if we understand that our process has an 'ideal' rate and if we know what that rate is.

Example:
Consider the actions which an operator or team of operators must perform in a factory producing sandwiches. The sandwich consists of 2 slices of bread plus various ingredients.

Firstly, both slices are buttered evenly, ensuring an ideal amount of butter is used.
Then a layer of cheese must be neatly and evenly placed on one slice.
Then a layer of salad must be neatly and evenly placed on the cheese.
Then an amount of mayonnaise is distributed evenly over the lettuce.
Then the top slice is placed on the loaded bottom slice
Finally, the sandwich is cut diagonally.

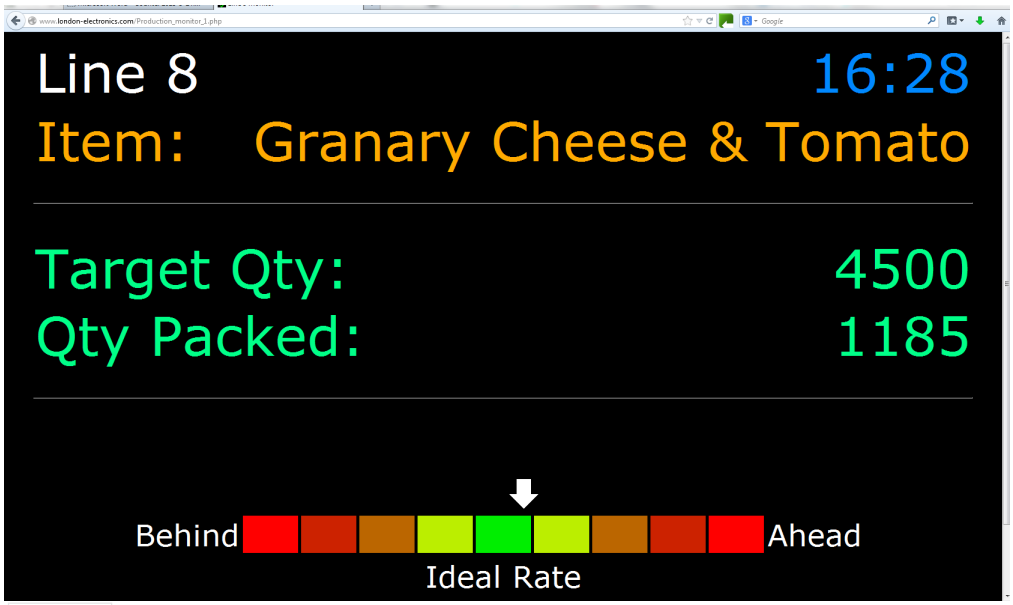
If this process is done too slowly, the factory will not be able to earn enough profit, as the output will be too few sandwiches per shift.

If the process is done too quickly, the quality of the product will become unacceptable. Some slices will be over buttered, some under buttered. The presentation of the cheese and lettuce may look shabby and quantities may vary greatly if the sandwiches have been assembled in a rush.

The manufacturing team will determine, by experiment, an optimum speed, which will ensure that quality can be maintained and that throughput will be sufficiently fast to allow the line to earn sufficient during each shift.

This applies to most manual tasks, whether in the food industry, vehicle production, machine assembly and many others.

The London Electronics Rate Monitor software is ideal for giving teams guidance on their rate.



Production total vs Target total

This shows us how near to completion we are at any time. There are two ways of displaying the target value.

1. Display desired total, to be achieved by the end of the production run.

For example, if we have an order for 5000 items, the displayed target would be set as 5000 and this is the number which will be permanently displayed.

This is useful if you want to show how near to completion you are.

It is of **limited value**, however, as it does not give the team any clue as to whether they will be able to achieve their target, so they will not know whether to speed up or slow down at any time during the shift.

Remember that slowing down can be an acceptable decision in many processes, because beyond a certain speed, operators and in some cases machinery will start to create product with quality issues. Operators find themselves rushing, panicing and spending too little time concentrating on the detail of their work. Machines can start to jam, can damage components and can otherwise create sub-standard product.

Getting near to the end of a shift and only then realising that you will have to work twice as fast to finish the last few items is a bad thing.

2. Display a moving target of total starting at 0, increasing through the shift.

For example we have an order for 5000 items to complete in an 8 hour shift.

The Target display would show 625 after 1 hour, 1250 after 2 hours, 2500 after 4 hours and 5000 at 8 hours.

This is very useful to the team, as they can see at all times if they are behind, on target or ahead of target. There should be less chance of surprises, so control of quality should be easily manageable. Some allowance is usually made for possible unscheduled stoppages, based on past experience.

During scheduled stops, such as tea breaks , lunch time and planned maintenence, the moving target can be frozen, to ensure that it realistrically reflects what is expected of the team at any time.

Total downtime

Time is money, and downtime represents wasted opportunity to earn money. Downtime can be expressed in hours, minutes seconds days or CURRENCY LOST

The latter can have more of an impact than simple time alone, as everyone can relate to amounts of money, whereas time, in a group, may have less impact.

Machine availability

Machinery represents investment, so in order to repay its cost, machinery must be in operation, earning money.

Availability tells you what % of the time the machine has been earning money.

Not just switched on, but actually earning money by producing product.

To measure availability, we normally look at the output of the machine. While we see there is output, we add to the availability figure. While we see a stoppage in output, we subtract from availability.

A machine which only works for a single 8 hour shift, 7 days a week cannot have an availability higher than 33.3%. If it works a single 8 hour shift, 5 days a week, its availability drops to 23.8% at best. That is assuming no stoppages and that the machine is operating at its optimum speed.

This machine may only have a realised availability of 15 to 18% due to maintenance, cleaning, unplanned stoppages, setup time etc.

On the plus side, such a machine could potentially cope with more than 400% increase in demand, if necessary.

Low availability means longer repayment of investment term and possible inability to meet required targets, if the low availability is due to machine failures. To analyse the reasons for low availability, our **Downtime Analysis** tool is available and can be customised to your exact needs.

Machine speed versus Optimum speed

A machine, like a person, will have an optimum output speed. Too slow, and not enough money will be earned to cover costs.

Too fast, and accidents will happen. Stresses will be higher, breakages will be more common and quality will tend to drop.

Experimentation will reveal that there is an ideal speed for a given machine, which operates just under the speed at which unreliability appears, and well above the speed required to cover costs.

Machine speed versus optimum speed is a measure of how well tuned your overall system is.
Speed is measured according to rate of product output, not rate of the cogs turning.
Anyone can turn up the machine speed and make the cogs go faster, the trick is to keep the output rate high, within the narrow ideal range.

This measurement gives us a real-time clue to the expected quality and expected earning potential of the machine.

Start asking questions if it is low, recommend restraint if it is too high.

Materials availability

There is nothing worse than having a workforce and plant ready to make product, but being unable to do so because you have a shortage of a key part or ingredient.

This can rapidly bankrupt a factory, if it relies on manufacturing a narrow range of products, or a wide range of products, many of which rely on that one ingredient.

Measuring materials availability is done by setting a flag as soon as a key material is unavailable and resetting it when availability returns.

The % of time it is available is the material availability figure.

Your aim is to have 100% availability throughout the period of demand.

Having less than 100% requires further analysis, to identify ways of preventing this from happening again.

Shift changeover time vs target

Do your teams think they are slick and efficient at shift changeovers?

A team who performs slickly usually has a high level of pride and satisfaction in what they do. It just feels good to be good, and when you feel good, you can work more effectively.

Training is the key, so that everyone knows exactly what they need to do, when they need to do it. No standing around with hands in pockets, no repeat journeys back to the same place to do a slightly different thing - all must be well managed.

Shift changeovers can take many forms, and your teams will probably have a wide range of things to deal with at changeover time.

In the simplest case, the machines keep running and the new shift team comes on line, is briefed on any issues they need to deal with and the old shift clocks off.

In some cases, the whole production line is cleared at the end of the shift and a changeover meeting is held, before the line is set up by new team and re-started. There may be several hours between the end of one shift and the start of the next.

In some cases, shift changeovers are partial, where some team members change over at different times to others.

Whatever system is used, you will want to know how long it should take. Too slow and people feel like they are wasting time, which decreases job satisfaction and wastes time, and time is money. Too fast and people trip over each other, things are dropped, broken, spilled, forgotten and the whole process could take longer than the slow team!

An ideal changeover time will exist, in which there is enough time to do everything properly, provided everyone works as a well trained team. This develops job satisfaction and team spirit and delivers the best value to the company.

You can detect stoppages automatically by looking at product output rate at shift changeovers. We make a wide range of **large digit timers** which can be tailored to help teams manage their changeovers efficiently.

Mind the gap!

Telling everyone who needs to know, without holding a meeting

When something happens on your production line which either needs immediate attention, or which needs several people to know about it right now, the London Electronics LineMonitor software offers an automatic solution.

For example consider a high volume material processing plant, which cuts material into sized strips.

Imagine that the cutting blade breaks or is damaged and needs immediate replacement.

Who needs to know about this and how are you going to tell them?

1. The maintenance engineer responsible for that machine must be told right away.
He needs to know what has happened and where it has happened.

2. The production manager must be told right away.
He needs to know what has happened and where it has happened so that he can be on hand to re-assign machinery and workforce if needed.

3. Stores must be told right away
He needs to know what is needed and where it is needed so he can get it there without delay

4. Purchasing must be told.
They need to know what has been used so they can re-order to maintain adequate spares stock.

5. Sales must be told right away.
They need to be aware of a possible delay, so they can let their Customer know, should this be a critical timed job.

6. The event needs to be logged so that breakdowns can be analysed whenever needed.

7. Everyone needs to be told as soon as the problem is resolved.

Rather than telephone each person or compose an email to each person, the LineMonitor software can either email or send an SMS or a combination of the two, to all necessary parties, as soon as the fault is detected.

You can create rules for who needs to know what, when something happens.

The fault details can be logged automatically.

The time of clearance can be logged as soon as it is cleared, and a ‘resolved’ message can be sent to everyone on the list to let them know that all is back and running.

Efficient, fast, fully logged and easy to implement.

The London Electronics LineMonitor software can be customised to fit your needs precisely.

The London Electronics Ltd. production line toolbox

A selection of handy tools which we have developed to help make your life as an efficient production manager easy and rewarding.

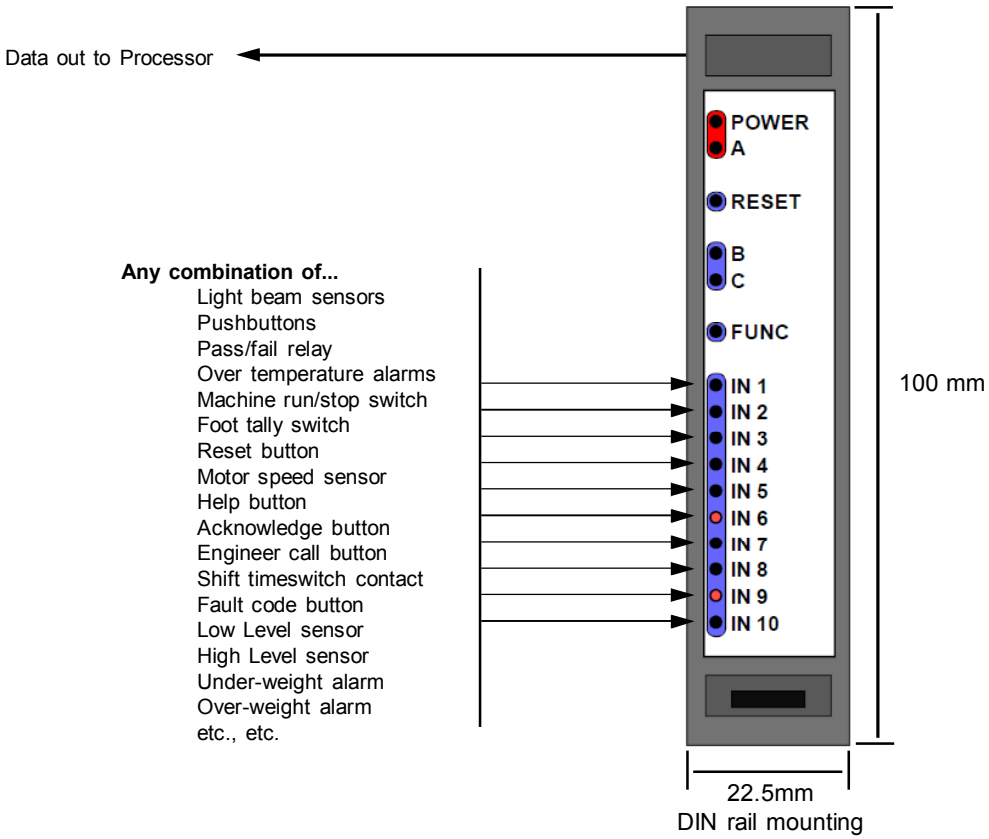
We design for simplicity. Simple thing which do a job well are better than complex things which do the same job with the same result.

Simple is easier for everyone to understand, there is less confusion, less to go wrong and it normally costs less as a result.

Here are some of the tools...

1. The LineLogger.

A compact, low cost module which collects pulses or switch status info from around your plant and sends that information to a processing module, which can populate a database, trigger visual board values, activate andon beacons etc.



Each LineLogger (you can have up to 32 of them) can accept up to 10 inputs, which could be ...

- Pulses from opto sensors as product goes down the production line
- A running or stopped switch telling us the status of a piece of machinery
- A temperature alarm relay, or pressure alarm or any alarm relay.
- A pass/fail signal from an automatic QA checker, such as a colour camera.
- A 'HELP' pushbutton to alert a supervisor that assistance is needed
- A Fault code button. There could be 10 buttons each with different reasons

2. The Fusion Numeric Display module

Fusion numeric display modules provide large digit readouts of important values, such as target, rate, actual, time etc., all sealed in a robust IP65 enclosure with glanded cable entries suitable for washdown environments

They are available with a range of digit heights to suit different max. viewing distances

57mm high for viewing up to 25m away
102mm high for viewing up to 50m away
150mm high for viewing up to 75m away
200mm high for viewing up to 100m away
300mm high for viewing up to 150m away
400mm high for viewing up to 200m away

They come in a range of display formats...

8.8.8.8.	4 digits with decimal points
88 : 88	4 digits with colons
8.8.8.8.8.8.	6 digits with decimal points
88 : 88 : 88	6 digits with colons

They come in a range of digit colours, Red, Yellow, Green, Blue or White.

They accept different input signals...

Pulse inputs for counting or rate measurement
Load cell inputs for weight measurement
Serial data or Ethernet input to act as remote slave displays
Temperature sensor input for temperature displays
Pushbuttons for Elapsed timer or Countdown time functions
4-20mA or 0-10V inputs for pressure, humidity level etc.

They can also provide various outputs...

Alarm relays for HI or LOW or out of band alarms
4-20mA retransmission to data loggers, PLCs etc
ASCII serial data output to slave displays, PC s etc.

They are self contained, with all the necessary processing you need. They can be supplied alone, or can be grouped into a multi-function display board. Most importantly, they are built to suit your needs exactly.

3. The Titan Text Display module

Titan text display modules provide large areas where dynamic text can be displayed, to suit current conditions in the area. Available in a wide range of character heights and line widths so that all the team can clearly see important information without having to leave their workplace to view a small screen.

Messages can include information on next job, fault reasons, safety messages, driver instructions at warehouses, simple graphics such as arrows, traffic lights etc. The displays can store a library of 250 messages.

Inputs include contact closures, RS232, RS485 and Ethernet

They can either be supplied as stand-alone modules as shown below ....

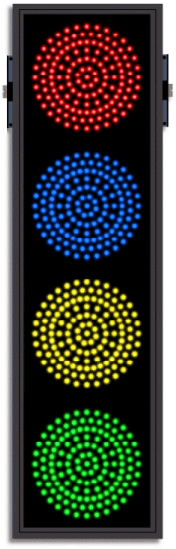
... or they can be built into a custom display along with numeric or traffic light displays, to suit your exact needs, such as this one ...

3. Traffic light and andon displays

Traffic lights and andons give clear status information to your teams and supervisors.

A range of size and colour combinations is available, including sounders, to create the ideal signalling system for your operation.

Lights can be controlled by contact closures, RS485 or Ethernet, iPhone, Android and a full history of beacon statuses can be included as part of an easy to use web-based fault/down-time diagnostics package.



4. Fanless PCs to provide reliable local computing power

These miniature PCs can be used to collect data from our LineLogger modules and publish the data live to the web, or they can be used to allow operators to select downtime or fault reasons from a list, so that a history of reasons can be created in real time.

We can supply these with touch screen monitors, environmental protection housings and pre-installed software.

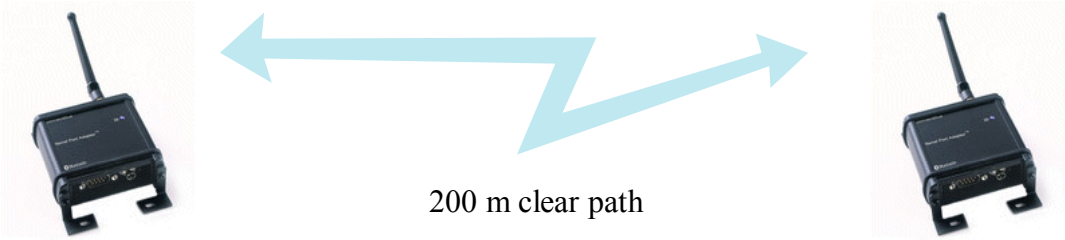
These PCs offer an economical and reliable means of easily gathering live production information. We can also provide large format LCD screens with full site status overviews, updated in real time. We specialise in writing custom control, analysis and display software to focus precisely on what is important for you.

5. Wireless device connection modules

Adding wiring in a busy processing area can be disruptive and costly. In some cases it is impractical, especially if machinery is modular to allow breakdown and reconfiguration in various positions.

Using our wireless modules, you can transfer pushbutton, pulse or data easily across your factory, with the minimum of disruption to your installation and processes.

Wide addressability and frequency hopping functions allow these modules to co-exist in busy data areas with excellent reliability and speed.

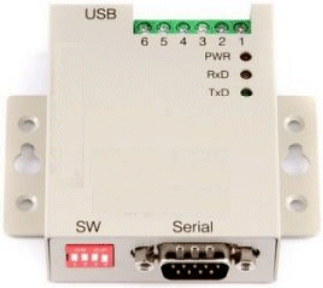


Available as point to point, one to many or many to one, the flexibility of this system is ideal for even the most complex combination of devices.

We can also integrate into your WiFi network.

6. USB to RS485 multi-drop data converters.

If you need to communicate with numerous RS485 devices using a PC, we offer this handy data converter. It has optical isolation built in, to protect your PC from any potentially damaging electrical noise pulses created by large machinery, arc welding, discharge lighting etc.



7. Line Sensors

We can help to select and supply sensors for your lines, counting product totals, line speed, stoppages, rejects, OEE, weight, temperature, pressure, volume, humidity.

Anything which can physically alter in your process can be sensed, measured and recorded.