

**Using
Flexible Transfer Systems for
LEAN MANUFACTURING
Applications**

Implementing Lean Manufacture using Flexible Transfer Systems (FTS).

ADM Automation are a leading UK supplier of automated systems for lean manufacture. Many of our systems are based on the FTS principle. This short brochure outlines the concepts of FTS and how to evaluate its possible use within your lean manufacturing process.

All of the application photos shown are of systems designed and manufactured by ADM.

What's happened to JIT, POKA YOKE, KANBAN...; does FTS replace these? Thankfully no; FTS is an enabling tool, it enables you to implement your lean manufacturing strategy more effectively. It's flexible enough to fit in with **your** way of working and adapt as you strive to improve your process.

It can be evolutionary or revolutionary; it's up to you!

ADM are the leading UK based supplier of FTS systems based on BOSCH Rexroth products. BOSCH Rexroth are the worlds largest source of FTS components. By working together we can provide total solutions to your manufacturing problems.

Rexroth
Bosch Group

Sales partner



Flexible Transfer Systems: FTS

Moving product from place to place within a production area, loading and unloading each individual process is often a focus for Lean Manufacturing.

Fortunately it is often the simplest part of the process to automate.

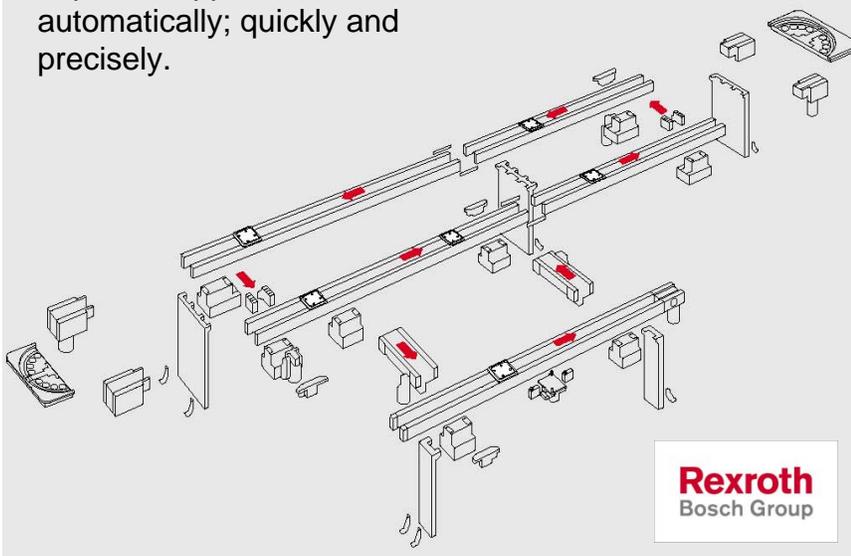
The modular philosophy behind FTS permits the construction of flexible assembly installations which are precisely tailored to the individual requirements and the space available yet are constructed from a common range of “off the shelf” components. Where would the fork lift truck be without the pallet? The same principle of a common transport medium can be applied on the production line but without the need for a fork lift driver!

Moving product from place to place happens automatically; quickly and precisely.

Four basic versions have proved themselves in practice:

- the rectangular configuration
- the in-line configuration
- the rectangular configuration with cycle-independent work places
- the in-line configuration with cycle independent work places

These four basic versions can be supplemented if necessary by additional buffers which can also be built from the same modular components. The result is that it is possible to rapidly and economically construct highly flexible assembly installations for manual, semi-automatic and fully automatic assembly of products.



High Connectivity, modular construction, simple to use

- ⇒ Numerous standardized components for individual organization of the circulation system
 - Workpiece pallet
 - Conveyor sections
 - Curves
 - Transverse conveyors
 - Positioning units
 - Stop gates

⇒ Predefined modules simplify planning and project preparation

When should I use FTS to support Lean Manufacturing?

There are a number of factors that influence this decision.

As with any form of automation, used with lean manufacturing concepts, the aim is to eliminate or reduce the “7 wastes” when compared to the existing process. Where are the benefits likely to come from?

There are a wide variety of ways to measure benefits. There are also other critical factors that can affect how successful this can be for your company including the speedy introduction of new products, reduced batch sizes, reduced WIP, minimised waiting and transport times plus fewer rejects reaching the customer. Different companies will place a different emphasis on each factor.

Also remember that you don't have to automate the whole process. FTS lets you mix automatic and manual stations. It can also provide buffering between stations to compensate for the variation in manual station cycle times. FTS also lets you automatically route product to different areas if necessary.

Influencing factors:

What are the influencing factors in your application? The list below will help you identify them:

1. Piece numbers

How many pieces have to be produced per month? What quantity fluctuations are to be expected (seasonal variation)? Is it a small, medium or a large-scale series?

Note: The definition of the series size has to be determined individually, depending on the product range and company specific criteria.

2. Available time period

How much time is available for the acquisition of an assembly system from planning until the start of production?

3. Running period of the product

How will product quantity vary through the product life cycle? When does the run up phase begin, when does it end? When does the run-down time begin and end?

4. Variety of types and variants

Which types and variants have already been approved, which are still being developed? What's the minimum batch size. What happens to rejected units?

5. Job content

How large is the job content of a product or a subassembly?

- Number of components to be assembled and number of joining processes
- Determination of the cycle time needed, e.g. with the help of an MTM planning analysis and process time analysis.

6. Degree of difficulty

What are the degrees of difficulty of the various assembly activities?

- Are components delivered unsorted (e.g. are they self supporting?)
- In handling the parts (e.g. gripping and correct positioning for joining)
- In the joining process (e.g. soft soldering, gluing, alignment)

Will the automated process be too difficult or expensive? Would it be more economical to employ manual assembly for part/all of the task?

Lean Manufacture with FTS

7. Product transport

How are products or subassemblies transported from one workplace to the next?

Is a pallet necessary?

- Base part is not stable
- Risk of damage by sliding and pile-ups?
- Defined product position must be maintained because of automated joining processes
- Product is too heavy for manual transportation (≥ 5 kg in short-cycle activities)

This process of examination and decision-making can be traced in the orientation and decision aid below (Figure 3-6). However, the values given have to be set by each company according to its own particular criteria.

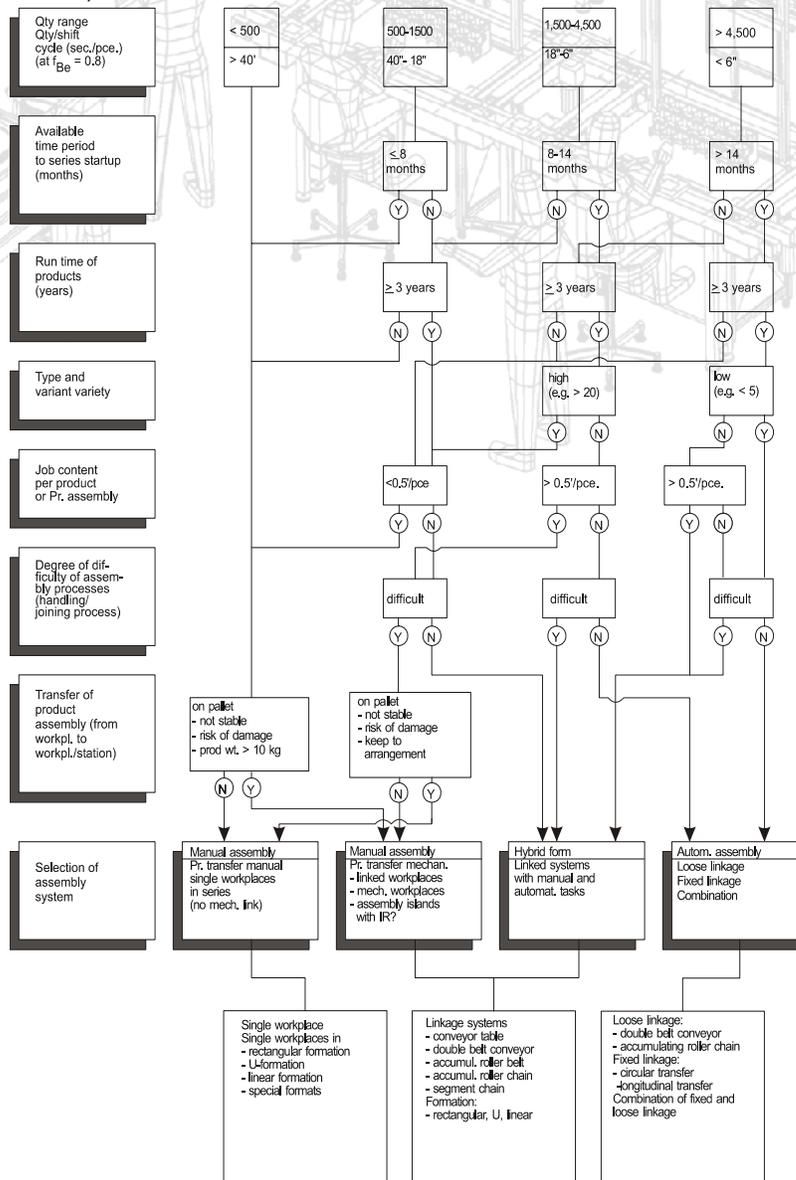
Depending on a yes- or no- decision on the above criteria, there are four kinds of assembly systems:

- Manual assembly, manual transfer, no pallet required
- Manual assembly, automated transfer, pallet required
- Mixed form, interlinked assembly systems with both manual and automated operations and automated transfer via pallet
- Automated assembly with loose or rigid interlinking between stations, or a combination of both link types.

Usually when working with more complex products, several system variations with varying degrees of automation and different kinds of work organisation are combined to form an overall system:

- Single workplaces with integral assembly, pre-assembly for subassemblies
- Interlinked workplaces with division of labour in assembly, e.g. final assembly

In this kind of pre-selection of an assembly system merely a rough idea is given as to whether manual, partially automated or fully automated assembly is the best way of fulfilling the determined goals in accordance with the task assigned.



key:
 f_{Be} = utilisation factor
 f_{shift} op. $\geq 0,85$
 2- shift op. $\geq 0,80$
 Pr = product
 Y = yes N = no

What form of FTS?

Basic form	w/o pallet	with pallet
1. Rectangular		
2. U		
3. Linear		
4. Special formations		

This diagram gives four different basic forms of assembly systems. In addition assembly systems are distinguished according to whether transfer takes place on pallets or without support.

A pallet is necessary if a product lacks a stable base or if the surface can be damaged or the sliding surface soiled when pushed onwards to the next workplace.

Another advantage of using pallets is that a definite assembly position and fixation of the product when force is applied (e.g. screwing in, pressing in, etc.) is guaranteed, without additional unproductive times becoming necessary.

Note:

The single-person workplace (the lowest implementation level in an assembly system) is not shown in this diagram.

In systems 2, 3 and 4 with pallets, return of the pallet to the first workplace is performed manually, either by means of an inclined plane or in a stack with the aid of a transport shuttle. With job contents of >1.5 min per workplace the resulting unproductive times have an increasingly low influence on the productivity of the system.



Rexroth
Bosch Group

This diagram shows three basic forms of assembly systems. Pallets are used in each of the systems as transportation aids, to allow the automation of one or more adjoining processes. Apart from the careful product transport, use of pallets ensures a defined assembly position even at manual workplaces. Thus time wasted in the necessary adjusting and fastening of the product at the assembly places are avoided.

Basic form	with pallet return	
	at work level	above/ below work level
1. Rectangular		
2. U		
3. Linear		
A = Automaton	⊙ = Upwards lift	⊗ = Downwards lift

Use pallets to reduce the “7 wastes”.

If a part has a stable base then does it need to be transported on a pallet? It needs to be transported on a pallet if it **REDUCES** manufacturing costs. Would the following benefits help reduce your costs?

Less materials handling

Reduction of handling time via mechanized workpiece transportation, no need for manual transportation

Lower cycle time

Reduction of cycle time, the workpiece must not constantly be repositioned as it is in a fixed position on pallet

Lower WIP

Minimal amount of capital tied up via short flow times, reduction in WIP

Better Quality

Quality Assurance via:
 – gentle workpiece surface treatment due to pallet fixture which allows precise assembly and insertion positions to be constantly achieved
 – organized material flow

Reduced Workload

Relieves the operator of repetitive lifting

Are there other benefits?

There are a number of other benefits that can apply in specific applications

Other benefits:

Consider which of the following benefits may apply to your process:

1. Multiple parts per pallet

You can sometimes gain benefit from having a number of components on the pallet. Pallet transfer time is shared between each component reducing the overall station cycle time.

2. Automate in stages

Where product volumes begin at a low level it's possible to start with a manual station and change it to an automated cell later.

3. Quick Changeover Times

Pallets or the pallet tooling can be simply lifted from the line and swapped over when a different product type is to be manufactured. In some cases it's possible for different products to be travelling on the system at the same time. (Coding on the pallets can identify to automatic stations the process to carry out on a particular product variant.)

4. Reduced floorspace

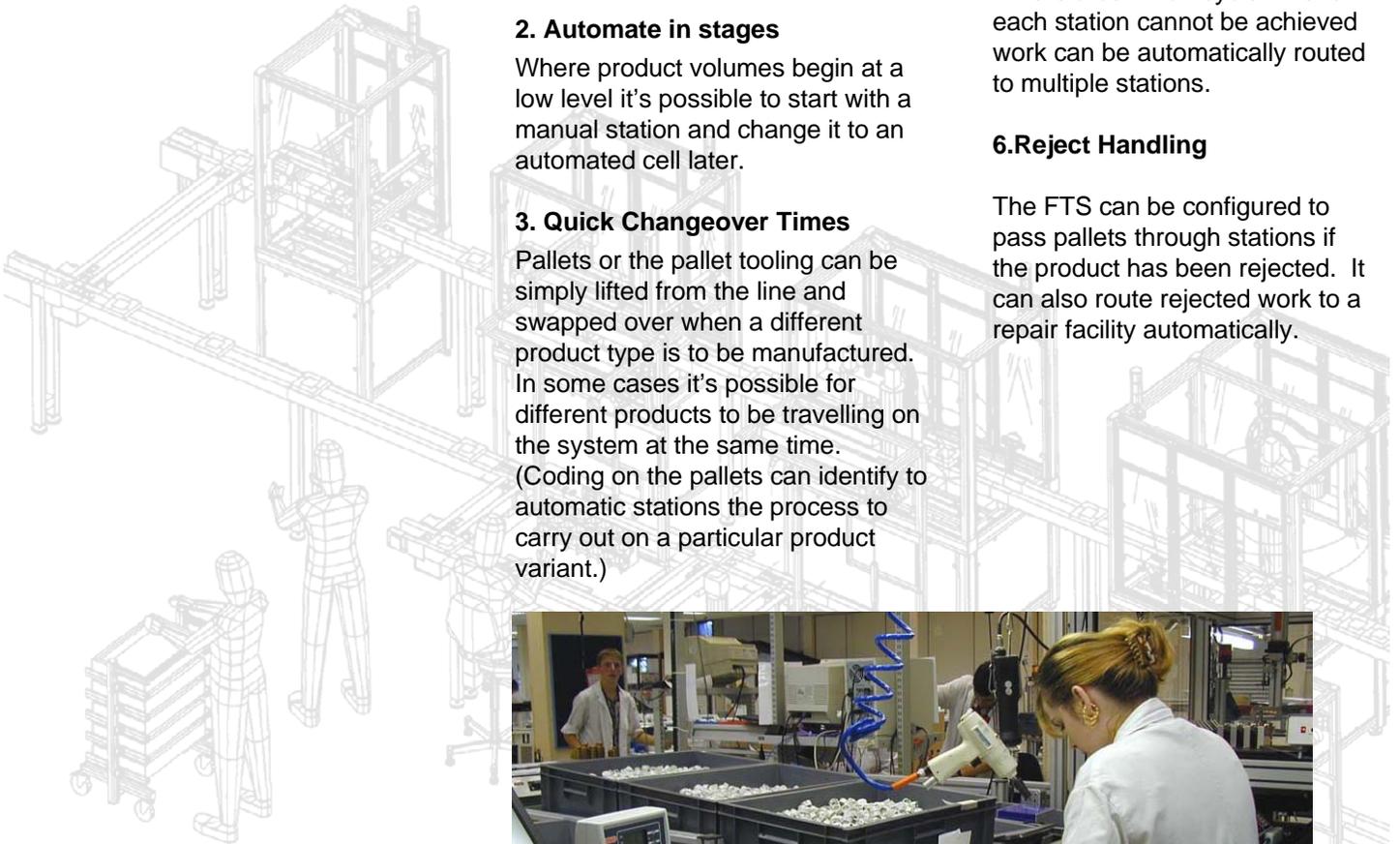
You can save floorspace by allowing the system to operate at different levels. Empty pallets often return at a low level. Sometimes curing or cooling buffers can be accommodated in this way

5. Work Balance

Where a common cycle time for each station cannot be achieved work can be automatically routed to multiple stations.

6. Reject Handling

The FTS can be configured to pass pallets through stations if the product has been rejected. It can also route rejected work to a repair facility automatically.



ADM AUTOMATION LIMITED
NEST ROAD,
FELLING INDUSTRIAL ESTATE
GATESHEAD, TYNE & WEAR
UK
NE10 0ES
Tel : +44 (0) 191 4387888
Fax: +44 (0) 191 4387899

FTS is a well proven technology used successfully in many manufacturing facilities. It can make a real difference in improving quality and reducing manufacturing costs.