ASMPT enabling the digital world

White Paper

Maximizing uptime with 100% visibility

Seamless automated material flow optimization in the intelligent factory

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What this white paper covers

This white paper covers the rising demands on synchronized material management processes in electronics production environments – a topic that has been neglected in many factories but is becoming increasingly important. Weaknesses and interruptions in the flow of materials are the most frequent causes of downtime in electronics manufacturing today. And let's not forget: the pressure of customers and markets to become ever more flexible with shrinking lot sizes and more frequent product changeovers and tougher delivery deadlines means that material management is becoming more important every day.

This white paper will help executives, SMT production managers and material logistics specialists to identify weak spots in their material flow and make improvements with the help of modern information technology.

Analyzing the material flow, two fundamental aspects can be distinguished:

- First, the "where", i.e. the exact inventory data: Which reel with which material is located where?
- Second, the "where to", i.e. the equally precise demand data: Which material is needed in what quantity where and when?

The software solution used must be able to answer these fundamental questions quickly and reliably at all times. Then and only then is optimization of the material flow possible and successful. Both basic functions are mapped in modern programs such as Factory Material Manager and WORKS Logistics from ASMPT.

Modern material management is not just about tracking inventory but it must support all material-related processes such as receiving, warehousing, stock issues and returns, production planning, and setup processes.

It must also manage the replenishment of material to the production lines and synchronize the material flows.

The best possible results are achieved if users receive all relevant information about the flows of materials at their workstations – quickly, reliably, and in line with their respective duties and tasks.

To put it bluntly, an ERP system will not give you 100% visibility of all material at every location in your factory, but that is what is needed, particularly for the shop floor processes and at the workstations in SMT production and related areas.

Introduction

“If we keep track of our inventory, why would my electronics plant need a special material management solution?”

Yes, most electronics manufacturers already have powerful ERP, inventory management and/or warehouse management systems. They can print out inventory listings, predict requirements based on new orders and bills of materials (BOMs), and report what products were manufactured in recent months. Does that mean that everything is transparent and running smoothly? Not at all. Inventory management and material management have two very different objectives: The former focuses on keeping an eye on inventory and the capital that is tied up in it, while the latter focuses on optimizing material flows and the support of all material-related processes on the production level, i.e. the value that is being created and the visibility of where the material is located.

A look at the shop floor level shows that components are often in stock, but don’t make it to the production line in time. Operators waste time hunting down certain parts, and taking inventory is a nightmare. Orders reach the line, but must be delayed or even canceled because components do not arrive at the line on time. In view of the long distances and multiple stock removals and returns, specialists often talk about the problem of “material tourism” in electronics production.

The material flows are frequently not coordinated with the production processes, which means that supplies become a bottleneck. And the more lot sizes shrink as a result of more product versions and variants, the more troublesome it becomes. The results: larger (emergency) inventories (or safety stock), very long lead and throughput times, time wasted looking for parts, and shortfalls output – in short: insufficient production agility.

In this document we want to outline a step-by-step solution approach by asking some typical questions.

- Which symptoms in your production indicate weaknesses in your material management and material flow?
- What can modern material management accomplish?
- In concrete terms, what potential improvements can a professional, SMT-specific material management system like the Factory Material Manager deliver for processes and people?
- How can a application, like WORKS Logistics optimize the material flow in electronic production?
- Which factors should you include in your ROI calculation when deciding whether or not to invest in a material management solution?

Of course material management is a complex issue in SMT production, because the manufacturing processes are company- or application-specific. That’s why this white paper is no substitute for thoroughly analyzing your current material management and evaluating potential solutions. If this text makes you aware of the problem and provides you with a rough analytical framework and a degree of orientation regarding this important issue, however, we have performed an important task by opening your eyes to potential improvements on your shop floor.

Which symptoms in my production indicate weaknesses in my material management?

Since there are many signs indicating potential weaknesses in your material management system, we have compiled a list of their symptoms. Individual symptoms may also be caused by other weaknesses, but if you can identify several of them and they extend over different areas of your production, you can be certain that your material management is in need of improvement.

Please use this short questionnaire for an initial evaluation and self-assessment.

If you find yourself checking mostly dark grey fields, you have weaknesses in your material management and a material flow that lacks in agility.

WAREHOUSE MANAGEMENT		
	Yes	**No**
Do your systems have only one storage location for your electronic components (such as the main component warehouse)?		
Are components that have been removed from storage shown merely as “WIP” (work in progress) or “in production”?		
Can you locate components on the shop floor (for example, “set up on line 3/machine 4”, “in kitting area”, etc.)?		
Do you have to return components to the main warehouse after each order in order to make them appear as available for subsequent orders?		
Are MSD reels automatically blocked when their exposure times are exceeded?		
Are components removed in accordance with the FIFO principle (first in, first out)?		
Does your system compute the consumption of components by multiplying the number of boards produced with the information on the BOM (plus any applicable safety allowances)?		
Does your system record the consumption of components based on machine data?		
May partly used component reels not be returned to the main warehouse for system-related reasons?		

COMPONENT/PACKAGE IDENTIFICATION		
	Yes	**No**
Do you record and label components only by type or batch?		
Does your receiving department label each component package separately with a unique ID?		
Are the component package labels machine-readable (barcode, data matrix, etc.)?		

PROCESS SUPPORT		
	Yes	**No**
WAREHOUSE		
Do your warehouse and your shop floor operate with printed pick lists, inventory lists, etc.?		
Are your pick lists path-optimized?		
Are your automated storage systems (Kardex, etc.) or material towers controlled separately? Do you have to enter material requests manually?		
Do you take classic physical inventories to regularly reconcile your actual stock with the theoretical stock numbers in the system?		
Are material requirement lists generated automatically?		
Does your warehouse staff get notified in advance of required material provisions?		
Are these notifications issued not schedule-based, but based on the actual production progress?		
PRODUCTION PLANNING		
Is your material availability planning based on global, not package-based inventory data? (Example: 10,000 units of A instead of 2 reels with 6,000 and 4,000 units respectively)		
Does your system frequently schedule jobs for which not all materials are available?		
OPERATORS		
Are your operators notified proactively that certain feeders must be refilled?		
Are your operators notified proactively that a new setup needs to be prepared in the offline area?		
Do you frequently encounter line stops because materials were not delivered to the line in time?		
Can your operators see whether the number of units remaining on a reel is sufficient for the current job or whether the feeder must be refilled before the job is complete?		
Do your operators have to request refills manually?		
Do the machines send refill requests automatically and with appropriate lead time to the material issue department?		
Do you have to frequently cancel scheduled jobs in mid-stream because of unforeseen material shortages?		
Do your machines stop with an error message if the wrong material was set up?		
Are the exposure times of MSD reels recorded automatically? Are MSD reels blocked from being set up or does the machine stop if the exposure time is exceeded?		
SETUP PREPARATION AREA		
Do you know which feeder and reels can be used for the upcoming setups?		
Do you have a chance to store feeder and reel in the offline area for further usage?		
Are you able to use mounted feeders as a pick-to-light system?		
Do you operate with flexible setup concepts?		

PROCESS SUPPORT		
	Yes	**No**
SETUP PREPARATION AREA		
Can you look up the precise location of required components anywhere in the plant via your current system?		
Do provisioned materials frequently stack up in your setup preparation area because a job has been delayed due to missing items?		

What can a modern material management system accomplish?

ERP and inventory control systems provide a stock- oriented view of materials and components. Put simply, the support provided by these systems ends at the warehouse door, i.e. “before” the shop floor.

Several points make this clear:

The shop floor is a storage site

Many ERP systems see the entire shop floor as a single storage location and don’t differentiate between shop floor, warehouse areas, lines, and setup preparation areas. Once components have been removed from the main warehouse, they label them as “WIP” or “issued to the shop floor”. Pinpointing the exact location of components (for example, “set up on line 4”) is either impossible or only possible with severe limitations.

No production-relevant information about the inventory

Most ERP and inventory control systems record components only generally by material. The system shows only a certain quantity of components is in the warehouse, but production-relevant information like the distribution over reels, MSD exposure times, etc. is recorded not at all or only in a very rudimentary manner.

No networking with the shop floor level

There are no data links with systems and processes on the shop floor level. Most of these systems are unable to control automated storage systems or record actual consumption data from the machines. They compute the consumption of materials on the shop floor based on theoretical data (number of units x BOM units + safety allowance) and not based on information supplied by the machines. This lack of communication eventually leads to discrepancies between actual and theoretical stock quantities, which in turn results in expensive scheduling errors and line stops, as well as the need for expensive physical inventories.

No process support on the shop floor

An optimized shop floor is a complex system of individual processes that require synchronization between material flow and production requirements. Examples include availability checks, detailed planning systems, the grouping and distribution of production runs, the on-time provision of materials from the warehouse, product setups and changeovers, setup verifications, and replenishment requests. ERP and inventory control systems provide only very limited support, if any, for all of these.

No optimization of material flows

Material tourism in the shop floor in most cases is quite high. Operators are lacking information, if the material may be needed in upcoming setups. If production is done all material will be re-stored in the main warehouse, even if some parts will be needed again at short notice for follow-up orders. The production has no information about which replenishment material is needed at which time to supply the lines.

No SMT-specific functionalities

SMT production has several characteristics that can’t be mapped in ERP systems or only at very great expense. A simple example is the recording of exposure times for moisture-sensitive devices or expiry date and the automatic blocking of their use if these exposure times are exceeded.

Data integration replacing paper checklists: Comprehensive networking creates the basis for process optimization.

Material management provides the link between the ERP system and the shop floor – including process support

This is exactly the point where modern solutions like Factory Material Manager come into play. They supplement the higher-level ERP systems and link them with the production processes on the shop floor level. They also provide manufacturers wanting to make their production more efficient and flexible with the necessary process support.

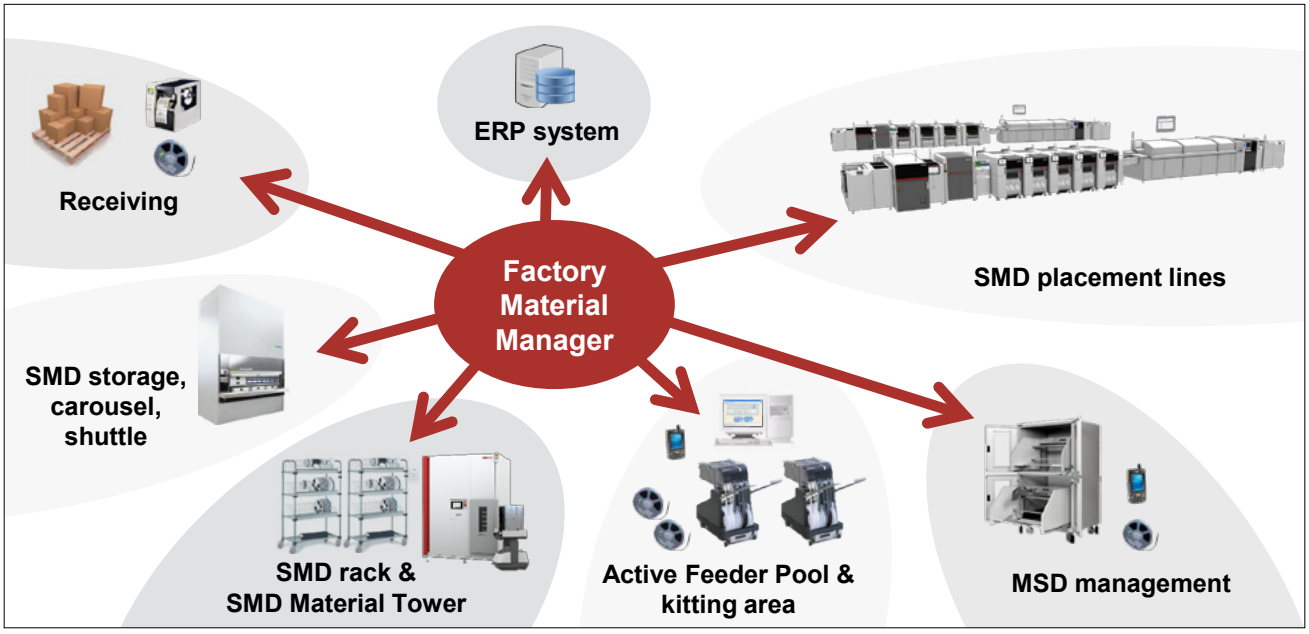
If we look at material management solutions from an overall IT perspective, their general benefits are readily apparent.

Link between shop floor and ERP and other upstream IT systems

Material management solutions like the Factory Material Manager complement ERP systems. While the master data, material order data, order entry data, etc. remains in the ERP system, the material management solution takes this data and enriches it with SMT-specific information to provide the foundation for IT-based shop floor support. ERP and material management solutions are therefore not alternative systems, but complement each other, which is why the Factory Material Manager interfaces with ERP and other IT systems.

Networking and automatic data exchange on the shop floor level

To manage the flow of material on the shop floor, material management solutions network with the various production-level systems. The Factory Material Manager takes this networking to the extreme. It links not only the placement machines including their filling level controls and splicing sensors along with all relevant applications for Planning, Logistics, Preparation and Operations of the WORKS Software Suite, it also controls automatic storage systems like Kardex, Hänel or ASMPT's Material Tower, keeps tracks of MSD exposure times, manages the printing of machine-readable labels in the receiving department, records the data of all mobile and stationary scanners, and controls the data output on user devices such as tablets, handhelds, etc.



Centralized material management and optimized material flows in SMD production

Automation and process- and workplace-oriented views support SMT-specific workflows

Based on the networking described above, material management solutions like the Factory Material Manager provide workflow- and workplace-oriented views in addition to process automation options. As an initial benefit, this allows you to eliminate all paper from your production processes by replacing printed checklists with scanners. This prevents errors, and simplifies the synchronization of processes.

Examples include: displaying path-optimized pick lists on PDAs; transmitting data from the scheduling department to workstations in the warehouse, setup preparation areas and lines; automatically blocking placement processes when MSD exposure times are exceeded; and special search screens for quickly locating components on the shop floor.

The bottom line: the Factory Material Manager is the first system that provides comprehensive, paperless visibility of material flow data on the entire production level.

The ideal companion to real-time inventory management with Factory Material Manager is the WORKS Logistics material flow optimization application. Its two main tasks are fact- and time-slice-based material tracking during order processing and cross-order optimization of interim material storage, which avoids unnecessary storage and retrieval.

Time slice-based demand forecast

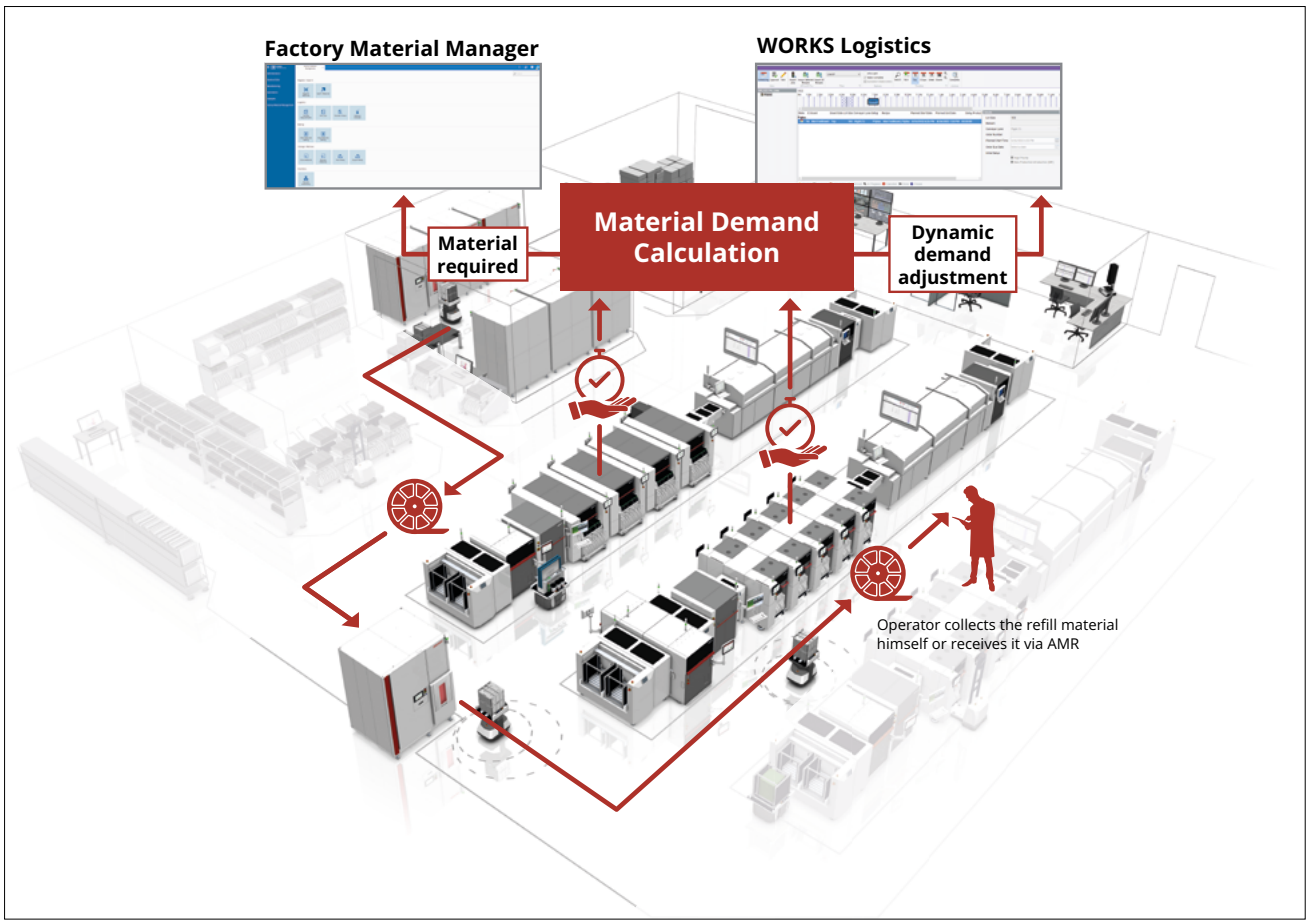
A central task of WORKS Logistics is estimating material requirements: the software continuously analyzes the current production progress- and the consumption data - and uses this to create a time-slice-based forecast of which material is required on the line at what time and in what quantity. It can also check whether an MSD is about to expire and order a replacement if necessary.

Package chains – frequently underestimated

Splicing reels together is a frequent occurrence in SMT production. In terms of data management, however, this simple procedure harbors a great deal of complexity that classic ERP and inventory management system are often unable to reflect.

By interacting with placement machines and intelligent SIPLACE Smart Feeders, the Factory Material Manager combines the spliced reels into so-called package chains that track every splice – even when many small snippets are taped together. Via splice detectors, the system is able to determine when the transition between components from different reels takes place. This kind of tracking is important for applications that require traceability, precise inventory management, expiration date tracking, or the tracking of MSD exposure times. At this time, the Factory Material Manager is the only material management system that can track this SMT-specific activity (including error handling and corrections) so accurately.

Many other software solutions, on the other hand, “prohibit” splicing, and require the user to let the feeder run empty before kitting and scanning a new reel. In short, weaknesses in these software applications increase the risk of unproductive downtimes or make accurate material management impossible. Other systems, for instance ERP systems, lead to “downstream” errors such as the faulty tracking of MSD exposure times or inventory discrepancies.



Material Demand Calculation at a glance: The networked closed-loop control system simplifies line operations and creates transparency in internal logistics. It can even eliminate the need for intermediate storage at the line by handing over materials from the warehouse directly to the operator.

This information is transferred to the Factory Material Manager as a material requirements list, which generates supply orders to central and interim warehouses as well as transport orders in correlation with the expected replenishment time. The interaction between the two programs enables automated just-in-time intralogistics to be set up, which consistently implements the 4R principle: the right material in the right quantity in the right place at the right time.

Fact-based planning

The function Material Demand Calculation of WORKS Logistics is based on production planning with the function Material Flow Optimizer of WORKS Logistics. Once the plan has been set up and the production jobs approved, Material Demand Calculation computes the material requirements and the time needed for retrieval and setup preparation.

These parameters are then transferred in a time-controlled manner to WORKS Preparation for the setup tasks and to SIPLACE Line Control for the automatic updating of production schedules and downloading to the line.

Material Demand Calculation continuously analyzes the material consumption, cycle times and production progress on the line, taking into account special events such as excess scrap, unplanned maintenance, and much more. It then provides the Factory Material Manager with the corresponding material requests for procuring the necessary components in the respective time slice.

Dynamic material flow control

In conventional workflows, material requirements are calculated before the production starts, and the resulting material quantities are used for the entire production cycle.

As a result, the calculated and actual material consumption numbers can diverge more and more over time. WORKS Logistics on the other hand, continuously recomputes the material requirements. The otherwise static material planning and supply thus becomes a time-based closed-loop control system that dynamically computes the material needs and even compensates for non-linear requirements during setups and teardowns along with other disturbances.

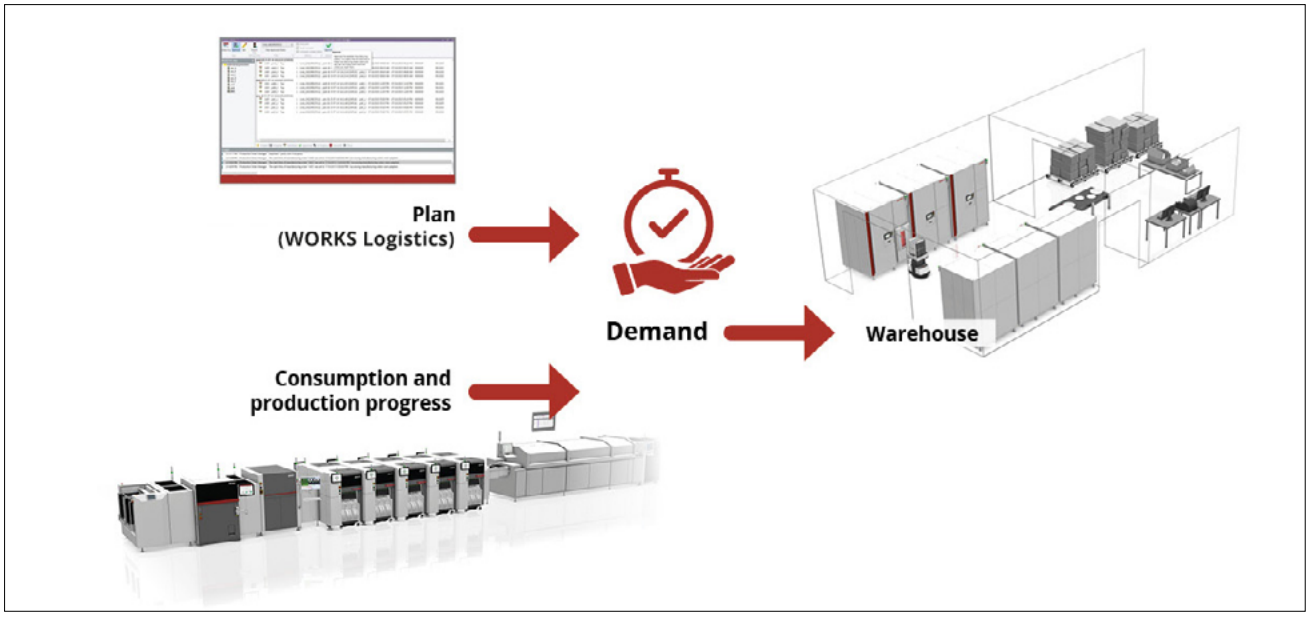
Optimized space utilization along the line

Abundant material stocks along the line may seem reassuring at first glance, but they create more problems than they solve. Space on the shop floor is scarce and expensive. Accordingly, ASMPT designs its machines to deliver maximum performance in the smallest possible footprint. However, this advantage is quickly nullified if too much material has to be kept on the line due to a lack of information about the actual material demand. With multiple lines, the problem becomes even worse, and things can quickly get cramped on the factory floor. If you use Material Demand Calculation function of WORKS Logistics to plan your material replenishments, however, you no longer need to maintain emergency stocks at the line and can keep your production areas free for the essentials such as additional placement solutions, special machines, or the Autonomous Mobile Robot (AMR) fleets that are an essential automation component in the intelligent factory.

Relief for employees

Factory employees are involved in many processes and must be true multi-tasking geniuses to have total control over the production process at all times. WORKS Logistics, on the other hand, always knows exactly what is needed where and in what quantities – no component is forgotten or ordered incorrectly or too late.

With the help of Material Demand Calculation, applications such as WORKS Operations automatically inform operators on the line about upcoming tasks via monitors and mobile devices (tablets, smartphones, smart watches, or smart glasses). As a result, the employees no longer need to worry about where and how they can obtain the necessary information about upcoming material supplies. The optimization of material flows also saves time spent on unnecessary material transports. Scarce and expensive specialists can now focus on their value-adding main tasks and be deployed much more efficiently.



Demand-based in-house logistics: Material Demand Calculation continuously combines plan data and actual data to generate retrieval requests and transport jobs.

Always up-to-date and resilient

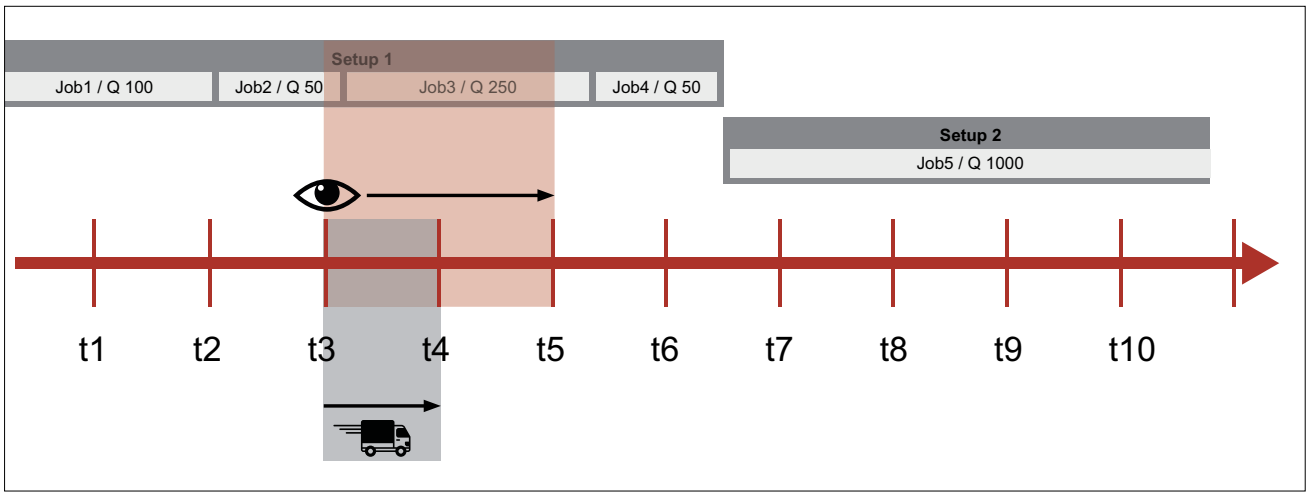
Static material flow planning only works until the first unforeseen event happens. Any disturbances caused by things like unplanned maintenance interruptions, incorrectly delivered materials, etc. require a manual correction or an entirely new plan. The dynamic process of Material Demand Calculation, on the other hand, recognizes deviations from the target automatically and takes immediate countermeasures before the machine comes to a standstill.

Flexible calculation intervals

Because every product being manufactured is different and places individual demands on production processes and materials, the lengths of the intervals based on which Material Demand Calculation continuously recalculates the situation and requests materials accordingly can also be determined individually. The only prerequisite: each interval must be long enough to provide the material for the following interval during the defined period of time. The software does not transfer the material requirements for the entire production run to the material management systems involved, but only what is needed for the next two intervals.

The length of the interval affects how Material Demand Calculation controls the processes: long intervals result in larger material stocks on the line. While this increases the resilience to supply interruptions, it also requires greater buffer capacities. Shorter intervals tend to supply the line more in accordance with the just-in-time principle, leading to less material on the line while increasing the demands on supply continuity.

The planning for the current and the next interval can only be changed to a limited extent, as these are already being processed. However, plans for the following interval can be changed at any time and will be accepted by Material Demand Calculation and executed with the corresponding retrieval setup preparation tasks. In this way, the system remains flexible at all times and can react instantly to changing situations.



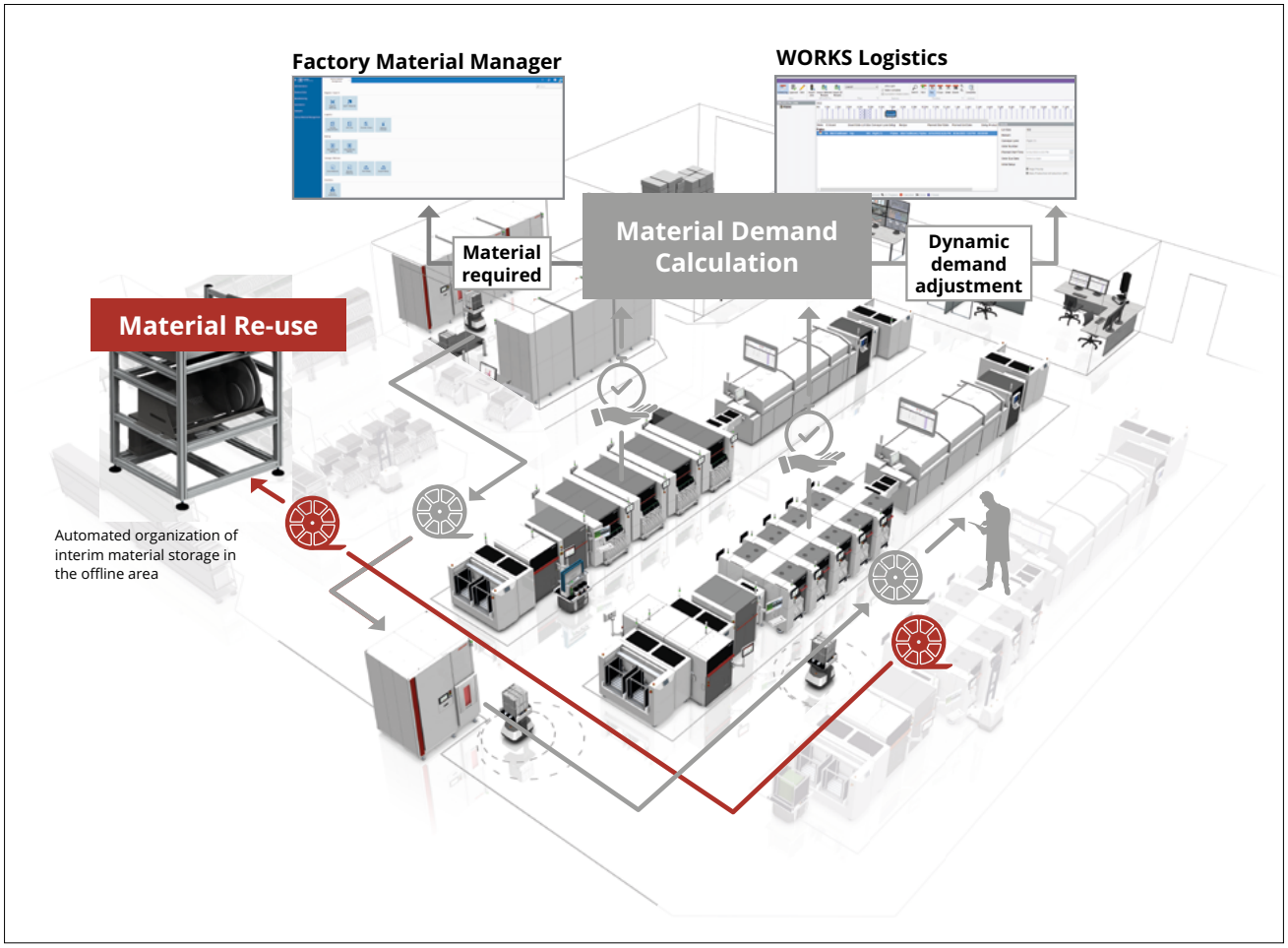
Example of an interval-based process: Material Demand Calculation determines the current material stock at time t3 on the line and calculates the line's expected material requirements between times t3 and t5 based on the planning stored in WORKS Logistics. The difference between stock and demand results in the quantity of material being requested from the warehouse

Active Feeder Rack: Kitted feeders that will soon be needed again are temporarily stored here. The LED signals immediately show employees which feeders are needed for the next setup. The target track of the new setup is also displayed.

Cross-order optimization

However, modern material flow optimization does not just look at the individual production order. Otherwise, it could happen that after completion, material for the next product is torn down and stored - and only a few minutes later takes the opposite route.

This is why WORKS Logistics checks after each production order is completed whether the material still on the machine will be needed for further orders in the next few days. If this is the case, it remains in the setup preparation area. Operators on the line receive clear work orders from the software: Red flashing feeder conveyors are to be set up and the material stored back, a green-colored signal means: The feeder is kept ready in the Active Feeder Rack close to the line for the next setups.



Material Re-use avoids unnecessary storage and retrieval: The WORKS Logistics function checks whether material will soon be needed again for further orders. If this is the case, the feeder and components are temporarily stored close to the line in the pre-setup area. This avoids superfluous transportation.

What improvements can a intelligent, SMT-specific material management system make possible for processes and people?

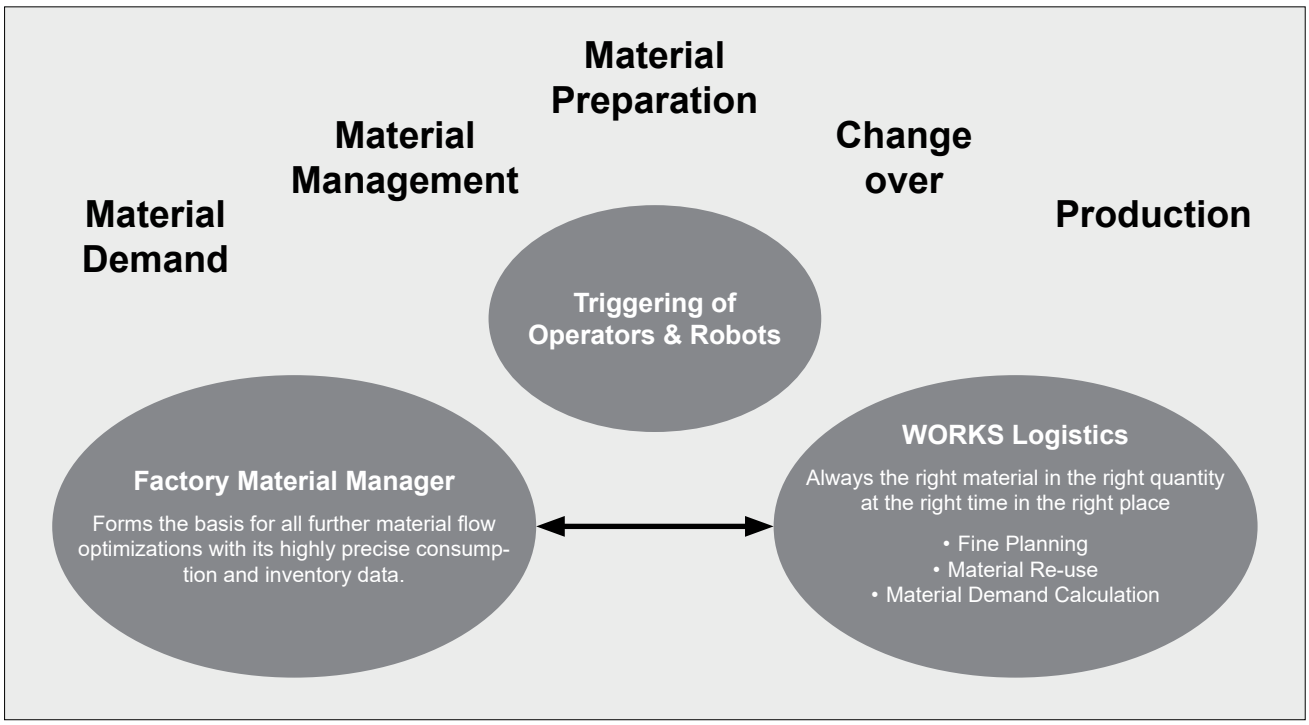
The previous sections laid out the benefits of an IT- based material management system on a more general level. To put them in even more concrete terms, the following sections show process improvements on the shop floor that the Factory Material Manager and WORKS Logistics make possible.

Using some before and after scenarios, we will explain how processes can be optimized with the use of the intelligent and powerful software duo and what impact this will have on important factors like productivity, flexibility, reliability, quality, time, and costs.

Needless to say, this list of examples is neither complete nor does it apply to each production environment. Depending on the individual plant, the processes and potential improvements may differ.

In addition, both the Factory Material Manager and WORKS Logistics feature a modular structure that lets the user build the system step-by-step or install it only in certain areas for systems that already exist.

What's important to remember, however, is the fact that improvements made with the Factory Material Manager and WORKS Logistics accumulate across the entire production chain: one plus one becomes much more than two!



Optimizing seamless, automated material flows is one of the core components of ASMPT's intelligent factory concept. Two software solutions work hand in hand to get the most out of existing production equipment through intelligent inventory, planning, and material requirements. Factory Material Manager keeps track of material inventory. WORKS Logistics generates optimized material requirements and setup orders from each production order, ensuring that the line is replenished as needed in real-time.

Planning

Material availability checks in the planning process

Before:

The systems have access to total inventory data, but no information on the items' breakdown into individual packages, or reels. In addition, leftover quantities can only be computed on the basis of units produced multiplied by the quantities per BOM. As a result, orders are frequently scheduled for production despite the fact that not all parts are available. For example, you may have sufficient units in inventory, but they are distributed over too many reels, or the residual amounts posted in the system are incorrect.

With Factory Material Manager and WORKS Planning:

You get 100% visibility of all SMT reels in your factory. Thanks to the UID, WORKS Planning checks material availability based on total quantity and the location and distribution of that quantity across a set of reels. Residual amounts are not computed, but recorded accurately and directly from each machine (including discards). The rough planning created by WORKS Planning is then passed on to WORKS Logistics to be converted into precise fine planning according to the real conditions on the shop floor.

Results:

- More planning transparency and reliability.
- No more unscheduled production stops and wasted setups as a result of missing parts.
- Improved productivity and line utilization.
- Improved delivery reliability.

Scheduling rush jobs

Before:

Squeezing in rush jobs is expensive and risky. Changing the production schedule involves lots of coordination across the entire plant. Lists must be reprinted, and the individual jobs must be re-sequenced at the various workstations. Despite all this effort, communication gaps often lead to line stops because some warehouse, setup or line process cannot adjust quickly enough. The required materials may be available, but cannot be located in time. Because of all these problems, most plants operate with long lead times and "lock in" the planning periods as mandatory.

With WORKS Logistics:

Schedule changes such as those caused by rush jobs are transmitted instantly to all affected entities and inserted into the new job sequence. They are also updated on all tablets, handhelds and stationary systems. Users can already see for example, in the planning stage how much lead time is needed, for provisioning of materials. The system also rearranges setup sequences automatically. The positive experience with successful rush jobs enables producers to schedule jobs in a more customer-oriented manner.

Results:

- Significantly improved flexibility with regard to short term
- Automated notifications to the warehouse, offline area and production line; significantly less communication effort with improved planning reliability
- Notify the offline area about a new sequence of jobs to be prepared

Warehouse

Placing goods into automatic storage systems

Before:

Incoming components are sorted by material ID and stored in automatic storage systems (Kardex, Hänel, etc.). The storage locations are assigned by the system's proprietary controls. In most cases, all components of the same material are placed in a dedicated bin. All movements must be executed manually by the operator via a storage system terminal. There is no true inventory transparency, because the component quantities on the individual reels are unknown.

With Factory Material Manager:

Thanks to the UID and the storage system communication with the Factory Material Manager, a "chaotic" storage approach is possible. Operators can place the reels into any bin in the order they arrive. This applies not only to newly received components, but also to components being returned from the shop floor.

Results:

- Much easier and faster storage and withdrawals
- Significantly improved space utilization in the storage systems
- Saving floor space
- Accurate stock data, because the system knows the component quantities on each reel

Software-supported material stock extraction: employees receive pick lists optimized by Factory Material Manager to their handheld devices and confirm the removal by scanning the UID.

Withdrawing materials for placement jobs

Before:

Materials are withdrawn based on production orders. Warehouse staff use printed lists, pick items in the order listed, and check them off one by one. They manually enter the component numbers into the automatic storage system so that the storage system can travel to the respective location. The user is then instructed to retrieve the appropriate reel from the bin (based on quantity, date because of FIFO, etc.).

With Factory Material Manager:

The software notifies the warehouse staff of the required materials in a timely manner and in the correct order. Employees receive path-optimized pick lists on their handheld devices. They check off the items by scanning them. The system makes sure that only reels with sufficient quantities are picked according to the FIFO principle. Factory Material Manager can also trigger automated storage systems and request material without any human input.

Results:

- Setup-based material withdrawal
- Less sorting of the reels in the offline area, because material is released from stock table by table
- Automated and synchronized information on material provisions
- Scanning of the reel improves the process reliability
- Shorter distances and faster material provisioning
- Paperless communication with handhelds, tablets, etc.
- Much faster issuing stock by automated storage systems
- Elimination of time-consuming and error-prone manual procedures

Taking inventory

Before:

To keep the discrepancies between calculated and actual inventory quantities in the main warehouse from getting too large and to minimize the resulting planning errors, physical inventories must be scheduled, which is expensive and takes a lot of time.

With Factory Material Manager:

By interfacing directly with the placement machines (e.g. splice sensors), the Factory Material Manager collects very accurate component consumption data. This allows manufacturers to switch to a perpetual inventory system. Any physical inventory counts can be performed during non-production periods and in the main warehouse only, for example by sampling individual packages based on the material.

Results:

- Perpetual inventory saves time
- Production-oriented planning of random sample counts

Kitting areas/placement lines

From simple to flexible setup concepts

Before:

Because of bad experiences as a result of material supply problems, many electronics manufacturers hesitate to employ more flexible setup concepts. Most plants use changeover table-based concepts where the tables are set up between orders with components supplied from the warehouse. When the tables are removed from the lines, they are completely torn down, and all components are returned to the warehouse. Printed lists and long material provisioning lead times make more flexible concepts or even the side-by-side use of different setup concepts impossible.

With Factory Material Manager:

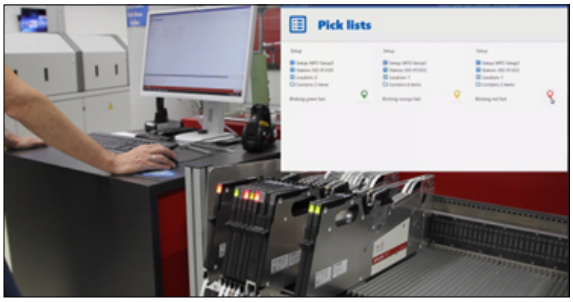
The fully transparent material management system radically reduces the “hidden and lost parts in the production” and opens the door to much more flexible setup concepts. WORKS Logistics indicate which feeders and components will still be needed for one of the upcoming production jobs by blinking the LEDs on the SIPLACE Smart Feeders. Similar functions are also available on the placement machines when setups must be changed.

Even preparing of a new setup is much faster. Thanks to the pick-to-light function of the feeders, the operator is guided through the picking process just by following the feeder LEDs.

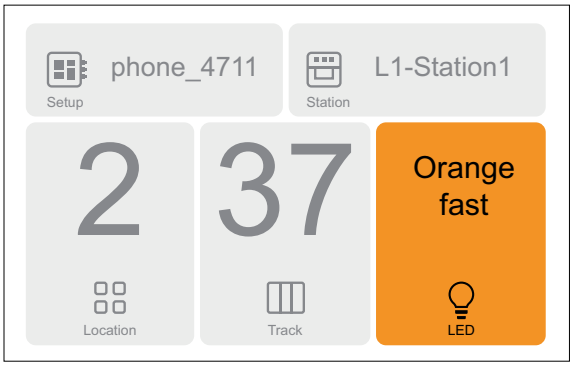
As a result, many components don’t need to be returned to the main component warehouse. Factory Material Manager also considers the setup preparation area to be “storage location” and it keeps track of all components located there. This further reduces the travel distances for frequently needed components. ASMPT’s Material Tower can also function as a fully automated storage system in the setup preparation area. Since the Factory Material Manager controls the issue of reels sorted by tables and tracks, this on-demand supply system simplifies and accelerates setups and eliminates mistakes. Even MSD reels can be stored in the Material Tower close to the line to reduce their exposure time considerably.

Results:

- Ability to employ more flexible, powerful and productivity-enhancing setup concepts
- Visual control of setup processes via LEDs on SIPLACE Smart Feeders
- Path- and time-optimized storage of components in the setup preparation area or adjacent to the line (Material Tower)
- Significant reduction of material movements and postings
- When feeders and changeover tables are removed from the line, the materials become instantly available and can be used on other lines without having to be returned to the main warehouse
- Picklists are sent to the Active Feeder Rack in order to realize a pick-to-light function by using the Feeder LEDs



- Much faster kitting process because of user guidance at Active Feeder Pool by pick-to-light function



Automated material requests for replenishment processes

Before:

When a feeder runs empty, the machine indicates this to the operator. In many cases, however, refills take too long because the operator is busy somewhere else, or the required reel must still be supplied from the warehouse, or several feeders run out of components at the same time. As a result, the line stops. Operators are instructed to avoid such stops, which is why they sometimes splice reels that still have enough components for the current job with fresh ones.

With WORKS Logistics:

Following the 4R principle for intralogistics, WORKS Logistics ensures that the right material is provided in the right quantity in the right place at the right time. The application controlls and optimizes the material flow throughout the factory.

WORKS Logistics continuously calculates the material requirement at the line based on freely definable time slices and interacts with the Factory Material Manager application to ensure automatic replenishments.

Results:

- Just in time delivery of refill
- Only material, which is needed will be requested at the main warehouse.
- Reduce line downtime due to missing material, because material is ordered automatically
- Material is not bound in the shop floor for a long period of time
- Reduce material at line side stock
- Save labor costs, by reducing the number of transports between warehouse and shop floor

These examples show that modern material management is much more than inventory management, because it supports all material-related operations.

The production environment becomes faster, more reliable and more efficient. It may even attain a new level of efficiency with entirely new processes. How can you translate this into a cost-benefit or ROI analysis?

Material Tower

ASMPT's Material Tower is a compact and completely automated storage system that is fully integrated into the Factory Material Manager, and is also MSD-capable. The Material Tower makes it possible to keep materials near or next to the line, which reduces the supply lead time considerably.

Material requests are issued to the tower by Factory Material Manager, and issuing a reel takes less than 20 seconds. The system can even issue the supplies in the proper track order for each changeover table. Refilling the Material Tower is also automatic via UID scanning. It even sends a replenishment request to the main material warehouse after it has issued a reel.

TECHNICAL DATA	
Storage capacity	Up to 928 7” reels or 464 15” reels, automatically adapting for diameter and tape width
Components	Reel diameter from 4” to 15”, tape width 4 mm to 72 mm, boxes for trays or sticks
Material output	Single unit or AMR-ready batch unit
Options	MMSD, AMR-ready batch unit, tower chaining
Dimensions	1,850 mm (W) x 1,500 mm (D) x 2,500 mm (H)
Modes	Standalone or linked as central storage
Storage/retrieval time	2-3 reels per minutes

Which factors should you include in your ROI calculation when deciding whether to invest in a material management solution?

In the previous section we covered how the Factory Material Manager increases transparency and stock availability in your factory and how efficiently it can support your operators. More transparency also means more speed and reliability in your electronics production.

The extent to which these improvements affect factors like productivity, reliability, on time delivery, customer loyalty and costs will vary depending on your organizational structure and other circumstances.

However, in many cases measurable improvements have been identified in the following areas:

- **Inventories**
  - Reduction of safety stock and the amount of capital tied up in inventory
  - Improved transparency regarding residual quantities
  - Consistent FIFO compliance reduces losses caused by spoiled MSD stock

- **Physical (year end) inventory**
  - Cost savings through the elimination of costly physical inventories and the introduction of a perpetual inventory system

- **Warehouse**
  - Less or no material bound in shop floor warehouse close to the line thanks to Just in Time material delivery
  - Time savings through path-optimized pick lists
  - Time savings through material storage adjacent to the offline area (Material Tower)
  - More efficient workflows using shorter replenishment lead times
  - Faster response times and improved process reliability for rush jobs
  - Error-proofing using scanner verification
  - Time saving by eliminating manual data entries on automated storage systems
  - Improved space utilization with automated storage systems

- **Production**
  - Significant reduction of material-related line stops
  - Much faster kiting process due to pick-to-light function at Active Feeder Rack
  - Less material travel and transportation costs (more transparency, faster localization, storage adjacent to the line, WORKS Logistics)
  - Implementation of more flexible and efficient setup concepts
  - Improved control of placement order deadlines

- **General**
  - Paperless production using mobile devices and electronic lists
  - Improved process verification (scanning)
  - Significantly less stress on the entire shop floor, which reduces the need for ad-hoc communication
  - Fewer manual entries into the ERP system due to direct interface with Factory Material Manager
  - Improved transparency of inventories and work in progress
  - Significantly fewer manual postings

Sample ROI calculations from customer projects

Although amounts vary because of different organizational and salary structures, the following ROI examples prepared by current customers provide some indications of the scope of potential savings.

Reduction of safety stock

A customer with € 5 million tied up in inventory calculated a five-percent reduction in his safety stock. Assuming an interest rate of 5%, the company came up with annual cost savings of € 25,000 (plus one-time benefits of the reduction).

Kanban control of consignment inventory

A customer computed his reduction in downtime at 10 minutes per day per line as a result of the improvement in scheduling. With seven lines running, his production team came up with a productivity improvement of €98,000 annually.

More storage capacity in Kardex systems

After the conversion to Factory Material Manager, a customer was able to reduce his Kardex systems from five to two. According to the company, each Kardex system represents an €80,000 investment.

Elimination of physical inventories

One customer calculated that a classic physical inventory takes 20 man days and costs approximately €5,000, not including any opportunity costs caused by the reduction of productive time.

Less line downtime through improved operator notifications

One electronics manufacturer determined that the automated material requests based on current production orders minimized downtime due to missing material by 30%. The reduction in downtime alone resulted in annual cost savings/productivity gains of €49,000.

WORKS Logistics reduces setup costs

Roughly 50 percent – that's how much an electronics manufacturer recently estimated he saved in material supply, setup and material return costs as a result of using Factory Material Manager and WORKS Logistics.

In summary

A modern material management system provides transparency and opens the door to new opportunities.

A modern material management system does not just keep track of inventory, but supports your production processes. Over the short term, the greatest potential savings come from more efficient warehousing processes and the minimization of material-related downtimes. Over the medium and long term, the gains in flexibility and process reliability on the shop floor will be even greater. Without improving the flow of materials, more flexible production concepts (made necessary by smaller lot sizes, Industry 4.0, etc.) are doomed to fail. Flexible and on-demand production is possible only if the components are supplied to the line in a flexible and timely manner as well. The production levels must be networked and the flows of materials and information must be synchronized with your processes, which is precisely what SMT-specific material management solutions like the Factory Material Manager can accomplish: 100% visibility of all the SMT reels in your factory.

FACTORY MATERIAL MANAGER VS. ERP SYSTEM		
Requirement	**Factory Material Manager**	**ERP system**
Interface to placement machine	Yes	?
Just in time material request for refill material (requires WORKS Logistics)	Yes	?
Checking of material re-use in the offline area (requires WORKS Logistics)	Yes	?
Package-based storage management	Yes	?
Interface to Setup Center	Yes	?
Update capability to handle new products, features, or machine generations	Yes	?
Accurate stock management that integrates the machine's fill level control	Yes	?
Reel chains are tracked in the warehouse and on the line	Yes	?
Stock releases based on SIPLACE Pro setups and jobs	Yes	?
Consistent and automated MSD handling from warehouse to placement machine, including reel chain handling	Yes	?
Online blocking of reels in the warehouse and on the placement machine	Yes	?
Material availability check based on SIPLACE Pro data across multiple lines (requires WORKS Planning)	Yes	?
Automatic transfer posting of packages on the shop floor for accurate reel localization	Yes	?
Support for alternative components also in the warehouse	Yes	?
Interfaces to all common storage systems (like Kardex, Hänel, ASMPT's Material Tower)	Yes	?
Complete handling of SMT and THT materials from a single source	Yes	?
Project duration	Quick installation thanks to standard products and automated data transfer	?

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Benefits from ASMPT's extensive know-how

Talk with us and set up an appointment in one of our Centers of Competence to develop a custom-tailored solution with our SMT specialists.

ASMPT shares its decades of SMT experience with its customers and partners in our Centers of Competence worldwide, one of which is located in Munich. All of them are staffed with engineers who have lots of practical experience and access to full-featured SMT lines. This allows us to meet your requirements, particularly with regard to SMT process miniaturization, and optimize your planning, production and inspection workflows quickly and reliably.

Together with ASMPT specialists you can evaluate, test and develop applications on site in a realistic environment. The Centers of Competence also offer individual remote demos via live-streams.

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