SHARK 2.0
Warehouse Management System

SHARK is an intelligent material handling system with special focus on automated storage and retrieval equipment. It is a scalable and flexible solution, which can be used for any installation from a small single computer installation to a large multi-server site with a large number of clients. SHARK provides a modulized design and thereby easy to adapt to the requested solution. This brochure defines the standard features, which can be extended by additional modules or customized functionality.

SHARK is designed from the idea that huge saving in cost and time can be achieved by optimizing the performance of the warehouse by minimizing the manual work that has to be done, this by finding optimal storage locations for each article, by controlling the sequence of orders to pick and by supporting advanced equipment that improves the speed. To achieve this SHARK is based on advanced algorithms that optimize location usages, picking speed and space utilization, all hidden for the normal user but still working to improve the working speed. Another important issue is the quality of the warehouse operations, it is expensive to pick the wrong article and therefore SHARK supports control functions, barcodes in all areas, pick-to-light systems and other techniques that ensures the right article at the right place.

Advanced functionality is fine, but not if it requires special training to make use of it. SHARK is very easy to use for the normal operator, fast to learn and with intuitive functionality, so new operators can be trained to the system with a short introduction.

Wireless hand terminal with built-in barcode scanner and SHARK software

There are many advantages having a true real-time system where all information is available to all users and always up-to-date. Wireless terminals or PDAs supports this regardless of where the work has to be done.

Support for automated storage is an integrated part of SHARK.

SHARK is special suitable for control of automated storage like the LogiMat, where a long list of built-in functions optimize picking speed, storage utilization and make use of advanced functions like tilted trays (indidividual selectable for each tray), control of pick-to-light, individual user selectable variable working height for the operator of the gate. Ordinary shelfs and flow-rack can be used in combination with automats and thereby further optimizing speed and minimizing cost by storing fast-runners in easy accessibly locations close to the automats.

SHARKs batch picking (picking more than one order á time), improves picking speed dramatically because waiting time can be minimized to a minimum or even be removed completely. This because SHARK optimizes the sequence of order lines and orders, so the equipment can be operated as fast as possibly. All equipment are operating in parallel so while the operator picks in one automat, the other machines are busy retrieving the next articles.
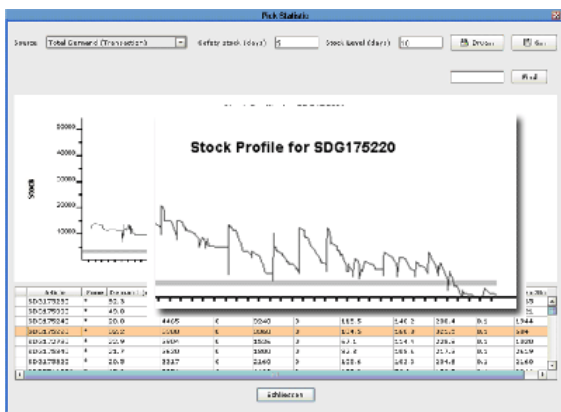
The replenishment system in SHARK can for example generate a stock profile for an article to provide a quick way of decid-

ing if the specific article is handled the most cost effective way. SHARK may also suggest what the security stock level should be pin-point urgent replenishment where orders cannot be picked due to low stock.


Flow-racks can be integrated with automats for high-frequency articles.

The inventory module provides a fast and secure way to keep the stock on track. Inventorying orders can be created, counting can be done on paper or directly entered into the system, recounting is supported and the result can be printed as reports and reported back to an ERP system and the actual stock in SHARK can of course be adjusted according to the result of the counting.

The inventorying functions provides a fast and secure way of doing stocktaking.

By showing the difference result as graphical symbols, it is fast to have an overview of what to recount or check. One of the other nice feature is that if counting is done in automats, SHARKs can get the tray automatically and will show a graphical picture of tray and use a light pointer if available, to guide the operator to the right location.
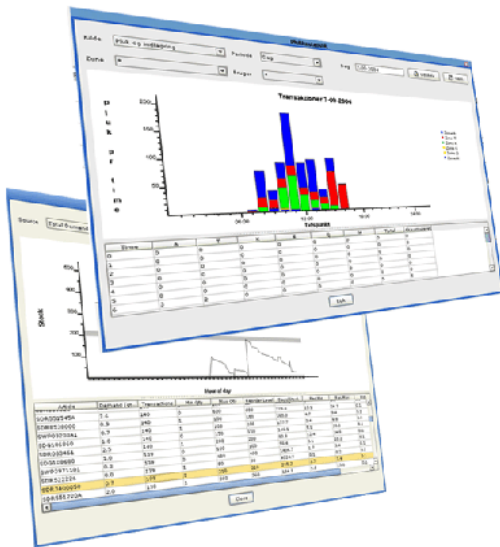
Various statistic views are a fast way to analyze the system performance.

Most Warehouse Management Systems must work in close cooperation with other IT systems and supports for integration with external systems are an important functionality of SHARK, implemented in the module *SHARK Link.* SHARK Link can be fully automated for automatic exchange of data, but can also be used manually.

SHARK has been installed for warehouse management in combination with a large selection of ERP systems like for example SAP, Movex, Mapics, IFS, Concorde, BAAN, XAL, Axapta, Navision and a number of customized solutions for example on an AS400 platform. Logiware has a lot of experience in implementation of specific solutions and works in close cooperation with the customers IT department or IT supplier.

SHARK has also been installed with existing Warehouse Management Systems where the uniqe featureas in SHARK for control of automated storage equipment are used while an existing system still are used for other functions as for example shipment and packaging.

Shark support pickcarts, intelligent with wireless connection to the server and with pick-to-light marked boxes with confirmation button for each box, as more traditional pickcarts with for example a barcode for control.
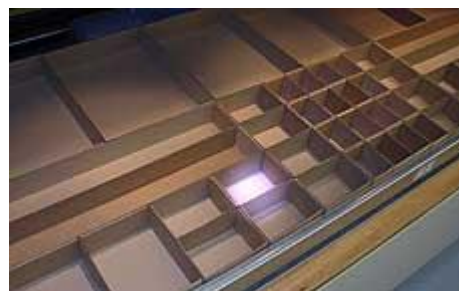
*P*ick-to-light systems improve performance and quality dramatically. Light directs pickers to pick location, minimizing time spent looking for products

The Conveyor Module supports close integration of conveyors with SHARK and communication to PLC or PC controllers. A simple integration is when SHARK get the information that a box has arrived to a picking zone and autotically takes action, more advanced solutions are when SHARK controls the conveyor and facility for route optimization, automatic replenishment using the conveyor, etc.

The batch pick window has all information available and is still simple to understand. A the upper left corner a green arrow shows that the article goes into the stor-

age, a graphical drawing of the tray layout shows clearly where the article should go. Article number, description, order number, quantity on location and push buttons for printing labels, make corrections to the pick as for example changing the quantity are easily accessibly. Does an express order arrives that requires special handling, a red flag indicates to the operator that special action is required, it is here always possibly to stop a batch operation, do something else and later return to the interruption point and continue the work.

Wireless truck terminals ensure fast and reliable real-time operations. Change the priority of an order and it will immediately be reflected on the truck. It also provides the operator with all information he needs for improving the work process. The online operation also provides the warehouse manager with a continuous overview of the operation.

Screen shot from the PDA (wireless terminal) used for all kind of operations. The PDA has a built-in barcode scanner, touch screen and a user friendly interface, this makes it possibly to use the PDA with a

minimum of training for picking,

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put-away, goods reception, etc. The PDA is also a very convenient tool for getting fast information: Read the barcode of a location and the display shows the content, read a transport box or pallet and the PDA shows what in the box or on the pallet, read an order number and the PDA shows the order with all lines and status information, etc. Stock errors are also reported immediately by the PDA, no need to go back to a stationary PC to enter stock adjustment and similar operations.

SHARK 2.0 Specifications

Warehouse Management System (WMS) for all size of warehouses, supporting automated storage as well as standard shelving and pallets.

Design: Client/server based with all information stored on a central server for easy maintenance and high reliability. Runs on Windows 2000/XP/2003 server.

Technology: Based on state-of-the-art technologies like Java, Web and XML. The system is a real-time system where all operations are performed on-line and immediately available for all users of the system.

Database: Microsoft SQL Server 2000 or Microsoft MSDE (Microsoft Desktop Engine).

Web Server: For the PDA (hand-held terminal) a Tomcat web server is used. It is installed as an integrated part of SHARK.

Article Database

Database size: SQL Server version only limited by disk size. The MSDE version is limited to 2GByte database file.

Article Master Data: Article number, description, dimensions, weight, preferred location type, EAN code, replenishment information (min, max, replenishment source), storage strategy (fixed, floating, FIFO), package size information. ABC (picking rate information).

Search function: Search for article number or description.

Functions: Create new, delete, search, and change.

Batch number: Articles can be saved and retrieved with batch (lot) numbers.

Replenishment Information: For each article, it can be specified in what location types the article should go, the quantity that fits on each location type and in what zones the article should be stored. See also "replenishment" for automatic replenishment of articles. Quantities can be calculated from the physical dimensions.

Location Management

Strategy: Fixed, floating (chaotic), FIFO (First-In First-out). A default value is set for the system, but the strategy can be set individually for each article.

Control: Can be either automatic controlled where SHARK finds the optimal location or user controlled.

Barcodes: Barcodes can be used on locations, articles, etc.

Put-away (floating): SHARK suggest a new location at put-away. The operator may override the suggestion or split the operations on more than one location if required.

Put-away (fixed location): SHARK will always suggest the same location, this can be overridden by the operator.

Put-away (FIFO): SHARK will always suggest a new location to avoid mixing articles from different batches on the same location.

Zones: The warehouse is divided into zones. A zone is a way of dividing the warehouse into separate work areas. One operator is only working in one zone a time.

Location naming: max 7 levels.
1) Zone name - automat - tray - location on tray (row, col).
2) Zone name - aisle - section - shelf - location on shelf (row, col)
Example: A3-15-D3 (Zone A, Automat 3, tray 15, location in tray: D3.

Flexible zones: With the flexible zone system, 2 or more automat zones can be put together for a period, typical if the workload is load, to allow one operator to cover more than one zone. (Enterprise version only).

Layout editor: A graphical environment/configuration tool makes it easy to define the warehouse layout.

Tray layout: Default tray types are created using s graphical editor. This makes it easy and fun to create even complex layouts.

Location concept: Each article type (SKU) on unique location. Each article type can be put on more than one location. In case batch/lot numbers are used, there can be stored none or one batch-number per location.

Manual transactions (Hot-picks)

Functions for simple/fast/hot picks, put-away and stock adjustment.

Searh: Find an article from number, description or location.
Pick: Simple picking without orders.
Search free location: Find a free location of the requested type.
Put-away: Articles can be stored based on existing locations or on new locations.
Stock Adjustment: The article count for a specific location can be adjusted.
Graphical location finder: The manual picking window shows on a graphical picture where the article is placed. Locations can be selected by clicking the location by the mouse or directly on the screen if a touch sensitive monitor is used.

Order attachment: It is possibly to perform manual pick and put operation and assign them an existing order or create a new. This supports for example returning items on a pick order.

Transaction Log

Log: All operations that influence the stock location or quantity are logged in the transaction log.

Sorting: The log is shown in chronological order.

Searching: It is possibly to search in a time intervals, for a specific article number, order number, location, transport box or operator name.

Systemlog

The system log is used for identifying system errors. For example will all errors from automated storage equipment be logged in a central place.

Log: All SHARK modules use the same log, it is thereby easy to search for specific events and correlate events at different locations.

Sorting: The log is shown in chronological order.

Searching: Search for error source, error type, error numner and in specific time intervals.

Language

Language: English, german, danish, swedish.

Changing language: Program must be restarted after language is changed.

System Requirements

The computer used for a standard installation, where everything is installed on a single computer, must fulfill the following requirements:

Supported operating systems: Windows 2000 Professional/Windows 2000 Server (Service Pack 2 or later)/ Windows 2003 Server/Windows XP. It is recommended not to use the computer for other purposes.

CPU: Pentium III, 1.2 GHz or better.

RAM: Min. 256MByte RAM

Disk: 500MByte free harddisk, CD-ROM (for installation).

Serial ports: Depending on connected equipment. Automats, printers, etc. may need serial ports. SHARK supports control of serial ports through ethernet -> serial port converters.

Database: MSDE is included in the SHARK installation (Microsoft SQL Desktop Server Engine). Optional use a Microsoft SQL 2000 2000 for better administration tools, improved performance and if the database is expected to exceed 2GBytes.

Netværk: TCP/IP network must be supported.

Security: For installations where uptime is critical, it is recommended to use UPS and/or RAID disks.

Backup: It is recommended that a backup possibility is established. SHARK might create a one-file backup of the database on a specified location, the database contains all information that is needed for daily backup, and there is no need to backup clients daily.

Support: It is highly recommended that a method for remote login is provided (via Internet or modem).

Batch pick

Batch picking: Batch picking is supported where several orders are picked in parallel. The batch is *floating* meaning that new orders can be added and removed at any time. This ensures that the batch always contains a high number of lines for optimal speed. An aging system ensures that now orders will be "forgotten".

Optimization: The picklines are sorted for optimal picking speed. For automats, picks from the same tray is picked together, then to minimize waiting time, automats are selected in sequence depending on when the trays are ready. The orders of trays are selected to minimize the time used to retrieve the trays.

Confirmation: The selected method for pick confirmation can be selected freely. Supported are (one or more): by the enter key, article number, location code, order number, transport box number.

Creating of orders: Orders are typical received from an external ERP system, but they can also be created directly in SHARK.

Batch put-away

Articles can be put-away in a batch job with semilar advantages as with batch picking.

Put-away orders: A put-away order is used to define what to put-away. The order can be imported from an ERP system by SHARK link.

Optimization: The sequence is sorted for optimal speed.

Finding new locations: SHARK has a number of methods to find the optimal location for the article. This might depend on picking frequency, relation to other articles, size, etc.

Confirmation: The selected method for put-away confirmation can be selected freely. Supported are (one or more): by the enter key, article number, location code, order number, transport box number.

Barcodes: A barcode can be printed either automatically or by request at put-away. The layout can be customized.

User Management

Authentication: Users must logon to the system, each user has an access right level.

Authentication Levels: Operator, Administrator, System.

Number of users: No limits.

Order Management

An *order* in SHARK is a collection of *orderlines*. Each orderline is again split into one or more *transactions* that specify how to pick or put one orderline. More than one transaction can be needed to fulfill one orderline (for example if more than one location is needed to pick the total required quantity)

Order main types: Pick, put and adjustments**.** Internal transport orders (stocking moving) is a combinatin of a pick and put order.

Order subtypes: For each major order type, sub ordertypes can be defined with specific order type information, default priority, name, etc.

Order priority: Each order has a default priority, an operator defined priority and a dynamic priority defined by the system. The later tries to collect orders that shares picking locations or trays to optimize the working process.

Order information: Order number, delivery note, delivery information (customer, address, etc), notes, delivery/created/received/pickstart/pickend dates, Misc 1-5, priority, shipment information.

Basic order status: waiting, partly picked, cancelled, OK, consolidated.

Order release: Orders must be *released* before they can be picked. This can be done automatically or manually. The order release functionality makes it possibly to arrange for an administrator what to dispose next (for example all orders that must go with a waiting truck).

Inventory

An advanced inventory system makes stock-counting easy.

Inventory orders: Can be created in SHARK or received via SHARK link from an ERP system. An inventory order may contain all or a number of articles and/or an area of the warehouse. Selections can also be done depending on last inventory date, put-away date, access date.

Method: Counting can be done on the screen or by paperlists, the later with a barcode for easy identification. The operator does not see the expected quantity. The adminstrator decided what have to be recounted. No limits on the number of recounts.

Reports: The stock can be reported back to an ERP system and a difference report can be generated.

Replenishment

An advanced replenishment system is available as a separate module. This module can make internal and external replenishment from article master data and some general rules.

High-rack and standard shelving

Picking zones for high-racks or ordinary shelving.

User interface: The recommended interface for picking zones with shelving are hand-held online terminals (PDAs) or truck terminals.

Picking lists: Picking lists are supported. They are printed with a unique number (barcode) that later can be used for confirmation of the picking list. Picking lists may contain one or more orders.

Picking sequence: Optimized for shortest way and a minimum of operations.

Layout: The layout is zone, aisle, shelves, trays, row/columns in tray.

PDA functions: The PDA has a smaller screen than an ordinary PC and no keyboard, so the functionality is designed for this. The PDA software is web based and is running in an Internet browser, so no specific software has to be installed on the PC (easy to maintain). The following functions are available on the PDA:

Order selection (batch pick).

Batch pick/put window.

Manual operations like pick/put and stock corrections.

Information: read a ordernumber, transport box number, article number or position number and the PDA shows known information about the item.

Real-time update. All information is updated immediately in the system and reflected for all other users.

Number of users : Der is no limit on the number of operators in the shelving picking zone.

Network: The PDA requires a wireless 802.11 network.

Goods Reception

Module for goods reception and preparation of put-away operations.

Order registration: Put-away orders are received from an ERP system or created manually. When received the operator enters the order number or the article number and select the right order from a list if more than one matches the criterias.

Preparation: SHARK may find the locations for put-away automatically (by supplied *replenishment information* like zone, locationtype, package size) or the operator can select put-away zones manually. The articles can be put into a box with a barcode

that later is used for fast identification in the put-away process.

Labels: Labels can be generated by SHARK for boxes and pallets.

Cross-docking: If one or more picking orders exists that wait for the article that are received, the operator can decide to pick the orders immediately in the goods reception window and thereby avoid a time and work costly putaway-pick process.

Quarantine: Received articles that are damaged, no papers received or similar problems that means they cannot be picked immediately can be put on quarantine. A special zone is dedicated for this purpose (only supported in the enterprise version).

Consolidation and shipment

In the consolidation and shipment module, articles picked in different zones are combined and optional checked if they are picked correctly. Furthermore they can be packed and labels can be generated for the packing.

Paper: Delivery note or packing list. Address or box label.

Merging af picking boxes: Collect orders picked in several boxes or zones.

Picking of missing articles: It is supported that articles can be picked in the consolidation zone, for example articles that physical are placed in the shipment area.

Control: Is is possibly to check the picked quantity for each line by reading the barcode of the articles.

Integrated Inventorying

SHARK has an integrated inventorying module.

Counting orders: An unlimited number of counting orders can be generated.

Counting with paper lists: Counting lists can be printed, optional with a barcode. The barcode can later be used to fast report back the result.

Counting directly on screen: Counting can be done directly on the screen, where the location can be shown and for automats, the tray can be retrieved automatically.

Re-counting: An unlimited number of recounts can be performed.

User administration: Normal users have no access to the actual stock level or able to change the counting orders.

Stock update: The actual stock update is done under administrator control and first when the counting has been approved.

Reports: Difference reports can be generated.

ERP commitment: The final stock can be reported back to the ERP system.

Location management: The inventory system keeps track of last access time, store time and inventory time for each location.

Reports

A number of reports can be generated by the system.

Stock: Lists of all articles in the system.

Tray statistic: Shows information about tray utilization and picking rates (is most of the picks from the nearest trays).

System log: Log over all system events.

Transaction log: All transactions that influence the stock are logget and can be printed.

Pick statistics: Picks/puts per day/month/year/zone/user.

Printer: Reports can be printed to a Windows printer.

Barcode scanners

In most cases barcode scanners are used in combination with SHARK.

Supported scanners: Intermec, Symbol or any other scanner with support for keyboard emulation. SHARK requires an end-of-line to be send ofter the scanned code.

Functions: Read articlenumber, positions, box numbers, login names, etc. A number of general commands can also be activated by specific barcodes (like printing a label).

Barcode printers

Support types: Intermec E4, MarkPoint MP Compact4, Zebra. Others on request.

Connection: via RS232 or a parallel printer port.

Format: Standard format at delivery. Can be modified by the user.

Off-line use

SHARK can be installed on computers for administrative purposes. These *off-line* users can not interfere with the picking and are not able to operate any equipment, but can make all administrative tasks.

SHARK Link

SHARK Link is used for exchange of data with external ERP or external Warehouse Management Systems.

Protocol: Data can be imported/exported from any folder.

File format: XML files in SHARK XML format or ASCII files in fixed length, CSV formats (using

scripts). See the SHARK link documentation for further description.

Scripting: Scripts can be written in Java syntax for import/export.

XSLT: XSLT stylesheets is suppored for easy integration with external XML formats.

Message types: Master Data, Pick and Put-Away Orders, Confirmations, stock adjustments, Order Cancel.

Confirmation types: When order is finalized, for each line, when order is partly finalized.

Inventory: Stockcounting lists can be imported from an external system (an ERP system can for example decide what to count). Stock status can be exported to an external system.

Synchronization: Selectable import delay, default 15 seconds, minimum is 5 seconds. Typical synchronization time is less than 30 seconds.

Customization: SHARK link can be customized to other protocols and formats as for example direct database access, message queue systems, etc. Customized interfaces can be written in Java.

Email reporting

An email based reporting system is available.

Setup: Each SHARK users can subscribe to specific errors. This means that one responsibly for the hardware operation can subscribe to hardware related errors and another responsibly for the ERP connection can subscribe to errors related to this interface.

Watchdog

A watchdog function is available to monitors the system and may restart critical processes and generate error emails in case potential problems are detected.

Conveyor Module

SHARK has a general module for interface to conveyor systems.

Conveyor control: Barcode scanners, direct to PLC. Must be adopted to the specific installation.

Automat control: SHARK may control a local queue in front of automats.

Pick-to-light: Control af position light for boxes on the conveyor.

Confirmation: Supports push buttons at the conveyor for confirmation.

Batch picking: Automatic batch start of orders (boxes) that arrives to a picking zone.

Optimization: SHARK may control the conveyor system and optimizes the order and pick sequence.

Maintenance

Client software updates: Clients can be automatically updated from the server, thereby new software versions only have to be maintained at one location.

Backup: Built-in backup task running at fixed intervals.

Customizations

Customization like special functionality, reports, etc. can be made on request.

Specifications valid for SHARK 2.0
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