

# White Paper

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*White paper for AGR Inventory Optimiser*

*August 2009*

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# 1. OVERVIEW

AGR Inventory Optimiser is an Inventory Planning and Optimisation solution that minimises both inventory costs and shortages. It uses data from the existing ERP system to determine forecast values. From these forecast values, the system then dynamically calculates order proposals and the safety stock, taking the service level, inventory status, lead times, minimum order quantities and the items' replenishment lead time into account.

## KEY FEATURES

AGR – Inventory Optimiser includes the following key features:

- **User friendly interface.** The system is user friendly and suitable for advanced inventory specialists as well as employees with less experience in purchasing and inventory management.
- **Integration with ERP systems.** The system has a 3-tier architecture and has been integrated with various ERP systems. It gives users the possibility to view historical data and forecasts enhancing their overview of past and present situation.
- **Sales forecasts.** Sales forecasts are generated based on proven statistical forecasting methods, taking into account historical sales, seasonal fluctuations, events etc. The system automatically selects the best fitting forecasting method for every single item in the database.
- **Automatic order proposals.** It is possible to have order proposals generated automatically and ready when the purchasing staff arrive for work on certain days.
- **Management reports.** Management reports increases overview and allows managers to evaluate the performance of various factors in the system.
- **Projected inventory.** The user interface provides a graphical view of projected inventory levels and a comparison of the influence of different buying proposals on the inventory.
- **Superseding items.** A product's historic sales can be combined with a new superseding product to forecast the demand of the new product line based on the historic demand of the 'old' item.
- **Multi location setup** AGR Inventory Optimiser has a functionality for companies with multilocation inventory systems. The system can be used to make order proposals for central warehouses but it can also be used to make purchases for stores from a central warehouse or supplier. The flow of goods can be multidirectional. Goods can flow in various ways from supplier to warehouse, from warehouse to stores or between warehouses or even between stores etc. Figure 1.1 illustrates this.

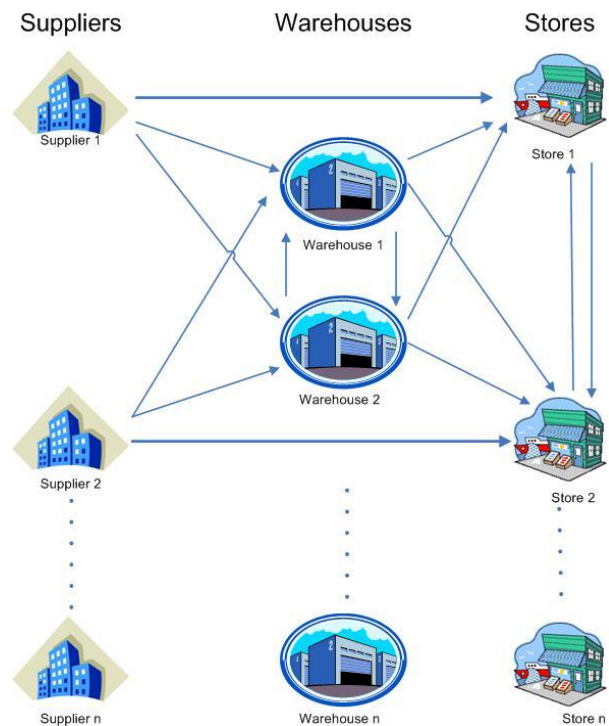


Figure 1.1

## 2. USING AGR INVENTORY OPTIMISER

### ITEM DETAILS

The Item details form shows all existing information for the chosen item. The following figure shows the structure of the Item details. To the left, all preconditions regarding the item can be seen. Also shown: Graphical information as shown on the graph and various data in table format (Data tab page)

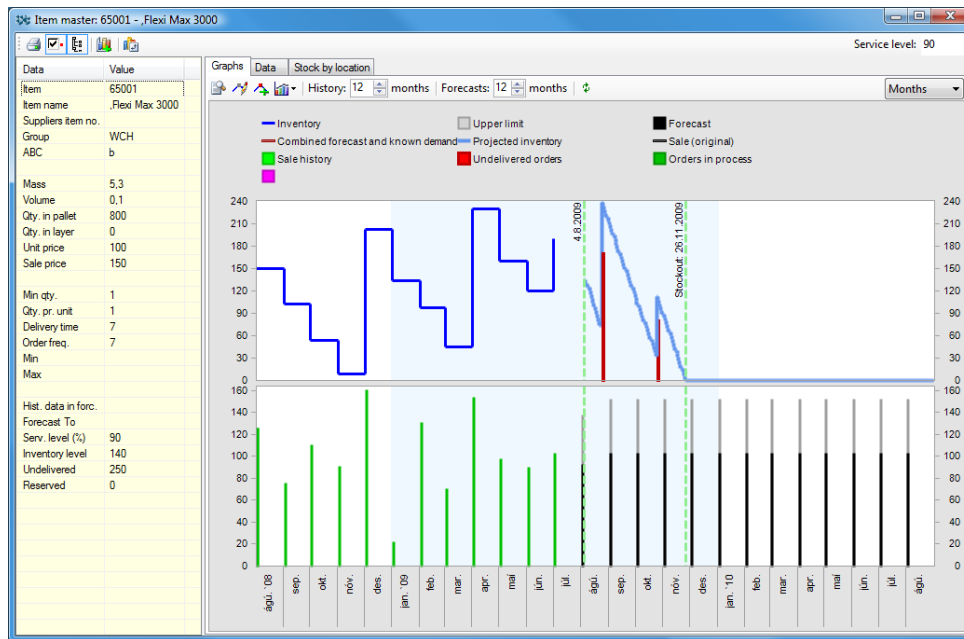


Figure 2.1. Item details

On the graph shown on figure 2.1, historical data and future estimates are presented graphically. One can view historical inventory development, historical sales figures, future forecasts, undelivered orders and projected inventory levels. See more detailed explanation in the following text.

### Time horizon in graphs

Above the graphs, it is possible to choose the number of periods back in time to show historical data. The user can also choose whether data is presented for months, weeks or days.

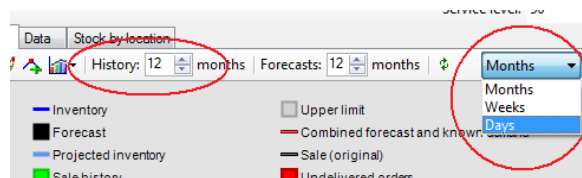


Figure 2.2

### Historical Inventory

The historical inventory levels are represented on the graph by a blue line. The stock history in units is shown on the vertical axis and the horizontal axis shows the dates for each value.

### Sale history

The sale history is represented by green columns, with the number of sold units on the vertical axis and the dates on the horizontal axis.

## **Sale forecasts**

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The sale forecast for the next periods is represented by black columns. The expert system incorporated in the best-fit forecasting module automatically chooses among five classes of forecasting models to satisfy all mainstream business forecasting requirements. The sale forecast is based on historical sales data. It is though possible that historical data is not accurate enough to base forecasts on. E.g. if a stockout had occurred for two months due to supplier problems then it is not feasible to predict that a stockout will occur again the same time next year. In such instances it can be necessary to change historical data in order for the sale forecast to be generated from "correct" data.

## **Upper limit**

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The upper limit of the sales forecast appears as a grey column above the sale forecast. The upper limit is calculated from the set service level and variations in sale. The difference between the sale forecast and the upper limit is in fact the calculated safety stock. The difference between the sale forecast and the upper limit is also determined by how predictable the item is in sale. The system will calculate low safety stock levels for predictable items and high safety stock levels for unpredictable items with large variations in sale, if those variations can not be described by seasonal effects or special events.

## **Projected inventory**

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Projected inventory levels are represented by a light blue line. These calculations are based on the current stock level, sales forecasts and undelivered orders.

## Stock by location

Inventory levels can be viewed graphically in the item master by location, either in units or days. (shown here in units by location)

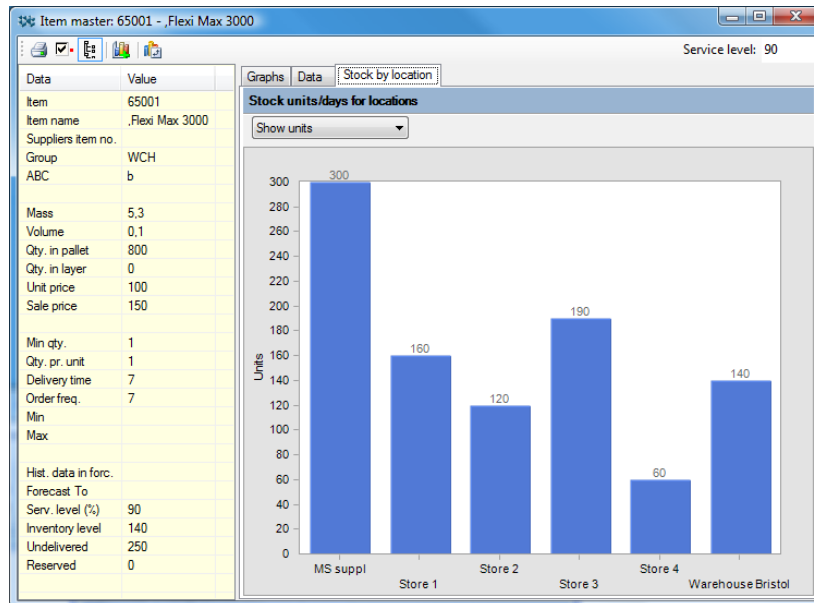


Figure 2.3. Stock by location

## Custom info

Custom info table can display whatever information is needed. On figure 2.4 there are few examples.

The screenshot shows the 'Custom info' window with the 'Sale data' tab selected. The table displays sales data for a product by month from 2007 to 2009. The columns are 'Nr', 'Month', '2007', '2008', and '2009'. The rows represent months from January to June.

Nr	Month	2007	2008	2009
1	January	40647	44058	56163
2	February	50913	48820	58662
3	March	67490	65185	70689
4	April	62177	68606	77632
5	May	49364	55990	69381
6	June	44609	42954	45664

2.4. The custom info table showing sale for one product by months.

## Sale details

Sale details shows breakdown of sale for each SKU. In item master total sale is shown for each month/week/day but further breakdown of that sale is not visible in that form. Sale details form shows further breakdown for each sale period (month/week/day) for the SKU. It is possible to have up to 10 different dimensions for the breakdown, country, store, customer etc. and see how the sale was distributed for each dimension. This is useful to determine abnormal peaks in sales etc.

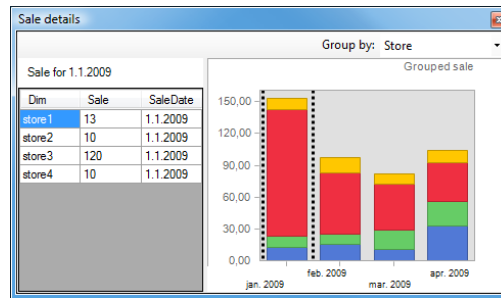



Figure 2.5. Sale details by store

## Sales history generated for new items

When new items are created in the database it is not possible to create forecasts when no historical data exists. By clicking on the shortcut button , the window in figure 2.4 opens and it is possible to generate sales history for new items from that of existing items.

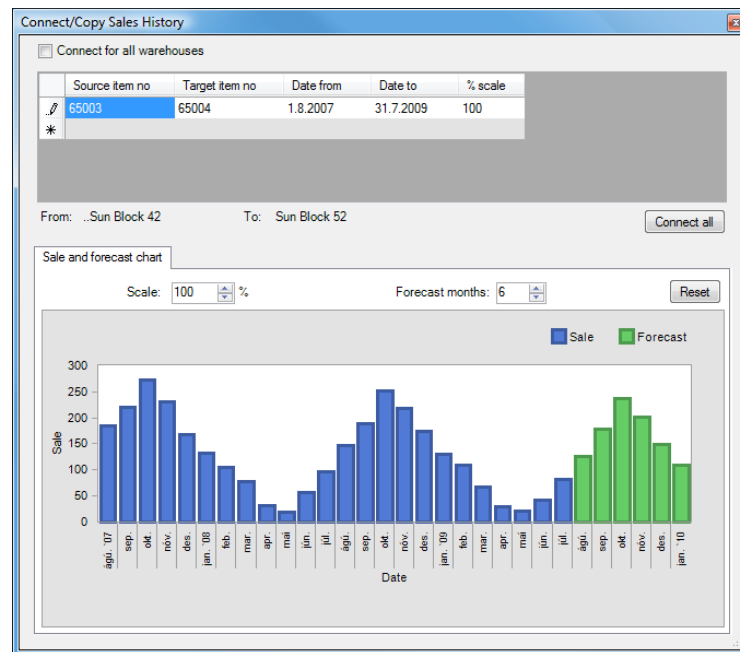


Figure 2.6

It is both possible to create new sale history only for the location which the user is ordering for or all locations at the same time by checking the box: Connect for all warehouses.

## CREATING ORDER PROPOSALS

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Order proposals can be created both manually and by creating automatic proposals.

### Automatic proposals

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This procedure will reduce manual work by automating inventory management tasks. Users predefine purchases for various suppliers or groups of items, making the purchasing recommendations automatic. The system could for example be scheduled to automatically generate order proposals for suppliers A-D on Mondays, E-H on Thursdays etc. When the purchasers arrive at work on these days, all they have to do is review the proposals and send them to the ERP system.

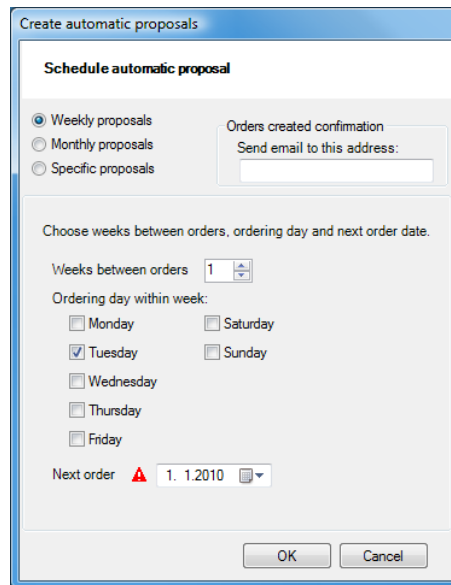


Figure 2.7. Automatic proposals

Here it is possible to create scheduled orders and manage them. It is also possible to get an e-mail confirmation once the order has been created. Scheduled orders are created automatically at defined intervals by the user, e.g. on Mondays, every other Monday, once a month, first day of the month or at specific dates.

### Manual order proposals

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By right-clicking the mouse it is possible to create an order for all products or for checked products. By clicking on inverse checked selection, all check marks are changed.

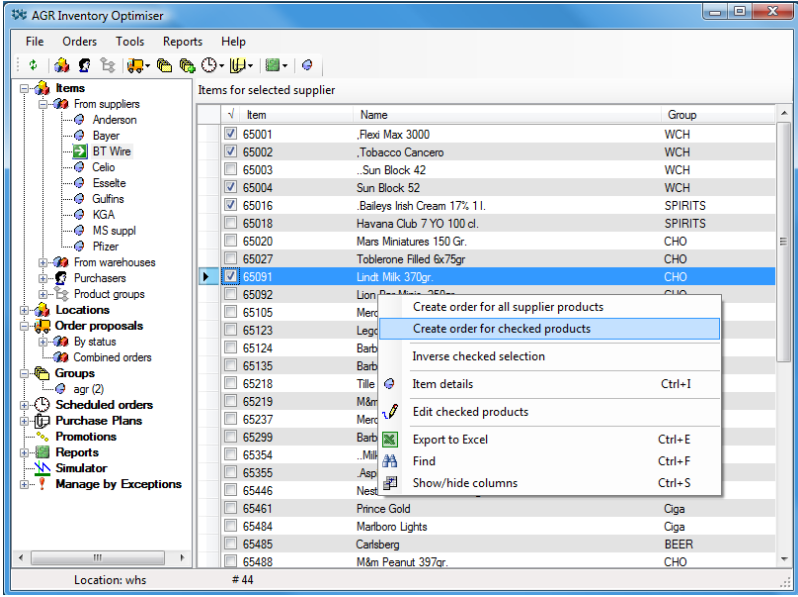


Figure 2.8. Manual order proposals

**Constrained order**

Based on sales forecasts and the inventory status, together with data on the mass, volume, number of pallets and delivery times, the model calculates how much of each product should be ordered so as to utilise container space to the fullest and ensure that the shelf life of the goods in each container is similar.

To fill up the container or load an optimisation model is used. The objective is to fill up the container so that the shelf life of all ordered items is the same without breaking volume, weight and number of pallets constraints. This feature can also be used to fill up to a certain price of an order or up to certain number of days when ordering for some seasonal products.

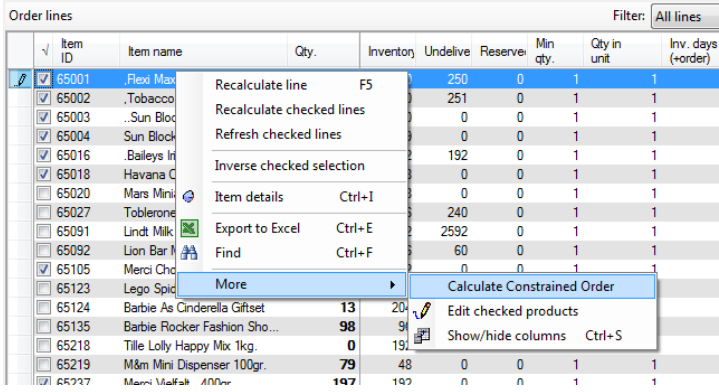


Figure 2.9. Constrained ordering

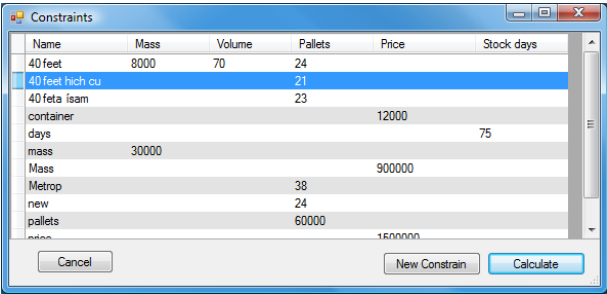


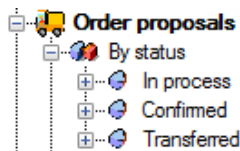
Figure 2.10. Constraints defined for order proposal calculation

It is possible to define constraints for the calculation which will be saved reuse. After choosing constraints the system will fill up the order until the first constrain is broken.

If the user wants to fill up the order with some certain items it is possible to mark items that should fill the order and only marked items will be recalculated.

## MANAGING ORDER PROPOSALS

All proposals that have been made have a status, depending on where in the process they are at each time:



**In Process** means that an order proposal has been generated, but it is waiting to be reviewed and confirmed.

**Confirmed** means that order has been confirmed but it is waiting to be transferred out of the Inventory optimiser into the ERP system.

**Transferred** means that order has been transferred out of the Inventory Optimiser into the ordering part of the ERP system or into a text file, depending on the setup of the data transfer.

## Order proposals reviewed

Order proposals that have been generated and have the status “In process” can be found in the tree of the main screen under Order proposals -> By Status. **Error! Reference source not found.** shows a list of all order proposals that are waiting to be reviewed and sent to the ERP system. The upper table shows a list of all proposals. When a line is chosen by mouse-click, a list of all items in the proposals appear in the table below. Here it can be seen that order proposal number 1060 is chosen and in the lower table a list of all items in that proposal appears.

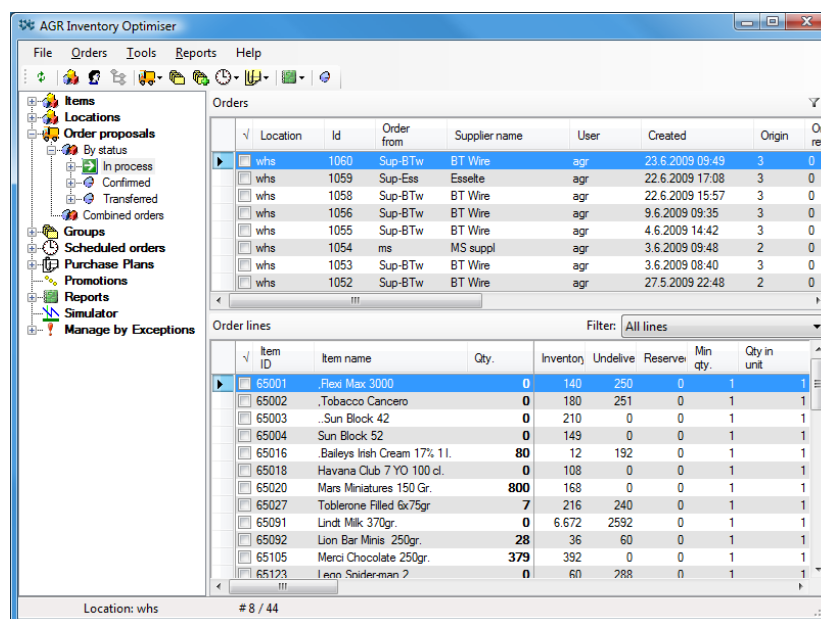


Figure 2.11. Order proposals in process

The purchaser should review the proposed purchasing amount for each item in the proposal. He can review each line and change the proposed amount if necessary. It is also possible to right-click the mouse and choose Item master. The item master is updated automatically according to the item number that is being reviewed, showing historical sales, inventory levels and forecasts enabling the purchaser to get a good overview of past and future situations before making the final decision on how much to order of each item as shown on the next figure.

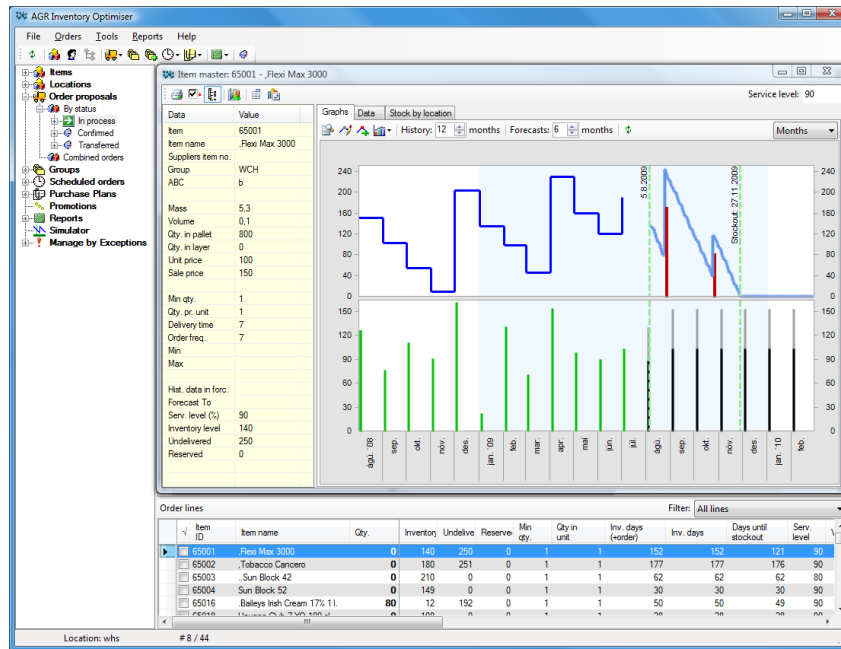


Figure 2.12. Order proposals reviewed

While reviewing the order proposal the purchaser might see it necessary to alter the proposed amount or change some preconditions in the item details. This could for example be if he sees that there are some abnormal sales figure in the past that are effecting the forecast which will in turn also affect the order proposal. If preconditions are changed, it is necessary to recalculate the order proposal for the corresponding items. This can be done by right-clicking the mouse and choosing Recalculate line.

## Order proposals confirmed

Orders are confirmed by right-clicking the mouse button as showed on figure 2.10.

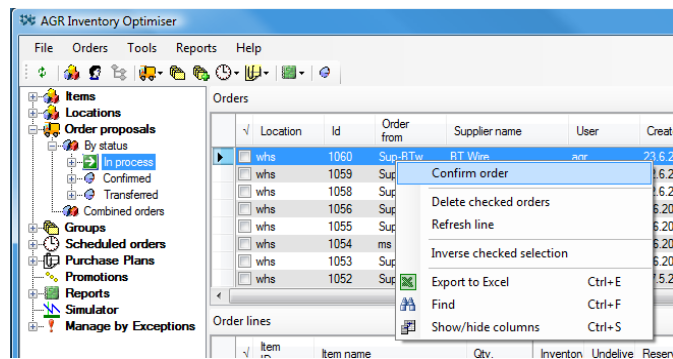


Figure 2.13. Confirm order

Order proposals that are confirmed are sent to the ERP system and get a new status: Transferred. By going into transferred order proposals it is possible to review old proposals.

## REPORTS

### Management overview

Management overview makes it possible for managers to evaluate the performance of various factors in the inventory system such as stock value development, turnover, turnover ratios for products, groups or locations, allowing them to closely monitor the performance of the system. If a future time horizon is chosen the system will forecast sales figures ahead. The picture shows stock development, sales figures and turnover ratios for Store 3. It also predicts sales until 1.7.2010.

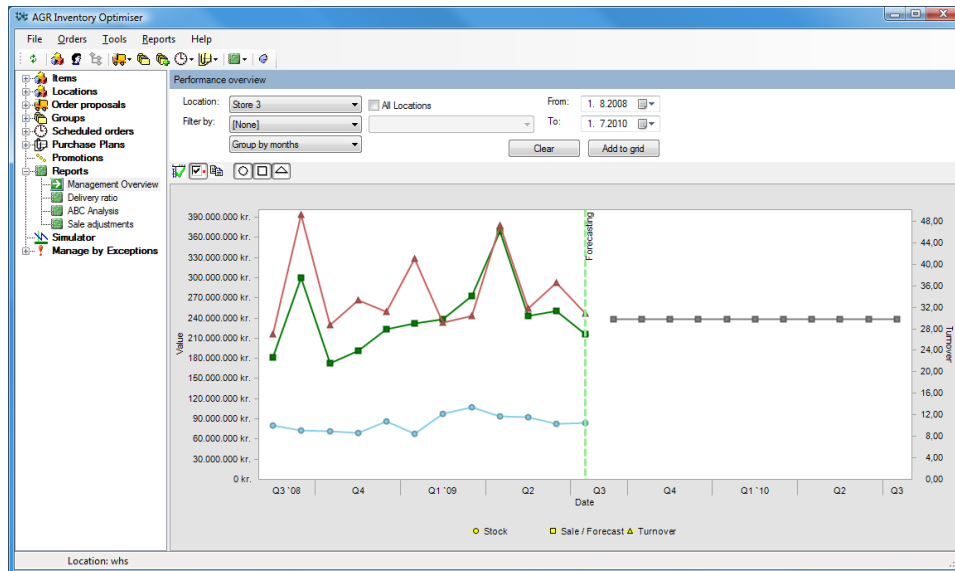


Figure 2.14. Management overview

## ABC analysis

It is possible to create two-dimensional ABC analyses, classifying items simultaneously based on turnover value and sold units, e.g. AA, AC, BA, etc. This enables users to prioritise their efforts in terms of the importance of each product. The analyses can be made for the whole company, a location, a product group, supplier, etc. A items account for 80% of the turnover/sold units, B items for 15% and the C items for the remaining 5%.

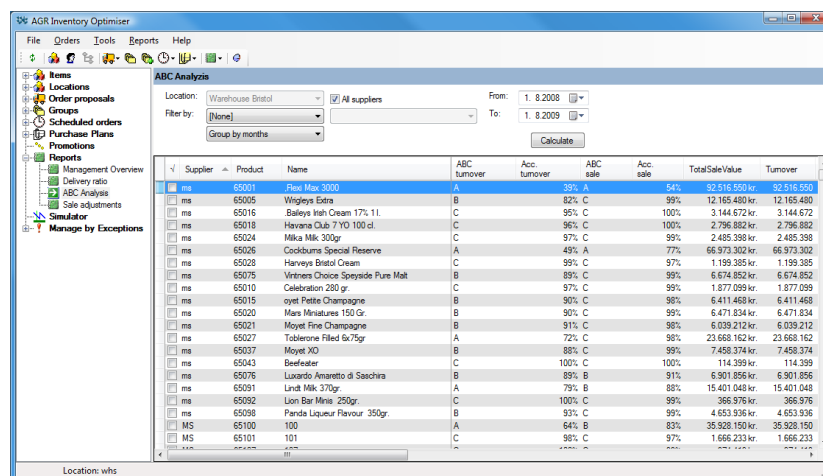


Figure 2.15. ABC analysis

## Sale adjustments

It is possible to adjust the sale history for entire groups of items to influence future forecasts. If the changes are confirmed, the history for all underlying items in the group is changed proportionally. This can be useful for example if there was a promotion at a specific location or for a specific group of items and the user wants to adjust the historical figures for more realistic forecasts.

Sale adjustments are done by changing the height of the green columns and the forecasts are automatically updated.

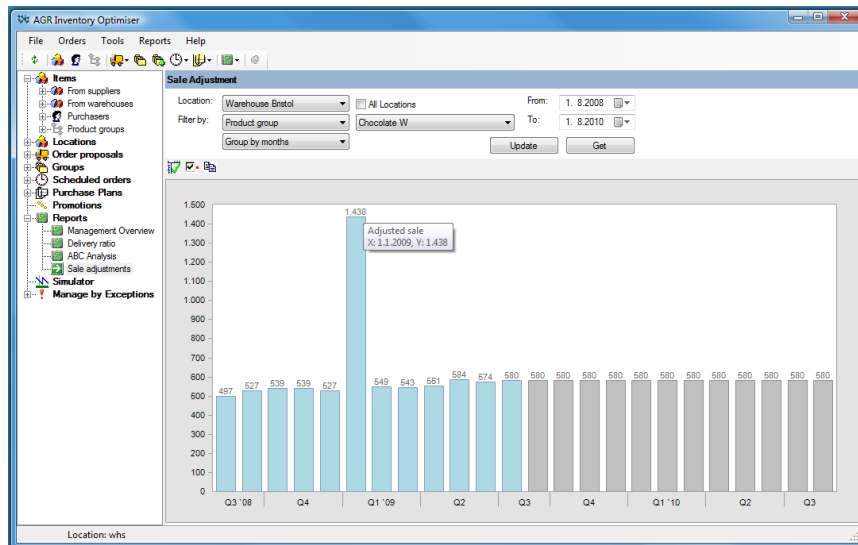


Figure 2.16. Sale adjustment

## EXCEL OUTPUT

When a user is viewing a table in the system it is always possible to right-click the mouse and export the data being viewed into Excel. The picture below illustrates how forecast values can be exported into Excel.

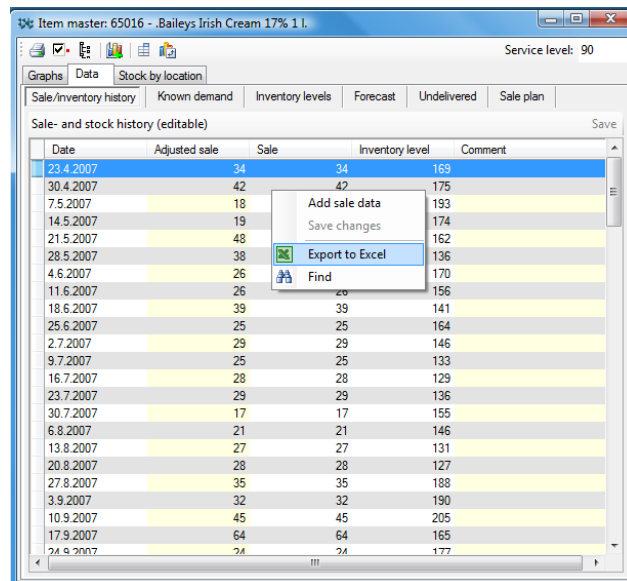


Figure 2.17. Excel output

## 3. DEMAND FORECASTS

The AGR Inventory optimiser includes an expert system that automatically calculates sales forecasts as new sales data arrives. It chooses among the following five classes of forecasting models to satisfy all mainstream business forecasting requirements. Below are the details of the 5 classes of forecasting models:

- **Simple Methods**  
For very short or extremely volatile data, Forecast Pro includes moving average models.
- **Curve fitting**  
This provides a quick and easy way to identify the general form of the curve that the data is following. Forecast Pro supports 4 types of curves – straight-line, quadratic, and exponential and growth.
- **Low volume models**  
Croston's Intermittent Demand Model and Discrete Data Models are provided to accommodate low volume and 'sparse' data (i.e. data where the demand is often zero).
- **Exponential smoothing**  
Twelve different Holt-Winters Exponential Smoothing Models are provided to accommodate a wide range of data characteristics. The robustness of exponential smoothing makes it ideal when there are no leading indicators, and when the data is too short or volatile for Box-Jenkins.
- **Box-Jenkins**  
For stable data sets, the engine supports a multiplicative seasonal Box-Jenkins model.

The sale forecast for the next periods is presented by black columns. Sale forecasts are done on monthly, weekly and daily basis as illustrated in the following three pictures for the same item:

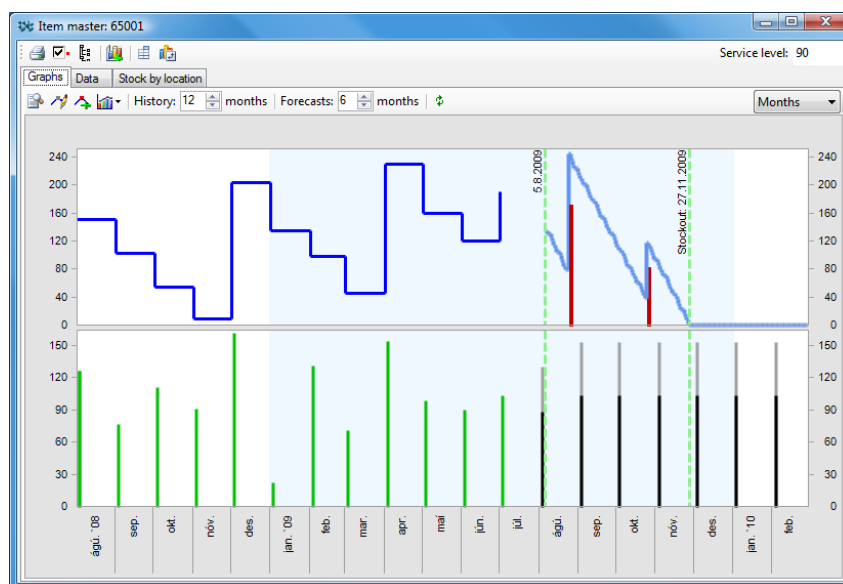


Figure 3.1. Monthly forecasts.

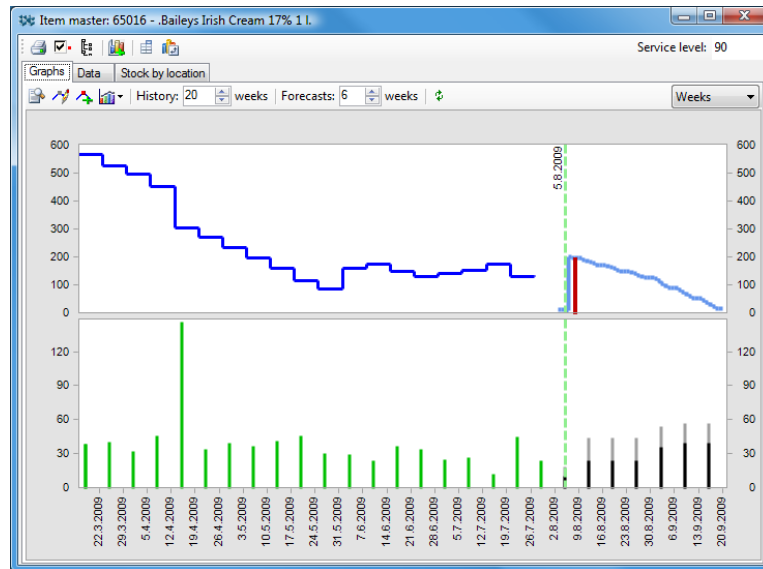


Figure 3.2. Weekly forecasts

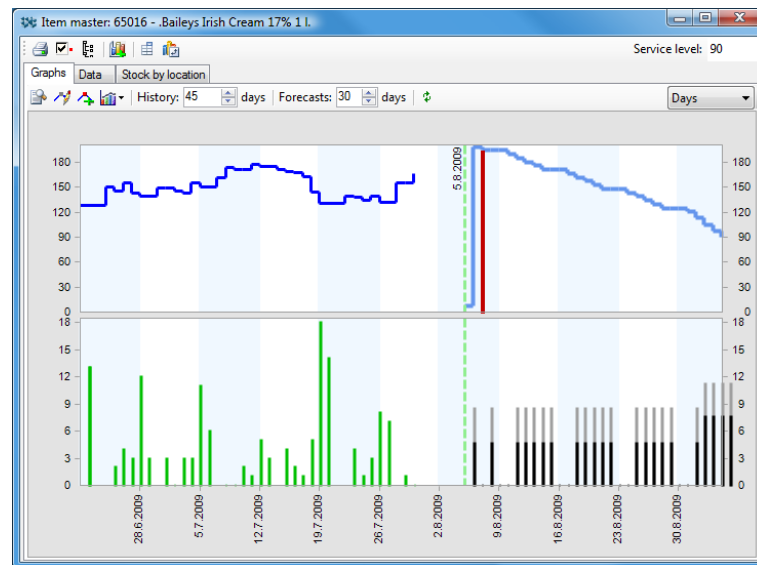


Figure 3.3. Daily forecasts

Important note: The sale forecast is based on historical sales data. It is possible that historical data is not accurate enough to base forecasts on. E.g. if a stockout had occurred for two months due to supplier problems then one will not want the sale forecast for next year predict that a stockout will occur again for the same time. In such instances it can be necessary to change historical data in order for the sale forecast to be generated from “correct” data. It is possible to move those points that need to be changed by dragging them to the correct values. If monthly values are changed, the system will scale weekly and daily values proportionally. In figure 3.4 data points that have “wrong” sales history values due to stockouts and how they are changed.

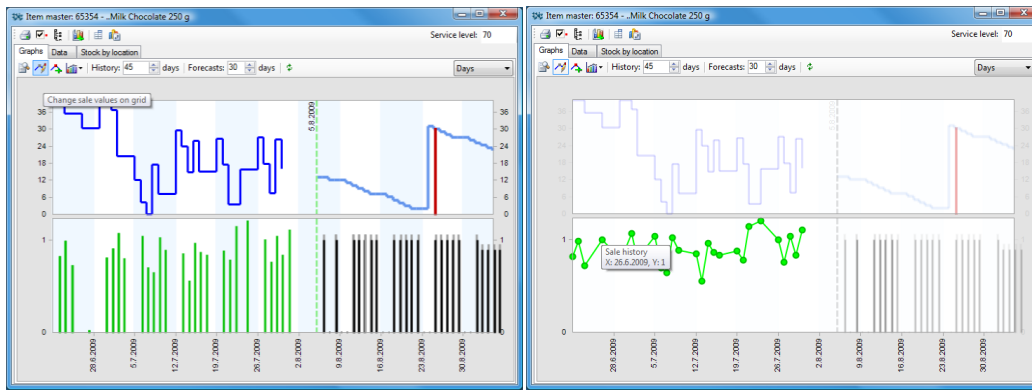


Figure 3.4. Data changes activated

Data in change mode

It is also possible to change historical data in table format.

## Upper limit

The upper limit of the sales forecast appears as grey column above the sale forecast. The upper limit is calculated from the set service level and variations in sale. The difference between the sale forecast and the upper limit is in fact the calculated safety stock. The difference between the sale forecast and the upper limit is also determined by how predictable the item is in sale. The system will calculate low safety stock levels for predictable items and high safety stock levels for unpredictable items that have large variations in sale if those variations can not be described by seasonal effects or special events. The pictures below illustrate two items with the same average forecast. One item is very unpredictable and therefore needs a high level safety stock but the other is very predictable and the need for safety stock is less.

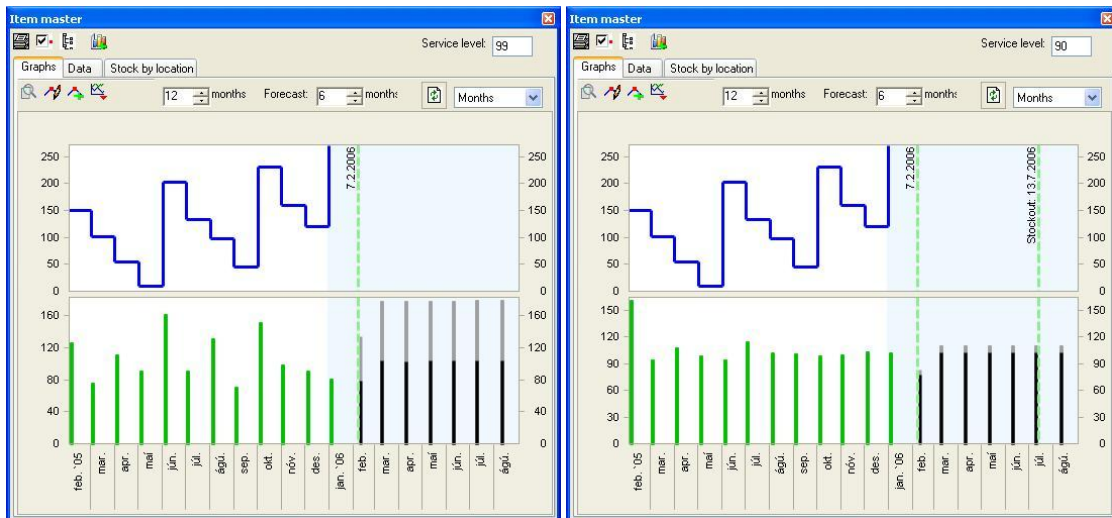


Figure 3.5. High safety stock

Low safety stock

## 4. ADDITIONAL MODULES

### PURCHASE PLANS

Purchase plans make it possible to create order plans for the future to increase vendor collaboration and information sharing. Purchase plans can be created for any defined group in the system. They are defined in the same manner as automatic orders by right-clicking on the group and choosing *Schedule purchase plans*. Purchase plans can be scheduled by weeks, months or on specific dates. The picture below illustrates how a purchase plan is scheduled to take place at monthly intervals:

Purchase plans that have been created can be viewed in the tree and they are also shown in the item master as shown on the following figure:

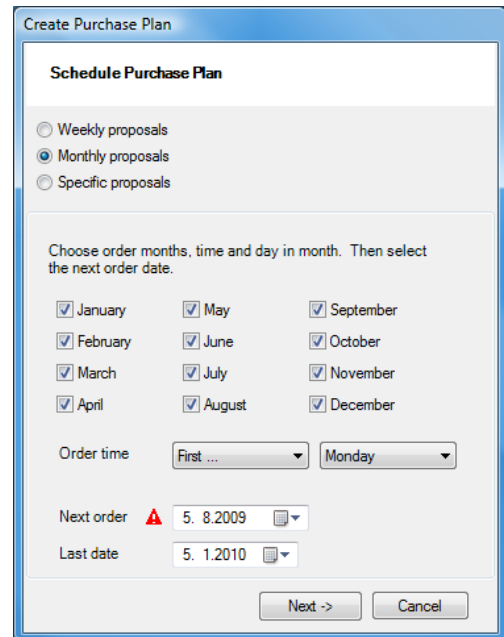


Figure 4.1. Monthly purchase plan scheduled

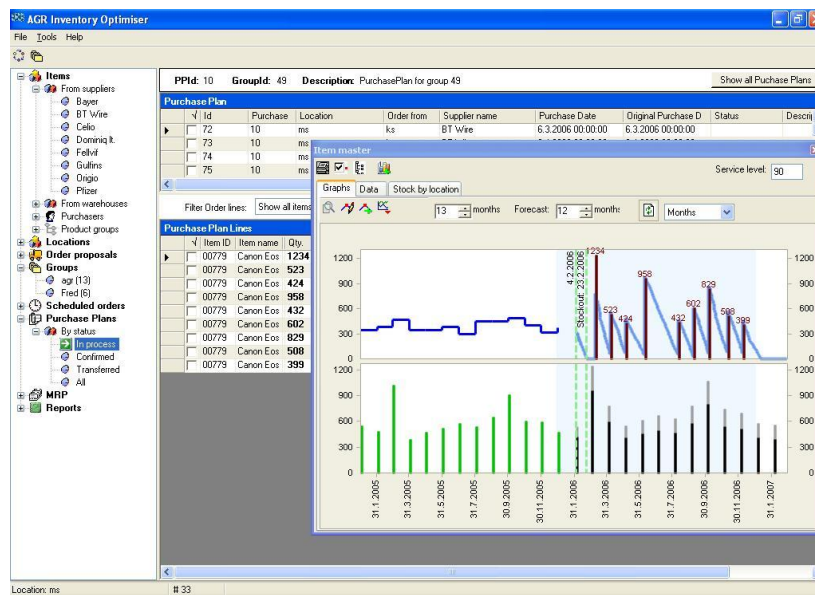


Figure 4.2. A purchase plan shown

## EXCEPTION REPORTING (MBE)

By enabling an exception based reporting module users can create rules to deal with alertable exceptions helping to manage by exception. Dynamic lists are presented when certain criterias are met, e.g. potential stockouts, overdue orders, overstocked items, understocked items, items with high forecasting errors etc.

Advanced users can define their own criteria by writing SQL statements in an advanced filter which is included in the system.

### Basic usage

MBE allows the user to create item lists and select which data to include in the list and specify filter for any data needed. After that the user can save the list for use later. The basic steps for creating custom list are these:

1. Select data to use in the list.
2. Specify data filters if needed.
3. Execute the report to get the item list.
4. Select items to exclude from the report.
5. Save the report for later use and give it name and pick group.
6. Work on the item list (create orders, manage base data, export to Excel etc.).

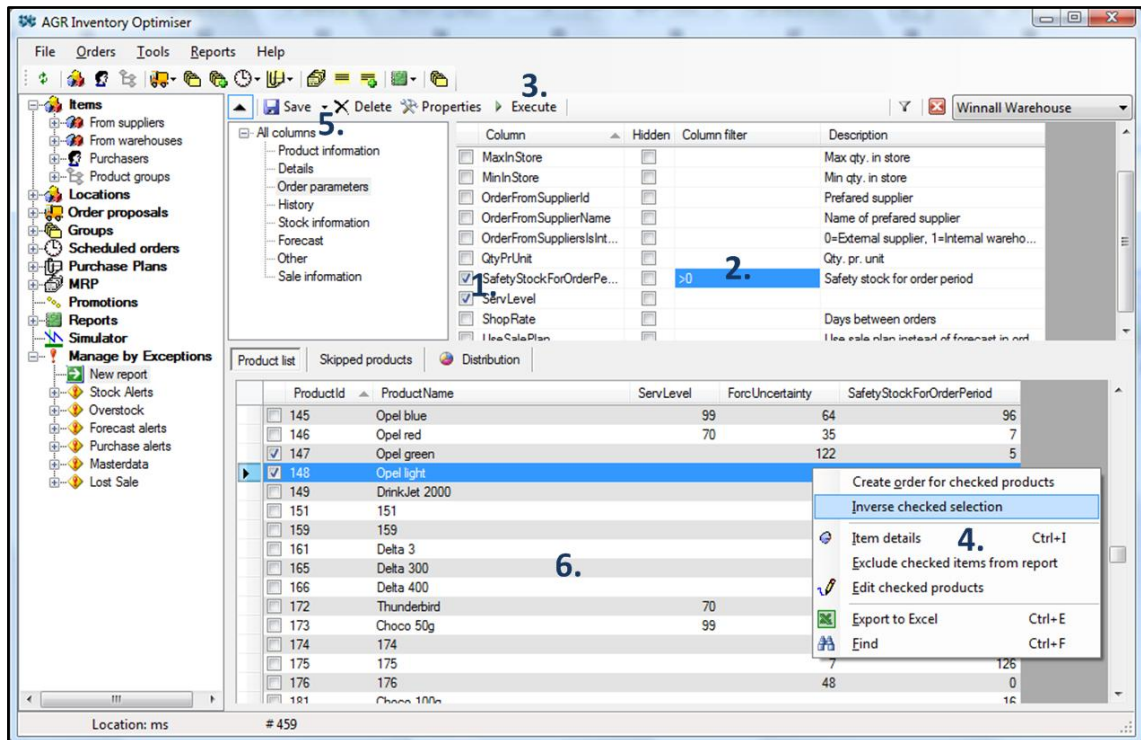


Figure 4.3. Basic usage

These working steps are based on a setup where a super user creates the lists who people responsible for ordering then work on without any knowledge on how to create or manage MBE lists.



K3 provides software solutions to organizations in retail, hospitality and supply chain. We focus on simplifying processes and improving business efficiency for retailers across the supply chain, head office, in-store, on-line and mail-order using a suite of applications built around Microsoft Dynamics. We are a Microsoft Gold Certified Partner with a strong focus on providing solutions and services to retailers.



AGR, founded in 1998 is a supply chain planning specialist offering solutions that optimize the flow of goods throughout the supply chain for distribution, retail and manufacturing companies. AGR's main solution, the Inventory Optimizer, is an inventory planning solution that increases profits by eliminating unnecessary costs from the supply chain. It uses raw data from any ERP or transaction system and automatically selects the best-fitting forecasting method to estimate future demand. Order proposals that minimize inventory costs are generated and uploaded back into the ERP system.

