Item Tracking in Microsoft Dynamics NAV 2013

Technical White Paper

Microsoft Dynamics ERP

ITEM TRACKING

As the flow of goods in today's supply chain becomes more and more complex, the ability to keep track of items is increasingly important to the companies involved. Monitoring an item's transaction flow is a legal requirement in the business of medical and chemical supply, but other businesses may want to monitor products with warranties or expiration dates for customer service reasons.

An item tracking system should provide a company with easy handling of serial and lot numbers, considering each unique piece of merchandise: when and where received, where stored, when and where sold. Microsoft Dynamics NAV has gradually expanded its coverage of this business requirement and today provides application-wide functionality and a solid core on which to develop extensions.

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ITEM TRACKING DESIGN

In the first version of Item Tracking in Microsoft Dynamics NAV 2.60, serial numbers or lot numbers were recorded directly on item ledger entries. This design provided full availability information and simple tracking of historic entries, but it lacked flexibility and functionality.

From Microsoft Dynamics NAV 3.00, item tracking functionality was in a separate object structure with intricate links to posted documents and item ledger entries. This design was flexible and rich in functionality, but item tracking entries were not fully involved in availability calculations.

Since Microsoft Dynamics NAV 3.60, item tracking functionality is integrated with the reservation system, which handles reservation, order tracking, and action messaging. For more information, see "Reservation, Order Tracking, and Action Messaging" in "Supply Planning".

This latest design incorporates item tracking entries in total availability calculations throughout the system, including planning, manufacturing, and warehousing. The old concept of carrying serial and lot numbers on the item ledger entries is reintroduced to ensure simple access to historical data for item tracking purposes. In connection with item tracking improvements in Microsoft Dynamics NAV 3.60, the reservation system was expanded to non-order network entities, such as journals, invoices, and credit memos.

With the addition of serial or lot numbers, the reservation system handles permanent item attributes while also handling intermittent links between supply and demand in the form of order tracking entries and reservation entries. Another different characteristic of serial or lot numbers compared to the conventional reservation data is the fact that they can be posted, either partially or fully. Therefore, the **Reservation Entry** table (T337) now works with a related table, the **Tracking Specification** table (T336), which manages and displays summing across active and posted item tracking quantities. For more information, see Active versus Historic Item Tracking Entries.

The following diagram outlines the design of item tracking functionality in Microsoft Dynamics NAV 2013.
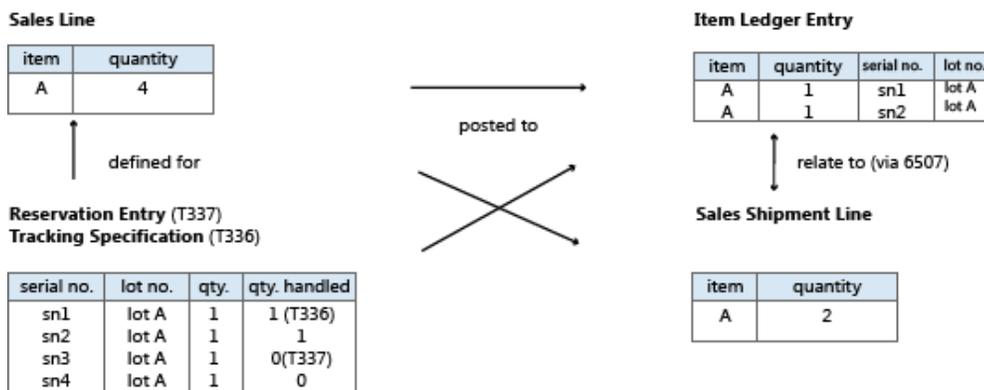
The central posting object is redesigned to handle the unique subclassification of a document line in the form of serial or lot numbers, and special relation tables are added to create the one-to-many relations between posted documents and their split item ledger entries and value ledger entries.

Codeunit 22, **Item Jnl. – Post Line**, now splits the posting according to the item tracking numbers that are specified on the document line. Each unique item tracking number on the line creates its own item ledger entry for the item. This means that the link from the posted document line to the associated item ledger entries is now a one-to-many relation. This relation is handled by the following item tracking relation tables.

Table	Description
Item Entry Relation (T6507)	Relates shipped or received lines to item ledger entries
Value Entry Relation (T6508)	Relates invoiced lines to value entries

For more information, see Item Tracking Posting Structure.

ITEM TRACKING POSTING STRUCTURE

To align with inventory costing functionality and to obtain a simpler and more robust solution, item ledger entries are used as the primary carrier of item tracking numbers.

Item tracking numbers on order network entities and non-order network entities are specified in the **Reservation Entry** table (T337). Item tracking numbers that are related to historical information are retrieved directly from the item ledger entries that are related to the transaction in question. This means that item ledger entries reflect the item tracking specification of the posted order line.

The **Item Tracking Lines** window retrieves the information from T337 and the item ledger entries and shows it through the temporary table, **Tracking Specification** (T336). T336 also hold the temporary data in the **Item Tracking Lines window** for item tracking quantities that remain to be invoiced.

ONE-TO-MANY RELATION

The **Item Entry Relation** table, which is used to link a posted document line with its related item ledger entries, consists of two main parts:

- A pointer to the posted document line, the **Order Line No.** field.
- An entry number pointing to an item ledger entry, the **Item Entry No.** field.

The functionality of the existing **Entry No.** field, which relates an item ledger entry to a posted document line, handles the typical one-to-one relation when no item tracking numbers exist on the posted document line. If item tracking numbers exist, then the **Entry No.** field is left blank, and the one-to-many relation is handled by the **Item Entry Relation** table. If the posted document line carries item tracking numbers but only relates to a single item ledger entry, then the **Entry No.** field handles the relation, and the no record is created in the **Item Entry Relation** table.

CODEUNITS 80 AND 90

To split the item ledger entries during posting, the code in codeunit 80 and codeunit 90, is encircled by loops that run through global temporary record variables. This code calls codeunit 22 with an item journal line. These variables are initialized when item tracking numbers exist for the document line. To keep the code simple, this looping structure is always used. If no item tracking numbers exist for the document line, then a single record is inserted, and the loop runs only once.

POSTING THE ITEM JOURNAL

Item tracking numbers are transferred via the reservation entries that relate to the item ledger entry, and the looping through item tracking numbers occurs in codeunit 22. This concept works in the same way when an item journal line is used indirectly to post a sale or purchase order as when an item journal line is used directly. When the item journal is used directly, the **Source Row ID** field points to the item journal line itself.

CODE UNIT 22

Codeunits 80 and 90 loop the call of codeunit 22 during the invoice posting of item tracking numbers and during the invoicing of existing shipments or receipts.

During quantity posting of item tracking numbers, codeunit 22 retrieves item tracking numbers from the entries in T337 that relate to the posting. These entries are placed directly on the item journal line.

Codeunit 22 loops through the item tracking numbers and splits the posting into the respective item ledger entries that carry the item tracking numbers. Information about which item ledger entries are created is returned to T337 by using a temporary T336 record, which is called by a procedure in codeunit 22. This procedure is triggered when codeunit 22 has finished its run because at that point, the codeunit 22 object contains the information. When the temporary T336 record is retrieved, codeunits 80 and 90 create records in the **Item Entry Relation** table to link the created item ledger entries to the created shipment or receipt line. Codeunits 80 or codeunit 90 then converts the temporary T336 records to real T336 records that are related to the line in question. However, this conversion occurs only if the posted document line is not deleted, because it is only partially posted.

ACTIVE VERSUS HISTORIC ITEM TRACKING ENTRIES

When parts of a document line quantity are posted, only that particular quantity is transferred to the item ledger entries and its item tracking numbers. However, you will want to access all relevant item tracking information directly from the active document line. That is, not only will you want to see the entries that are related to the remaining quantity, you will also want information about the units that have been posted. When you view or modify the **Item Tracking Lines** window, the collective contents of the **Tracking Specification** table (T336) and **Reservation Entry** table (T337) are presented in a temporary version of T336. This ensures that historic and active item tracking data is accessed as one.

The following table shows how T336 and T337 are used in a purchase scenario. The bold figures represent values that the user manually enters in the **Item Tracking Lines** window.

	Quantity (Base)	Qty. to Handle	Qty. to Invoice (Base)	Quantity Handled (Base)	Quantity Invoiced (Base)
Step 1: Create a purchase order line of seven pieces with item tracking numbers.					
T337	7	0	0	0	0
T336	0	0	0	0	0
Step 2: Receive four pieces.					
Item Tracking Lines window	7	**4**	**0**	0	0
T337	3	0	0	0	0
T336	4	0	0	4	0
Step 3: Receive two pieces and invoice two pieces.					
Item Tracking Lines window	7	**2**	**2**	4	0
T337	1	0	0	0	0
T336	6	0	0	6	2
Step 4: Receive one piece.					
Item Tracking Lines window	7	**1**	**0**	6	2
T336	7	0	0	7	2
Invoice 5 pieces.					
Item Tracking Lines window	7	0	**5**	7	2
T336	7	0	0	7	7

ITEM TRACKING LINES WINDOW

Item tracking records and reservation records are created in the reservation system, and their availability is calculated dynamically. Data that is entered in the **Item Tracking Lines** window is managed in a temporary version of the **Tracking Specification** table. When the window is closed, the active data is committed to the **Reservation Entry** table and the historic data is committed to the **Tracking Specification** table. For more information, see Active versus Historic Item Tracking Entries.

Lookups from the **Serial No.** and **Lot No.** fields show availability based on both the **Item Ledger Entry** table and the **Reservation Entry** table, with no date filter. The matrix of quantity fields on the header of the **Item Tracking Lines** window dynamically displays the quantities and sums of item tracking numbers that are being entered on the lines of the window. The quantities must correspond to those of the document line, which is indicated by **0** in the **Undefined** fields in the header of the window.

To coordinate the flow of serial and lot numbers through inventory, the following rules exist for entering data in the **Item Tracking Lines** window:

- For both inbound and outbound item tracking lines, you cannot enter a serial number, with or without a lot number, more than once in the same instance of the **Item Tracking Lines** window. If you try to enter any combination of serial or lot numbers that is already present in the window, then an error message blocks the data entry.
- For inbound item tracking lines, you cannot post the related document if an item of the same variant and with the same serial number is already in inventory. If you try to post a positive line for an inventory item with the same variant and serial number, then an error message blocks the posting. However, for both inbound and outbound item tracking lines on open documents, you can have the same combination of serial or lot numbers that relate to different source document lines, that is, existing in different instances of the **Item Tracking Lines** window until the related document is posted.
- If the item is set up for serial number-specific tracking or lot number- specific tracking, then you cannot post an outbound document line unless an item with the defined serial or lot number exists in inventory. If you try to post an outbound document line for an item with a serial lot number that is not in inventory, then an error message blocks the posting.

The rules for entering data in the **Item Tracking Lines** window also support the coupling principles that govern order tracking, planning, and reservation. For more information, see Item Tracking and Planning.

ITEM TRACKING AVAILABILITY

The **Item Tracking Lines** and **Item Tracking Summary** windows provide dynamic availability information for serial or lot numbers. The purpose of this is to increase transparency for users on outbound documents, such as sales orders, by showing them which serial numbers or how many units of a lot number are currently assigned on other open documents. This reduces uncertainty that is caused by double allocation and instills confidence in order processors that the item tracking numbers and dates that they are promising on unposted sales orders can be fulfilled. For more information, see Item Tracking Lines Window.

When you open the **Item Tracking Lines** window, availability data is retrieved from the **Item Ledger Entry** table and the **Reservation Entry** table, with no date filter. When you choose the **Serial No.** field or the **Lot No.** field, the **Item Tracking Summary** window opens and shows a summary of the item tracking information in the **Reservation Entry** table. The summary contains the following information about each serial or lot number on the item tracking line:

Field	Description
Total Quantity	The total quantity of the serial or lot number that is currently in inventory.
Total Requested Quantity	The total quantity of the serial or lot number that is currently requested in all documents.
Current Pending Quantity	The quantity that is entered in the current instance of the **Item Tracking Lines** window but is not yet committed to the database.
Total Available Quantity	The quantity of the serial or lot number that is available for the user to request. This quantity is calculated from other fields in the window as follows: *total quantity* – (*total requested quantity* + *current pending quantity*).

📝 **Note**
You can also see the information in the preceding table by using the **Select Entries** function in the **Item Tracking Lines** window.

To preserve database performance, availability data is only retrieved once from the database when you open the **Item Tracking Lines** window and use the **Refresh Availability** function in the window.

CALCULATION FORMULA

As described in the preceding table, the availability of a given serial or lot number is calculated as follows.

total available quantity = *quantity in inventory* – (*all demands* + *quantity not yet committed to the database*)

🔹 **Important**
This formula implies that the serial or lot number availability calculation considers only inventory and ignores projected receipts. Accordingly, supply that is not yet posted to inventory does not affect item tracking availability, as opposed to regular item availability where projected receipts are included.

ITEM TRACKING AND PLANNING

Because they are stored in the reservation system, item tracking numbers are fully coordinated with order tracking records. This means that items with order tracking records can be assigned item tracking numbers. Conversely, items that have item tracking numbers can become order tracking records. For more information, see Item Tracking Design.

For more information about the integrated reservation system, see the "Reservation, Order Tracking, and Action Messaging" section in the Supply Planning in Microsoft Dynamics NAV 2013 white paper.

Because order tracking is only concerned with specific item application, the coordination with item tracking numbers only applies to items that are set up to use specific item tracking. This is set by the **SN Specific Tracking** and **Lot Specific Tracking** fields on the item card, which specify the following:
- The item must carry a serial number or lot number when it is posted.
- The item must apply to the same serial number or lot number when it is posted outbound.

In alignment with standard supply/demand balancing principles, the planning system and the related order tracking feature only match supply and demand carrying item tracking numbers if the item in question uses specific item tracking. In all other cases, the planning and order tracking systems ignore item tracking numbers when they apply supply to meet demand or apply demand to supply.

For example, when order tracking exists for a given item, it implies that records for the item are already in the **Reservation Entry** table, which is the core of the reservation system, before the item tracking numbers are defined. Therefore, the following coupling restrictions apply to the item tracking numbers to be order tracked.
- Demand with a serial number or lot number can only cover supply with the same serial number or lot number.
- Demand without a serial or lot number can cover any supply, with or without a serial or lot number.

Apart from their consequences on dynamic order tracking, the item tracking coupling restrictions do not affect the planning system significantly.

On the supply side, a serial or lot number is typically not entered until immediately before the order is posted, such as a purchase receipt into the warehouse. When entering a serial or lot number on the demand side, such as on a sales order, that serial or lot number is already in inventory. Accordingly, item tracking numbers are typically not an issue in supply planning.

For items that use specific item tracking, all demand carrying serial or lot numbers must be matched by corresponding supply. In most cases, it does not make sense to reorder a specific serial or lot number, so the planning of purchase or production supplies is probably not affected. However, when transferring items from one location to another, it is likely that the transfer is for a specific lot, so planning transfer supplies might be affected by the specific coupling restriction.

For more information, see the "Transfers in Planning" section in the Supply Planning in Microsoft Dynamics NAV 2013 white paper.

BALANCING DEMAND AND SUPPLY

If an item requires specific item tracking, then an order tracking link is made from all the item's item tracking demand to any corresponding item tracking supply, with the sole limitation that supply should come before demand. If, under those circumstances, no item tracking supply can be found that corresponds to the item tracking-specific demand, then a new item tracking supply is created immediately and without considering order sizing, planning parameters, or rescheduling of existing supply of the same serial or lot number.

If item tracking numbers are assigned on the demand side or on the supply side without requiring specific item tracking, then an order track link is made from the demand to that supply, based on the most suitable timing and quantity, as in the usual balancing procedure. The specified item tracking number goes into the order tracking record in the same way that any specified item tracking quantity defines one end of the order tracking link. This means that the item tracking number that is entered is preserved while it is also part of the order tracking record.

If item tracking numbers are assigned on the supply side without requiring specific item tracking, then this supply is regarded as fixed by the planning system. No resizing or rescheduling is suggested for this supply, but the supply is taken into consideration when the planning system tries to meet the gross requirements.

For more information, see the "Balancing Demand and Supply" section in the Supply Planning white paper.

ITEM TRACKING AND RESERVATIONS

Simultaneous use of reservation and specific item tracking is uncommon, because they both create a coupling between supply and demand. Except for situations where a customer or production planner requests a specific lot, it rarely makes sense to reserve inventory items that already carry item tracking numbers for specific application. Although it is possible to reserve items that require specific item tracking, special functionality is needed to avoid availability conflicts between order processors that request the same item-tracked items.

The concept of Late Binding ensures that a nonspecific reservation of a serial number or a lot number remains loosely coupled until posting. At posting time, the reservation system can reshuffle nonspecific reservations to ensure that fixed application is possible against the serial or lot number that is actually picked. Meanwhile, the serial or lot number is made available for specific reservation in other documents that request that particular serial or lot number.

A nonspecific reservation is one in which the user does not care which specific item is picked, and a specific reservation is one in which the user does care.

📝 **Note**
   The Late Binding functionality relates only to items that are set up with specific item tracking, and it applies only to reservations against inventory, not against inbound supply orders.

Reservation of item tracking numbers falls into two categories, as shown in the following table.

Reservation	Description
Specific	You select a specific serial or lot number when you reserve the inventory item from a demand, such as a sales order. This is a regular reservation. It is a rigid link between supply and demand that both carry serial or lot numbers. 📝 **Note** The demand carries serial or lot numbers. For example, you want to reserve a can of blue paint from Lot A, because the customer requests it. A can of blue paint from Lot A is shipped to the customer.
Nonspecific	You do not select a specific serial or lot number when you reserve the inventory item from a demand, such as a sales order. This is a state that is imposed on a reservation entry for serial or lot numbers that are not selected specifically. 📝 **Note** The demand does not carry serial or lot numbers. For example, you want to reserve a can of blue paint from any lot for your sales order. A can of blue paint from a random serial or lot number is shipped to the customer.

The main difference between specific and nonspecific reservation is defined by the existence of serial or lot numbers on the demand side, as shown in the following table.

	Supply	Demand
Specific	Serial or lot number.	Serial or lot number.
Nonspecific	Serial or lot number.	No serial or lot number.

When you reserve inventory quantities from an outbound document line for an item that has item tracking numbers assigned and is set up for specific item tracking, the **Reservation** window leads you through different workflows depending on your need for the serial or lot numbers.

SPECIFIC RESERVATION

When you choose **Reserve** from the outbound document line, a dialog box appears that asks you if you want to reserve specific serial or lot numbers. If you choose **Yes**, then a list is displayed with all the serial or lot numbers that are assigned to the document line. The **Reservation** window opens after you select one of the serial or lot numbers, and you can then reserve among the selected serial or lot numbers in a typical fashion.

If some of the specific item tracking numbers that you are trying to reserve are held in nonspecific reservations, then a message at the bottom of the **Reservation** window informs you how many of the total reserved quantity are held in nonspecific reservations and whether they are still available.

NONSPECIFIC RESERVATION

If you choose **No** in the dialog box that appears, the **Reservation** window opens and allows you to reserve among all serial or lot numbers in inventory.

Because of the structure of the reservation system, when you place a nonspecific reservation on an item-tracked item, the system must select specific item ledger entries to reserve against. Because the item ledger entries carry the item tracking numbers, the reservation indirectly reserves specific serial or lot numbers, even though you did not intend to. To handle this situation, the reservation system tries to reshuffle nonspecific reservation entries before posting.

The system actually still reserves against specific entries, but then it uses a reshuffling mechanism whenever there is specific demand for the lot or serial number in the nonspecific reservation. This can be the case when you post a demand transaction, such as a sales order, consumption journal, or transfer order, for the serial or lot number, or when you try to specifically reserve the serial or lot number. The system reshuffles the reservations to make the lot or serial number available to the demand or to the specific reservation, thereby placing a different lot or serial number in the nonspecific reservation. If there is insufficient quantity in inventory, the system reshuffles as much as possible, and you receive an availability error if there is still insufficient quantity at the time of posting.

📝 **Note**
> On a nonspecific reservation the lot number or serial number field is blank in the reservation entry that points at the demand, such as the sale.

RESHUFFLE

When a user posts an outbound document after picking the wrong serial or lot number, other nonspecific reservations are reshuffled to reflect the actual serial or lot number that is picked. This satisfies the posting engine with a fixed application between supply and demand.

For all supported business scenarios, reshuffling is possible only against positive item ledger entries that carry reservation and serial or lot numbers but without defined serial or lot numbers on the demand side.

SUPPORTED BUSINESS SCENARIOS

The Late Binding functionality supports the following business scenarios:

- Entering a specific serial or lot number on an outbound document with nonspecific reservation of a wrong serial or lot number.
- Reserving a specific serial or lot number.
- Posting an outbound document with nonspecific reservation of a serial or lot number.

ENTERING SERIAL OR LOT NUMBERS ON AN OUTBOUND DOCUMENT WITH WRONG NONSPECIFIC RESERVATION

This is the most common of the three supported scenarios. In this case, the Late Binding functionality ensures that a user can enter a serial or lot number, which is actually picked, on an outbound document that already has a nonspecific reservation of another serial or lot number.

For example, the need arises when an order processor has first made a nonspecific reservation of any serial or lot number. Later when the item is actually picked from inventory, the picked serial or lot number must be entered on the order before it is posted. The nonspecific reservation is reshuffled at posting time to ensure that the picked serial or lot number can be entered without losing the reservation and to ensure that the picked serial or lot number can be fully applied and posted.

RESERVE SPECIFIC SERIAL OR LOT NUMBERS

In this business scenario, Late Binding functionality ensures that a user who is trying to reserve a particular serial or lot number that is currently nonspecifically reserved can do so. A nonspecific reservation is reshuffled at the time of reservation to free the serial or lot number for the specific request.

The reshuffle happens automatically, but embedded Help is displayed at the bottom of the **Reservation** window and shows the following text:

XX of the Total Reserved Quantity are nonspecific and may be available.

In addition, the **Nonspecific Reserved Qty.** field shows how many reservation entries are nonspecific. By default, this field is not visible to users.

POSTING AN OUTBOUND DOCUMENT WITH NONSPECIFIC RESERVATION OF SERIAL OR LOT NUMBERS

This business scenario is supported with Late Binding functionality that enables fixed application and outbound posting of what is actually picked by reshuffling another nonspecific reservation of a serial or lot number. If reshuffling is not possible, then the following standard error message appears when the user tries to post the shipment:

Item XX cannot be fully applied.

ITEM TRACKING IN THE WAREHOUSE

Serial number or lot number handling is primarily a warehouse task, and therefore all inbound and outbound warehouse documents have standard functionality for assigning and selecting item tracking numbers.

However, because the reservation system is based on item ledger entries, warehouse activity documents that register only warehouse entries are not fully supported. Because reservations and item tracking numbers can be handled only at the location level, not at the bin and zone level, the **Item Tracking Lines** window, cannot be opened from warehouse activity documents. The same applies to the **Reservation** window.

After a serial or lot number has been added to a location inventory, it can be moved and reclassified freely in the warehouse by using an independent item tracking structure that is unrelated to the reservation system. **Serial No.** and **Lot No.** fields are accessed directly on warehouse document lines. When the serial or lot number later partakes in outbound posting, it is synchronized with the reservation system as a part of ordinary bin adjustment. For more information, see "Integration with Inventory" in "Warehouse Management".

However, the reservation system does take warehouse activities into consideration when it calculates availability. For example, items that are allocated to picks, or registered as picked, cannot be reserved. For more information, see the "Warehouse Availability" section in the Warehouse Management in Microsoft Dynamics NAV 2013 white paper.

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