INTEGRATED

Microsoft Dynamics™ NAV 5.0

Item Tracking

Technical White Paper

This paper describes the design of the item tracking system in Microsoft Dynamics NAV. It also briefly outlines the serial/lot number features of earlier Navision versions. The functionality referred to in version 3.60 also applies to 3.70, 4.0 and 5.0.

The document is aimed at a broad Microsoft Dynamics NAV audience and, therefore, it focuses on conceptual and logical design. Design details are provided in Appendix A.

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Microsoft Dynamics™

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Introduction

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. While monitoring an item's transaction flow is a legal requirement in the business of medical and chemical supply, other businesses may wish to monitor products with warranties or expiration dates for customer service reasons.

Essentially, an item tracking system should provide a company with easy handling of serial and lot numbers, taking into account each unique piece of merchandise: when and where received, where stored, as well as when and where sold.

Microsoft Dynamics NAV has gradually expanded its coverage of this business requirement and today the program provides application-wide functionality and a solid core on which to develop extensions.
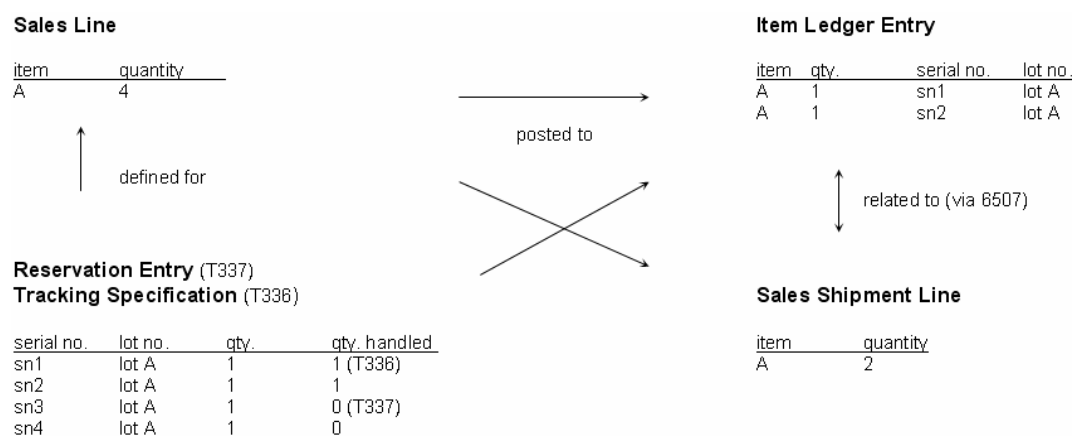
Item Tracking with Navision 3.60 and Higher

The objective of the item tracking project for Navision 3.60 was to fully embed the functionality into the program to optimize the RTAM structure in order to ensure seamless integration of order tracking, reservation, and item tracking in the same engine. The RTAM was expanded to non-order network entities such as journals, invoices, and credit memos. This incorporates item tracking entries in total availability calculations throughout the system, including planning, manufacturing, and warehousing.

The following sections merely outline the design. More details on individual objects and their relations are available in Appendix A.

Design

The RTAM engine now handles a type of item specification that is permanent, and not merely a link between intermittent supply and demand. Additional objects are created to solve this, and the existing item repository reincorporated; the old concept of carrying serial and lot numbers to the item ledger entries is reintroduced to ensure simple access to historical data for item tracking purposes. Another different attribute of item tracking numbers, compared to the conventional RTAM data, is the fact that they may be posted—either fully or partially. Therefore, the Reservation Entry table now works in conjunction with a sister table, the Tracking Specification table, which manages and displays summing across active and posted item tracking quantities. The central posting object is redesigned to handle the unique subclassifications of a document line in the form of serial/lot numbers, and a special relation table is added to create the one-to-many relations between posted documents and their split item ledger entries.

Sales Line

item	quantity
A	4

defined for ↑

posted to →

Item Ledger Entry

item	qty.	serial no.	lot no.
A	1	sn1	lot A
A	1	sn2	lot A

related to (via 6507) ↕

Reservation Entry (T337)
Tracking Specification (T336)

serial no.	lot no.	qty.	qty. handled
sn1	lot A	1	1 (T336)
sn2	lot A	1	1
sn3	lot A	1	0 (T337)
sn4	lot A	1	0

Sales Shipment Line

item	quantity
A	2

Posting Structure

Codeunit 22, Item Jnl. –Post Line, (CU22) now splits the posting according to the item tracking numbers 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. Special item tracking relation tables handle this for posting and lookup situations:

- **Table 6507 Item Entry Relation (T6507): between shipped/received lines and item ledger entries**

- **Table 6508 Value Entry Relation (T6508): between invoiced lines and value entries**

Active versus Historic Entries

When parts of a document line quantity are posted, only that particular quantity is transferred to the item ledger entries along with its item tracking numbers. However, we want to access all relevant item tracking information directly from the active document line. That is, not only do we want to see the entries related to the remaining quantity, we also want information about the units that have been posted. When you view or modify the Item Tracking Lines form, 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 usage of T336 and T337 is clarified by the flow through a purchase order scenario, as demonstrated in the table below. The shaded lines symbolize the lines shown in the Item Tracking Lines form, and the bold figures are the ones typed in by the user before activating the posting procedure for the next step.

	Quantity	Qty. to Handle	Qty. to Invoice	Qty. Handled	Qty. Invoiced
Create purchase order line of 7 pcs. with item tracking numbers					
T337	7				
(T336)				0	0
Receive 4 pcs.					
	7	**4**	**0**	0	0
T337	3				
T336	4			4	0
Receive 2 pcs. and invoice 2 pcs.					
	7	**2**	**2**	4	0
T337	1				
T336	6			6	2
Receive 1 piece					
	7	**1**	**0**	6	2
T336	7			7	2
Invoice 5 pcs.					
	7		**5**	7	2
T336	7			7	7
End content					
	7			7	7

Item Tracking Lines Form

Item tracking records are created in the RTAM engine alongside reservation records, and they are selected from their calculated availability at any time. Data entered in the Item Tracking Lines form is created in a temporary version of T336 and committed to T337 (live) and T336 (historic) when the form is closed.

Lookups from the serial/lot number fields show availability based on both the Item Ledger Entry table (T32) and the Reservation Entry table (T337), with no date filter. The matrix of quantity fields in the Item Tracking Lines form header dynamically displays the quantities and sums of item tracking numbers being defined in the form. The quantities must correspond to those of the document line, which is indicated by 0 in the Undefined fields.

To coordinate the flow of serial and lot numbers through inventory, a set of rules is implemented for handling these records via the Item Tracking Lines form:

- **For both positive and negative item tracking lines, you cannot use a serial number, with or without a corresponding lot number, more than once in the same item tracking form. If you try to enter any combination of serial number with/without lot number that is already present in the form, the program shows an error message and prevents the record.**

- **For positive item tracking lines, you cannot post 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 when there are items in inventory carrying the same variant and serial number, the program shows an error message and aborts the posting. However, both for positive and negative item tracking lines on open documents, you can have the same combination of serial number with/without lot number relating to different source lines (that is, existing in different item tracking forms) until posting.**

- **When requiring SN/LN specific tracking, you cannot post an outbound line if there are no items with the defined serial number with or without lot number in inventory. If you try to post an outbound line for an item with a serial/lot number combination that is not in inventory, the program shows an error message and aborts the posting.**

The preceding rules for entering item tracking numbers in the item tracking form support the coupling principles that govern order tracking, planning and reservation. See the section Integration with the Planning Engine.

For details about the processes behind the Item Tracking Lines form, see Appendix A, Posting Structure.

Availability Information in Microsoft Dynamics NAV 5.0

In version 5.0, enhanced availability information is introduced into the Item Tracking Lines and Item Tracking Summary forms. The purpose of this is to increase transparency, allowing users to see how much of a lot or serial number is currently being used on other documents, thereby reducing errors and uncertainty caused by double allocations.

When you open the Item Tracking Lines form, the program collects availability data based on the Item Ledger Entry table (T32) and the Reservation Entry table (T337), with no date filter. When you perform a lookup from the serial or lot number fields, the program opens the Item Tracking Summary window using a temporary version of the Entry Summary table (T338), which contains a summary of the information in T337. This temporary Entry Summary table contains information on each lot or serial number's total requested quantity, current pending quantity, total available quantity, and current reserved quantity. This same information is shown when you use the Select Entries function from the Functions menu.

As a performance measure, the program collects this availability data only once from the database when the form is opened, only refreshing it when the form is closed and when you use the Refresh Availability function from the Item Tracking Lines form.

The availability calculation for a given lot or serial number is:

Total Available = Quantity on Inventory – (All Demands + Quantity not yet saved in the Database)

This means that supply, which is not yet posted to inventory, will not affect availability.

If the quantity of the lot or serial number that you select is not available, according to the described formula, the Item Tracking Lines form shows a warning icon, from which you can drill down to a form that shows the fields that are used in the availability calculation. From here, you can drill down further to find where quantities of a lot or serial number are allocated.

Integration with the Planning Engine

Item tracking is fully integrated with order tracking. This means that items with order tracking records can be assigned item tracking numbers, and vice versa.

Note: In this respect, both the planning engine and the reservation engines are concerned with specific item application only. Therefore, the item in question must be set up to use specific item tracking. SN/Lot Specific Tracking check marks:

- **must carry serial/lot number when posted.**

- **must apply to same serial/lot number when posted outbound.**

When, for example, order tracking exists for a given item, it implies that records will be in T337 even before item tracking numbers are defined. The program, therefore, dictates certain coupling restrictions concerning the item tracking numbers to be reserved or order tracked. The implemented principles are adopted from Navision 2.60:

- **Demand with serial/lot number can only cover supply with the same serial/lot number.**

- **Demand without serial/lot number can cover any supply—with or without serial/lot number.**

Planning and Order Tracking with Item Tracking

As implemented in the RTAM engine, the planning engine is only concerned with serial/lot numbers if set up for specific item application. The planning system will only require a specific match if specific item tracking is required. In all other cases, the system will ignore item tracking numbers when applying supply to meet demand—and vice versa.

Normally, a serial/lot number will only be specified immediately before posting a replenishment order. When pre-specifying a serial/lot number on the demand side, that number will already be in inventory. Consequently, item tracking numbers are not much of an issue when planning supply. However, after calculating a plan, the order network must be in balance—also concerning item tracking. For items using specific item tracking, all demand carrying serial/lot numbers must be matched by corresponding supply. In most cases, it does not make much sense to reorder a specific lot or serial number, but, in transferring from one location to another, it will be unnatural not to ask for the transfer of a specific lot.

Integration with the Reservation Engine

Simultaneous use of reservation and specific item tracking is uncommon, as they both create a coupling between supply and demand. Except for situations where a customer or production planner requests a specific lot, it will rarely make sense to reserve inventory items that already carry item

tracking numbers for specific application. However, it is possible for you to place reservations on items that require item tracking.

These reservations fall into two categories: nonspecific reservations, where lot and serial numbers are not specified at the time of reservation, and specific reservations, where you reserve specific lot or serial numbers from inventory.

On a nonspecific reservation the lot number or serial number field is blank in the reservation entry pointing at the demand (for instance, the sale).

In Microsoft Dynamics NAV 5.0 there are improvements that make the use of inventory reservations on item-tracked items easier (see "Nonspecific Reservations" below.)

Nonspecific Reservations

Because of the structure of the reservation system, when you place a nonspecific reservation on an item-tracked item in inventory, the program must nevertheless select specific item ledger entries to reserve against. Since the item ledger entries carry the item tracking information, the reservation therefore indirectly reserves specific lot or serial numbers, even though you did not intend this.

In versions earlier than 5.0, this has the potential to cause conflicts in several situations. For example, when you:

- Post a demand transaction, such as a sales order, with lot or serial numbers that were already nonspecifically reserved on another demand transaction. The program shows an error.

- Try to place a specific reservation on the same item tracking number that was used for the nonspecific reservation. The program shows that the item-tracking number is not available.

- Try to assign an item tracking number to a nonspecifically reserved item. The program deletes the reservation.

Version 5.0 implements late binding, this allows the program to handle the interaction of nonspecific and specific reservations.

The program actually still reserves against specific entries, but then 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 lot or serial number, or when you try to specifically reserve the lot or serial number. The program reshuffles the reservations to make the lot or serial number available to the demand or the specific reservation, thereby placing a different lot or serial number in the nonspecific reservation. If there is not sufficient quantity in inventory, the program reshuffles as much as possible, and you will receive an availability error if there is still insufficient quantity at the time of posting.

Specific Reservations

The reservation of an item carrying item tracking numbers takes you into a special workflow based on the following design:

When opening the Reservation window from a document line carrying item tracking *and running specific item tracking*, the program opens a list of all serial/lot numbers that exist on that line. The Reservation window opens only after selecting one of these, and you can then reserve from the selected serial/lot number combination.

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

Solution Synopsis

This section describes in more detail the concepts behind item tracking in planning. For more information, please refer to the Microsoft Dynamics NAV white paper, "Supply Planning".

If specific item tracking has been requested, an order track will be made from all item tracking demand to any corresponding item tracking supply, with the sole limitation that supply should come before demand. If, under those circumstances, the program cannot find corresponding item tracking supply for the item tracking-specific demand, a new item tracking supply is created immediately and without considering order sizing, planning parameters, or rescheduling existing supply of the same serial/lot number.

If item tracking numbers are specified on the demand side and/or the supply side, but without requiring specific item tracking application, the program creates an order track from the demand to that supply, based on the most suitable regarding timing and quantity (normal planning procedure). The specified item tracking number goes into the order tracking in the same way that any specified item tracking quantity defines the one end of the order track. This means that the program preserves the item tracking number entered, but lets it be part of the order track.

If item tracking numbers are specified on the supply side, but without requiring specific item tracking application, the program regards this supply as fixed from a planning perspective. The program does not suggest the resizing or rescheduling of this supply, but it will, of course, take it into consideration when investigating how the gross requirement can be met.

Integration with Warehouse Management Systems

Serial/lot number handling is primarily a warehouse task and, accordingly, all the inbound and outbound warehouse documents have features for assigning and selecting item tracking numbers. The RTAM engine does not consider the internal warehouse structure, meaning that it is only possible to assign reservation and item tracking to locations, not zones or bins. Once an item is in the warehouse and part of the inventory, the warehouse employees can transfer, reclassify, and move the item between zones and bins using an independent item tracking structure, which is synchronized with the RTAM engine.

In versions 3.60 and 3.70, the RTAM engine does not take into consideration warehouse activities when calculating availability. Therefore, a serial number or a lot number is only either inbound or in an inventory location. This has been changed in Microsoft Dynamics NAV 4.0 and higher, where the RTAM engine takes warehouse activities into consideration when calculating availability. Items that are allocated to picks, or registered as picked, cannot be reserved. Refer to the Microsoft Dynamics NAV white paper, "Warehouse Management Systems" for detailed information.

Advantages (Navision 3.70 and higher)
- No conflict with reservation and order tracking

- Centralized

- Easier to customize (changes to core affect all related areas)

Disadvantages (Navision 3.60 and higher)
- **Central objects (F6510, CU6500)** control many scenarios and require in-depth developer knowledge to customize.

Glossary

RTAM

Reservation, Tracking and Action Messaging

Note: Originally a Navision project that now refers to a complete system foundation.

Quantity to handle

Quantity to receive/ship/transfer in the Item Tracking Lines form.

Note: The Item Tracking Lines form is almost the same for all document types and, therefore, the quantity fields are generic.

specific tracking

Setup option for an item tracking number assigned to a specific item.

Note: Indicates that the item must be applied specifically against an existing serial/lot number when posted outbound.

split line

One document line split into several item ledger entries.

For example: One sales line of four serial numbers is posted as four individual item ledger entries.

order/non-order network entity

Any document line representing supply or demand.

Abbreviation: ONE/NONE

Appendix A

Posting Structure—Navision 3.60 and higher

In order to align with the costing area and to obtain a simpler and more robust solution, Item Ledger Entry (ILE) is used as the primary carrier of Item Tracking (IT). The main concept is that IT on Order Network Entities (ONEs) and Non-order Network Entities (NONEs) are specified in the Reservation Entry table (T337), whereas item tracking related to historical information is retrieved directly from the ILEs related to the transaction in question. This means that ILEs will be fragmented to the level of detail in the IT specification on the order line being posted.

The form used for showing IT retrieves the information from the ILEs and shows it in a temporary table. The Tracking Specification table (T336) is used as the basis for the temporary table, in which the IT information retrieved from T337 as well as from ILEs, is shown. Furthermore, the table actually carries data in the database when IT related to invoicing has been defined for an order, but not yet invoiced.

One-to-Many Relation

The relation table used for making the link between a posted document line and related ILEs consists of only two parts: a pointer to the document line and an entry number pointing at an ILE. The pointer for the document line is based on the standard six-field type. The current ILE field on the posted document line is retained; in cases where IT is not applied, the functionality is not changed, that is, there is a one-to-one relation between the posted line and an ILE. The current ILE field is left blank when a one-to-many relation is present. If the posted line carries IT, but only relates to one single ILE, the entry number field on the line is used and no relation record created.

Codeunits 80 and 90

In order to achieve the splitting of ILEs, the parts of the code in codeunit 80, Sales – Post (CU80) and codeunit 90, Purch.- Post (CU90) that call codeunit 22, Item Jnl.- Post Line (CU22) with an item journal line, have been encircled by loops running through some global temporary record variables. These variables are initialized with the IT defined for the posted line. In order to keep the code simple, this looping structure is always used; if no IT is defined for the line, a single record is inserted and the loop runs only once.

Posting of Item Journal

Item tracking is transferred via the reservation entries related to the ILE, and looping through IT is done in codeunit 22.

This concept works the same for both a journal line used indirectly during a sales posting and for a line used directly, such as in connection with a positive adjustment posting the journal line directly. In the latter case, the Source Row ID would then point at the line itself.

Codeunit 22

The IT posting routine is based on letting CU80 and CU90 loop the call of CU22 during invoicing of existing shipments/receipts.

When it comes to posting of availability, CU22 retrieves IT from the reservation entries related to the posting. These entries are placed directly on the journal line due to the transfer of reservations and IT must be read from there.

CU22 is responsible for looping the IT and splits the posting into the ILEs necessary to carry the IT information. Information regarding which ILEs have been created is returned using a temporary T336

record. This record could have been transferred back and forth as part of the parameter list for CU22 but, in order to interfere as little as possible, a procedure is added to CU22 for returning a temporary 336 data set. This procedure is triggered when CU22 has finished its run—at this point, the CU22 object contains the information.

After retrieving the temporary 336 record, CU80 and CU90 create records in the Item Entry Relation table (T6507) to link the created ILEs to the created shipment or receipt line. CU80 or CU90 then converts the temporary T336 records to real T336 records related to the line in question; however, this only happens if the posted document line is not deleted (only partially posted).

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