

Warehouse R_x[®] Inventory Management Software

Technical Overview



January 19, 2009

System Overview

Warehouse R_X[®] is the latest version of Daifuku America’s Warehouse Control System (WCS) software. It provides integrated inventory management and automated equipment control for today’s highly automated ASRS systems. Warehouse R_X[®] operates in either an “inventory management” mode where part specific data is maintained in the Warehouse R_X[®] data base or in a “load management” mode where Warehouse R_X[®] maintains only Load ID/Location information with no part specific knowledge. This document describes the “inventory management” mode of operation. There is a separate document that provides a functional overview of the “load management” mode of operation. Throughout the remainder of this document the Warehouse R_X[®] Inventory Management Software will be referred to as simply Warehouse R_X[®].

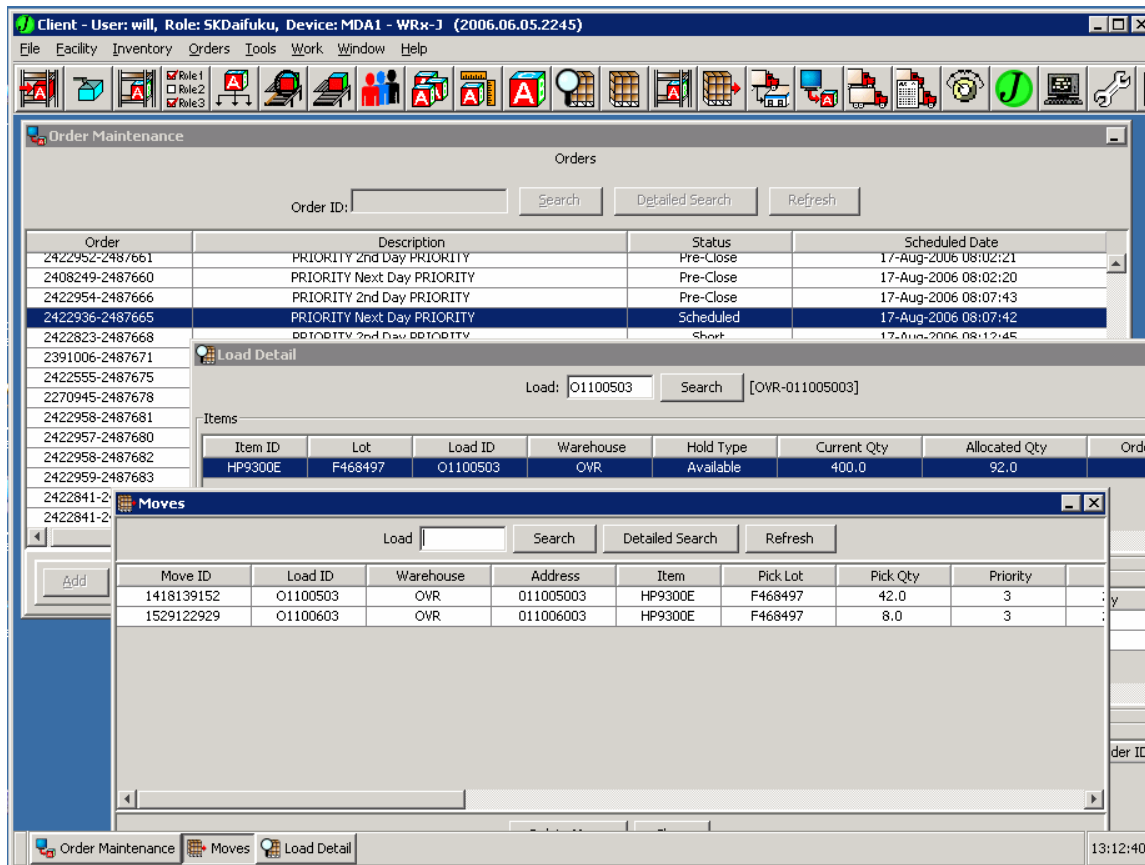
Warehouse R_X[®] - Major Features and Functions

Warehouse R_X[®] provides a rich compliment of functionality for managing your inventory and optimizing the use of your ASRS. The key features and functions to help you effectively manage your ASRS are listed below. Each of these functions is described in detail in the following sections.

- Navigating Warehouse R_X[®]
- Security Protection
- Real Time Inventory Management
- Expected Receipts
- Storing Material
- Ordering Material
- Scheduling and Allocation of Orders
- Picking Material
- Cycle Counting Material
- Managing and Monitoring Equipment
- System Logging
- Reporting
- Interfacing with Host Computers - Optional

Navigating Warehouse R_X[®]

Warehouse R_X[®] uses a Graphical User Interface, or “GUI” to navigate around the screens available. It has the look and feel of most programs that run on the Windows platform. The following figure shows an example of a Warehouse R_X[®] GUI main screen with multiple open user windows (Order Maintenance, Load Detail and Moves):



Security Protection

Security is a very important feature in any system that tracks and controls valuable inventory. In Warehouse RX[®], security features have been built in to insure that only authorized users have access to the system.

Each user is set up in the Warehouse RX[®] system by an administrator who has access to the “Users” set up screen as well as the “Roles” screen. These two screens allow the administrator to give each user a User ID, an encrypted password, and a “role”. The User ID and password are used to access the system, and the “role” is used to limit or allow access to the different screens of the system. Each user is assigned a “role” which determines what they have access to in the Warehouse RX[®] system. What this means is that the system controls what screens a user has access to and what users are allowed to do in each screen they are authorized to use.

Real Time Inventory Management

Under computer direction using location mapping and unique load ID’s, the system ensures accurate tracking of all inventory within the domain of Warehouse RX[®]. And since all transactions are recorded in real time as inventory moves, location and load/item status is always current.

In addition to the tracking accuracy of Warehouse R_X[®], the system includes tools that provide the inventory manager with the necessary visibility and control of the inventory to effectively manage the warehouse.

Those tools include:

- Item (part #) verification, views and editing
- Item quantity views and editing
- Lot control
- Load and location views
- Load and location editing

Item Attributes

Each item stored in the AR/RS has an Item Master record in Warehouse R_X[®]. The Item Master contains details of each item that can be stored in Warehouse R_X[®], such as the items ID, a description of the item, a cycle count point, and whether the Item Master should be deleted when the total quantity is picked to zero for that item. Item Master records are typically received through a host computer interface, but can be created locally on Warehouse R_X[®] using the Items screen. This screen is also used to modify or delete existing Item Master records.

Item Details

Each occurrence (load, item, lot combination and quantity) of an item in Warehouse R_X[®] is referred to as an Item Detail. Whereas the Item Master is descriptive of an item, an Item Detail is the actual inventory record stored on a load. The total inventory of an item in the AS/RS is the summation of all the Item Detail quantities. With the appropriate authorization a user can view, add, modify and delete item detail records for an Item.

Lot Control

In addition to an Item's ID, Warehouse R_X[®] lets you further identify, track, and order material by qualifying the Item ID with a lot designation. Each occurrence (item detail) of an item can be uniquely identified by its Load ID, item ID and lot number. When ordering material, users can request a specific lot of an item to fill the order or, by not specifying a lot, Warehouse R_X[®] will select the oldest item regardless of lot to fill the order.

Locations

Each load in the warehouse is assigned to a rack location when it is scheduled to be stored. The load-location mapping and associated information can be viewed using the Location screen. Just like users can view and edit Item Details by selecting them from the Load screen or the Item screen, they can also view and edit Load and Item Details for a selected location by double clicking the Location.

Container Types

Warehouse R_X[®] allows multiple types of loads such as wood pallet, plastic pallet, tray, tote, bin, etc. These are called container types. This allows a user to request the correct load type to store items on where multiple load types are used.

Loads

A load is the handling and tracking unit of the ASRS and its associated contents. The contents are referred to as items. A load can be empty (no items) or can contain a single item or multiple items. Users can view, and with the appropriate authorization, add, modify and delete loads and Item Details

on a load by selecting a Load ID on the Load screen. By double clicking a specific Load, all Item Details on that load are displayed.

Expected Receipts

Expected Receipts are used to identify material in advance of their arrival at the ASRS. Expected Receipts can be created using the Expected Receipt Screen or can be received from a host computer system. Warehouse R_X[®] will hold the expected receipt in its data base until the corresponding material arrives. Expected Receipts make storing material more efficient by not requiring a user to identify the material at storing time.

Storing Material

Storage of material can be done by a user who identifies items on a load that is ready for induction into the ASRS and then releases the load to storage. Or, if an expected receipt has been received, that user can simply enter the Expected Receipt ID and release the load to storage. Warehouse R_X[®] will use the data from the Expected Receipt to create a new Load Record. Finally, if automatic bar code scanners are utilized, Warehouse R_X[®] can automatically scan the Load as it enters the system, use the data from the Expected Receipt to create a new Load Record and store the Load.

Ordering Material

The Warehouse R_X[®] Order Function provides a complete set of features to support the Ordering of Material.

Orders are maintained in the Warehouse R_X[®] Order database. Orders are added by a user using an Order screen or received from a Host computer using the optional host interface. All orders are assigned a destination and given a priority which determines the sequence in which the orders are allocated (see “Allocation and Scheduling” below for a description of the allocation process). A higher priority order is allocated before lesser priority orders.

Orders can be either for a load or loads by load ID or for an item or items and quantity.

Load Orders

Load orders bring only the requested loads to a specified destination station.

Item Orders

An item order can be for a single item or it can be an order for multiple items. Item orders may require that several loads be retrieved to fill the order. If orders are for less than full load quantities, loads are brought to a user station, and the user is directed to pick the items required to fill the order. (See “Picking Material” below) If orders are for full load quantities, the loads can be retrieved and dispatched out of the ASRS.

An Order Maintenance screen is supplied to give users access to the Order database. This screen allows users to display the contents of an Order and to add, modify, or delete items, quantities or loads on an order (provided that the orders are not yet allocated and scheduled).

Allocation and Scheduling

Allocation is the process of assigning actual items in inventory or a load to an Order. For Load Orders, the specific load requested is allocated and scheduled. For Item orders, the Warehouse R_X[®] allocation function performs this operation on a First-In First-Out (FIFO) sequence based on the store date of the items.

Scheduling is the process of directing the movement of loads from a storage location to a picking station or to an output station or from an input station to a storage location. The scheduler coordinates the movement of a load to and from stations in order to keep the stations busy with retrieves and stores.

Picking Material

Picking is the process of fulfilling orders and depleting inventory. As Warehouse R_X[®] processed orders, loads are delivered to stations for picking. For item orders with less than full load quantities, Warehouse R_X[®] provides functionality allowing users to pick material from loads, returning the unused material to storage. When a load arrives at the user station, the item to be picked is automatically displayed in a Pick screen. This screen directs the user to confirm that they have picked the correct item and quantity. When the user has completed the picking and releases the load, Warehouse R_X[®] returns the load into AS/RS storage.

Full load picking resulting from either an item order or a load order can be performed in two ways. When users are doing the pick, the user may confirm the pick of all items on the load or the load itself using the Pick screen. Where no user interaction is involved, pick confirmation is done by Warehouse R_X[®] doing an “auto-pick” when the load is physically delivered to an output station.

For each item/load that is picked a “pick complete” message is sent to the host computer and the item quantity and/or load is deleted from the Warehouse R_X[®] database.

Cycle Counting Material

Warehouse R_X[®] provides functionality for verifying item inventory using cycle counts. Cycle counts occur in two ways. First, if the user confirms a short pick, or picks the quantity below a level specified in the Item Master, Warehouse R_X[®] will automatically initiate a cycle count for the picker to confirm that the item quantity remaining on the load is correct.

Secondly, users can create Cycle Count orders, using the Warehouse R_X[®] Order Cycle Count screen. Users may choose to cycle count a specific item, item and lot combination, a specific storage location, or a range of storage locations. The items or loads that fill a Cycle Count order are retrieved to the specified station and counted there by a user.

If the result of the cycle count different from the Warehouse R_X[®] database, Warehouse R_X[®] adjusts the data base accordingly and if the system has an optional host interface, notifies the host of the adjustment

Finally, Warehouse R_X[®] maintains the last time a cycle count is done for an item or location, so the system administrator can manage the cycle count process for auditing purposes.

Managing and Monitoring Equipment

Warehouse R_X[®] allows users to manage and monitor equipment through a Maintenance Operating System (MOS) screen. The MOS provides a graphical depiction of the AS/RS and its stations. It shows for each AS/RS crane if the device is online or in error and also communications status with the AS/RS controller(s). The MOS also provides the ability to set the equipment online or offline and to recover from errors. Additionally, it shows loads at or moving to or from a station.

System Logging

Warehouse R_X[®] keeps logs to help monitor and control the operation of the system. The logs can be read to get information on:

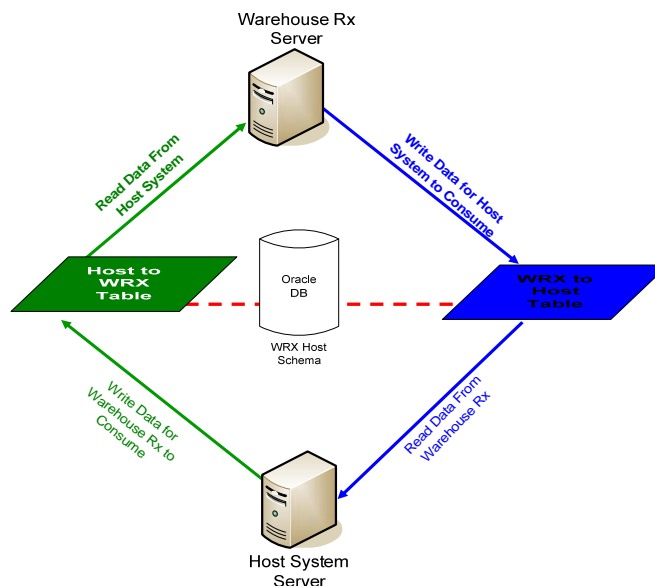
1. System errors
2. Equipment communications
3. Load move transactions
4. Inventory change transactions

Reports

Warehouse R_X[®] provides a comprehensive data source for users to generate the management reports needed to manage their warehouse. One license for Crystal Reports is provided along with the Warehouse R_X[®] license for this purpose. Crystal Reports is a non-programmer like, user friendly report generator.

Interfacing with Host Computers

Warehouse R_X[®] communicates with HOST computers through a database connection over an Ethernet network (LAN). Through this connection, transactions between the HOST and Warehouse R_X[®] are sent and received via Oracle shared database tables. The “receiving” system marks each record when finished to indicate that the record was processed successfully or encountered an error. The following figure depicts the Host interface process.

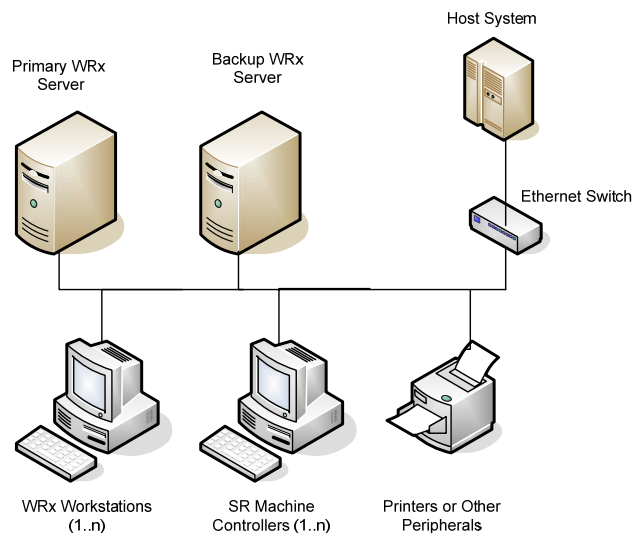


Warehouse R_x[®] Computing Environment

Warehouse R_x[®] is a state of the art Object Oriented application. It is written in the Java programming language and runs in a Microsoft Windows environment. It utilizes the popular Oracle Data Base Management system. An Oracle is included with the Warehouse R_x[®] application.

Warehouse R_x[®] runs on Windows PC Servers with RAID disk arrays, and with the configuration of a backup computer provides for complete system redundancy and data backup. Client PC's also running Windows provide a user friendly Graphical User Interface.

The Warehouse R_x[®] and equipment controller computer architecture is depicted in the following block diagram.



Warehouse Rx[®] System Architecture

Warehouse Rx[®] runs in a client/server architecture. The following diagram depicts the Warehouse Rx[®] server and client functional modules and their underlying system technologies.

Warehouse Rx[®] Technology Diagram

