

Warehouse R_x[®]
Load Management
Software

Technical Overview



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Warehouse R_X[®] Load Management Software

System Overview

Warehouse R_X[®] Load Management Software is the latest version of Daifuku America's integrated load management and automated equipment control system for today's highly automated ASRS systems. Warehouse R_X[®] Load Management Software maintains Load Tracking and Storage Location information with no knowledge of the contents of the loads it tracks. Data related to the contents of the loads is maintained by a higher level host system. Warehouse R_X[®] Load Management Software responds to load movement commands from a host computer system. Throughout the remainder of this document the Warehouse R_X[®] Load Management Software will be referred to as simply Warehouse R_X[®].

Before reading this document you should familiarize yourself with the terminology used by Warehouse R_X[®].

Load – A Load is the handling and tracking unit of the AS/RS and its associated contents though Warehouse R_X[®] has no knowledge those contents. This unit can be a pallet, tote, tray, basket etc. The system can manage loads of varying height when the storage rack is configured with multiple size openings.

Load ID – each load in the system is identified with a unique identifier referred to as the Load ID. Generally a bar code label is attached to the load with the Load ID encoded in the bar code. However bar code labels are not mandatory.

Location – each storage opening in the AS/RS rack is referred to as a location. Each location has an address defined by it's row (left or right of the storage aisle), bay (horizontal position) & tier (vertical position).

Station – a Station is a position in the system where loads are inducted into the system or where loads are delivered by the system. Each station in the system is identified by a unique identifier referred to as the Station ID.

Warehouse R_X[®] - Major Features and Functions

Warehouse R_X[®] provides a rich compliment of functionality for 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[®]

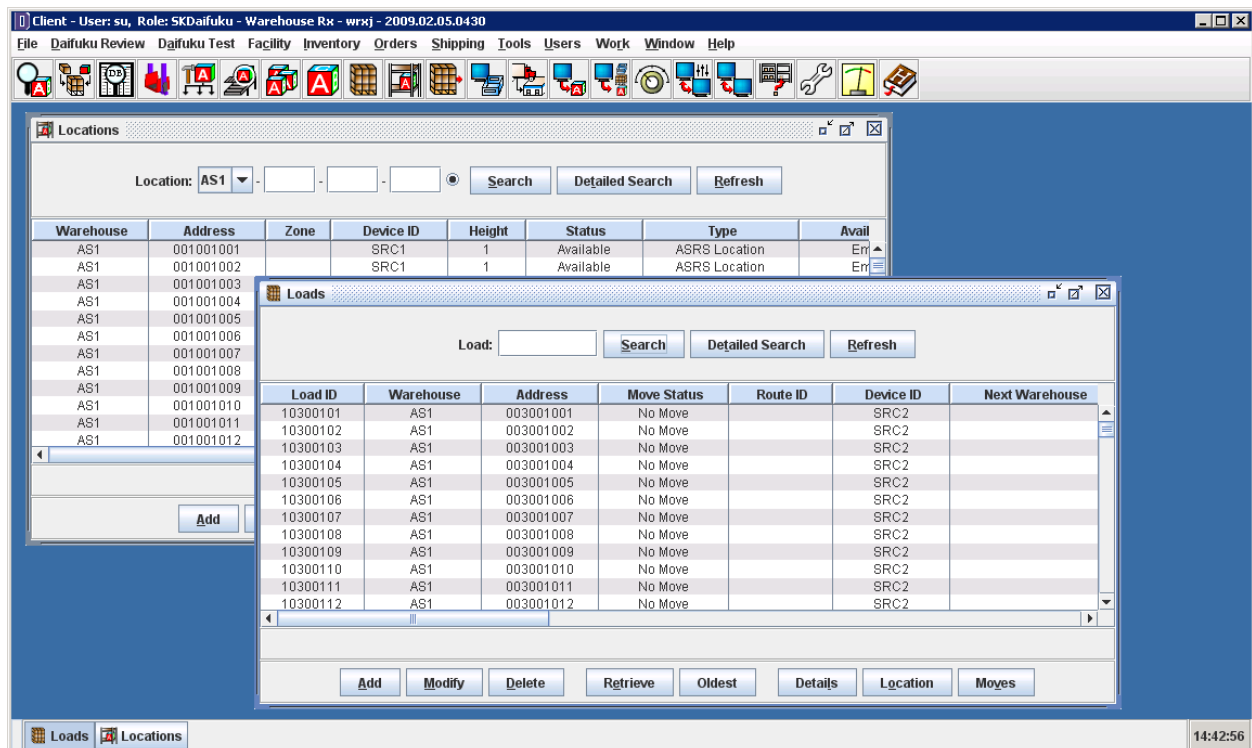
Security Protection

Managing Loads and Locations

- Expected Loads
- Storing Loads
- Ordering Loads
- Retrieving Loads
- 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 available screens. The GUI has the look and feel of most programs that run on the Windows Operating System. The following figure shows an example of a Warehouse R_x[®] GUI main screen with the Loads and Locations screens displayed.



Security Protection

Security is a very important feature in any system that tracks and controls valuable inventory. In Warehouse R_X[®], 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 R_X[®] 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 R_X[®] 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.

Managing Loads and Locations

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

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

Those tools include:

- Load and location views
- Load and location editing

Loads

Users can view, and with the appropriate authorization, add, modify and delete loads in the ASRS by selecting a Load ID of interest on the Load screen and taking the desired action.

Locations

Each load in the warehouse is assigned to a storage 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 operators can view and edit Load information by selecting Loads from the Load screen, they can in like manner view and edit Load information for a selected location by double clicking the Location.

Expected Loads

The use of the Expected Loads feature is optional. This feature allows a host system to ensure that all loads stored into the AS/RS have completed all pre-storage processes and are ready for storage. Prior to their arrival at the AS/RS, the Host computer system sends Expected Load messages to Warehouse R_X[®] identifying loads that are cleared for storage into the ASRS.

Warehouse R_X[®] will hold the Expected Load in its data base comparing all arriving loads to Expected Loads. Any load that arrives at the AS/RS that is not Expected will be rejected.

Storing Loads

When a load arrives at the AS/RS to be stored, it must be identified to Warehouse R_X[®]. This can be accomplished by an operator using the Warehouse R_X[®] Store screen to scan or key in the Load ID or if the system is equipped with automatic barcode readers, the system can scan the barcode and automatically store the Load. When a load is first identified and added to the Warehouse R_X[®] database, the Host is notified by means of a Store Complete message. Warehouse R_X[®] maintains a Load/Location map and based on that map selects the optimum storage location where the Load will be stored. When a Load is deposited into a rack location by the storage crane, the host is notified by means of a Location Arrival message.

Ordering Loads

The Warehouse R_X[®] Order Function provides a complete set of features for Ordering Loads out of the system.

Orders are maintained in the Warehouse R_X[®] Order database. Orders are added by an operator using the Order Load screen or downloaded 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 processed. The higher the priority the sooner the order is processed.

Orders can be for a single Load or for multiple Loads going to the same destination station. An order identifies Loads to be retrieved by their Load ID's.

An Order Maintenance screen is available 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 loads on an order (provided that the orders are not yet scheduled for retrieval).

Retrieving Loads

As orders are processed, Warehouse R_X[®] schedules loads for retrieval and directs them to their final destination as specified in the order. As loads arrive at their final destination, the Host is notified by means of a Load Arrival message and the load record is deleted from the Warehouse R_X[®] database. When the last load of an order is delivered to its final destination, an Order Complete message is sent to the Host and the Order is deleted from the Warehouse R_X[®] database.

Managing and Monitoring Equipment

Warehouse R_X[®] allows operators 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:

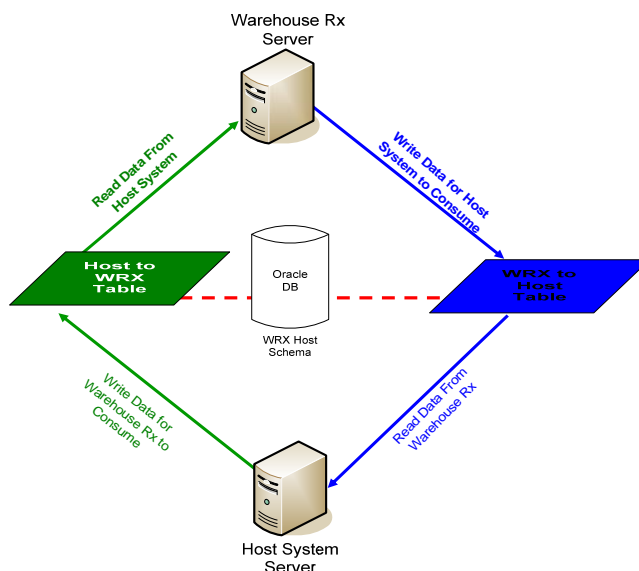
1. System errors
2. Equipment communications
3. Load move transactions

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 in 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.

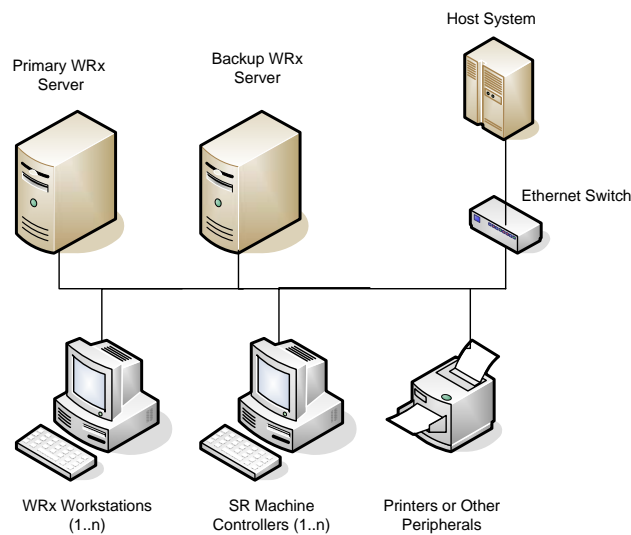


Warehouse R_x[®] Computing Environment

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 license 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.

