



white paper

Warehouse Control System Five-Level Controls Model

Dematic Corp.
507 Plymouth Ave. NE
Grand Rapids, MI 49505

Tel: (877) 725-7500
USInfo@dematic.com
www.dematic.com

Creating Logistics Results



DEMAC



WCS Five-Level Controls Model

Introduction

A typical automated warehouse/distribution center has a computer system that consists of a multi-tier control architecture in which each level in the control hierarchy has a defined role. The software that is used to manage and control this equipment is referred to as the Warehouse Control System (WCS).

The five-level model is used to describe how a Warehouse Management System (WMS), Warehouse Control System (WCS) and the Material Handling Equipment (MHE) for an automated material handling system are architected, from a controls perspective. It is based on the assignment of functionality to levels within a hierarchical structure and the subsequent assignment of levels to systems such as WMS, WCS, and Programmable Logic Controllers (PLCs).

The result of using the five-level model is the distribution of functions to the different levels. The systems within each level can be clearly defined along with their interfaces. These systems can be applied together or separately so the system is scalable and flexible in how these levels are applied.

Level 4 - WMS

Level 3 - WCS (by Dematic)

This level of software provides the management and logistics functionality for the facility. It includes inventory control, order planning and processing, resource management, quality control, receiving and putaway, cycle counting, pallet and case cubing, slotting, replenishment, reporting, analytics, operational visibility, and dock management.

Level 2 - Execution Systems (by Dematic)

This level of software provides the optimization logic for specific equipment, and the mapping from logical to physical equipment. It includes picking, sortation and routing, AS/RS, Multishuttle, and AGVS.

Level 1 - Equipment Controls (by Dematic)

This level of control provides the actual machine control. It includes PLC, RSC, RSFlex, RSCX, RSCT, MSC, and SCS systems.

Level 0 - Equipment Level (by Dematic)

These are the actual hardware components. It includes devices and equipment such as an SRM, a photo-eye, motor starters, motors, and power circuits.





WCS Five-Level Controls Model

Five Levels Defined

Level 4 - (WMS)

This is the level of software that collects order data from outside sources; it is in charge of overall system inventory and accounting functions. It supplies the WCS with the orders that need to be fulfilled. For many systems, this level of software is provided within a Warehouse Management System (WMS) supplied by vendors like Manhattan or Red Prairie, or it could be a home grown system. It can also be provided from modules of an Enterprise Resource Planning (ERP) system or supply chain execution suite.

Level 3 - (WCS / WMCS) - Warehouse Control System (supplied by Dematic)

This level of computer system includes inventory control, order planning and processing, resource management-equipment and labor, quality control, receiving and putaway, cycle counting, pallet and case cubing, slotting, replenishment, reporting, analytics, operational visibility, and dock management. The levels of functions and features at this level are determined by the capabilities of the host (WMS). When the majority of the inventory control and order management functionality resides at this level, the system is referred to as a Warehouse Management Control System (WMCS). This level reports to level 4 the order completion execution results on a per-order basis.

Level 2 - Execution Systems (supplied by Dematic)

This level includes equipment and subsystem optimization along with strategic transport control. It maps the correlation between logical and physical destinations within a system. Transport orders are created, started, controlled and supervised.

An example of a subsystem controller at this level would be one which manages the SRM-related movement. It doesn't directly control the SRM, but rather it provides the high-level commands to store and retrieve carriers. Typically, there are execution systems for all the





WCS Five-Level Controls Model

different kinds of equipment included at the site. This could include AGVs, SRMs, Multi-shuttles, pallet conveyor, case conveyor, merges, and sorters. In addition, personnel such as pickers and fork truck drivers are sometimes managed by this level.

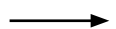
Level 1 - Equipment Controllers (supplied by Dematic)

This is the machine control level and it is a real-time system. It is responsible for the control of peripheral components as well as signal processing, interlocking mechanisms, fault and error detection, and positioning tasks. These systems execute the directives provided by Level 2, and report back the success/failure of the tasks that were given.

An example of an equipment controller would be the system that controls a linear sorter. This software controls the induction of cartons onto the sorter and coordinates with the level 2 software, to determine each carton's destination. It then controls the equipment (Level 0) to ensure that the carton is diverted successfully.

Level 0 - Equipment (supplied by Dematic)

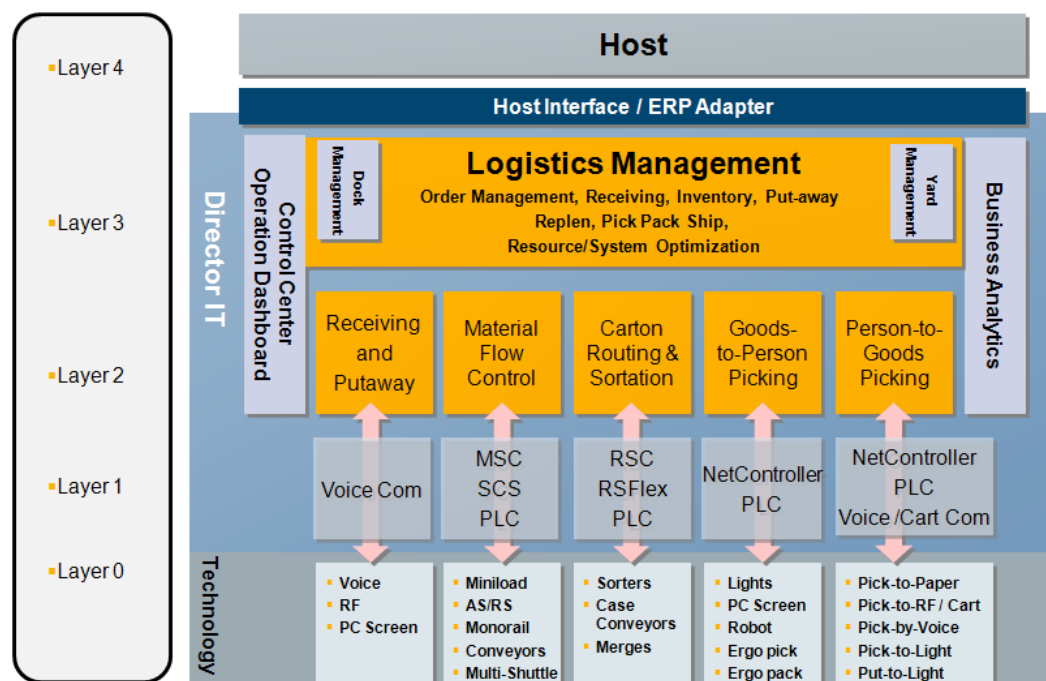
This level is comprised of equipment such as motor starters, power circuits, safety (E-STOP) equipment, photo-eyes, motors, pick-to-light devices, SRMs and conveyors.





WCS Five-Level Controls Model

The following figure shows the assignment of functions to these levels in a system.



Conclusion

Dematic uses the five-level model as our software and controls architecture in order to allow our systems to be scalable and flexible. It also allows us to design and build independent products that are focused on a specialized task that fit into our offerings. Our focus is on optimizing the hardware and minimizing the labor required to operate the systems that we install. We offer flexibility in the application of our products. This permits support for many configurations as a result of our distributed architecture approach.





WCS Five-Level Controls Model

On one end of the scale, we can install a simple stand-alone voice picking subsystem, driven by the customer's WMS. On the other end of the scale, we can provide a complete integrated system that provides optimized automated receiving, putaway, order planning, retrieval, picking, and shipping using automated equipment to perform most of the work.

About Dematic

Dematic provides logistics solutions that optimize material and information flow from receiving to shipping within the four walls of the factory, warehouse, or distribution center. These solutions, built around automated material handling technologies, process improvements, and software, are engineered to improve overall supply chain and business performance.

Dematic's integrated systems are supported by a seamless, one source, implementation capability that reduces time, cost, and risk. This is accomplished by owning and controlling data driven design services, real time WMCS software, proven material flow technologies, and best in class engineering, project management, and life cycle support services.

Dematic is dedicated to customer satisfaction & guarantees successful system performance. For more information, visit: www.dematic.com

If you are interested in learning more about this topic and how we can help, please contact Dematic at (877) 725-7500.