

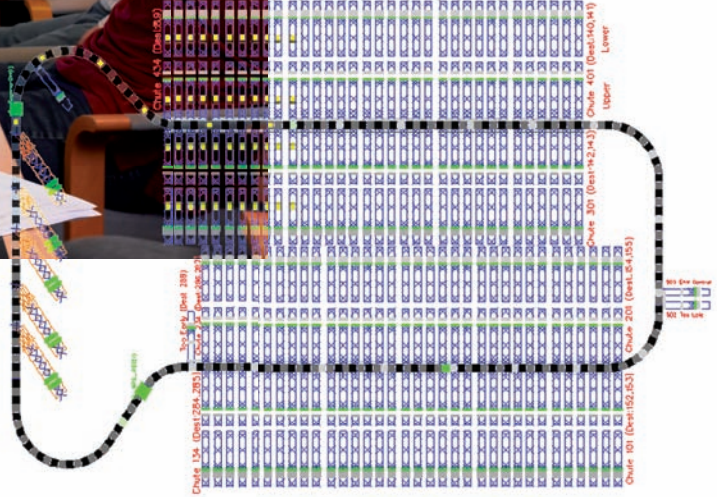
Emulation

Material Handling Systems





The commissioning phase is optimised considerably with use of simulation and a complete auto generated emulation model.



Emulation

At Crisplant, the use of emulation for material handling systems is an important part of the process when building reliable controls hardware and software. All material handling projects of high scale and complexity are submitted to a multi-stage test concept, which includes module tests, software integration tests and a FAT & SAT (Factory Approval Test & Site Acceptance Test). System simulation and emulation is used as part of these tests to verify the software and hardware upon completion of the system design and software coding. Having the opportunity to perform an emulation process to test the system early in the project, before the equipment is packed and delivered for assembly on site, is a direct benefit that minimises valuable project site time and reduces costs.

At Crisplant, emulation is performed in-house in close cooperation between software and mechanical equipment teams. Based on experience from more than 1,500 sorting projects, our teams always take a customer-orientated approach to be certain to meet the customer's individual needs for reliability in a specific product installation project.

Emulation Process

Crisplant has developed a software tool to generate emulation from the project specific 3D AutoCAD drawings of a material handling system. The emulation process is a test sequence in which the actual hardware and the controls software will be linked to a computer model running the actions and initiating the I/Os and telegram flow in real time. The process ensures that the upper and low level software is fully tested before shipment to the site.

By linking the hardware and controls software to the computer model, the controls system is made to believe that it is connected to the real physical activities in a warehouse or post and parcel centre. This method not only tests the configuration of the mechanical system, it also proves the reliability of the controls software.

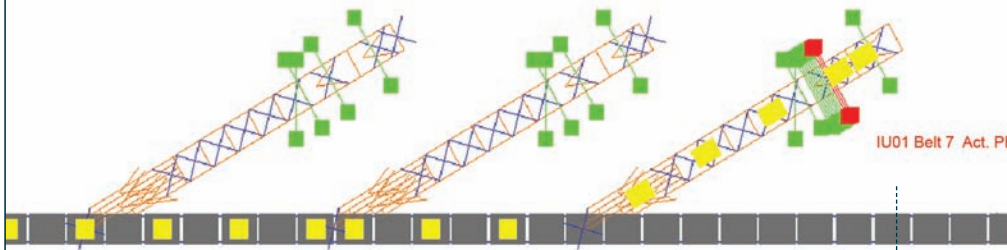
Using the real control system, the entire material handling system is subjected to realistic tests of the layout capacity, peak throughput, error handling, operational scenarios etc. This ensures that the team is able to correct any problems at a very early stage, thereby reducing cost and time for on-site tests.



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Messages
233.99: 1452 14:18:34.254 IU:1 Belt:3 PECpos:1 PEC#5 is blocked (I304.4 State:0)
233.99: 1453 14:18:34.254 IU:1 Belt:3 PECpos:1 PEC#6 is blocked (I304.5 State:0)
233.99: 1454 14:18:34.254 IU:1 Belt:3 PECpos:1 PEC#7 is blocked (I304.6 State:0)
234.14: 1455 14:18:34.395 IU:1 Belt:2 PECpos:1 PEC#4 is blocked (I302.3 State:0)
234.14: 1456 14:18:34.411 IU:1 Belt:2 PECpos:1 PEC#5 is blocked (I302.4 State:0)
234.14: 1457 14:18:34.411 IU:1 Belt:2 PECpos:1 PEC#6 is blocked (I302.5 State:0)
234.14: 1458 14:18:34.411 IU:1 Belt:2 PECpos:1 PEC#7 is blocked (I302.6 State:0)
234.19: 1459 14:18:34.473 IU:1 Belt:3 PECpos:1 PEC#4 is cleared (I304.3 State:1)
234.19: 1460 14:18:34.473 IU:1 Belt:3 PECpos:1 PEC#5 is cleared (I304.4 State:1)
234.19: 1461 14:18:34.473 IU:1 Belt:3 PECpos:1 PEC#6 is cleared (I304.5 State:1)
234.19: 1462 14:18:34.473 IU:1 Belt:3 PECpos:1 PEC#7 is cleared (I304.6 State:1)
234.34: 1463 14:18:34.598 IU:1 Belt:2 PECpos:1 PEC#4 is cleared (I302.3 State:1)
234.34: 1464 14:18:34.598 IU:1 Belt:2 PECpos:1 PEC#5 is cleared (I302.4 State:1)
234.34: 1465 14:18:34.598 IU:1 Belt:2 PECpos:1 PEC#6 is cleared (I302.5 State:1)
234.34: 1466 14:18:34.598 IU:1 Belt:2 PECpos:1 PEC#7 is cleared (I302.6 State:1)
236.59: 1467 14:18:36.848 IU:1 Belt:3 PECpos:1 PEC#4 is blocked (I304.3 State:0)
236.59: 1468 14:18:36.848 IU:1 Belt:3 PECpos:1 PEC#5 is blocked (I304.4 State:0)
236.59: 1469 14:18:36.864 IU:1 Belt:3 PECpos:1 PEC#6 is blocked (I304.5 State:0)
236.59: 1470 14:18:36.864 IU:1 Belt:3 PECpos:1 PEC#7 is blocked (I304.6 State:0)
236.74: 1471 14:18:37.004 IU:1 Belt:2 PECpos:1 PEC#4 is blocked (I302.3 State:0)
236.74: 1472 14:18:37.004 IU:1 Belt:2 PECpos:1 PEC#5 is blocked (I302.4 State:0)
236.74: 1473 14:18:37.004 IU:1 Belt:2 PECpos:1 PEC#6 is blocked (I302.5 State:0)
236.74: 1474 14:18:37.004 IU:1 Belt:2 PECpos:1 PEC#7 is blocked (I302.6 State:0)
236.79: 1475 14:18:37.051 IU:1 Belt:3 PECpos:1 PEC#4 is cleared (I304.3 State:1)
236.79: 1476 14:18:37.051 IU:1 Belt:3 PECpos:1 PEC#5 is cleared (I304.4 State:1)
236.79: 1477 14:18:37.051 IU:1 Belt:3 PECpos:1 PEC#6 is cleared (I304.5 State:1)
236.79: 1478 14:18:37.051 IU:1 Belt:3 PECpos:1 PEC#7 is cleared (I304.6 State:1)
236.94: 1479 14:18:37.208 IU:1 Belt:2 PECpos:1 PEC#4 is cleared (I302.3 State:1)
236.94: 1480 14:18:37.208 IU:1 Belt:2 PECpos:1 PEC#5 is cleared (I302.4 State:1)
236.94: 1481 14:18:37.208 IU:1 Belt:2 PECpos:1 PEC#6 is cleared (I302.5 State:1)
236.94: 1482 14:18:37.208 IU:1 Belt:2 PECpos:1 PEC#7 is cleared (I302.6 State:1)
236.95: 1483 14:18:37.239 F.StationArr..Chute: Chute[34] CMCDest[35] --- Test Activation of carrier: 5 Side:0 I/O:6043
236.95: 1484 14:18:37.239 P.Chute_Tilt : Chute[34] CMCDest[35] Carrier#:5 [lof1] (Cart Status:1) - Activate carrier
236.95: 1485 14:18:37.239 P.Chute_Item_Sorted: Dest[35] Item_Sorted
  
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IU01 Single: 84 Double: 0 Total: 84 Hourly Capacity: 4500 (1 of 183)



Depending on the specific project, the emulation process contains sorters, conveyors, robotics and/or other equipment handling devices. During the emulation process the team is able to see the physical items move through a 3D model of the material handling system in real time. When an item is discharged in a chute, the team follows the specific action on the screen and simultaneously watches the item data in the software, just as it would be in a real material handling system control room in operation.

Future proof

As an extra safety measure, the emulation process is conducted as a stress on the performance tests of the controls. Such a test can be based on system item growth forecasts, e.g. for the next 10 years. In addition, emulation can force the speed of the system to a level far beyond the demand for performance, forcing everything to run faster than real-time and thereby submitting the system to a stress level higher than the actual mechanical system. Crisplant always run tests on worst case scenario conditions for material handling performance, ensuring a high confidence level in the control system and a smooth material handling operation when installed at the mail centre.

Emulation helps Crisplant to deliver extensive projects, on specification, on time, every time. Due to the material handling solution being tested and proven at a very early stage, the installation and commissioning phase runs on a predictable time frame with minimised project risk.

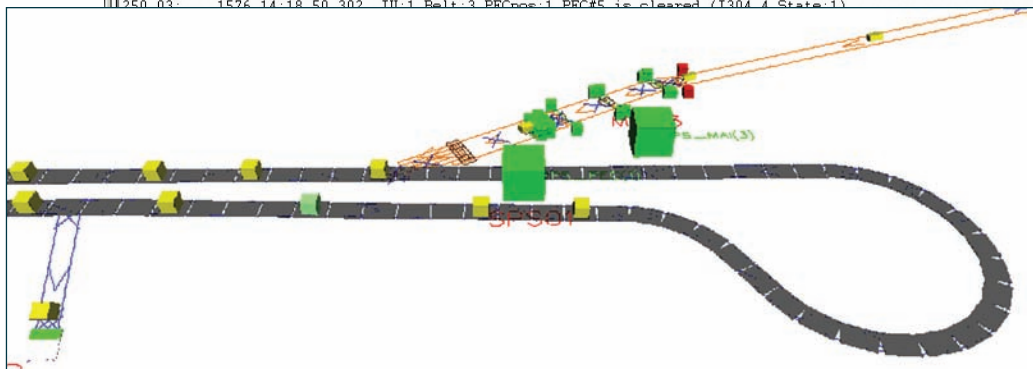
Servers mounted in racks and ready to ship to the site after the emulation sequence



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Messages
247.25: 1548 14:18.47.520 IU:1 Belt:3 PECpos:1 PEC#6 is blocked (I304.5 State:0)
247.25: 1549 14:18.47.520 IU:1 Belt:3 PECpos:1 PEC#7 is blocked (I304.6 State:0)
247.40: 1550 14:18.47.661 IU:1 Belt:2 PECpos:1 PEC#4 is blocked (I302.3 State:0)
247.40: 1551 14:18.47.661 IU:1 Belt:2 PECpos:1 PEC#5 is blocked (I302.4 State:0)
247.40: 1552 14:18.47.661 IU:1 Belt:2 PECpos:1 PEC#6 is blocked (I302.5 State:0)
247.40: 1553 14:18.47.661 IU:1 Belt:2 PECpos:1 PEC#7 is blocked (I302.6 State:0)
247.45: 1554 14:18.47.739 IU:1 Belt:3 PECpos:1 PEC#4 is cleared (I304.3 State:1)
247.45: 1555 14:18.47.739 IU:1 Belt:3 PECpos:1 PEC#5 is cleared (I304.4 State:1)
247.45: 1556 14:18.47.739 IU:1 Belt:3 PECpos:1 PEC#6 is cleared (I304.5 State:1)
247.45: 1557 14:18.47.739 IU:1 Belt:3 PECpos:1 PEC#7 is cleared (I304.6 State:1)
247.60: 1558 14:18.47.864 IU:1 Belt:2 PECpos:1 PEC#4 is cleared (I302.3 State:1)
247.60: 1559 14:18.47.864 IU:1 Belt:2 PECpos:1 PEC#5 is cleared (I302.4 State:1)
247.60: 1560 14:18.47.864 IU:1 Belt:2 PECpos:1 PEC#6 is cleared (I302.5 State:1)
247.60: 1561 14:18.47.864 IU:1 Belt:2 PECpos:1 PEC#7 is cleared (I302.6 State:1)
248.19: 1562 14:18.48.458 F_StationArr..Chute: Chute[37] CMCdest[38] --- Test Activation of carrier: 17 Side:0 I/O:6046
248.19: 1563 14:18.48.458 P_Chute_Tilt : Chute[37] CMCdest[38] Carrier#:17 [1of1] (Cart Status:1) - Activate carrier
248.19: 1564 14:18.48.458 P_Chute_Item_Sorted: Dest[38] Item sorted
248.29: 1565 14:18.48.552 P_Chute_Item_Sorted: CMC Dest[38] Set FULL PEC input LOW - Full Inp:10046 State:0
248.64: 1566 14:18.48.895 P_Chute_Item_Sorted: CMC Dest[38] Set Full PEC input HIGH - Full Inp:10046 State:1
249.83: 1567 14:18.50.099 IU:1 Belt:3 PECpos:1 PEC#4 is blocked (I304.3 State:0)
249.83: 1568 14:18.50.099 IU:1 Belt:3 PECpos:1 PEC#5 is blocked (I304.4 State:0)
249.83: 1569 14:18.50.099 IU:1 Belt:3 PECpos:1 PEC#6 is blocked (I304.5 State:0)
249.83: 1570 14:18.50.099 IU:1 Belt:3 PECpos:1 PEC#7 is blocked (I304.6 State:0)
249.98: 1571 14:18.50.239 IU:1 Belt:2 PECpos:1 PEC#4 is blocked (I302.3 State:0)
249.98: 1572 14:18.50.239 IU:1 Belt:2 PECpos:1 PEC#5 is blocked (I302.4 State:0)
249.98: 1573 14:18.50.239 IU:1 Belt:2 PECpos:1 PEC#6 is blocked (I302.5 State:0)
249.98: 1574 14:18.50.255 IU:1 Belt:2 PECpos:1 PEC#7 is blocked (I302.6 State:0)
250.03: 1575 14:18.50.302 IU:1 Belt:3 PECpos:1 PEC#4 is cleared (I304.3 State:1)
250.03: 1576 14:18.50.302 IU:1 Belt:3 PECpos:1 PEC#5 is cleared (I304.4 State:1)

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During emulation, it is possible to rotate, tilt and pan the view of items moving in the system.



Virtual training and test tool

As an option, simulations and emulations can be expanded to work as a tool for parcel centres to have their own virtual training or test environment. This option can be tailored both for training system operators and supervisors, and for testing the installed system according to a parcel centre's master plan development.

The training of operators combines the virtual system with a copy of the actual controls software in an educational simulated environment, providing hands-on material handling system training. The training tool has the ability to mimic the operator stations and is very useful for off-line incident management training before the material handling system goes live. Through the use of an emulated parcel centre flow, the system operators prepare themselves for all types of material handling scenarios. Various incidents can be emulated and every reaction and action is logged and analysed to identify and correct procedural problems.

The training can last until all procedures are in place and the mail centre staff feels comfortable operating the new system.

The system has a user interface in which incoming flow schedules, scanner read rates, EDS reject rates and other data can be loaded into the computer models. Using this data, the distribution centre can simulate a day production and make the system generate reports to be used for analysis. As an example, the distribution centre can verify how changes in the truck schedules will influence the sorting system, or what will happen with the material handling system if two trucks arrive at same time. Being able to perform this type of simulation and emulation gives the mail centre an early insight on future planning and further investment needed in the material handling system.

Not only does this type of training save valuable time and training costs, it is also a tool to help ensure the continued overall satisfaction and success of the distribution centre.



Endless Performance

Crisplant a/s
P.O. Pedersens Vej 10
DK-8200 Aarhus N
Denmark
Phone: +45 87 41 41 41
Mail: info@crisplant.com
Web: www.crisplant.com