

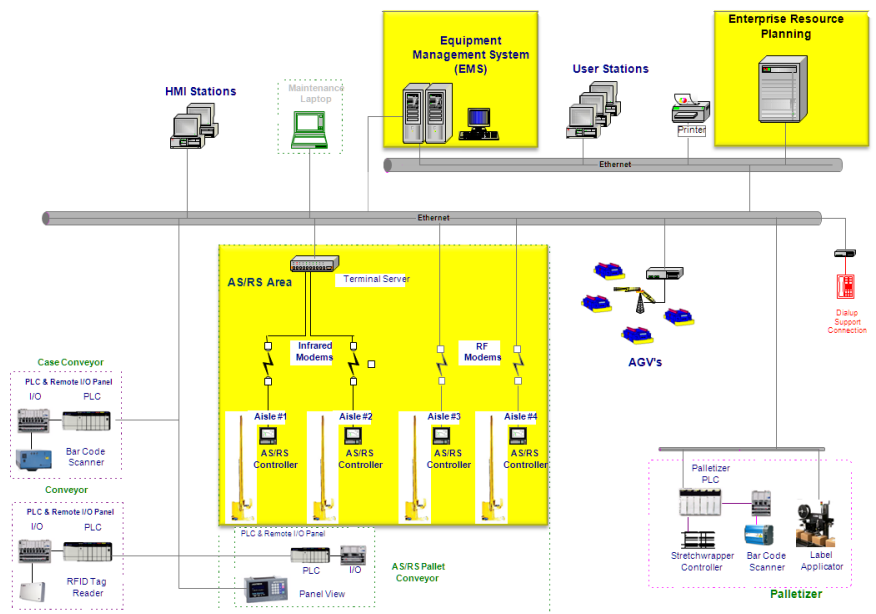
## AS/RS Life-Cycle Upgrades

### Host-to-SRM Interface and Control

**Problem:** The corporate IT department has a project to replace Host business systems. They also have a requirement to absorb all AS/RS management functions into the Host system, originally provided by a separate AS/RS Manager system. The biggest source of risk with AS/RS integration is the SRM equipment interface.

The following are difficulties that need to be considered when implementing a new Host ERP or MES that will provide for AS/RS management and interface with automated Storage/Retrieval Machines (SRM).

- A significant challenge for an ERP or MES Host-to-AS/RS integration is to have a direct interface to the SRM(s). A reliable SRM interface requires more functionality than simply sending commands and receiving acknowledgements during normal machine operations. There are easily overlooked SRM monitoring and error handling functions required that ensure optimal machine availability with minimal manual intervention.
- An SRM is typically controlled by a PLC. A Host computer system instructs the SRM machine on what to do by writing to registers/memory within the PLC. The PLC notifies the computer system on status and command completions by writing to the computer system as if it is a PLC. The format of the registers/memory going back and forth between the PLCs is typically unique for different SRM manufacturers. The commands needed to write and read to registers within the PLC are also PLC vendor specific. These methods and protocols can be very difficult to decipher and recreate without an SRM Interface specification. The interfaces method for older systems is typically a serial interface protocol; newer/upgraded equipment control systems may utilize Ethernet-based protocols.



Typical AS/RS Control Architecture

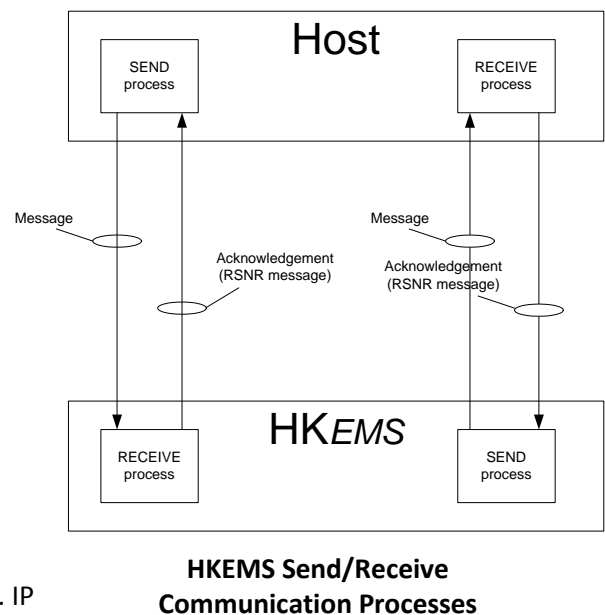
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- Serial interface methods typically require terminal server devices on the local area network that act as an Ethernet-to-RS232 switch for transferring message streams to/from the SRM's. These devices are vulnerable to power outages and surges and are difficult to troubleshoot for plant maintenance personnel. Most companies want to perform SRM upgrades in conjunction with the software project to eliminate those serial conversion devices and provide an Ethernet interface direct to the SRM. There are other benefits of better program monitoring and diagnostics capability with an Ethernet interface.
- The protocol used to transport the data back and forth across an Ethernet LAN to the SRM PLC is the ODVA (Open DeviceNet Vendor Association) Ethernet/IP network protocol standard. An ERP or MES Host application would need to develop applications for these various protocols or use a 3<sup>rd</sup>-party product that provides those services – a potentially costly interface to develop and test.

### **Solution: Implement HKEMS SRM Controller Host Interface**

The following describes the features and benefits associated with HK's recommendation for the implementation of a direct ERP or MES Host-to-SRM interface using HKEMS SRM Controller software.

- HKEMS SRM Controller software provides a user configurable SRM Interface that provides the communication link between a Host System and an HK SRM PLC with standard Ethernet Protocol. Modifications may be made to adapt the software for other 3<sup>rd</sup>-party SRM interfaces.
- The Host system directs SRM activities using simple move commands while HKEMS formats and sends commands to the SRM and monitors SRM status for command completions. HKEMS provides the command translation for the SRM PLC communication protocol.
- HKEMS provides for easily overlooked SRM monitoring and error handling functions to ensure commands are processed before reporting back to the Host.
- The HKEMS interface is well documented and HK's proposal provides consultative support to help integrators of the Host ERP or MES system implement the interface efficiently and correctly.
- A standardized TCP/IP client-server socket interface provides a communication interface between the HKEMS and the customer's Host. Both the Host and the HKEMS have a SEND and RECEIVE process. The SEND process is the client. The RECEIVE process acts as the server. The HKEMS Send and Receive Communications Processes diagram is shown on the right.
- The TCP protocol provides reliable, flow-controlled, two-way transmission of data. It is a byte-stream protocol used to support a single socket connection, the SOCK\_STREAM socket type. TCP constructs virtual circuits between peer entities that consist of remote Internet addresses, remote ports, local Internet addresses and local ports. IP uses the Internet addresses to direct messages



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between hosts and the port numbers to identify a TCP entity at a particular host.

- HKEMS deliverables include interface documents, HKEMS application software on an installation CD with user configuration and setup instructions. An SRM emulator is also included to assist the customer for in-house testing of SRM interfaces. HKEMS licensing fees are based on the number of devices which include a one-year product support contract.
- Optionally, HK SRM controls engineers perform SRM controls upgrades to eliminate serial communication devices and upgrade the PLC for Ethernet communications. The Ethernet interface infrastructure would eliminate the need for corporate IT staff to support serial communication lines and Ethernet-to-serial communication servers/switches on the network. An Ethernet interface will enable maintenance personnel to perform real-time monitoring of the SRM PLC program execution from anywhere on the AS/RS network, including remote (off-site) VPN access.

### Links: [More Supporting Information](#)

- [HKEMS Software Applications](#)
- [HK SRM Communication Upgrade](#)
- [HK SRM Control Upgrades](#)
- [HK Modernization Services](#)