Table of Contents

System Description

Introduction

Harris is providing vital upgrades to Aurora's current mission critical radio communications system. This includes four key enhancements: 1) Upgraded OpenSky/P25 HA (High Availability)-NSC (Network Switching Center) core, 2) New OpenSky/P25 Symphony IP consoles at the Dispatch Centers, 3) Updated site and interoperability software, and, 4) Updated site networking and monitoring equipment.

In addition to the new NSC Core and consoles, Harris has included the required upgrades for bringing the existing communications equipment current to the latest system release. In addition to the new core and console equipment, Harris has included the necessary software upgrades at the RF base stations. The system upgrades allow Aurora to take advantage of virtualized applications and enhanced system redundancy and resiliency.

The cabinets and associated server network equipment will be changed in the NSC equipment room at the Aurora PD and Fire Station 8 BCC (Backup Control Center). The new NSC cabinets will be assembled and tested in Lynchburg as a drop-in replacement.

There will be no physical changes made to the backhaul connectivity and the current system coverage will not be impacted.

Scope of Work

To upgrade Aurora's system to the current SR10A.4 system release for hardware and software, Harris has included the following detailed scope of services:

- System Engineering
- Project Management
- Installation Services
- Training (SR10A.4 maintenance)
- Staging & Shipping

The Harris Solution

The new equipment and services required to support the Aurora system upgrade including the following:

- Premier SR10A.4 release Virtual Core configured in geo-graphically separated High Availability
- 21 Symphony consoles configured at the Dispatch Centers
- Software updates to the SkyMASTR's and UAC (Unified Audio Card) interop gateways
- Replace Access Routers and Network Sentry's at the eight RF sites
- BeOn Premier Upgrade for 500 users (shared between Naperville and Aurora)

- 25 iOS or Android user licenses (shared between Naperville and Aurora)
- Status Aware – BeOn Integration only (100 end user licenses)

Upon order, Harris will build and configure the new NSC to standard Harris configuration. After successful staging and testing, Harris will ship the equipment to the customer site for installation into the designated equipment rooms.

The Harris team will power up the new equipment and perform a system health audit to verify proper installation and function of the new equipment. The Harris Team will then configure the new VIDA (Voice, Interoperability, Data, and Access) cores and prepare the system for cutover and acceptance testing.

Integration to the SR10A.4 Premier NSC Core

The Symphony Dispatch Platform connects directly to the radio network without the need for a backroom console switch. The Network Switching Center (NSC) cores will remain at the current Aurora PD/911 Center. The NSC core is co-located with dispatch centers that will house the Symphony consoles. During the system cutover, the current talkgroups will be replicated on the new Symphony consoles providing a seamless transition.

THIRD-PARTY ITEMS

While the proposed Harris cores and consoles have been configured to maintain compatibility throughout all the network devices, Harris recognizes that Aurora each have third-party devices that are connected to their individual networks, such as the logging recorders and CAD systems. These third-party devices may require updates to ensure compatibility with the new NSC cores. Aurora will need to contact the manufacturers of these devices to confirm they are operating on their latest system release. Any potential labor for software updates or testing of these devices are not included in the Harris proposal.

Acceptance Testing

Harris will perform system acceptance testing per the attached functional acceptance test plan (FATP). The Harris Upgrade Team will notify Aurora when installation and upgrade activities are complete, and the system is ready for acceptance testing.

Training

Harris will provide console configuration and equipment operator training per the attached training curriculum.

System Documentation

Harris will provide typical as-built documentation for system upgrades which include:

- 21 Symphony consoles configured at the Dispatch Centers
- Technical Manuals and Users Guides for the new components

VIDA Changes to the Existing System

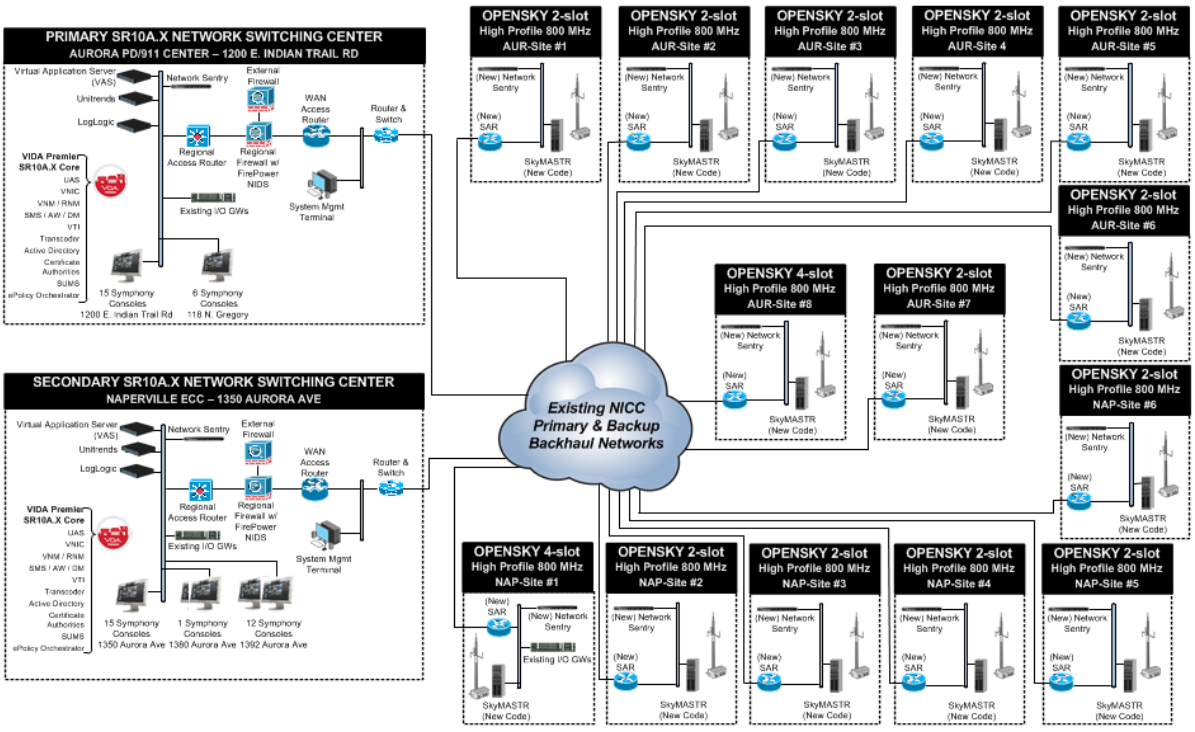
The new NSC core operates on the SR10A.4 system release and will be connected to all existing devices. Harris has included the necessary updates for these devices which require some level of reconfiguration to work on the new SR10A.4 NSC core.

Figure 1. SR10A.4 Upgrades

Existing Equipment	SR10A.4 Upgrade Requirement
VIDA NSC Core (Release SR9A)	Replace core management servers with virtual machines and provide new network routers
C3 Maestro ^{IP} Consoles	Replace with new Symphony IP consoles
RF Sites	Replace Network Sentry's, replace Cisco 2911 site access routers, and update software code in the SkyMASTR Base Stations
Subscriber Radios	Firmware updates to the radios are not expected to be required, however if updates are needed for SR10A.4 compatibility, they will be performed by Harris Field Services
VIDA Interoperability Gateway	Update software code for UAC cards in the I/O Gateways
NICE Logging Recorders	Update software code (Customer-maintained)

The designated locations for the geographically-separated NSC's, dispatch centers, and RF sites will continue to reside at the locations configured in the current system design.

Figure 2. System Block Diagram



VIDA Network Architecture

Premier Network Switching Center (NSC) Elements

The following sections provide brief descriptions of the equipment comprising the Premier NSC.

VIDA APPLICATION SERVER (VAS)

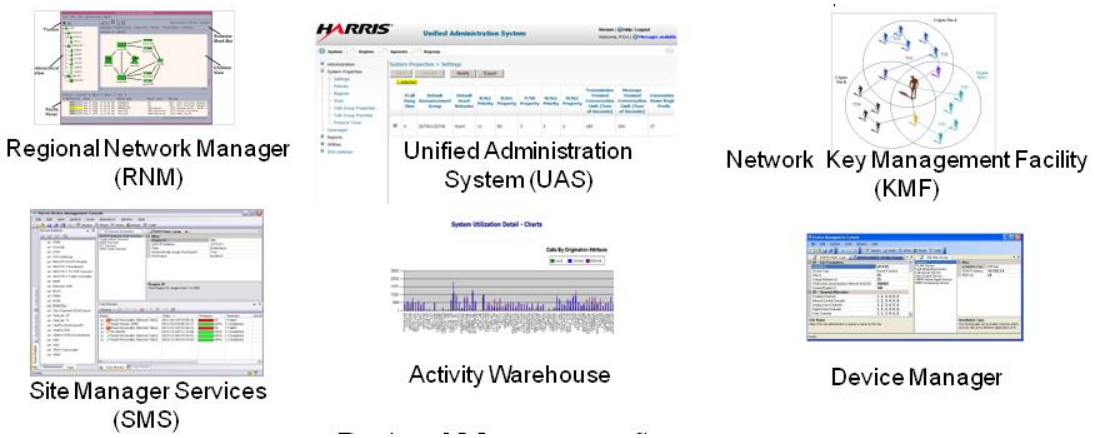
The VAS provides the single point of access for call switching as well as management and administrative tasks for a VIDA network. Powerful virtual machine (VM) technology consolidates several call routing and management applications on a single server (as opposed to running on separate servers).

The VAS routes calls to and from each voice group or mobile data user on a real-time basis. In addition, it regulates voice and data traffic on the network. Each voice user belongs to a voice group of peers. A network administrator assigns the members of a voice group and sets the voice group parameters, including priority, hang time, preferred site, and response time. This governs the functional behavior of user devices operating on the network. The VAS maintains a database of these voice group files. The VAS routes the IP voice traffic of one member to all others of a given voice group.

The VAS is a server workstation running a Red Hat Linux operating system. It hosts a voice controller application performing routing functions for digital trunked voice messages through an IP backbone. By tracking the radio site location of subscriber unit radios and their voice group affiliation, the VAS ensures delivery of voice messages only to those radio sites essential to reach the destined radios. In addition to call routing based on user radio (to site) registration, it is possible to set up the system to force certain talkgroup calls to those locations required for scanning.

The VAS is configured with a separate Storage Array Network (SAN) of hard drives and is designed in an HA (redundant) configuration; increasing the robustness and survivability of the network core equipment. Figure 3 shows the available applications that run on the VAS for the VIDA Premier NSC.

Figure 3. VAS Applications



REGIONAL NETWORK MANAGER (RNM)

The Regional Network Manager (RNM) provides users with powerful tools facilitating effective management of a VIDA network. The radio system manager can monitor the overall health of the Network Switching Server, view real-time diagnostics, monitor call activity of trunking systems, and set system/network configuration parameters.

UNIFIED ADMINISTRATION SYSTEM (UAS)

The Unified Administration System is an integrated real-time administration tool based on client-server architecture allowing multiple authenticated users at any Network Switching Center or remote location. By using the UAS, the administrator can securely modify a user or a group of user's priority, privileges, and encryption properties.

NETWORK SWITCHING SERVER (NSS)

The NSS, an application residing on the VAS, routes calls to and from each voice group or mobile data user on a real-time basis. In addition, it regulates voice and data traffic on the network. Each voice user belongs to a voice group of peers (talkgroup). A network administrator assigns the members of a voice group and sets the voice group parameters, including priority, hang time, preferred site, and response time. This governs the functional behavior of user devices operating on the network. The NSS maintains a database of these voice group files. The NSS routes the IP voice traffic of one member to all others of a given voice group.

The NSS application operates on a Red Hat Linux operating system. It is a voice controller application performing routing functions for digital trunked voice messages through an IP backbone. By tracking the radio site location of subscriber unit radios and their voice group affiliation, the NSS ensures delivery of voice messages only to those radio sites essential to reach the destined radios. In addition to call routing based on user radio registration, it is possible to set up the system to force certain talkgroup calls to those locations required for scanning, regardless of user radio affiliations. The highly scalable design of the NSS supports IP networks of various sizes. One NSS supports a single-region network serving the communications needs of city, county, and regional networks.

VIRTUAL MACHINE (VM) TECHNOLOGY

VM technology allows many applications running under separate operating systems to co-exist on a single server. The VM software allocates processor power, Random Access Memory (RAM), and Network Interface resources to each application. It isolates each application and ensures that no application impacts the operation of the others. VM technology also allows the addition of software capabilities on the server. For example, a customer adding encryption to the radio system can easily install the KMF VM software package on the VAS (instead of the conventional installation of a separate server to support that application).

HIGH-AVAILABILITY CONFIGURATION

In addition to the application services running on the VAS, there are an array of internal hard drives that accompany the Cisco UCS servers housed within the VAS. This increases the robustness and survivability of the network core equipment.

Figure 4. Premier NSC Equipment at Aurora

Location	VIDA NSC Equipment	Description
AURORA PD/911 CENTER Primary NSC	- (1) VIDA Application Server 1 (VAS1) - Network Switching Server Application 1 VM (NSS1) - Regional Network Manager 1 VM (RNM1) - Active Directory Server 1 VM (AD1) - BeOn Server 1 VM (BeOn1) - Internet Firewall - (21) Symphony IP Consoles	Geographically separated Network Switching Servers, network management and control applications, network security application, BeOn 4G network interface. Firewall for VPN management access, BeOn access, Email and text messaging alerts.

Network Management and Administration

Users need to view and monitor their radio network in real time. They also need to perform administrative tasks. Region network management and administrative applications and devices enable users to do their job.

The following sections discuss the applications and devices that comprise network management and administration within the proposed radio system.

Regional Site Manager Professional (RSM Pro)

The RSM Pro is a suite of applications which run on the VIDA Application Server (VAS). These applications include the Site Management Services (SMS), Device Manager, and Activity Warehouse.

The SMS provides an interface between the UAS and the Site Management Interface software, which resides on the Network Sentry at the RF sites. The SMS is responsible for distributing the large database of talkgroups and individual user information from the UAS to the RF sites. It consolidates site alarms and call activity to report site faults and alarms to the RNM.

The RSM Pro also includes two system management applications, the Activity Warehouse and the Device Manager. The RSM Pro applications make use of a Storage Array Network (SAN) to store and protect all configuration and activity data. The RSM Pro supports an encrypted database for all the data stored on the SAN. Additionally, the RSM Pro applications support redundancy configurations, whether collocated or geographically separated.

ACTIVITY WAREHOUSE

The Activity Warehouse is a report-generating program used to monitor various aspects of a radio network that comes standard with the RSM Pro. It uses network-accessible web pages for initiating and delivering reports. These reports are based on IP call activity related to RF sites, consoles, gateways, and other devices on the radio network.

The Activity Warehouse performs data searches on call-logging data created and stored by network components. It can search the parameters stored within this data and report them in textual, table, and graphical formats.

This program automatically stores call detail history. Administrators create user accounts allowing users to generate reports from the data. The call information data facilitate creation of several system reports, including:

- Number of inbound and outbound calls (Call Activity Report)
- Percentage of uptime (System Channel Uptime Report)
- Message traffic by agency (User Agency Report)
- Message traffic by transaction type (Call Activity with Events Report)
- Network bandwidth utilization (RNM Network Utilization Report)

VIDA Interoperability Gateway

The Aurora system has Interoperability Gateways deployed in the dispatch center. These gateways do not require new hardware and will therefore not need to be replaced. However, the gateways will require software updates to the UAC cards in order to provide compatibility with the new SR10A.4 NSC core. The gateways will continue to map legacy audio to the active talkgroups on the systems.

There is one Interoperability Gateway chassis equipped on the Aurora system. Additional interoperability can be added to the new system at any time, upon request. Figure 5 illustrates the location and number of talkpaths that are equipped and will be updated in the systems.

Figure 5. Existing Interoperability Gateway Locations

Location	Number of Talkpaths	Number of Chassis
AURORA PD/911 CENTER	12	1

Dispatch Console Replacement

Harris has included new Symphony IP consoles to replace the current obsolete Maestro twenty-one console positions at the Aurora PD/911 Center and BCC/911 Center. The Symphony Dispatch Console represents the next generation of dispatching with an intuitive user interface and the ability to support mapping and video in the future. The console inventory by location is illustrated in Figure 6.

Figure 6. Dispatch Consoles by Location

Location by Address	New Symphony IP Consoles
AURORA PD/911 CENTER - 1200 E. Indian Trail Rd	15
AURORA PD/911 CENTER - 118 N. Gregory	6

Symphony Dispatch Platform

The Symphony Dispatch Platform connects directly to the radio network without the need for a backroom console switch. It uses a solid-state design that makes it completely silent and more reliable than other hardware platforms.

Figure 7. Symphony Dispatch Console

The Symphony also incorporates both the workstation and audio functions into a compact, single rack-unit design. It is capable of managing multiple audio sources in a single headset by utilizing the Call Director interface button. Telephone audio from 911 dispatch phone systems or business phone systems can be connected to the Symphony via 4-wire POTS lines with an off-hook indication. This connection allows the dispatchers to select the audio source for their headset to manage 911 and administration phone calls while dispatching the radio system.

Each dispatch console is typically configured with the following:

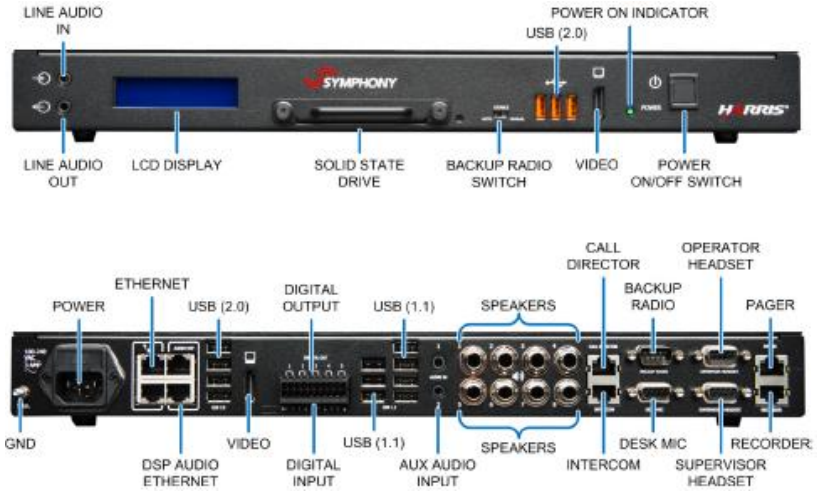
- Symphony Dispatch Platform (SDP) – Premier Bundle includes a local screen and baton, eight patch activations, 16 patch definitions, 16 simul-select definitions, I-calls, four user setups, 16 workspace tabs and a remote Baton.
- Vocoding services
- 24” high definition touchscreen monitors
- Keyboard
- Optical scroll mouse
- Dual footswitch
- Adapter and Jack box
- Headset
- Two Speakers per console position
- AES Encryption
- Spare workstation or spare hard drive

*Consult the Aurora price pages for final console configuration

The consoles are independent of one another, each position utilizing an existing UPS provided by Aurora. Hence, failure of one console does not affect operations of the other consoles. Any other console can be quickly reprogrammed with the functionality of the failed console. Any user can log into any available console and continue dispatching. Likewise, the Symphony console supports individual dispatcher login and personalization to permit dispatch specific settings and common architecture so dispatchers can access their specific settings at any dispatch console location. Harris will work with the Aurora to customize the design of their console screen layout to meet the individual dispatcher needs.

The audio processor is the connecting hub for most of the console accessories. It collects audio from the microphones and other audio inputs and plays received audio in the speakers and headsets. Dispatchers no longer have to make room for a PC and a separate audio tower. Standard PC accessories, such as keyboard, mouse and/or trackball, are used as part of the Symphony Dispatch Platform. In addition, the Symphony Dispatch Platform provides automatic gain control of various inputs and simplifies cabling between the Symphony and all possible peripheral options.

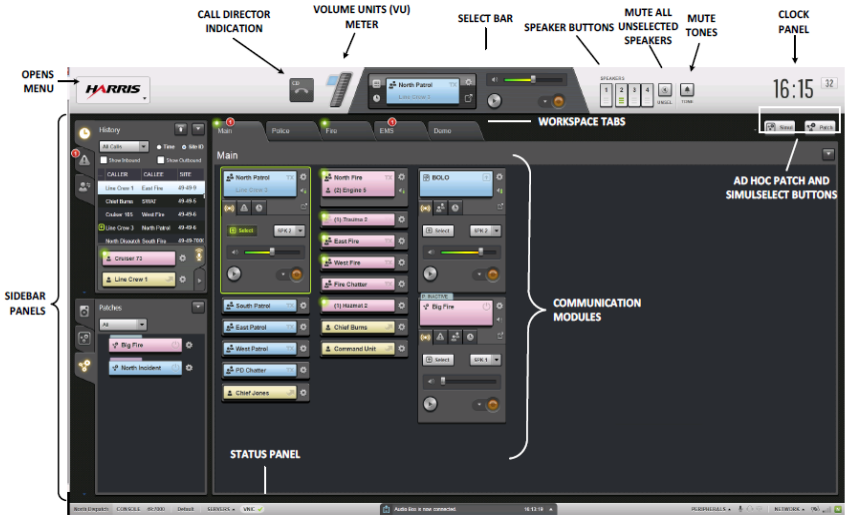
Figure 8. Symphony Dispatch Platform (SDP) Enclosure – Front and Back



DYNAMIC USER INTERFACE

Featuring patent-pending technology, dispatcher workflow is simplified by putting the features they use the most where they need them. This completely customizable user interface allows individual dispatchers to work in a manner that makes sense to them. Standard multi-tabbed modules personalized in 14 different colors allow dispatchers to move audio to different speakers, replay calls, and handle emergency calls. Multiple screen configurations can be created for scenarios ranging from crisis situations to shift/staffing changes. Figure 9 is a typical full screen Symphony display.

Figure 9. Symphony Functional Tab



SYSTEM ADMINISTRATION

Symphony offers several administration models. An administration model is a combination of settings that control:

- How parts of the Symphony configuration are shared among dispatchers
- Controlling who is allowed to change configuration items

Controlling who can change configuration items allows administrators and supervisors to lock down the console configuration so that some or all of it cannot be changed by dispatch users. Symphony leverages Microsoft Windows security to control access to configuration. Many of the configuration items can only be changed by Windows administrators. The configuration tools themselves are compatible with User Account Control (UAC), which means they will prompt non-Administrator users for an administrator password before they are run.

There are four basic configuration models that Symphony supports: default, local controlled, power user, and networked. It is also possible to mix and match aspects of these models to support more advanced scenarios. All these models are primarily concerned with controlling which users can change the screen layout and other GUI settings.

CONSOLE FEATURES

In addition to classic dispatch functions such as patch, simul-select, emergency, and call history, Symphony provides many advanced features such as an integrated call check recorder, digital audio technology providing end-to-end encrypted communications that are free from unauthorized access. AES encryption on each of the console positions is included.

The following are a list of features available on the Symphony Dispatch console.

- **Patches** – Each dispatcher can define a minimum of two Patches, also referred to as definitions; however only one patch can be active. The maximum number of active patches available per operator position is eight.

- **Simul-select** – Each dispatcher can define a minimum of two Simul-selects, also referred to as definitions; only one simul-select can be active. The maximum number of active patches available per operator position is eight.
- **Paging** – An on-screen encoder or an external encoder are available for paging.
- **Aux I/O** – Up to six opto-coupler auxiliary inputs and up to five outputs are available.
- **User Setups** – The Symphony console is capable of storing up to 12 setups. Each licensed setup can be unique in terms of communication module programming.

SIGNALING CAPABILITIES

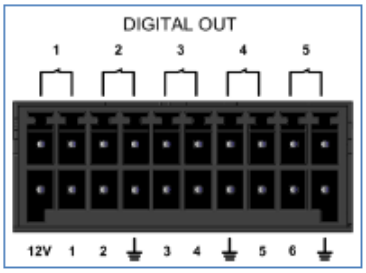
Alert Controls allows a dispatcher to choose the type of alert tone from a drop-down list and transmit the tone to the module entity. Typically, alert tones are utilized during emergency operations to signal radio units of various pre-defined emergency conditions, with voice transmissions following. When a tone is transmitted from the console, it is simultaneously heard in a speaker at the console. To prevent voice interference, all console microphone audio is muted during transmissions. Three distinctive alert tones transmitted from the console include:

- Alert Tone (A) – a steady medium-frequency tone (1000 Hz) that sounds while the respective button is depressed.
- Warble Tone (W) – a repeating sequence of a medium-frequency tone followed by a higher frequency tone that sounds while the respective button is depressed.
- Pulse Tone (P) – Medium-frequency tones (1000 Hz) that turns on and off repeatedly while the respective button is depressed.

AUXILIARY INPUT/OUTPUT CONNECTIONS

Auxiliary input and output connections are made using the Auxiliary I/O Connector, which is located on the Symphony Dispatch Platform's rear panel. The connector has six optocoupler auxiliary input lines (bottom row) and five output lines (top row) that can be used for interfacing with two-state external devices.

Figure 10. Auxiliary Input/Output Connections



The Symphony console can be configured in "demo" mode to enable the supervisor to conduct training on the dispatch console without interruption to the live system.