

Project 25 and Radio Dispatch Consoles

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1 Introduction

This white paper provides background and information relating to radio dispatch consoles and Project 25 (P25) digital two-way radio systems.

2 Scope

The intent of this white paper is to help inform those who specify, procure and use P25 systems about issues relating to using radio dispatch consoles in a P25 system. It is not intended to describe the goals of P25, what a P25 radio system is or why P25 is important. The information provided in this document is not limited to Zetron or its products; it pertains to any radio dispatch console system in a P25 environment.

For more information about P25, see the Project 25 Technology Interest Group (PTIG) website: www.project25.org. For information about Zetron's P25-capable radio dispatch consoles, call Zetron at (425) 820-6363 or obtain Zetron's "P25 Application Note" from www.zetron.com.

3 Background

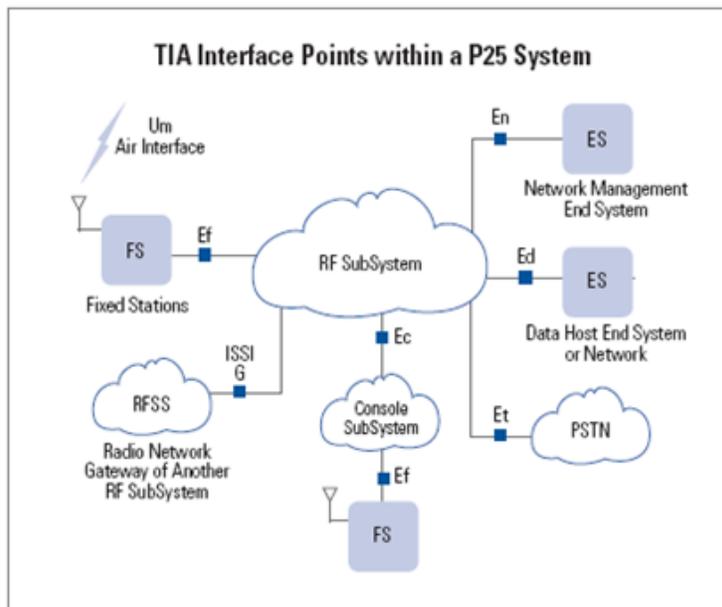
Project 25 is a user-driven standard, meaning that local and state public safety agencies and many federal agencies have defined and continue to define its features. These features are defined and periodically refined in a document called the P25 Statement of Requirements (SOR). The standards-development organization, the Telecommunications Industry Association (TIA), uses the P25 SOR to steer its standards development work within TIA's TR-8 engineering committee.

It is important to note that P25 is a "living" standard, whose features grow over time as new public safety communications needs are identified. Thus, P25 is characterized by "phases."

Unlike all other open-standard, digital two-way radio protocols, the published standards for P25 cover not only the wireless, over-the-air protocols, but also wireline interconnections between P25 network infrastructure components, including radio dispatch consoles.

The suite of P25 published standards include three "wireline" IP-based interfaces: the Inter Subsystem Interface (ISSI), the Console Subsystem Interface (CSSI) and the Fixed Station Interface (FSI).

In the diagram on page 2, these are identified as the "G," "Ec" and "Ef" interfaces, respectively.



The three interfaces are utilized as follows:

- Inter Subsystem Interface (ISSI) – Interconnects Radio Frequency Subsystems (RFSS). Typically used to allow overlapping or adjacent P25 systems to interoperate. The primary published standard document for the ISSI is TIA 102.BACA-A.
- Console Subsystem Interface (CSSI) – Connects a Console Subsystem (CSS) to an RFSS. Typically used for trunked P25 systems or for complex conventional P25 systems. The primary published standard documents for the CSSI are TIA 102.BAGA, 102.BACA-A & 102.BACA-2.
- Fixed Station Interface (FSI) – Connects conventional P25-base stations or repeaters to either an RFSS or a CSS. The primary published standard document for the FSI is TIA 102.BAHA.

Of these three interfaces, two may be used for radio dispatch consoles: the CSSI for trunked systems and the FSI for conventional systems. The CSSI protocol shares a significant set of the ISSI protocol.

All three of these wireline interfaces are IP-based. In addition, the FSI also has an analog variant that can use 4-wire audio circuits (either E&M or Tone Remote Control).

Published TIA standards are available for a fee from Global Engineering Documents (<http://global.ihs.com>). Public agencies may be able to obtain the documents directly from TIA for free.

4 Standard P25 Console Interface Availability

Although the P25 standards have identified three wireline interfaces, not all three of these interfaces are available in all P25 systems. There are three primary reasons for this.

For one thing, early (Phase 1) P25 systems did not include these open-standard wireline interfaces because the standards for those interfaces had not yet been published when these early systems were developed and deployed. In many cases, these older P25 systems cannot be upgraded to add later P25 features, such as wireline interfaces.

In addition, the P25 Statement of Requirements (SOR) does not make the wireline interfaces a mandatory part of all P25 systems. Rather, it gives manufacturers the discretion to choose to develop and offer for sale the wireline interfaces. Some manufacturers who offer open-standard wireline interfaces sell them as an extra-cost option. Thus, not all systems are deployed with those options.

Finally, because the full suite of five or six TIA standards documents for the console wireline interfaces have not yet been published, not all manufacturers have completed their development or testing of those interfaces. As a result, although some manufacturers might intend to offer wireline interfaces in the future, they might not yet be ready to deploy them.

5 Non-Standard, Proprietary P25 Console Interfaces

The situations described above have caused some P25 manufacturers to develop their own non-standard, proprietary wireline interfaces.

P25 manufacturers who make both the RF Subsystem (RFSS) and their own Console Subsystem (CSS) sometimes use their own proprietary protocol to interconnect their systems. Although this approach solves a problem for the manufacturer, it can create problems for a system user who might need a console that is manufacturer-independent and is therefore able to interoperate with neighboring agencies' non-P25 radio systems (such as Motorola ASTRO and iDEN, Harris EDACS, and Kenwood NEXEDGE®/NXDN).

In addition, because some RFSS manufacturers have not yet adopted the P25 open-standard FSI or CSSI, some independent console manufacturers, including Zetron, have developed other means of interfacing to otherwise-closed P25 systems.

Some RFSS manufacturers offer an analog console gateway to their P25 trunked system. (For conventional P25 systems, such an interface is standardized as the Analog FSI.) This allows legacy consoles using analog 4-wire Tone Remote Control (TRC) or Local Control (aka E&M) to access a trunked P25 system. Tone Remote Control generally allows selection of up to 15 channel attributes, such as air mode (analog/digital), encryption, talk group and/or NAC privacy code.

For P25 systems whose RFSS does not have provisions for open-standards such as IP-based FSI, CSSI or legacy analog TRC, another method, known as a "wireless" console interface, can be used to interface consoles to the system. This method uses P25 mobile radios as the console gateway, and may allow many desirable P25 console features, such as PTT-ID, emergency calls, talk group selection and encryption selection. It should be noted, however, that wireless interfaces are not capable of performing pre-emptive dispatching (interrupting a call in progress).

Both of these non-digital interface methods, wired and wireless, lack some of the features enabled by the open-standard P25 FSI and CSSI, or the RFSS manufacturer's proprietary interface. For this reason, large P25 systems served by multiple dispatch centers often use the RFSS manufacturer's console at the primary dispatch center and other consoles (via non-standard interfaces) at secondary dispatch centers. Because the exact features supported by a particular analog interface and console can vary, however, it is important to check with the console manufacturer to determine which P25 features they support for a given RFSS.

6 Future Standard P25 Wireless Console Interface

The Project 25 SOR dated March 2010 reflects a new requirement for a wireless/mobile console interface. This was a result of P25 users agreeing that a full-blown CSSI might not fit the budget or need of smaller dispatch centers or mobile dispatch centers. It is also an effort toward standardizing an interface that has been proprietary.

Currently, mobile radios are sometimes used as a non-standard gateway for consoles in a P25 system. But because P25 mobile radios are designed as subscriber units, they do not typically include provisions that allow an external console to fully control all of its features, and its features do not generally include all of those that may be desired for a radio dispatch console. As a result, there is a need for an additional interface that supports both proper console interfacing and proper dispatching features. Because this is a new requirement (as of the date of this writing), TIA has not yet initiated the development of the interface specification for the wireless/mobile console. But the addition of the requirement to the SOR recognizes the legitimacy and capability of “wireless” consoles.

7 Standard P25 Console Interface Evolution

The primary documents of the entire P25 TIA wireline standard have been published. At this writing, the TIA TR-8 engineering committee is working on revisions to the published wireline standards documents. These revisions provide corrections to prior errors, clarifications, and in some cases, enhancements to the protocol to enable new features. Thus, the capabilities of each open-standard wireline interface generally increase with each new release of the applicable standard.

Deployed P25 systems that comply with an older release of the published wireline standard may or may not be capable of being retrofitted with software/firmware that is compliant with a new release of the standard. If such software/firmware is available, system owners might expect to pay a fee to retrofit their systems with the latest compliant release.

8 Compliance Testing Of P25 Console Interfaces

Public safety interoperable communications grant funding available from the US federal government is contingent on the communications equipment being compliant with the P25 standards. Thus the National Institute of Standards & Technology (NIST) has created a P25 Compliance Assessment Program (CAP) that creates compliance test documents and qualifies manufacturers and independent labs to perform the testing. The results of the tests are posted on the federal Responder Knowledge Base (www.RKB.us).

As of the date of this writing, neither of the TIA P25 wireline console interfaces (FSI or CSSI) are subject to the federal CAP because the full suite of TIA standards for those interfaces are not yet published (particularly those relating to testing). Once the full suite of documents have been published, NIST will fold the FSI and CSSI into the CAP program and each manufacturer will be required to submit their product for testing if they want their products to qualify for purchase through federal interoperability grants.

It is important to note that any potential purchaser of P25 components may access the published test documentation on the Responder Knowledge Base, whether or not they intend to use grants to purchase the equipment. Thus purchasers will be able to know whether or not the FSI or CSSI capable equipment under consideration complies with the applicable P25 standards.

9 Standard P25 Console Interface Feature Support

The following table outlines the features that can be supported by the various P25 open-standard wireline interfaces. Note, however, that a particular manufacturer's implementation may not necessarily support all of these features. It is best to consult the manufacturer (of both RFSSs and CSSs) to verify which features are supported by their implementation of the wireline standards.

Feature	P25 Analog FSI	P25 Digital FSI	P25 CSSI	Future P25 Wireless/Mobile Console Interface
Conventional P25	X	X	Planned	Goal
Trunked P25			X	Goal
Voice Calls				
Group & Unaddressed Calls	X	X	X	Goal
System-Wide Call		X	X	Goal
Announcement Group Call			X	Desired
Broadcast Calls			X	Desired
Unit-to-Unit Calls		X	X	Goal
Discrete Listening of U2U		X	X	Goal
Emergency Group Calls		X	X	Goal
Audible Signaling		Conditional	Conditional	Goal
Digital DTMF		Conditional	Conditional	Goal
Call Priority		X	X	Goal
Dispatcher Interrupt	X	X	X	Desired
Dispatcher Call Termination			X	

Feature	P25 Analog FSI	P25 Digital FSI	P25 CSSI	Future P25 Wireless/Mobile Console Interface
For Outgoing Calls				
Talk Group ID Selection	channel†	X	X	Goal
Privacy Code ID Selection	channel†	X	X	Goal
Unit ID Selection		X	X	Goal
Key ID Selection	channel†	X	X	Goal
Encryption Mode Selection	channel†	X	X	Goal
Air Mode Selection	channel†	X	X	Goal
For Incoming Calls				
Talk Group ID Display		X	X	Goal
Privacy Code ID Display		X	X	Goal
Unit ID Display		X	X	Goal
Key ID Display		X	X	Goal
Encryption Mode Display		X	X	Goal
Air Mode Display		X	X	Goal
Subscriber Signaling				
Call Alert		X	X	Goal
Emergency Alert		X	X	Goal
Radio Check		X	X	Goal
Radio Monitor		X	X	Goal
Radio Inhibit		X	X	Goal
Status Query		X	X	Goal
Status Report/Update		X	X	Goal
Location Query		Planned	Planned	
Fixed Station Control				
Radio Channel† Selection	X	X	Planned	Goal
Scan Control	Planned	Planned	Planned	
Repeat On/Off	X	X	Planned	
Privacy Code Monitor	X	X	Planned	
Wild Card On/Off	X	X	Planned	
Site Intercom	X	X	Planned	

Feature	P25 Analog FSI	P25 Digital FSI	P25 CSSI	Future P25 Wireless/Mobile Console Interface
Voted Rcvr Status/Control		X	Planned	
Voter Transmitter Selection		Planned	Planned	
Other Features				
Predefined Messages		X	X	Goal
Packet Data & OTAR		Planned	Planned	
Dynamic Regrouping			Planned	Desired
Multiple Resource Arbitration				
Busy Channel Lockout		X	X	
Phone Patching			X	
Cross-Channel Patching			X	
Patch non-Transcoding			X	
Parallel Console Audio			X	
Unicast UDP			X	
Multicast UDP			Allowed	

Notes:

- The ability to send audible signaling with little distortion requires the use of the DVSI Enhanced IMBE (AMBE+2) Vocoder on both the sending and receiving end. This new vocoder started appearing in P25 equipment in 2007.
- TRF frequency, talk group, privacy code (NAC or CTCSS), encryption key/mode, and air mode may be determined by the fixed station channel attributes.

10 About Zetron

Zetron is a manufacturer of mission critical radio dispatch console systems used world-wide. Zetron's consoles interface to a wider variety of two-way radio technologies than any other console manufacturer, including legacy proprietary systems such as Motorola SMARTNET/SmartZone, Motorola ASTRO, Harris EDACS, Harris OpenSky, Trident Passport as well as modern open-standard digital systems such as Project 25, TETRA, and NXDN.

Zetron is an active participant in the TIA TR-8 engineering committee, and have staff that have served as leaders of particular sub-committees.

11 Appendix

The following is a table of P25 manufacturers who are known to support open-standard, TIA-published console wireline interfaces as of the date of this writing.

	Analog FSI	Digital FSI	CSSI
RFSS Manufacturers			
Auria Wireless			X
Daniels Electronics	X	X	
EADS			TBD
EF Johnson	X	X	
Harris	TBD	TBD	TBD
Kenwood	TBD	TBD	
Midland	X	TBD	
Motorola	TBD	TBD	TBD
Raytheon			X
Spectra Engineering		X	
Tait Radio Communications	X	X	
Console Manufacturers			
Avtec	X	X	
EF Johnson	X	TBD	TBD
Harris	X	TBD	TBD
Motorola	X	TBD	TBD
Pantel	X	TBD	X
Raytheon	X	TBD	X
Telex	X	X	
Zetron	X	X	X