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VGC Processor WJ-9424



The WJ-9424 Voice Grade Channel (VGC) Processor is a modular digital signal processing (DSP) system capable of demodulating and decoding most standard Modem, Voice Frequency Telegraphy (VFT) and Facsimile (FAX) signals on up to 30 VGCs simultaneously. By modifying demodulation parameters, an operator can also configure the WJ-9424 to demodulate nonstandard signal formats. The key to the unit's versatility is the Flexible Demodulator (FLX) board: a compact, self-contained plug-in card that performs blind equalization, carrier and clock recovery, demodulation, demultiplexing, derandomizing, and decoding functions on a high-speed, programmable DSP chip. An operator selects the desired demodulation mode individually for each FLX via the front-panel or remote-control interface. Various character decoding formats such as ASCII, BAUDOT and EBCDIC are operator-selectable.

As shown on the WJ-9424 block diagram, the WJ-9424 contains 30 slots that accept FLX boards. Of these, eight slots can alternatively be populated with one or more VGC Input Formatter boards. Available VGC Input Formatter boards include T1, Level 1 CEPT, and 6-Channel Analog Audio. Other slots are available to accept one of a number of Output Data Formatter modules for interfacing the demodulated digital data to external computers, workstations, printers, or mass data storage devices.

Features

- ❑ Up to 30 flexible VGC demodulators in a single unit
- ❑ Demodulation & decoding of a variety of standard signal formats including Modem, VFT & FAX
- ❑ User-specified demodulation for nonstandard signal formats
- ❑ A variety of available VGC input & data output interfaces
- ❑ Capability to accept digitized VGC data from WJ-954X FDM Demultiplexers or other WJ-9424s via a proprietary 240-channel TDM bus
- ❑ Compact size: 3.5-in (8.89 cm) half-rack package
- ❑ Built-in test capability & modular design to facilitate field maintenance
- ❑ Full local & IEEE-488 remote control (other interfaces available)

HEIGHT	3.5 in (8.89 cm)	DEPTH	22 in (55.88 cm)
WIDTH	8.25 in (20.96 cm)	WEIGHT	20 lb (9.05 kg)

*Excluding connectors, knobs & handles

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The WJ-9424 architecture is built around the same 16-bit, parallel TDM bus used within the WJ-954X family of Digital FDM Demultiplexers. Therefore, the WJ-9424 accommodates not only the FLX, but any other standard WJ-9548 VGC Option Card. The TDM bus has a maximum capacity of 240 standard 4-kHz VGCs and accepts data from up to eight separate devices. VGC Data source devices include external WJ-954X units and Input Formatters installed within WJ-9424s. A hypothetical system configuration diagram includes the following VGC Data source devices:

- Two WJ-9548 FDM Demultiplexers
- Four 6-Channel Analog Input Formatters (9424/MAI)
- CEPT Input Formatter (9424/CEPT)
- T1 Input Formatter (9424/T1)

The TDM bus effectively allows all interconnected units to share the available voice grade data from these sources. FLX boards, installed within each of the WJ-9424 units shown, can be commanded to access any VGC on the TDM bus in a completely nonblocking fashion.

Each FLX board incorporates an individual RS-232 (transmit-only) interface to provide output data in an ASCII or binary format. Some or all of these serial lines can be brought directly out to the rear panel, or can be processed by the installed Output Data Formatter board to satisfy particular system requirements. Possible Output Data Formatters include a Quad RS-232 Matrix Switch or one of a number of high-speed data communications interfaces such as SCSI, Ethernet or FDDI. Consult the factory for specific Output Data Formatter interface requirements.

Individual data records can be internally buffered, and transmitted in blocks with appropriate header and trailer information to provide the most efficient utilization of the output bus bandwidth. When a VFT demodulation mode is selected, the operator may choose to output one or all channels within a given VGC. VFT modes include FSK VFT protocols such as R.35 through R.39 as well as the TDM VFT protocols of R.101A and R.101B. In the case of FAX signal demodulation, the T.30 handshake information as well as the T.4-encoded image data is available at the WJ-9424 outputs. PC-compatible software is provided to collect this pixel data, via the PC's serial communications port, and reconstruct the FAX images on a VGA monitor.

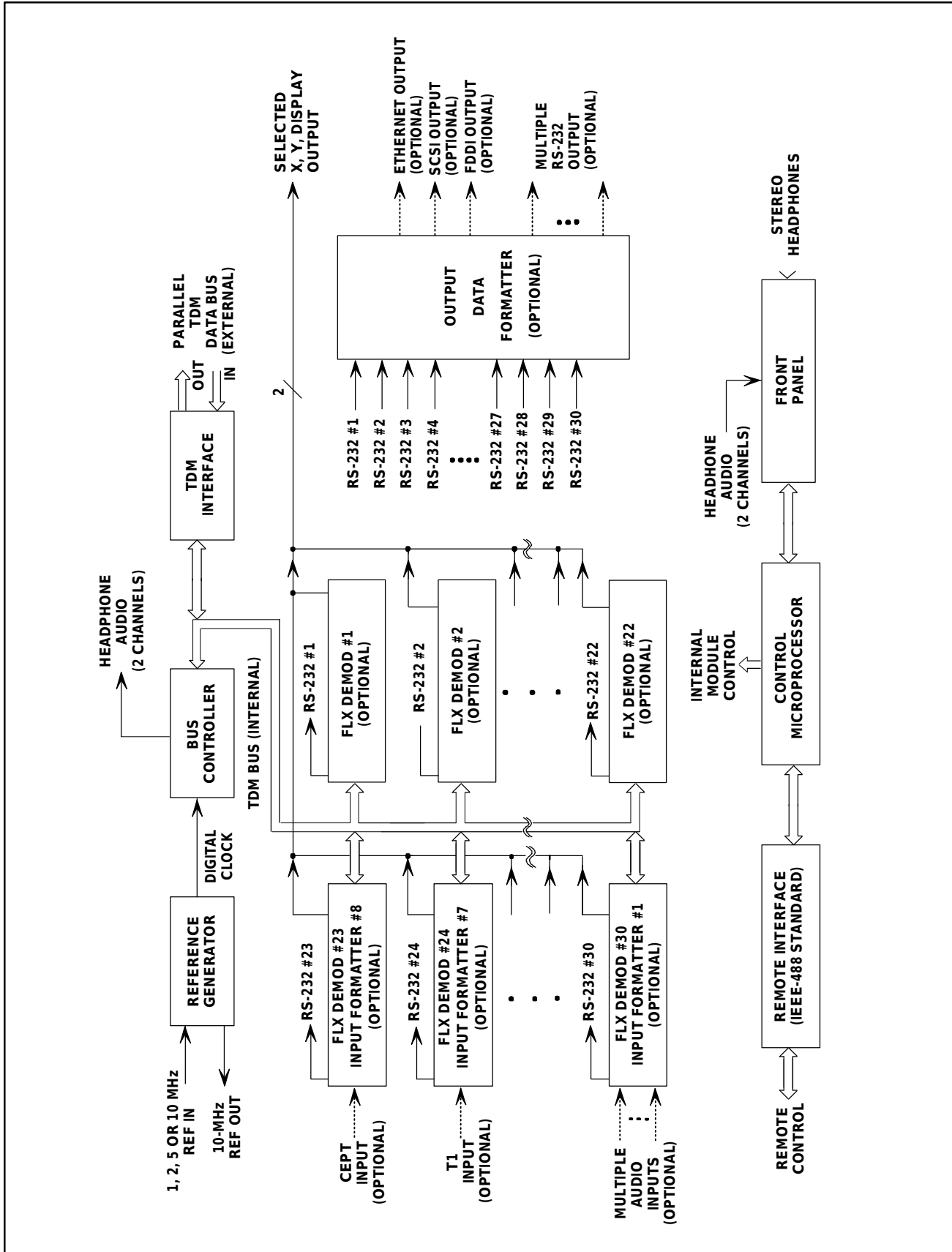
Analog X/Y display outputs are provided to generate eye diagram or constellation displays on an external 2-channel oscilloscope. Any FLX installed within the WJ-9424 can be commanded to drive these display outputs.

The WJ-9424 can be controlled either locally, via the front-panel liquid crystal display (LCD) and keypad controls, or remotely, via the standard IEEE-488 interface. The display is a menu-driven, 8 x 40 character LCD with LED backlighting. Unit and demodulator parameters are presented in a variety of display formats. Parameter entry is accomplished via the numeric keypad or cursor, and edit control knobs on the unit's front panel. With the exception of headphone volume control and bus address, all operator-selectable parameters are controlled and accessed via the standard IEEE-488 interface. Consult the factory for alternative remote control interfaces.

For all of its capability, the WJ-9424 VGC Processor is extremely compact. Two units, mounted side-by-side, fit into a standard 19-inch (48.26 cm) equipment rack, occupying only 3.5 inches (8.89 cm) of vertical rack space. The weight of the unit is approximately 20 pounds (9.05 kg).

Standard Connector (Inputs/Outputs)

I/O	Function	Type
Inputs	TDM Data input	Multipin
	Reference input	BNC
	AC Power	IEC Male
Outputs	TDM Data output	Multipin
	Reference output	BNC
	Headphones	0.25-in (0.64cm) stereo jack
Bidirectional	Remote Control	IEEE-488



WJ-9424 VGC Processor Functional Block Diagram

Specifications

Input Characteristics

TDM Data Bus (Standard)	16-bit, parallel VGC data bus, 240-channel capacity; compatible with WJ-954X FDM Demultiplexers
Input Formatters (Optional)	6-channel analog audio CEPT (30-channel PCM, 2.048 Mbps) T1 (24-channel PCM, 1.544 Mbps)
Number of Input Formatters	Up to 4 installable (FLX + Input Formatters cannot exceed 30) where up to 4 can be MAI option
Analog Audio Input (Optional)	6 channels of audio, digitized to 16-bits via sigma-delta A/D converters
Input Impedance	600 ohms, unbalanced or balanced
Input Level Range	-50 to +10 dBm into 600 ohms (7 mV to 7 V peak-to-peak)
Frequency Response	120 to 3600 Hz (-3 dB)
Anti-Aliasing Rejection	80 dB, 4.4 to 500 kHz
Gain Control Modes	AGC-Fast, AGC-Slow & Manual (Operator-selectable on a per-channel basis)
Gain Control Range	50 dB
Manual Gain Increments	1 dB, nominal
Input Connector	D-type, 25-pin female (single connector supports 2 6-channel analog input options)
T1 PCM Input (Optional)	T1, 24-channel capacity, 1.544 Mbps
Input Impedance	100 ohms, balanced
Line Code	B8ZS or AMI (operator-selectable)
Decoding	m255 linear (operator-selectable)
Framing Formats	F4, F12 (D4), F24 (ESF), F72 (SLC-96)
Input Connector	Bayonet-style Triax
CEPT PCM Input (Optional)	L1 CEPT, 30-channel capacity, 2.048 Mbps
Input Impedance	75 ohms, unbalanced
Line Code	HDB3 per CCITT G.703
Decoding	A-law or linear (operator-selectable)
Framing Format	G.704 Standard or CRC Multiframe
Input Connector	BNC

Output Characteristics

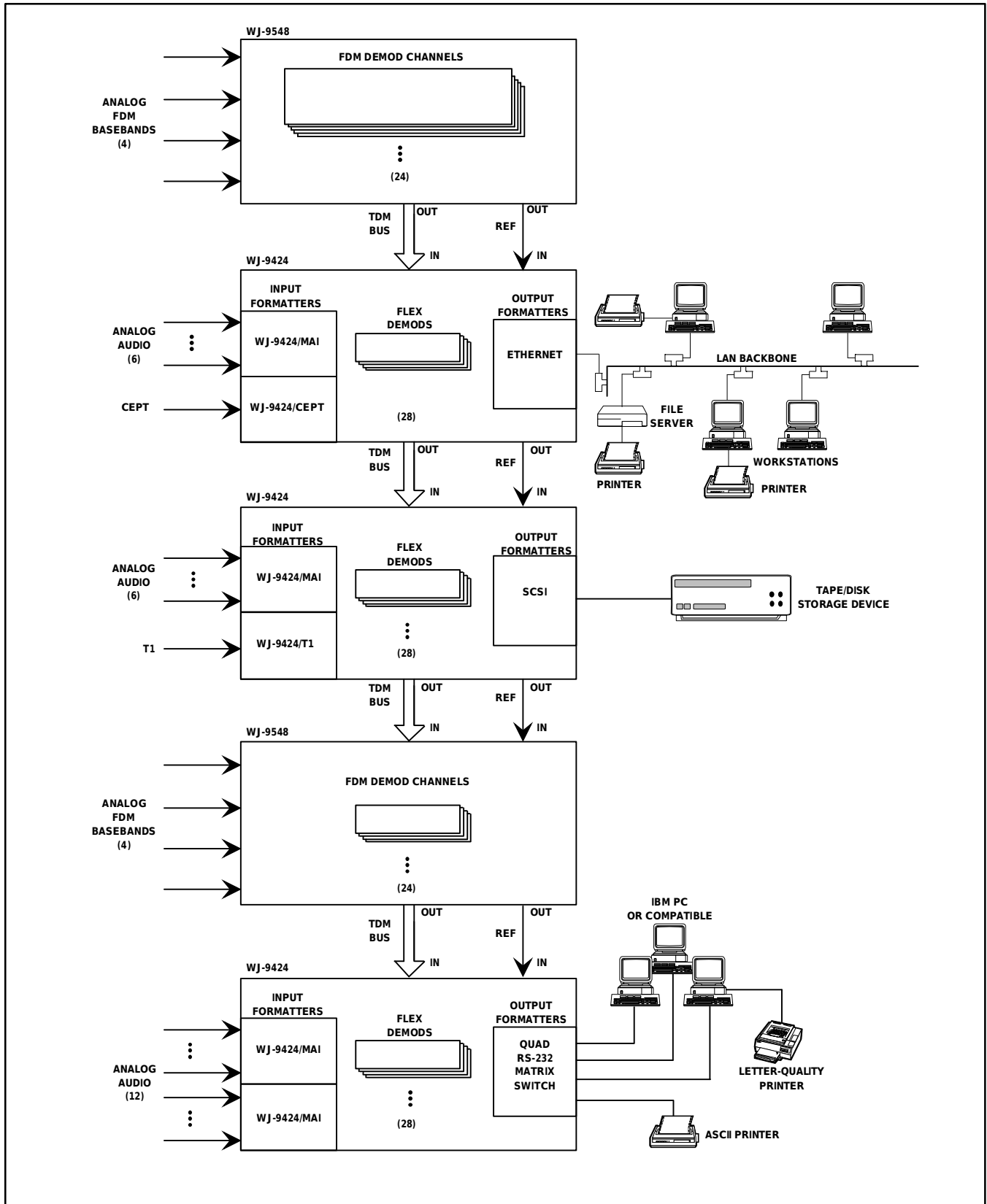
TDM Data Bus (Standard)	Output version of the TDM Data Bus input to allow daisy chain connection with WJ-954Xs or other WJ-9424s
Headphone Output (Standard)	Toll quality stereo; independent channel selection & volume control for each side
Output Impedance	600 ohms
Nominal Output Level	Adjustable up to 8 dBm into 600 ohms
Analog X/Y Output (Standard)	I/Q baseband or symbol synchronization signals used to display an eye diagram or constellation of a selected data channel

Output Data Interfaces (Optional)	Multiple RS-232 transmit only (Individual Data Outputs or Quad Output Matrix Switch); consult factory for special high-performance data interfaces
Flexible Demodulator (Optional)	
Demodulation Modes	See separate FLX data sheet for specific Modem, FAX & VFT modulations, & protocols supported
Frequency Reference	
Stability	$\pm 5 \times 10^{-7}$, max (internal)
Aging	$\pm 3 \times 10^{-9}$ drift per day, max (internal)
External Reference	Accepts 1, 2, 5 or 10 MHz (± 1 PPM), 200 mV peak-to-peak min into high-impedance load; automatically switches to external reference upon application of signal
Reference Output	10 MHz, 0 dBm, nominal, 50 ohms
Diagnostics	
Built-In Test	Operator-initiated; detects circuit faults to the module level
Physical/Environmental	
Temperature Range Operating	0 to 50°C; meets all specs 10 to 40°C
Power Requirements	115/230 Vac $\pm 15\%$, 48 to 420 Hz
Power Consumption	70 W, max (fully loaded)

Options

Nomenclature	Functions	Physical Characteristics
<p>9424/FLX Flexible Demodulator</p>	<ul style="list-style-type: none"> • Provides a single-channel VGC demodulator capable of demodulating & decoding a variety of Modem, VFT & FAX signal formats • Performs: <ul style="list-style-type: none"> - Symbol timing recovery - Adaptive blind equalization - Carrier Recovery - Data derandomizing - Data decoding • Provides demodulated character data via the 9424/IDO option or an installed Output Data Formatter option • Outputs eye diagrams & constellation patterns on X/Y analog outputs • In VFT applications, all canals or a single selected data canal can be output • See separate FLX data sheet for list of protocols supported 	<ul style="list-style-type: none"> • Uses 1 of 30 available VGC option slots • Consists of: <ul style="list-style-type: none"> - FLX - PC Assembly
<p>9424/MAI Multiple Analog Input</p>	<ul style="list-style-type: none"> • Provides 6 high dynamic range analog audio inputs • Inputs driven by balanced or unbalanced sources • Provides independent AGC or manual gain control for each input channel • 50-dB gain control range • Provides signal level indicator for each input channel 	<ul style="list-style-type: none"> • Uses 1 of 4 VGC Input Formatter option slots • Consists of: <ul style="list-style-type: none"> - Analog Input PC Assembly - Internal Cable Assemblies - Set of rear panel identification (ID) plates & decals - 25-pin D connector that accommodates up to 2 /MAI options

Nomenclature	Functions	Physical Characteristics
9424/T1 T1 Input Formatter	<ul style="list-style-type: none"> • Accepts a standard T1 input data stream containing up to 24 VGCs • Allows selection of linear or u-law decoding on a channel-by-channel basis • Supports a variety of framing & line code formats 	<ul style="list-style-type: none"> • Uses 1 of 8 VGC Input Formatter option slots • Consists of: <ul style="list-style-type: none"> - T1 Formatter PC Assembly - Internal Cable Assembly - Set of rear-panel ID & decals
9424/CEPT CEPT Input Formatter	<ul style="list-style-type: none"> • Accepts a standard CEPT input data stream containing up to 24 VGCs • Allows selection of linear or A-law decoding on a channel-by-channel basis • Supports 2 framing formats & the HDB3 line code 	<ul style="list-style-type: none"> • Uses 1 of 8 VGC Input Formatter option slots • Consists of: <ul style="list-style-type: none"> - CEPT Formatter PC Assembly - Internal Cable Assembly Set of rear-panel ID plates & decals
9424/IDO Individual Data Output	<ul style="list-style-type: none"> • Provides individual RS-232 outputs for 12 Flexible Demodulator options • Up to 2 9424/IDO options installable per WJ-9424 unit 	<ul style="list-style-type: none"> • Occupies no option slots • Provides a rear-panel-mounted 25-pin D connector
9424/QMS Quad RS-232 Matrix Switch	<ul style="list-style-type: none"> • Allows routing of any 4 installed Flexible Demodulator RS-232 outputs to rear-panel connector • Output routing totally non-blocking & can be dynamically changed 	<ul style="list-style-type: none"> • Occupies Output Data Formatter option slot • Consists of: <ul style="list-style-type: none"> - QMS PC Assembly - 4 internal cables terminating in individual BNC connectors
WJ-9424/BR Blank Rack	<ul style="list-style-type: none"> • Allows the mounting of a single WJ-9424 into a standard 19-in (48.26 cm) rack 	



Hypothetical System Configuration