
NI-9375/9401/9402/9403 Explosive Atmospheres User Guide

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Explosive Atmospheres UG NI

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NI 9375: 30 V, 32-Channel (Sinking Input, Sourcing Output), 7 μ s (Input)/500 μ s (Output) C Series Digital Module

NI 9401: 5 V/TTL, 8 Bidirectional Channels, 100 ns C Series Digital Module

NI 9402: LVTTTL, 4 Bidirectional Channels, 55 ns C Series Digital Module

NI 9403: 5 V/TTL, 32 Bidirectional Channels, 7 μ s C Series Digital Module

NI 9411: \pm 5 V to 24 V, 6 Differential/Single-Ended Channels, 500 ns C Series Digital Module

NI 9421: 24 V, 8-Channel (Sinking Input), 100 μ s C Series Digital Module

NI 9423: 24 V, 8 Channel (Sinking Input), 1 μ s C Series Digital Module

NI 9425: 24 V, 32-Channel (Sinking Input), 7 μ s C Series Digital Module

NI 9426: 24 V, 32 Channel (Sourcing Input), 7 μ s C Series Digital Module

NI 9470: 5 VDC to 30 VDC, 8-Channel (Sourcing Output), 2 kHz C Series Digital Module

NI 9472: 24 V, 8-Channel (Sourcing Output), 100 μ s C Series Digital Module

NI 9474: 30 V, 8-Channel (Sourcing Output), 1 μ s C Series Digital Module

NI 9475: 60 V, 8-Channel (Sourcing Output), 1 μ s C Series Digital Module

NI 9476: 36 V, 32-Channel (Sourcing Output), 500 μ s C Series Digital Module

NI 9477: 60 V, 32-Channel (Sinking Output), 8 μ s C Series Digital Module

NI 9478: 50 V, 16-Channel (Sinking Output), 50 μ s C Series Digital Module

Physical Characteristics

Weight

NI 9375 with push-in spring terminal	164 g (5.8 oz)
NI 9375 with spring terminal	159 g (5.6 oz)
NI 9375 with DSUB	148 g (5.3 oz)
NI 9401 with DSUB	145 g (5.1 oz)
NI 9402 with BNC	199 g (6.9 oz)
NI 9403 with DSUB	150 g (5.3 oz)
NI 9411	136 g (4.8 oz)
NI 9421 with screw terminal	166 g (5.9 oz)
NI 9421 with spring terminal	153 g (5.4 oz)
NI 9421 with DSUB	144 g (5.0 oz)
NI 9423 with screw terminal	150 g (5.3 oz)
NI 9423 with spring terminal	145 g (5.1 oz)
NI 9425 with spring terminal	163 g (5.7 oz)
NI 9425 with DSUB	147 g (5.2 oz)
NI 9426 with DSUB	147 g (5.2 oz)

NI 9470 with Ultra-Fit	140 g (4.9 oz)
NI 9472 with screw terminal	150 g (5.3 oz)
NI 9472 with spring terminal	139 g (4.9 oz)
NI 9472 with DSUB	145 g (5.1 oz)
NI 9474 with screw terminal	150 g (5.3 oz)
NI 9474 with spring terminal	139 g (4.9 oz)
NI 9475 with DSUB	142 g (4.9 oz)
NI 9476 with spring terminal	167 g (5.9 oz)
NI 9476 with DSUB	147 g (5.2 oz)
NI 9477 with DSUB	145 g (5.1 oz)
NI 9478 with DSUB	148 g (5.2 oz)

Dimensions	Visit ni.com/dimensions and search by module number.
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Note Some NI C Series modules offer two types of spring terminal connectors: push-in spring terminal and spring terminal. The black/orange push-in spring terminal connectors do not require a tool for signal connection; push the wire into the terminal when using solid wire or stranded wire with a ferrule, or by pressing the push button when using stranded wire without a ferrule. The black spring terminal connectors require a flathead screwdriver with a 2.3 mm × 1.0 mm (0.09 in. × 0.04 in.) blade for signal connection; insert the screwdriver into a spring clamp activation slot to open the corresponding connector terminal, press a wire

into the open connector terminal, and then remove the screwdriver from the activation slot to clamp the wire into place.

NI 9375 with Push-In Spring Terminal (Black/Orange Connector)

Spring terminal wiring

Gauge 0.14 mm² to 1.5 mm² (26 AWG to 16 AWG) copper conductor wire

Wire strip length 10 mm (0.394 in.) of insulation stripped from the end

Temperature rating 90 °C, minimum

Wires per spring terminal One wire per spring terminal; two wires per spring terminal using a 2-wire ferrule

Ferrules

Single ferrule, uninsulated 0.13 mm² to 1.5 mm² (26 AWG to 16 AWG) 10 mm barrel length

Single ferrule, insulated 0.13 mm² to 1.0 mm² (26 AWG to 18 AWG) 12 mm barrel length

Two-wire ferrule, insulated 2x 0.34 mm² (2x 22 AWG) 12 mm barrel length

Connector securement

Securement type Screw flanges provided

Torque for screw flanges 0.2 N · m (1.80 lb · in.)

NI 9375 with Spring Terminal (Black Connector)

Spring terminal wiring

Gauge	0.08 mm ² to 1.0 mm ² (28 AWG to 18 AWG) copper conductor wire
Wire strip length	7 mm (0.28 in.) of insulation stripped from the end
Temperature rating	90 °C, minimum
Wires per spring terminal	One wire per spring terminal

Connector securement

Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m (1.80 lb · in.)

NI 9402

Cable	50 Ω BNC
Cable length	2 m maximum

NI 9411

Screw terminal wiring (Vsup)

Gauge	0.05 mm ² to 1.5 mm ² (30 AWG to 14 AWG) copper conductor wire
Wire strip length	6 mm (0.24 in.) of insulation stripped from the end

Temperature rating	90 °C, minimum
Torque for screw terminals	0.22 N · m to 0.25 N · m (1.95 lb · in. to 2.21 lb · in.)
Wires per screw terminal	One wire per screw terminal; two wires per screw terminal using a 2-wire ferrule
Ferrules	0.25 mm ² to 1.5 mm ²

Connector securement

Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m (1.80 lb · in.)

NI 9421 with Screw Terminal, NI 9423 with Screw Terminal

Screw terminal wiring

Gauge	0.2 mm ² to 2.5 mm ² (26 AWG to 14 AWG) copper conductor wire
Wire strip length	13 mm (0.51 in.) of insulation stripped from the end
Temperature rating	90 °C, minimum
Torque for screw terminals	0.5 N · m to 0.6 N · m (4.4 lb · in. to 5.3 lb · in.)
Wires per screw terminal	One wire per screw terminal; two wires per screw terminal using a 2-wire ferrule

Connector securement

Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m (1.80 lb · in.)

NI 9421 with Spring Terminal, NI 9423 with Spring Terminal

Spring terminal wiring	
Gauge	0.2 mm ² to 2.5 mm ² (30 AWG to 12 AWG) copper conductor wire
Wire strip length	10 mm (0.39 in.) of insulation stripped from the end
Temperature rating	90 °C, minimum
Wires per spring terminal	One wire per spring terminal; two wires per spring terminal using a 2-wire ferrule

Connector securement	
Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m (1.80 lb · in.)

NI 9425 with Spring Terminal, NI 9476 with Spring Terminal

Spring terminal wiring	
Gauge	0.14 mm ² to 1.5 mm ² (26 AWG to 16 AWG) copper conductor wire

Wire strip length	10 mm (0.394 in.) of insulation stripped from the end
Temperature rating	90 °C, minimum
Wires per spring terminal	One wire per spring terminal; two wires per spring terminal using a 2-wire ferrule
Ferrules	0.14 mm ² to 1.5 mm ²
Connector securement	
Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m (1.80 lb · in.)

NI 9470 with Ultra-Fit

I/O plug type	Molex Ultra-Fit, part number 1722583116
Crimp terminal	
18 AWG to 16 AWG	Molex Ultra-Fit, part number 1722536012
22 AWG to 20 AWG	Molex Ultra-Fit, part number 1722536112
Wire gauge	22 AWG to 16 AWG

NI 9472 with Screw Terminal, NI 9474 with Screw Terminal

Screw terminal wiring

Gauge	0.2 mm ² to 2.5 mm ² (26 AWG to 14 AWG) copper conductor wire
Wire strip length	13 mm (0.51 in.) of insulation stripped from the end
Temperature rating	90 °C, minimum
Torque for screw terminals	0.5 N · m to 0.6 N · m (4.4 lb · in. to 5.3 lb · in.)
Wires per screw terminal	One wire per screw terminal; two wires per screw terminal using a 2-wire ferrule
Ferrules	0.25 mm ² to 2.5 mm ²

Connector securement

Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m (1.80 lb · in.)

NI 9472 with Spring Terminal, NI 9474 with Spring Terminal

Spring terminal wiring

Gauge	0.2 mm ² to 2.5 mm ² (30 AWG to 12 AWG) copper conductor wire
Wire strip length	10 mm (0.39 in.) of insulation stripped from the end
Temperature rating	90 °C, minimum
Wires per screw terminal	One wire per screw terminal; two wires per screw terminal using a 2-wire ferrule

Ferrules	0.25 mm ² to 2.5 mm ²
Connector securement	
Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m (1.80 lb · in.)

Environmental

Refer to the manual for the chassis you are using for more information about meeting these specifications.

Operating temperature	-40 °C to 70 °C
Storage temperature	-40 °C to 85 °C
Ingress protection	IP40
Operating humidity	10% RH to 90% RH, noncondensing
Storage humidity	5% RH to 95% RH, noncondensing
Pollution Degree	2

Maximum altitude

NI 9375 with push-in spring terminal	5,000 m
NI 9375 with spring terminal	2,000 m
NI 9375 with DSUB	5,000 m

NI 9401	2,000 m
NI 9402	2,000 m
NI 9403	5,000 m
NI 9411	2,000 m
NI 9421	2,000 m
NI 9423	2,000 m
NI 9425	5,000 m
NI 9426	2,000 m
NI 9470	5,000 m
NI 9472	2,000 m
NI 9474	2,000 m
NI 9475	2,000 m
NI 9476 with spring terminal	5,000 m
NI 9476 with DSUB	2,000 m
NI 9477	2,000 m
NI 9478	2,000 m

Indoor use only.

Hazardous Locations

Explosive atmospheres rating	Ex nA IIC T4 Gc
CCC certificate number	2021312310000312

Safety Guidelines for Hazardous Voltages (Screw Terminal and Spring Terminal Products)

If hazardous voltages are connected to the device, take the following precautions. A hazardous voltage is a voltage greater than 42.4 Vpk voltage or 60 V DC to earth ground.

You may connect signals which may be floating at hazardous voltages only to the products with screw terminal or spring terminal connectors. Do not connect hazardous voltages to the NI 9375, NI 9470, or to products with DSUB or BNC connectors.



Caution Ensure that hazardous voltage wiring is performed only by qualified personnel adhering to local electrical standards.



Caution All wiring must be insulated for the highest voltage used.



Caution Do not mix hazardous voltage circuits and human-accessible circuits on the same module.



Caution Ensure that devices and circuits connected to the module are properly insulated from human contact.



Caution (NI 9421/9423) You must use the NI 9927 connector backshell to ensure that the terminals are not accessible.



Caution (NI 9472/9474) You must use the NI 9927 connector backshell kit with the product with screw terminal and the NI 9981 connector backshell kit with the product with spring terminal to ensure that the terminals are not accessible.

Safety Guidelines for Hazardous Locations

These products have been evaluated as Ex nA IIC T4 Gc equipment and are CCC certified. Each product is suitable for use within ambient temperatures of $-40\text{ }^{\circ}\text{C} \leq T_a \leq 70\text{ }^{\circ}\text{C}$ in either nonhazardous locations or Zone 2 hazardous locations. If you are using the products in Gas Group IIC hazardous locations, you must use the device in an NI chassis that has been evaluated as Ex nA IIC T4 Gc equipment.

Follow these guidelines if you are installing the product in a potentially explosive environment. Not following these guidelines may result in serious injury or death.



Caution Do not disconnect I/O-side wires or connectors unless power has been switched off or the area is known to be nonhazardous.



Caution Do not remove modules unless power has been switched off or the area is known to be nonhazardous.



Caution Substitution of components may impair suitability for Zone 2.



Caution Transient protection shall be provided that is set at a level not exceeding 140% of the peak rated voltage value of 85 V at the supply terminals to the equipment.



Caution The system shall only be used in an area of not more than Pollution Degree 2, as defined in IEC/EN 60664-1.



Caution The system shall be mounted in a CCC-certified enclosure with a minimum ingress protection rating of at least IP54 as defined in GB3836.1.



Caution The enclosure must have a door or cover accessible only by the use of a tool.

Safety Voltages

NI 9375

Connect only voltages that are within the following limits:

Channel-to-COM	30 V DC maximum
External power supply (Vsup) voltage range	6 V DC to 30 V DC, 18 mA
Isolation	
DI bank-to-DO bank	60 V DC maximum
Channel-to-Channel	No isolation between channels
Channel-to-earth ground	
Continuous	60 V DC, Measurement Category I
Withstand up to 3,000 m	1,000 V RMS, verified by a 5 s dielectric withstand test
Withstand up to 5,000 m (DSUB and push-in spring terminal)	860 V RMS



Caution Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

NI 9401

Connect only voltages that are within the following limits:

Input range	0.8 V to 5.25 V
Output range	0.1 V to 4.7 V, 100 μ A
Maximum voltage	
Channel-to-COM	\pm 30 V maximum on one channel at a time, Measurement Category I
Isolation voltages	
Channel-to-channel	None
Channel-to-earth ground	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test



Caution Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

NI 9402

Connect only voltages that are within the following limits:

Input range	0.8 V to 5.25 V
Output range	0.1 V to 3.0 V, 100 μ A

Input overvoltage protection	±30 V maximum on one channel at a time
Channel-to-earth ground	±30 V maximum, Measurement Category I
Isolation	
Channel-to-channel	None
Channel-to-earth ground	None



Caution Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

NI 9403

Connect only voltages that are within the following limits:

Input range	-0.25 V to 5.25 V
Output range	0.1 V to 5.2 V, 100 µA
Channel-to-COM	±30 V maximum on up to 8 channels at a time, Measurement Category I

Isolation

Channel-to-channel None

Channel-to-earth ground

Continuous 60 V DC, Measurement Category I

Withstand

up to 3,000 m altitude 1,000 V RMS, verified by a 5 s dielectric withstand test

up to 5,000 m altitude 860 V RMS, verified by a 5 s dielectric withstand test



Caution Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

NI 9411

Connect only voltages that are within the following limits.

Input range	0 V to 24 V single-ended -300 mV to 24 V differential -7 V to 12 V common-mode
Overvoltage protection, channel-to-COM	30 V maximum, Measurement Category I
External power supply (Vsup)	5 V DC to 30 V DC

Isolation

Channel-to-channel None

Channel-to-earth ground

Continuous 30 V RMS, 42.4 Vpk, 60 V DC

Withstand 400 V RMS, verified by a 5 s dielectric withstand test



Caution Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

NI 9421 with Screw Terminal, NI 9421 with Spring Terminal

Connect only voltages that are within the following limits:

Channel-to-COM	30 V maximum
Overvoltage protection	40 V maximum
Reverse-biased voltage	-30 V maximum
Isolation	
Channel-to-channel	None
Channel-to-earth ground	
Continuous	250 V RMS, Measurement Category II
Withstand	2,300 V RMS, verified by a 5 s dielectric withstand test



Caution Do not connect the product to signals or use for measurements within Measurement Categories III or IV.

NI 9421 with DSUB

Connect only voltages that are within the following limits:

Channel-to-COM	30 V maximum
Overvoltage protection	40 V maximum
Reverse-biased voltage	-30 V maximum

Isolation

Channel-to-channel None

Channel-to-earth ground

Continuous 60 V DC, Measurement Category I

Withstand 1,000 V RMS, verified by a 5 s dielectric withstand test



Caution Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

NI 9423 with Screw Terminal, NI 9423 with Spring Terminal

Connect only voltages that are within the following limits:

Channel-to-COM	30 V maximum
Overvoltage protection	35 V maximum
Reverse-biased voltage	-30 V maximum

Isolation

Channel-to-channel None

Channel-to-earth ground

Continuous 250 V RMS, Measurement Category II

Withstand 2,300 V RMS, verified by a 5 s dielectric withstand test



Caution Do not connect the product to signals or use for measurements within Measurement Categories III or IV.

NI 9425 with Spring Terminal

Connect only voltages that are within the following limits.

Channel-to-COM	24 V
I/O protection	
8 channels	60 V DC maximum -60 V DC reverse-bias
32 channels	30 V DC maximum -30 V DC reverse-bias
Channel-to-channel	
Up to 8 channels simultaneously	±60 V maximum
All channels simultaneously	±30 V maximum
Isolation	
Channel-to-channel	None
Channel-to-earth ground	
Continuous	250 V RMS, Measurement Category II
Withstand up to 5,000 m	3,000 V RMS, verified by a 5 s dielectric withstand test



Caution Do not connect the product to signals or use for measurements within Measurement Categories III or IV.

NI 9425 with DSUB

Connect only voltages that are within the following limits.

Channel-to-COM	24 V
I/O protection	
8 channels	60 V DC maximum -60 V DC reverse-bias
32 channels	30 V DC maximum -30 V DC reverse-bias
Channel-to-channel	
Up to 8 channels simultaneously	±60 V maximum
All channels simultaneously	±30 V maximum
Isolation	
Channel-to-channel	None
Channel-to-earth ground	
Continuous	60 V DC, Measurement Category I
Withstand up to 2,000 m	1,000 V RMS, verified by a 5 s dielectric withstand test

Withstand up to 5,000 m 500 V RMS, verified by a 5 s dielectric withstand test



Caution Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

NI 9426

Connect only voltages that are within the following limits:

V _{sup-to-channel}	30 V DC maximum
Isolation	
Channel-to-channel	None
Channel-to-earth ground	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test



Caution Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

NI 9470

Connect only voltages that are below these limits.

V _{sup-to-COM}	0 V DC to 30 V DC maximum, Measurement Category I
Isolation	

Channel-to-channel	None
Channel-to-earth ground	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test



Caution Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

NI 9472 with Screw Terminal, NI 9472 with Spring Terminal

Connect only voltages that are within the following limits.

Channel-to-COM	30 V DC maximum
External power supply (Vsup) voltage range	6 V DC to 30 V DC

Isolation	
Channel-to-channel	None
Channel-to-earth ground	
Continuous	250 V RMS, Measurement Category II
Withstand	2,300 V RMS, verified by a 5 s dielectric withstand test



Caution Do not connect the product to signals or use for measurements within Measurement Categories III or IV.

NI 9472 with DSUB

Connect only voltages that are within the following limits.

Channel-to-COM	30 V DC maximum
External power supply (Vsup) voltage range	6 V DC to 30 V DC
Isolation	
Channel-to-channel	None
Channel-to-earth ground	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test



Caution Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

NI 9474 with Screw Terminal, NI 9474 with Spring Terminal

Connect only voltages that are within the following limits.

Channel-to-COM	30 V DC maximum
External power supply (Vsup) voltage range	5 V DC to 30 V DC
Isolation	
Channel-to-channel	None
Channel-to-earth ground	

Continuous	250 V RMS, Measurement Category II
Withstand	2,300 V RMS, verified by a 5 s dielectric withstand test



Caution Do not connect the product to signals or use for measurements within Measurement Categories III or IV.

NI 9475

Connect only voltages that are within the following limits:

Vsup-to-COM	60 V DC maximum, Measurement Category I
Isolation	
Channel-to-channel	None
Channel-to-earth ground	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test



Caution Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

NI 9476 with Spring Terminal

Connect only voltages that are within the following limits.

External power supply (Vsup) voltage range	6 V DC to 36 V DC
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$V_{\text{sup-to-COM}}$	40 V DC maximum
DO	$V_{\text{COM}} \leq V_{\text{DO}} \leq V_{\text{sup}}$
Isolation	
Channel-to-channel	None
Channel-to-earth ground	
Continuous	250 V RMS, Measurement Category II
Withstand up to 5,000 m	3,000 V RMS, verified by a 5 s dielectric withstand test




Caution Do not connect the product to signals or use for measurements within Measurement Categories III or IV.

NI 9476 with DSUB

Connect only voltages that are within the following limits.

External power supply (V_{sup}) voltage range	6 V DC to 36 V DC
$V_{\text{sup-to-COM}}$	40 V DC maximum
DO	$V_{\text{COM}} \leq V_{\text{DO}} \leq V_{\text{sup}}$
Isolation	
Channel-to-channel	None
Channel-to-earth ground	

Continuous	60 V DC, Measurement Category I
Withstand up to 2,000 m	1,000 V RMS, verified by a 5 s dielectric withstand test

 **Caution** Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

NI 9477

Connect only voltages that are within the following limits:


External power supply (Vsup) voltage range	0 V DC to 60 V DC
Channel-to-COM	60 V DC maximum, Measurement Category I

Isolation

Channel-to-channel None

Channel-to-earth ground

Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test

 **Caution** Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

NI 9478

Connect only voltages that are within the following limits:

External power supply (V_{sup}) voltage range	0 V DC to 50 V DC
V_{sup} -to-COM	50 V DC maximum, Measurement Category I
Isolation	
Channel-to-channel	None
Channel-to-earth ground	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test



Caution Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

Installing C Series Modules

Verify that power is not connected to the I/O connector(s) on the C Series module.

Removing C Series Modules

Verify that power is not connected to the I/O connector(s) on the C Series module before you remove a module from the chassis.

Safety Compliance and Hazardous Locations Standards

This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use:

- IEC 61010-1
- IEC 60079-0: Ed 6, IEC 60079-15; Ed 4
- GB3836.1, GB3836.8



Note For safety certifications, refer to the product label or the [Product Certifications and Declarations](#) section.

Product Certifications and Declarations

To obtain product certifications and the DoC for NI products, visit ni.com/product-certifications, search by model number, and click the appropriate link.

Worldwide Support and Services

NI corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504, USA.