Technical Data

Original Instructions

Signal Conditioner Specifications

Bulletin Number 931

Topic	Page
Summary of Changes	2
Introduction	3
Functions of a Signal Conditioner	3
Common Measurement Instruments that Interface with Signal	5
Product Range -Problem Solvers for Process Automation	6
Analog Signal Processing	7
Bulletin 931N - Nano Series	8
Bulletin 931S-Smart Series	33
Power Feed Module, 931A-FM	71
USB Interface Cable, 931A-CB	72
Power Rail Sets	73
Approximate Dimensions	74
Glossary	76

Summary of Changes

This publication contains new and updated information. This list includes substantive updates only and is not intended to reflect all changes.

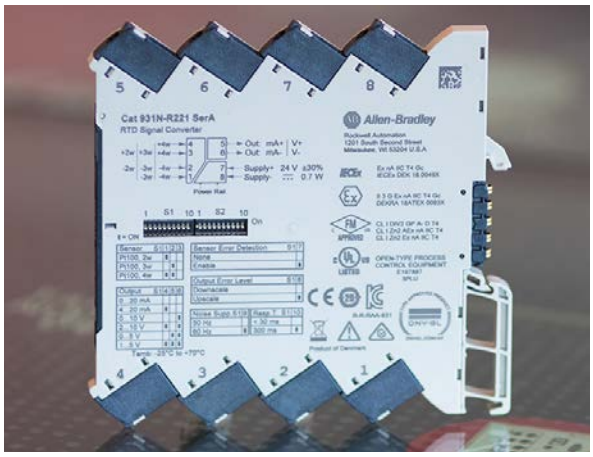
Topic	Page
Updated Certifications and Hazardous (Ex) Area Marking	Throughout
Updated Approximate dimensions	Throughout
Updated Wiring diagrams	Throughout
Updated Bulletin 931S-Smart Series table	31
Added Dual Channel Converter, 931S-C144	38
Added Analog Signal Converter, 931S-C161	39
Added Analog Signal Splitter, 931S-C162	40
Added Frequency Signal Converter - Interactive Display 931S-F591	42
Added Temperature Signal Converter - Interactive Display 931S-N591	56
Update Universal Signal Converter – Output Loop, 931S-U561 layout	68
Added rok.auto/support to download software and DTM files	72
Updated 931N Nano Series signal conditioners figure	74
Updated Smart Series dimensions	75

Introduction

Signal Conditioners improve signal quality by accurately transmitting process measurements between field devices and the control system. Signal Conditioners apply the principle of transformer coupling to galvanically isolate and reproduce the signal. This cost effective method of transmission promotes process efficiency in a production or automation environment.

Critical process measurements such as temperature, pressure, flow, level, weight, speed, frequency, current, or voltage in your continuous or batch production process are exposed to ground loops, noise, and harsh environmental conditions that result in erroneous signals. Signal conditioners can overcome these challenges to provide a reliable signal.

Functions of a Signal Conditioner



Isolation

Process measurement signals are often inaccurate and degraded between the measurement point and control system due to reasons such as different ground references in one loop, losses due to long wire lengths and electrical noise from environment. Signal conditioners receive the signal from the field, isolate, reproduce, and transmit the higher-quality signal to the control system.

- **Two-way Isolation -** the input and output signals are separated electrically from each other and decoupled.
- **Three-way isolation**- the input, output, and auxiliary power supply are separated electrically from each other and also decoupled.
- **Four-way isolation -** is provided when there are multiple channel in either input or output side.

Signal Conversion

The breadth of process measurement technologies and manufacturers has led to a wide variety of signal outputs from the measurement device. These signals may not be a standard process signal that the control system can read. Signal conditioners can solve this challenge by converting the signal from field device to a control system preferred signal type. The ability to convert current measurements up to 60 A and voltage measurements up to 480V to a standard 4...20mA, 0...10V or relay output has become attractive for several applications that prefer transmitting low energy signals.

Signal Amplification

When a measured signal is too low for processing, signal conditioners can amplify the signal and provide a higher-level standard analog signal. An example of low-level signal would be a thermocouple that has millivolt output.

Signal Linearization

Many of the process variables do not have linear characteristics for changes in measurement. Signal conditioner can process these non-linear signals by compensation and create a standard linear signal. Level measurement in an uneven container and thermocouple are some examples for a non-linear signal output.

Signal Splitting

Signal conditioners have the ability to produce two outputs from one input. This is useful when process measurements are needed at two different locations for monitoring and control.

Applications

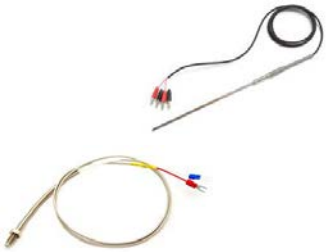
Signal conditioners are commonly used in the following industries.

- Food and Beverage Production
- Water Treatment
- Chemical Processing
- Energy and Power Plants
- Steel Production
- Oil and Gas
- Pharmaceutical

Common Measurement Instruments that Interface with Signal Conditioners

Measurement Instruments

Temperature, Pressure, Flow, Level Sensors



Thermocouples

Sensor - Presence, Speed, Frequency

Potentiometer, Linear Resistors

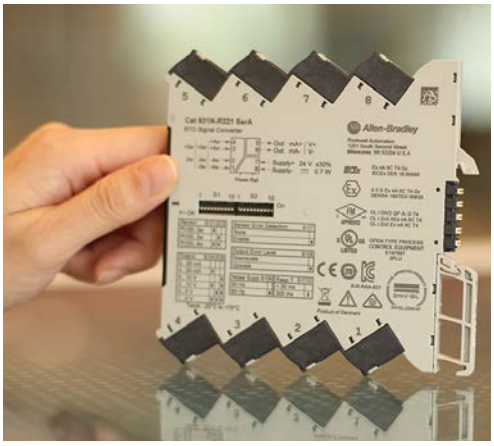
Load Cell, Strain Gauge, Bridge Circuit

Current, Voltage, Frequency,

Signal Conditioner

Control and Monitoring Systems

Product Range -Problem Solvers for Process Automation



Given the wide variety of analog I/O available in modern industrial and process control systems, some question why Analog Signal Conditioners are used. Here are a few examples of why an Analog Signal Conditioner are desirable or required in an installation.

Local Alarm/Indication

Many analog signals are passed to local indicators and alarms, which then need to be isolated from each other.

Long-Distance Transmission

Instead of running expensive cable to the control system (for example, thermocouples for temperature), Analog Signal Conditioners can isolate and convert to a high-level signal that is easier to transmit (for example, 4...20 mA).

Non-Isolated Analog I/O

If the existing control system does not provide isolated analog inputs, a separate Analog Signal Conditioner is often used to provide signal isolation when required for example, if the control system requires protection from electrical noise pulses on its analog inputs.

Isolation of the Power Source

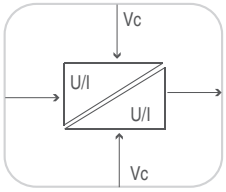
Where the control system cannot provide power for the sensor/transmitter, it is often convenient to provide isolation of the power source using an Analog Signal Conditioner.

Local Display and Linearization

When a dedicated local display is required, the analog signal can be split using an analog signal conditioner. Signal conditioners offer the flexibility to

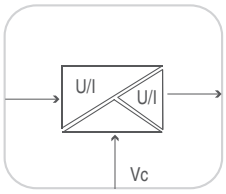
Analog Signal Processing

Analog signals involve the measurement of constantly changing physical operating characteristics, which come in many different forms, the most common of which are temperature and pressure. These signals are often found in processes that involve harsh industrial environments or are exposed to the elements. Such environmental conditions can significantly affect the quality of the transmitted signal and are also constantly changing themselves. Additionally, such industrial processes often require that these signals are able to be accurately transmitted over long distances.



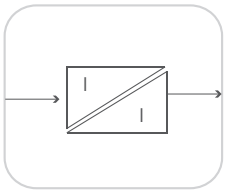
Two-Way Isolation

Analog signal conditioners with 2-way isolation separate the input and output signals from each other electrically and decouple the measuring circuits. Potential differences caused by long line lengths and common reference points are eliminated. The electrical separation also protects against irreparable damage caused by over voltages and inductive and capacitive interference.



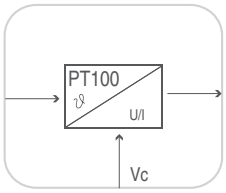
Three-Way Isolation

Analog signal conditioners with three-way isolation separate the supply voltage from the input and output circuits.



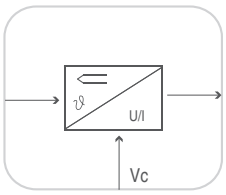
Passive Isolation

Analog signal conditioners with passive isolation offer an additional advantage in that they do not require an additional voltage supply. The power supply to the analog signal conditioner can be provided either by the input or output circuit. This current loop feed is characterized by low power consumption



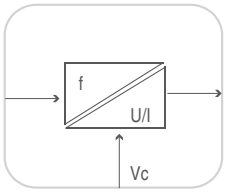
Temperature Measurement
PT100

A number of analog signal conditioners are available for temperature measurements. For example, PT100 signals in 2-, 3- and 4-wire systems are converted into standard 0...20 mA, 4...20 mA, and 0...10V signals.



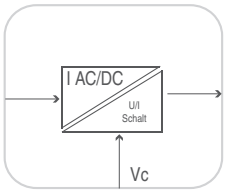
Temperature Measurement
Thermocouples

Analog signal conditioners for connecting conventional thermocouples are fitted with cold trap compensation as standard. These devices amplify and linearize the voltage signal that is provided by the thermocouple. This guarantees accurate analog signal conditioning while eliminating sources of interference or error.



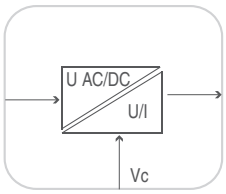
Frequency Conversion

Analog signal conditioners are available to convert frequencies into standard analog signals. Downstream controls can therefore directly process standard analog signals.



Current Monitoring

Analog signal conditioners are available for current monitoring for currents up to 60 A AC or DC. These devices cause a switched output to be triggered by currents above or below the set value and may also provide analog outputs for continuous monitoring of the load current.



Voltage Monitoring

Analog signal conditioners are available for current monitoring for currents up to 60 A AC or DC. These devices cause a switched output to be triggered by currents above or below the set value and may also provide analog outputs for continuous monitoring of the load current.

Bulletin 931N - Nano Series

Isolate, Convert, Split, and Amplify Numerous Signals

- Analog 0/4...20 mA, 0/1/2...10V
- Bipolar ± 10 mA, ± 20 mA and -11.5...+11.5V
- Thermocouple B, E, J, K, L, N, R, S, T, U, W3, W5, LR
- RTD Pt10/20/50/100/200/250/300/400/500/1000, Ni50/100/120/1000
- Linear Resistance 0...10,000 Ω
- Potentiometer 10...100 kΩ

Features

- Space-saving 6 mm housing
- Easy onboard configuration
- Angled terminals for ease of wiring
- High galvanic isolation: 2.5 kV AC
- High accuracy: 0.05%
- Fast response time for all analog signals: <5/7 ms
- Low power consumption
- Sensor and signal error detection
- Power rail option reduces supply wiring
- One feed module powers up to 75 devices
- Extensive global certifications: UL/CSA, CE, ATEX, IECEx, FM, DNV, KC, RCM, CMIM, UKCA, CCC Ex
- Hazardous Area (Class 1 Div 2/Zone 2) Extensive global certifications: UL/CSA/cULus, CE, ATEX, IECEx, FM, DNV-GL, KC, RCM, Class 1 Div 2 N

Input \ Output	0...23 mA	0/4...20 mA 0/1/2...5/10 V Configurable	4...20 mA; 20...4 mA	± 10mA, ± 20 mA	Channel	Power
0...23 mA	931N -C121				1	24V DC
	931N -C122				Splitter	24V DC
	931N -C141				1	Input Loop
	931N -C144				2	Input Loop
	931N-C161				1	Output Loop
	931N-C164				2	Output Loop
0/4...20 mA; 0/1/2...5/10V (Configurable)		931N-A221			1	24V DC
		931N-A222			Splitter	24V DC
±10/±20 mA, ±10V (Configurable)		931N-X221			1	24V DC
		931N-X422		931N-X422	Splitter	24V DC
Thermocouple J/K		931N-T221			1	24V DC
PT100			931N-R161		1	Output Loop
		931N-R221			1	24V DC
Thermocouple J, K; PT100			931N-N161		1	Output Loop
Universal[1]	931N-U221				1	24V DC

(1) All thermocouples, PT/RTDs, Potentiometer, Resistance, Current, Voltage

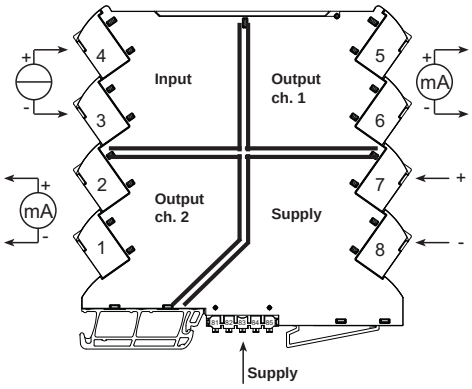
931N - Nano Series Signal Conditioners

Analog Signal Converter -24V DC, 931N-C121

- Space saving design - 6.1 mm wide
- Power rail option eliminates power supply wiring
- Easy installation, no setup
- High galvanic isolation and accuracy
- Fast response time < 7 ms
- NAMUR NE21 compliant, top measurement performance in harsh EMC conditions

This device provides three-way galvanic isolation between input, output, and power supply; and replicates the exact input signal value to output. The isolation eliminates ground loop/noise related errors to provide a reliable signal. The input is protected against overvoltage and polarity error. This device offers a cost-effective way to isolate and convert current signals to PLC or control system.

Wiring Diagram



931N-C121 — Specifications

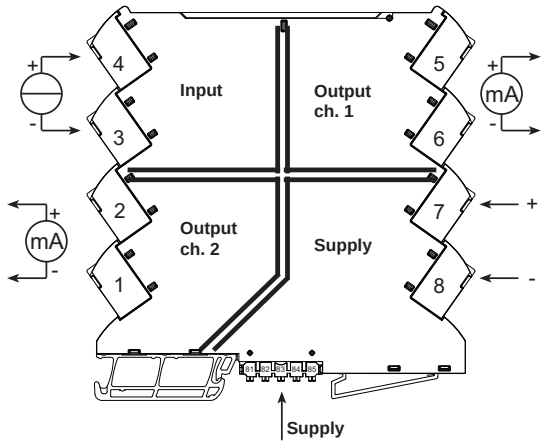
Input	
Number of Channels	1
Current	0...20 mA, 4...20 mA, 0...23 mA
Input Voltage Drop	< 1.5V DC
Input Resistance	70 Ω
Input	Passive
Output	
Number of Channels	1
Current (O/P to match I/P values)	0...20 mA, 4...20 mA, 0...23 mA
Cutoff Frequency	100 Hz
Load Impedance, Current	≤ 600 Ω, @ max 23 mA
Output	Active
Supply	
Supply Voltage	24V DC ± 30%
Power Consumption, Typ/Max	0.46 W/0.65 W
General Specification	
Accuracy	< 0.05% of Measuring Range
Step Response Time	< 7 ms
Temperature Coefficient	< ±0.01% of span / °C
Galvanic Isolation	3 way Isolator
Isolation Voltage	2.5 kV eff /1 min
Rated Voltage	300V eff
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	None
Screw Terminal Torque	0.5 N•m (4.43 0.5 lb•in)
Wire Size	0.13...2.5 mm^2 / AWG 26...12 Stranded Wire
Dimensions, approx.W x H x D	6.1 x 112.5 x 114.3 mm (0.24 x 4.43 x 4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25...+70 °C (-13...+158 °F)
Temperature, Storage	-40...+85 °C (-40...+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457321
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, RCM, CCC-Ex
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

Analog Signal Splitter - 24V DC, 931N -C122

- Space saving design - 6.1 mm wide
- Power rail option eliminates power supply wiring
- 2 outputs from 1 input
- Easy installation - no setup
- High galvanic isolation and accuracy
- Fast response time < 7 ms
- NAMUR NE21 compliant, top measurement performance in harsh EMC conditions

This device isolates and replicates the exact input signal values to output. The four-way galvanic isolation between power supply, input, (2) outputs eliminates ground loop/noise related error to provide a reliable signal. The input is protected against overvoltage and polarity error. This device offers a cost-effective way to isolate and convert current signals to PLC or control system.

Wiring Diagram



931N-C122 — Specifications

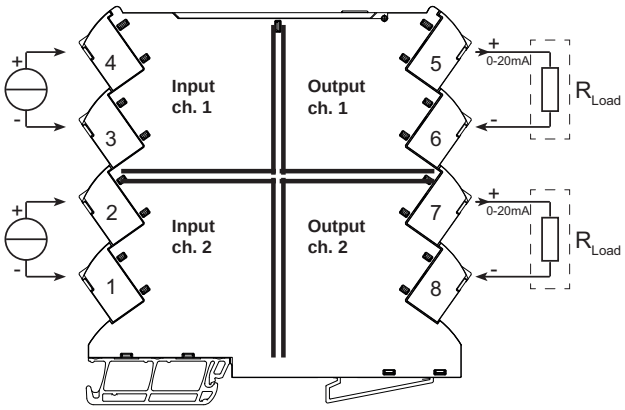
Input	
Number of Channels	1
Current	0...20 mA, 4...20 mA, 0...23 mA
Input Voltage drop	< 1.5V DC
Input Resistance	70 Ω
Input	Passive
Output	
Number of Channels	2
Current (O/P to match I/P values)	0...20 mA, 4...20 mA, 0...23 mA
Cutoff Frequency	100 Hz
Load Impedance Current	< 300 Ω, Per Channel @ Max 23 mA
Output	Active
Supply	
Supply Voltage	24V DC ± 30%
Power Consumption, Typ/Max	0.53 W/0.75 W
General Specification	
Accuracy	< 0.05% of Measuring Range
Step Response Time	< 7 ms
Temperature coefficient	< ±0.01% of span / °C
Galvanic Isolation	4-way Isolator
Isolation Voltage	2.5 kV eff /1 min
Rated Voltage	300V eff
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	None
Screw Terminal Torque	0.5 N•m (4.43 lb•in)
Wire Size	0.13...2.5 mm^2 / AWG 26...12 Stranded Wire
Approximate Dimensions W x H x D	6.1 x 112.5 x 114.3 mm (0.24 x 4.43 x 4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25...+70 °C (-13...+158 °F)
Temperature, Storage	-40...+85 °C (-40...+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457322
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, RCM, CCC-Ex
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc, IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

Analog Signal Converter - Input Loop, 931N-C141

- Space saving design - 6.1 mm wide
- High galvanic isolation and accuracy
- Fast response time < 5 ms
- NAMUR NE43 compliant
- NAMUR NE21 compliant, top measurement performance in harsh EMC conditions

This device provides two-way galvanic isolation between the input and output to eliminate ground loop/noise related errors to provide a reliable signal. This device is powered by the input measuring circuit. This device offers a cost-effective way to isolate and convert current signals to PLC or control system.

Wiring Diagram



931N-C141 — Specifications

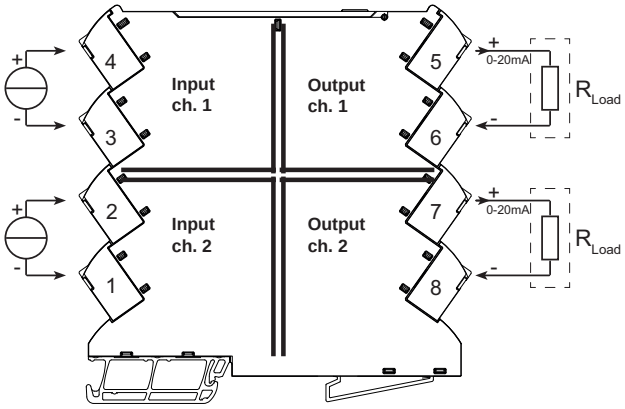
Input	
Number of Channels	1
Current	4...20 mA, 0...23 mA
Input Voltage drop	1.35V + (0.015 x Vout.)
Input Frequency	100 Hz
Start-up Current, typ.	10 µA
Input	Passive
Output	
Number of Channels	1
Current (O/P to match I/P)	0...20 mA, 4...20 mA, 0...23 mA
Cutoff Frequency	100 Hz
Load Impedance, Current	≤ 600 Ω
Output	Active
Supply	
Supply Voltage	Loop Powered, via 4...20 mA Input
Power Consumption	30 mW Per Channel
General Specification	
Accuracy	< 0.1% of Measuring Range
Step Response Time	< 5 ms
Temperature Coefficient	≤ 0.01% / °C
Galvanic Isolation	2 way Isolator
Isolation Voltage	2.5 kV eff /1 min
Rated Voltage	300V eff
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	None
Screw Terminal Torque	0.5 N•m (4.43 lb•in)
Wire Size	0.13...2.5 mm^2/ AWG 26...12 Stranded Wire
Approximate Dimensions W x H x D	6.1 x 112.5 x 114.3 mm (0.24 x 4.43 x 4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25...+70 °C (-13...+158 °F)
Temperature, Storage	-40...+85 °C (-40...+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457323
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, RCM, CCC-Ex
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

Dual Channel Converter- Input Loop, 931N-C144

- Space saving design - 6.1 mm wide
- High galvanic isolation and accuracy
- Fast response time < 5 ms
- NAMUR NE43 compliant
- NAMUR NE21 compliant, top measurement performance in harsh EMC conditions

This 2 channel device provides four- way galvanic isolation between the inputs and outputs. The isolation helps eliminate ground loop/noise related errors to provide a reliable signal. This device is powered by the input measuring circuit. This device offers a cost-effective way to isolate and convert current signals to PLC or control system.

Wiring Diagram



931N-C144 — Specifications

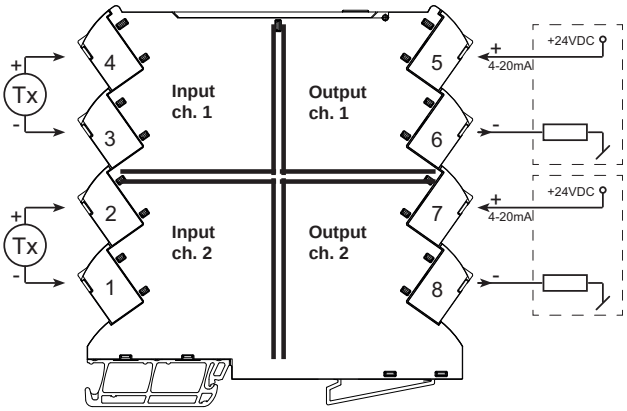
Input	
Number of Channels	2
Current	4...20 mA, 0...23 mA
Input Voltage drop	1.35V + (0.015 x Vout.)
Input Frequency	100 Hz
Start-up Current, typ.	10 µA
Input	Passive
Output	
Number of Channels	2
Current (O/P to match I/P)	0...20 mA, 4...20 mA, 0...23 mA
Cutoff frequency	100 Hz
Load impedance current	≤ 600 Ω (channel 1 + 2)
Output	Active
Supply	
Supply Voltage	Loop Powered, via 4...20 mA Input
Power Consumption	30 mW Per Channel
General Specification	
Accuracy	< 0.1% of Measuring Range
Step Response Time	< 5 ms
Temperature Coefficient	≤ 0.01% / °C
Galvanic Isolation	4-way Isolator
Isolation Voltage	2.5 kV eff /1 min.
Rated Voltage	300V eff
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	None
Screw Terminal Torque	0.5 N•m (4.43 lb•in)
Wire Size	0.13...2.5 mm^2 / AWG 26...12 Stranded Wire
Dimensions, approx. W x H x D	6.1 x 112.5 x 114.3 mm (0.24 x 4.43 x 4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25...+70 °C (-13...+158 °F)
Temperature, Storage	-40...+85 °C (-40...+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457324
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, RCM, CCC-Ex
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

Analog Signal Converter - Output Loop, 931N-C161

- Space saving design - 6.1 mm wide
- High galvanic isolation and accuracy
- Fast response time < 5 ms
- NAMUR NE43 compliant
- NAMUR NE21 compliant, top measurement performance in harsh EMC conditions

This device provides two-way galvanic isolation between the input and output. The isolation helps eliminate ground loop/noise related errors to provide a reliable signal. This device is powered by the output loop circuit. This device offers a cost-effective way to isolate and convert current signals to PLC or control system.

Wiring Diagram



931N-C161 — Specifications

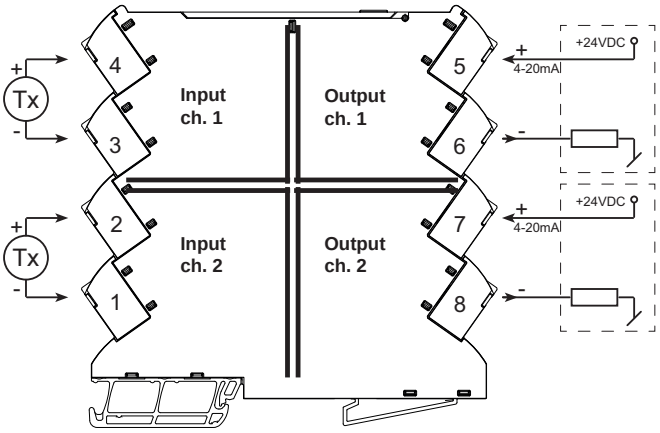
Input	
Number of Channels	1
Current Input	4...20 mA, 3.5...23 mA
Input Voltage drop	2.5V
2 Wire Transmitter Supply	3.5...32.5V
Input	Active
Output	
Number of Channels	1
Current (O/P to match I/P)	4...20 mA, 3.5...23 mA
Signal Range, Input to Output	3.8...20.5 mA
Cutoff frequency	100 Hz
Output	Passive
Supply	
Supply Voltage	Output Loop Powered (6...35V DC)
Power Consumption	0.5 W
General Specification	
Accuracy	< 0.05% of Measuring Range
Step Response Time	< 5 ms
Temperature Coefficient	≤± 0.07 µA x (Δ °C x Vsupply) @ Tamb < 25 °C, ≤±0.02 µA x (Δ °C x Vsupply) @ Tamb > 25 °C
Galvanic Isolation	2 way Isolator
Isolation Voltage	2.5 kV eff /1 min
Rated Voltage	300V eff
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	None
Screw Terminal Torque	0.5 N•m (4.43 lb•in)
Wire Size	0.13...2.5 mm^2 / AWG 26...12 Stranded Wire
Dimensions, approx. W x H x D	6.1 x 112.5 x 114.3 mm (0.24 x 4.43 x 4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25...+70 °C (-13...+158 °F)
Temperature, Storage	-40...+85 °C (-40...+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457326
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, RCM, CCC-Ex
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

Dual Channel Converter -Output Loop, 931N-C164

- Space saving design - 6.1 mm wide
- Powered by output loop signal
- High galvanic isolation and accuracy
- Fast response time < 5 ms
- NAMUR NE43 compliant
- NAMUR NE21 compliant, top measurement performance in harsh EMC conditions

This 2 channel device provides four way galvanic isolation between the inputs and outputs. The isolation helps eliminate ground loop/ noise related errors to provide a reliable signal. This device is powered by the output loop circuit. This device offers a cost-effective way to isolate and convert current signals to PLC or control system.

Wiring Diagram



931N-C164 — Specifications

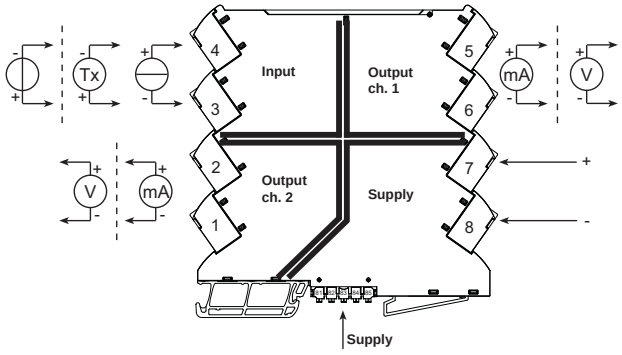
Input	
Number of Channels	2
Current Input	4...20 mA, 3.5...23 mA
Input Voltage drop	≤ 3V
2 Wire Transmitter Supply	3.5...32.5V
Input	Active
Output	
Number of Channels	2
Current (O/P to match I/P)	4...20 mA, 3.5...23 mA
Signal Range, Input to	3.8...20.5 mA
Cutoff frequency	100 Hz
Output	Passive
Supply	
Supply Voltage	Output Loop Powered (6...35V DC)
Power Consumption	0.5 W Per Channel
General Specification	
Accuracy	< 0.05% of Measuring Range
Step Response Time	< 5 ms
Temperature Coefficient	≤± 0.07 µA x (Δ °C x V_{supply}) @ Tamb < 25 °C, ≤±0.02 µA x (Δ °C x V_{supply}) @ Tamb > 25 °C
Galvanic Isolation	4-way Isolator
Isolation Voltage	2.5 kV eff /1 min
Rated Voltage	300V eff
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	None
Screw Terminal Torque	0.5 N•m (4.43 lb•in)
Wire Size	0.13...2.5 mm^2 / AWG 26...12 Stranded Wire
Dimensions, approx. W x H x	6.1 x 112.5 x 114.3 mm (0.24 x 4.43 x 4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25...+70 °C (-13...+158 °F)
Temperature, Storage	-40...+85 °C (-40...+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457327
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, RCM, CCC-Ex
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc, IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

Analog Signal Converter, 931N-A221

- Space saving design - 6.1 mm wide
- Power rail option eliminates power supply wiring
- High galvanic isolation and accuracy
- Fast response time < 7 ms
- NAMUR NE21 compliant, top measurement performance in harsh EMC conditions

This device converts analog current/voltage signals and provides three-way galvanic isolation between input, output and power supply. The isolation helps eliminate ground loops/noise related errors to provide a reliable signal. The input is protected against overvoltage and polarity error. This device offers a cost-effective way to isolate and convert current signals to PLC or control system.

Wiring Diagram



Dip Switch Configuration

DIP switch setting

Range	Input Setup				Output setup		
	1	2	3	4	5	6	7
0…20 mA							
4…20 mA			■			■	
0…10 V		■			■		
2…10 V		■	■		■	■	
0…5 V		■		■	■		■
1…5 V		■	■	■	■	■	■
0…20 mA (Loop)	■						
4…20 mA (Loop)	■		■				

■ = ON

931N-A221— Specifications

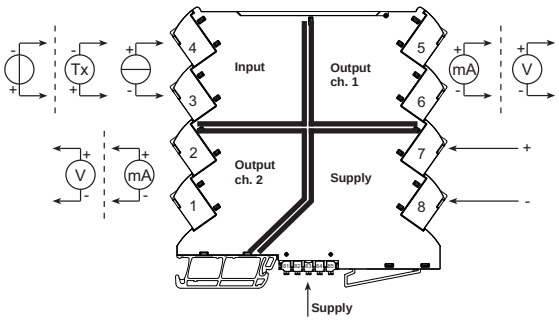
Input	
Number of Channels	1
Current Input	0…23 mA
Programmable Current Range	0…20 mA, 4…20 mA
Input Voltage drop	< 1.5V DC
Voltage Input	0…10.25V, 0…11.5V, 0…5.75V
Programmable Voltage Range	0/1…5 and 0/2…10V
Input Resistance	≥ 500 kΩ
2 Wire Transmitter Supply	> 17V / 20 mA
Input	Active or Passive
Output	
Number of Channels	1
Current Output	0…23 mA
Programmable Current Range	0…20 mA, 4…20 mA
Load (@ Current Output)	≤ 600 Ω
Voltage Output	0…10V DC
Programmable Voltage Range	0/1…5V and 0/2…10V
Load (@ Voltage Output)	≥ 10 kΩ
Cutoff frequency	100 Hz
Output	Active
Supply	
Supply Voltage	24V DC ± 30%
Power Consumption, Typ/Max	0.84 W/1.2 W
General Specification	
Accuracy	< 0.05% of measuring range
Step Response Time	< 7 ms
Temperature Coefficient	≤. 0.01% /°C
Galvanic Isolation	3 Way Isolator
Isolation Voltage	2.5 kV eff /1 min
Rated Voltage	300V eff
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	DIP Switch
Screw Terminal Torque	0.5 N•m (4.43 lb•in)
Wire Size	0.13…2.5 mm^2 / AWG 26…12 Stranded Wire
Dimensions, approx. W x H x D	6.1 x 112.5 x 114.3 mm (0.24 x 4.43 x 4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25…+70 °C (-13…+158 °F)
Temperature, Storage	-40…+85 °C (-40…+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457319
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, RCM, CCC-Ex
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc, IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

Analog Signal Splitter, 931N-A222

- Space saving design - 6.1 mm wide
- Power rail option eliminates power supply wiring
- 2 outputs from 1 input
- High galvanic isolation and accuracy
- Fast response time < 7 ms
- NAMUR NE21 compliant, top measurement performance in harsh EMC conditions

This device can convert analog current/voltage signals and provide two isolated outputs from one input signal. The four way galvanic isolation between power supply, input, (2) outputs eliminates ground loop/noise related error to provide a reliable signal. The input is protected against overvoltage and polarity error. This device offers a cost-effective way to isolate and convert current signals to PLC or control system.

Wiring Diagram



Dip Switch Configuration

DIP switch setting

Range	Input Setup				Output setup					
					Channel 1			Channel 2		
	1	2	3	4	5	6	7	8	9	10
0…20 mA										
4…20 mA			■			■			■	
0…10 V		■			■			■		
2…10 V		■	■		■	■		■	■	
0…5 V		■		■	■		■	■		■
1…5 V		■	■	■	■	■	■	■	■	■
0…20 mA (Loop)	■									
4…20 mA (Loop)	■		■							

■ = ON

931N-A222— Specifications

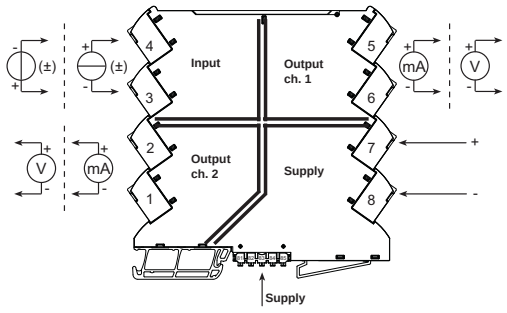
Input	
Number of Channels	1
Current Input	0…23 mA
Programmable Current Range	0…20 mA, 4…20 mA
Input Voltage drop	< 1.5V DC
Voltage Input	0…10.25V, 0…11.5V, 0…5.75V
Programmable Voltage Range	0/1…5V and 0/2…10V
Input Resistance	≥ 500 kΩ
2 Wire Transmitter Supply	> 17V / 20 mA
Input	Active or Passive
Output	
Number of Channels	2
Current Output	0…23 mA
Programmable Current Range	0…20 mA, 4…20 mA
Load (@ Current Output)	≤ 300 Ω
Voltage Output	0…10V DC
Programmable Voltage Range	0/1…5V and 0/2…10V
Load (@ Voltage Output)	≥ 10 kΩ
Cutoff frequency	100 Hz
Output	Active
Supply	
Supply Voltage	24V DC ± 30%
Power Consumption, Typ/Max	0.84 W/1.2 W
General Specification	
Accuracy	< 0.05% of measuring range
Step Response Time	< 7 ms
Temperature Coefficient	≤. 0.01% /°C
Galvanic Isolation	4-way Isolator
Isolation Voltage	2.5 kV eff /1 min
Rated Voltage	300V eff
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	DIP Switch
Screw Terminal Torque	0.5 N•m (4.43 lb•in)
Wire Size	0.13…2.5 mm^2 / AWG 26…12 Stranded Wire
Dimensions, approx. W x H x D	6.1 x 112.5 x 114.3 mm (0.24 x 4.43 x 4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25…+70 °C (-13…+158 °F)
Temperature, Storage	-40…+85 °C (-40…+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457320
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, RCM, CCC-Ex
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc, IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

Bipolar Signal Converter, 931N-X221

- Space saving design - 6.1 mm wide
- Power rail option eliminates power supply wiring
- High galvanic isolation and accuracy
- Fast response time
- NAMUR NE21 compliant, top measurement performance in harsh EMC conditions

This device converts bipolar analog current and voltage signals to configurable unipolar analog signals. The three-way galvanic isolation between input, output and power supply helps eliminate ground loop/noise related errors to provide a reliable signal. All terminals are protected against overvoltage and polarity error. This device offers a cost-effective way to isolate and convert current signals to PLC or control system.

Wiring Diagram



Dip Switch Settings

DIP switch setting

Input Setup					
Bandwidth	1	Input range	2	3	4
10 Hz	■	-10...+10 mA	■	■	■
100 Hz		-20...+20 mA	■	■	
■ = ON		-5...+5 V			■
		-10...+10 V			

Output setup	Output range	5	6	7
	0...20 mA			
	4...20 mA		■	
	0...10 V	■		
	2...10 V	■	■	
	0...5 V	■		■
	1...5 V	■	■	■

931N-X221— Specifications

Input	
Number of Channels	1
Current Input	-23...+23 mA
Programmable Current Range	± 10 and ± 20 mA
Input Voltage drop	< 1V DC @ 23 mA
Voltage Input	-11.5...+11.5V
Programmable Voltage Range	±5 and ±10V
Input Resistance	≥ 1 MΩ
Input	Passive
Output	
Number of Channels	1
Current Output	0...23 mA
Programmable Current Range	0/4...20 mA
Load (@ Current Output)	≤ 600 Ω
Voltage Output	0...10V DC
Programmable Voltage Range	0/1...5 and 0/2...10V
Load (@ Voltage Output)	≥ 10 kΩ
Cutoff frequency (-3 dB)	≥100 Hz, 10 Hz
Output	Active
Supply	
Supply Voltage	24V DC ± 30%
Power Consumption, Typ/Max	0.56 W/0.8 W
General Specification	
Accuracy	< 0.05% of measuring range
Response Time (0..90%,	< 7 ms or < 44 ms
Temperature Coefficient	≤. 0.01% /°C
Galvanic Isolation	3 Way Isolator
Isolation Voltage	2.5 kV eff /1 min
Rated Voltage	300V eff
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	DIP Switch
Screw Terminal Torque	0.5 N•m (4.43 lb•in)
Wire Size	0.13...2.5 mm^2 / AWG 26...12 Stranded Wire
Dimensions, approx. W x H x D	6.1 x 112.5 x 114.3 mm (0.24 x 4.43 x 4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25...+70 °C (-13...+158 °F)
Temperature, Storage	-40...+85 °C (-40...+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457334
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, RCM, CCC-Ex
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc, IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

Bipolar Signal Splitter, 931N-X422

- Space saving design - 6.1 mm wide
- Power rail option eliminates power supply wiring
- 2 outputs from 1 input
- High galvanic isolation and accuracy
- Fast response time
- NAMUR NE21 compliant, top measurement performance in harsh EMC conditions

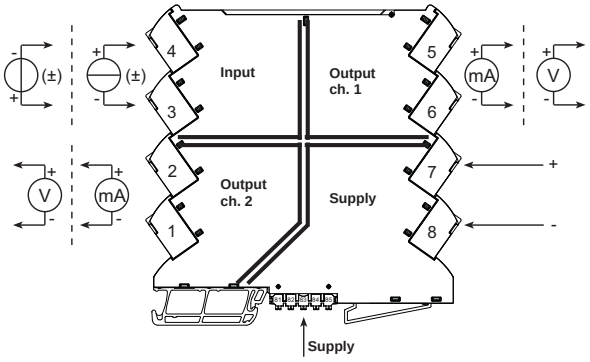
This device can convert bipolar analog process signals to configurable unipolar analog signals. The four way galvanic isolation between power supply, input, (2) outputs eliminates ground loop/noise related error to provide a reliable signal. The input is protected against overvoltage and polarity error. This device offers a cost-effective way to isolate and convert current signals to PLC or control system.

931N-X422— Specifications

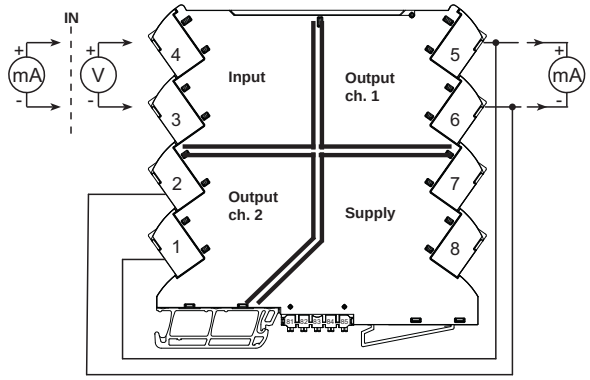
Input	
Number of Channels	1
Current Input	-23...+23 mA
Programmable Current Range	± 10 and ± 20 mA
Input Voltage drop	< 1V DC @ 23 mA
Voltage Input	-11.5...+11.5V
Programmable Voltage Range	±5 and ±10V
Input Resistance	≥ 1 MΩ
Input	Passive
Output	
Number of Channels	2
Current Output	0...23 mA
Programmable Current Range	0/4...20 mA
Bipolar Output	±10 and ± 20 mA
Load (@ Current Output)	≤ 300 Ω Per Channel
Voltage Output	0...10V DC
Programmable Voltage Range	0/1...5 and 0/2...10V
Load (@ Voltage Output)	≥ 10 kΩ
Cutoff frequency (-3 dB)	≥100 Hz, 10 Hz
Output	Active
Supply	
Supply Voltage	24V DC ± 30%
Power Consumption, Typ/Max	0.84 W/1.2 W
General Specification	
Accuracy	< 0.05% of measuring range
Response Time (0..90%, 100..10%)	< 7 ms or < 44 ms
Temperature Coefficient	≤. 0.01% /°C
Galvanic Isolation	4 Way Isolator
Isolation Voltage	2.5 kV eff /1 min
Rated Voltage	300V eff
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	DIP Switch
Screw Terminal Torque	0.5 N•m (4.43 lb•in)
Wire Size	0.13...2.5 mm^2 / AWG 26...12 Stranded
Dimensions, approx. W x H x D	6.1 x112.5x114.3 mm (0.24 x 4.43x4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25...+70 °C (-13...+158 °F)
Temperature, Storage	-40...+85 °C (-40...+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457335
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, RCM, CCC-Ex
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

Bipolar Signal Splitter, 931N-X422 (continued)

Wiring Diagrams



wiring for output:
-10...0...+10 mA / -20...0...+20 mA



IMPORTANT Splitter function is not available when bipolar output function is used.

Dip Switch Configuration

Input Setup					
Bandwidth	1	Input range	2	3	4
10 Hz	▮	-10...+10 mA	▮	▮	▮
100 Hz		-20...+20 mA	▮	▮	
		-5...+5 V			▮
▮ = ON		-10...+10 V			

Output setup	Output 1			Output 2		
Output range	5	6	7	8	9	10
0...20 mA						
4...20 mA		▮			▮	
0...10 V	▮			▮		
2...10 V	▮	▮		▮	▮	
0...5 V	▮		▮	▮		▮
1...5 V	▮	▮	▮	▮	▮	▮
±20 mA set-up			▮			▮
±10 mA set-up		▮	▮		▮	▮

Thermocouple Signal Converter, 931N-T221

- Space saving design - 6.1 mm wide
- Power rail option eliminates power supply wiring
- High galvanic isolation and accuracy
- Fast response time
- NAMUR NE21 compliant, top measurement performance in harsh EMC conditions
- Selectable internal/external CJC

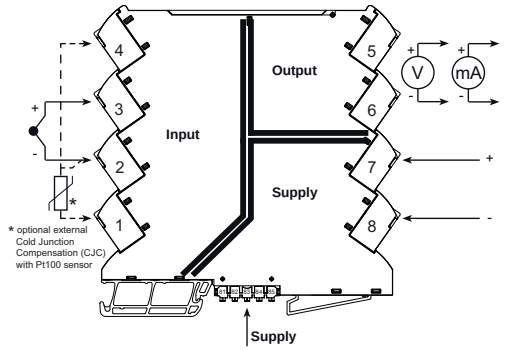
This device can isolate and convert Thermocouple J and K measurements to configurable analog current/voltage output signals. The three-way galvanic isolation between input, output and power supply helps eliminate ground loop/noise related errors to provide a reliable signal. This device offers a cost-effective way to transfer temperature measurements.

931N-T221— Specifications

Input	
Number of Channels	1
Thermocouple	Type J: -100...+1200 °C; Type K: -180...+1372
Min Measurement Span	50°C
Sensor cable resistance	< 5 kΩ per wire
CJC Accuracy @ external Pt100	Better than ±0.15°C
CJC Accuracy @ internal CJC	Better than ±2.5°C
Sensor Error Detection	Yes
Input	Passive
Output	
Number of Channels	1
Current Output	0...23 mA
Programmable Current Range	0 / 4...20 mA
Sensor Error Indication (0...20	0 mA or 23 mA / OFF
Sensor Error Indication (4...20	3.5 mA or 23 mA / acc. to NAMUR NE43 or OFF
Load (@ Current Output)	≤ 600 Ω
Programmable Voltage Output	0/1...5V and 0/2...10V
Sensor Error Indication	0V / 10% above the max./none
Open Output	< 18V
Update Time	10 ms
Output	Active
Supply	
Supply voltage	24V DC ± 30%
Power consumption	0.49 W/0.7 W
General Specification	
Accuracy	Better than 0.05% of Selected Range
Response Time (0..90%,	< 30 ms / 300 ms (Selectable)
Temperature Coefficient, Greater	0.1 °C/°C or ≤ ±0.01%/°C
Galvanic Isolation	3 Way Isolator
Isolation Voltage	2.5 kV eff /1 min
Rated Voltage	300V eff
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	DIP Switch
Screw Terminal Torque	0.5 N•m (4.43 lb•in)
Wire Size	0.13...2.5 mm^2 / AWG 26...12 Stranded Wire
Dimensions, approx. W x H x D	6.1 x 112.5 x 114.3 mm (0.24 x 4.43 x 4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25...+70 °C (-13...+158 °F)
Temperature, Storage	-40...+85 °C (-40...+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457332
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, RCM
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc, IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

Thermocouple Signal Converter, 931N-T221 (continued)

Wiring Diagram



Dip Switch Configuration

TC sensor type	S1 1	2	3
J (internal CJC)			■
K (internal CJC)	■		■
J (external CJC) 1)		■	■
K (external CJC) 1)	■	■	■

Output	4	5	6
0...20 mA			
4...20 mA	■		
0...10 V			■
2...10 V	■		■
0...5 V		■	■
1...5 V	■	■	■

Sensor error detection	7
none	
enabled	■

Output error level	8
downscale	
upscale	■

Noise suppression	9
50 Hz	
60 Hz	■

Response time	10
< 30 ms	
300 ms	■

Temperature range [°C]
TC J: -100...+1200 °C // TC K: -180...+1372 °C

Min. Temp.	S2 1	2	3	4
-200				
-180				■
-150			■	
-100			■	■
-50		■		
-25		■		■
-10		■	■	
-5		■	■	■
0	■			
5	■			■
10	■		■	
20	■		■	■
25	■	■		
50	■	■		■
100	■	■	■	
200	■	■	■	■

Max. Temp.	S2 5	6	7	8	9	10
0						
5						■
10					■	
15					■	■
20				■		
25				■		■
30				■	■	
35				■	■	■
40			■			
45			■			■
50			■		■	
55			■		■	■
60			■	■		
65			■	■		■
70			■	■	■	
75			■	■	■	■
80		■				
85		■				■
90		■			■	
95		■			■	■
100		■		■		

Max. Temp.	S2 5	6	7	8	9	10
105		■		■		■
110		■		■	■	
115		■		■	■	■
120		■	■			
125		■	■			■
130		■	■		■	
135		■	■		■	■
140		■	■	■		
145		■	■	■		■
150		■	■	■	■	
160		■	■	■	■	■
170	■					
180	■					■
190	■				■	
200	■				■	■
225	■			■		
250	■			■		■
275	■			■	■	
300	■			■	■	■
325	■		■			
350	■		■			■

Max. Temp.	S2 5	6	7	8	9	10
375	■		■		■	
400	■		■		■	■
450	■		■	■		
500	■		■	■		■
550	■		■	■	■	
600	■		■	■	■	■
650	■	■				
700	■	■				■
750	■	■			■	
800	■	■			■	■
850	■	■		■		
900	■	■		■		■
950	■	■		■	■	
1000	■	■		■	■	■
1050	■	■	■			
1100	■	■	■			■
1150	■	■	■		■	
1200	■	■	■		■	■
1250	■	■	■	■		
1300	■	■	■	■		■
1350	■	■	■	■	■	
1372	■	■	■	■	■	■

■ = ON
1) optional

RTD Signal Converter- Output Loop, 931N-R161

- Space saving design - 6.1 mm wide
- Pre-calibrated temperature ranges
- Fast response time
- Sensor error detection and NAMUR 43 compliant
- NAMUR NE21 compliant, top measurement performance in harsh EMC conditions

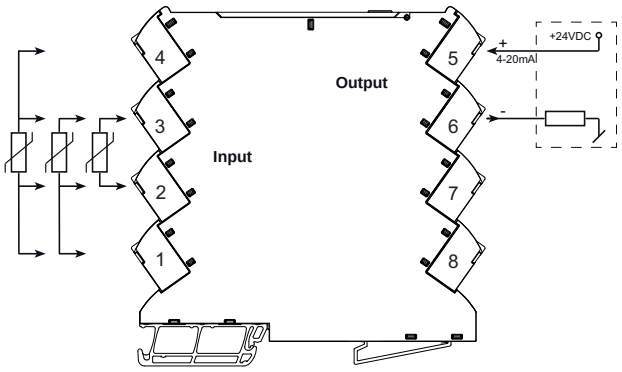
This device converts temperature measurement from RTD PT100 to configurable analog current output signal. This device is powered by the output loop circuit. All terminals are protected against overvoltage and polarity error. This device offers a cost-effective way to transfer temperature measurements with high signal reliability.

931N-R161— Specifications

Input	
Number of Channels	1
RTD Input	PT100 (2/3/4 wire) -200...+850 °C
Min Measurement Span	10 °C
Sensor Current	< 150 µA
Sensor cable resistance	< 50 Ω per wire
Effect of sensor cable resistance (3-/4-wire)	< 0.002 Ω / Ω
Sensor Error Detection	Yes
Broken Sensor Detection	> 800 Ω
Shorted Sensor Detection	< 18 Ω
Input	Active
Output	
Number of Channels	1
Programmable Current Range	4...20 and 20...4 mA
Load (@ Current Output)	≤ (Vsupply - 3.3) / 0.023 [Ω]
Sensor Error Indication	3.5 mA or 23 mA / acc. to NAMUR NE43 or OFF
Update Time	10 ms
Output	Passive
Supply	
Supply voltage	Output Loop Powered (3.3...35V DC)
Power consumption, Typ/Max	0.48 W/0.8W
General Specification	
Accuracy, Greater of	Better than 0.1% of span or 0.2°C
Response Time (0..90%, 100..10%)	< 30 ms / 300 ms (Selectable)
Temperature Coefficient, Greater of	0.02 °C/°C or ≤ ±0.01%/°C
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	DIP Switch
Screw Terminal Torque	0.5 N•m (4.43 lb•in)
Wire Size	0.13...2.5 mm^2 / AWG 26...12 Stranded
Dimensions, approx. W x H x D	6.1x112.5x114.3 mm (0.24 x4.43 x 4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25...+70 °C (-13...+158 °F)
Temperature, Storage	-40...+85 °C (-40...+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457330
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, RCM
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

RTD Signal Converter, 931N-R161 (continued)

Wiring Diagram



Dip Switch Setting

RTD & TC sensor type	S1 1	2	3
Pt100 2 wire	■		
Pt100 3 wire		■	
Pt100 4 wire	■	■	

Output	4	5	6
4...20 mA	■		
20...4 mA	■	■	

Sensor error detection	7
none	
enabled	■

Output error level	8
downscale	
upscale	■

Noise suppression	9
50 Hz	
60 Hz	■

Response time	10
< 30 ms	
300 ms	■

Temperature range [°C] Pt100: -200...+850 °C

Min. Temp.	S2 1	2	3	4
-200				
-180				■
-150			■	
-100			■	■
-50		■		
-25		■		■
-10		■	■	
-5		■	■	■
0	■			
5	■			■
10	■		■	
20	■		■	■
25	■	■		
50	■	■		■
100	■	■	■	
200	■	■	■	■

Max. Temp.	S2 5	6	7	8	9	10
0						
5						■
10					■	
15					■	■
20				■		
25				■		■
30				■	■	
35				■	■	■
40			■			
45			■			■
50			■		■	
55			■		■	■
60			■	■		
65			■	■		■
70			■	■	■	
75			■	■	■	■
80		■				
85		■				■
90		■			■	
95		■			■	■
100		■		■		

Max. Temp.	S2 5	6	7	8	9	10
105		■		■		■
110		■		■	■	
115		■		■	■	■
120		■	■			
125		■	■			■
130		■	■		■	
135		■	■		■	■
140		■	■	■		
145		■	■	■		■
150		■	■	■	■	
160		■	■	■	■	■
170	■					
180	■					■
190	■				■	
200	■				■	■
225	■			■		
250	■			■		■
275	■			■	■	
300	■			■	■	■
325	■		■			
350	■		■			■

Max. Temp.	S2 5	6	7	8	9	10
375	■		■		■	
400	■		■		■	■
450	■		■	■		
500	■		■	■		■
550	■		■	■	■	
600	■		■	■	■	■
650	■	■				
700	■	■				■
750	■	■			■	
800	■	■			■	■
850	■	■		■		

■ = ON

RTD Signal Converter, 931N-R221

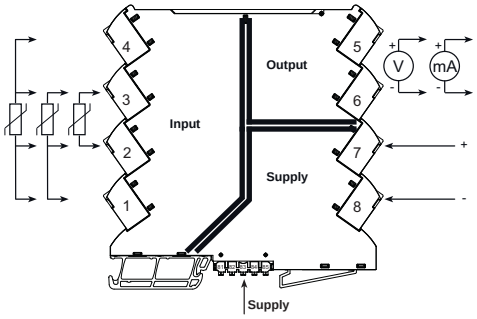
- Space saving design - 6.1 mm wide
- Power rail option eliminates power supply wiring
- Pre-calibrated temperature ranges
- Fast response time
- Sensor error detection and NAMUR 43 compliant
- NAMUR NE21 compliant, top measurement performance in harsh EMC conditions

This device converts temperature measurement from RTD PT100 to configurable analog current and voltage output signal. The three-way galvanic isolation between input, output and power supply helps eliminate ground loop/noise related errors to provide a reliable signal. All terminals are protected against overvoltage and polarity error. This device offers a cost-effective way to transfer temperature measurements with high signal reliability.

931N-R221— Specifications

Input	
Number of Channels	1
RTD Input	PT100 (2/3/4 wire) -200...+850 °C
Min Measurement Span	10°C
Sensor Current	< 150 µA
Sensor cable resistance	< 50 Ω per wire
Effect of sensor cable resistance	< 0.002 Ω / Ω (3/4- wire)
Sensor Error Detection	Yes
Broken Sensor Detection	> 800 Ω
Shorted Sensor Detection	< 18 Ω
Input	Active
Output	
Number of Channels	1
Current Output	0...23 mA
Programmable Current Range	0 / 4...20 mA
Sensor Error Indication (0...20	0 mA or 23 mA / OFF
Sensor Error Indication (4...20 mA)	3.5 mA or 23 mA / acc. to NE43 or OFF
Load (@ Current Output)	≤ 600 Ω
Programmable Voltage Output	0/1...5V and 0/2...10V
Sensor Error Indication	0V / 10% above the max./none
Open Output	< 18V
Update Time	10 ms
Output	Active
Supply	
Supply voltage	24V DC ± 30%
Power consumption, Typ/Max	0.49 W/0.7W
General Specification	
Accuracy, Greater of	Better than 0.05% of Selected Range
Response Time (0..90%,	< 30 ms / 300 ms (Selectable)
Temperature Coefficient, Greater	0.02 °C/°C or ≤ ±0.01%/°C
Galvanic Isolation	3 Way Isolator
Isolation Voltage	2.5 kV eff /1 min
Rated Voltage	300V eff
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	DIP Switch
Screw Terminal Torque	0.5 N•m (4.43 lb•in)
Wire Size	0.13...2.5 mm^2 / AWG 26...12 Stranded Wire
Dimensions, approx. W x H x D	6.1 x 112.5 x 114.3 mm (0.24 x 4.43 x 4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25...+70 °C (-13...+158 °F)
Temperature, Storage	-40...+85 °C (-40...+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457331
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, RCM
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc, IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

Wiring Diagram



Dip Switch Settings

DIP switch setting

RTD sensor type	S1 1	S1 2	S1 3
Pt100 2 wire	■		
Pt100 3 wire		■	
Pt100 4 wire	■	■	

Output	4	5	6
0...20 mA			
4...20 mA	■		
0...10 V			■
2...10 V	■		■
0...5 V		■	■
1...5 V	■	■	■

Sensor error detection	7
none	
enabled	■

Output error level	8
downscale	
upscale	■

Noise suppression	9
50 Hz	
60 Hz	■

Response time	10
< 30 ms	
300 ms	■

Temperature range [°C]
Pt100: -200...+850 °C

Min. Temp.	S2 1	S2 2	S2 3	S2 4
-200				
-180				■
-150			■	
-100			■	■
-50		■		
-25		■		■
-10		■	■	
-5		■	■	■
0	■			
5	■			■
10	■		■	
20	■		■	■
25	■	■		
50	■	■		■
100	■	■	■	
200	■	■	■	■

Max. Temp.	S2 5	S2 6	S2 7	S2 8	S2 9	S2 10
0						
5						■
10					■	
15					■	■
20				■		
25				■		■
30				■	■	
35				■	■	■
40			■			
45			■			■
50			■		■	
55			■		■	■
60			■	■		
65			■	■		■
70			■	■	■	
75			■	■	■	■
80		■				
85		■				■
90		■			■	
95		■			■	■
100		■		■		

Max. Temp.	S2 5	S2 6	S2 7	S2 8	S2 9	S2 10
105		■		■		■
110		■		■	■	
115		■		■	■	■
120		■	■			
125		■	■			■
130		■	■		■	
135		■	■		■	■
140		■	■	■		
145		■	■	■		■
150		■	■	■	■	
160		■	■	■	■	■
170	■					
180	■					■
190	■				■	
200	■				■	■
225	■			■		
250	■			■		■
275	■			■	■	
300	■			■	■	■
325	■		■			
350	■		■			■

Max. Temp.	S2 5	S2 6	S2 7	S2 8	S2 9	S2 10
375	■		■		■	
400	■		■		■	■
450	■		■	■		
500	■		■	■		■
550	■		■	■	■	
600	■		■	■	■	■
650	■	■				
700	■	■				■
750	■	■			■	
800	■	■			■	■
850	■	■		■		

■ = ON

Temperature Signal Converter, 931N-N161

- Space saving design - 6.1 mm wide
- Pre-calibrated temperature ranges
- Fast response time
- Sensor error detection and NAMUR 43 compliant
- NAMUR NE21 compliant, top measurement performance in harsh EMC conditions
- Selectable internal/external CJC

This device can convert both RTD PT100 and Thermocouple (J and K) inputs to passive analog current output signals. This device is powered by the output loop circuit. This device offers a cost-effective way to transfer temperature measurements with high signal reliability.

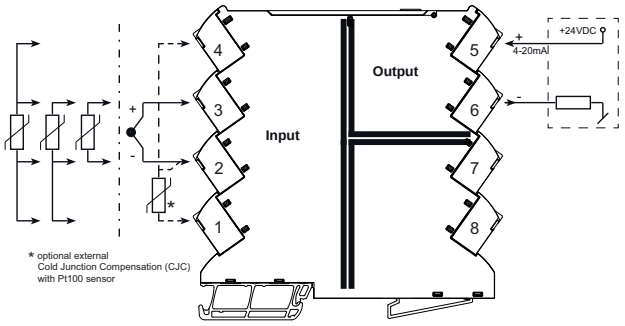
931N-N161— Specifications

Input	
Number of Channels	1
RTD Input	PT100 (2/3/4 wire) -200...+850 °C
Min Measurement Span	10 °C
Sensor Current	< 150 µA
Sensor cable resistance	< 50 Ω per wire
Effect of sensor cable resistance	< 0.002 Ω / Ω (3-/4-wire)
Sensor Error Detection	Yes
Broken Sensor Detection	> 800 Ω
Shorted Sensor Detection	< 18 Ω
Thermocouple Input	Type J: -100...+1200 °C; Type K: -180...+1372 °C
Min Measurement Span	50°C
Sensor cable resistance	< 5 kΩ per wire
CJC Accuracy @ external Pt100 input	Better than ±0.15°C
CJC Accuracy @ internal CJC	Better than ±2.5°C
Sensor Error Detection	Yes
Input	Active or Passive
Output	
Number of Channels	1
Programmable Current Range	4...20 and 20...4 mA

931N-N161— Specifications

Load (@ Current Output)	≤ (Vsupply - 5.5) / 0.023 [Ω]
Sensor Error Indication	3.5 mA or 23 mA / acc. to NAMUR NE43 or OFF
Update Time	10 ms
Output	Passive
Supply	
Supply voltage	Output Loop Powered (5.5...35V DC)
Power consumption	0.48 W/0.8 W
General Specifications	
Accuracy - RTD	Better than 0.05% of span or 0.1 °C
Accuracy - Thermocouple	Better than 0.05% of span or 0.5 °C
Temp Coefficient - RTD, Greater of	0.02°C/°C or ≤ ±0.01%/°C
Temp Coefficient- TC J/K, Greater of	0.1°C/°C or ≤ ±0.01%/°C
Response Time (0..90%, 100..10%)	< 30 ms / 300 ms (Selectable)
Galvanic Isolation	2 Way Isolator
Isolation Voltage	2.5 kV eff /1 min
Rated Voltage	300V eff
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	DIP Switch
Screw Terminal Torque	0.5 N•m (4.43 lb•in)
Wire Size	0.13...2.5 mm^2 / AWG 26...12 Stranded Wire
Dimensions, approx. W x H x D	6.1 x 112.5 x 114.3 mm (0.24 x 4.43 x 4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25...+70 °C (-13...+158 °F)
Temperature, Storage	-40...+85 °C (-40...+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457329
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, RCM, CMIM, UKCA
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc, IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

Wiring Diagram



Dip Switch Configuration

RTD & TC sensor type	S1 1	2	3
Pt100 2 wire	■		
Pt100 3 wire		■	
Pt100 4 wire	■	■	
J (internal CJC) 1)			■
K (internal CJC) 1)	■		■
J (external CJC) 1) 2)		■	■
K (external CJC) 1) 2)	■	■	■

Output	4	5	6
4...20 mA	■		
20...4 mA	■	■	

Sensor error detection	7
none	
enabled	■

Output error level	8
downscale	
upscale	■

Noise suppression	9
50 Hz	
60 Hz	■

Response time	10
< 30 ms	
300 ms	■

Temperature range [°C]
Pt100: -200...+850 °C // TC J: -100...+1200°C // TC K: -180...+1372 °C

Min. Temp.	S2 1	2	3	4
-200				
-180				■
-150			■	
-100			■	■
-50		■		
-25		■		■
-10		■	■	
-5		■	■	■
0	■			
5	■			■
10	■		■	
20	■		■	■
25	■	■		
50	■	■		■
100	■	■	■	
200	■	■	■	■

Max. Temp.	S2 5	6	7	8	9	10
0						
5						■
10					■	
15					■	■
20				■		
25				■		■
30				■	■	
35				■	■	■
40			■			
45			■			■
50			■		■	
55			■		■	■
60			■	■		
65			■	■		■
70			■	■	■	
75			■	■	■	■
80		■				
85		■				■
90		■			■	
95		■			■	■
100		■		■		

Max. Temp.	S2 5	6	7	8	9	10
105		■		■		■
110		■		■	■	
115		■		■	■	■
120		■	■			
125		■	■			■
130		■	■		■	
135		■	■		■	■
140		■	■	■		
145		■	■	■		■
150		■	■	■	■	
160		■	■	■	■	■
170	■					
180	■					■
190	■				■	
200	■				■	■
225	■			■		
250	■			■		■
275	■			■	■	
300	■			■	■	■
325	■		■			
350	■		■			■

Max. Temp.	S2 5	6	7	8	9	10
375	■		■		■	
400	■		■		■	■
450	■		■	■		
500	■		■	■		■
550	■		■	■	■	
600	■		■	■	■	■
650	■	■				
700	■	■				■
750	■	■			■	
800	■	■			■	■
850	■	■		■		
900	■	■		■		■
950	■	■		■	■	
1000	■	■		■	■	■
1050	■	■	■			
1100	■	■	■			■
1150	■	■	■		■	
1200	■	■	■		■	■
1250	■	■	■	■		
1300	■	■	■	■		■
1350	■	■	■	■	■	
1372	■	■	■	■	■	■

■ = ON
1) only
2) optional

Universal Signal Converter, 931N-U221

- Space saving design - 6.1 mm wide
- Power rail option eliminates power supply wiring
- High galvanic isolation and accuracy
- Fast response time
- Sensor error detection and NAMUR 43 compliant
- NAMUR NE21 compliant, top measurement performance in harsh EMC conditions

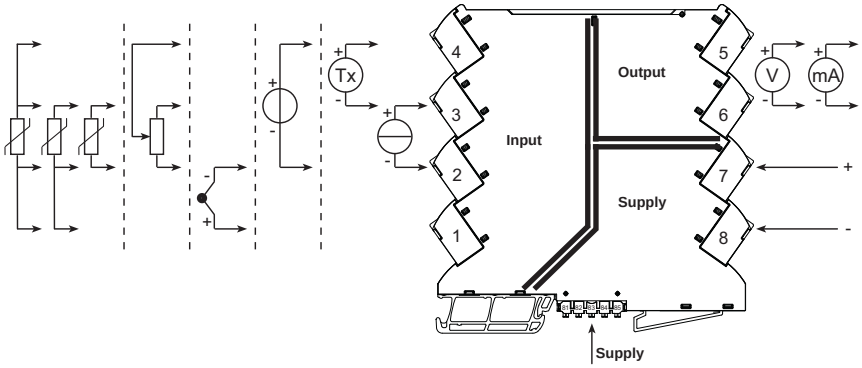
This universal device can convert a broad range of signals including RTDs, Thermocouples, current, voltage, potentiometer and resistance inputs to analog current/voltage outputs. The three-way galvanic isolation between input, output and power supply helps eliminate ground loop/noise related errors to provide a reliable signal. This device gives a great flexibility to be used across several signal input types.

931N-U221— Specifications[1]

Input	
Number of Channels	1
RTD input	Pt10/20/50/100/200/250/300/Pt400/500/1000; Ni50/100/120/1000
Cable resistance per wire	50 Ω (max.)
Sensor current	Nom. 0.2 mA
Effect of sensor cable resistance (3-/4-wire)	< 0.002 Ω / Ω
Sensor Error Detection	Yes
Short circuit detection	< 15 Ω
Linear resistance Input (min..max)	0 Ω...10000 Ω
Potentiometer Input (min..max)	10 Ω...100 kΩ
Thermocouple Input	B, E, J, K, L, N, R, S, T, U, W3, W5, LR
CJC via int. mounted sensor	±(2.0 °C + 0.4 °C * Δt); Δt = Internal temp - Ambient temp
Sensor Error Detection	Yes
Sensor Error Current: When detecting / else	Nom. 2 µA / 0 µA
Current Input	0...23 mA
Programmable Current Range	0...20 mA, 4...20 mA
Input resistance	Nom. 20 Ω + PTC 50 Ω
Voltage Input	0...12V DC
Programmable Voltage Range	0/0.2...1, 0/1...5, 0/2...10V DC
Input resistance	Nom. 10 MΩ
2-wire transmitter supply	> 15V / 20 mA
Input	Active or Passive
Output	
Number of Channels	1
Current Output	0...23 mA
Programmable Current Range	0...20, 4...20, 20...0, 20...4 mA
Load (@ Current Output)	≤ 600 Ω
Sensor Error indication	0 / 3.5 / 23 mA / none
NAMUR NE43 Upscale/ Downscale	23 mA / 3.5 mA
Voltage output	0...10V DC
Programmable Voltage Range	0/0.2...1V, 0/1...5V, 0/2...10V, 1...0.2/0V, 5...1/0V, 10...2/0V
Load (@ Voltage Output)	≥ 10 kΩ
Output	Active
Supply	
Supply voltage	24V DC ± 30%
Power consumption	0.48 W/0.8 W
General Specification	
Accuracy	Better than 0.1% of selected range
Temp Coefficient	≤ 0.01% / °C
Response Time - Temperature Input (0..90%, 100..10%)	≤ 1 s
Response Time - mA /V input (0...90%, 100...10%)	≤ 400 ms
Galvanic Isolation	3 Way Isolator
Isolation Voltage	2.5 kV eff /1 min
Rated Voltage	300V eff
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	FDT/DTM Software
Screw Terminal Torque	0.5 N•m (4.43 lb•in)
Wire Size	0.13...2.5 mm^2 / AWG 26...12 Stranded Wire
Dimensions, approx. W x H x D	6.1 x 112.5 x 114.3 mm (0.24 x 4.43 x 4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25...+70 °C (-13...+158 °F)
Temperature, Storage	-40...+85 °C (-40...+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457333
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, RCM, CMIM, UKCA, CCC-Ex
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc, IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

(1) Continued on the next page.

Wiring Diagram



Notes:

Bulletin 931S-Smart Series

These signal conditioners provide a wide range of highly configurable and flexible functionality – to help solve and prevent many problems in control and process applications.

Isolate and Convert Numerous Signals

- HART transparent and Bidirectional
- Current up to 60 A AC/DC, through-hole and inline wiring, voltage up to 480V AC and 660V DC frequency
- Load cell, strain gauge and bridge circuits
- Universal (including most thermocouples and potentiometers analog and relay outputs)

Features

- High galvanic isolation, up to 4 kV AC
- High accuracy: up to 0.05%
- Fast response time up to 0.5 ms
- Low power consumption
- Extensive global certifications: UL, CE, ATEX, IECEx, KC, RCM, CMIM, CCC-Ex, UKCA Hazardous Area (Class 1 Div 2/Zone 2)
- Configuration without any tools and Interactive display
- Three phase voltage and current monitoring in a compact housing
- Removable terminals with error-proof keys

Input \ Output	0…22 mA, 0…11 V	0/4…20 mA, 0/1/2…5/10 V[3]	0/4…20 mA with HART	0/2…10 V	0/4…20 mA, ± 20 mA, 0/1/2…5/10 V, ± 5/10 V	4…20mA	Relay	Relay; 0/4…20 mA, ± 20 mA, 0/1/2…5/10 V, ± 5/10 V	0/4…20 mA, Transistor	Channels	Power
0…22 mA, 0…11 V[1]	931S-A481									1	12…60V DC
Load Cell/Bridge ± 10 mV,± 20 mV, ± 30 mV, ± 50 mV		931S-B481								1	10…60V DC
0/4…20 mA with HART			931S-C121							1	24V DC
			931S-C122							Splitter	
			931S-C124							2	
0/4…20 mA									931S-C144	2	12…30V DC (Input Current Loop)
4…20 mA						931S-C161				1	12…30V DC (Output Current Loop)
4…20 mA						931S-C162				Splitter	12…30V DC (Output Current Loop)
0/4…20 mA				931S-C221						1	24 V DC
Mechanical switch, PWM Encoder, 2-/3-wire PNP/NPN resistor					931S-F591					1	24…230V DC 48…230V AC
POT, RTD, TC											
0…1/5/10 A AC or DC					931S-L521					1	24 V DC
0…40/50/60 A AC or DC							931S-M321			1	24 V DC
0…5/10 A AC or DC								931S-M5211		Splitter	24 V DC
0…20/25/30 A AC or DC								931S-M5213		Splitter	24 V DC
0…40/50/60 A AC or DC								931S-M5216		Splitter	24 V DC
PT100, PTC							931S-N392			Splitter	20…264V AC/DC
POT, RTD, TC					931S-N591					1	24…230V DC 48…230V AC

± 0.1mA...±100 mA, ±20 mV...±300 V					931S-P491					1	24...240V AC/DC
0...660 V DC, 0...440 V AC		931S-V291								1	24...240V AC/DC
200...480 V AC (3Ph)							931S-V342			Splitter	Input Loop
110/240/400 V AC/DC							931S-V392			Splitter	24...240V AC/DC
Universal(2)							931S-U382			Splitter	9...60V DC
							931S-U392				90...264V AC
									931S-U561		Output Loop

(1) Configurable in small measurement ranges, 4 mA/2V.
(2) All Thermocouples, PT/RTDs, Potentiometer, Resistance, Current, Voltage).
(3) Configurable.

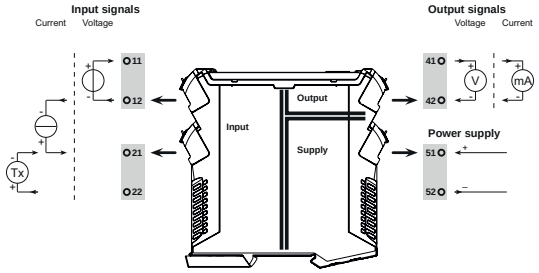
931S - Smart Series Signal Conditioners

Configurable Signal Converter - Low Span, 931S-A481

- Removable terminals with error proof keys
- Highly configurable input and output signals
- Easy configuration via onboard adjustments and DIP switches
- High galvanic isolation and accuracy
- Wide power supply

This device has a high degree of configuration of analog signals for input and outputs. The minimum range/span of measurement has to be either 4 mA or 2V. The lowest measurement for input and output is 0 mA or 0V. This device can convert analog current/voltage signals and provide three-way galvanic isolation between input, output, and power supply. This device offers a cost-effective way to isolate and convert signals especially when dealing with a small range of measurement signal such as within 4 mA or 2V.

Wiring Diagram



DIP Switch Settings

Input

Input range	DIP switch S2	
	1	2
current	▮	
voltage		▮

▮ = ON

Output

Output range	DIP switch S1			
	1	2	3	4
current	▮			▮
voltage			▮	
filtered response		▮		
fast response				

931S-A481– Specifications

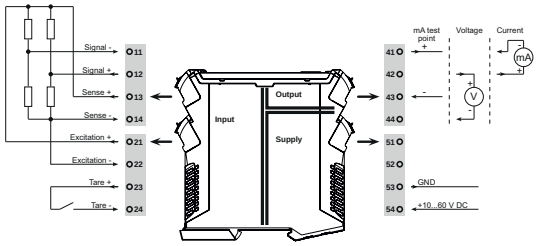
Input	
Number of Channels	1
Current Input	Configurable, 0...22 mA (min measurement span 4 mA)
Voltage Input	Configurable, 0...11 V (min measurement span 2V)
Input Resistance	100 Ω
Input Resistance	≥ 1 MΩ
Sensor Supply	24V DC
Input Resolution	3.5 µA / 1.76 mV per bit
Input	Active or Passive
Output	
Number of Channels	1
Output, Current	Adjustable, 0...22 mA, Output range min span 4 mA
Load (@ Current Output)	≤ 1 kΩ
Output, Voltage	Adjustable, 0...11 V, Output range, min span 2V
Load (@ Voltage Output)	≥ 500 kΩ
Offset Voltage	≤ 20 mV
Output	Active
Supply	
Supply Voltage	12...60 V DC
Power Consumption	3 W
General Specification	
Accuracy	< ± 0.1% of signal range, Typ. ± 0.05% of signal range
Step Response Time	350 ms
Temperature Coefficient	< 0.05% / °C
Long Term Drift	0.1% / 10,000 h
Galvanic Isolation	3-way Isolator
Isolation Voltage	2 kV
Impulse Withstand Voltage	4 kV (1.2/50 µs)
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	DIP switch, Keys and status indicator display, with reference voltage/current sources
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	30...14 AWG
Approx. Dimensions WxHxD	12.5 x 117.2 x 113.6 mm (0.49 x 4.62 x 4.47 in.)
Weight	80 g
Temperature, Operating	-20 °C ...+60 °C
Temperature, Storage	-25 °C ...+70 °C
Relative Humidity	< 90%, No Condensation
Part Number	PN-457336
Certifications	c-UL-us, CE, KC, RCM, RoHS
Hazardous (Ex) Area Marking	CL I DIV 2 GP A-D-T5

Strain Gauge Converter, 931S-B481

- Removable terminals with error proof keys
- Highly configurable input and output signals
- Easy configuration via onboard adjustment
- High galvanic isolation and accuracy
- Supply of up to four parallel connected measuring bridges, 350 Ω
- Four wire and six wire measurement
- Device status indicator

This device can convert measurement data from weigh scale, strain gauge, wheatstone bridge, load cell and resistance measuring bridges to standard analog signals. The device offers a 5V or 10V excitation. The device supports simple compensation of the tare weight with a separate input for an external button or an external PLC signal. This device also offers three-way isolation between input, output, and power supply.

Wiring Diagram



DIP Switch Settings

DIP switch setting

	DIP switch							
Excitation	1	2	3	4	5	6	7	8
10 V	■							
5 V								
Output	1	2	3	4	5	6	7	8
mA		■						
V								
Input span	1	2	3	4	5	6	7	8
10 mV			■					
20 mV				■				
30 mV					■			
50 mV						■		
Measuring method	1	2	3	4	5	6	7	8
4-wire							■	■
6-wire								

■ = ON

931S-B481 — Specifications

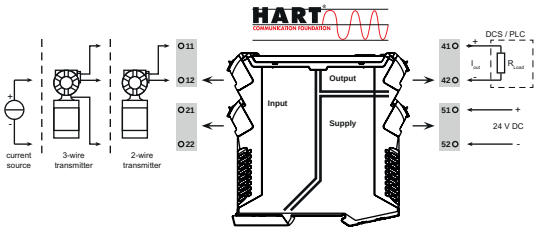
Input	
Number of Channels	1
Input Signal	Load Cell, Weigh Scale, Wheatstone Bridge Resistors
Sensor	Resistance measuring bridge, Total resistance of all parallel resistance measuring bridges: min.87Ω
Sensor Supply	120 mA @ 10V (= 4 x350 Ω bridge resistors)
Input Measurement Range	± 10 mV / ± 20 mV / ± 30 mV / ± 50 mV (adjustable)
Bridge Supply Voltage	5V or 10V
Bridge Sensitivity	1.0 mV / V to 5.0 mV / V
Input	Active
Output	
Number of Channels	1
Output, Current	0...22 mA (adjustable)
Output, Voltage	0...11 V (adjustable)
Load Impedance, Current	≤ 600 Ω
Load Impedance, Voltage	600 Ω
Output	Active
Supply	
Supply Voltage	10...60 V DC
Power Consumption	3 W @ 24V DC
General Specification	
Accuracy	0.05% of Full Scale Range
Step Response Time	< 400 ms (10...90%)
Temperature Coefficient	typ. 0.005% / °C
Long Term Drift	0.1% / 10,000 h
Galvanic Isolation	3 Way Isolator
Isolation Voltage	5.7 kV: Input - Output, Input - Supply
Rated Voltage	300 Veff
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	DIP Switch and Button
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 30...14
Approx. Dimensions W x H x D	22.5 x 119.2 x 113.6 mm (0.89 x 4.7 x 4.47 in)
Weight	176 g
Temperature, Operating	-40...+70 °C
Temperature, Storage	-40...+85 °C
Relative Humidity	10...95%, No Condensation
Part Number	PN-457338
Certifications	c-UL-us, CE, KC, RCM, RoHS

Analog Signal Converter - HART, 931S-C121

- Removable terminals with error proof keys
- HART compatible, 0.5...2.5 kHz
- High galvanic isolation and accuracy
- No configuration needed
- Device status indicator
- Hazardous area rated

This device is HART transparent and enables bidirectional HART signal transmission between the input and output side. The device provides three way galvanic isolation between input, output, and power supply; and replicates the exact signal value to output. The device's isolation function will help provide a reliable signal by eliminating noises and protect the control system from transients in a cost effective way

Wiring Diagram



931S-C121 —Specifications

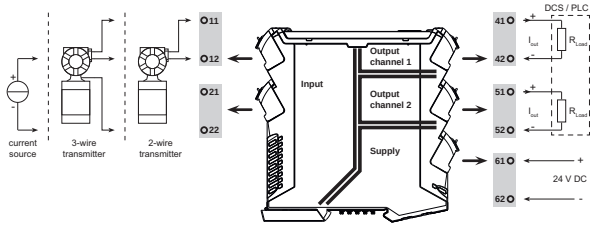
Input	
Number of Channels	1
Current Input	0...20 mA, 4...20mA
Input Signal	2/3 wire transmitter, HART signal Transparent and bidirectional
Input Voltage drop	Approx 3.8 V @ RLoad = 0 Ω; Approx 15 V @ RLoad = 600 Ω; (Iinput = 20 mA)
Sensor Supply	> 17 V DC at 20 mA, max 30 V @ open circuit, max 50 mA @ short-circuit
Input	Active or Passive
Output	
Number of Channels	1
Current Output	0...20 mA, 4...20mA, HART digital signal
Load Impedance	≤ 550 Ω
Output	Active
Supply	
Supply Voltage	20...30 V DC
Power Consumption	≤60 mA (24V power supply, 20mA output)
General Specification	
Accuracy	< 0.1% of end value
Step Response Time	≤ 0.5 ms
Temperature Coefficient	80 ppm/K
Galvanic Isolation	3 Way Isolator
Isolation Voltage	2 kV
Impulse Withstand Voltage	4 kV (1.2/50 µs)
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	None
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 30...14
Approx. Dimensions W x H x D	12.5 x 117.2 x 113.6 mm (0.49 x 4.62 x 4.47 in.)
Weight	110 g
Temperature, Operating	-20 ...+ 60 °C
Temperature, Storage	-40...+ 85 °C
Relative Humidity	5...95%, No Condensation
Part Number	PN-457339
Certifications	c-UL-us, CE, ATEX, IECEx, KC, RCM, RoHS, CCC-Ex
Hazardous (Ex) Area Marking	CL I DIV 2 GP A,B,C,D Temp Code T5

Analog Signal Splitter – HART, 931S-C122

- Removable terminals with error proof keys
- HART compatible, 0.5...2.5 kHz
- High galvanic isolation and accuracy
- No configuration needed
- Device status indicator
- Hazardous area rated

This device is HART transparent and enables bidirectional HART signal transmission between the input and output side. The device provides four way galvanic isolation between input, output, and power supply; and replicates the exact signal value to output. The device has a split function to provide two output signals from one input signal. The device's isolation function will help provide a reliable signal by eliminating noises and protect the control system from transients in a cost effective way

Wiring Diagram



931S-C122 —Specifications

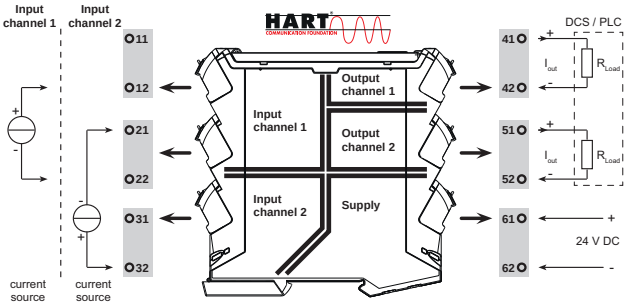
Input	
Number of Channels	1
Current Input	0...20 mA, 4...20mA
Input Signal	2/3 wire transmitter, HART signal Transparent and Bidirectional
Input Voltage drop	Approx 3.8 V @ RLoad = 0 Ω; Approx 15 V @ RLoad = 600 Ω; (Iinput = 20 mA)
Sensor Supply	> 17 V DC at 20 mA, max 30 V @ open circuit, max 50 mA @ short-circuit
Input	Active or Passive
Output	
Number of Channels	2
Current Output	0...20 mA, 4...20mA, HART digital signal
Load Impedance	< 300 Ω
Output	Active
Supply	
Supply Voltage	20...30 V DC
Power Consumption, Typ/ Max	≤60 mA (24V power supply, 20mA output)
General Specification	
Accuracy	< 0.1% of end value
Step Response Time	≤ 0.5 ms
Temperature Coefficient	80 ppm/K
Galvanic Isolation	4 Way Isolator
Isolation Voltage	2 kV
Impulse Withstand Voltage	4 kV (1.2/50 µs)
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	None
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 30...14
Approx. Dimensions W x H x D	12.5 x 117.2 x 113.6 mm (0.49 x 4.62 x 4.47 in.)
Weight	110 g
Temperature, Operating	-20 ...+ 60 °C
Temperature, Storage	-40 ...+85 °C
Relative Humidity	5...95%, No Condensation
Part Number	PN-457340
Certifications	c-UL-us, CE, ATEX, IECEx, KC, RCM, RoHS, CCC-Ex
Hazardous (Ex) Area Marking	CL I DIV 2 GP A,B,C,D Temp Code T5

Dual Channel Converter - HART, 931S-C124

- Removable terminals with error proof keys
- HART compatible, 0.5...2.5 kHz
- High galvanic isolation and accuracy
- No configuration needed
- Device status indicator
- Hazardous area rated

This two channel device is HART transparent and enables bidirectional HART signal transmission between the input and output side. The device provides five way galvanic isolation between inputs, outputs and power supply; and replicates the exact signal value to output. The device's isolation function will help provide a reliable signal by eliminating noises and protect the control system from transients in a cost effective way.

Wiring Diagram



931S-C124 — Specifications

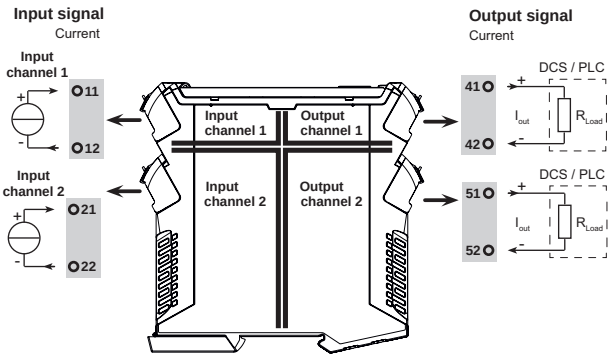
Input	
Number of Channels	2
Current Input	0...20 mA, 4...20mA
Input Signal	2 wire transmitter, HART signal Transparent and Bidirectional
Input Voltage drop	≤ 1 V
Sensor Supply	> 17 V DC at 20 mA, max 30 V @ open circuit, max 50 mA @ short-circuit
Input	Passive
Output	
Number of Channels	2
Current Output	0...20 mA, 4...20mA, HART digital signal
Load Impedance	< 300 Ω per channel
Output	Active
Supply	
Supply Voltage	20...30 V DC
Power Consumption, Typ/ Max	≤60 mA (24V power supply, 20mA output)
General Specification	
Accuracy	< 0.1% of end value
Step Response Time	≤ 0.5 ms
Temperature Coefficient	80 ppm/K
Galvanic Isolation	5 Way Isolator
Isolation Voltage	2 kV
Impulse Withstand Voltage	4 kV (1.2/50 µs)
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	None
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 30...14
Approx. Dimensions W x H x D	12.5 x 117.2 x 113.6 mm (0.49 x 4.62 x 4.47 in.)
Weight	172 g
Temperature, Operating	-20 ...+ 60 °C
Temperature, Storage	-40 ...+85 °C
Relative Humidity	5...95%, No Condensation
Part Number	PN-457341
Certifications	c-UL-us, CE, ATEX, IECEx, KC, RCM, RoHS, CCC-Ex
Hazardous (Ex) Area Marking	CL I DIV 2 GP A,B,C,D Temp Code T5

Dual Channel Converter, 931S-C144

- Removable terminals with error proof keys
- High galvanic isolation and accuracy
- No configuration needed
- Hazardous area rated

This two channel device provides four way galvanic isolation between all inputs and outputs; and replicates the exact signal value to output. The device's isolation function will help provide a reliable signal by eliminating noises and protect the control system from transients in a cost effective way. The device is powered via the input current loop.

Wiring Diagram



931S-C144 —Specifications

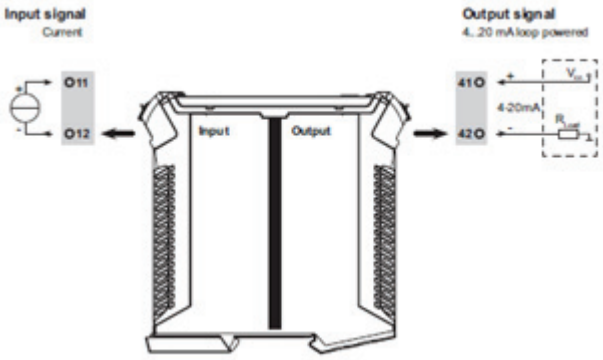
Input	
Number of Channels	2
Current Input	0...20 mA, 4...20mA
Input Voltage Drop	Approx 3.5 V (Iinput = 20 mA)
Start-up Current, typ.	250 mA
Input	Passive
Output	
Number of Channels	2
Current Output	0...20 mA, 4...20mA,
Load Impedance	< 600 Ω (channel 1+2)
Output	Active
Supply	
Supply Voltage	12 ...30 V DC (Input Loop Powered)
Power Consumption, Typ/ Max	≤60 mA (24V power supply, 20mA output)
General Specification	
Accuracy	< 0.1% of end value
Step Response Time	< 20 ms
Temperature Coefficient	100 ppm/K
Galvanic Isolation	4 way Isolator
Isolation Voltage	2 kV
Impulse Withstand Voltage	2.5 kV (1.2/50 µs)
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	None
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 26...14
Approx. Dimensions W x H x D	12.5 x 117.2 x 113.6 mm (0.49 x 4.62 x 4.47 in.)
Weight	110 g
Temperature, Operating	-20 ...+ 60 °C
Temperature, Storage	-40 ...+85 °C
Relative Humidity	5...95%, No Condensation
Part Number	PN-457343
Certifications	c-UL-us, CE, ATEX, IECEx, KC, CMIM, RCM, CCC, RoHS, CCC-Ex
Hazardous (Ex) Area Marking	CL I DIV 2 GP A,B,C,D Temp Code T6

Analog Signal Converter, 931S-C161

- Removable terminals with error proof keys
- High galvanic isolation and accuracy
- No configuration needed
- Hazardous area rated

This device providestwo way galvanic isolation between input and output and replicates the exact signal value to output. The device's isolation function will help provide a reliable signal by eliminating noises and protect the control system from transients in a cost-effective way. The device is powered via the output current loop.

Wiring Diagram



931S-C161 Specifications

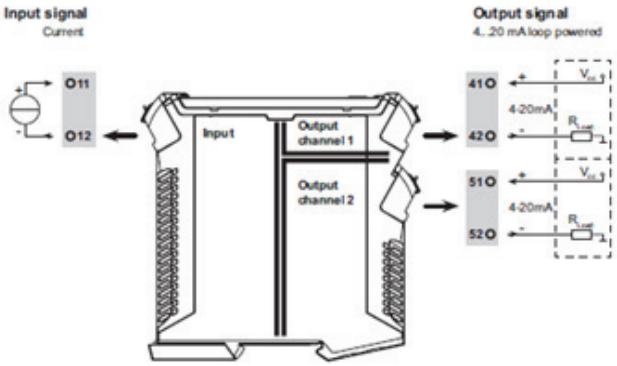
Input	
Number of Channels	1
Current Input	4...20mA
Input Voltage Drop	Approx 3V (I input = 20 mA)
Input	Active
Output	
Number of Channels	1
Current Output	4...20mA
Load Impedance	< 600 Ω
Output	Passive
Supply	
Supply Voltage	12 ...30 V DC (Input Loop Powered)
Power Consumption, Typ/Max	≤60 mA (24V power supply, 20mA output)
General Specification	
Accuracy	< 0.1% of end value
Step Response Time	< 20 ms
Temperature Coefficient	100 ppm/K
Galvanic Isolation	2 way Isolator
Isolation Voltage	2 kV
Impulse Withstand Voltage	2.5 kV (1.2/50 µs)
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	None
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 26...14
Approx. Dimensions W x H x D	12.5 x 117.2 x 113.6 mm (0.49 x 4.62 x 4.47 in.)
Weight	110 g
Temperature, Operating	-20 ...+ 60 °C
Temperature, Storage	-40 ...+85 °C
Relative Humidity	5...95%, No Condensation
Part Number	PN-457344
Certifications	c-UL-us, CE, ATEX, IECEx, KC, CMIM, RCM, CCC, RoHS, CCC-Ex
Hazardous (Ex) Area Marking	CL I DIV 2 GP A,B,C,D Temp Code T6

Analog Signal Splitter, 931S-C162

- Removable terminals with error proof keys
- High galvanic isolation and accuracy
- No configuration needed
- Hazardous area rated

The device has a split function to provide two output signals from one input signal. This device provides three way galvanic isolation between input and all outputs and replicates the exact signal value to output. The device's isolation function will help provide a reliable signal by eliminating noises and protect the control system from transients in a cost-effective way. The device is powered via the output current loop.

Wiring Diagram



931S-C162 Specifications

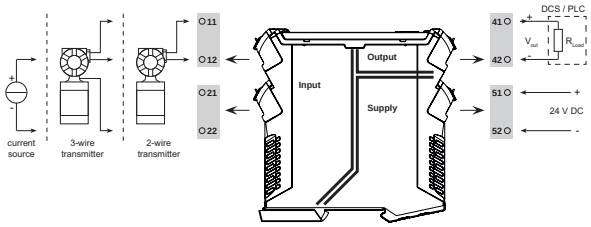
Input	
Number of Channels	1
Current Input	4...20mA
Input Voltage Drop	Approx 3V (I input = 20 mA)
Input	Active
Output	
Number of Channels	2
Current Output	4...20mA
Load Impedance	< 600 Ω
Output	Passive
Supply	
Supply Voltage	12 ...30 V DC (Input Loop Powered)
Power Consumption, Typ/ Max	≤60 mA (24V power supply, 20mA output)
General Specification	
Accuracy	< 0.1% of end value
Step Response Time	< 20 ms
Temperature Coefficient	100 ppm/K
Galvanic Isolation	3 way Isolator
Isolation Voltage	2 kV
Impulse Withstand Voltage	2.5 kV (1.2/50 µs)
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	None
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 26...14
Approx. Dimensions W x H x D	12.5 x 117.2 x 113.6 mm (0.49 x 4.62 x 4.47 in.)
Weight	100g
Temperature, Operating	-20 ...+ 60 °C
Temperature, Storage	-40 ...+85 °C
Relative Humidity	5...95%, No Condensation
Part Number	PN-457345
Certifications	c-UL-us, CE, ATEX, IECEx, KC, CMIM, RCM, CCC, RoHS, CCC-Ex
Hazardous (Ex) Area Marking	CL I DIV 2 GP A,B,C,D Temp Code T6

Analog Signal Converter, 931S-C221

- Removable terminals with error proof keys
- High galvanic isolation and accuracy
- No configuration needed
- Device status indicator
- Hazardous area rated

The device provides three way galvanic isolation between input, output, and power supply; and converts analog current signal to voltage signal on the output. The device's isolation function will help provide a reliable signal by eliminating noises and protect the control system from transients in a cost effective way.

Wiring Diagram



931S-C221 –Specifications

Input	
Number of Channels	1
Current Input	0...20 mA, 4...20mA
Input Signal	2/3 wire transmitter
Input Voltage drop	≤ 1 V
Sensor Supply	> 17 V DC at 20 mA
Input	Active or Passive
Output	
Number of Channels	1
Current Output	0...10 V, 2...10 V
Load Impedance	≥ 600 kΩ
Output	Active
Supply	
Supply Voltage	20...30 V DC
Power Consumption, Typ/Max	≤60 mA (24V power supply, 20mA output)
General Specification	
Accuracy	±0.1% FSR (Full Scale Range) max., 0.05% FSR typ.
Step Response Time	≤ 0.5 ms
Temperature Coefficient	80 ppm/K
Galvanic Isolation	3 Way Isolator
Isolation Voltage	2 kV
Impulse Withstand Voltage	4 kV (1.2/50 µs)
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	None
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 30...14
Approx. Dimensions W x H x D	12.5 x 117.2 x 113.6 mm (0.49 x 4.62 x 4.47 in.)
Weight	110 g
Temperature, Operating	-20 ...+ 60 °C
Temperature, Storage	-40 ...+85 °C
Relative Humidity	5...95%, No Condensation
Part Number	PN-457342
Certifications	c-UL-us, CE, ATEX, IECEx, KC, RCM, RoHS, CCC-Ex
Hazardous (Ex) Area Marking	CL I DIV 2 GP A,B,C,D Temp Code T5

Frequency Signal Converter - Interactive Display 931S-F591

- Interactive, on-board display for easy configuration
- Wide range of input signals
- Digital output for alarms with delay function
- Operation and alarm output LED
- Operation and error status display
- Universal power supply
- Removable terminals with error proof keys
- NAMUR NE43 compliant
- Hazardous area rated

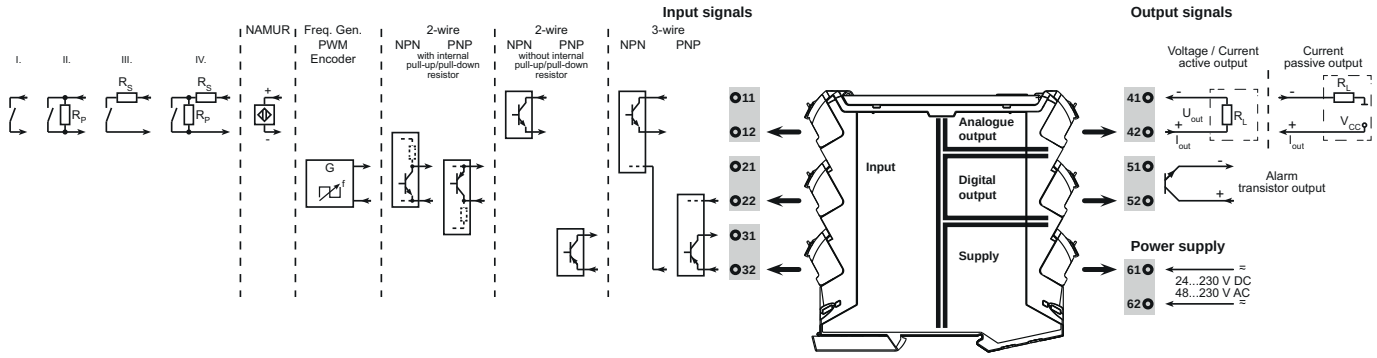
This device provides a user friendly display with three buttons on the front face plate to ease the configuration process without any tools or programs.
This device can convert signals from 2-/3-wire PNP/NPN transistors, frequency generator, mechanical switch or Namur sensor to relay output for the desired alarms at preset limits.
User can define the alarm outputs for limit monitoring, sensor error detection, etc. The device's four way galvanic isolation between input, output, and power supply will help provide a reliable signal by eliminating noises and signal degradation.

931S-F591 - Specifications

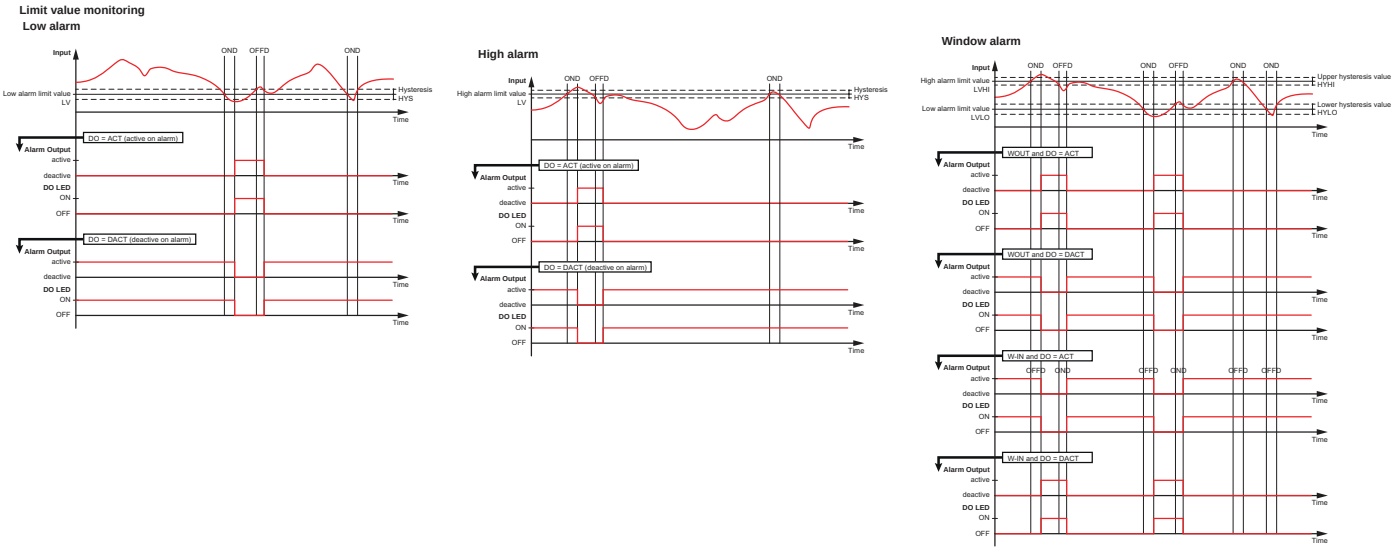
Input	
Number of Channels	1
Input	Frequency, PWM
Frequency Input	2-/3- wire PNP/NPN sensor, 2-wire NAMUR, frequency generator, PWM, encoder, mechanical switch
PWM Input	2-/3- wire PNP/NPN sensor, 2-wire NAMUR, frequency generator, PWM, encoder
Input range	Configurable, depends on input type
Frequency input range	
2-wire NAMUR (EN 60947-5-6) input range	0.01...200 kHz
Mechanical switch input range	0.001...10 Hz
Mechanical switch input range	0.001...10 Hz
3-wire NPN/PNP sensor and 2-wire NPN/PNP sensor without internal pull-up/pull-down resistor	0.01...150KHz
2-wire NPN/PNP sensor with internal pull-up/pull-down resistor, frequency generator, PWM, encoder	0.01...400 kHz
Input failure detection	Yes
Input	Passive
Analog Output	
Number of Channels	1
Output, Current	Adjustable, 0...±20 mA
Output, Voltage	Adjustable, 0...±10V
Load Resistance, Current	≤ 600 kΩ
Load Resistance, Voltage	≥1 kΩ
Input Failure Indication	Upscale or Downscale
Output:	Active or Passive
Digital Output	
Signal	Transistor, NPN
Alarm Function: Programmable	Top and bottom limit values, Window range (IN/OUT), Input Failure
Hysteresis	1... 20% (adjustable)
Alarm delay (ON/OFF)	0...180 s
Max. switching frequency	5kHz @ 24V DC
Supply	
Supply Voltage	24... 230V DC 48 ... 230V AC @ 48...62 Hz
Power Consumption	≤3.5 W
General Specification	
Accuracy	±0.05% FSR (Full Scale Range)
Step Response Time	Selectable, depends on period/gate time
Resolution	Up to 0.001 Hz
Galvanic Isolation	4 Way Isolator
Isolation Voltage	4 kV
Rated Voltage	300V
Pollution Degree	2

Surge Voltage Category	II
Protection Degree	IP20
Configuration	On board display with pushbuttons
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 26...14
Approx. Dimensions W x H x D	12.5 x 117.2 x 113.6 mm (0.49 x 4.62 x 4.47 in.)
Weight	140 g
Temperature, Operating	-40 ...+ 70 °C
Temperature, Storage	-40 ...+85 °C
Relative Humidity	5...95%, No Condensation
Part Number	PN-457346
Certifications	c-UL-us, CE, ATEX, IECEx, KC, CMIM, CCC-Ex RCM, RoHS
Hazardous (Ex) Area Marking	CL I DIV 2 GP A,B,C,D Temp Code T4

Wiring Diagram



Alarm Graphs



Current Measurements Converter- 10 A, 931S-L521

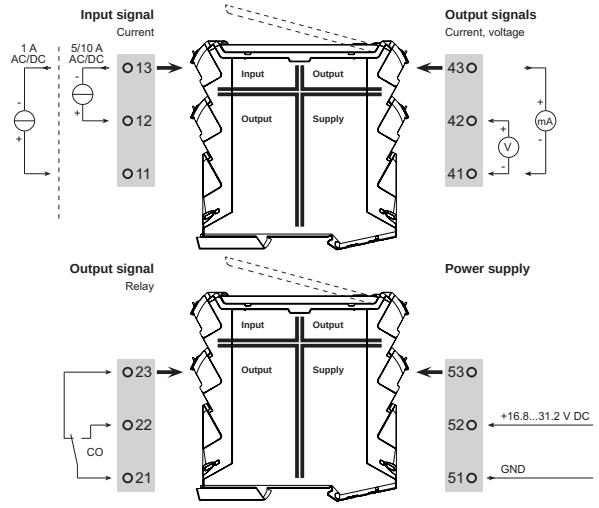
- Measure, monitor, and convert current AC or DC up to 10 amps
- Configurable relay output for over-current or under-current
- Operation status and error display status indicator per NE43, NE44, and NE107
- True RMS or arithmetic average for precise monitoring
- Adjustable trigger delay for filtering current peaks
- High galvanic isolation and accuracy

This device measures and monitors AC and DC currents up to 10A. True RMS algorithm will provide a precise measurement even in cases with distorted current waveform. The device offers both analog and digital output options enabling a low energy transmission or contact switching for desired conditions. The relay output can be configured for desired conditions such as over-current, under-current, etc. The device provides four way galvanic isolation between the input, output(s) and power supply. This device offers a cost effective way to monitor and convert current measurements.

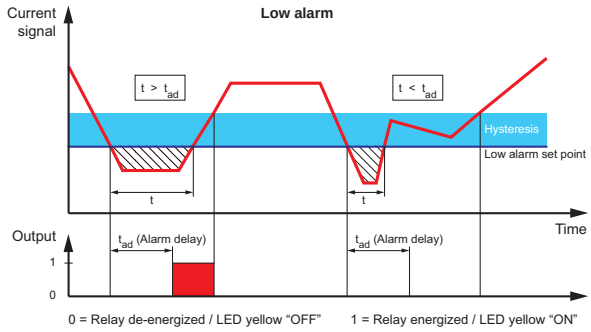
931S-L521—Specifications

Input	
Number of Channels	1
Input, Current	Configurable, 0…1/5/10 A AC (RMS) or DC
Input Frequency	AC: 15…400 Hz (true root mean square), AC: 50 Hz (arithmetic average)
Input	Passive
Output	
Number of Channels	2
Analog Output	
Output, Current	Adjustable, 0…20 mA, 4…20 mA, -20…+20 mA
Output, Voltage	Adjustable, 0…10 V, 2…10 V, 0…5 V, 1…5 V, -5…+5 V, -10…+10 V
Load Impedance, Current	≤ 600 Ω
Load Impedance, Voltage	≥ 10 kΩ
Output	Active (For Analog Output)
Digital Output	**1 Changeover contact relay, inverse adjustment**
Max. switching voltage, AC	250 V
Max. switching voltage, DC	24 V
Rated Switching Current	2 A
Supply	
Supply Voltage	16.8 V …31.2 V
Power Consumption	2.2 W
General Specification	
Accuracy	≤ ±0.3% @ 1 A/5 A, ≤±0.6% @ 10 A
Step Response Time	≤ 300 ms (RMS), ≤ 60 ms (AA)
Temperature Coefficient	≤ ±100 ppm/K @ -25…+55 °C, ≤ ±200 ppm/K @ +55…+70 °C
Galvanic Isolation	4 Way Isolator
Isolation Voltage	4 kVeff / 1 min
Impulse Withstand Voltage	6 kV (1.2/50 µs)
Rated Voltage	300 V ACrms
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	DIP Switch and Potentiometer
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 26…12
Approx. Dimensions W x H x D	17.5 x 117.2 x 113.6 mm (0.69 x 4.62 x 4.47 in)
Weight	141 g
Temperature, Operating	-25 …+60 °C
Temperature, Storage	-40 …+85 °C
Part Number	PN-457347
Certifications	c-UL-us, CE, KC, RCM, RoHS

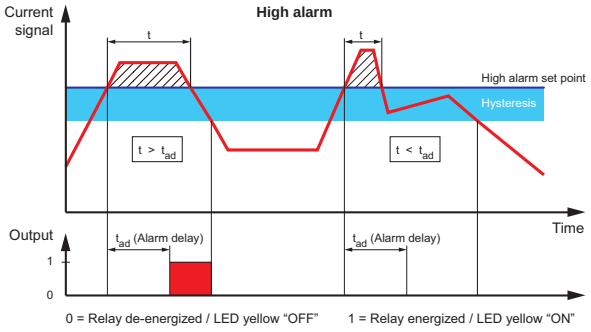
Wiring Diagrams



Low Alarm



High Alarm



DIP Switch Settings

DIP switch S1								
Current input range	1	2	3	4	5	6	7	8
0...1 A								
0...5 A	■							
0...10 A		■						
Measuring method								
True RMS								
Arithmetic average		■						
Alarm delay time								
0 s								
2 s			■					
5 s				■				
10 s			■	■				
Measuring range monitoring								
Yes								
No						■		
Output error action								
Upscale								
Downscale							■	
Transfer function								
Normal								
Inverse							■	

DIP switch S2								
Output range	1	2	3	4	5	6	7	8
0...10 V								
2...10 V		■						
0...5 V			■					
1...5 V		■	■					
-5...+5 V				■				
-10...+10 V		■		■				
0...20 mA	■							
4...20 mA	■	■						
-20...+20 mA	■			■				
Alarm relay action								
Energized								
De-energized					■			
Alarm hysteresis								
5 %								
10 %						■		
Alarm type								
High alarm								
Low alarm						■		

Current Measurements Converter, 60 A
931S-M321

- Measure, monitor, and convert current AC or DC up to 60 Amps
- Configurable relay output for over-current or under-current
- Operation status and error display LED per NE43, NE44, NE107
- True RMS or arithmetic average for precise monitoring
- Adjustable trigger delay for filtering current peaks
- High galvanic isolation and accuracy

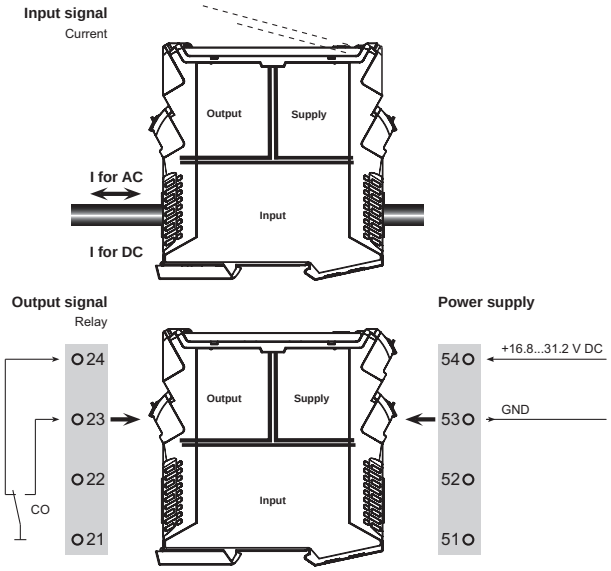
This device measures and monitors AC and DC currents up to 60A via through hole - hall effect sensor. True RMS algorithm will provide a precise measurement even in cases with distorted current waveform. The device offers both analog and digital output options enabling a low energy transmission or contact switching for desired conditions. The relay output can be configured for desired conditions such as over-current, under-current, etc. The device provides four way galvanic isolation between the input, output(s) and power supply. This device is a cost-effective way to monitor and convert current measurements.

931S-M321 — Specifications

Input	
Number of Channels	1
Input	Current carrying wire via through hole, Hall Effect Sensor, 10.5 mm ?
Current Measurement Range	Configurable, 0…40/50/60 A AC or DC
Input Frequency	AC: 15…700 Hz (true root mean square), AC: 50 Hz (arithmetic average)
Input	Passive
Output	
Number of Channels	1
Digital Output	1 Changeover contact relay, inverse adjustment
Alarm Function	Surge current, Undercurrent, Alarm delay: 0…10 s, Hysteresis 5% / 10%
Max. switching voltage, AC	250 V
Max. switching voltage, DC	24 V
Rated Switching Current	6 A
Supply	
Supply Voltage	16.8 V …31.2 V
Power Consumption	2.2 W
General Specification	
Accuracy	< 0.75% FSR (Full Scale Range), < 1.5% FSR with meas. range 50/60 A AC
Step Response Time	≤ 300 ms (RMS), ≤ 60 ms (AA)
Temperature Coefficient	0.01%/K @ 0…40 A, 0.10%/K @ 40…55 A, 0.30%/K @ 55…60 A
Galvanic Isolation	3 Way Isolator
Isolation Voltage	4 kVeff / 1 min
Impulse Withstand Voltage	6.4 kV (1.2/50 µs)
Rated Voltage	300 V AC eff
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	DIP Switch and Potentiometer
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 26…12
Approx. Dimensions W x H x D	22.5 x 119.2 x 113.6 mm (0.89 x 4.7 x 4.47 in)
Weight	158 g
Temperature, Operating	-25 …+60 °C
Temperature, Storage	-40 …+85 °C
Part Number	PN-457351
Certifications	c-UL-us, CE, KC, RCM, RoHS

Current Measurements Converter, 60 A 931S-M321 (continued)

Wiring Diagram



Dip Switch Settings

Current input range	DIP switch S1 1	2	3	4	5	6	7	8
0...40 A								
0...50 A	■							
0...60 A		■						

Measuring method	1	2	3	4	5	6	7	8
True RMS								
Arithmetic average			■					

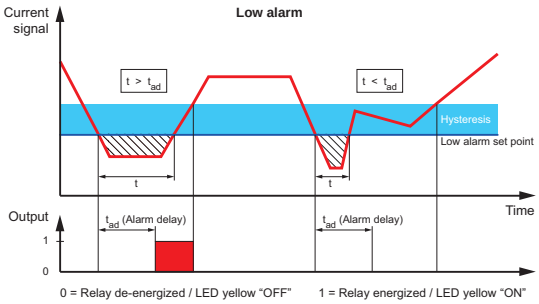
Alarm delay time	1	2	3	4	5	6	7	8
0 s								
2 s				■				
5 s					■			
10 s				■	■			

Alarm relay action	DIP switch S2 1	2	3	4	5	6	7	8
Energized								
De-energized					■			

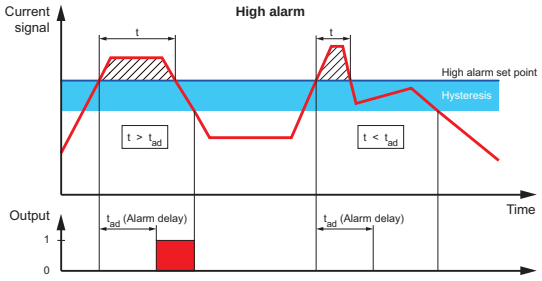
Alarm hysteresis	1	2	3	4	5	6	7	8
5 %								
10 %						■		

Alarm type	1	2	3	4	5	6	7	8
High alarm								
Low alarm							■	

Low Alarm



High Alarm



Current Measurements Converter, 10 A
931S-M5211

- Measure, monitor, and convert AC or DC current up to 10 Amps
- Configurable relay output for over-current or under-current
- Operation status and error display status indicator per NE43, NE44, and NE107
- True RMS or arithmetic average for precise monitoring
- Adjustable trigger delay for filtering current peaks
- High galvanic isolation and accuracy

This device measures and monitors AC and DC currents up to 10 Amps. The device offers a contactless through-hole for the current carrying conductor to pass in. True RMS algorithm will provide a precise measurement even in cases with distorted current waveform. The device offers both analog and digital output options enabling a low energy transmission or contact switching for desired conditions. The relay output can be configured for desired conditions such as over-current, under-current, etc. The device provides four way galvanic isolation between the input, output(s) and power supply. This device is a cost-effective way to monitor and convert current measurements.

931S-M5211 —Specifications

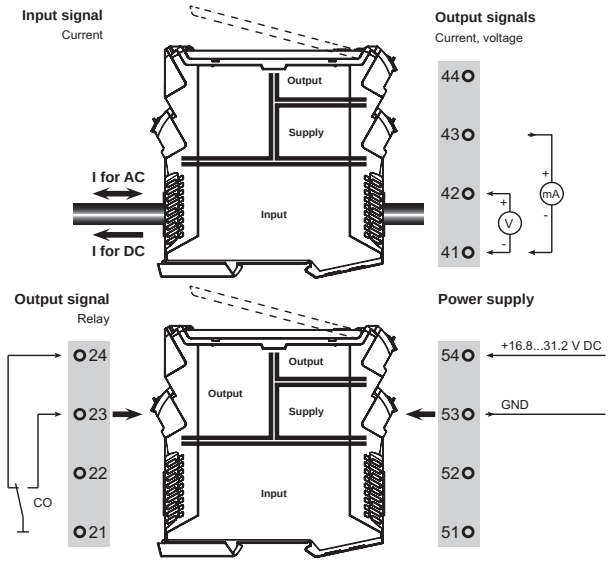
Input	
Number of Channels	1
Input	Current carrying wire via through hole, Hall Effect Sensor, 10.5 mm ?
Current Measurement Range	Configurable, 0…5/10 A AC (RMS) or DC
Input Frequency	AC: 15…700 Hz (true root mean square), AC: 50 Hz (arithmetic average)
Input	Passive
Output	
Number of Channels	2
Analog Output	
Output, Current	Adjustable, 0…20 mA, 4…20 mA, -20…+20 mA

931S-M5211 —Specifications

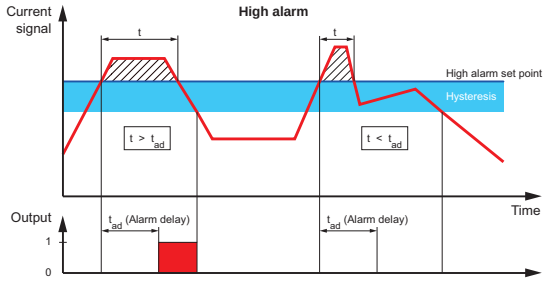
Output, Voltage	Adjustable, 0…10 V, 2…10 V, 0…5 V, 1…5 V, -5…+5 V, -10…+10 V
Load Impedance, Current	≤ 600 Ω
Load Impedance, Voltage	≥ 10 kΩ
Output	Active (For Analog Output)
Digital Output	1 Changeover contact relay, inverse adjustment
Alarm Function	Surge current, Undercurrent, Alarm delay: 0…10 s, Hysteresis 5% / 10%
Max. switching voltage, AC	250 V
Max. switching voltage, DC	24 V
Rated Switching Current	6 A
Supply	
Supply Voltage	16.8 V …31.2 V
Power Consumption, Typ/Max	2.2 W
General Specification	
Accuracy	< 0.75% Full Scale Range
Step Response Time	≤ 300 ms (RMS), ≤ 60 ms (AA)
Temperature Coefficient	≤ ±100 ppm/K @ -25…+55 °C, ≤ ±200 ppm/K @+55…+70 °C
Galvanic Isolation	4 Way Isolator
Isolation Voltage	4 kVeff / 1 min
Impulse Withstand Voltage	6.4 kV (1.2/50 µs)
Rated Voltage	300 V ACrms
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	DIP Switch and Potentiometer
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 26…12
Approx. Dimensions W x H x D	22.5 x 119.2 x 113.6 mm (0.89 x 4.7 x 4.47 in)
Weight	211 g
Temperature, Operating	-25 …+60 °C
Temperature, Storage	-40 …+85 °C
Relative Humidity	5…95%, No Condensation
Part Number	PN-457348
Certifications	c-UL-us, CE, KC, RCM, RoHS

Current Measurements Converter, 10 A 931S-M5211(Continued)

Wiring Diagram



High Alarm



Dip Switch Settings

DIP switch S1								
Current input range	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0...5 A								
0...10 A		■						

Measuring method	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
True RMS								
Arithmetic average			■					

Alarm delay time	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0 s								
2 s				■				
5 s					■			
10 s				■	■			

Measuring range monitoring	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Yes								
No						■		

Output error action	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Upscale								
Downscale							■	

Transfer function	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Normal								
Inverse								■

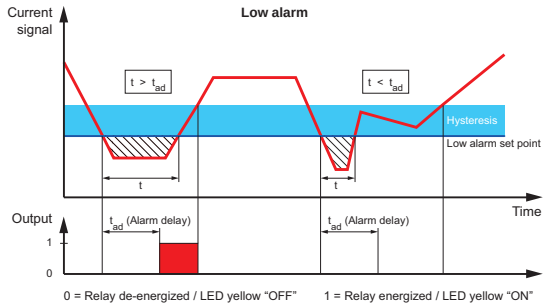
DIP switch S2								
Output range	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0...10 V								
2...10 V		■						
0...5 V			■					
1...5 V		■	■					
-5...+5 V				■				
-10...+10 V		■		■				
0...20 mA	■							
4...20 mA	■	■						
-20...+20 mA	■			■				

Alarm relay action	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Energized								
De-energized					■			

Alarm hysteresis	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
5 %								
10 %					■			

Alarm type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
High alarm								
Low alarm							■	

Low Alarm



0 = Relay de-energized / LED yellow "OFF" 1 = Relay energized / LED yellow "ON"

Current Measurements Converter, 30 A
931S-M5213

- Measure, monitor, and convert AC or DC current up to 30 Amps
- Configurable relay output for over-current or under-current
- Operation status and error display status indicator per NE43, NE44, NE107
- True RMS or arithmetic average for precise monitoring
- Adjustable trigger delay for filtering current peaks
- High galvanic isolation and accuracy

This device measures and monitors AC and DC currents up to 30 Amps. The device offers a contactless through-hole for the current carrying conductor to pass in. True RMS algorithm will provide a precise measurement even in cases with distorted current waveform. The device offers both analog and digital output options enabling a low energy transmission or contact switching for desired conditions. The relay output can be configured for desired conditions such as over-current, under-current, etc. The device provides four way galvanic isolation between the input, output, and power supply. This device offers a cost effective way to monitor and convert current measurements.

931S-M5213—Specifications

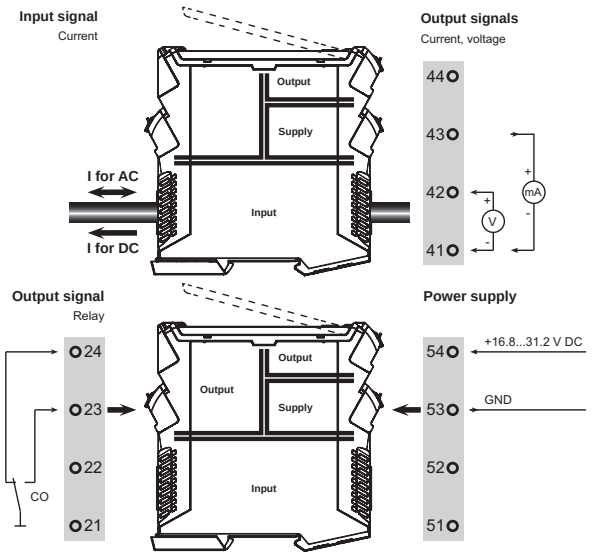
Input	
Number of Channels	1
Input	Current carrying wire via through hole, Hall Effect Sensor, 10.5 mm ?
Current Measurement Range	Configurable, 0…20/25/30 A AC (RMS) or DC
Input Frequency	AC: 15…700 Hz (true root mean square), AC: 50 Hz (arithmetic average)
Input	Passive
Output	
Number of Channels	2
Analog Output	
Output, Current	Adjustable, 0…20 mA, 4…20 mA, -20…+20 mA

931S-M5213—Specifications

Output, Voltage	Adjustable, 0…10 V, 2…10 V, 0…5 V, 1…5 V, -5…+5 V, -10…+10 V
Load Impedance, Current	≤ 600 Ω
Load Impedance, Voltage	≥ 10 kΩ
Output	Active (For Analog Output)
Digital Output	**1 Changeover contact relay, inverse adjustment**
Alarm Function	Surge current, Undercurrent, Alarm delay: 0…10 s, Hysteresis 5% / 10%
Max. switching voltage, AC	250 V
Max. switching voltage, DC	24 V
Rated Switching Current	6 A
Supply	
Supply Voltage	16.8 V …31.2 V
Power Consumption, Typ/ Max	2.2 W
General Specification	
Accuracy	< 0.75% Full Scale Range
Step Response Time	≤ 300 ms (RMS), ≤ 60 ms (AA)
Temperature Coefficient	typ. 0.04% / K, max. 0.09% / K
Galvanic Isolation	4 Way Isolator
Isolation Voltage	4 kVeff / 1 min
Impulse Withstand Voltage	6.4 kV (1.2/50 µs)
Rated Voltage	300 V ACrms
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	DIP Switch and Potentiometer
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 26…12
Approx. Dimensions W x H x D	22.5 x 119.2 x 113.6 mm (0.89 x 4.7 x 4.47 in)
Weight	158 g
Temperature, Operating	-25 …+60 °C
Temperature, Storage	-40 …+85 °C
Relative Humidity	5…95%, No Condensation
Part Number	PN-457349
Certifications	c-UL-us, CE, KC, RCM, RoHS

Current Measurements Converter, 30 A 931S-M5213 (continued)

Wiring Diagram



Dip Switch Settings

DIP switch S1								
Current input range	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0...20 A								
0...25 A	■							
0...30 A		■						
Measuring method	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
True RMS								
Arithmetic average			■					
Alarm delay time	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0 s								
2 s				■				
5 s					■			
10 s				■	■			
Measuring range monitoring	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Yes								
No						■		
Output error action	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Upscale								
Downscale							■	
Transfer function	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Normal								
Inverse								■

DIP switch S2								
Output range	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0...10 V								
2...10 V		■						
0...5 V			■					
1...5 V		■	■					
-5...+5 V				■				
-10...+10 V		■		■				
0...20 mA	■							
4...20 mA	■	■						
-20...+20 mA	■			■				
Alarm relay action	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Energized								
De-energized					■			
Alarm hysteresis	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
5 %								
10 %						■		
Alarm type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
High alarm								
Low alarm							■	

Current Measurements Converter, 60 A
931S-M5216

- Measure, monitor and convert AC or DC current up to 60 Amps
- Configurable relay output for over-current and under-current
- Operation status and error display status indicator per NE43, NE44, NE107
- True RMS or arithmetic average for precise monitoring
- Adjustable trigger delay for filtering current peaks
- High galvanic isolation and accuracy

This device measures and monitors AC and DC currents up to 60 Amps. The device offers a contactless through-hole for the current carrying conductor to pass in. True RMS algorithm will provide a precise measurement even in cases with distorted current waveform. The device offers both analog and digital output options enabling a low energy transmission or contact switching for desired conditions. The relay output can be configured for desired conditions such as over-current, under-current, etc. The device provides four way galvanic isolation between the input, output, and power supply. This device offers a cost effective way to monitor and convert current measurements.

931S-M5216 —Specifications

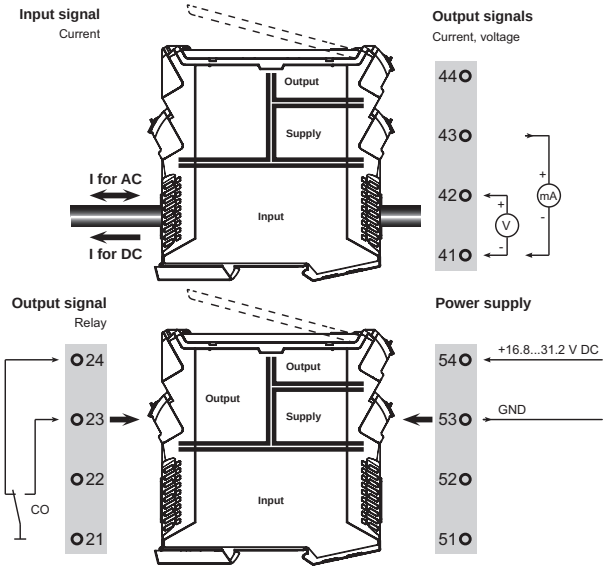
Input	
Number of Channels	1
Input	Current carrying wire via through hole, Hall Effect Sensor, 10.5 mm ?
Current Measurement Range	Configurable, 0…40/50/60 A AC (RMS) or DC
Input Frequency	AC: 15…700 Hz (true root mean square), AC: 50 Hz (arithmetic average)
Input	Passive
Output	
Number of Channels	2
Analog Output	

931S-M5216 —Specifications

Output, Current	Adjustable, 0…20 mA, 4…20 mA, -20…+20 mA
Output, Voltage	Adjustable, 0…10 V, 2…10 V, 0…5 V, 1…5 V, -5…+5 V, -10…+10 V
Load Impedance, Current	≤ 600 Ω
Load Impedance, Voltage	≥ 10 kΩ
Output	Active (For Analog Output)
Digital Output	**1 Changeover contact relay, inverse adjustment**
Alarm Function	Surge current, Undercurrent, Alarm delay: 0…10 s, Hysteresis 5% / 10%
Max. switching voltage, AC	250 V
Max. switching voltage, DC	24 V
Rated Switching Current	6 A
Supply	
Supply Voltage	16.8 V …31.2 V
Power Consumption, Typ/Max	2.2 W
General Specification	
Accuracy	< 0.75% FSR (Full Scale Range), < 1.5% FSR with meas. range 50/60 A AC
Step Response Time	≤ 300 ms (RMS), ≤ 60 ms (AA)
Temperature Coefficient	0.01%/K @ 0…40 A, 0.10%/K @ 40…55 A, 0.30%/K @ 55…60 A
Galvanic Isolation	4 Way Isolator
Isolation Voltage	4 kVeff / 1 min
Impulse Withstand Voltage	6.4 kV (1.2/50 µs)
Rated Voltage	300 V ACrms
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	DIP Switch and Potentiometer
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 30…14
Approx. Dimensions W x H x D	22.5 x 119.2 x 113.6 mm (0.89 x 4.7 x 4.47 in)
Weight	158 g
Temperature, Operating	-25 …+60 °C
Temperature, Storage	-40 …+85 °C
Relative Humidity	5…95%, No Condensation
Part Number	PN-457350
Certifications	c-UL-us, CE, KC, RCM, RoHS

Current Measurements Converter, 60 A 931S-M5216 (continued)

Wiring Diagram



Dip Switch Settings

DIP switch S1								
Current input range	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0...40 A								
0...50 A	■							
0...60 A		■						

Measuring method	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
True RMS								
Arithmetic average			■					

Alarm delay time	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0 s								
2 s				■				
5 s					■			
10 s				■	■			

Measuring range monitoring	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Yes								
No						■		

Output error action	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Upscale								
Downscale							■	

Transfer function	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Normal								
Inverse								■

DIP switch S2								
Output range	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0...10 V								
2...10 V		■						
0...5 V			■					
1...5 V		■	■					
-5...+5 V				■				
-10...+10 V		■		■				
0...20 mA	■							
4...20 mA	■	■						
-20...+20 mA	■			■				

Alarm relay action	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Energized								
De-energized					■			

Alarm hysteresis	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
5 %								
10 %						■		

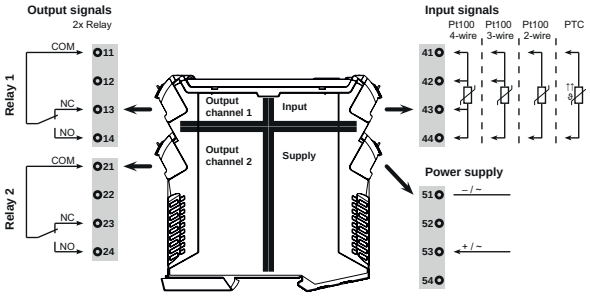
Alarm type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
High alarm								
Low alarm							■	

Temperature Signal Converter, 931S-N392

- Dual Relay output, 5 amps
- Removable terminals with error proof keys
- High galvanic isolation and accuracy
- Device and output status indicator
- Hazardous area rated

This device can convert temperature measurements from PT100 and PTC to relay output for the desired alarms at preset limits. The device's four way galvanic isolation between input, output, and power supply will help provide a reliable signal by eliminating noises and signal degradation.

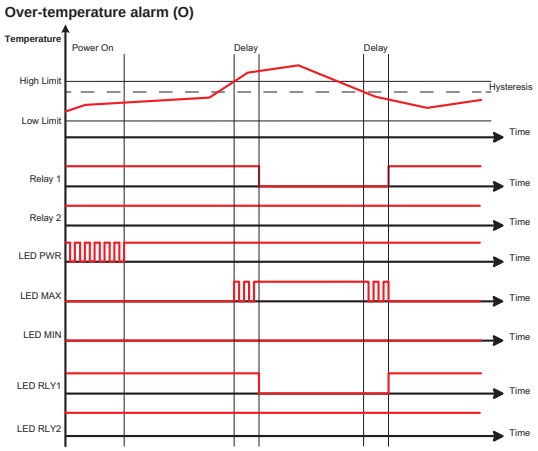
Wiring Diagram



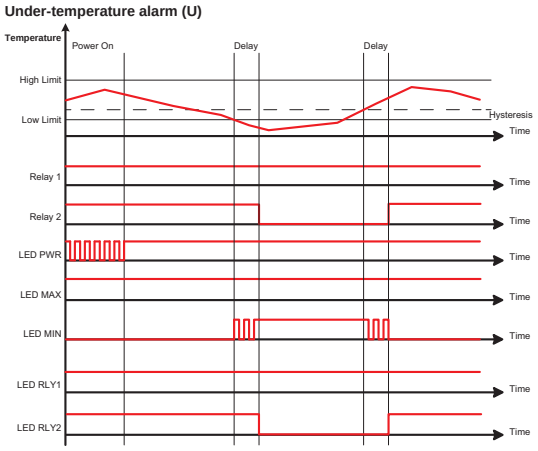
931S-N392 —Specifications

Input	
Number of Channels	1
RTD Input	PT100 2/3/4 wire; PTC: 0...4 kΩ
Temperature input range	Configurable, PT100: -200 °C...850 °C
Input	Active
Output	
Number of Channels	2
Current Output	2 Changeover Contact Relays
Alarm Function	Alarm range: -200...850 °C, Top and bottom limit values, window range, Hysteresis: 2 °C (adjustable), Alarm delay: 0...10 s
Max. switching voltage, AC	250 V
Max. switching voltage, DC	30 V
Rated Switching Current	5 A
Supply	
Supply Voltage	20...264 V AC/DC
Power Consumption, Typ/Max	≤ 100 mA @ 24 VDC, ≤120mA @ 24V AC
General Specification	
Accuracy	0.2% Full Scale Range, ≤ 2 °C (PT100), ≤ 8 Ω (PTC)
Step Response Time	≤ 500 ms
Temperature Coefficient	≤ 100 ppm/K
Galvanic Isolation	4 Way Isolator
Isolation Voltage	2 kV (Input /Output), 1 min, 50 Hz
Impulse withstand Voltage	4 kV (1.2/50 µs)
Rated Voltage	300 V
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	FDT/DTM Software
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 30...14
Approx. Dimensions W x H x D	22.5 x 119.2 x 113.6 mm (0.89 x 4.7 x 4.47 in)
Weight	110 g
Temperature, Operating	-25 °C...65 °C
Temperature, Storage	-40 ...+85 °C
Relative Humidity	5...95%, No Condensation
Part Number	PN-457352
Certifications	c-UL-us, CE, ATEX, IECEx, KC, RCM, RoHS, CCC-Ex
Hazardous (Ex) Area Marking	CL I DIV 2 GP A,B,C,D Temp Code T5

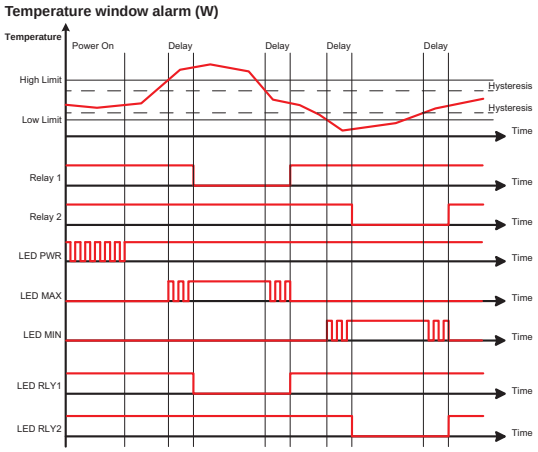
Over Temperature Alarm



Under Temperature Alarm



Temperature Window Alarm



Temperature Signal Converter - Interactive Display 931S-N591

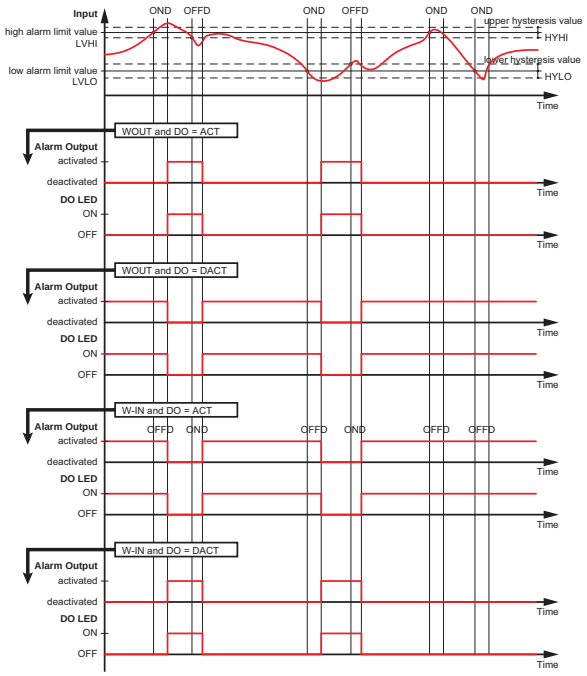
- Interactive, on-board display for easy configuration
- Wide range of input signals
- Thermocouple signal has selectable internal/ external cold junction compensation
- Digital output for alarms with delay function
- Operation and alarm output LED
- Operation and error status display
- Universal power supply
- Removable terminals with error proof keys
- Hazardous area rated

This device provides a user friendly display with three buttons on the front face plate to ease the configuration process without any tools or programs. This device can convert signals from resistance thermometers, thermocouples, potentiometers and voltage signal transmitters to relay output for the desired alarms at preset limits. User can define the alarm outputs for limit monitoring, sensor error detection, etc. The device's four way galvanic isolation between input, output, and power supply will help provide a reliable signal by eliminating noises and signal degradation.

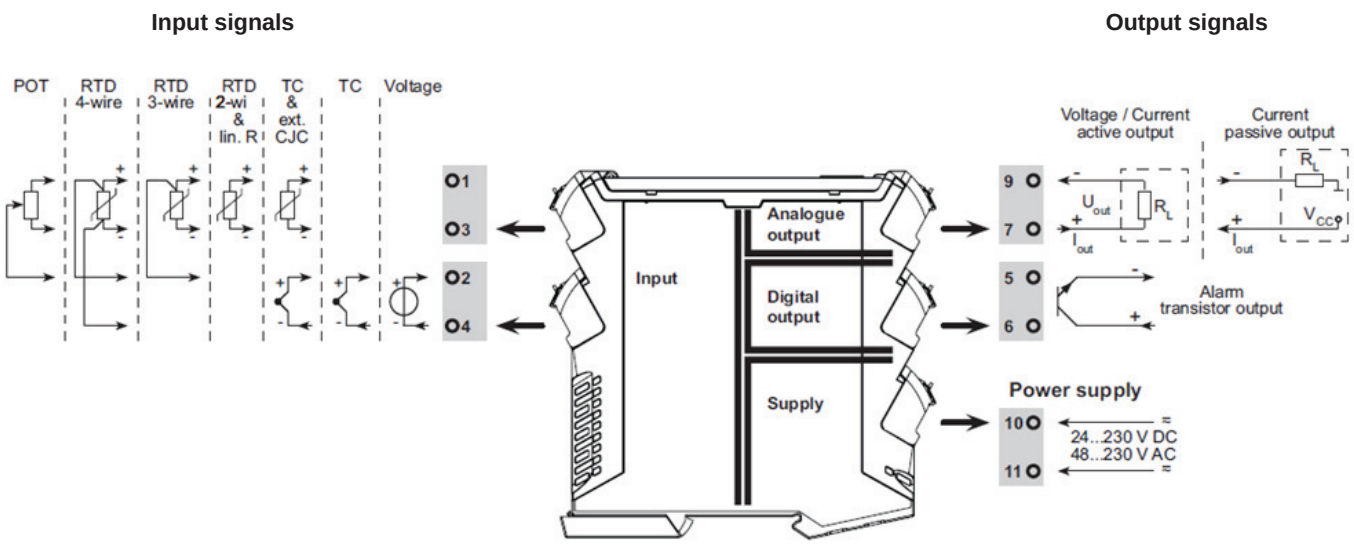
931S-N591 — Specifications

Input	
Number of Channels	1
Input	RTD, Thermocouples, Potentiometer, Voltage
RTD input	2/3/4-wire: Pt100/200/500/1000; Ni50/100/120/1000 Cu10/25/50/100 2-wire: KTY82 /110/120/121/122/150/210/220/221/250 KTY83 /110/120/121/122/150/210/220/221/250 KTY84/130, KTY16, KTY19 ST13, ST20
Thermocouple input	B, E, J, K, N, R, S, T, U, L
Temperature input range	Configurable, depends on RTD or TC type
CJC via int. mounted sensor	±(2.0°C + 0.4°C * Δt); Δt = Internal temp - Ambient temp
Cable resistance per wire	50 Ω (max.)
Resistance input range	0...15 kΩ
Potentiometer input range	0...120 kΩ
Voltage input range	0...300 mV
Input Failure Detection	Yes
Input	Passive
Analog Output	
Number of Channels	1
Output, Current	Adjustable, 0...±20 mA
Output, Voltage	Adjustable, 0...±10 V
Load Impedance, Current	≤ 600 Ω
Load Impedance, Voltage	≤ 1 kΩ
Input Failure Indication	Upscale or Downscale
Output	Active or Passive
Digital Output	
Signal	Transistor, NPN
Alarm Function	Programmable: Top and bottom limit values, Window range (IN/OUT), Input Failure Hysteresis: 1... 20% (adjustable) Alarm delay (ON/OFF): 0... 180 s
Max. switching frequency	5 kHz @ 24 V DC
Supply	
Supply Voltage	24... 230 V DC 48 ... 230 V AC @ 48...62 Hz
Power Consumption	≤ 3 W
General Specification	
Accuracy	0.05% Full Scale Range, ≤ 8 °C (TC), ≤ 6 °C (RTD)
Step Response Time	Selectable, 170 ms ...15 s
Temperature Coefficient	≤ 100 ppm/K
Galvanic Isolation	4 Way Isolator
Isolation Voltage	4 kV: Inputs - Outputs - Supply (1 min, 50 Hz)
Rated Voltage	300 V: Inputs - Outputs - Supply
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	On board display with pushbuttons
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 26...14
Approx. Dimensions W x H x D	12.5 x 117.2 x 113.6 mm (0.49 x 4.62 x 4.47 in)
Weight	140 g
Temperature, Operating	-40 °C...70 °C
Temperature, Storage	-40 ...+85 °C
Relative Humidity	5...95%, No Condensation
Part Number	PN-457353
Certifications	c-UL-us, CE, ATEX, IECEx, KC, CMIM, CCC, RCM, RoHS
Hazardous (Ex) Area Marking	CL I DIV 2 GP A,B,C,D Temp Code T4

Window Alarm Graph



Wiring Diagram

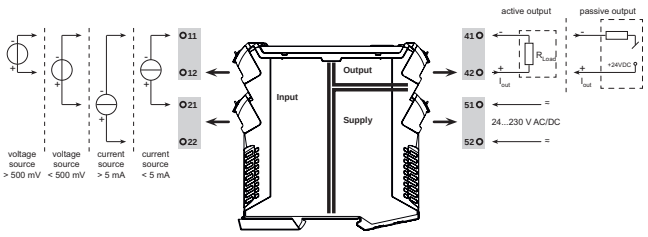


Programmable Signal Converter - Interactive Display
931S-P491

- Interactive, on-board display for easy configuration
- Wide range of input signals
- Universal power supply
- Operation status display
- Removable terminals with error proof keys
- Hazardous area rated

This device provides a user friendly display with three buttons on the front face plate to ease the configuration process without any tools or programs. The device offers three way galvanic isolation and conversion of a broad range of input signals to standard analog signals.

Wiring Diagram



DIP Switch Settings

Configuration

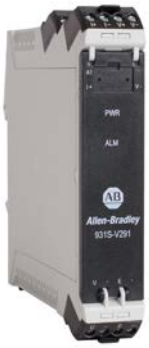
Input range	DIP switch 1	2	3	4	Output range	DIP switch 5	6	7	8
configuration via display					configuration via display				
-10...+10 V				■	-10...+10 V				■
-5...+5V			■		-5...+5V			■	
0...300 V			■	■	10...0 V *			■	■
0...100 V		■			0...10 V		■		
0...30 V		■		■	2...10 V		■		■
0...10 V		■	■		5...0 V *		■	■	
2...10 V		■	■	■	0...5 V		■	■	■
0...5 V	■				1...5 V	■			
1...5 V	■			■	-20...+20 mA	■			■
0...150 mV	■		■		-10...+10 mA	■		■	
0...60 mV	■		■	■	20...0 mA *	■		■	■
-20...+20 mA	■	■			0...20 mA	■	■		
0...20 mA	■	■		■	20...4 mA *	■	■		■
4...20 mA	■	■	■		4...20 mA	■	■	■	
reserved	■	■	■	■	reserved	■	■	■	■

■ = ON * Inverted output range: Output polarity must be reversed!

931S-P491 — Specifications

Input	
Number of Channels	1
Input, Current	Configurable, ± 0.1 mA...±100 mA
Input Resistance, Current	< 5 mA: approx. 100 Ω; >5 mA: approx. 5 Ω
Input, Voltage	Configurable, ±20 mV...±300 V, Measuring range. min 40 mV
Input Resistance, Voltage	approx. 1 MΩ
Input	Passive
Output	
Number of Channels	1
Output, Current	Adjustable, 0...±20 mA
Output, Voltage	Adjustable, 0...±10V
Load Impedance, Current	≤ 600 Ω
Load Impedance, Voltage	≥ 1 kΩ
Cut-off frequency (-3 dB)	> 10 kHz/ < 10 Hz
Offset Current	20 µA
Offset Voltage	< 10 mV
Output	Active or Passive
Supply	
Supply Voltage	24...230 V DC ±20%, 24...230 V AC ±10% @ 48...62 Hz
Power Consumption, Typ/Max	≤ 2.3 W
General Specification	
Accuracy	< 0.05% of measuring range
Step Response Time	≤50 µs
Temperature Coefficient	≤0.01% of the measuring range / °C
Galvanic Isolation	3 Way Isolator
Isolation Voltage	4 kVeff, Input - Output - Supply
Impulse Withstand Voltage	5 kV (1.2/50 µs)
Rated Voltage	600 V
Pollution Degree	2
Surge Voltage Category	II
Protection Degree	IP20
Configuration	DIP switch or On board display with push buttons
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 26...14
Approx. Dimensions W x H x D	12.5 x 117.2 x 113.6 mm (0.49 x 4.62 x 4.47 in.)
Weight	130 g
Temperature, Operating	-25 °C...70 °C
Temperature, Storage	-40 ...+85 °C
Part Number	PN-457354
Certifications	c-UL-us, CE, ATEX, IECEx, KC, RCM, RoHS
Hazardous (Ex) Area Marking	CL I DIV 2, CL I Zone 2

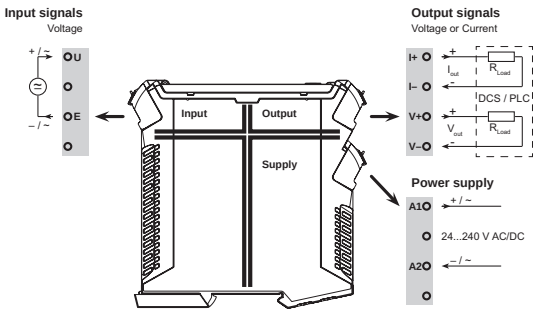
Voltage Measurements Converter, 931S-V291



- Measure, monitor, and convert voltage up to 660V DC or 440V AC
- Signal and alarm triggers for preset voltage condition and reverse polarity
- Operation status indicators
- Removable terminals with error proof keys
- High galvanic isolation and accuracy

This device measures and monitors AC and DC voltages and offers low energy analog output signals allowing for a reliable transmission of signals. The device provides three way galvanic isolation between input, output, and power supply.

Wiring Diagram



931S-V291 — Specifications

Input	
Number of Channels	1
Input Voltage	0...30 V DC, 0...60 V DC, 0...150 V DC, 0...300 V DC, 0...440 V DC, 0...660 V DC, 0...60 V AC, 0...144 V AC, 0...300 V AC, 0...440 V AC
Input Signal	V DC, V AC effective value (sinusoidal only) 40-60 Hz
Voltage Phase	Single Phase

931S-V291 — Specifications

Input Resistance, Voltage	1 MΩ ±5%
Input	Passive
Output	
Number of Channels	1
Output, Current	0 (4)...20 mA
Output, Voltage	0...10 V
Load Impedance, Current	≤ 500 Ω
Load Impedance, Voltage	≥ 10 kΩ
Output	Active
Supply	
Supply Voltage	24...240 V AC/DC (±10%)
Power Consumption, Typ/Max	≤ 100 mA @ 24 VDC, ≤120mA @ 24V AC
General Specification	
Accuracy	0.5% Full Scale Range
Step Response Time	< 300 ms
Temperature Coefficient	≤ 200 ppm/K
Galvanic Isolation	3 Way Isolator
Isolation Voltage	2.2 kVAC, 1 min @ 50 Hz
Impulse withstand Voltage	4 kV (1.2 / 50 µs): Input - Output - Supply, 6 kV (1.2/50 µs): Input- Output
Rated Voltage	300 VAC: Supply - Output; 500 VAC: Supply - Input / Input - Output
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	FDT/DTM Software
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 30...14
Approx. Dimensions W x H x D	22.5 x 119.2 x 113.6 mm (0.89 x 4.7 x 4.47 in)
Weight	110 g
Temperature, Operating	-25 °C...65 °C
Temperature, Storage	-40 ...+85 °C
Relative Humidity	5...95%, No Condensation
Part Number	PN-457360
Certifications	cURus, CE, KC, RCM, RoHS

Voltage Measurements Converter, 931S-V342

- Measure, monitor, and convert voltages up to 480V AC, 3-phase
- Dual relay output for alarms on various phase conditions
- Time delay option for alarm trigger
- Operation and error status indicators
- Removable terminals with error proof keys
- High galvanic isolation and accuracy

This device measures and monitors AC and DC voltages. The two isolated relay outputs can be configured for preset voltage measurement levels, phase asymmetry, phase loss, phase sequence errors and phase angle errors. The device provides three way galvanic isolation between input and two outputs. This device is input loop powered.

931S-V342 — Specifications

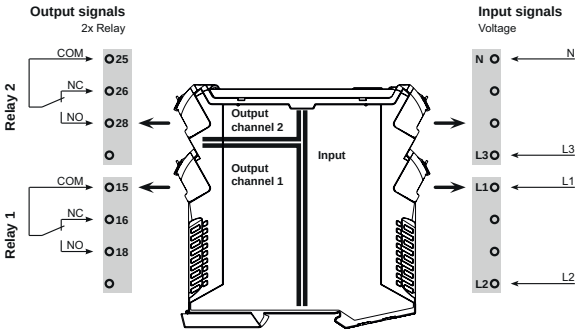
Input	
Number of Channels	1
Input Voltage	180…500 VAC
Input Measurement Range	200…480 VAC
Voltage Phase	3 Phase
Input Resistance, Voltage	≥1.8MΩ
Input Frequency	40…60 Hz, DC
Input	Passive
Output	
Number of Channels	2
Output	2 Changeover Contact Relays
Alarm Function	Top and bottom limit values, Window range, Holding function can be activated, Phase error, Phase sequence, Asymmetry, Alarm delay: 0…10 s
Max. switching voltage, AC	250 V
Max. switching voltage, DC	30 V
Rated Switching Current	5 A
Supply	
Supply Voltage	Input Loop Powered

931S-V342 — Specifications

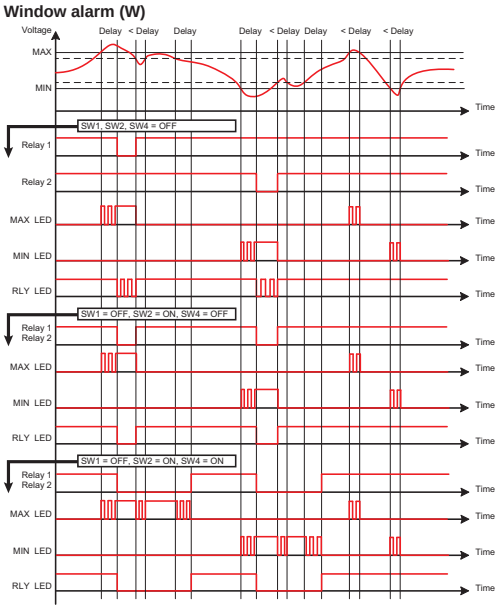
Power Consumption, Typ/Max	≤ 3VA
General Specification	
Accuracy	3% V rated voltage
Repeat Accuracy	2% V rated voltage
Step Response Time	< 100 ms
Temperature Coefficient	350 ppm/K
Galvanic Isolation	3 Way Isolator
Isolation Voltage	2.5 kV: input - output
Impulse withstand Voltage	6 kV: Input - Output; 4 kV: Output 1 - Output 2, 1.2/50 µs
Rated Voltage	600 VAC: Input - Output; 300 VAC: Output 1 - Output 2
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	DIP switch and Potentiometer
Alarm Configuration	Overvoltage: 70…120% V rated voltage, Undervoltage: 50…100% V rated voltage
Unbalanced	Hysteresis: 5%, Phase imbalance in range of adjustment: 5…25%, OFF
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 30…14
Approx. Dimensions W x H x D	22.5 x 119.2 x 113.6 mm (0.89 x 4.7 x 4.47 in)
Weight	233 g
Temperature, Operating	-25 °C…65 °C
Temperature, Storage	-40 …+85 °C
Relative Humidity	5…85%, No Condensation
Part Number	PN-457359
Certifications	cURus, CE, KC, RCM, RoHS

Voltage Measurements Converter, 931S-V342 (continued)

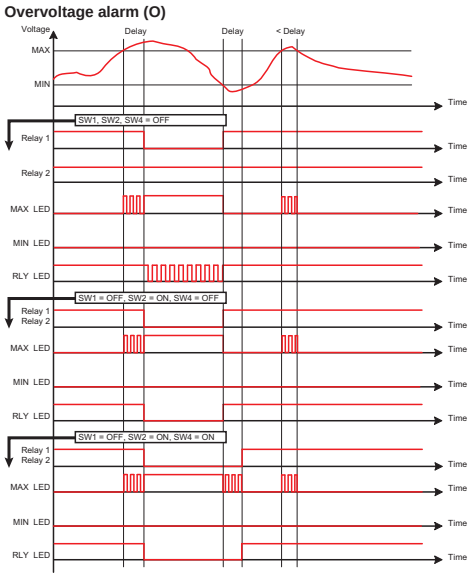
Wiring Diagram



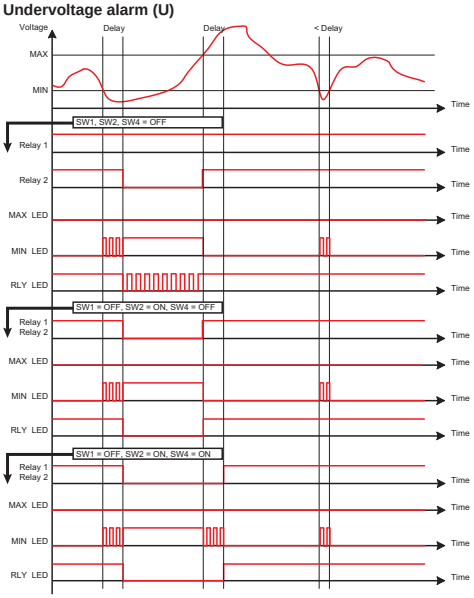
Window Alarm Graph



Overvoltage Alarm Graph



Undervoltage Alarm Graph



Voltage Measurements Converter, 931S-V392

- Measure, Monitor and Convert voltages up to 480V AC/DC
- Dual relay output for alarms with delay function
- Operation and Error Status LED
- Removable terminals with error proof keys
- High galvanic isolation and accuracy
- Universal power supply

This device measures and monitors AC and DC voltages up to 480 V. The two isolated relay outputs can be configured for alarms, under-voltage, over-voltage or any pre-defined levels. There is a configurable time delay function for the output alarms. This device provides four way galvanic isolation between input, output(s) and power supply.

931S-V392 — Specifications

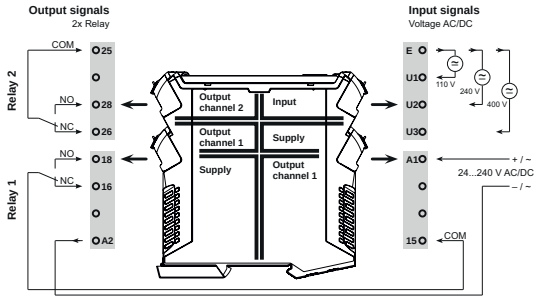
Input	
Number of Channels	1
Input Voltage	Channel 1 (U1-E): 110V AC/DC, Channel 2 (U2-E): 240V AC/DC, Channel 3 (U3-E): 400V AC/DC
Input Measurement Range	50…120% V rated voltage
Voltage Phase	Single phase (Line, Neutral)
Input Resistance, Voltage	1 MΩ±5%
Input Frequency	40…60 Hz, DC
Input	Passive
Output	
Number of Channels	2
Output	2 Changeover Contact Relays, Relay polarity can be inverted
Alarm Function	Surge voltage, Undervoltage, Voltage window, Holding function can be activated, Alarm delay: 0…10 s
Max. switching voltage, AC	250 V
Max. switching voltage, DC	30 V
Rated Switching Current	5 A
Supply	

931S-V392 — Specifications

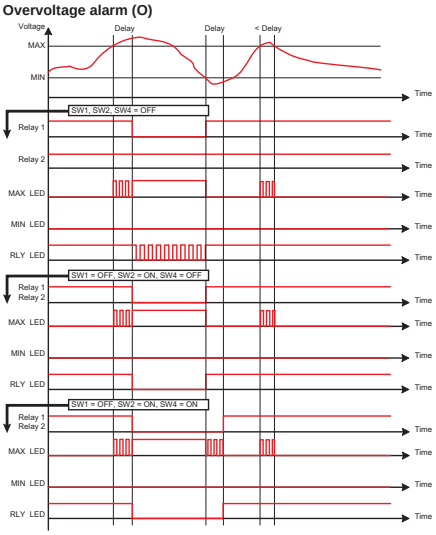
Supply Voltage	24…240 V AC/DC ±10%
Power Consumption, Typ/Max	≤ 100 mA @ 24 VDC, ≤120mA @ 24V AC
General Specification	
Accuracy	3% V rated voltage (110, 240 and 400V)
Step Response Time	< 220 ms (10…90%)
Temperature Coefficient	350 ppm/K
Galvanic Isolation	4 Way Isolator
Isolation Voltage	2.5 kV: input - output, 2 kV: input - output - power supply
Impulse withstand Voltage	4 kV: Supply - output; 6 kV input-output, 1.2/50 µs:
Rated Voltage	300 VAC: Output 1 - Output 2; 300 VAC: Supply - Output; 500 VAC: Supply - Input, Input - Output
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	DIP switch and Potentiometer
Measurement Calibration	Max (Overvoltage): 70…120% V rated voltage, Min (Undervoltage): 50…100% V rated voltage
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 30…14
Approx. Dimensions W x H x D	22.5 x 119.2 x 113.6 mm(0.89 x 4.7 x 4.47 in)
Weight	199 g
Temperature, Operating	-25 °C…65 °C
Temperature, Storage	-40 …+85 °C
Relative Humidity	5…85%, No Condensation
Part Number	PN-457358
Certifications	cURus, CE, KC, RCM, RoHS

Voltage Measurements Converter, 931S-V392 (continued)

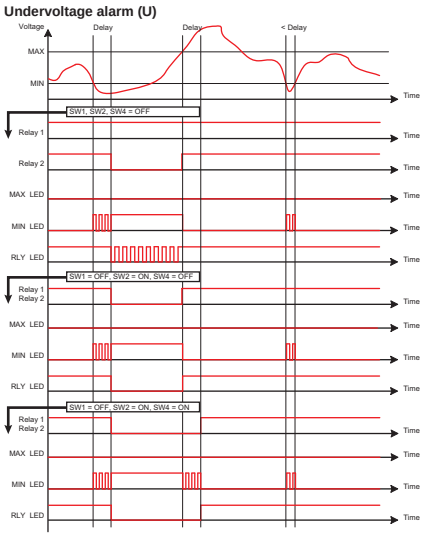
Wiring Diagram



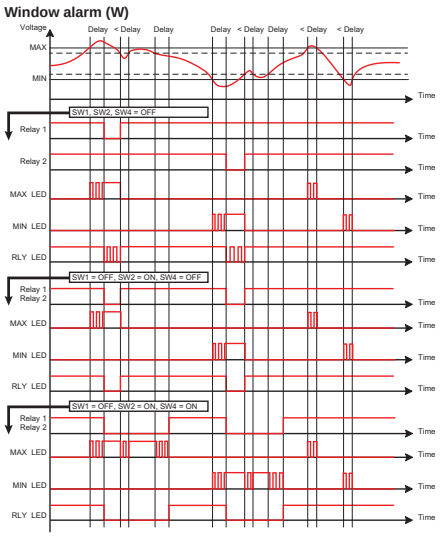
Overvoltage Alarm



Undervoltage Alarm



Window Alarm



Universal Signal Converter, 931S-U382

- Broad range of input signals, active and passive
- Dual Relay Output for alarms with delay function
- Operation and Error Status LED
- Removable terminals with error proof keys
- High galvanic isolation and accuracy
- Hazardous Area rated

This devices offers great versatility as it can isolate, convert and amplify several types of input signals. This highly customizable device provides two isolated output relays that can be configured for user desired alarm/trip settings including auto/manual resets. The device offers delay function for the output alarm. The device is four way galvanic isolated between the input, output(s) and power supply. The configuration can be done using the on-board buttons/ encoders or FDT/DTM program.

931S-U382 — Specifications

Input	
Number of Channels	1
Input	Thermocouples: B, E,J, K, L, N, R, S, T, U; PT100/2/ 3wire, PT200, PT1000, N120, Cu 10; Potentiometer: 1.2 kΩ -500 kΩ, Resistance: 0 - 1.5kΩ, 0 - 12 kΩ, 0 - 750 Ω
Input Measurement Range	Configurable, PT100 -200...+850 °C, TC J: -100...+1200°C, TC K: -200...+1370°C
Sensor Supply	0.1 mA / 0.05 mA (depending on measuring range) @ RTD cable
Sensor Cable Resistance	5 Ω @ RTD cable
Input, Current	Configurable, ± 25 mA DC, ±5 A DC
Input Resistance, Current	40 Ω
Input, Voltage	Configurable, ±150 mV DC, ± 600mV DC, ±30 V DC, ±300 V DC
Input Resistance, Voltage	2 MΩ, > 10 MΩ
Cable-length compensation	< ±0.002 Ω per cable resistance Ω
Potentiometer	1.2...500 kΩ
Resistance	0...1.5 kΩ, 0...12 kΩ, 0...750 Ω
Input	Active or Passive
Output	
Number of Channels	2
Output	2 Changeover Contact Relays, Normal/Inverse Adjustment
Alarm Function	Configurable, Alarm mode: Delay, Switch ON or ON/OFF, Top and bottom limit values, window ranges, Hysteresis adjustable, Auto / Manual reset
Switching Frequency	20 Hz
Max. switching voltage, AC	240 V
Max. switching voltage, DC	110 V
Rated Switching Current	200mA @ 110V DC, 6A @ 24V DC / 240V AC
Supply	
Supply Voltage	9...60 V DC
Power Consumption, Typ/Max	≤ 3.5 W
General Specification(1)	
Accuracy	< 0.1% of measuring range
Step Response Time	450 ms
Temperature Coefficient	< 0.02 °C of measuring range / °C
Cold Junction Compensation	±2°C @ -20°C...70°C)

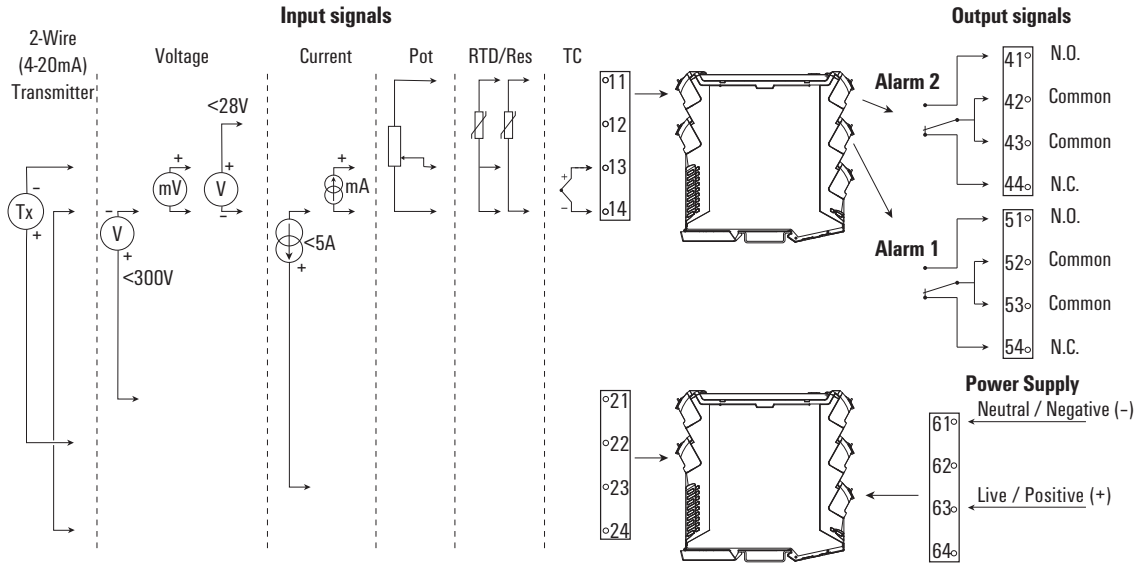
(1) Continued on the next page.

Universal Signal Converter, 931S-U382 (continued)

931S-U382 — Specifications (continued)

Galvanic Isolation	4 Way Isolator
Isolation Voltage	4 kV: Input - Output - Supply
Impulse Withstand Voltage	4 kV (1.2/50 µs)
Rated Voltage	300 Veff
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	FDT/DTM Software or On board display with push buttons and rotary encoder
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 30...14
Approx. Dimensions W x H x D	22.5 x 119.2 x 113.6 mm (0.89 x 4.7 x 4.47 in)
Weight	201 g
Temperature, Operating	-20 °C...70 °C
Temperature, Storage	-20 °C...70 °C
Relative Humidity	10...90%, No Condensation
Part Number	PN-457356
Certifications	c-UL-us, CE, KC, RCM, RoHS
Hazardous (Ex) Area Marking	CL I DIV 2 GP A,B,C,D Temp Code T5

Wiring Diagram



Universal Signal Converter, 931S-U392

- Broad range of input signals, active and passive
- Wide power supply
- Dual Relay Output for alarms with delay function
- Operation and Error Status LED
- Removable terminals with error proof keys
- High galvanic isolation and accuracy
- Hazardous Area rated

This devices offers great versatility as it can isolate, convert and amplify several types of input signals. The highly customizable device provides two isolated output relays that can be configured any user desired alarm/trip settings including auto/manual resets. The device offers delay function for the output alarm. The device is four way galvanic isolated between the input, output(s) and power supply. The configuration can be done using the on-board buttons/ encoders or FDT/DTM program.

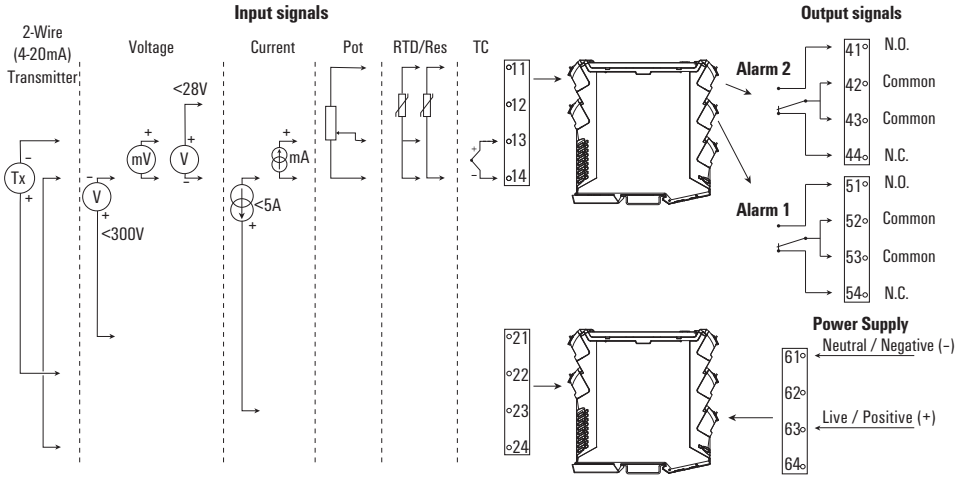
931S-U392 — Specifications

Input	
Number of Channels	1
Input	Thermocouples: B, E,J, K, L, N, R, S, T, U; PT100/2/3wire, PT200, PT1000, N120, Cu 10; Potentiometer: 1.2 kΩ -500 kΩ, Resistance: 0 - 1.5kΩ, 0 - 12 kΩ, 0 - 750 Ω
Input Measurement Range	Configurable, PT100 -200...+850 °C, TC J: -100...+1200°C, TC K: -200...+1370°C
Sensor Supply	0.1 mA / 0.05 mA (depending on measuring range) @ RTD cable
Sensor Cable Resistance	5 Ω @ RTD cable
Input, Current	Configurable, ± 25 mA DC, ±5 A DC
Input Resistance, Current	40 Ω
Input, Voltage	Configurable, ±150 mV DC, ± 600mV DC, ±30 V DC, ±300 V DC
Input Resistance, Voltage	2 MΩ, > 10 MΩ
Cable-length compensation	< ±0.002 Ω per cable resistance Ω

931S-U392 — Specifications

Potentiometer	1.2...500 kΩ
Resistance	0...1.5 kΩ, 0...12 kΩ, 0...750 Ω
Input	Active or Passive
Output	
Number of Channels	2
Output	2 Changeover Contact Relays, Normal/Inverse Adjustment
Alarm Function	Configurable, Alarm mode: Delay, Switch ON or ON/OFF, Top and bottom limit values, window range, Hysteresis adjustable, Auto / Manual reset
Switching Frequency	20 Hz
Max. switching voltage, AC	240 V
Max. switching voltage, DC	110 V
Rated Switching Current	200 mA @ 110V DC, 6A @ 24V DC / 240V AC
Supply	
Supply Voltage	90...264 V AC
Power Consumption, Typ/Max	≤ 3.5 W
General Specification	
Accuracy	< 0.1% of measuring range
Repeat Accuracy	± 0.05% of measuring range final value
Step Response Time	450 ms
Temperature Coefficient	< 0.02 °C of measuring range / °C
Cold Junction Compensation	±2°C @ -20°C...70°C)
Galvanic Isolation	4 Way Isolator
Isolation Voltage	4 kV: Input - Output- Supply
Impulse Withstand Voltage	4 kV (1.2/50 µs)
Rated Voltage	300 Veff
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	FDT/DTM Software or On board display with push buttons and rotary encoder
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 30...14
Approx. Dimensions W x H x D	22.5 x 119.2 x 113.6 mm (0.89 x 4.7 x 4.47 in)
Weight	208 g
Temperature, Operating	-20 °C...70 °C
Temperature, Storage	-20 °C...70 °C
Relative Humidity	10...90%, No Condensation
Part Number	PN-457357
Certifications	c-UL-us, CE, KC, RCM, RoHS
Hazardous (Ex) Area Marking	CL I DIV 2 GP A,B,C,D Temp Code T5

Wiring Diagrams



Universal Signal Converter – Output Loop, 931S-U561

- Broad range of input signals, active and passive
- Analog and Digital Outputs
- Thermocouple signal has internal cold-junction compensation
- Removable terminals with error proof keys
- High galvanic isolation and accuracy
- Hazardous Area rated

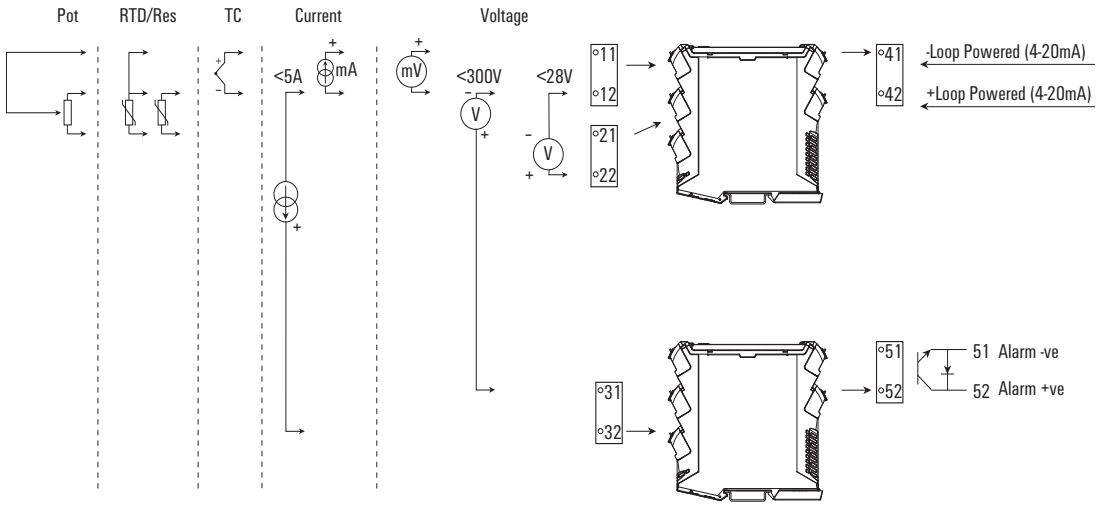
This devices offers great versatility as it can isolate, convert and amplify several types of input signals. This highly customizable device provides both analog and digital outputs. User can define the alarm outputs for limit monitoring, sensor error detection, etc. The device provides three way galvanic isolation between the input and the two outputs. The device is output loop powered.

931S-U561 — Specifications

Input	
Number of Channels	1
Input	PT100 / 2/3/4 wire, PT1000 2/3/4 wire, PT200, N120, Thermocouples: B, E,J, K, L, N, R, S, T, U, Potentiometer
Input Measurement Range	PT100 -200...+850 °C, TC J: -100...+1200°C, TC K: -200...+1370°C
Sensor Supply	0.1 mA / 0.05 mA (depending on measuring range) @ RTD cable
Sensor Cable Resistance	5 Ω @ RTD cable
Input, Current	Configurable, ± 5 A DC (min measurement range 0.5 A)
Input Resistance, Current	40 Ω
Input, Voltage	Configurable, ± 300V D, 0...300V AC, (min.measurement range 100V)
Input Resistance, Voltage	2 MΩ, > 10 MΩ
Cable-length compensation	< ±0.002 Ω per cable resistance Ω
Potentiometer	1.2...500 kΩ
Resistance	0...1.5 kΩ, 0...12 kΩ, 0...750 Ω
Input	Passive (For Sensor)
Output	
Number of Channels	2
Output, Current	4...20 mA, 20...4 mA
Output Signal Limit	Harmonics: <10 mV (peak to peak)
Load Impedance, Current	typ. 700 Ω @ 24V DC
Cold Junction Compensation	≤±1°C (-20°C...60°C)
Output	Passive (For Analog Output)
Digital Output	
Signal	Transistor, Open Collector
Rated Switching Current	20 mA
Rated Switching Voltage	≤ 30 V DC
Supply	
Supply Voltage	Output Loop Powered (10...45V)
General Specification	
Accuracy	< 0.1% of measuring range
Step Response Time	450 ms
Temperature Coefficient	< 0.02 °C of measuring range / °C
Galvanic Isolation	3 Way Isolator
Isolation Voltage	3.51 kV: Input - Output
Impulse Withstand Voltage	4 kV (1.2/50 µs)
Rated Voltage	300 Veff
Pollution Degree	2
Surge Voltage Category	III
Protection Degree	IP20
Configuration	FDT/DTM Software
Screw Terminal Torque	0.6 N•m (5.31 lb•in)
Wire Size	AWG 30...14
Approx. Dimensions W x H x D	12.5 x 117.2 x 113.6 mm (0.49 x 4.62 x 4.47 in.)

Weight	157 g
Temperature, Operating	-20 °C...70 °C
Temperature, Storage	-20 °C...70 °C
Relative Humidity	10...90%, No Condensation
Part Number	PN-457355
Certifications	c-UL-us, CE, KC, RCM, RoHS
Hazardous (Ex) Area Marking	CL I DIV 2 GP A,B,C,D Temp Code T5

Wiring Diagram



Notes:

Bulletin 931 Accessories

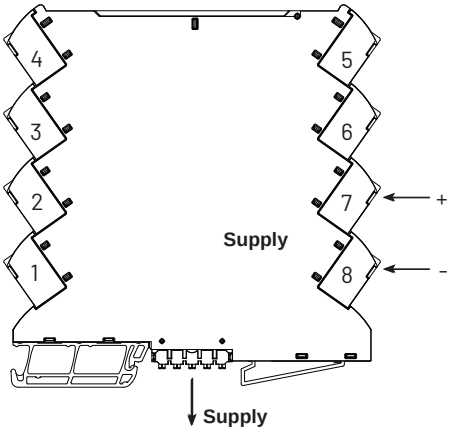
Power Feed Module, 931A-FM

IMPORTANT The Power Feed Module is only applicable with 931N products.

- Space saving design - 6.1 mm wide
- Eliminates the need to wire devices for supply
- Provides up to 2.5 A
- Potentially powers up to 75 signal conditioners

This module feeds power from the input to the bus circuit on the DIN rail. This device can be mounted adjacent to the NANO series (931N) products on the DIN rail. One of these device can potentially provide power up to 75 devices. Adding a feed module to the other end of the DIN rail offers a redundant solution in ensuring a highly reliable power supply to the devices.

Wiring Diagram



931A-FM—Specifications

Input	
Supply Voltage	21.6...26.4V DC
Input Current	0.5...2.5 A DC
Output	
Output Voltage	Corresponds to Input Voltage
Output Current	Equivalent to Input Current
Internal power dissipation	0.25 W (max.)
General Specification	
Protection Degree	IP20
Screw Terminal Torque	0.5 N•m
Wire Size	0.13...2.5 mm^2 /AWG 26...12 Stranded Wire
Dimensions, approx. W x H x D	6.1 x 112.5 x 114.3 mm (0.24 x 4.43 x 4.5 in.)
Weight	70 g (0.15 lb)
Temperature, Operating	-25...+70 °C (-13...+158 °F)
Temperature, Storage	-40...+85 °C (-40...+185 °F)
Relative Humidity	< 95%, No Condensation
Part Number	PN-457322
Certifications	cULus, CE, ATEX, IECEx, FM, DNV, KC, CMIM, RCM, CCC, RoHS
Hazardous (Ex) Area Marking	ATEX: II 3 G Ex ec IIC T4 Gc, IECEx: Ex ec IIC T4 Gc FM: Cl. I, Div. 2, Gp. A, B, C, D T4 or Cl I Zn2 Gp IIC T4 or Cl. I, Zone 2, AEx/Ex ec IIC T4 Ex ec IIC T4

USB Interface Cable, 931A-CB

The 931A-CB USB is a USB2.0/RS232 interface converter with galvanic isolation. It has additional functionality for controlling and supplying the connected RS232 device. The 931A-CB makes it possible to configure products that use DTM files. Visit ab.com to download the software and DTM files. Visit rok.auto/support to download the software and DTM files.

931A-CB —Specifications

Input	
Type	USB 2.0 (USB type A plug)
Input Current	≤ 100 mA
Input Resistance	22 kΩ
Input Voltage	1.6...5.6 V
Output	
Type	RS232 (4-pole, 2.5 mm jack plug)
Output voltage	3.3V regulated
Output current	3 A
Level on interfaces	1.8...5.6V (automatically adapted)
Baud rate	≤ 115 kBd
Activation signal	9...15 V typ. 12V/4 mA
General Specifications	
Insulation Voltage	2.5 kV (input/output)
Part Number	PN-457370

Power Rail Sets

IMPORTANT Power rail sets are only applicable with 931N products.

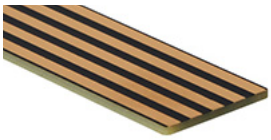
Photo	Description	DIN Rail Size	Accessory Length	Catalog Number
	Kit Contains: • 1 bus circuit layer insert • 1 support section • 1 cover • 1 end left plate • 1 end right plate	35 x 7.5 mm	250 mm	931A-CS
			500 mm	931A-FS
		35 x 15 mm	250 mm	931A-CL
			500 mm	931A-FL

Review the description for the kit contents. The base circuit layer insert is installed into the appropriate support section, and then inserted into the DIN Rail. To order individual parts of the kit, see the table below.

Inserting the circuit layer into the support section

The circuit layer /support section installed into the DIN Rail

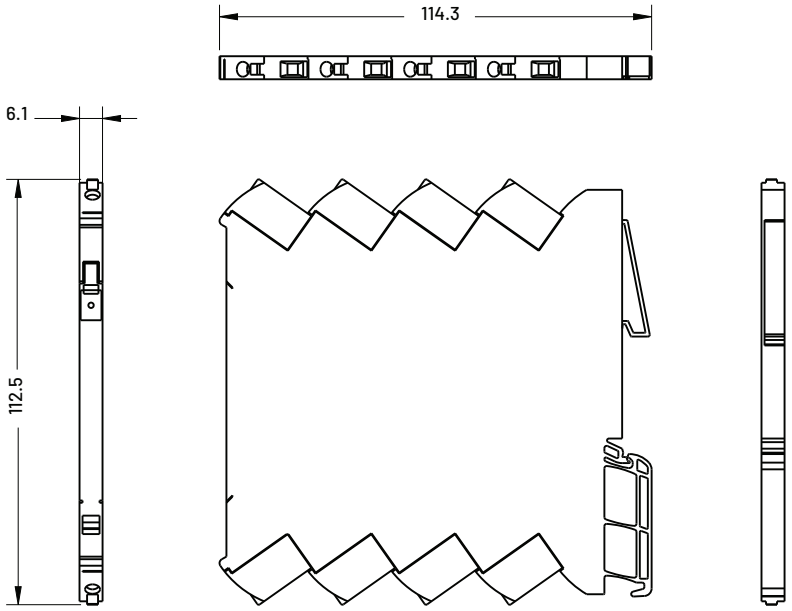
Power Rail Components

Photo	Description	Pkg. Qty.	Catalog Number
	Support Section TS 35 x 7.5; 500 mm (19.69 in.)	2	931A-SS
	Support Section TS 35 x 15; 500 mm (19.69 in.)	2	931A-SL
	Bus Circuit Layer Insert 500 mm (19.69 in.)	2	931A-PC
	Cover Plate 500 mm (19.69 in.)	2	931A-CP
	Power Bus End Right Plate	10	931A-RP
	Power Bus End Left Plate	10	931A-LP

Approximate Dimensions

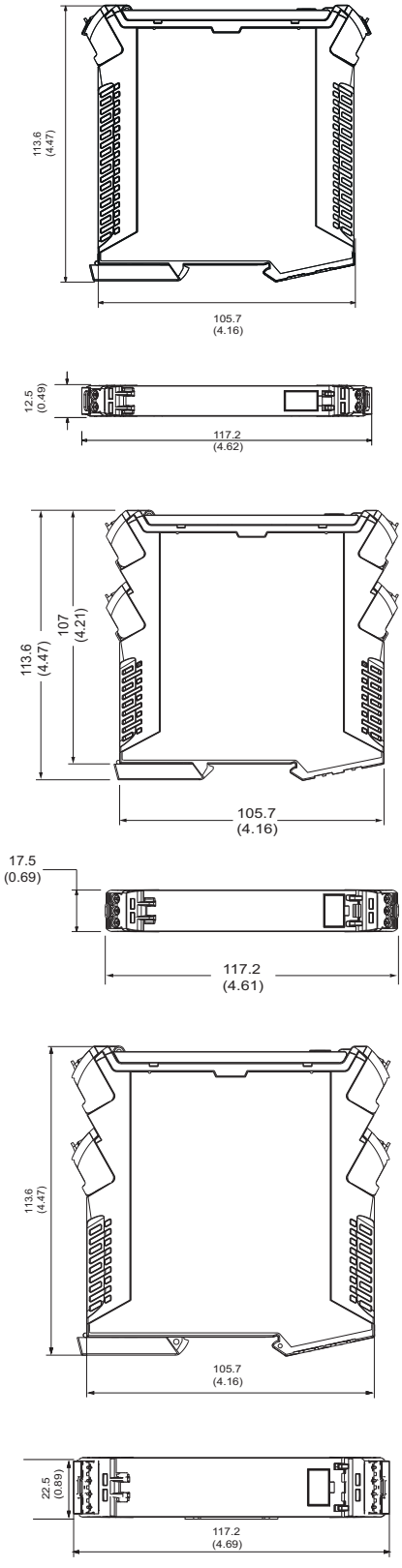
Nano Series

Approximate Dimensions are listed in mm (in.) and are not to be used for manufacturing purposes.



931N Nano Series Signal Conditioners

Smart Series



Glossary

2-way Isolation

The input and output signals are separated electrically from each other and decoupled. Potential differences caused by long wire lengths and common reference points are eliminated.

3-way Isolation

The input, output and auxiliary power supply are separated electrically from each other and also decoupled. Potential differences caused by long wire lengths and common reference points are eliminated.

A

A/D Converter

Converts standardized analog current and voltage signals into an 8-bit, 12-bit or 16-bit digital signal. It can be necessary to convert analog signals into digital signals when you need the analog signal from the surroundings to work with the typical digital processing requirements of process monitoring.

AC

Alternating current

Accuracy

Describes the ability of an analog signal isolating converter to transmit a measured value as precisely as possible. It is specified in the percent deviation from the measuring range end value at room temperature.

Active Input/Output

Refers to the input or output of a specific device and defines if the input or output is supplying power for the respective analog loop. Synonymous with sourcing.

Active Converter

An active converter is used to provide electrical **isolation and conversion** between differing analog signal ranges. They are designed with 2-way or 3-way isolation. The isolation of the potentials eliminates interference on the measurement signal that can be caused by earth loops or common-mode noise. The active converter makes use of an auxiliary voltage source for its power supply. It functions without feedback; a change on the output side load does not influence the input circuit.

Active Isolator

An active isolator is used to provide electrical **isolation** between the same analog signal range. They are designed with 2-way or 3-way isolation. The isolation of the potentials eliminates interference on the measurement signal that can be caused by earth loops or common-mode noise. The active isolator makes use of an auxiliary voltage source for its power supply. It functions without feedback; a change on the output side load does not influence the input circuit.

Active Sensor

In an active sensor, an electrical signal is generated from the measurement itself, for example dynamometric or piezo-electric, thus no auxiliary power source is required. Because of their physical operating principals (since energy cannot be sent during the static and quasi-static states), only a change in the measured variable can be detected.

Alarm Contact

A switching contact that activates when a disturbance occurs (for example, an overload or short circuit).

Ambient Temperature

Refers to the temperature of the surrounding air or medium at which the equipment can be properly and safely operated. This is a part of the surrounding physical and operational conditions. Failure to maintain this temperature level can invalidate the product warranty.

Analog Signal

A signal is designated as an analog signal if it transmits parameter information that is infinitely variable between a minimum and maximum value (this includes instantaneous values such as current, voltage or temperature). This applies to practically all real-world processes or states. It is theoretically possible to register any small signal changes (there is a very large dynamic range).

ATEX

The ATEX directive from 23.4.1994 is valid within the EU and the EFTA Western European nations. It applies to devices, machinery components, controllers and protective systems that are to be used in hazardous areas. This directive harmonizes the different national regulations from the EU member nations concerning the proper and intended use of machines and facilities in hazardous areas.

ATEX is derived from the phrase 'ATmosphere EXplosive'. It stipulates that operators should prevent explosions and ensure protection.

Regarding explosion protection in a potentially explosive atmosphere, the ATEX directive 94/9/EC has precedence over machinery directives and must be followed The directive describes the following steps:

Describe how often a potentially explosive atmosphere occurs and where it occurs.

These areas are then divided into zones according to the specifications.

Make sure that only properly categorized equipment is present within each different zone. As soon as an area is classified as being dangerous, steps must be taken to limit the potential ignition sources that are present there.

C

CE

Abbreviation for Communauté Européenne (the European Community). Manufacturers use the CE label to confirm that their products comply with the corresponding EC directives and the 'essential requirements' therein.

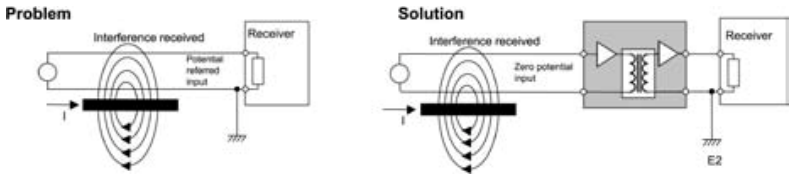
Cold-junction Compensation

Thermocouples require a temperature reference point to compensate for unwanted 'cold junctions'. The usual method for achieving this is by measuring the temperature at the reference junction with a temperature sensor that can be read immediately. The interfering voltage can then be compensated for in the measurement results. This process is referred to as cold-junction compensation (CJC). Our

thermocouple signal conditioners have cold-junction compensation to compensate for unwanted 'cold-junctions' or temperature changes at the terminal connection for the thermocouple.

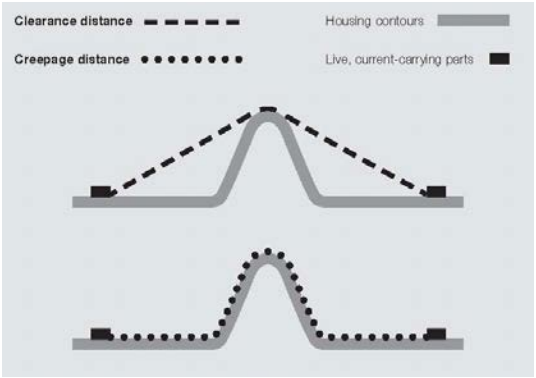
Common-Mode Interference

Interfering currents and voltages that can occur on the connecting cables between electrical devices and facility components. These can then spread with similar phase and current direction to the feed line and the return line.



Creepage and Clearance Distances

The safety gaps between two current-carrying wires. The creepage distance is the shortest path along an insulating surface between two live components. The clearance distance is the shortest path in the air between two points of reference.



D

D/A Converter

D/A converters convert standardized digital signals (for example, with an 8-bit structure) into analog current and voltage signals.

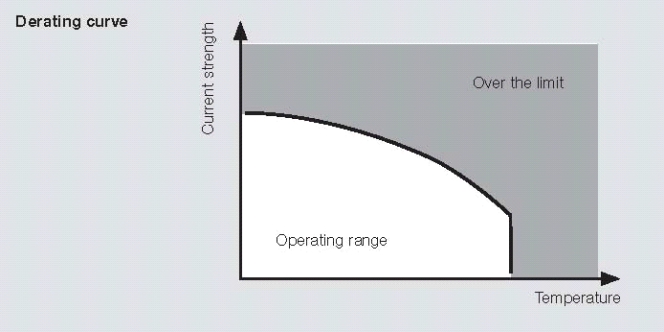
It can be necessary to convert digital signals into analog signals when you need the analog signal from the surroundings to work with the typical digital processing requirements of process monitoring.

DC

Direct current

De-rating

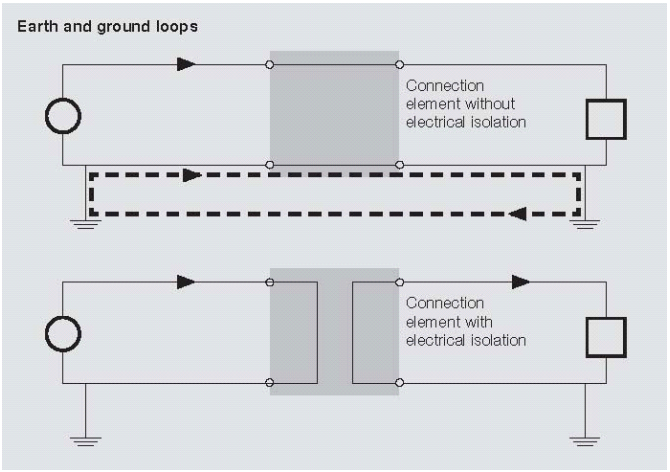
The continuous current level reduction in relation to an ambient temperature increase, represented as a de-rating curve (a load reduction curve).



E

Earth (Ground) Loops

A main cause of error in process systems comes from earth loops. An earth loop occurs when two or more circuits are connected to each other and referenced to earth or a reference point. This reference point usually does not have the identical electrical potential at each position. When the two ends of the line are earthed at two different positions, the voltage differential between the two earth potentials on the line can lead to a compensating current that can corrupt analog measurement signals. This corruption of measurement signals occurs when field sensors have a separate earth or separate power feed. Analog signal isolation amplifiers use electrical isolation to separate the input and output circuits thus preventing the measurement signal from being corrupted.



Electrical Equipment

All of the electrical and electronic components and circuits within an enclosure.

F

Frequency Converter

Converts frequencies into analog signals. In-line control systems can then directly process pulse strings from speed or rotational measurements.

G

Galvanic Isolation

Potential-free isolation between electrical components. Normally, the input circuit, output circuit and power supply are designed so that they are electrically isolated from each other. The isolation can be achieved using optical means (an optocoupler) or by using a transformer. The electrical isolation of measurement signals ensures that the differences in earth potentials and common-mode interference are suppressed

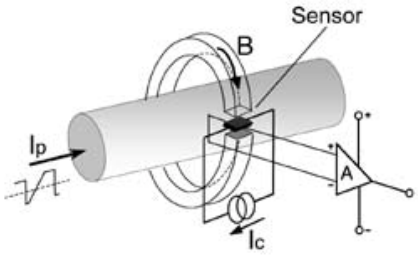
Ground Loop

See 'Earth Loop.'

H

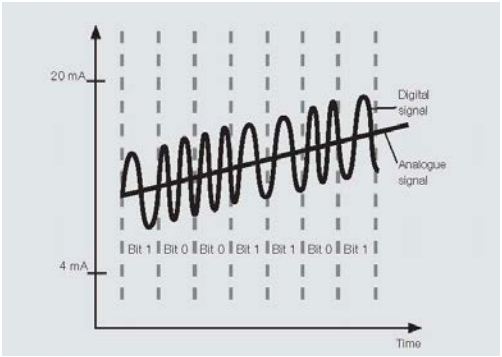
Hall Sensor Current Measurement

Hall sensors can measure the magnetic field of a conducting wire. They then generate a proportional voltage on the measurement output (the Hall voltage). This can be converted to a standardized signal by means of an amplifier circuit. Such a measurement is well suited for measuring high DC and AC currents with frequencies up to 1 kHz. Start-up currents and current peaks cannot damage a Hall sensor.



HART

HART (Highway Addressable Remote Transducer) is a communications protocol for bus-addressed field devices used in process automation. In HART®-based communications, field devices and controllers are connected together over 4...20 mA current loops. This analog signal is superimposed with a digital signal by using the FSK process (Frequency Shift Keying). The process allows additional measurements, configuration and device data to be transmitted without influencing the analog signal. HART.



Hysteresis

Specifies the percent difference between the switch-on and switch-off points of a switching contact. The hysteresis must not fall below a minimal value. Otherwise it would no longer be possible to carry out specific switching during the monitoring of threshold.

I

Impulse Withstand Voltage

The high pulse voltage of a specified form and polarity that does not lead to an insulation breakthrough or flashover, under the specific conditions defined in EN 60664-1.

Initiator PNP/NPN Switched

Two wires in a three-wire sensor are responsible for keeping the supply activated. The third connecting wire is used for transferring commands (NO/NC contact). Initiators with NPN outputs switch the load in active mode towards the minus potential. Proximity switches with PNP outputs switch toward the plus potential.

Input Loop-Powered

Input loop powered equipment is 2-wire and has a 4 - 20 mA input. The equipment is supplied with power via the current loop on the input side.

Insulation Voltage

For electronics components with electrical isolation, this is the maximum AC test voltage that can be applied for a specified time interval (5 s / 60 s) without causing a break-through.

Isolation Amplifier

See ' Active Isolator.'

L

Leakage Current

The current on the load side of an optocoupler, Triac, transistor, or any other electronic switching device that flows towards the output circuit while in a closed state.

Limiting Frequency

The limiting frequency of an analog signal isolating converter is that frequency where the output signal is reduced to 1/(√2) of the value of the input signal (approx. 70.7 % = -3 dB).

Line Break Monitoring

Analog measuring transducer with wire-break detection capability that permanently monitors the input signal. In the event of an fault (a wire break), the output signal jumps up to a defined value over the nominal range so that a controller wired further down the circuit can evaluate the error.

Linearization

Temperature-dependent components normally do not have a linear characteristic curve. Their characteristic curves must be linearized so that they can be evaluated as precisely as possible. The measurement curves of thermocouples and temperature-dependent resistors (NTC/PTC), in particular, exhibit significant deviation from an "ideal curve". In the linearization process, the measurement signal is processed by a microprocessor and an ideal characteristic curve is generated which can then be analyzed or processed further.

Load Cell

A load cell is a special type of force sensor used in weighing systems (that is, scales). Load cells usually have a spring mechanism used as a force sensor. The spring is a specially shaped piece of metal whose shape changes slightly when under the influence of weight. This elastic deformation is recorded by strain gauges and converted into an electrical signal. Weights can be recorded ranging from a few hundred grams to several thousand tons.

Load Resistance (Load)

This is the load resistance on the output side of a measuring transducer or transmitter. For analog current outputs, the load is 500...600 ohms maximum. Voltage outputs normally have a load of at least 10 kOhm.

M

Measurement Isolating Transformer

Converts electric and non-electric input signals into standard analog signals. At the same time it provides electrical isolation between the input and output (2-way isolation) or between the input, output and supply (3-way isolation). Measurement isolators are typically used to record temperatures (RTD, thermocouples) or for measuring current, voltage, power, frequency, resistance and conductivity.

Measuring Bridge

Sensors based on Wheatstone bridge circuitry can capture force, pressure and torque. Relatively small length changes under 10 - 4 mm can be recorded using DMS strain gauges in the form of resistance changes. A typical application is for capturing measurements in load cells.

N

Namur Sensor

NAMUR-compliant sensors (The standardization commission for measuring and control technology in the German chemical industry) operate with a load-independent current. They have four modes so that an analog evaluative unit can detect a sensor malfunction.

1) Current of 0 mA => wire break, circuit is open

2) Current of approx. 20% of the max. value => Sensor ready, activated

3) Current of approx. 60% of the max. value => Sensor ready, not activated

4) Current at max. value => short circuit, max. current

NAMUR sensors are suited for use in hazardous areas.

Nominal Switching
Current -Load Side

The permitted load current of a relay contact or semiconductor contact when in continuous operations.

Nominal Switching
Voltage - Load Side

The switching voltage that a relay contact or semiconductor contact uses in relation to its application.

O

Output Loop-Powered

Output loop powered 2-wire devices have a 4 - 20 mA output. The device is supplied with power via the current loop on the output side.

Overvoltage Category

The overvoltage categories are described in DIN EN 60664-1. The category dictates the insulation clearance gaps required. Category III is the default specification (EN 50178).

Overvoltage category I: Devices that are intended to be connected to the permanent electrical building installation. The measures for limiting transient surge voltages to the proper level are taken outside of the device. The protective mechanisms can either be in the permanent installation or between the permanent installation and the device.

Overvoltage category II: Devices that are intended to be connected to the permanent electrical building installation (such household appliances or portable tools).

Overvoltage category III: Devices that are a part of the permanent installation and other devices where a higher degree of availability is required. This includes the distributor panels, power switches, distribution systems (including cable, busbars, distributor boxes, switches and outlets) that are part of the permanent installation, devices intended for industrial use, and devices that are continually connected to the permanent installation (such as stationary motors).

Overvoltage category IV: Devices that are intended to be used on or near the power feed in a building's electrical installation - ranging from the main distribution to the mains power system. This includes electrical meters, surge protection switches and ripple control equipment.

P

Passive Input/Output

Refers to the input or output of a specific device. Synonymous with sinking, which means does NOT supply power for the respective analog loop.

Passive Converter

This device is powered by either its input or output analog loop and provides electrical **isolation and conversion** to differing analog signal ranges. The amount of current needed internally is so small that the measurement signal is not influenced. Passive converters do not require an auxiliary voltage supply. Transformers are used to provide the isolation between the input and the output. The advantages include: eliminates the influence of the mains power system, highly accurate, minimal signal delay, and minimal power used. Passive converters do not function free from feedback; so a load change on the output circuit will automatically affect the input circuit as well.

Passive Isolator

This device is powered by either its input or output analog loop and provides electrical **isolation** between the same analog signal range. The amount of current needed internally is so small that the measurement signal is not influenced. Passive converters do not require an auxiliary voltage supply. Transformers are used to provide the isolation between the input and the output. The advantages include: eliminates the influence of the mains power system, highly accurate, minimal signal delay, and minimal power used. Passive isolators do not function free from feedback; so a load change on the output circuit will automatically affect the input circuit as well.

Passive Sensor

Contains passive components whose parameters can be changed by the measured variables. A primary electronic mechanism converts these parameters into electric signals. An auxiliary external power source is needed for the passive sensor. Passive sensors can be used to determine both static and semi-static measured variables. For this reason, the majority of sensors have a passive construction. Examples of this type include load cells and resistance thermometers.

Pollution Severity Level

The pollution severity level specifies the conditions of the immediate surroundings. It is defined in DIN EN 50178, Section 5.2.15.2.

The pollution (contamination) severity level should be used to determine the required creepage distance for the insulation. Pollution degree 2 is the default specification.

Pollution severity level 1: There is no contamination or only dry occurrences of non-conductive pollution. This pollution has no influence.

Pollution severity level 2: There is only non-conductive pollution. Temporary occurrences of conductivity caused by condensation may also occur.

Pollution severity level 3: Conductive pollution or dry, non-conductive pollution that can become conductive due to condensation is likely to occur.

Pollution severity level 4: The contamination leads to continual conductivity which can be caused by such contaminants as conductive dust, rain or snow.

R

Rated Voltage

Specified by the insulation coordination - the rated voltage is the voltage level at which the product can be safely operated, in relation to the corresponding pollution severity level and the surge voltage category.

Relative Humidity

The relationship between the actual moisture and the maximum possible quantity of water in the air. Expressed as a percentage.

RoHS

The EC directive 2002/95/EC - concerning the restriction of the use of certain hazardous substances in electrical and electronic equipment - regulates the use of hazardous materials within devices and components. This directive, and it's various implementations into national laws, are referred to by the abbreviation RoHS (Restriction of Hazardous Substances).

RTD/ PT100/1000

RTD sensors are temperature probes that operate based on the resistance changes which take in metal as the temperature changes. They are resistance thermometers based on PTC resistors. The electrical changes in resistance of a platinum wire or platinum film is often used for measuring temperatures ranging from -200 ...+850 °C. The platinum temperature sensors are characterized by their nominal resistance R0 at a temperature of 0 °C. The standard types include:

Pt100 (R0= 100 Ohm)

Pt1000 (R0= 1 kOhm)

A two-wire, three-wire or four-wire electrical connection can be used to electrically connect the PT/RTD sensor to the evaluative electronics. A three-wire or four-wire method eliminates any errors caused by the inherent resistance of the sensor connecting wires.

In the three-wire method, one end is equipped with two pigtail connectors. In the four-wire method, both ends are equipped with two pigtail connectors.

S

Sensor

A sensor is a physical component capable of capturing certain physical or chemical properties (such as thermal radiation, temperature, humidity, pressure, noise, brightness, or acceleration) as a measurement. It can also analyze the quality of the composition of the material surroundings. These values are captured using physical or chemical phenomena and then converted into another form (usually electrical signals) so they can be post-processed.

Signal Splitter

A signal isolator that accepts an analog input signal and delivers at least two isolated and independent signals on the output side. This permits the signal to be transmitted to a PLC/DCS system and to a separate display. A signal multiplier is designed either as an active isolator with an external power feed or as an output loop powered version.

SIL

Safety Integrity Level. The components must meet the requirements of IEC 61508 is order to reduce risk. This standard provides general requirements for avoiding and minimizing device and equipment outages. It stipulates organization and technical requirements concerning device development and operation. Four safety levels are defined (from SIL1 for minimal risk to SIL4 for very high risk) for classifying facilities and risk-reduction measures. Risk-reduction measures must be more reliable when the classified risk level is higher.

Status Indicator

An LED that displays the operational status, such as operational (yellow), switching (green), and alarm/malfunction (red).

Step Response Time

This is the time delay in the output signal change when there is a signal jump ranging from 10...90% on the input side. The step response time is inversely proportional to the limiting frequency.

Storage Temperature

The permitted ambient temperature, related to a specific relative humidity level, for which the product should be stored while in a current-free state.

Switching Threshold

The switch-on or switch-off point.

T

Temperature Coefficient

The temperature coefficient describes the relative change of a physical variable based on the temperature change relative to a reference temperature (room temperature). It directly influences the precision of an analog signal converter. The coefficient is specified in ppm/K of the corresponding measuring range end value.

Thermocouple

A thermocouple is a component made of two different materials which are connected to each other at one end. An electrical voltage is created (based on the principle of the Seebeck effect) along a wire that connects the unattached ends when there is a temperature differential.

The juncture point and the unattached ends must have different temperatures for a voltage to be generated.

The following thermocouples are used for industrial applications:

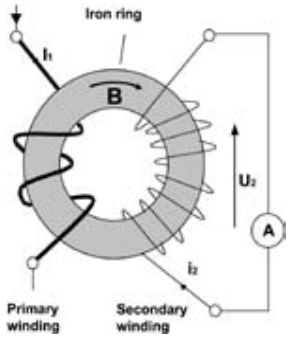
Thermal pair	Short name	Type	Temperature range in °C
Nickel/Chrome-Nickel/Al	NiCr-Ni/Al	K	-200 ... +1372
Iron-constantan	Fe-CuNi	J	-200 ... +1200
Copper-constantan	Cu-CuNi	T	-200 ... +400
Nickel/Chrome-constantan	NiCr-CuNi	E	-200 ... +1000
Platinum/10% Rhodium-Platinum	Pt10Rh-Pt	S	–50 ... +1760
Platinum/13% Rhodium-Platinum	Pt13Rh-Pt	R	-50 ... +1760
Nickel/Chrome-Nickel/Magnesium	NiCr-NiMg	N	-200 ... +1300
Platinum/30% Rhodium - Platinum/6% Rhodium	Pt30Rh - Pt6Rh	B	0 ... +1820

Threshold Monitoring

The limiting values of physical variables must be continually monitored for industrial processes. This includes fill levels, temperatures, speed, positions, weights and frequencies. Specialized threshold monitoring components are used for this purpose. The sensor signals are captured on the input side, evaluated electronically and converted. The corresponding threshold (min/max) is then made available via the digital switching outputs (relays or transistors) to the external devices. Potentiometers can be used to customize each switching point and its minimum/maximum threshold as well as the switching hysteresis.

Transformer-Based Current Measurement

Signal converters with transformer coupling are used for taking cost-effective measurements of sinusoidal currents (50/60 Hz). The current being measured flows directly through the primary coil of the measurement transformer. It is then stepped down and electronically processed in the converter.



Type of Contact

A contact is called normally open (NO) or a make contact if it is open when the armature is dropped out (no current in coil) and closed when the armature is picked up (current flowing in coil). A contact is called a break contact or normally closed (NC) contact if it interrupts the circuit when the armature is picked up. A combination of NC and NO is called a changeover (CO) contact. A relay can have one or more of such contacts.

Notes:

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation. You can view or download publications at rok.auto/literature.

Resource	Description
Safety Guidelines for the Application, Installation, and Maintenance of Solid-state Control, publication SGI-1.1	Designed to harmonize with NEMA Standards Publication No. ICS 1.1-1987 and provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid-state components.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Selection and Configuration tools, rok.auto/systemtools	Helps configure complete, valid catalog numbers and build complete quotes based on detailed product information.
Rockwell Automation Global SCCR tool, rok.auto/sccr	Provides coordinated high-fault branch circuit solutions for motor starters, soft starters, and component drives.
Product Certifications website, rok.auto/certifications	Provides declarations of conformity, certificates, and other certification details.

Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, Knowledgebase, and product notification updates.	rok.auto/support
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Technical Documentation Center	Quickly access and download technical specifications, installation instructions, and user manuals.	rok.auto/techdocs
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

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