Bulletin 931 Signal Conditioners

Technical Data

Allen-Bradley

LISTEN. THINK. SOLVE.®

Product Line Overview

			
Bulletin	931-H	931-S	931-U
Type	**High-Density Signal Conditioners**	**Standard Signal Conditioners**	**Universal Signal Conditioners**
Features	• Cost-effective analog signal conditioning in a high-density (6 mm wide) housing	• Provide solutions for a wide variety of analog signals • Available in compact sizes ranging from 12.5 mm to 22.5 mm wide.	• Programmable— allowing the devices to be used on a wide variety of analog signals • Two models are available, one housing is 12.5 mm wide, the other is 45 mm wide
Product Selection by Function Type			
Current/Voltage	**Page 11**	**Page 14**	**Page 35**
RTD	**Page 21**	**Page 23**	**Page 35**
Thermocouple	**Page 24**	**Page 26**	**Page 35**
Line-Monitoring	—	**Page 27**	—
Bridge	—	**Page 32**	—
Frequency	—	**Page 33**	**Page 35**
HART	**Page 34**	—	—

Analog Signal Conditioner Functionality

Analog Signal Conditioners are designed for use with Rockwell Automation I/O systems to provide reduced installation and maintenance costs in process applications. The products are available with two way isolation (between input and output) or three way isolation (between input, output and power).

- Isolation of analog measurement and control signals with 2 way isolation (between input and output) or 3 way isolation (between input, output and power).
- Conversion of analog signals from voltage to current. (i.e. 0...10V to 4...20 mA, etc.)
- Amplification, linearization, and transmission of low level sensor signals (i.e., mV signals from thermocouples, etc.).
- Transmission of analog signals over long distances
- Provides local display using a splitter or remote status indications and alarms via relay contact closures based on the analog signals.

Typical Applications

Analog Signal Conditioners are used wherever temperature, pressure, level, flow, weight, speed, etc. is measured and controlled as part of a continuous or batch production process. Analog Signal Conditioners help to prevent these measurements from being degraded on their way from the field to the control room by providing protection from external influences or problems that result from the installation methods used. Typical industries include power plants, steel production, water and wastewater plants, oil and gas production, and chemical processing.

Integrated Architecture
Scalable . . . Multi-disciplined . . . Information Enabled

The Rockwell Automation Integrated Architecture™ system improves your productivity and reduces total cost of ownership by providing unparalleled functionality, flexibility and scalability. Using sophisticated control, networking, visualization and information technologies, the Integrated Architecture addresses a full range of control and information needs for discrete, motion, process and batch control, drive control, and safety applications.

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.For these and a variety of other reasons, analog signal conditioning is often required between the measuring instrumentation and the control system. Analog signal conditioning is a long established practice in many process industries such as oil and gas processing, pharmaceutical and chemicals industries and standardized electrical signals are normally used. Currents of 0...20 mA or 4...20 mA and voltages of 0...10 V DC are the most often specified by controls engineers.

Bulletin 931 Signal Conditioners Product Range

Rockwell Automation offers a wide range of products to condition analog signals according to industry standards. The Bulletin 931 Analog Signal Conditioners also provide the necessary isolation of the field measurement device from the controller as well as from any external power supplies. Such isolation prevents interference that can occur due to ground loops or common mode noise. The wide range of Allen-Bradley Bulletin 931 Analog Signal Conditioners completely covers the functions involved in analog signal conversion, isolation, and monitoring. The product range addresses nearly all applications in industrial measuring technology and safeguards the elementary functions between field signals and control systems. The products are easily mounted on 35 mm DIN rail and come in standard electronic housings with widths of 6, 12.5, 17.5, 22.5, or 45 mm.

Standard

High-Density

Universal

Analog Signal Conditioners

Problem solvers for process automation.

Given the wide variety of analog I/O available with today's modern industrial and process control systems, some may question why Analog Signal Conditioners are used. Here are a few examples of why an Analog Signal Conditioner might be 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 (e.g., thermocouples for temperature), Analog Signal Conditioners can isolate and convert to a high level signal that is easier to transmit (e.g., 4...20 mA).

- **Non-Isolated Analog I/O**

If the existing control system does not provide isolated analog inputs, a separate Analog Signal Conditioner will often be used to provide signal isolation when required e.g., if the control system needs to be protected from electrical noise pulses on its analog inputs.

- **Isolation of the Power Source**

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

- **Local Display and Linearization**

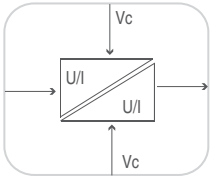
When a dedicated local display is required, the analog signal can be split using an Analog Signal Conditioner. For example, where a liquid volume indicator is needed for filling a bulk storage tank, but the measurement is level (level to volume conversion depends on the shape of the tank).

- **The remaining I/O available in an existing system does not provide for the input type of the sensor required.**

Example: The remaining I/O in the control system requires a 4...20mA analog inputs and the sensors provide less common signals – e.g., 0…20mV, 2...10V, 0...10V , 0...1mA, 4...12 mA, 0...5 A (AC), etc.

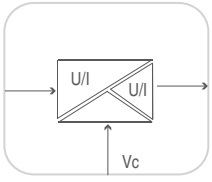
Analog Signal Processing

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.



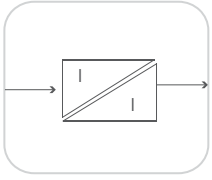
Two-Way Isolation

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 as well as inductive and capacitive interference.



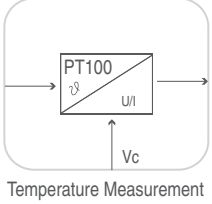
Three-Way Isolation

Analog signal conditioners with three-way isolation separate the supply voltage from the input and output circuits as well and enables the analog circuit to operate with just one operating voltage.



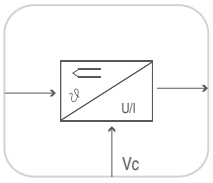
Passive Isolation

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 very low power consumption.



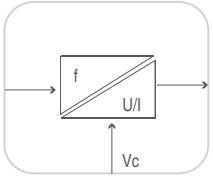
Temperature Measurement
PT100

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.



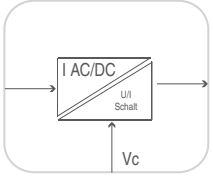
Temperature Measurement
Thermocouples

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



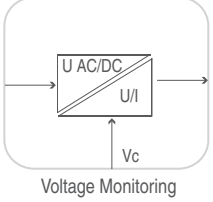
Frequency Conversion

Analog signal conditioners are available to convert frequencies into standard analog signals. Downstream controls can therefore directly process pulse strings for measuring rpm or speed.



Current Monitoring

Analog signal conditioners are available for current monitoring for currents up to 60A 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 voltage monitoring of both AC and DC voltages. Voltage fluctuations due to switching processes or overload conditions can be detected for voltages above or below the user-defined switching threshold.

Catalog Number Explanation

Note: Examples given in this section are for reference purposes. This basic explanation should not be used for product selection; some combinations may not produce a valid catalog number.

931	S	–	A1	A1	N	-	IP	N
	a		*b*	*c*	*d*	*-*	*e*	*f*

a

Code	Description
H	High-density
S	Standard
U	Universal

b

Input Type	
Code	**Description**
Current	
A1	0(4)…20 mA
A2	4…20 mA
A3	0…1 A, 0…5 A or 0…10 A AC
A4	0…20 A, 0…25 A or 0…30 A AC/DC
Bridge	
B1	-500 mV…+500 mV
Voltage or Current	
C1	0…5V or 0…1V DC
	0…20 mA or 4…20 mA
C2	0…10V DC
	0…20 mA or 4...20mA
C3	0…10V DC
	0…22 mA
C4	±20mV...±200V
	±0.1 mA…100 mA
C9	Universal Inputs
Frequency	
F1	2-,3-wire PNP/NPN, namar initiator, push/pull step
Potentiometer	
P1	PT 100/2/3/4-Conductor or Ni 100/2/3/4-Conductor
P2	PT 100/2/3-Conductor
P3	PT 100/2/3/4-Conductor
Thermocouple	
T1	Type J
T2	Type K
T9	Types K,J,T,E,N,R,S,B
Voltage	
V1	24…70V, 70…140V, 140…210V or 210…260V AC/DC

c

Output Type	
Code	**Description**
Current	
A1	0(4)…20 mA
A2	4…20 mA
A5	(2) 4…20 mA
Voltage or Current	
C1	0…5V or 0…1 VDC
	0…20 mA or 4…20 mA
C2	0…10V DC
	0…20 mA or 4...20mA
C3	0…10V DC
	0…22mA
C5	0...±10V
	0…±20 mA
C6	0…5V, 5…0V DC or 10…0V, 0…10V DC
	0…20 mA, 20…0 mA or 4…20 mA, 20…4 mA
C7	0…±10V
	0...±20 mA
R1	3 A relay contact closure digital output

d

Configuration Setting	
Code	**Description**
N	Non-configurable
D	DIP Switch
J	Jumper
C	Computer

e

Power Type	
Code	**Description**
IP	Input Loop Power
OP	Output Loop Power
BC	Aux AC or DC Power
DC	DC Aux Power
MC	from the Measuring Circuit

f

Miscellaneous	
Code	**Description**
1	One Channel
2	Two Channels
Hall	Hall Effect Sensor
Hart	Hart Communication Protocol
Cable	Cable
1R	One Relay
2R	Two Relays

Bulletin 931H - High-Density Series

The modules in the High-Density series provide cost-effective analog signal conditioning in a very small package.

- Extreme high-density mounting (6 mm wide modules)
- Provide isolation and conversion solutions for a variety of signals
  - Current
  - Voltage
  - Temperature (thermocouples and RTDs)
- The DIP switches can be accessed from outside the housing
- Capability to jumper incoming power from unit to unit using standard Bulletin 1492 terminal block jumpers on most Bulletin 931H devices
- Wiring diagrams printed on outside of housing for ease of use in commissioning and maintenance activities
- End barrier is required for Cat Nos: 931H-P2A2N-OP and 931H-A1A1N-IP.

Cat. No. 931H-P2A2N-OP

Cat. No. 931H-A1A1N-1P

End Barrier, Cat. No. 931H-EB1

Power Connections

Standard Bulletin 1492 jumpers can be used to connect units to the same Bulletin 1606 power supply. These jumpers provide a fast and easy way to provide power to a series of Bulletin 931 analog signal conditioners mounted together on a DIN Rail.

DIP Switch Programmable

The Bulletin 931H products are easily programmable with the DIP switches located on the outside of the housing along with the printed tables of the possible input and output combinations.

High-Density Housing

The Bulletin 931H product line offers a wide range of functionality in the high-density 6mm housing.

.

Wiring Diagrams

Bulletin 931H products have the wiring diagrams printed on the outside of the housing to reduce complexity during installation and maintenance.

Bulletin 931S - Standard Series

The Bulletin 931S Standard Series of analog signal conditioners provide solutions for a wide variety of analog signals. They are available in compact sizes ranging from 12.5... 22.5 mm in width.

- Provide isolation and conversion solutions for a wide variety of signals:
  - Current
  - Voltage
  - Temperature (thermocouples and RTDs)
  - Frequency
  - Load Cells (bridge transducers)
  - Potentiometers
- Removable, plug-in terminal blocks are coded to eliminate wiring errors.
- The printed circuit board can be removed and re-installed without tools providing ease-of-use when accessing the internal DIP switches.
- Capability to jumper incoming power from unit to unit using standard Bulletin 1492 terminal block jumpers on some 931S devices.
- Jumper settings printed on outside of housing for ease-of-use in commissioning and maintenance activities.

Bulletin 931U- Universal Series

The Bulletin 931U Universal Series of analog signal conditioners are programmable, allowing the devices to be used on a wide variety of analog signals. Two models are available, one in a 12.5mm wide housing and one in a 45mm wide housing. Both are programmable using software.

- Provide isolation and conversion solutions for a wide variety of signals:
  - Current
  - Voltage
  - Temperature (thermocouples and RTDs)
  - Potentiometers
  - AC and DC current monitoring
- Removable, plug-in terminal blocks are coded to eliminate wiring errors.
- Programmable using software, which is bundled with the programming cable - Cat. No. 931U-CABLE.

Bulletin 931U Programming Software

Universal Inputs

The Bulletin 931U products can input a wide range of analog signals (current, voltage, thermocouple, RTD, resistance, frequency, etc).

Software Programmable

The Bulletin 931-U products are programmed using the software and cable included in 931U-CABLE product. The cable connects from the front of the signal conditioner unit to your computer's USB port.

Certifications

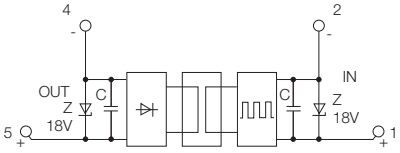
Allen-Bradley's Bulletin 931U product line has been certified to global certifications. These products not only have cULus – Class 1, Div. 2, Groups A, B, C, and D ratings, but also the European CE and ATEX markings.

Analog/Digital Outputs

The Bulletin 931U products have the capability to output both analog and digital signals. Using the programming software you can have the unit output a current or voltage signal and also dual digital signals from two CO contacts.

Passive Isolator, 1 Channel

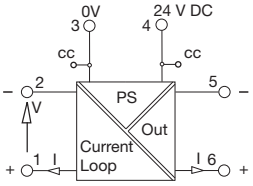
- Passive isolator for electrical isolation of standard 0...20 mA or 4...20 mA signals
- No need for auxiliary power supply
- Low power consumption

	931H-A1A1N-IP
	
Specifications	***Passive Isolator, 1-Channel***
Wiring Diagram	
Standards Compliance	UL 508, CSA C22.2 No. 142-M1987, CSA C22.2 No. 0-10, CSA C22.2 No. 14-10, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cURus (NRAQ2/8.E113724), CSA, CE
Input Ratings	
Current	0(4)...20 mA
Max Voltage	15V
Max Current	50 mA
Pick-up Current	< 100 µA
Voltage Drop	2.5….3 V at 20 mA
Input	Passive
Output Ratings	
Current	0(4)...20 mA
Voltage	—
Load Impedance (voltage/current)	— / ≤ 500 Ω
Step Response Time	approx. 1.2 ms
Accuracy	< 0.1% of final value
Temperature Coefficient	≤ 50 ppm/K of measurement value at 0 Ω load resistance
Residual Ripple	< 10 mV
Cut-off Frequency	approx. 200 kHz
Output	Active
General Specifications	
Power Type	Input Loop Powered
Operating Temperature	-25 °C…+60 °C
Storage Temperature	-40 °C…+85 °C
Isolation Voltage Input - Output	$500V_{eff}$
Rated Isolation Voltage	50V
Connection Type	Tension clamp
L x W x H (mm)	91 x 6 x 63.2

Signal Conditioner	**Cat. No.**	Pkg. Quantity
	931H-A1A1N-IP	1
End Barrier (required)	**931H-EB1**	10

Active Isolator, 3-Way

- Two conductor system
- Three port isolation
- Power supply can be cross-connected using center jumpers

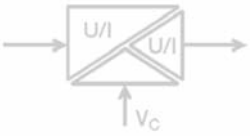
	931H-A2A2N-DC
	
Specifications	***Active Isolator, 3-Way***
Wiring Diagram	
Standards Compliance	UL 508,CSA C22.2 No. 0-10, CSA C22.2 No. 14-10, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cURus (NMTR2/8.E56639), CE
Input Ratings	
Current	4...20mA
Sensor	2-conductor
Supply Voltage	16.5V / constant for 3…22 mA
Input	Active
Output Ratings	
Current	4...20 mA
Load Impedance (voltage/current)	≥ 10 kΩ/ ≤ 500 Ω
Accuracy	< 0.1 %
Temperature Coefficient	≤ 50 ppm/K
Step Response Time	≤ 2ms
Offset Current	< 30 µA
Residual Ripple	< 10mV
Output	Active
General Specifications	
Supply Voltage	24V DC ± 15%
Power Consumption	approx. 1 W
Current Carrying Capacity of Cross Connect	≤ 2 A
Operating Temperature	0 °C…+55 °C
Storage Temperature	-25 °C…+85 °C
Rated Insulation Voltage	300V
Isolation Voltage Input - Output	$1.5kV_{eff}$
Surge Category	II
Pollution Severity	2
Connection Type	Screw
L x W x H (mm)	88 x 6.1 x 97.8

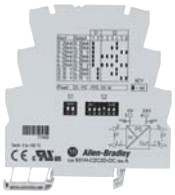
Signal Conditioner	**Cat. No.**	Pkg. Quantity
	931H-A2A2N-DC	1

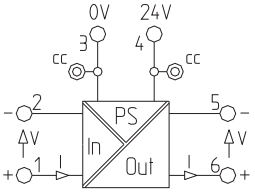
Active Converter, 3-Way

- Three way isolation
- Calibrated change over via DIP switch
- Power supply can be cross-connected using plug-in jumpers
- Low power loss

931H-C2C2D-DC





Specifications	*Active Converter, 3 Way*
Wiring Diagram	
Standards Compliance	UL 508,CSA C22.2 No. 0-10, CSA C22.2 No. 14-10, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cURus (NMTR2/8.E56639), CE
Input Ratings	
Voltage	0...10V
Max. Voltage	30V
Current	0...20 mA / 4...20 mA
Max. Current	< 100 mA
Input Resistance (voltage/current)	100 kΩ / ≤ 5 Ω
Voltage Drop	< 0.1V at I_{IN} =20 mA (current input)
Input	Passive
Output Ratings	
Voltage	0...10V
Current	0...20 mA / 4...20 mA
Load Impedance (voltage/current)	≥ 10 kΩ / ≤ 500 Ω
Step Response Time	10 ms
Accuracy	< 0.5% of final value
Temperature Coefficient	≤ 150 ppm/K of final value
Cut-off Frequency (-3 dB)	> 100 Hz
Output	Active
General Specifications	
Supply Voltage	24V DC ± 15%
Power Consumption	approx. 0.6 W
Current Carrying Capacity of Cross Connect	≤ 2 A
Operating Temperature	0 °C...+55 °C
Storage Temperature	-25 °C...+85 °C
Default Settings	0...20 mA / 0...20 mA
Rated Insulation Voltage	50V
Isolation Voltage Input - Output	$500V_{eff}$ / 1 s
Surge Category	II
Pollution Severity	2
L x W x H (mm)	88 x 6.1 x 97.8

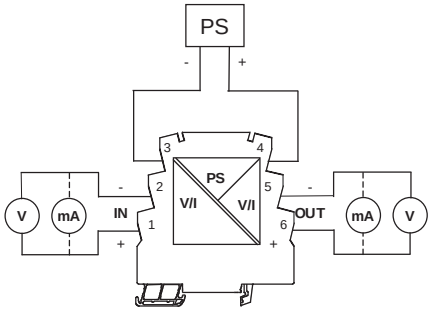
Signal Conditioner	Cat. No.	Pkg. Quantity
	931H-C2C2D-DC	1

Setting options/switch position

Switch									
		S1		S2					
Input	Output	1	2	1	2	3	4	5	6
0 ... 20 mA	0 ... 20 mA	■	□	□	□	□	■	□	□
0 ... 20 mA	4 ... 20 mA	■	□	□	□	■	■	□	□
0 ... 20 mA	0 ... 10 V	■	□	□	□	□	□	■	■
4 ... 20 mA	0 ... 20 mA	■	□	■	■	■	■	□	□
4 ... 20 mA	4 ... 20 mA	■	□	□	□	□	■	□	□
4 ... 20 mA	0 ... 10 V	■	□	■	■	■	□	■	■
0 ... 10 V	0 ... 20 mA	□	■	□	□	□	■	□	□
0 ... 10 V	4 ... 20 mA	□	■	□	□	■	■	□	□
0 ... 10 V	0 ... 10 V	□	■	□	□	□	□	■	■

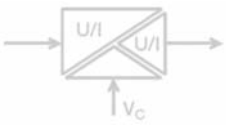
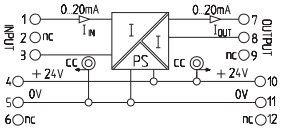
■ = on
□ = off

Connection



Active Converter, 3-Way

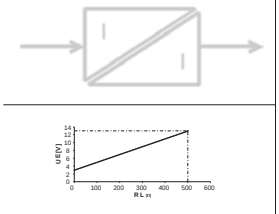
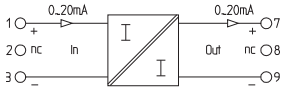
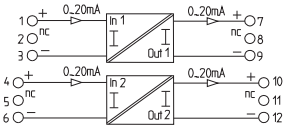
- Signal conversion
- Electrical isolation between input/output signal and power supply
- Power supply can be cross-connected using center jumpers

	931S-A1A1N-DC
	
Specifications	***Active Isolator, 3-Way***
Wiring Diagram	
Standards Compliance	UL 508, CSA C22.2 No. 142-M1987, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-4:2007
Certifications	cULus (NRAQ/7.E113724), CE
Input Ratings	
Current	0(4)...20 mA
Max Current	25 mA
Input	Passive
Output Ratings	
Current	0(4)...20 mA
Load Impedance (voltage/current)	— / ≤ 600 Ω
Step Response Time	≤ 45 ms
Accuracy	0.2%
Temperature Coefficient	≤ 250 ppm/K of final value
Cut-off Frequency (-3 dB)	10 Hz
Output	Active
General Specifications	
Supply Voltage	24V DC ± 25%
Power Consumption	< 1.5 W at I_{OUT} =20 mA
Current-Carrying Capacity of Cross-Connect	≤ 2A
Operating Temperature	0 °C…+55 °C
Storage Temperature	-20 °C…+85 °C
Rated Insulation Voltage	300V
Impulse Withstand Voltage	4kV
Isolation Voltage Input/Output	$2kV_{eff}$ /5 s
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D (mm)	92.4 x 17.5 x 112.4

Signal Conditioner	Cat. No.	Pkg. Quantity
	931S-A1A1N-DC	1

Passive Isolator

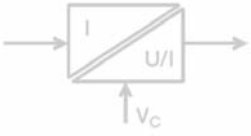
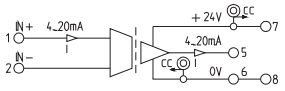
- Reliable isolation
- Very low power consumption

	931S-A1A1N-IP1	931S-A1A1N-IP2
		
Specifications	***Passive Isolator, 1-channel***	***Passive Isolator, 2-channel***
Wiring Diagram		
Standards Compliance	UL 508, UL 1604, CSA C22.2 No. 142-M1987, CSA C22.2 No. 213-1987, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007	UL 508, UL 1604, CSA C22.2 No. 142-M1987, CSA C22.2 No. 213-1987, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (Class 1, Div. 2, Groups A, B, C and D, NRAG/7.E10314), CSA, CE	cULus (Class 1, Div. 2, Groups A, B, C and D, NRAG/7.E10314), CE
Input Ratings		
Voltage	—	—
Current	0(4)...20 mA	0(4)...20 mA
Pick-up Current	<100 µA	<100 µA
Voltage Drop	approx. 3V at R_L =0 Ω, approx. 13V at R_L =500 Ω (I_{IN} =20mA)	approx. 3V at R_L =0 Ω, approx. 13V at R_L =500 Ω (I_{IN} =20mA)
Max Voltage	18V	18V
Max Current	50 mA	50 mA
Input	Passive	Passive
Output Ratings		
Voltage	—	—
Current	0(4)...20 mA	0(4)...20 mA
Load Impedance (voltage/current)	— / ≤ 500 Ω	— / ≤ 500 Ω
Temperature Coefficient	≤ 50 ppm/K of final value	≤ 50 ppm/K of final value
Residual Ripple	<20 mV	<20 mV
Step Response Time	4.5 ms	4.5 ms
Accuracy	< 0.1% of final value	< 0.1% of final value
Output	Active	Active
General Specifications		
Power Type	Input Loop Powered	Input Loop Powered
Operating Temperature	-25 °C...+70 °C	-25 °C...+70 °C
Storage Temperature	-40 °C...+80 °C	-40 °C...+80 °C
Rated Insulation Voltage	300V	300V
Impulse Withstand Voltage	6kV	6kV
Isolation Voltage Input - Output	4kV/1 s	4kV/1 s
Surge Category	III	III
Pollution Severity	2	2
Connection Type	Screw	Screw
L x W x D (mm)	92.4 x 17.5 x 112.4	92.4 x 17.5 x 112.4

Signal Conditioner	Cat. No.	Pkg. Quantity	Cat. No.	Pkg. Quantity
	931S-A1A1N-IP1	1	**931S-A1A1N-IP2**	1

Active Isolator

- Signal conversion
- Electrical isolation between input and output signals
- Power supply can be cross-connected using center jumpers

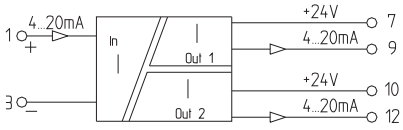
	931S-A2A2N-DC
	
Specifications	***Active Isolator***
Wiring Diagram	
Standards Compliance	UL 508, UL 1604, CSA C22.2 No. 142-M1987, CSA C22.2 No. 213-1987, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2:2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (Class 1, Div. 2, Groups A, B, C and D, NRAG/7.E10314), CE
Input Ratings	
Current	4...20 mA
Max Current	25 mA
Max Voltage	7V
Input	Passive
Output Ratings	
Current	4...20 mA
Load Impedance (voltage/current)	— \ ≤ 500 Ω
Accuracy	± 0.2% of final value
Temperature Coefficient	≤ 250 ppm/K
Step Response Time	< 30 ms
Cut-off Frequency (-3 dB)	≥ 15 Hz
Output	Active
General Specifications	
Supply Voltage	24V DC ± 20%
Current Consumption	<32 mA at I=20 mA
Current Carrying Capacity of Cross-Connect	≤ 2 A
Operating Temperature	0 °C…+55 °C
Storage Temperature	-20 °C…+85 °C
Rated Insulation Voltage	300V
Impulse Withstand Voltage	4kV
Isolation Voltage Input - Output	1.2kV$_{eff}$/1 s
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D (mm)	92.4 x 12.5 x 112.4

Signal Conditioner	Cat. No.	Pkg. Quantity
	931S-A2A2N-DC	1

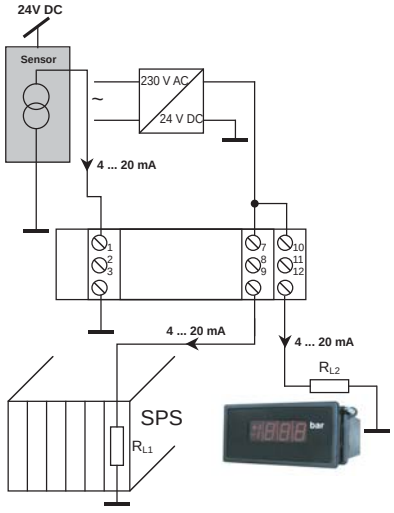
Passive Isolator, Splitter

- Electrical isolation
- Input and output current loop feed
- Very low power consumption
- No callibration necessary

931S-A2A5N-OP

Specifications	***Passive Isolator, Splitter***
Wiring Diagram	
Standards Compliance	UL 508, UL 1604, UL 60079-15, CSA E60079-15:02, CSA C22.2 No. 213-1987, CSA C22.2 No. 142-M1987, EN 50178:1997, EN 60079-0:2006, EN 60079-15:2005, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (Class 1, Div. 2/Zone 2, Groups A, B, C and D, NRAG/7.E10314 and NWGD/7.E10314), CE, ATEX (Class 1, Zone 2, Demko 09ATEX 0929065X)
Input Ratings	
Current	4...20 mA
Max Current	40 mA
Voltage Drop	3.8V
Input	Passive
Output Ratings	
Current	2 x 4...20 mA
Output Signal Limit	approx. 31 mA
Load Impedance (voltage/current)	— / R_L = (U_B-12 V) / 20 mA e.g. 600 Ω at 24 V
Accuracy	Typical 0.1%, max. 0.2%
Temperature Coefficient	≤ 150 ppm/K
Step Response Time	< 20 ms
Cut-off Frequency (-3 dB)	30 Hz
Output	Passive
General Specifications	
Supply Voltage	min. 12V DC, max. 30V DC
Power Type	Output Loop Powered
Operating Temperature	0 °C…+55 °C
Storage Temperature	-20 °C…+85 °C
Rated Insulation Voltage	300V
Impulse Withstand Voltage	4kV
Isolation Voltage Input - Output	$4kV_{eff}$/5s
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D (mm)	92.4 x 17.5 x 112.4

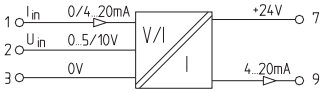
Signal Conditioner	**Cat. No.**	Pkg. Quantity
	931S-A2A5N-OP	1



Passive Converter

- Electrical isolation
- Very low power consumption
- Input range selected via DIP switch
- No callibration necessary

931S-C1A2D-OP

Specifications	***Passive Converter***
Wiring Diagram	
Standards Compliance	UL 508, CSA C22.2 No. 142-M1987, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (NRAQ/7.E113724), CE
Input Ratings	
Voltage	0...5V / 0...10V
Current	0...20 mA / 4...20 mA
Max Voltage	30V DC
Max Current	40 mA
Input Resistance (voltage/current)	0…5V: 210 kΩ; 0…10V: 430 kΩ / 51 Ω
Input	Passive
Output Ratings	
Current	4...20 mA
Output Signal Limit	approx. 24 mA
Load Impedance (current)	$R_L = (U_B\text{-}12\ V) / 20\ mA$ e.g. 600 Ω at 24 V
Accuracy	0.2% of measuring range final value
Temperature Coefficient	≤ 150 ppm/K
Residual Ripple	50 mV at 500 Ω
Step Response Time	< 10 Hz: 80 ms; 100 Hz: 50 ms
Cut-off Frequency (-3 dB)	< 10 Hz/ 100 Hz switchable
Output	Passive
General Specifications	
Supply Voltage	min. 12V DC, max. 30V DC
Power Type	Output Loop Powered
Operating Temperature	0 °C…+55 °C
Storage Temperature	-20 °C…+85 °C
Default Settings	0...20 mA, 10Hz
Rated Insulation Voltage	300V
Impulse Withstand Voltage	4 kV
Isolation Voltage Input - Output	4 kV_{eff} / 5 s
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D (mm)	92.4 x 17.4 x 112.4

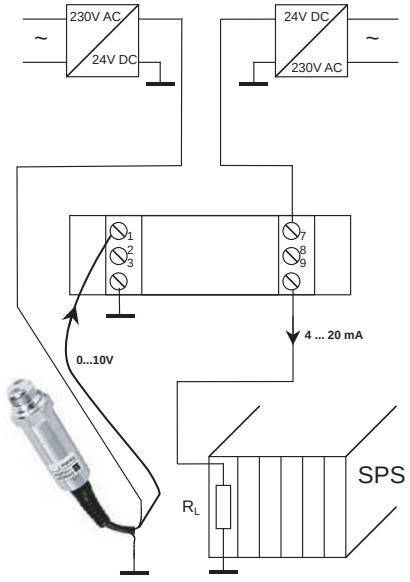
Signal Conditioner	Cat. No.	Pkg. Quantity
	931S-C1A2D-OP	1

Setting options/switch position

	SW 1			
Input	**1**	**2**	**3**	**4**
0…20 mA	□	□	□	□
4…20 mA	■	□	□	□
0…5 V	■	■	■	□
0…10 V	□	■	□	□
Transmission frequency				
10 Hz	□	□	□	■
100 Hz	□	□	□	□

■ = on
□ = off

Example of application



Active Converter, 3-Way

- Auxiliary power supply, 12...60V DC
- Current or voltage input configurable with DIP switch
- Input or output scaling

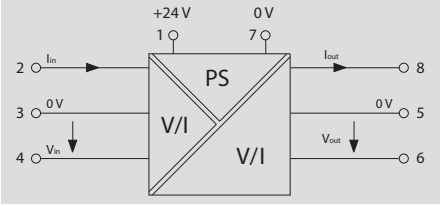
931S-C3C3J-DC

Specifications	***Active Converter, 3-Way***
Standards Compliance	UL 61010B-1, CSA C22.2 No. 61010-1-2004, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-4:2007
Certifications	cULus (PICQ/7.E345550), CE
Input Ratings	
Type	Current or voltage input ★
Input Signal Limits	0...22 mA / 0...10V
Sensor Supply	20 mA @ 24V DC output
Input Resistance (voltage/current)	1 MΩ / 100 Ω
Input	Active or Passive ★
Output Ratings	
Type	Current or voltage output ★
Output Signal Limits	0...22 mA / 0...10V
Accuracy	± 0.1% of end value
Load Resistance (voltage/current)	≥ 500 Ω / ≤ 1 kΩ
Step Response Time	< 220 ms (10...90%)
Residual Ripple	< 20 mV
Temperature Coefficient	≤ 0.05 % / °C
Resolution	3.5 µA/1.76 mV per bit
Output	Active
General Specifications	
Supply Voltage	12...60V DC
Power Consumption	< 2.5 W
Operating Temperature	0 °C...+60 °C
Storage Temperature	-25° C...+70° C
Impulse Withstand Voltage	4kV (1.2/50 µs)
Rated Voltage	$300V_{eff}$
Isolation Voltage Input-Output	2 kV
Surge Category	III
Pollution Severity	2
L x W x D (mm)	92.4 x 12.5 x 112.4
Connection Type	Screw

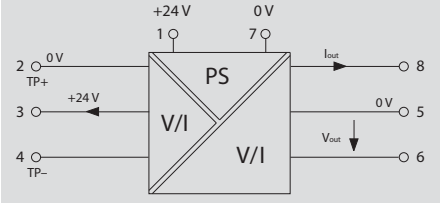
Signal Conditioner	Cat. No.	Pkg. Quantity
	931S-C3C3J-DC	1

★ Configurable with jumpers

Wiring possibility A (input passive)



Wiring possibility B (input active)



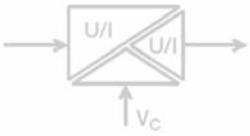
Connections

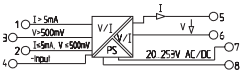
Terminal	Signal	
1	Signal +	Supply voltage
7	Signal –	
4	Signal +	Voltage input
3	Signal –	
2	Signal +	Current input
3	Signal –	
3	Signal +	Loop Powered Input
2	Signal –	
6	Signal +	Voltage output
5	Signal –	
8	Signal +	Current output
5	Signal –	

Active Converter, 3-Way

- Universally adjustable using DIP switch
- 931S Configurator to assist with DIP switch selection, download at www.ab.com
- Voltage supply 20...230V AC/DC
- Low power loss
- Adjustable transmission frequency

931S-C4C5D-BC



Specifications	***Active Converter, 3 Way***
Wiring Diagram	
Standards Compliance	UL 508, CSA C22.2 No. 142-M1987, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (NRAQ/7.E113724), CE
Input Ratings	
Voltage	± 20mV...± 200V
Current	± 0.1 mA...± 100 mA
Input Resistance (voltage/current)	1 MΩ /< 5 mA: approx. 100 Ω; >5 mA: approx. 5 Ω
Input	Passive
Output Ratings	
Voltage	0...±10V
Current	0...±20 mA
Load Impedance (voltage/current)	≥ 1 kΩ / ≤ 600 Ω
Accuracy	< 0.1% of final value
Temperature Coefficient	≤ 60 ppm/K end value
Offset Current/Voltage	20 µA / 10 mV
Step Response Time	1 ms/ 100 ms (switchable)
Adjustment Range, Zero Point	± 25% of measuring range of chosen output range
Adjustment Range, Amplification	0.33...3.30 x final value of selected output range
Offset Potentiometer	100%, -50%, 0%, 50%, 100% of measuring range
Cut-off Frequency (-3 dB)	> 10 kHz/ < 10 Hz
Output	Active
General Specifications	
Supply Voltage	22...230V AC/DC +10 %/ 48...62 Hz
Power Consumption	approx. 1 W
Operating Temperature	-10 °C...+70 °C
Storage Temperature	-40 °C...+85 °C
Default Settings	0...10V / 0...10V / 10Hz
Rated Insulation Voltage	600V
Impulse Withstand Voltage	5kV, 1.2/50 µs (IEC 255-4)
Isolation Voltage Input - Output	$4kV_{eff}$
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D (mm)	92.4 x 12.5 x 112.4

Signal Conditioner	Cat. No.	Pkg. Quantity
	931S-C4C5D-BC	1

Switch position/setting options

	Switch							
Input	**S1**				**S2**			
Input range	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
0 ... ±60 mV	□	□	□	□	□	□	□	■
0 ... ±100 mV	■	□	□	□	□	□	□	■
0 ... ±150 mV	□	■	□	□	□	□	□	■
0 ... ±300 mV	■	■	□	□	□	□	□	■
0 ... ±500 mV	□	□	■	□	□	□	□	■
0 ... ±1 V	■	□	■	□	□	■	□	■
0 ... ±5 V	□	■	■	□	□	■	□	■
0 ... ±10 V	■	■	■	□	□	■	□	■
0 ... ±100 V	□	□	□	■	□	□	■	■
0 ... ± ~0.3 mA	■	□	□	■	■	□	□	■
0 ... ±1 mA	□	■	□	■	■	□	□	■
0 ... ±5 mA	■	■	□	■	■	□	□	■
0 ... ±10 mA	□	□	■	■	■	□	□	■
0 ... ±20 mA	■	□	■	■	■	□	□	■
0 ... ±50 mA	□	■	■	■	■	□	□	■
4 ... ±20 mA*	■	■	■	■	■	□	□	■

*Offset conversion not calibrated

	Switch S2	4
calibratet ranges		■
Span-pot. activated: input x 0.33	.. x 3.30	

	Switch				
Output	**S1**			**S3**	
Output range	**5**	**6**	**7**	**1**	**2**
0 ... ±10 V	□	□	□	■	■
2 ... 10 V	■	□	□	■	■
0 ... ±5 V	□	■	□	■	■
1 ... 5 V	■	■	□	■	■
0 ... ±20 mA	□	□	■	□	□
4 ... 20 mA	■	□	■	□	□

Offset	**S1**			**S2**
(in % of output voltage)	**8**	**9**	**10**	**5**
0 %	□	□	□	■
-100 %	■	□	□	■
-50 %	□	■	□	■
+50 %	■	■	□	■
+100 %	□	□	■	■
Zero pot. activated: additional ±25 %				

	Switch S3	3
Bandwidth 10 kHz		□
Bandwidth 10 Hz		■

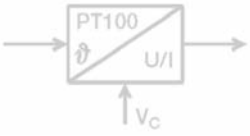
Set range can be documented on side of housing.

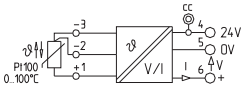
■ = on
□= off

Active Converter, PT100/RTD

- Two way isolation between input and output/power supply
- PT100 two or three conductor
- Power supply can be cross-connected using center jumpers
- Low power loss

931H-P2C1D-DC



Specifications	*Active Converter, PT100/RTD*
Wiring Diagram	
Standards Compliance	UL 508, UL 1604, UL 60079-15, CSA E60079-15:02, CSA C22.2 No. 213-1987, CSA C22.2 No. 142-M1987, EN 50178:1997, EN 60079-0:2006, EN 60079-15:2005, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (Class 1, Div. 2/Zone 2, Groups A, B, C and D, NRAG/7.E10314 and NWGD/7.E10314), CE, ATEX (Class 1, Zone 2, Demko 09ATEX 147279X)
Input Ratings	
Sensor	PT100/2-/3-conductor (to IEC 751)
Supply Current	0.8 mA
Temperature Input Rating	0…100 °C
Input	Passive
Output Ratings	
Voltage	0…10V / 0…5V
Current	0...20 mA / 4...20 mA
Load Impedance (voltage/current)	≥ 10 kΩ / ≤ 300 Ω, ≤ 400 Ω @ 24V
Accuracy	< 0.5% of measuring range
Temperature Coefficient	≤ 250 ppm/K of final value
Step Response Time	< 0.7 s
Output	Active
General Specifications	
Supply Voltage	24V DC ± 10 %
Power Consumption	approx. 0.6 W
Operating Temperature	0 °C…+55 °C
Storage Temperature	-20 °C…+85 °C
Default Settings	0…20 mA
Rated Insulation Voltage	100V
Impulse Withstand Voltage	1.5kV
Isolation Voltage Input - Output	$500V_{eff}$ / 1 s
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x H (mm)	88 x 6.1 x 97.8

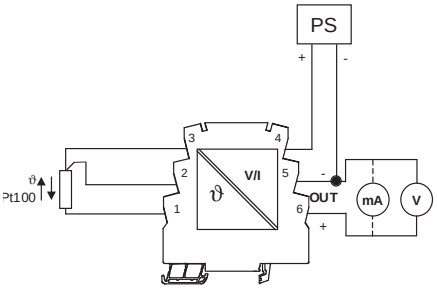
Signal Conditioner	Cat. No.	Pkg. Quantity
	931H-P2C1D-DC	1

Setting options/switch position

Output	Switch 1	2	3	4
) … 10 V	■	■	■	□
) … 20 mA	□	□	□	□
4 … 20 mA	□	□	□	■
) … 5 V	■	■	■	■

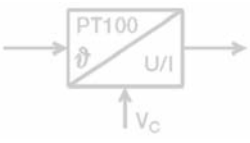
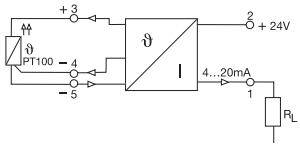
■ = on
□ = off

Connection



Passive Converter, PT100/RTD

- For two or three conductor PT100 sensors
- Loop-fed output current
- High accuracy and linearity

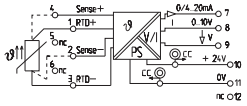
	931H-P2A2N-OP
	
Specifications	***Passive Converter, PT100/RTD***
Wiring Diagram	
Standards Compliance	UL 508, CSA C22.2 No. 142-M1987, CSA C22.2 No. 0-10, CSA C22.2 No. 14-10, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cURus (NRAQ2/8.E113724), CSA, CE
Input Ratings	
Sensor	PT100/2-/3-conductor (to IEC 751)
Temperature Input Range	0 °C…+200 °C
Input	Passive
Output Ratings	
Current	4...20 mA
Load Impedance (voltage/current)	— / ≤ 600 Ω
Accuracy	typical 0.2%, max. 0.5% of FSR
Step Response Time	10 ms
Output	Passive
General Specifications	
Supply Voltage	9...30V DC
Power Type	Output Loop Powered
Operating Temperature	0 °C…+50 °C
Storage Temperature	-20 °C…+85 °C
Connection Type	Tension Clamp
L x W x H (mm)	91 x 6 x 93.2

Signal Conditioner	**Cat. No.**	Pkg. Quantity
	931H-P2A2N-OP	1
End Barrier (required)	**931H-EB1**	10

Active Converter, 3-Way, RTD

- Universally adjustable using DIP switch
- Bul. 931S Configurator to assist with DIP switch selection, download at www.ab.com
- Three way isolation
- Linearization
- Power supply can be cross-connected using center jumpers

931S-P1C2D-DC

Specifications	***Active Converter, 3 Way, RTD***
Wiring Diagram	
Standards Compliance	UL 508, UL 1604, CSA C22.2 No. 142-M1987, CSA C22.2 No. 213-1987, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (Class 1, Div. 2, Groups A, B, C and D, NRAG/7.E10314), CE
Input Ratings	
Sensor	PT100/2-/3-/4-cond., Ni100/2-/3-/4-cond., potentiometer: min. 0...100 Ω, max. 0...100 kΩ, resistor: 0...450 Ω
Temperature Range	Configurable
Input	Passive
Output Ratings	
Voltage	0...10V
Current	0…20 mA / 4…20 mA
Load Impedance (voltage/current)	≥ 1 kΩ / ≤ 600 Ω
Step Response Time	fast/ slow: 2-, 3-, 4-conductor: 1.2 / 2.2 s; potentiometer: 0.5 /1.1 s
Line resistance in measuring	50 Ω for 3- and 4- conductor
Offset Current/ Voltage	max 100 µA/max. 0.05V
Wire Break Detection	LED flashed (output value > 20 mA, >10V)
Fine Adjustment	≥ ± 5 %, Version 1: > = 12.5% / Poti: 12.5...25%
Status Indicator	Active: LED On; Wire broken: LED Flashing; Error: LED Off
Output	Active
General Specifications	
Supply Voltage	24V DC ± 25 %
Power Consumption	830…880…980 mW at I_{OUT} = 20 mA
Current-carrying Capacity of Cross-Connect	≤ 2 A
Operating Temperature	0 °C…+55 °C
Storage Temperature	-20 °C…+85 °C
Default Settings	PT100/3-cond./ 0…100°C / 4…20 mA / man. fine calib.: off / slow step response
Rated Insulation Voltage	300V
Impulse Withstand Voltage	4 kV
Isolation Voltage Input - Output	2 kV_{eff} / 5 s
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D	92.4 x 17.5 x 112.4

Signal Conditioner	**Cat. No.**	Pkg. Quantity
	931S-P1C2D-DC	1

Switch positions/setting options

■ = on
□ = off

Selection of input		Switch 1		
Input		1	2	3
PT100	2-conductor	■	■	■
PT100	3-conductor	□	■	■
PT100	4-conductor	■	□	■
R	2-conductor	□	□	■
NI100	2-conductor	■	■	□
NI100	3-conductor	□	■	□
NI100	4-conductor	■	□	□
Potentiometer		□	□	□

Selection of minimum input size			Switch 1			
ϑ_{min}	R_{min}	$Poti_{min}$	4	5	6	7
0 °C	0 Ω	0 %	■	■	■	■
–10 °C	10 Ω	10 %	■	■	■	□
–20 °C	20 Ω	20 %	■	■	□	■
–25 °C	20 Ω	25 %	■	■	□	□
–30 °C	30 Ω	30 %	■	□	■	■
–40 °C	40 Ω	40 %	■	□	■	□
–50 °C	50 Ω	50 %	■	□	□	■
–60 °C	60 Ω	60 %	■	□	□	□
–70 °C	70 Ω	70 %	□	■	■	■
–80 °C	80 Ω	80 %	□	■	■	□
–90 °C	90 Ω		□	■	□	■
–100 °C	100 Ω		□	■	□	□
–150 °C	150 Ω		□	□	■	■
–200 °C	200 Ω		□	□	■	□
Special range			□	□	□	■

Activating the manual fine calibration	Switch 1
Man. Cal.	8
On	□
Off	■

Choice of measuring range			Switch 2				
T	R	Potentiometer	1	2	3	4	5
40K	20 Ω	20 %	■	■	■	■	■
50K	25 Ω	25 %	■	■	■	■	□
60K	30 Ω	30 %	■	■	■	□	■
70K	35 Ω	35 %	■	■	■	□	□
80K	40 Ω	40 %	■	■	□	■	■
90K	45 Ω	45 %	■	■	□	■	□
100K	50 Ω	50 %	■	■	□	□	■
110K	55 Ω	55 %	■	■	□	□	v
120K	60 Ω	60 %	■	□	■	■	■
125K	62.5 Ω	62.5 %	■	□	■	■	□
130K	65 Ω	65 %	■	□	■	□	■
140K	70 Ω	70 %	■	□	■	□	□
150K	75 Ω	75 %	■	□	□	■	■
160K	80 Ω	80 %	■	□	□	■	□
170K	85 Ω	85 %	■	□	□	□	■
180K	90 Ω	90 %	■	□	□	□	□
190K	95 Ω	95 %	□	■	■	■	■
200K	100 Ω	100 %	□	■	■	■	□
250K	125 Ω	---	□	■	■	□	■
300K	150 Ω	---	□	■	■	□	□
350K	175 Ω	---	□	■	□	■	■
400K	200 Ω	---	□	■	□	■	□
450K	225 Ω	---	□	■	□	□	■
500K	250 Ω	---	□	■	□	□	□
550K	275 Ω	---	□	□	■	■	■
600K	300 Ω	---	□	□	■	■	□
650K	325 Ω	---	□	□	■	□	■
700K	350 Ω	---	□	□	■	□	□
750K	375 Ω	---	□	□	□	■	■
800K	400 Ω	---	□	□	□	■	□
850K	425 Ω	---	□	□	□	□	■
900K	450 Ω	---	□	□	□	□	□

Selection of output	Switch 2	
Output	6	7
0...10V	■	□
0..20 mA	□	□
4..20 mA	□	■

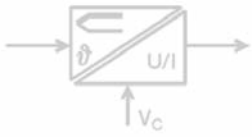
Selection of step response time	Switch 2
Step Response	8
Slow	■
Quick *	□

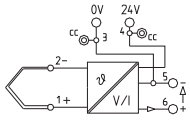
* less exact measuring

Thermocouple, Type J

- Two-way isolation between input and output/power supply
- Cold junction compensation
- Linearization
- Output can be switched via DIP switch

931H-T1C1D-DC



Specifications	***Thermocouple, Type J***
Wiring Diagram	
Standards Compliance	UL 508, UL 1604, UL 60079-15, CSA E60079-15:02, CSA C22.2 No. 213-1987, CSA C22.2 No. 142-M1987, EN 50178:1997, EN 60079-0:2006, EN 60079-15:2005, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (Class 1, Div. 2/Zone 2, Groups A, B, C and D, NRAG/7.E10314 and NWGD/7.E10314), CE, ATEX (Class 1, Zone 2, Demko 09ATEX 147279X)
Input Ratings	
Sensor	Thermo element to IEC 584, type: J
Temperature Input Rating	0…700 °C
Input	Passive
Output Ratings	
Voltage	0…10V / 0…5V
Current	0...20 mA / 4...20 mA
Load Impedance (voltage/current)	≥ 10 kΩ /≤ 300 Ω, ≤ 400 Ω @ 24V
Accuracy	< 0.7% of measuring range
Temperature Coefficient	≤ 250 ppm/K of final value
Step Response Time	< 0.7 s
Wire Break Detection	output value:.> 20 mA, >10V
Residual Ripple	< 20 mV_{eff}
Output	Active
General Specifications	
Supply Voltage	24V DC ± 10 %
Power Consumption	approx. 0.6 W
Current Carrying Capacity of Cross Connect	≤ 2 A
Operating Temperature	0 °C…+55 °C
Storage Temperature	-20 °C…+85 °C
Default Settings	0…20 mA
Rated Insulation Voltage	100V
Impulse Withstand Voltage	1.5 kV
Isolation Voltage Input - Output	500V_{eff} / 1 s
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D (mm)	88 x 6.1 x 97.8

Signal Conditioner	Cat. No.	Pkg. Quantity
	931H-T1C1D-DC	1

Setting options/switch position

Output	Switch 1	2	3	4
0 … 10 V	■	■	■	□
0 … 20 mA	□	□	□	□
4 … 20 mA	□	□	□	■
0 … 5 V	■	■	■	■

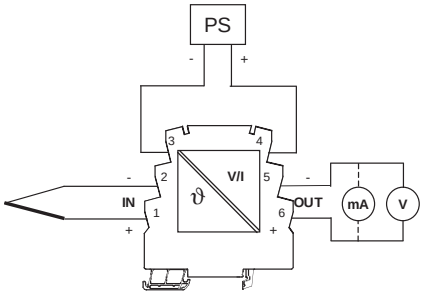
■ = on
□ = off

Setting options/switch position

Output	Switch 1	2	3	4
0 … 10 V	■	■	■	□
0 … 20 mA	□	□	□	□
4 … 20 mA	□	□	□	■
0 … 5 V	■	■	■	■

■ = on
□ = off

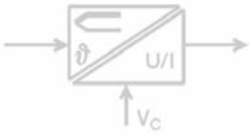
Connection

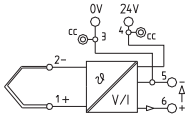


Thermocouple, Type K

- Two-way isolation between input and output/power supply
- Cold junction compensation
- Linearization
- Output can be switched via DIP switch

931H-T2C1D-DC



Specifications	***Thermocouple, Type K***
Wiring Diagram	
Standards Compliance	UL 508, UL 1604, UL 60079-15, CSA E60079-15:02, CSA C22.2 No. 213-1987, CSA C22.2 No. 142-M1987, EN 50178:1997, EN 60079-0:2006, EN 60079-15:2005, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (Class 1, Div. 2/Zone 2, Groups A, B, C and D, NRAG/7.E10314 and NWGD/7.E10314), CE, ATEX (Class 1, Zone 2, Demko 09ATEX 147279X)
Input Ratings	
Sensor	Thermo element to IEC 584, type: K
Temperature Input Rating	0…1000 °C
Input	Passive
Output Ratings	
Voltage	0…10V / 0…5V
Current	0...20 mA / 4...20 mA
Load Impedance (voltage/current)	≥ 10 kΩ / ≤ 300 Ω, ≤ 400 Ω @ 24V
Accuracy	< 0.6% of measuring range
Temperature Coefficient	≤ 250 ppm/K of final value
Step Response Time	< 0.7 s
Wire Break Detection	output value: .> 20 mA, >10V
Residual Ripple	< 20 mV_{eff}
Output	Active
General Specifications	
Supply Voltage	24V DC ± 10 %
Power Consumption	approx. 0.6 W
Current Carrying Capacity of Cross Connect	≤ 2 A
Operating Temperature	0 °C…+55 °C
Storage Temperature	-20 °C…+85 °C
Default Settings	0…20 mA
Rated Insulation Voltage	100V
Impulse Withstand Voltage	1.5 kV
Isolation Voltage Input - Output	500V_{eff} / 1 s
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D (mm)	88 x 6.1 x 97.8

Signal Conditioner	Cat. No.	Pkg. Quantity
	931H-T2C1D-DC	1

Setting options/switch position

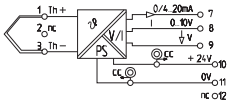
	Switch			
Output	**1**	**2**	**3**	**4**
0 … 10 V	■	■	■	□
0 … 20 mA	□	□	□	□
4 … 20 mA	□	□	□	■
0 … 5 V	■	■	■	■

■ = on
□ = off

Universal Thermocouple, 3-Way

- Universally adjustable using DIP switch
- 931S Configurator to assist with DIP switch selection, download at www.ab.com
- Three way isolation
- Internal cold-junction compensation
- Power supply can be cross-connected using center jumpers

931S-T9C2D-DC

Specifications	***Universal Thermocouple, 3 Way***
Wiring Diagram	
Standards Compliance	UL 508, UL 1604, CSA C22.2 No. 142-M1987, CSA C22.2 No. 213-1987, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (Class 1, Div. 2, Groups A, B, C and D, NRAG/7.E10314), CE
Input Ratings	
Sensor	Thermo element (IEC 584) type: K,J,T,E,N,R,S,B
Temperature Range	-200…+1820 °C
Input	Passive
Output Ratings	
Voltage	0...10V
Current	0…20 mA / 4…20 mA
Load Impedance (voltage/current)	≥ 1 kΩ / ≤ 600 Ω
Step Response Time	max. 1.4 s; with filter, max. 7.5 s
Line resistance in measuring circuit	50 Ω for 3- and 4-conductor
Offset Current/Voltage	≥ 1 kΩ / ≤ 600 Ω
Wire Break Detection	LED Flashes (output value > 20 mA, >10V)
Fine Adjustment	± 5 % (switchable)
Status Indicator	Active: LED On; Wire Broken: LED Flashes; Error: LED Off
Output	Active
General Specifications	
Supply Voltage	24V DC ± 25 %
Power Consumption	830…880…980mW at I_{OUT} = 20 mA
Current-carrying Capacity of Cross-Connect	≤ 2 A
Operating Temperature	0 °C…+55 °C
Storage Temperature	-20 °C…+85 °C
Default Settings	Type K/ 0…1000 °C / 4…20 mA / filter off / man. calibration off
Rated Insulation Voltage	300V
Impulse Withstand Voltage	4 kV
Isolation Voltage Input - Output	2 kV_{eff} / 5 s
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D (mm)	92.4 x 17.5 x 112.4

Signal Conditioner	Cat. No.	Pkg. Quantity
	931S-T9C2D-DC	1

Select of thermocoupler

Typ	SW1 1	2	3
K	■	■	■
J	□	■	■
T	■	□	■
E	□	□	■
N	■	■	□
R	□	■	□
S	■	□	□
B	□	□	□

Selection of minimum temperature

min	SW1 4	5	6	7
0°C	■	■	■	■
-10°C	■	■	■	□
-20°C	■	■	□	■
-30°C	■	■	□	□
-40°C	■	□	■	■
-50°C	■	□	■	□
-100°C	■	□	□	■
-150°C	■	□	□	□
-200°C	□	■	■	■
+50°C	□	■	■	□
+100°C	□	■	□	■
+150°C	□	■	□	□
+200°C	□	□	■	■
+250°C	□	□	■	□
500°C	□	□	□	■
Special range	□	□	□	□

Selection of temperature span

Span	SW2 1	2	3	4	5
100°C	■	■	■	■	■
150°C	■	■	■	■	□
200°C	■	■	■	□	■
250°C	■	■	■	□	□
300°C	■	■	□	■	■
350°C	■	■	□	■	□
400°C	■	■	□	□	■
450°C	■	■	□	□	□
500°C	■	□	■	■	■
550°C	■	□	■	■	□
600°C	■	□	■	□	■
650°C	■	□	■	□	□
700°C	■	□	□	■	■
750°C	■	□	□	■	□
800°C	■	□	□	□	■
850°C	■	□	□	□	□
900°C	□	■	■	■	■
950°C	□	■	■	■	□
1000°C	□	■	■	□	■
1050°C	□	■	■	□	□
1100°C	□	■	□	■	■
1150°C	□	■	□	■	□
1200°C	□	■	□	□	■
1250°C	□	■	□	□	□
1300°C	□	□	■	■	■
1350°C	□	□	■	■	□
1400°C	□	□	■	□	■
1450°C	□	□	■	□	□
1500°C	□	□	□	■	■
1600°C	□	□	□	■	□
1700°C	□	□	□	□	■
1800°C	□	□	□	□	□

■ = on
□ = off

Selection of output

Output	SW2 6	7
0...10V	■	□
0...20mA	□	□
4...20mA	□	■

Switching on the manual fine adjustment

man. adjust.	SW1 8
off	□
on	■

Switching on the filter function

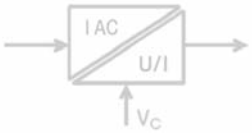
Filter	SW2 8
off	□
on	■

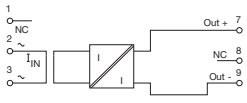
Temperature coefficient

K	-200°C...-150°C	± (5K + 0,1% of set range)
	-150°C...1200°C	± (3K + 0,1% of set range)
	1200°C...1372°C	± (4K + 0,1% of set range)
J	-200°C...-150°C	± (4K + 0,1% of set range)
	-150°C...1200°C	± (3K + 0,1% of set range)
T	-200°C...-150°C	± (5K + 0,1% of set range)
	-150°C ...400°C	± (3K + 0,1% of set range)
E	-200°C...-150°C	± (4K + 0,1% of set range)
	-150°C...1000°C	± (3K + 0,1% of set range)
N	-200°C...-150°C	± (6K + 0,1% of set range)
	-150°C...1300°C	± (3K + 0,1% of set range)
R	-50°C ...200°C	± (10K + 0,1% of set range)
	200°C...1760°C	± (6K + 0,1% of set range)
S	-50°C ...200°C	± (10K + 0,1% of set range)
	200°C...1760°C	± (6K + 0,1% of set range)
B	50°C ...250°C	± (25K + 0,1% of set range)
	250°C ...500°C	± (10K + 0,1% of set range)
	500°C...1820°C	± (6K + 0,1% of set range)

Passive Converter, Current Monitoring - Loop Powered

931S-A3A2D-OP



Specifications	***Passive Converter, Monitoring - Loop Powered***
Wiring Diagram	
Standards Compliance	UL 508, UL 1604, UL 60079-15, CSA E60079-15:02, CSA C22.2 No. 213-1987, CSA C22.2 No. 142-M1987, EN 50178:1997, EN 60079-0:2006, EN 60079-15:2005, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (Class 1, Div. 2/Zone 2, Groups A, B, C and D, NRAG/7.E10314 and NWGD/7.E10314), CE, ATEX (Class 1, Zone 2, Demko 09ATEX 0929065X)
Input Ratings	
Current	0…1 A AC/ 0…5 A AC/ 0…10 A AC
Frequency	50…60 Hz
Max Current	100 A for 1 s
Voltage of Measuring Circuit	250 V AC
Sensor	Transforming (internally)
Input	Passive
Output Ratings	
Voltage	—
Current	4…20 mA
Load Impedance (voltage/current)	— / ≤ 600 Ω
Step Response Time	Typically 700 ms
Temperature Coefficient	≤ 200 ppm/ K
Accuracy	0.5% FSR
Offset Current/Voltage	max. 100 µA/ —
Status Indicator	LED ON: OK; FLASHING: signal out of range; LED OFF: Error
Output	Passive
General Specifications	
Supply Voltage	13...30V DC
Power Type	Output Loop Powered
Operating Temperature	0 °C…+50 °C
Storage Temperature	-20 °C…+70 °C
Default Settings	0…5 A AC, 4…20 mA
Rated Insulation Voltage	300V
Impulse Withstand Voltage	6kV
Isolation Voltage Input - Output	$4kV_{eff}$ / 5 s
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D (mm)	72 x 22.5 x 92.4

Signal Conditioner	Cat. No.	Pkg. Quantity
	931S-A3A2D-OP	1

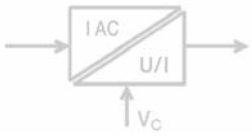
	Switch			
Input	**1**	**2**	**3**	**4**
1 Aa	□	□	■	
5 Aa	□	■	□	
10 Aa	■	□	□	

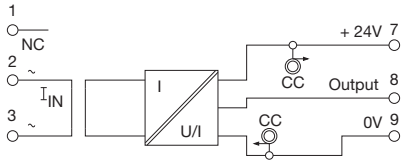
	Switch			
Frequency	**1**	**2**	**3**	**4**
50 Hz				□
60 Hz				■

■ = on
□ = off

Active Converter, Monitoring

931S-A3C2D-DC



Specifications	***Active Converter, Monitoring***
Wiring Diagram	
Standards Compliance	UL 508, CSA C22.2 No. 142-M1987, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (NRAQ/7.E113724), CE
Input Ratings	
Current	0…1 A AC/ 0…5 A AC/ 0…10 A AC
Frequency	50…60 Hz
Max Current	100 A for 1 s
Voltage of Measuring Circuit	250 V AC
Sensor	Transforming (internally)
Input	Passive
Output Ratings	
Voltage	0…10V
Current	0…20 mA / 4…20 mA
Load Impedance (voltage/current)	≥ 1 kΩ / ≤ 600 Ω
Step Response Time	Typically 700 ms
Temperature Coefficient	≤ 200 ppm/ K
Accuracy	0.5% FSR
Offset Current / Voltage	max. 100 µA/ max. 0.05V
Status Indicator	LED ON: OK; FLASHING: signal out of range; LED OFF: Error
Output	Active
General Specifications	
Supply Voltage	24V DC ± 10 %
Current Consumption	40 mA at I_{OUT} =20 mA
Current-carrying Capacity of Cross-Connect	≤ 2 A
Operating Temperature	0 °C…+50 °C
Storage Temperature	-20 °C…+70 °C
Default Settings	0…5 A AC, 4…20 mA
Rated Insulation Voltage	300V
Impulse Withstand Voltage	6kV
Isolation Voltage Input - Output	$4kV_{eff}$ / 5 s
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D (mm)	72 x 22.5 x 92.4

Signal Conditioner	Cat. No.	Pkg. Quantity
	931S-A3C2D-DC	1

	Switch							
Input	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 Aa	□	□	■					
5 Aa	□	■	□					
10 Aa	■	□	□					

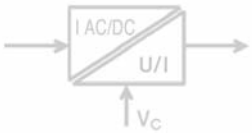
	Switch							
Output	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0...10V				■	□	■	■	□
0...20 mA				□	□	□	□	■
4...20 mA				□	■	□	□	■

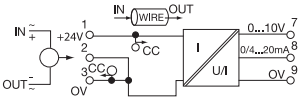
■ = on
□ = off

Active Isolator, Half-Effect Current Monitoring

- Input/output electrically isolated
- Input and output ranges adjustable using DIP switch
- No calibration necessary

931S-A4C2D-DCHALL



Specifications	***Active Isolator, Half-Effect Monitoring***
Wiring Diagram	
Standards Compliance	UL 508, CSA C22.2 No. 142-M1987, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (NRAQ/7.E113724), CE
Input Ratings	
Current	0…20 A AC/DC / 0…25 A AC/DC / 0…30 A AC/DC
Frequency	0…2 kHz (true RMS to DC converter)
Voltage of Measuring Circuit	400V AC, >400V AC depends on conductor insulation
Sensor	Hall sensor (internal)
Diameter of Entry	8 mm
Input	Passive
Output Ratings	
Voltage	0…10V
Current	0…20 mA / 4…20 mA
Load Impedance (voltage/current)	≥ 1 kΩ / ≤ 600 Ω
Step Response Time	Typically 700 ms
Temperature Coefficient	≤ 650 ppm/ K
Accuracy	1% FSR
Offset Current / Voltage	max. 150 µA/ max. 0.08V
Status Indicator	LED ON: OK; FLASHING: signal out of range; LED OFF: Error
Output	Active
General Specifications	
Supply Voltage	24V DC ± 10 %
Current Consumption	50 mA at I_{OUT} =20 mA
Current-carrying Capacity of Cross-Connect	≤ 2 A
Operating Temperature	0 °C…+50 °C
Storage Temperature	-20 °C…+70 °C
Default Settings	0…25 A, 4…20 mA
Rated Insulation Voltage	300V
Impulse Withstand Voltage	6kV
Isolation Voltage Input - Output	$4kV_{eff}$ / 5 s
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D (mm)	92.4 x 22.5 x 112.4

Signal Conditioner	Cat. No.	Pkg. Quantity
	931S-A4C2D-DCHALL	1

	Switch				
Input	**1**	**2**	**3**	**4**	**5**
20 A	□	□			
25 A	□	■			
30 A	■	□			

■ = on
□ = off

	Switch				
Output	**1**	**2**	**3**	**4**	**5**
0...10V			■	□	
0...20 mA			□	□	
4...20 mA			□	■	

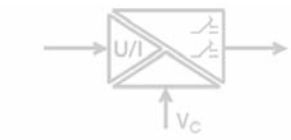
■ = on
□ = off

	Switch				
Current Type	**1**	**2**	**3**	**4**	**5**
AC Current					■
DC Current					□

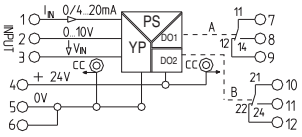
■ = on
□ = off

Isolator, 3-Way, Limit Value Monitoring

- Three-way Isolation
- Low Trip/ High Trip
- Failsafe/Non-Failsafe
- Two relay outputs



931S-C2R1D-DC2R

Specifications	*Isolator, 3-Way, Limit Value Monitoring*
Wiring Diagram	
Standards Compliance	UL 508, CSA C22.2 No. 142-M1987, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (NRAQ/7.E113724), CE
Input Ratings	
Voltage	0...10V
Current	0...20 mA / 4...20 mA
Input Resistance (voltage/current)	≥ 100 kΩ / ≤ 110 Ω
Input	Passive
Output Ratings	
Contact Complement	2 change-over contacts
Contact Material	AgNi 90/10
Switching Thresholds	1...90% (independently for channel 1 and channel 2)
Hysteresis	1...10% (independently for channel 1 and channel 2)
Switching Voltage, Max	253V AC
Step Response Time	≤ 62 ms
Continuous Current	3 A
Temperature Coefficient	≤ 500 ppm/K
Status Indicator	LED green ON: OK, LED red ON: alarm (per channel)
Output	Relay
General Specifications	
Supply Voltage	24V DC ± 25 %
Power Consumption	typically 1 W both relays picked up
Current-carrying Capacity of Cross-Connect.	≤ 2 A
Operating Temperature	-10 °C...+55 °C
Storage Temperature	-20 °C...+85 °C
Default Settings	channel A/B: low trip and FAILSAFE
Rated Voltage	300V
Impulse Withstand Voltage	4kV
Isolation Voltage Input - Output	$2kV_{eff}$ /5 s
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D (mm)	92.4 x 17.5 x 112.4

Signal Conditioner	Cat. No.	Pkg. Quantity
	931S-C2R1D-DC2R	1

Switch position/setting options

	SW 1			
function	**1**	**2**	**3**	**4**
Channel A High Trip	■			
Channel A Low Trip	□			
Channel B High Trip		■		
Channel B Low Trip		□		
FAILSAFE, Channel 1 & 2			□	□
NON FAILSAFE, Chan. 1 & 2			■	■

■ = on
□ = off

NON FAILSAFE: The relay picks up when the alarm is triggered

FAILSAFE: The relay drops out when the arlarm is triggered. An alarm is also triggered in the FAILSAFE mode, if for example, the operating voltage to the moduls fail

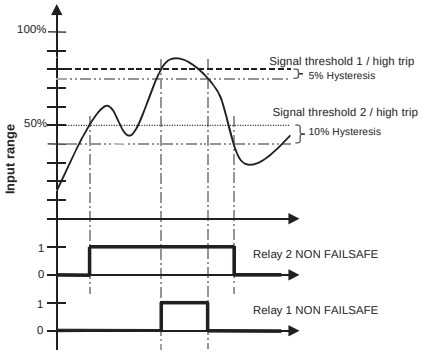
Low Trip: Alarm is triggered if the signal is undershoot the threshold.

High Trip: Alarm is triggered if the signal is overshoot the threshold.

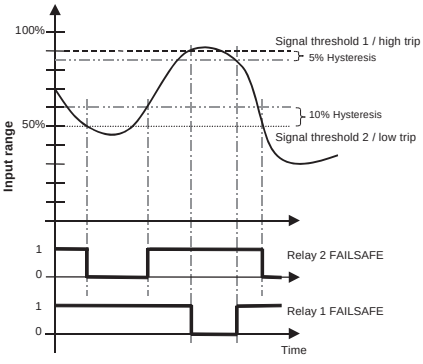
Signal threshold: Adjustments of the signal threshold (1...90)% are made for channel 1 with the potentiometer P1, and separately for channel 2 via potentiometer P2.

Hysterese: Adjustments of the hysteresis (1...10)% are made for channel 1 with the potentiometer P3, and separately for channel 2 via potentiometer P3.

Example 1



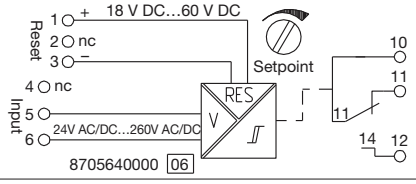
Example 2



Isolator, 3-Way, Voltage Monitoring

- Three-way isolation
- Monitoring of single-phase systems up to 260V AC/DC
- 4 input ranges selected by DIP switches
- One relay with change-over contact
- Switchable hysteresis
- Switch adjusted via potentiometer
- Reset input

931S-V1R1D-MC1R

Specifications	*Isolator, 3-Way, Monitoring*
Wiring Diagram	
Standards Compliance	EN 50178UL 508, CSA C22.2 No. 142-M1987, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (NRAQ/7.E113724), CE
Input Ratings	
Voltage	24…70 / 70…140 / 140…210 / 210…260V AC / DC
Frequency	50…60 Hz
Max Voltage	260V AC / DC
Input	Passive
Output Ratings	
Switching Voltage, Max	250V AC
Switching Current, Max	8 A
Continuous Current	3 A
Step Response Time	< 300 ms
Temperature Coefficient	≤ 250 ppm/ K
Accuracy	< 0.3% of set range
Hysteresis	24…70V AC, small = 5V / large = 10V
Status Indicator	LED green = OK / LED red/yellow = alarm status
Output	Relay
General Specifications	
Supply Voltage	from the measuring circuit
Reset Input Voltage Range	18V DC...30V DC
Minimum Pulse Length	700 ms
Operating Temperature	-10 °C…+55 °C
Storage Temperature	-20 °C…+70 °C
Default Settings	DIP switches: ON = 1,2,5,8 / OFF = 3,4,6,7
Rated Insulation Voltage	300V
Impulse Withstand Voltage	4 kV
Isolation Voltage Input - Output	2 kV_{eff}
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D (mm)	96.5 x 17.5 x 112.5

Signal Conditioner	Cat. No.	Pkg. Quantity
	931S-V1R1D-MC1R	1

Input	1	2	3	4	5	6	7	8
24 V AC/DC...70 V AC/DC				■	□	□	□	
70 V AC/DC...140 V AC/DC				□	□	□	■	
140 V AC/DC...210 V AC/DC				□	□	■	□	
210 V AC/DC...260 V AC/DC				□	■	□	□	
Trip								
High Trip	■							
Low Trip	□							
Memory								
Memory on		□						
Memory out		■						
Hysteresis								
Hysteresis small			□					
Hysteresis large			■					
Input voltage								
AC voltage								■
DC voltage								□

■ = on
□ = out

Status indicator

- ● Set value not exceeded.
- ● Alarm status.
- ○ Alarm status can be reset because set value has been exceeded.

Abb.1: Overvoltage monitoring
Alarm set to "high trip"
(Set permanently to closed-circuit principle.)

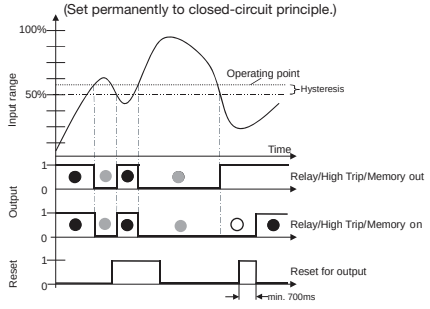
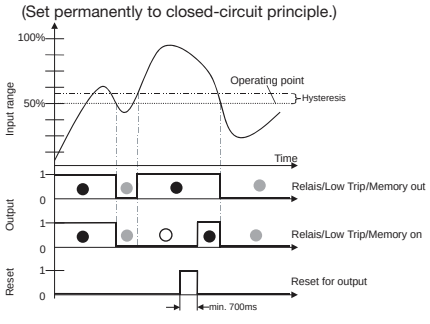
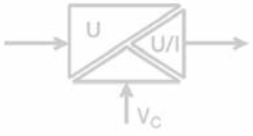


Abb.2: Undervoltage monitoring
Alarm set to "low trip"
(Set permanently to closed-circuit principle.)

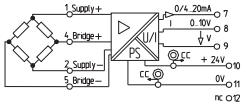


Bridge Converter, 3-Way

- Three-way isolation
- Input and output ranges adjustable using DIP switch
- No calibration necessary
- Inverse output signals possible



931S-B1C6D-DC

Specifications	***Bridge Converter, 3 Way***
Wiring Diagram	
Standards Compliance	UL 508, CSA C22.2 No. 142-M1987, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (NRAQ/7.E113724), CE
Input Ratings	
Input Voltage	-500mV...+500mV (adjustable)
Input Resistance	> 1 mΩ
Input	Active
Output Ratings	
Voltage	0…5V / 5…0V / 10…0V / 0…10V
Current	0…20 mA / 20…0 mA / 4…20 mA / 20…4 mA
Load Impedance (voltage/current)	≥ 1 kΩ / ≤ 600 Ω
Step Response Time	Typically <200 ms
Temperature Coefficient	≤ 250 ppm/ K of output range
Accuracy	0.3%of output range
Offset Current / Voltage	max. 100 µA/ max. 0.05V
Status Indicator	green LED
Wire Break Detection	output: 0V or 0/4 mA
Bridge Supply Voltage	+10V, +5V, 4.8…10.2V; offset adjustable; max. 40 mA
Output	Active
General Specifications	
Supply Voltage	24V DC ± 25 %
Power Consumption	max. 1.9 W at I_{OUT} = 20 mA
Current-carrying Capacity of Cross-connect	≤ 2 A
Operating Temperature	0 °C…+55 °C
Storage Temperature	-20 °C…+85 °C
Default Settings	-500 mV…+500 mV / 0…10V / + 10V / standard
Rated Insulation Voltage	300V
Impulse Withstand Voltage	4kV
Isolation Voltage Input - Output	$2kV_{eff}$ /5 s
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D (mm)	92.4 x 17.5 x 112.4

Signal Conditioner	Cat. No.	Pkg. Quantity
	931S-B1C6D-DC	1

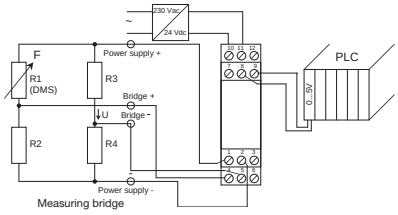
Switch position/setting options

	SW 1									
Input voltage	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0…10 mV						□	□	□	□	
0…20 mV						□	□	□	■	
0...50 mV						□	□	■	□	
0...100 mV						□	□	■	■	
0...200 mV						□	■	□	□	
0...500 mV						□	■	□	■	
-10 mV...10 mV						■	□	□	□	
· 20 mV...20 mV						■	□	□	■	
· 50 mV...50 mV						■	□	■	□	
· 100 mV...100 mV						■	□	■	■	
· 200 mV...200 mV						■	■	□	□	
· 500 mV...500 mV						■	■	□	■	
Output										
0...+10 V					□	□				
0...+5 V					□	■				
0...20 mA					■	□				
4...20 mA					■	■				
Bridge supply voltage										
+10V	■	□	□							
+5V	■	□	■							
+4.8...+10.2V adjustable	□	■	□							
+4.8...+10.2V adjustable man. adjustment and offset possible	□	■	■							
Transmission method										
standard output signal										□
inverse output signal										■

■ = on
□ = off

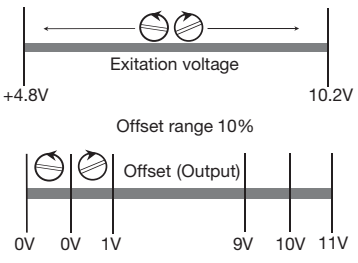
Status LED	
LED on	normal operating
LED off	Error
LED blinks slow	measurement range undershoot Uin < Umax – 10 %
LED blinks fast	measurement range overshoot Uin < Umax + 10 %

Application



Example for bridge supply voltage

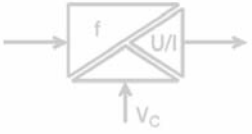
Temperature adjustment:	
Input voltage	0…10 mA
Output	0…10 V
Bridge supply voltage	+4.8…10.2 V
Bridge excitation	1 mV/V (Declaration from manufacturer)

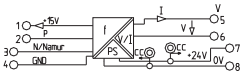


Frequency Converter, 3-Way

- Three-way isolation
- Max. input frequency 100 kHz
- Input and output ranges adjustable using DIP switch
- 931S Configurator to assist with DIP switch selection, download at www.ab.com
- No calibration necessary
- Special ranges can be programmed

931S-F1C2D-DC



Specifications	*Frequency Converter, 3-Way*
Wiring Diagram	
Standards Compliance	UL 508, UL 1604, CSA C22.2 No. 142-M1987, CSA C22.2 No. 213-1987, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (Class 1, Div. 2, Groups A, B, C and D, NRAG/7.E10314), CE
Input Ratings	
Sensor	2-, 3-wire PNP/NPN, namur initiator, push-pull step
Rated Input Level	Threshold / Hysteresis: Namur: approx. 1.7 mA/approx. 0.2 mA; NPN: approx. 6.5 V/approx. 0.2V; PNP: approx. 6.7V/approx. 0.5V
Input Frequency	0...100 kHz
Input	Active
Output Ratings	
Voltage	0...10V
Current	0…20 mA / 4…20 mA
Load Impedance (voltage/current)	≥ 1 kΩ / ≤ 600 Ω
Step Response Time	360 ms + 2-fold period of time of input frequency
Temperature Coefficient	max. 200 ppm/ K of output range
Accuracy	0.2% of output range
Offset Current / Voltage	max. 100 µA/ max. 0.05V
Status Indicator	green LED
Output	Active
General Specifications	
Supply Voltage	24V DC ± 25 %
Power Consumption	max. 1.6 W at I_{OUT} = 20 mA
Current-carrying Capacity of Cross-Connect	≤ 2 A
Operating Temperature	0 °C…+55 °C
Storage Temperature	-20 °C…+85 °C
Default Settings	0…10 kHz / 4…20 mA
Rated Insulation Voltage	300V
Impulse Withstand Voltage	6 kV
Isolation Voltage Input - Output	$4kV_{eff}$ /5 s
Surge Category	III
Pollution Severity	2
Connection Type	Screw
L x W x D (mm)	92.4 x 12.5 x 112.4

Signal Conditioner	Cat. No.	Pkg. Quantity
	931S-F1C2D-DC	1

Selecting the operating mode

Operating mode	Switch 2 3	4
0…fmax	□	□
fmin…fmax	□	■
saving fmin	■	□

f= (A+B) x C

Selecting the frequency

A	Switch 1 1	2	3	4
0	□	□	□	□
1	□	□	□	■
2	□	□	■	□
3	□	□	■	■
4	□	■	□	□
5	□	■	□	■
6	□	■	■	□
7	□	■	■	■
8	■	□	□	□
9	■	□	□	■
10	■	□	■	□
11	■	□	■	■
12	■	■	□	□
13	■	■	□	■
14	■	■	■	□
15	■	■	■	■

Selecting the frequency

B	Switch 1 5	6	7	8
0	□	□	□	□
0.1	□	□	□	■
0.2	□	□	■	□
0.3	□	□	■	■
0.4	□	■	□	□
0.5	□	■	□	■
0.6	□	■	■	□
0.7	□	■	■	■
0.8	■	□	□	□
0.9	■	□	□	■

Selecting the frequency

C	Switch 2 1	2
x1	□	□
x10	□	■
x100	■	□
x1000	■	■

Selecting the output

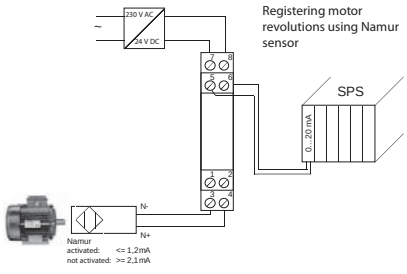
Output	Switch 2 5	6	7	8
0...10 V	■	□	■	■
0...20 mA	□	□	□	□
4...20 mA	□	■	□	□
0…5 V	■	■	■	■

Special range (frequency generator is required)

Function	Switch 2 1	2	3	4
save min. frequency	□	■	■	■
save max. frequency	■	□	■	■
select special range	■	■	■	■

■ = on
□ = off

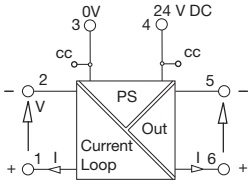
Application



Active Isolator, 3-Way, HART

- Two conductor system
- Three port isolation
- With HART transmission
- Output signal switchable

931H-A2C2D-DCHART

Specifications	***Active Isolator, 3-Way, HART***
Wiring Diagram	
Standards Compliance	UL 508,CSA C22.2 No. 0-10, CSA C22.2 No. 14-10, EN 61010-1:2001, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cURus (NMTR2/8.E56639), CE
Input Ratings	
Current	4...20 mA
Sensor	2-conductor
Supply Voltage	16.5V / constant for 3…22 mA
Input	Active
Output Ratings	
Current	0...20 mA / 4...20 mA
Voltage	0...10V
Load Impedance (voltage/current)	≥ 10 kΩ / ≤ 500 Ω
Step Response Time	≤ 2 ms
Temperature Coefficient	≤ 50 ppm/K
Accuracy	$I_{OUT:}$ < 0.1% / U_{OUT}: < 0.2%
Offset Current / Voltage	max. 30 µA/ max. 30 mV
Residual Ripple	< 10 mV_{eff}
Output	Active
General Specifications	
Supply Voltage	24V DC ± 15%
Power Consumption	approx. 1 W
Communication	to Hart specification
Current Carrying Capacity of Cross Connect	≤ 2 A
Operating Temperature	0 °C…+55 °C
Storage Temperature	-25 °C…+85 °C
Rated Insulation Voltage	600V
Isolation Voltage Input - Output	2.5kV_{eff}
Surge Category	II
Pollution Severity	2
Connection Type	Screw
L x W x H (mm)	88 x 6.1 x 97.8

Signal Conditioner	**Cat. No.**	Pkg. Quantity
	931H-A2C2D-DCHART	1

Setting options/switch position

	Switch			
Output	**1**	**2**	**3**	**4**
4 … 20 mA	□	□	■	□
0 … 20 mA	■	□	■	□
0 … 10 V	■	■	□	■

■ = on
□ = off

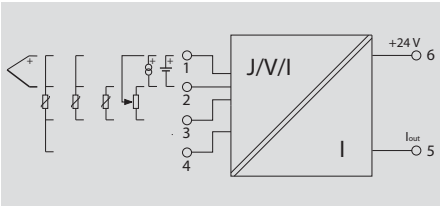
Passive Converter, Universal

- Output loop powered
- Programmable with PC, download software on www.ab.com
- Pluggable connection terminals
- Compact housing

931U-C9A2C-OP

Specifications	***Passive Converter, Universal***
Standards Compliance	UL 61010B-1, CSA C22.2 No. 61010-1-2004, EN 50178:1997, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-4:2007
Certifications	cULus (PICQ/7.E345550), CE
Input Ratings	
Type	Universal signal isolator/amplifier, thermocouple, RTD
Type, Thermocouple	B / C / E / J / K / L / N / R / S / T / W3 / W5 -200…+ 2300 °C depending on thermocouple
Type, RTD	PT100/ 200, Ni100, CU100 (all 2-, 3-, 4-wire) -200...+850 °C deprnding on RTD
Current	-10…+20 mA (min. span 1 mA)
Voltage	-5...+10 V / -100...+200 mV (min. span 0.5 V / 4 mV)
Input Resistance (voltage/current)	2 MΩ/ 40 Ω
Input	Passive
Output Ratings	
Type	Current output
Current	4...20 mA
Residual Ripple	< 20 mV
Step Response Time	Typically 200 ms (10...90%)
Temperature Coefficient	Typically 0.02% / °C
Load Resistance	[(Vs - 10) / 0.02] Ω (Typically 700 Ω @ 24V DC)
Transmit Function	Linear, $x_{1/2}$, $x_{3/2}$, $x_{5/2}$ or user defined curve (101 points)
Accuracy	Thermo: < ± 1%; RTD: < ± 0.5%; Resistance: < ± 0.1% of end value; DC < ± 0.1% of end value
Output	Passive
General Specifications	
Supply Voltage	10…40 V DC, powered by loop current
Power Type	Output Loop Powered
Operating Temperature	-10 °C…+70 °C
Storage Temperature	-20 °C…+70 °C
Long-term drift	0.1% / 10,000 h
Cycle Time	20...200 ms
Digital Filter Factor	1...100
Interference Radiation	< ± 0.5%
Rated Insulation Voltage	$300V_{eff}$
Impulse Withstand Voltage	4 kV (1.2/50 µs)
Isolation Voltage	2 kV between ports
Transmit Function	direct or reverse
Connection Type	Screw
L x W x D (mm)	92.4 x 12.5 x 112.4

Signal Conditioner	Cat. No.	Pkg. Quantity
	931U-C9A2C-OP	1



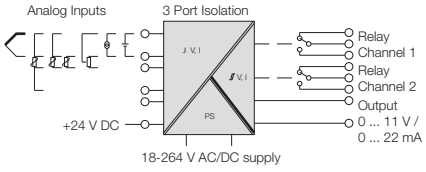
Connections

Terminal	Signal	
5	Loop –ve	Supply voltage
6	Loop +ve	
1	Signal + Power supply Sensor	Thermocouple
2	Signal + Power supply Storage (only for programming)	
1	A-Sense	4-wire PT100/RTD (or resistance)
3	A	
2	B	
4	B-Sense	
1	A-Sense	3-wire PT100/RTD (or resistance)
3	A	
2	B	
3	A	2-wire PT100/RTD (or resistance)
2	B	
1	Signal +	Voltage (mV or V)
2	Signal –	
1	Signal +	Current (mA)
2	Signal –	
3	A	Potentiometer
1	Wiper	
2	B	

Active Converter, 3-Way, Universal

- Universal inputs
- Programmable with PC, download software on www.ab.com
- Loop-powered or passive mA input
- AC or DC supply

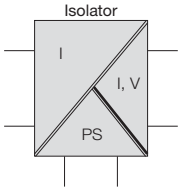
931U-C9C7C-BC

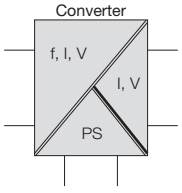


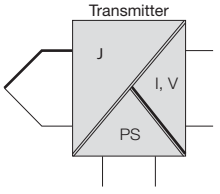
Specifications	*Active Converter, 3-way, Universal*
Standards Compliance	UL 508, UL 1604, CSA C22.2 No. 142-M1987, CSA C22.2 No. 213-1987, EN 50178:1997, EN 60079-0:2006, EN 60079-15:2005, EN 61000-6-1:2007, EN 61000-6-2: 2005, EN 61000-6-3:2007, EN 61000-6-4:2007
Certifications	cULus (Class 1, Div. 2, Groups A, B, C and D, NRAG/7.E10314), CE, ATEX (Class 1, Zone 2, DEKRA 11ATEX0015 X)
Input Ratings	
Type, Thermocouple	B, E, J, K, L, N, R, S, T (IEC 60584)
Type, RTD	PT100, PT1000, (EN 60571) Ni100, Ni1000, (JIS1604), Cu10, Cu25, Cu50, Cu100 (DIN 43760) 2-/3-/4-conductor
Potentiometer	100 Ω…100 kΩ
Resistance	10 Ω…5 kΩ
Frequency	2 Hz…100 kHz
Voltage	-200…500 mV (min. span 4 mV), -20…50V DC (min. span 0.5V)
Current	-20…50 mA (min. span 0.4 mA)
Sensor Supply	24V DC / 22 mA
Input	Active or Passive
Output Ratings - Analog	
Accuracy	< 0.1 % span (DC, RTD); 0.2 % span (or 1 °C) + CJ error
Temperature Coefficient	< 0.1 % /K (DC, RTD); <0.1% FSR/K + CJ error 0.07 °C/K (Thermocouples)
Voltage	-10…+10V (adjustable - min. span 2.5V)
Current	0…20 mA (adjustable - min. span 5 mA)
Output Signal During Wire Break	Configurable
Load Resistance Voltage	> 10 kΩ @ 0…10V / > 20 kΩ @ -10…+10V
Load Resistance Current	≤ 700 Ω
Step Response Time	50 ms...1 sec (RTD, mV inputs), 110 ms...1 sec (V, mA inputs)
Signal Output	Direct or inverted
Transmit Function	Linear, $x_{1/2}$, $x_{3/2}$, $x_{5/2}$ or user-defined curve (101 points)
Output Ratings - Digital	
Type	2 x 1 CO contact (hard gold plated)
Max Switching Voltage	250V
Continuous Current	3 A
Output	Active
General Specifications	
Supply Voltage	18…264V AC/DC
Power Consumption	< 3.5 W
Operating Temperature	-40 °C…+70 °C
Storage Temperature	-40 °C…+85 °C
Rated Insulation Voltage	300V
Impulse Withstand Voltage	6 kV
Isolation Voltage	2.5 kV
Connection Type	Screw
L x W x D (mm)	92.4 x 45 x 112.4
Surge Category	III
Pollution Severity	2

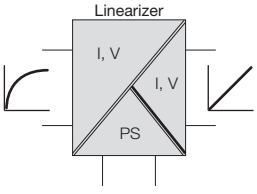
Signal Conditioner	Cat. No.	Pkg. Quantity
	931U-C9C7C-BC	1

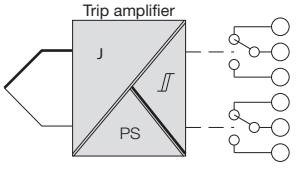
Typical functions











Accessories

The table below indicates the accessories available for each signal conditioner.

Markers		Jumpers		End Barrier	Cable	
1492-M5X10	1492-M6X10	1492CJLJ5-2-*	1492-CJLJ6-*	931H-EB1	931U-CABLE	Cat. No.
High-Density Signal Conditioners						
	•		•			931H-A2A2N-DC
•			•			931H-A2C2D-DCHART
•			•			931H-C2C2D-DC
	•		•			931H-P2C1D-DC
	•		•			931H-T2C1D-DC
	•		•			931H-T1C1D-DC
	•		•	•		931H-A1A1N-IP
	•		•	•		931H-P2A2N-OP
Standard Signal Conditioners						
•						931S-A1A1N-IP1
•						931S-A1A1N-IP2
•						931S-A2A5N-OP
•		•				931S-A2A2N-DC
•		•				931S-A1A1N-DC
•						931S-C1A2D-OP
•						931S-C4C5D-BC
•		•				931S-P1C2D-DC
•		•				931S-T9C2D-DC
•		•				931S-F1C2D-DC
	•	•				931S-B1C6D-DC
	•	•				931S-A3C2D-DC
	•					931S-A3A2D-OP
		•				931S-A4C2D-DCHALL
	•					931S-V1R1D-MC1R
•		•				931S-C2R1D-DC2R
						931S-C3C3J-DC
Universal Signal Conditioners						
•					•	931U-C9A2C-OP
•					•	931U-C9C7C-BC

* For size and color, please see product selection tables below.

Snap-in Markers

Description	Markers Per Card	Marker Size	Pkg. Quantity	Cat. No.
Snap-in Markers	144	5 X 10 mm	5	**1492-M5X10**
Snap-in Markers	120	6 X 10 mm	5	**1492-M6X10**

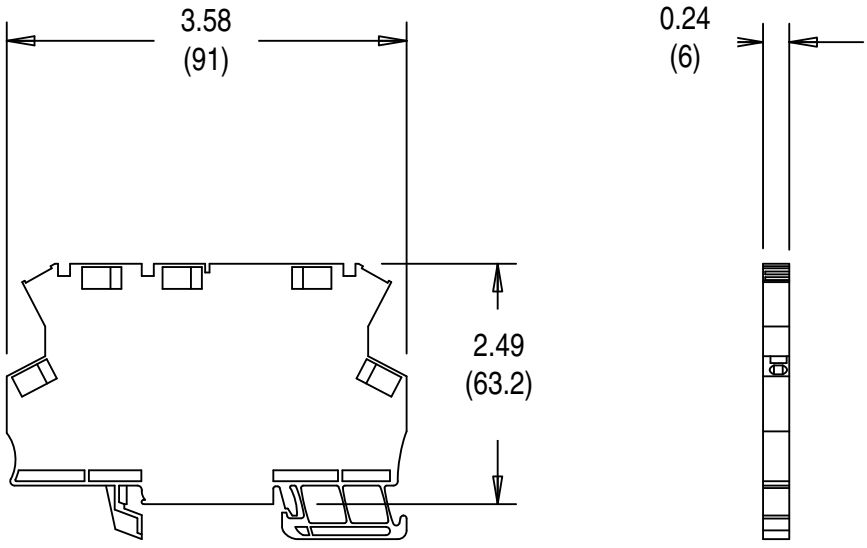
Plug-in Jumpers

Description	Color	Pkg. Quantity	Cat. No.
Plug-In Jumper, 2-pole, Yellow	Yellow	60	**1492-CJLJ5-2**
Plug-In Jumper, 2-pole, Red	Red	60	1492-CJLJ5-2-R
Plug-In Jumper, 2-pole, Blue	Blue	60	1492-CJLJ5-2-B
Plug-In Jumper, 2-pole, Black	Black	60	1492-CJLJ5-2-BL
Plug-In Jumper, 2-pole, Red	Red	60	1492-CJLJ6-2-R
Plug-In Jumper, 2-pole, Blue	Blue	60	1492-CJLJ6-2-B
Plug-In Jumper, 3-pole, Red	Red	60	1492-CJLJ6-3-R
Plug-In Jumper, 3-pole, Blue	Blue	60	1492-CJLJ6-3-B
Plug-In Jumper, 10-pole, Red	Red	20	**1492-CJLJ6-10-R**
Plug-In Jumper, 10-pole, Blue	Blue	20	**1492-CJLJ6-10-B**
Plug-In Jumper, 41-pole, Red	Red	10	**1492-CJLJ6-41-R**
Plug-In Jumper, 41-pole, Blue	Blue	10	1492-CJLJ6-41-B

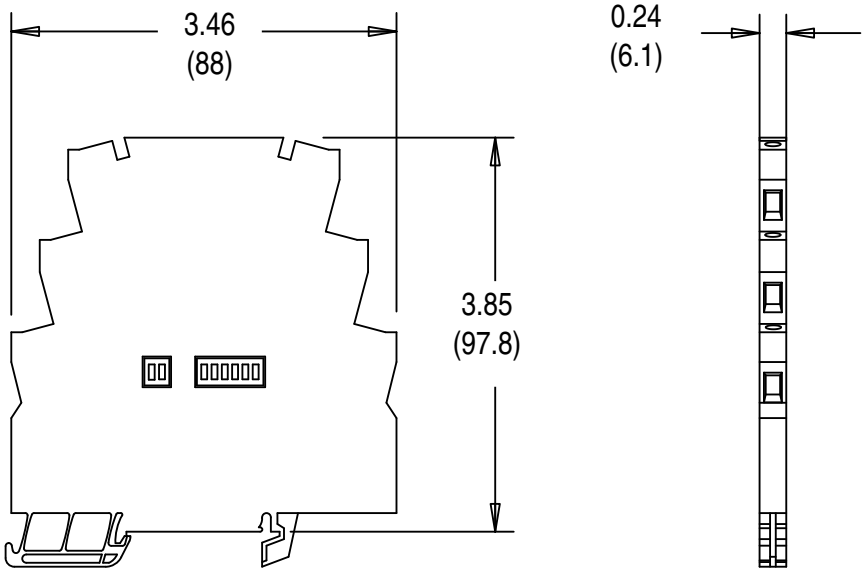
Approximate Dimensions

Approximate dimensions are shown in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.

- 931H-A1A1N-IP
- 931H-P2A2N-OP



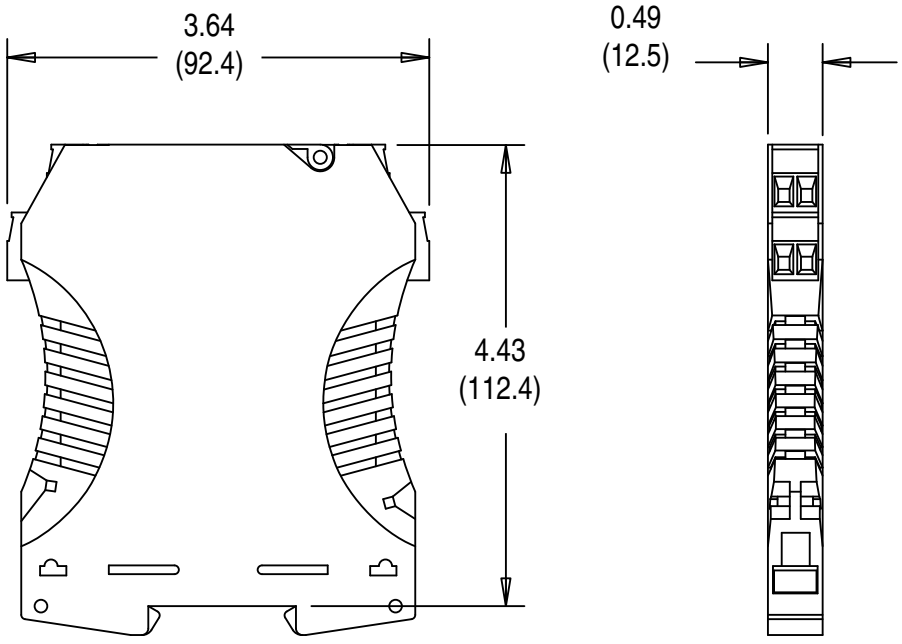
- 931H-A2A2N-DC
- 931H-A2C2D-DCHART
- 931H-C2C2D-DC
- 931H-P2C1D-DC
- 931H-T1C1D-DC
- 931H-T2C1D-DC



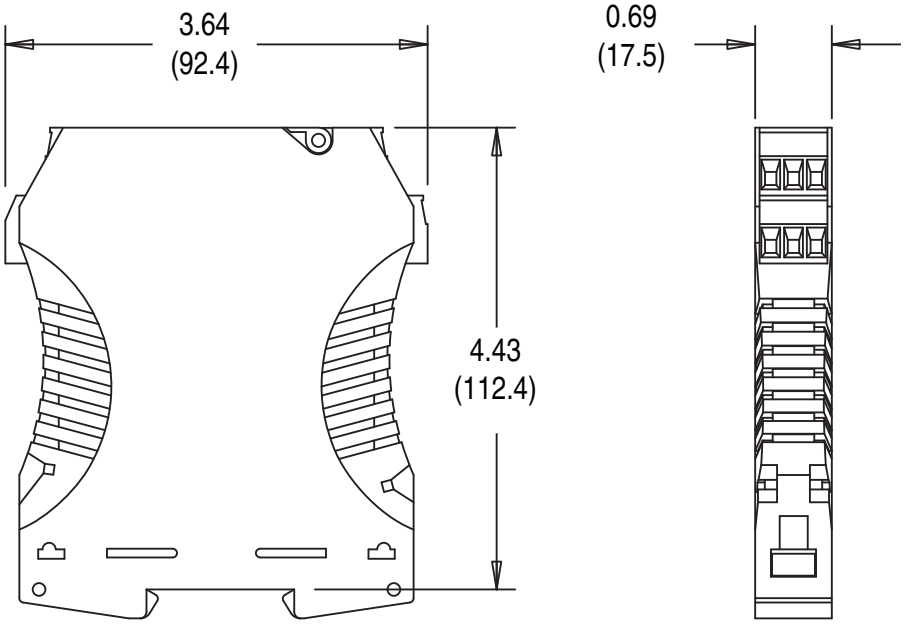
Approximate Dimensions

Approximate dimensions are shown in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.

- 931S-A2A2N-DC
- 931S-C3C3J-DC
- 931S-C4C5D-BC
- 931S-F1C2D-BC
- 931U-C9A2C-OP



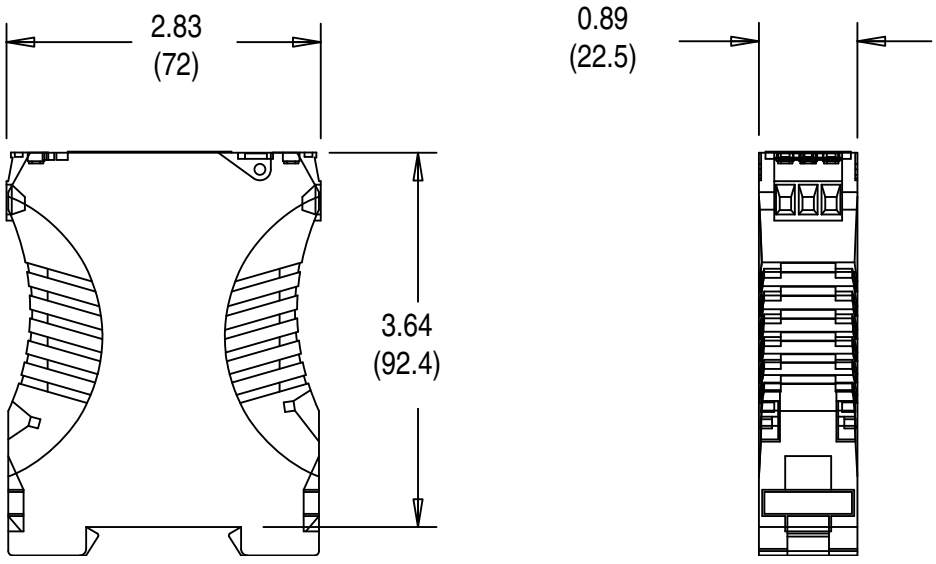
- 931S-B1C6D-DC
- 931S-C1A2D-OP
- 931S-C2R1D-DC2R
- 931S-P1C2D-DC
- 931S-A1A1N-DC
- 931S-A1A1N-IP1
- 931S-A1A1N-IP2
- 931S-A2A5N-OP
- 931S-T9C2D-DC
- 931S-V1R1D-MC1R



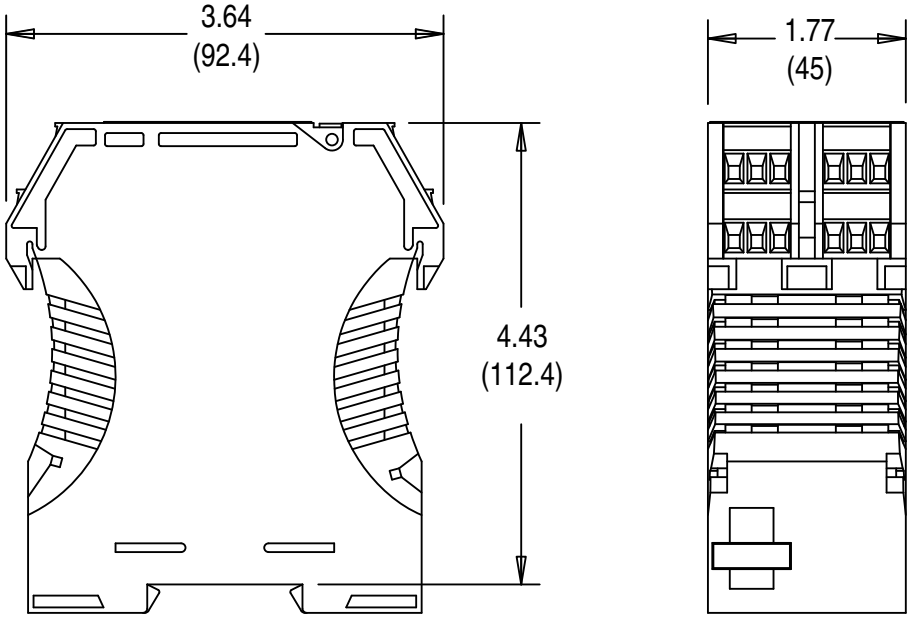
Approximate Dimensions

Approximate dimensions are shown in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.

- 931S-A3A2D-OP
- 931S-A3C2D-DC
- 931S-A4C2D-DCHALL



- 931U-C9C7C-BC



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 may 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.

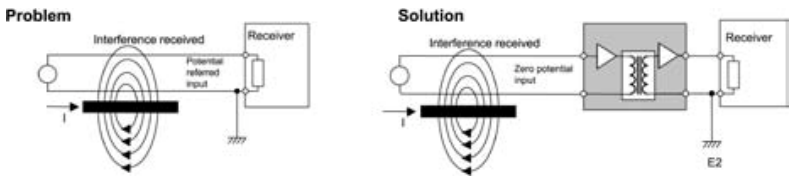
- ATEX is derived from the phrase "ATmosphere EXplosive". It stipulates that operators should prevent explosions and ensure protection.
- Regarding explosion protection in a potentially explosive atmosphere, the ATEX directive 94/9/EC has precedence over machinery directives and must be followed The 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

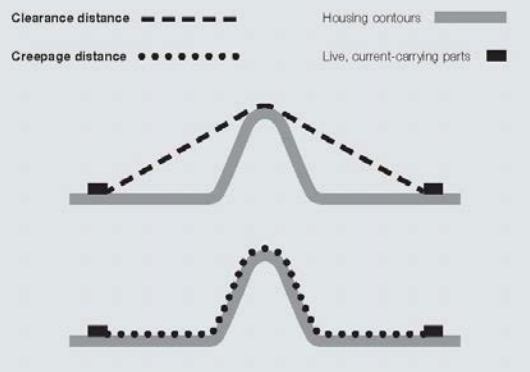
CE Abbreviation for Communauté Européenne (the European Community). Manufacturers use the CE label to confirm that their products comply with the corresponding EC directives and the "essential requirements" therein.

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.



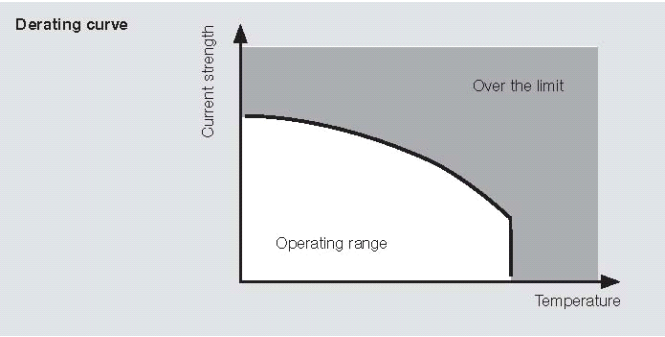
D

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

It may 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.

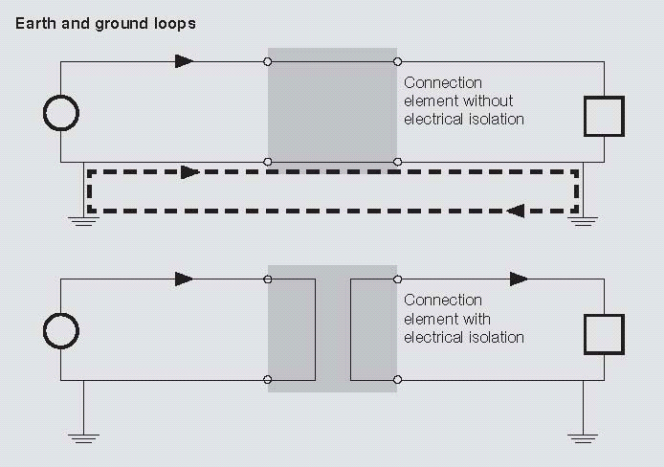
DC Direct current

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 may corrupt analog measurement signals. This 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.

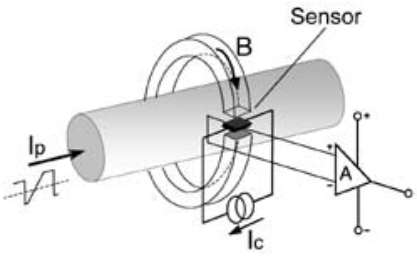
G

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

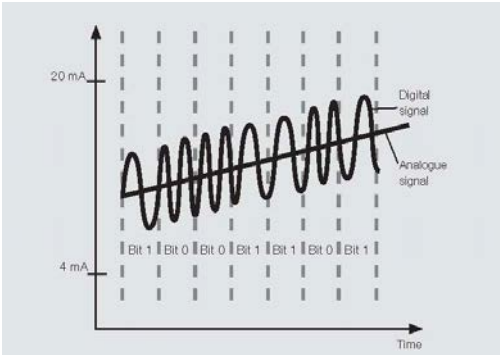
Ground Loop See 'Earth Loop.'

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 (i.e., with 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 °C to 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 may also be able to 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 to 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:

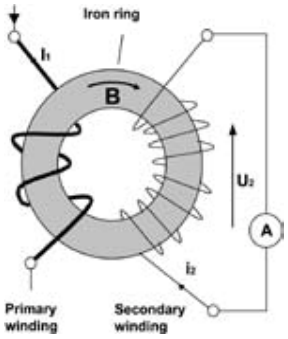
Thermal pair	Short name	Type	Temperature range in °C
Nickel/Chrome-Nickel/Al	NiCr-Ni/Al	K	-200 ... +1372
Iron-constantan	Fe-CuNi	J	-200 ... +1200
Copper-constantan	Cu-CuNi	T	-200 ... +400
Nickel/Chrome-constantan	NiCr-CuNi	E	-200 ... +1000
Platinum/10% Rhodium-Platinum	Pt10Rh-Pt	S	–50 ... +1760
Platinum/13% 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 may have one or more of such contacts.

Notes:

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 931-TD001D-EN-P – April 2012
Supercedes Publication 931-TD001C-EN-P – March 2012