Configurator Software

Catalog Number 931U-C9C7C-BC

User Manual

Allen-Bradley

Allen-Bradley • Rockwell Software

Rockwell Automation

Foreword

Revision history

Version	Date	Change
0.0	08/25/2011	First edition

Contact address

Rockwell Automation
1201 South Second Street
Milwaukee, Wisconsin
53204-2496
USA

Phone (1) 414-382-2000
Fax (1) 414-382-4444
Internet www.ab.com

Contents

1. Approvals

1.1 CE

CE Declaration is available from Rockwell Automation.

1.2 UL

Listing approval cULus

1.3 ATEX

Approval according ATEX directive EN 60079-0 and EN 60079-15 for NON Sparking

1.4 Class 1 Division 2

Approval according C1D2 Zone 2: ISA121201

2. Notes on Safety

2.1 Electrical precautions

	DANGER!
	This product may be connected to potentially lethal voltages!

	DANGER!
	The configuration plug jack must only be used for configuration in ***non-hazardous*** areas!

	WARNING!
	• Before you remove or mount the unit, turn-off the power supplies – i.e. to the instrument and to the relays, if used. • Product electronics must not be removed from its enclosure without disconnecting power sources. • Follow ESD installation regulations, including the EMI precautions given in chapter 5.

There are no procedures which involve the user removing the product electronics from its housing.

Set-up or Re-configuration (see chapter 6) is via a connector located behind the front cover, which is opened with the use of a small screwdriver (see Figure 1).

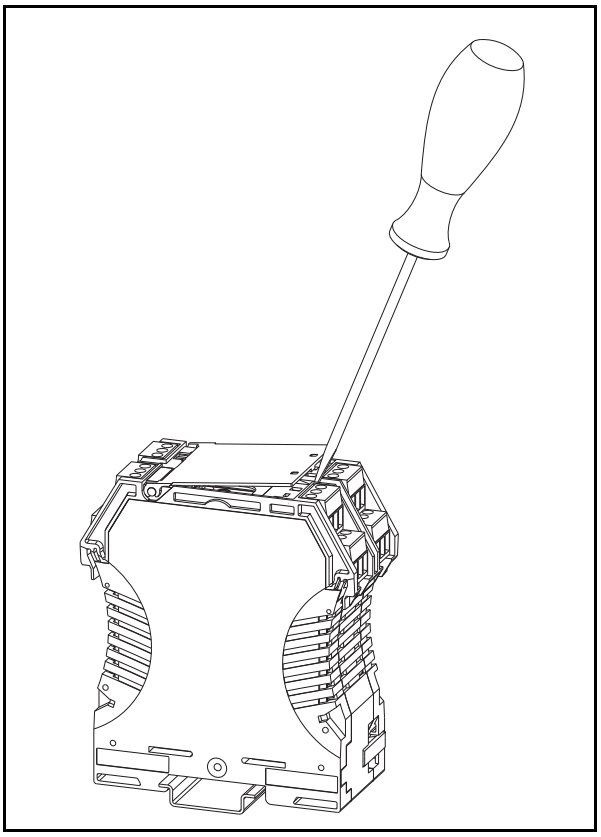


Figure 1 Handling

2.2 Handling

Check on receipt that the product received corresponds to the one ordered.

Unpack the 931U-C9C7C-BC carefully, and ensure the Installation instruction sheet is kept with the product until it is permanently mounted.

3. Introduction

3.1 Symbol identification

DANGER!

Potentially lethal voltages.

CE The CE mark proves the compliance of the product with the requirements of the directives.

3.2 Types / article numbers

This User Manual covers the following products:

931U-C9C7C-BC	Signal Conditioner
931U-CABLE	Programming Cable

3.3 General description / applications / examples

The 931U-C9C7C-BC is an accurate and stable signal converter / isolator / alarm generator for use in measurement and control systems. A wide variety of input / output range and type settings can be configured, using the 931U-CABLE Programming Cable and the 931U-C9C7C-BC Configurator software. The 931U-C9C7C-BC can be powered from DC or AC sources between 18 and 264 volts.

The primary characteristic of the 931U-C9C7C-BC is its versatility of input / output configurability. Hence many of the standard functions performed by DIN rail mounted signal conditioners can be done by the 931U-C9C7C-BC, such as

- Conversion (current to voltage, and vice versa)
- Isolation of temperature sensor and DC inputs
- Linearization of temperature sensor inputs
- Transmission of sensor signals over long distance
- Characterizing signals from DC transmitters
- Process alarm generation
- Relay control between high and low values can be done by the 931U-C9C7C-BC

Typical Applications

Typical of applications for the 931U-C9C7C-BC is the conversion of thermocouple temperature input (low range of millivolts) into a high level (e.g. 4-20 mA) value for transmission to a control system.

In this type of installation the 931U-C9C7C-BC provides:

- Linearization of the standard thermocouple temperature/millivolts characteristic.
- Isolation of the input signal to the control system. This allows the user to use a thermocouple with a grounded hot junction for a quick response at the measurement point. This would otherwise convey electromagnetic influences (high frequency noise) into the control system.
- Selectable output value for a thermocouple-break event.
- Flashing LED status indicator on the unit front on thermocouple-break.
- Relay alarm output if required on thermocouple-break.
- Relay alarm output on high or low process temperature.

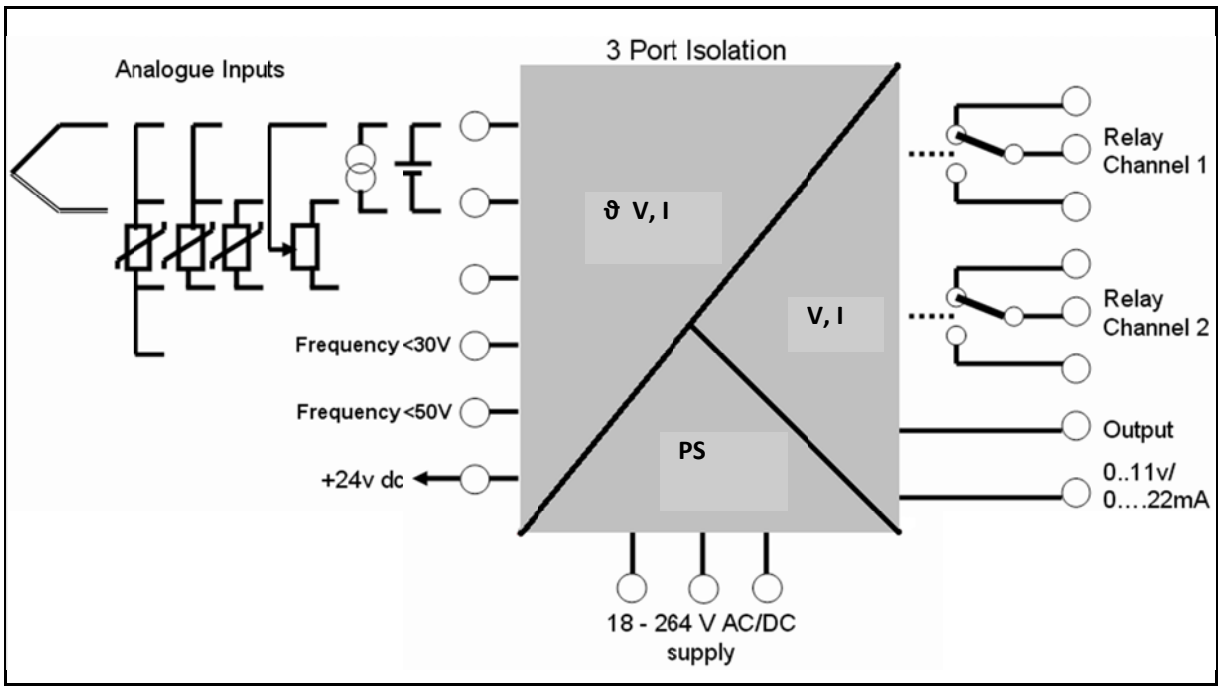


Figure 2 Installation overview

4. Operation

4.1 Status & alarm LEDs

Status LED

Under normal conditions this (green) LED is on continuously.

Figure 3 LEDs

A Status LED

B ALARM 2

C ALARM 1

The following table shows how alarm conditions are displayed.

Status indicator	Alarm conditions
Normal status	continuously on
Input open circuit	flashes at 0.5 Hz
Input short circuit	flashes at 5 Hz
Cold Junction error	2 pulses, rests, 2 pulses
Flash memory error	3 pulses, rests, 3 pulses

Table 1 Status Indicators

Analog Output status with alarm

- User may select output value under fault conditions
- Output compliant with NAMUR recommendations (NE43) can be set (< 3.6 mA or > 21 mA)

Input fault detection

Input faults such as short circuit or open circuit can be detected for most input types. These are shown in the table below.

Input type	Detection	
	Open circuit	Short circuit
Thermocouple	Yes	Yes
RTD	Yes	Yes
Millivolts	Yes	No
Volts (Positive)	Yes	No
Milliamps (Passive)	Yes*	No
Milliamps (Active)	Yes	Yes
Resistance	Yes	Yes
Potentiometer	Yes	Yes**

Table 2 Input fault detection

* Open circuit not detected for live zero ranges

** Short circuit for end-to-end

4.2 Functional block diagram

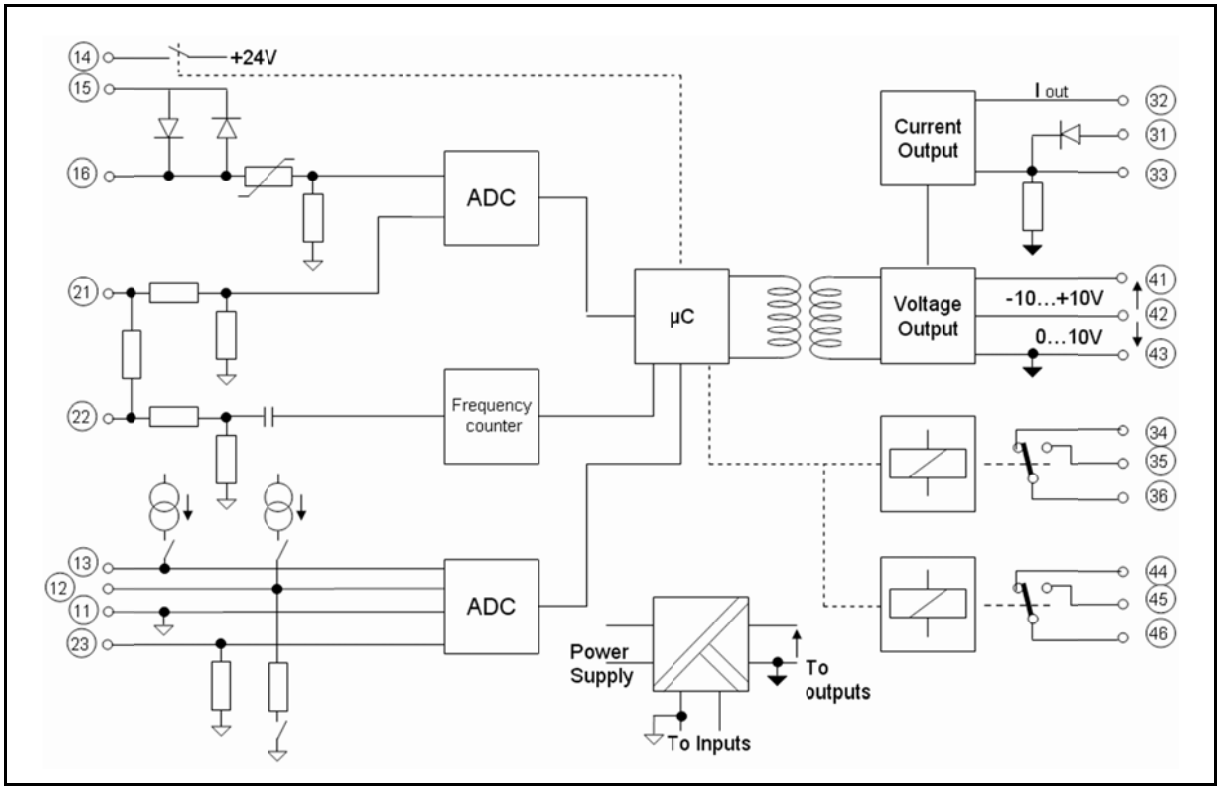


Figure 4 Functional block diagram

4.3 Specifications

Input types	
Thermocouple	Range -200...+1820 °C Types B, E, J, K , L, N, R, S, T to IEC 60584 plus custom specific
RTD	2, 3, 4 wire, within the range -200...+850 °C, for Pt100, Pt1000 to IEC 60571 and for Ni100 / Ni1000 to DIN 43760, for Cu10 and,100 plus custom specific
Potentiometer	10 Ω...100 kΩ
Resistance	10 Ω...5 kΩ
Frequency	2 Hz...100 kHz
Voltage	within the range -200...600 mV (min span 4 mV), within the range -20...50 V DC (min span 0.5 V)
Current	within the range -20...50 mA (min span 1 mA)
Current Loop supply	+24 V DC
Sensor break output	Selectable between -2% and 102% output
Analog Output	
DC voltage	0...5, 1...5, 0...10, 2...10 V or span-settable between -10...10 V (min span 2.5 V)
DC current	0...20, 4...20, 0...10 mA, or span-settable between 0...20 mA (min span 5 mA)
Max load (current / voltage)	700 Ω / >10 kΩ (>20 kΩ for -10 V…+10 V)
Action	Direct or Inverted Operation
Digital Output Relay	
Relays	2 x SPCO
Max voltage and current AC	250 V AC / 2 A
Max voltage and current DC	30 V DC / 2 A
General Data	
Rated voltage	24...240 V AC/DC 24…36 V AC / 24…50 V AC (ATEX Zone 2)

Min. / max. power supply (according VDE)	18…264 V AC/DC 18…40 V AC / 18…56 V DC (ATEX Zone 2)
Rated power	< 3,5 W
Ambient operating range	-40...+70 °C
Isolation test	1,5 kVrms / 1 min. between PE and power supply, as well as between PE and input or output 2,5 kVrms / 1 min between input and output
Rated insulation voltage	300 V protective separation between power supply and input or output, as well as between Relay output and all other circuits 100 V protective separation between input and output 300 V basic insulation between input and output
Performance	
Accuracy	DC, RTD inputs <0.1% span. Thermocouple inputs: 0.2% span (or 1 °C) + CJ error
Ambient temp effects	DC & RTD inputs < 0.01%/K Thermocouple inputs < 0.01% of full scale/K + CJ error 0.07 °C/K
Step Response/ Cut-off Frequency	Settable within 60 ms -1880 ms / 1 Hz (3 dB)
Physical	
Dimensions	92.4 x 112.5 x 45 mm
No. of connections	12
Connection types	screw
Housing material	UL 94 V0
Housing color	Gray
Ingress protection	IP20
Approvals	CE, cULus, GL
Approvals	CE, cULus, Class 1 Division 2 / Zone 2, ATEX Zone 2

Table 3 Specifications

5. Installation

5.1 General (Competence Warning)

The 931U-C9C7C-BC should only be installed by technically qualified personnel with sufficient qualification or knowledge in the subject of instrumentation and control engineering.

5.2 Mounting / Environmental / EMI protection / warm up

Mounting

931U-C9C7C-BC is designed to be mounted onto a TS35 DIN rail.

It clips onto the rail via a spring-loaded mounting foot, and can be removed via a spring release on the edge of the product near the mounting rail.

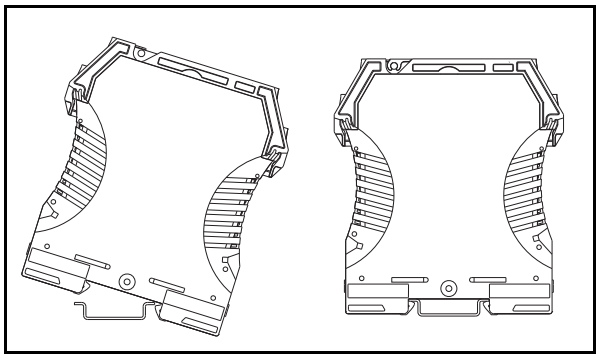


Figure 5 Mounting on DIN rail

Environment

The 931U-C9C7C-BC is designed for use either indoors (IP20) in a control panel, or in a weatherproof field enclosure. Its atmosphere should be dry, well ventilated and dust-free.

Avoid mounting in locations subject to vibration or physical impact.

The 931U-C9C7C-BC is suitable for EX applications and approved for installation in Zone 2. They shall be installed in an enclosure providing a degree of protection of at least IP54.

EMI protection

Do not install input, output and power supply cables close to sources of electrical interference. For example, such sources could include relays, contactors, motors and their controls, including thyristor drives, and the cables which connect these devices. Avoid installing 931U-C9C7C-BC cables in the same ducting as such cables.

Local electrical installation practices should be followed.

Warm-up

The product is designed to function as soon as power is supplied. However a warm-up period of 15 minutes is required before it performs to the specifications above.

NOTICE

	When auxiliary power is switched on, for the first 200 ms the 931U-C9C7C-BC will consume up to 200 mA.

5.3 Electrical Connections

Input, output and power supply wiring is made via numbered, pluggable connectors, which may be screw clamp or tension clamp type, depending on the item article number.

The connectors are coded to prevent the power supply connector being fitted in the wrong position.

Test terminals are included to permit input and output currents to be monitored without disconnection of cables (see connection diagram below).

	**WARNING!**
	931U-C9C7C-BC and PC have to be fully de-energized, before the programming interfaces 931U-CABLE will be connected.

	**NOTICE**
	Ensure that the connectors are inserted into the correct position **(see connection diagram)**.

5.4 Connection diagram

The connection diagram below is printed on the side of the 931U-C9C7C-BC housing.

Connection diagram – Power supply

Term. No.	
24	0 V
25	PE
26	24 - 240 V DC / AC

Table 4 Power supply

Connection diagram – Input

Term. No.	$I_{Passive}$ <50 mA	I_{Active} <20 mA	V <50 V	TC / V <600 mV	Resistor / RTD			Poti	Freq
					2-Wire	3-Wire	4-Wire		
11	In-		In-	In-	R-	R-	R-	Start	In-
12				In+		Sense-	Sense-	End	
13					R+	R+	R+	Wiper	
14		+24 V							
15	In+ / TP+	I_{Return} / TP+							
16	TP-	TP-							
21			In+						In+ (<50 V)
22									In+ (<30 V)
23							Sense+		

Table 5 Input

Connection diagram – Analog output

Term. No.	0…20 mA	0…10 V	-10 V…+10 V
31	TP+		
32	Out+ / TP-		
33	Out-		
41			Out-
42		Out+	Out+
43		Out-	

Table 6 Analog output

Connection diagram – Digital output relay

Term. No.	Alarm 1	Alarm 2
34	N/C	
35	N/O	
36	COM	
44		N/C
45		N/O
46		COM

Table 7 Digital output

6. Setup / Configuration

6.1 Default setting

Input range	4-20 mA
ADS Speed	medium
Transfer function	Linear
Response time	0.25 s
Output range	4-20 mA
Action	direct
Low limit	0 mA
High Limit	20 mA
Output @ error	21.5 mA
Digital outputs 1 and 2	Disabled

Table 8 Default settings

6.2 931U-CABLE USB introduction

The 931U-CABLE is the configuration interface for the 931U-C9C7C-BC. This is the same interface as can be used for configuring the 931U-C9A2C-OP Signal conditioner.

Connection to the computer is via USB port, and to the 931U-C9C7C-BC via a jack connector. Tx and Rx status are indicated by LEDs on the 931U-CABLE.

6.3 Configuration / diagram wiring

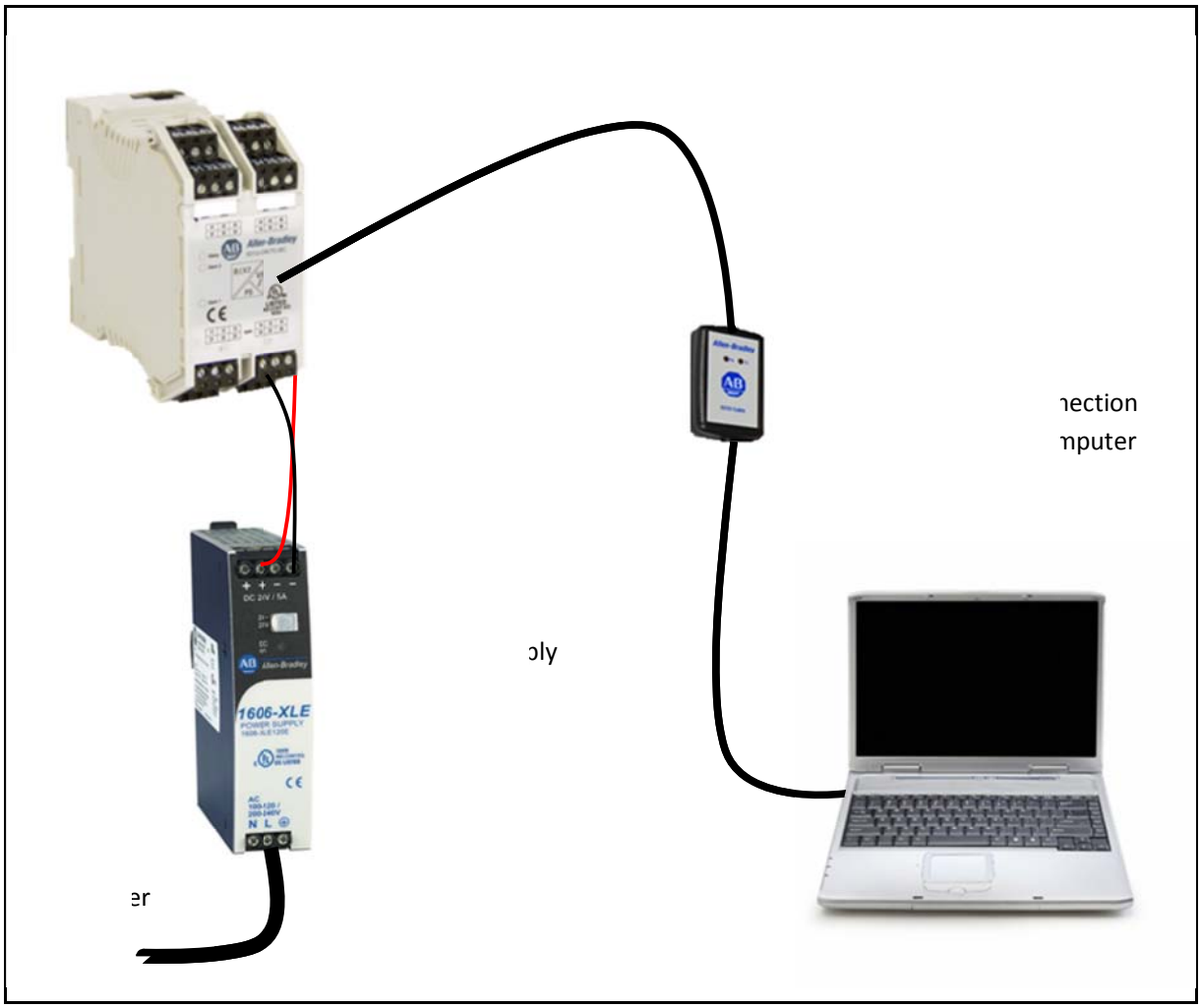


Figure 6 Configuration / diagram wiring

7. 931U-C9C7C-BC Configurator Software

7.1 Description

The Windows based 931U-C9C7C-BC Configurator software is used to set up the 931U-C9C7C-BC via the interface 931U-CABLE.

7.2 Installation

System Requirements

- Operation system Windows 2000 (SP4+), Windows XP, Windows Vista
- IBM PC with a spare USB port
- 931U-CABLE

Installation note

	NOTICE
	In order to install the program you need administrator rights on the computer involved.

Installing 931U-C9C7C-BC Configurator:

The 931U-C9C7C-BC Configurator software can be installed with the file "setup.exe".

7.3 Starting/exiting 931U-C9C7C-BC Configurator

Starting 931U-C9C7C-BC Configurator

You can start 931U-C9C7C-BC Configurator in two different ways:

1 Double-click on the icon 

on your computer desktop.

2 Click on the Windows Start button, then select: Programs > Allen-Bradley > 931U-C9C7C-BC Configurator > 931U-C9C7C-BC Configurator

Exiting 931U-C9C7C-BC Configurator

You can exit 931U-C9C7C-BC Configurator in the following ways.

1 Click the Exit button.

2 Click the X on the window frame.

7.4 Title bar

File

New	Change the setting to default settings.
Open	Open a configuration file *.tta from the hard disk.
Save	Save the actually configuration to a file *.tta.
Print	Print the actually configuration.
Exit	Exit the software 931U-C9C7C-BC Configurator.

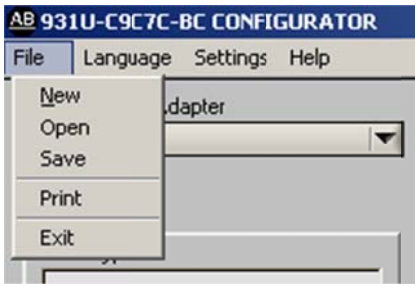


Figure 7 Title bar - File

Language

The menu text will be displayed depending on the selection in English or German language.

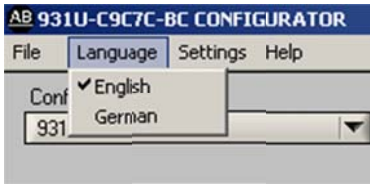


Figure 8 Title bar - Language

Settings

Temperature unit	Set the unit of the temperature for the configuration. Celsius or Fahrenheit

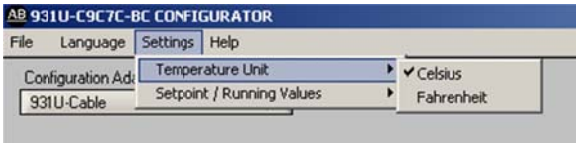


Figure 9 Title bar - Settings - Temperature unit

Setpoint / Running Values	Settings from the unit (percent or input units) of the trigger level of the digital outputs and the input unit of the running value indication.

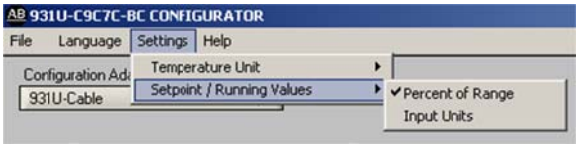


Figure 10 Title bar - Settings - Set point unit

Info

About	Open an information window about the software version and the contact address of Allen-Bradley

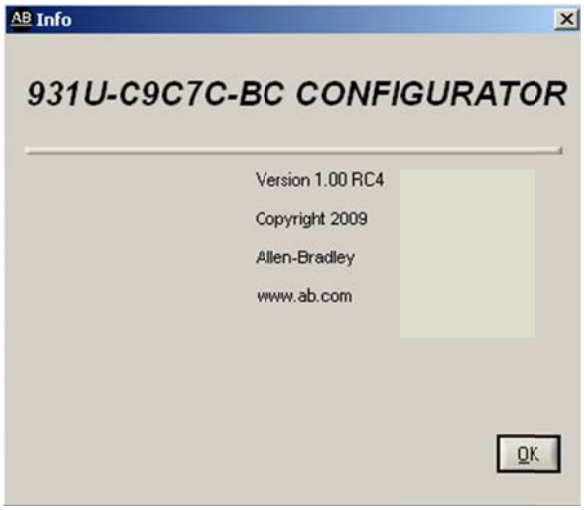


Figure 11 Title bar - Info

7.5 Overview parameters

Input parameters			
Type of input	Voltage - Range	V: -20 … +50 V DC Min. Span 0.5 V mV: -200 … +500 mV DC Min. Span: 4 mV	
	Current - Range	Passive Range mA: -20 … +50 mA Min. Span: 1 mA	
		Active Range mA: 0 … +20 mA Min. Span: 1 mA	
	Type of Thermocouple	K: -200 … +1372 °C J: -210 … +1200 °C T: -200 … +400 °C E: -200 … +1000 °C N: -200 … +1300 °C	R: -50 … +1767 °C S: -50 … +1767 °C B: +50 … +1820 °C L: -200 … +900 °C U: -200 … +600 °C User defined
	RTD	RTD type:	Connection type:
		PT100 PT1000 NI100 NI1000 NI120 Cu10 Ω at 25 °C Cu100 Ω at 0 °C User defined	2-wire 3-wire 4-wire
	Resistor - Range	10 Ω… 5 kΩ	
	Potentiometer - Range	10-50 Ω 50-100 Ω 100-200 Ω 200-400 Ω	400-800 Ω 800-2 kΩ 2 k-6.5 kΩ 6.5 k-100 kΩ
	Frequency - Sensitivity	Frequency range: Min. Span:	2 Hz … 100 kHz 10 Hz

Voltage range Pin21: -50 V … +50 V DC
Voltage range Pin22: -30 V … +30 V DC

Pin	High noise reduction High Level	Low noise reduction Low Level	Max. voltage range
22	550 mV	140 mV	±30 V
21	7.8 V	1.9 V	±50 V

Transfer parameters

Transfer function

Transfer function for the output signal:

Function	linear	SQRT	X^1.5	X^2	X^2.5
formula	Out = In	Out = $In^{0,5}$ x 10	Out = $In^{1,5}$ x 0.1	Out = In^{2} x 0.01	Out = $In^{2,5}$ x 0.001
Input in %	Output in %	Output in %	Output in %	Output in %	Output in %
0	0	0	0	0	0
10	10	32	3	1	0.3
20	20	45	9	4	2
30	30	55	16	9	5
40	40	63	25	16	10
50	50	71	35	25	18
60	60	77	46	36	28
70	70	84	59	49	41
80	80	89	72	64	57
90	90	95	85	81	77
100	100	100	100	100	100

In the SQRT function has low flow cut off. If the input Is smaller than 1% the out is zero.

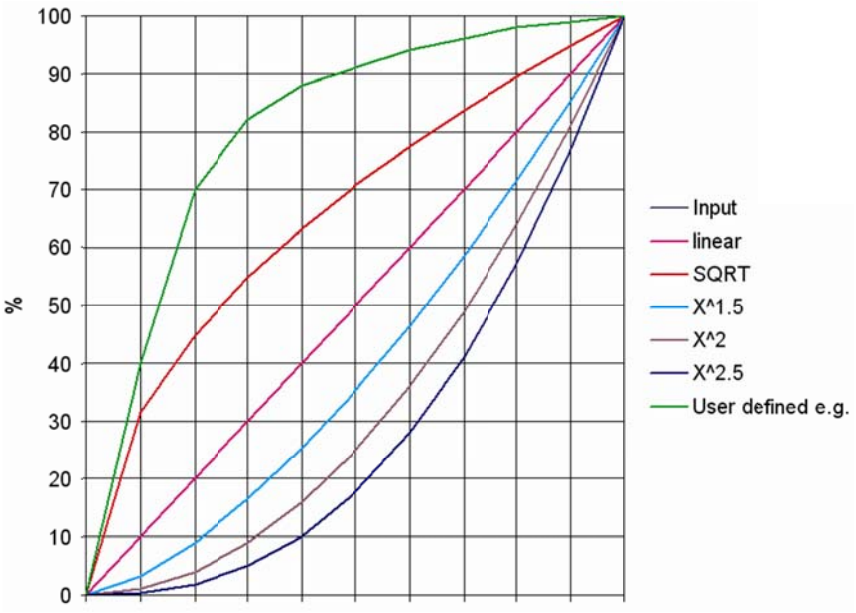


Figure 12 Transfer functions

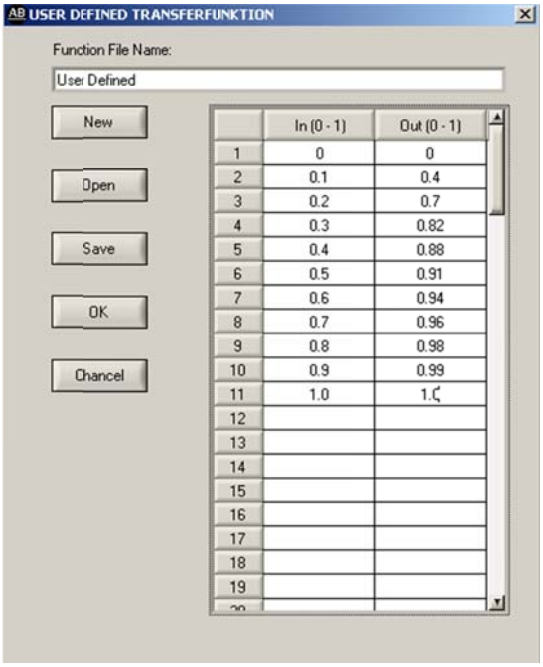


Figure 13 User-defined transfer function

ADC Speed

Fast	**Highest sampling rate**	**9.5 ms**

Medium	50 - 60 Hz	60 ms
Slow	50 - 60 Hz	180 ms

Response Time

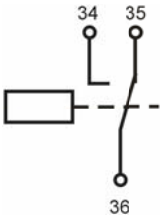
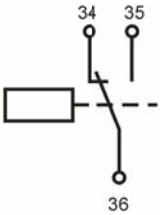
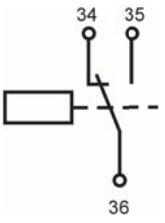
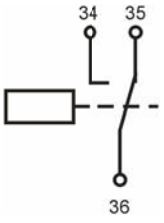
Response time is the time between an input step and the output step.

ADC speed	Response time in ms	Voltage / Current	mV / Therm o	Potentiometer / RTD 3-Wire	RTD 2-Wire 4-Wire
Fast	min.	140	60	90	60
	max.	1000	1000	1000	1000
Medi-um	min.	250	170	350	180
	max.	1070	1000	950	1050
Slow	min.	525	460	1020	470
	max.	1350	1280	1880	900

Range response time

Analog output parameters			
Type of output		Voltage	Current
		Voltage Max. Range: -10.1 … +11 V DC Min. Span: 2.5 V DC	Max. Range: 0 mA to 20 mA DC Min. Span: 5 mA DC
	Output – range low	Lowest Value This is the minimum voltage value at the output (related to 0% input).	Lowest Value This is the minimum current value at the output (related to 0% input).
	Output – range high	Highest Value This is the value at the output (related to 100% input).	Highest Value This is the maximum current value at the output (related to 100% input).
	Direct or reverse function	Direct action is output increasing as input increases. Reverse action is output decreasing as input increases.	Direct action is output increasing as input increases. Reverse action is output decreasing as input increases.
	Output – low limit	Low Limit This is the lowest possible value at the output.	Low Limit This is the lowest possible value at the output.
	Output – high limit	High Limit This is the highest possible value at the output.	High Limit This is the highest possible value at the output.
	Output – for error condition	Output @ Error If an input or 931U-C9C7C-BC error occurs the output is set to this value.	Output @ Error If an input or 931U-C9C7C-BC error occurs the output is set to this value.

Digital output parameters

Alarm output		Function		
Operating modes		Disabled The alarm is disabled. Low Type The alarm is switched on, if the input value is lower than the setpoint. High Type The alarm is switched on, if the input value is higher than the setpoint. Window The alarm is switched on, if the input value is outside the window value: window range = setpoint ± window value e.g.: setpoint 40%, window 10% = window value is from 30-50%. Input Error If an input or 931U-C9C7C-BC error occurs the output is set to this value. ON The alarm relay is activated after power on.		
Function circuit	Alarm Relay	Normally energised	No alarm  Coil on	Alarm  Coil off
		Normally de-energised	No alarm  Coil off	Alarm  Coil on
Settings	Setpoint	This is the relay switch on value 0…100%		
	Deadband	Switch off hysteresis in percent e.g. high type, setpoint 50% and deadband 2%: the alarm switches on if the value reaches 50% and switches off if the value decreases to 48%.		

ON Delay	Switch on delay in seconds In 0.1 second steps
OFF Delay	Switch off delay in seconds In 0.1 second steps
Window	Set a range around the Setpoint in percent
Error Action	Alarm ON The alarm relay is activated when an error is detected. Alarm OFF The alarm relay is deactivated when an error is detected. Hold The alarm relay hold the actually status. None No reaction on an error.

Table 9 Parameter

High Alarm

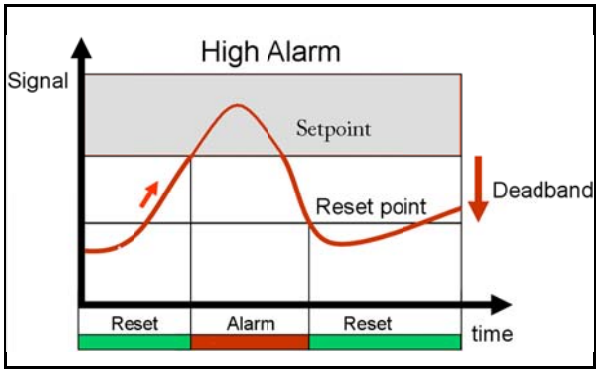


Figure 14 High Alarm

Low Alarm

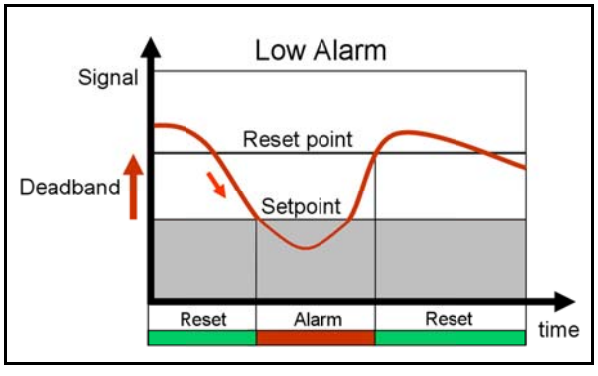


Figure 15 Low Alarm

Window Alarm

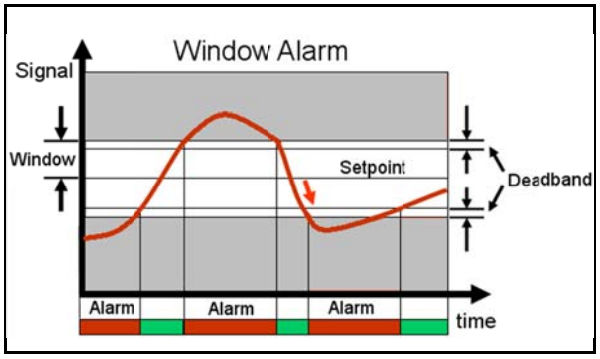


Figure 16 Window Alarm

Alarm Time Delay

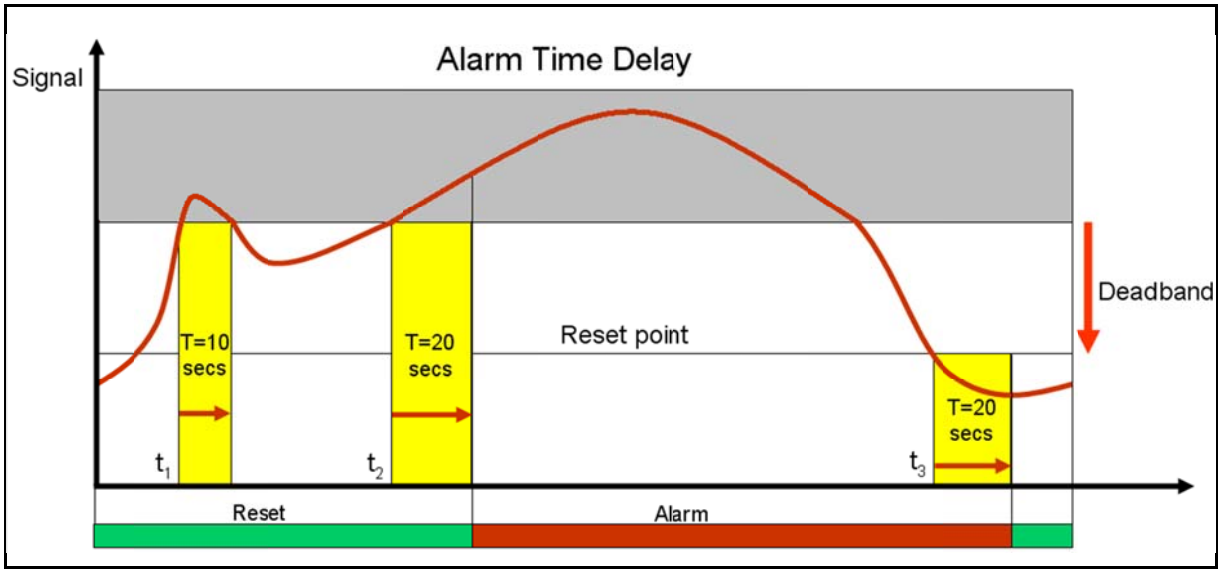


Figure 17 Alarm Time Delay

In this example the time delay is set for 20 seconds. At t_1 the measurement exceeds the alarm value, but this only lasts for 10 seconds so there is no trip. At t_2 the measurement again exceeds the alarm trip value and this lasts for longer than 20 seconds so the alarm trip occurs after 20 seconds.

7.6 Run mode

Start communication with the 931U-C9C7C-BC

1. Connect the 931U-C9C7C-BC to a Power supply.
2. Connect the 931U-C9C7C-BC with the 931U-CABLE to an available USB port on the PC.
3. Start the 931U-C9C7C-BC Configurator Software.
4. Input configuration
   Select the input value.
5. Output configuration
   Select the output value.
6. Alarm configuration
   Set the alarm relay behaviour.
7. Send configuration to 931U-C9C7C-BC.
   The button "Save to Instrument" transmits the new configuration to the 931U-C9C7C-BC.
8. Enter Password
   Enter your password (the default password is 0000).
9. Read Values
   With the button "Read Values" the actual values of the 931U-C9C7C-BC are displayed in the window "Running values".
   If the button "Read Continuous" is activated the values are updated every second (monitoring).
10. Read from Instrument
    To check the current configuration in the connected 931U-C9C7C-BC click on the "Read from instrument" button.

Running values

- Input: 931U-C9C7C-BC input value in percent.
- Output: 931U-C9C7C-BC output value in percent.
- CJC Temperature: This the temperature in Centigrade or Fahrenheit at the cold junction point in the 931U-C9C7C-BC.
- Alarm1: Shows the status of the first alarm relay
  - LED = red = relay switched on (alarm)
  - LED = off = relay switched off (no alarm)

- Alarm2: Shows the status of the second alarm relay
  - LED = red = relay switched on (alarm)
  - LED = off = relay switched off (no alarm)

7.7 Product identification

Table 10 Product identification

Unit Type:	Description of the module
Serial No.:	The serial number is printed on the side of the module.
Firmware No.:	The firmware number of the 931U-C9C7C-BC which is connected.
Configured by:	The company name of the person who last configured the module.
Initials:	Initials or the name of the person who last configured the module.
Date:	The date when the module was last configured the module.
ID Tag:	Typically, the user's plant reference
User Reference:	User descriptor
Version:	The Version of the software
Terminals:	Shows the terminal number where the sensor and output signals are connected.

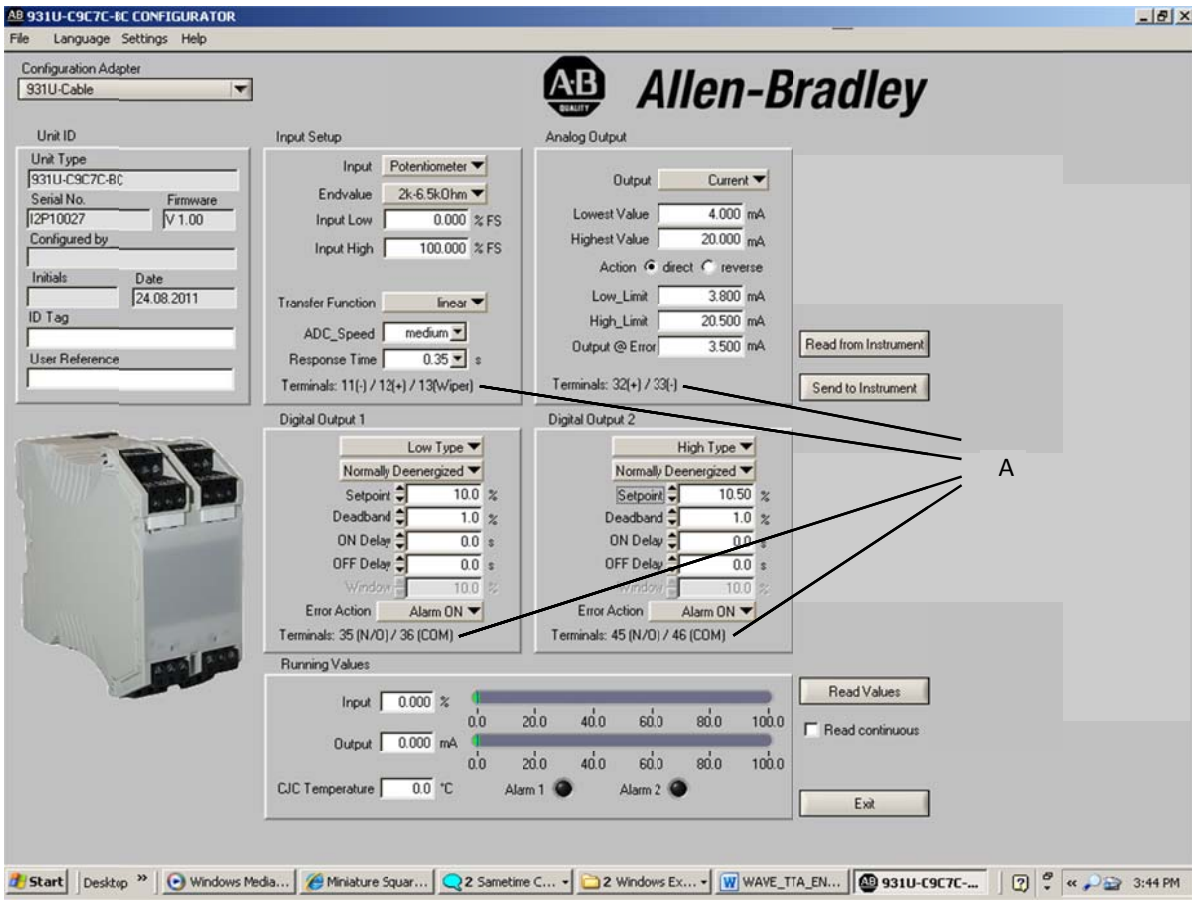


Figure 18 Unit-ID

A Terminals

8. Troubleshooting

8.1 Troubleshooting

If a 931U-C9C7C-BC is not working as expected, the best view of its complete set-up is via the 931U-C9C7C-BC Configurator Software.

Below are some examples of checks which can help the user overcome connection or configuration errors.

No communications

Configuration is being checked, 931U-C9C7C-BC Configurator soft-ware is installed, the 931U-C9C7C-BC is connected via the 931U-CABLE, but there is no communication.

Figure 19 Com Port configuration and settings

It could be a software or hardware problem.

1. Check your comport settings. The 931U-C9C7C-BC Configurator will show (on the top left) the current USB comport.
2. Check that the 931U-CABLE is connected between the 931U-C9C7C-BC and your computer.
3. Check that the 931U-C9C7C-BC is powered within the range given in the specifications.

No Status LED indication

The 931U-C9C7C-BC is installed, the wiring is done, but it shows no LED indication.

1. Check the power supply and consider the wiring diagrams and descriptions in chapter 4 and 5.
2. Ensure that the input / output connections are correct.

The green Status LED is flashing

It indicates sensor wiring (short circuit or open circuit) or internal fault.

See description in chapter 3 to identify fault source.

The DC output is incorrect

1. Ensure the input type and range are configured as required and wiring connections are correct.
2. Check the output configuration settings for correct range and transfer functions including direct or re-verse action.

The alarm relays have no function

1. Check the relay configuration settings including set-point, alarm type are as required and as described in chapter **Error! Reference source not found.**.
2. Check the input type and range is as required.
3. Check the input connections are made correctly.

The alarm relays are on / off with the wrong values of input

1. Check the relay configuration settings including set-point, alarm type are as required and as described in chapter **Error! Reference source not found.**.
2. Check the input type and range is as required.
3. Check the input connections are made correctly.

Appendix

Index

Rockwell Automation
1201 South Second Street
Milwaukee, Wisconsin
53204-2496
USA

Phone (1) 414-382-2000
Fax (1) 414-382-4444
Internet www.ab.com

DIR 10000203490

(Version 00)

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-UM001A-EN-P -August 2011 - DIR 10000203490 (Version 00)