A·B QUALITY **Allen-Bradley**

Universal Temperature Converter

Allen-Bradley • *Rockwell Software*

Rockwell Automation

Symbols Used

STOP Warning	*This symbol warns of possible danger.* *Failure to heed this warning may result in personal injury or death, or property damage, including destruction.*
⚠ **Attention**	*This symbol warns the user of a possible fault.* *Failure to heed this warning can lead to total failure of the device and any other connected equipment.*
Note	*This symbol draws attention to important information.*

Safety Notes

The Universal Temperature Converter must only be operated by trained personnel in accordance with this handbook.

Attention

The protection of operating personnel and of the system is only ensured if the devices are used in accordance with their intended purpose. Any other type of operation than that described in this manual places the safety and functionality of the devices and systems connected to them in question.

Attention

*The devices may only be installed, connected, and adjusted by electrical professionals **outside the hazardous area**.*

Attention

If faults cannot be eliminated, the devices must be taken out of operation and protected from being placed in service again inadvertently. Tampering with or making changes to the devices is dangerous and therefore not permitted. They render the warranty void.

Warning

The responsibility for the adherence to local safety standards lies with the operator.

Note

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Overview

The devices of the Bul. 937C IS Barriers, Isolators and Converters are used to transmit signals between field devices and the process control system or control.

The Bulletin 937 devices are suitable for connection to field devices in the hazardous area. The field current circuits of these devices are intrinsically safe and are galvanically isolated from the not intrinsically safe circuits. The devices thus represent an electrical isolation between the hazardous area and the secure area.

The temperature converter is used for temperature measurement.

Resistance temperature detectors, thermocouples, potentiometers or voltage sources can be connected to the inputs of the converter.

The Universal Temperature Converter converts the input signals into proportional current signals. The output signals can, for example, be for-warded to displays or analog inputs of the process control system.
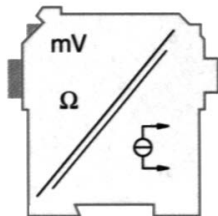
Further information (e. g. certificates, the data sheets for the Universal Temperature Converter and the operating instructions can be found on www.ab.com.

Mounting

⚠️ **Attention**

The Universal Temperature Converter is constructed in protection class IP20 and must therefore be protected from undesirable environmental conditions (water, dust, small foreign objects).

The Universal Temperature Converter can be mounted on a 35 mm top-hat rail corresponding to DIN EN 50022. The devices must be snapped onto the rail **vertically**, and never slanted or tipped to the side.

Further mounting alternatives, e. g. using the Power Rail, can be found in the operating instructions for the Bul 937 at www.ab.com.
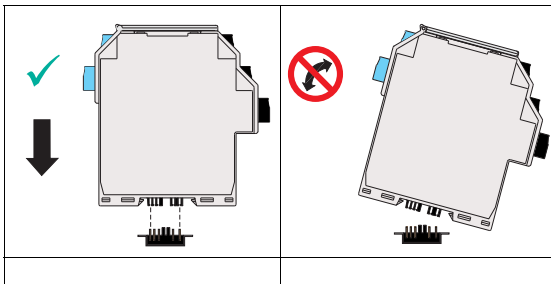
CORRECT: Device snapped on vertically.

INCORRECT: Device snapped on from the side. Can damage the contacts and cause the device to fail.

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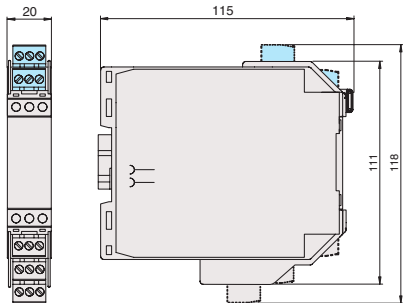
Connection

The slip-off terminals significantly simplify connection and construction of switching cabinets. They allow quick and error-free exchange of the unit when service is needed.

The terminals can be screwed on, are self-opening, and have generous connection room for a wire diameter of up to 2.5 mm² and coded plugs, so that leads cannot be confused.

Intrinsically safe field circuits are connected to the **blue** terminals 1 to 6 of the Universal Temperature Converter. These may be conducted using DIN EN 60079-14-compliant leads into the hazardous area.

Non-intrinsically safe field circuits are connected to the **black** terminals 7 to 15 of the Universal Temperature Converter.

Only one sensor can be connected to the Universal Temperature Converter.
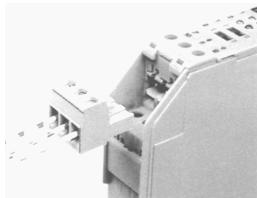
Mounting and Connection

The following sensors can be connected:

- Resistance temperature sensors
  - Pt10, Pt50, Pt100, Pt500, Pt1000 according to EN 60751: 1995 or GOST 6651-94
  - Ni 100 according to DIN 43760
  - Cu10, Cu50, Cu100 according to GOST P50353-92

  in 2-wire, 3-wire or 4-wire technique


equal lead resistances

- Thermocouples
  - Type B, E, J, K, N, R, S, T according to IEC 584-1: 1995
  - Type L according to DIN 43710
  - Type TXA, TXK, TXKH according to GOST P8.585-2001

  For a cold junction compensation (CJC), you require the 937A-TCJC terminal block as an accessory instead of the normal terminal block 1 to 3 or 4 to 6.

937A-TCJC

- Potentiometers (800 Ω - 20 kΩ) in 3-wire technique
- Sources for voltage signals between -100 mV and +100 mV

equal lead resistances
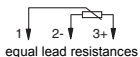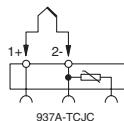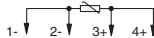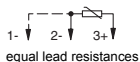
The remaining black terminals have the following functions (10,11,12 NA):

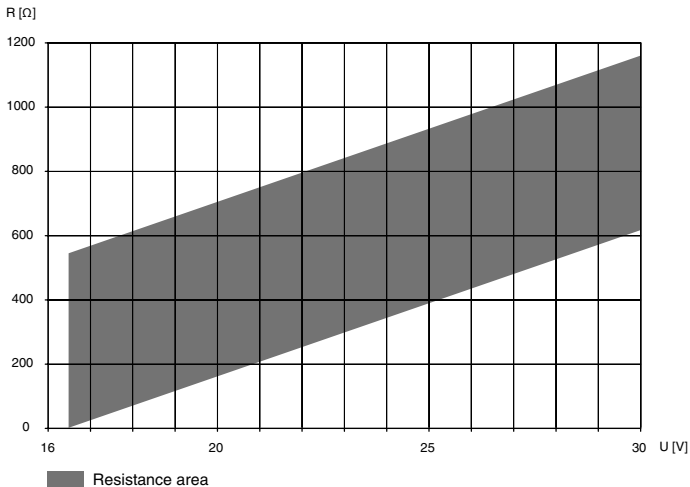7,8 Current output, source

7,9 Current output, sink
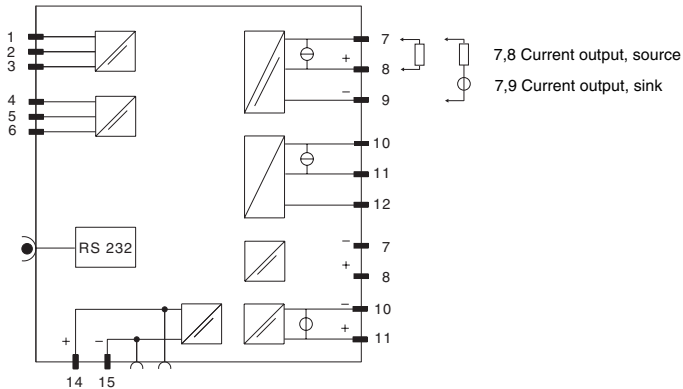
14,15 Power supply 24 VDC

If a current output is operated as a sink, the voltage across the terminals must be between 5 V and 30 V. An additional resistance is only required if the voltage is above 16.5 V. The resistance must be between (U - 16.5 V)/0.0215 A and (U - 5 V)/0.0215 A (see diagram).

Example: U = 24 V

(24 V - 16.5 V)/0.0215 A = 350 Ω

(24 V - 5 V)/0.0215 A = 880 Ω

R [Ω]

Resistance area

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If a current output is operated as a source, the load resistance must be between 0 Ω and 550 Ω (535 Ω if the output format is 4 mA to 20 mA unlimited).

Controls and indicators of the Universal Temperature Converter

Front panel of the universal temperature converter:

- LED ERR 1 (red) to indicate
  - a lead fault at input 1 (terminals 1 to 3; flashes red)
  - the simulation mode (flashes red)
  - a device fault (steady red)

- LED PWR (green) to indicate the supply voltage
- USB interface to connect to a PC for parameterization and diagnosis of the universal temperature converter using FDT

Configuration tools

The Bul 937CS-AITMP-DC1 Universal Temperature Converter is parameterised using an FDT configuration tool such as PACTwareTM.

Installation and connection with the device

Install the FDT software (ie PACTwareTM) on a PC.
Connect the PC and the Bul 937CS-AITMP-DC1 using the 937A-USBA USB cable. This cable can be ordered as an accessory.

Pressing the plug in by force may damage the end devices.
Connect the cable with the jack plug to the USB interface on the front panel of the Bul 937CS-AITMP-DC1. At the PC, connect the USB connector to a free USB interface port.

FDT Interface
This manual describes Parameterization mode of the universal temperature converter using the control panel. parameterization mode for the universal frequency converter is more convenient with a PC using Field Device Tool (FDT) software.

Some specialized functions can only be selected using the FDT .

The FDT interface is the specification describing the standardized data exchange between devices and control system or engineering or asset management tools. Examples include: PACTware^{TM} , FieldCare, FactoryTalk AssetCentre, and Process Device Configuration. FDT frame software can be downloaded from the web: www.pactware.com www.fdtgroup.org.
PACTware^{TM} is trademark of PACTware Consortium

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Communication driver

In a **PACT**_ware_**™** project, communication with a 937CS-AITMP-DC1 is only possible via the communication driver *P2P USB FDT*. If your project does not yet contain such a driver, please add it to the project from the device catalogue (see "**PACT**_wa re_**™** process automation configuration tool" manual).

The parameters of the communication DTM is the used PC interface and the number of retries. The parameter is set as follows:

- Double-click the *P2P RS232 FDT* driver with the mouse
- Select the *Communication Port*
- *Communication Retries*: number of retries the COM DTM attempts to establish communication to the connected device.

To add a 937CS-AITMP-DC1 to a project, select a *P2P RS232 FDT* driver of the project.

Then add the 937CS-AITMP-DC1 from the device catalog.

Further information on the individual steps can be found in the "**PACT**_ware_**™** process automation configuration tool" manual.

The description in the following chapter assumes that a 937CS-AITMP-DC1 has been selected in the project.
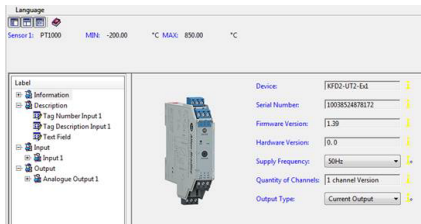
Measured value

If you have started the communication between **PACT**$_{ware}$**™** and device (e. g. via *Device data →
Establish connection*), you can open the Measured value window via *Device data → Measured value*.
It shows the following information on the outputs of the 937CS-AITMP-DC1 Universal Temperature
Converter:

- Measured values at the inputs as numerical values and bar graph, displayed in the selected units.
- Values of the analogue outputs as numerical value and bar graph, displayed in the selected unit.

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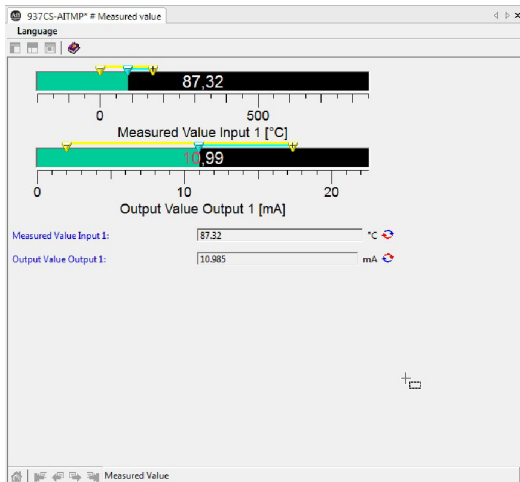
Simulation

If you have started the communication between **PACT**_ware_™ and Bul. 937CS-AITMP-DC1 (e. g. via *Device data → Establish connection*), you can open the Simulation window via *Device data → Simulation*.
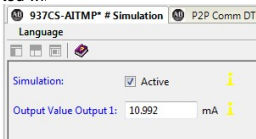
STOP

Warning

The simulation interrupts the normal function of the device!
Before starting the simulation, make sure that no dangerous condition in the plant will result.

The simulation mode is started with   *Active.*

937CS-AITMP* # Simulation	P2P Comm DTI
Language	

Simulation: ☑ Active

Output Value Output 1: 10.992   mA

You can now specify output currents or output voltages for testing purposes. Press Enter to take over the set numerical value.

Use the check box *Simulation ☐ Active* to end the simulation.

If the power supply is interrupted, the device ends the simulation.

Note

*You can close the simulation window with the Close button or by clicking on the Windows-standard ⊠ button at the top right. The device will **remain** in simulation mode, however, until you select Simulation Off again.*

Diagnosis

If you have started the communication between **PACT**$_{ware}$**™** and Bul. 937CS-AITMP-DC1
(e. g. via *Device data →Establish connection*), you can open the Diagnosis window via
Device data → Diagnosis. It shows the following information:
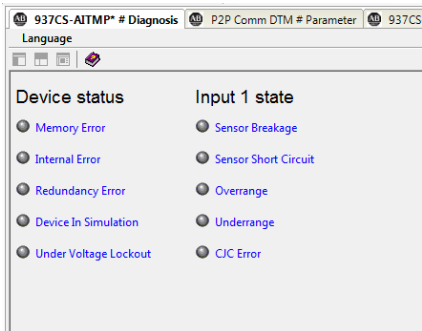
Explanations:

- *Memory error*: error in the memory of the Bul. 937CS-AITMP-DC1; if this error was caused by
  an incorrect data transfer, you can eliminate it via *Device data → Additional functions → Service*
  (see section Service); otherwise, please contact Rockwell Automation

- *Internal device error*: please contact Rockwell Automation

- *Redundancy error*: only if *Redundancy active* has been selected (see Menu Input Extras) in the case of
  a lead fault at **both** inputs (see below)

- *Simulation mode*: see Simulation section

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- *Undervoltage lockout*: the supply voltage is too low for the outputs to work properly, the outputs return 0 mA or 0 V, no matter which fault current/which fault voltage has been selected
- *Redundancy too large*: only if *Redundancy active* has been selected (see Menu Input Extra section), if the set maximum deviation is exceeded
- *Sensor breakage*: see Menu Input section
- *Sensor short circuit*: only RTD type of sensor; see Menu Input section
- *Overrange*, *Underrange*: measured variable outside the maximum measuring range of the selected sensor (see Menu Output section and Behavior of the current output or voltage output section)
- *CJC Error*: if the cold junction compensation has been selected (see Menu Input section) and a breakage or short circuit occurs within the Bul 937A-TCJC terminal
- *Input 1*: terminals 1 to 3 (also uses terminal 4 for 4-wire resistance measurement);

Service

In menu Service the factory settings of the Bul. 937CS-AITMP-DC1 can be reloaded.

Reload the factory settings via pressing the button *Factory Reset*.

Editing device data

STOP

Warning

Any change to device data will change the operation of the device!
Before transferring new data into the device, make sure that no danger to the
installation will result.

If you call the parameters for a Bul. 937CS-AITMP-DC1 in **PACTwareTM**
(e. g. *Device data → Parameters*, a window with menus for parameterization appears,
these manues will be described as follows.

Menu Information and Description
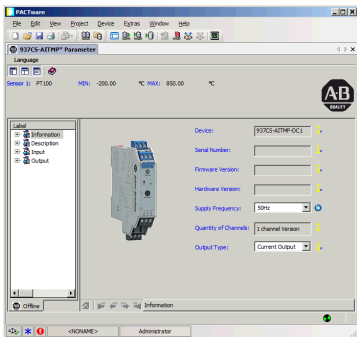
The information in the upper part of the menu *Information* is read from the 937CS-AITMP-DC1.
This information cannot be changed.

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Please specify the frequency of your supply network (50 Hz or 60 Hz) under *Net frequency*. This way you achieve the best possible suppression of influences of this net frequency on the Bul. 937CS-AITMP-DC1

Via Output Type the type of the analog output (current, voltage) can be preselected. This depends on the device which shall be parameterised.

The information in menu *Description* can be edited as desired.

Menu Input

The *Input* tab has the three subordinate tabs *I/input*, *II/input* and *Extras.*

Menu Input 1

On the menu *Input 1*, you set the parameters for the input at the terminals 1 to 3.

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The following parameters can be set:

- *Sensor* (see Connection section)*:*
  - Resistance temperature detector: *Pt10GOST* etc.
  - Thermocouple: *TXK* etc.
  - *Potentiometer*
  - *Voltage*
- *Connection mode* (for resistance temperature detectors only, see Connection section):
  - *2-wire*
  - *3-wire*
  - *4-wire*
- *Unit*:
  - for resistance temperature detectors and thermocouples: *°F*, *K* or *°C*
  - for potentiometers: fixed *ratio*
  - for voltage (sources): fixed *mV*

  The unit selected here will be used for **all** respective settings and displays in **PACT***ware***™**.

- *Cold junction compensation* (for thermocouples only):
  - external (Reference temperature)
  - internal (Bul 937A-TCJC)

  If you have selected *Ext. ref. temp.*, you can enter the external reference temperature (range of values: *-100 °C* to *320 °C*)

  For an *internal Cold junction compensation*, you require the Bul 937A-TCJC terminal block as an accessory instead of the normal terminal 1 to 3 (see Connection section).

- *Lead Resistance*: When connecting an RTD with 2 wire connection the lead resistance of the cabling can be entered numerically if known.
- *2-Wire Calibration*: When connecting an RTD with 2-wire connection the lead resistance of the cabling can be calibrated if the resistance is unknown. For calibration the sensor must be jumpered.
- *Sensor-breakage monitoring* (for all types of sensors)
- *Sensor-short-circuit monitoring* (for resistance temperature detectors only)

  You activate or deactivate monitoring by clicking the respective checkbox
 (☑ = selected, ☐ = deselected).

Behavior of the current output of the Bul. 937CS-AITMP-DC1

The linear behaviour outside the measurement range described in the following only results if temperature values ranging between the minimum value and the maximum value of the selected sensor correspond to the current values. If this is not the case, the output current jumps to the minimum or maximum specified value. The Diagnosis window (see Diagnosis section) shows the message *Above limit* or *Below limit*.

If you select *Characteristic inverted*, the conversion of start value and end value will be inverted.
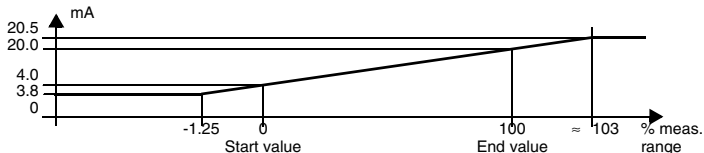
Setting 4 mA ... 20 mA unlimited
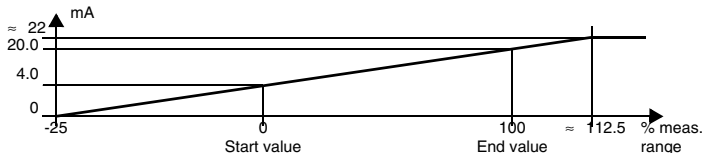
At this setting, the start value of the measurement range is converted to 4 mA and the end value to 20 mA. Intermediate values are converted proportionately.

If the value falls below the start value, the output current decreases linearly to a minimum of 0 mA (-25 % of the measurement range). Further decreases cannot be evaluated (output 0 mA). If the value exceeds the end value, the output current increases linearly to a maximum of 22 mA (approx. 112.5 % of the measurement range). Further increases cannot be evaluated (output approx. 22 mA).
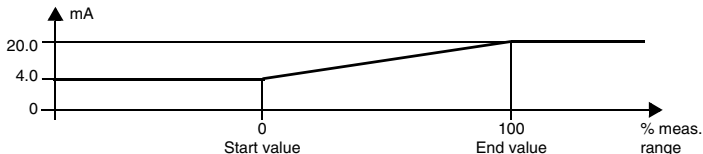
Setting 4 mA ... 20 mA (NE 43)

At this setting, the start value of the measurement range is converted to 4 mA and the end value to 20 mA. Intermediate values are converted proportionately.

If the value falls below the start value, the output current decreases linearly to a minimum of 3.8 mA (-1.25 % of the measurement range). Further decreases cannot be evaluated (output 3.8 mA). If the value exceeds the end value, the output current increases linearly to a maximum of 20.5 mA (approx. 103 % of the measurement range). Further increases cannot be evaluated (output 20.5 mA).
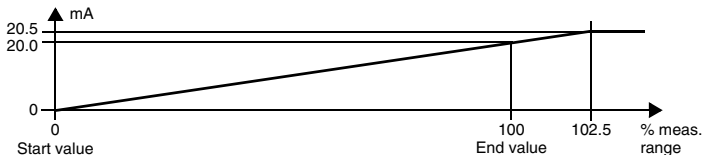
Setting 4 mA ... 20 mA limited

At this setting, the start value of the measurement range is converted to 4 mA and the end value to 20 mA. Intermediate values are converted proportionately.

Values below the start value cannot be evaluated (output 4 mA). Values above the end value cannot be evaluated either (output 20 mA).

Setting 0 mA ... 20 mA

At this setting, the start value of the measurement range is converted to 0 mA and the end value to 20 mA. Intermediate values are converted proportionately.

Values less than the start value cannot be evaluated (output 0 mA). If the value exceeds the end value, the output current increases linearly to a maximum of 20.5 mA (102.5 % of the measuring range). Further increases cannot be evaluated (output 20.5 mA).

Fault current

The following table shows the values of the current output during a fault, depending on the settings. For information on the behavior of the current output if *Redundancy active* has been selected, refer to Menu Input Extras section.

Setting	Characteristic 4 mA ... 20 mA unlimited	Characteristics 4 mA ... 20 mA (NE 43) 4 mA ... 20 mA limited	Characteristic 0 mA ... 20 mA
Upscale	approx. 22 mA (cannot be distinguished from value exceeding end value)	approx. 21.5 mA	approx. 21.5 mA
Downscale	0 mA (cannot be distinguished from value below start value)	2.0 mA	0 mA (cannot be distinguished from measurement of the start value)
Hold	last measured value before the fault		
Upscale/ downscale **only makes sense for RTD**	approx. 22 mA in the case of lead short circuit (cannot be distinguished from value exceeding end value)	approx. 21.5 mA in the case of lead short circuit	approx. 21.5 mA in the case of lead short circuit
	0 mA in the case of lead breakage (cannot be distinguished from value below start value)	2.0 mA in the case of lead breakage	0 mA in the case of lead breakage (cannot be distinguished from measurement of the start value)

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Publication 937-IN005A-EN-P - April 2014 (DIR 10001238756)