Cold Cathode/Pirani Gauge
ACC 2009

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User's Manual

adixen
by Alcatel Vacuum Technology

Alcatel Vacuum Technology France - 98, avenue de Brogny - BP 2069 - 74009 Annecy cedex - FRANCE
Tel. (33) 4 50 65 77 77 - Fax. (33) 4 50 65 77 89
Web site: www.adixen.com

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Cold Cathode/Pirani Gauge ACC 2009

English original version

The combination Cold cathode (Penning) /Pirani gauge ACC2009 has been designed for vacuum measurements of gases in the pressure range of 1000 mbar to 5×10^{-9} mbar.
It is an active gauge. The gauges of 0/10V can be operated with an Adixen controller (ACS 2000 or ACM2000) or as a stand alone gauge sending a signal directly to other equipment. **The gauges of RS485 type can be operated only with RS485 customer's equipment.**
This gauge must not be used for measuring flammable or combustible gases which react in air.

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Symbols used

CAUTION

This type of warning is used to indicate a potential risk that can cause significant damage to the equipment and/or installations if instructions are not followed.

⚠ WARNING

This type of warning is used to indicate a potential risk that can cause serious injury or death if instructions are not followed.

⚠ DANGER

This type of warning is used to indicate an imminent risk that can cause serious injury or death if instructions are not followed.

1 - Safety

General instructions

Intended Use: The Cold Cathode/Pirani Gauge ACC 2009 has been designed for vacuum measurement of gases in the pressure range of $5X10^{-9}$ ...1000 mbar. The gauge must not be used for measuring flammable or combustible gases which react in air.

⚠ WARNING

- **Use an Appropriate Power Source**
  Do not use this gauge with a power supply over 30V DC. Disregarding this maximum voltage can cause product damage or personnel injury.
- **Use appropriate grounds**
  An appropriate protective ground connection is mandatory to avoid electric shock in the event of a fault. Make sure there is no difference in protective ground potential between gauge head and controller device / power supply.
- **Use Caution when installing this gauge.**
  Check that there are no harmful gasses or vapors within the lines or chambers before opening them to install this gauge. Clean and purge with a clean dry gas to remove these harmful gasses or vapors if necessary.
- **Do not over pressure**
  Do not pressurize the inside of this gauge beyond the receivable maximum pressure. Disregarding this can lead to either damage to this gauge, or a gas leakage which may cause personnel injury.
- **Do not use this gauge for corrosive or toxic gasses**
  Do not use this gauge with corrosive, toxic, flammable or explosive gasses, as this can lead to gas leakage and cause injury.
- **Maintenance of the product**
  Do not disassemble the gauge head or electronics sub-assembly. Refer to section 8 for sub-assembly replacement Instructions.
- **Do not modify the product**
  Do not modify the electrical or mechanical components of this gauge. Any modification could cause damage or personnel injury.
- **Skilled personnel**
  All work described in this document should be carried out only by qualified persons who have suitable technical training and the necessary experience.

2 - Responsibility and Warranty

The end-user assumes the responsibility in conjunction withe the process gases used.

- fails to observe the instructions in this document,

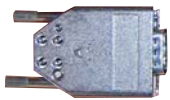
- uses this product in a way that is not consistent with the manufacturer's intended use,

- modifies this product in any way whatsoever,

- uses the product with accessories not listed in the product documentation,

Gauge failures due to contamination, as well as expendable parts (filament), are not covered by the warranty.

3 - Accessories

	Description	P/N
	Gauge cable length (5 m)	**112752**
	Gauge cable length (10 m)	**112753**
	Gauge cable length (20 m)	**112754**
	"D-Sub" 9P (female) connector (for custom equipment connections)	**114848**

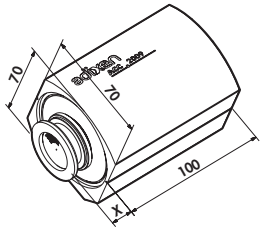
4 - Technical data

Specifications

Measurement principle		Thermal conduction (Pirani)/cold cathode ionization - inverted magnetron (Penning)
Measurement range		$5x10^{-9}$...1000 mbar
Accuracy		$5x10^{-9}$...1.10^{-8} mbar, ±50%
		$1x10^{-8}$...100 mbar ±30%
		100...1000 mbar ±50%
Repeatability (with ambiant temperature 25 °C)		$1x10^{-8}$...100 mbar ± 5%
Supply Voltage range		15...30 V DC
Tolerance ripple		> 2 Vpp
Power consumption		2 W (current <150 mA)
Protection		IP40
Gauge identification resistance		18 kΩ in Pirani mode, 15 kΩ in cold cathode mode
Nominal filament resistance (ambient temperature 25 °C)		56 to 58 Ω
Analog output (versions 0-10 V + SP)		0-10 V ; 8.6 V = 1000 mbar 1.8 V = $5x10^{-9}$ mbar
Set point		2 dry contacts - 1 A 30 V DC
Interface (model RS485 + SP)		RS485
Electrical connection		D-sub 9 Pin (Male)
Max. cable length		300 m - 1mm^2
Temperature range	Operation	+5 to +55 °C
	Storage	–20 to +70 °C
Filament temperature		120 °C
Bake out temperature		150 °C without any electronic
Relative humidity		70 % without any condensation
Vacuum connection		DN25 ISOKF, DN40 ISOKF, DN40CF-F
Operating position		Any orientation
Internal volume		18.3 cm^3
Receivable maximum pressure		2 bars
Materials exposed to vacuum		Molybdenum, SUS304, SUS430 Tungsten, AL_2O_3, Fe / Ni+Ni-planting, Glass, FPM
Filament material		Tungsten (W)

4 - Technical Data (ctd)

Gauges dimensions

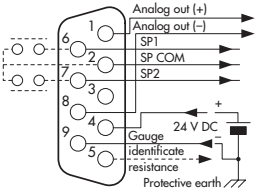


Connecting flange:

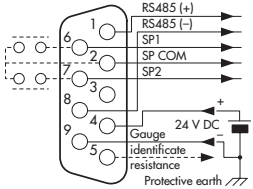
DN 25 ISO KF	X = 16 mm
DN 40 ISO KF	X = 16 mm
DN 40 CF-F	X = 35.5 mm

Electrical Connections

ACC 2009 - 0/10 V + SP



ACC 2009 - RS485 + SP



Pin	Signal	ACC 2009	
		0/10 V +SP	RS485 + SP
1	Analog output 0-10 V (+)	X	
	RS485 signal (+)		X
2	Set point (COM)	X	X
3	Not used		
4	DC power input (+)	X	X
5	Gauge ID	X	X
6	Set point (1)	X	X
7	Set point (2)	X	X
8	Analog output 0-10 V (–)	X	
	RS485 signal (–)		X
9	DC Power input (O V) (–)	X	X

⚠ WARNING

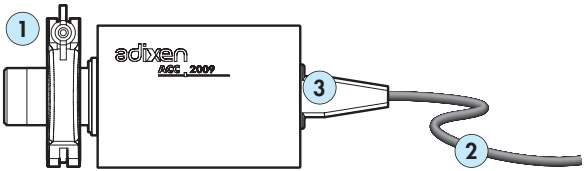
- **Do not use or apply voltage or ground to the pins marked "not used".**
- **Select the correct wire size for voltage if you use your own cable (4 p. 4) (1).**
- **Always connect the protective ground wires or an electric shock can result.**
- **Install a circuit breaker on the power source. Disregarding these instructions can cause damage and/or injury.**

(1) "D-Sub" 9P (female) connector is available to allow the gauge to be connected directly to customer equipment. (3 p. 3).

5 - Gauge Installation

Connection Connect the gauge to the installation using appropriate fitting accessories **(1)** (from the Adixen product catalog).

Connect the cable **(2)**. Use cable ties or other methods to support the cable so that its weight does not put excessive strain on the connector **(3)**.



⚠ WARNING

- **Do not exceed the receivable maximum pressure (4 p. 4). If the maximum pressure of the gauge is exceeded, it can lead to gas leakage and cause injury.**
- **Do not open the installation on which a gauge is installed when the internal pressure is above 1 bar. Internal components may be ejected and cause personal injury.**
- **Do not use this gauge with corrosive, toxic, flammable or explosive gasses.**
- **Do not heat this gauge beyond 70 °C. Disregarding this instruction can cause damage to the gauge circuits or a vacuum leak.**

CAUTION

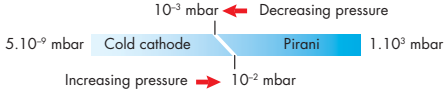
- **Do not touch the inside surfaces of this gauge with bare hands, especially the inlet flange. Fingerprints will increase outgassing in the gauge and cause erroneous pressure readings.**
- **Install this gauge on the vacuum system with care. If it is necessary to reposition it, do not twist or bend the sensor by the electronic enclosure. Disconnect the gauge, position it in the correct position, and connect it again.**
- **Install this gauge away from vibration. High vibration can cause the gauge to malfunction.**
- **This gauge is designed to operate in any orientation. Install the gauge horizontally for higher accuracy.**

Install this gauge away from drastic temperature changes (away from any heat sources or fans) for higher accuracy.

6 - Operation

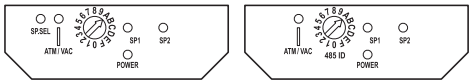
Measurement principle

The ACC2009 is a combination of a Pirani and a cold cathode (Penning) gauge. The crossover between the gauges occurs at a fixed set point as shown below:



The POWER Led indicates the gauge in operation:
- flashing = 'Pirani' gauge in operation, rough vacuum.
- steady = cold cathode gauge in operation, high vacuum.

Panel description



ACC 2009 - 0/10 V + SP — ACC 2009 - RS485 + SP

Lighting: ◯ Off / ● Steady / ((●)) Flashing

	State	Description
Power LED	((●)) green	Pirani gauge in operation
	● green	cold cathode in operation
	● orange	adjustment in progress
((●)) ou	● red	fault (see error catalog)
SP1 LED	◯	set point 1 opened
	● green	set point 1 closed
	((●)) orange or ● orange	adjustment in progress (6 p. 10)
SP2 LED	◯	set point 2 opened
	● green	set point 2 closed
	((●)) orange or ● orange	adjustment in progress (6 p. 10)

Switch		Description
VAC/ATM		atmosphere and zero adjustment
SP SEL		set point adjustment
Switch selector	ACC 2009 - 0/10 V + SP	use to enter set point data (6 p. 10)
	ACC 2009 - RS485 + SP	use to enter network address (refer to RS485 Communication Manual)

Analog Signal output 0/10 V

(ACC 2009 - 0/10 V + SP)

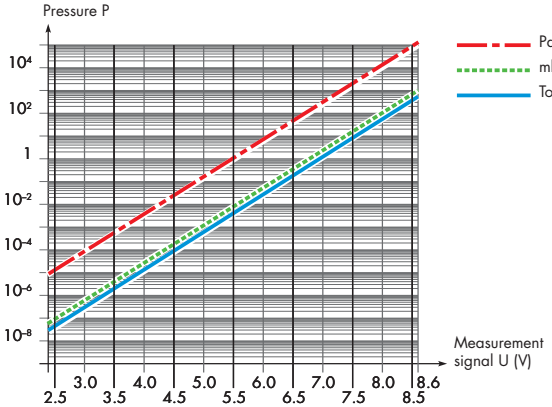
Unit	Pa	mbar	Torr
d	9.33	11.33	11.46

The analog output signal (0/10V) is available on Pins 1(+) and 8(–).

The analog signal can be converted to pressure according to the formula:

$P = 10^{(1.667 \times U - d)}$ where : P= pressure, U= analog signal voltage, d= constant.

Measurement limits: 8.6 V = 1000 mbar and 1.8 V = 5×10^{-9} mbar



For use with gasses other than Air, O_2, N_2, or CO, multiply the pressure reading by the conversion factor from the table below: This formula is useful only for pressures under 1 mbar.

$$P_{effective} = P_{read} \times C$$

Pressure / Gas	Gas	H_2	H_2O	CCl_2F_2	He	CO_2	Air, O_2 CO, N_2	Ne	Ar	Kr	Xe
10^{-3}<P<1mbar	C	0,5	0,5	0,7	0,8	0,9	1,0	1,4	1,7	2,4	3,0
< 10^{-5} mbar	C	2,4	-	-	5,9	-	1,0	4,1	0,8	0,5	0,4

RS485 Signal output

(ACC 2009 - RS485 + SP)

RS485 communication is available on the connector Pins 1(+) and 8(–) .

Refer to the RS485 Communication Manual for details.

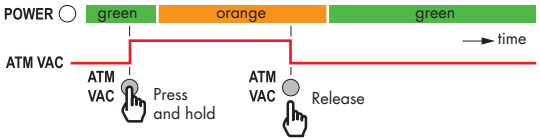
Adjustment of the gauge readings

The Pirani gauge can be adjusted at two points, atmospheric pressure (ATM) and at the low pressure limit of the gauge (VAC). The gauge automatically determines whether the conditions are at atmosphere or under low pressure (zero). Before adjustment, the gauge must be mounted in the same orientation and conditions it will be used in. It must be held in these conditions for at least 10 minutes before proceeding.

To adjust the zero, be sure the gauge current pressure is below 1×10^{-4} mbar (7.6×10^{-5} Torr).

ATM or VAC adjustments

Allow to restore the ATM or VAC stored value.



There is no adjustment for the cold cathode gauge.

Note: For ACC2009 – RS485 + SP models, the adjustments can also be donevia the RS485 interface.

Set Point set up

Set points 1 and 2 are modified using the switch selector:

- To set up the mantissa, use the digits 1 to 9 directly.

- To set up the exponent value (from +6 to –9) use the values in the table below:

- To set up the measurement units, use:
mbar= 2 , torr = 1 or Pascal = any other position.

Switch selector	A	B	C	D	E	F	0	1	2	3	4	5	6	7	8	9
Exponent	+6	+5	+4	+3	+2	+1	0	–1	–2	–3	–4	–5	–6	–7	–8	–9

Example values

Follow this example to set up the set points (refer also to table next page):

set point 1: $5 \times 10^{+2} = 500$ mbar

set point 2: $8 \times 10^{-1} = 0.8$ mbar

Set Point set up (ctd)

(ACC 2009 - 0/10 V + SP)

○ LED off

● LED on steady

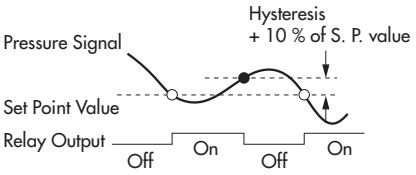
((●)) LED flashing

		Set the dial	Validate with the SP SEL button	Check the confirmation SP1	SP2
	Initial state			○ SP1	○ SP2
1	Start the process		SP.SEL	● SP1	○ SP2
2	Set the dial to '5' for the **mantissa** of set point 1 (**5**x10^{+2})		SP.SEL	((●)) SP1	○ SP2
3	Set the dial to 'E' for the **exponent** of Set point 1 (5x**10^{+2}**) (+2 = 'E' from the previous table)		SP.SEL	○ SP1	● SP2
4	Set the dial to '8' for the **mantissa** of set point 2 (**8**x10^{-1})		SP.SEL	○ SP1	((●)) SP2
5	5) Set the dial to '1' for the **exponent** of set point 2 (8x**10^{-1}**) (-1 = '1' from the previous table)		SP.SEL	((●)) SP1	((●)) SP2
6	Set the dial to '2' for **mbar** (1 = Torr, any other setting = Pascal) – End of process –		SP.SEL	○ SP1	○ SP2

Note: For the ACC2009 - RS485 + SP models, the set points are modified only via the RS485 interface (refer to the RS485 Communication Manual).

6 - Operation (ctd)

Set point output The set point relay output has a fixed 10% hysteresis.



7 - Gauge Removal

⚠ WARNING

■ Parts on a vacuum processing system can be contaminated with material that is detrimental to health and environment.
Before removing this gauge, confirm whether or not the gauge is contaminated with any harmful gasses or vapors. If it is contaminated with any harmful substances, be sure the gauge and equipment are purged and cleaned thoroughly before removal of the gauge.
Take the necessary precautions when handling contaminated parts, refer to 9 p. 13.

CAUTION

■ When removing this gauge from the vacuum system, do not touch the inside of the connecting flange of the gauge or vacuum system with bare hands. Fingerprints will increase outgassing in the gauge and cause erroneous pressure readings

- Vent the vacuum system to atmospheric pressure.
- Turn off the power to the gauge.
- Remove the electrical connector.
- Remove the gauge from the vacuum system.
- Place a protective cap on the fitting to prevent foreign substances from entering the gauge.
- If the gauge must be stored, we advise to keep it away from heat, moisture an dust (4 p. 4).

8 - Maintenance

CAUTION

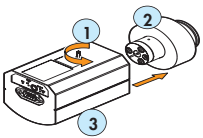
■ **Dirt and damages can impair the function of vacuum components. Disregard can lead to an increase of out gassing in the vacuum system and it may have negative effects on the vacuum process itself. Keep the gauge clean.**
Do not clean the measurement device except the connecting flange. Only use denatured alcohol to clean the outside of the gauge.

Tools required

- 1.5 mm and 3 mm hexagonal key wrenches
- Long-nose pliers; inside circlip pliers (18-60 mm); Ohmmeter.

Sub-assembly replacement

- The sensor and/or the electronics can be replaced. Proceed as follows:
- Loosen the set screw without removing it **(1)**
- Pull out the sensor **(2)** as shown.
- Replace the sensor **(2)** or the electronic **(3)** as needed.
- Carefully align the holes in the electronics to the pins on the sensor, then push the sensor into the electronics. Take care not to bend the pins on the sensor. Secure the sensor to the electronics with the set screw.
- Be sure to calibrate the sensor after assembly (6 p. 9).

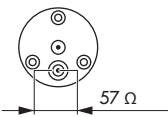


Item	Description	P/N
2	Sensor DN25 ISO KF ACC 2009	**113046**
	Sensor DN40 ISO KF ACC 2009	**113047**
	Sensor DN40 CFF ACC 2009	**113048**
	Maintenance kit (8 p. 13)	**113042**
	Trigger kit	**118808**
3	Electronics 0/10 V + SP ACC 2009	**113039**
	Electronics RS485 + SP ACC 2009	**113040**

Checking the filament

If it is necessary to check the Pirani filament of the Sensor, proceed as follows:

- Remove the sensor from the electronics as described above
- Using an ohmmeter, check the filament resistance between the pin of the Pirani sensor and its ground spring.
- If the measured value is out of this range, replace the sensor.



Maintenance of the sensor

The items required for maintenance of the sensor are available in a kit.

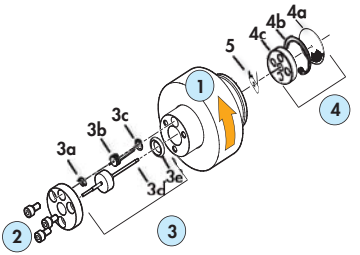
8 - Maintenance (ctd)

Replacement procedure:

1- Remove the sensor from the electronics (8 p. 12). **2**- Unscrew and remove the magnet **(1).** **3**- Remove the 3 screws **(2)** and remove the items to be replaced **(3. 4**- Pull out the protection screen **(4)** with a bent paperclip or similar tool, then remove the circlip **(4b)** with appropriate circlip pliers, then slide out the disk **(4c). 5**- Clean the interior of the sensor, the screen, circlip and disk with isopropol alcohol and lint free wipes, swabs and /or scrubbing pads. Do not scratch the interior finish of the metal. **6**- Reassemble the sensor in the reverse order of disassembly, replacing items with those supplied in the maintenance kit. **7**- If possible, test the reassembled sensor for leaks. **8**- Attach the gauge to a vacuum pump or vessel and evacuate for one hour before calibrating the gauge (6 p. 9)

Maintenance Kit P/N **113042**
Triger Kit (3 triggers) P/N 118808

Item	Description
3a	Spring
3b	Pirani gauge
3c	JO-ring
3d	Anode
3e	O-ring
5	Trigger



Error catalog

(*) = minor errors degraded working of the gauge

Error	Gauge ACC 2009 Power Led & Voltage (V)		Controller Message	Probable Error	Action
A	V ≥ 9,5 V	red	*ErrHi*	Broken filament of Pirani	Check Pirani filament Replace sensor head
B*	8,582 ≤ V < 9,5 V	green	*Or*	If correct ATM/VAC adjustment is not possible or in case of erractic measurements = sensor contaminated	Check sensor head Replace sensor head
C*	2,199 ≤ V < 8,582 V	green	*1x2 +2*		
D*	0,5 ≤ V < 2,199 V	green	*Ur*		
E	0,2 ≤ V < 0,5 V	red	*Err06*	Electronic error	Replace electronics
G	V < 0,2 V	red	*ErrL0*	Electronic error	Replace electronics

9 - Returning the Products

⚠ WARNING

■ **Contaminated products (e.g. with radioactive, toxic, caustic or microbiological hazard) can be detrimental to health and the environment. Products returned to the manufacturer should be cleaned and free of harmful substances. Be sure to follow the shipping regulations of all involved countries and forwarding companies and enclose a duly completed «Safety Questionnaire» available on our web site before shipping any products back to the manufacturer.**

Products that are not clearly declared as "free of harmful substances" are decontaminated at the expense of the customer. Products not accompanied by a duly completed "Safety Questionnaire" are returned to the sender at his own expense.

10 - Decontamination and Product Recycling

In compliance with Directive 2002/96/CE concerning the handling of electrical and electronic equipment waste and Directive 2002/9/CE concerning restrictions on hazardous substances, Adixen products that have reached the end of their service life must be returned to the manufacturer for decontamination and reuse. The manufacturer's obligation to recover such equipment applies only to complete items of equipment that have been neither modified nor retrofitted and have used only spare parts from Alcatel Vacuum Technology sold by Alcatel Vacuum Technology and including all their assemblies and sub-assemblies. This obligation does not include the cost of transporting the product to a reprocessing centre, nor the cost of the service which will be invoiced on to the customer. All equipment returned to the service centre, must have a properly filled in safety questionnaire. The questionnaire is available separately, or on our Web site.

⚠ DANGER

■ **Contaminated parts**
Contaminated parts can be detrimental to health and the environment. Before working on any parts, find out if they are contaminated. Adhere to any relevant regulations and take the necessary precautions when handling contaminated parts.

⚠ DANGER

■ **Substances detrimental to the environment.**
Products or parts thereof (mechanical and electriccomponents, operating fluids etc.) can be detrimental to the environment. Dispose of such substances in accordance with all relevant local regulations.

Separating the components

After disassembling the product, separate its components according to the following criteria:

Contaminated components: Contaminated components (radioactive, toxic, caustic, or biological hazard etc.) must be decontaminated in accordance with the relevant local regulations, separated according to their materials, and disposed of.

Other components: Such components must be separated according to their materials and recycled.

adixen

DECLARATION OF CONFORMITY

We, Alcatel Vacuum Technology France,
98, Avenue de Brogny, BP 2069
74009 ANNECY FRANCE

ISO 9001 CERTIFIED

declare under our sole responsibility that the following Adixen products

AP 2004 - APN 2004 - Pirani gauge
ACC 2009 - Cold cathode Pirani gauge
AHC 2010 - Hot cathode Crystal gauge
ASD 2001 - ASD 2002 - ASD 2003 - ASD 2004 Capacitance gauges

to which this declaration relates are in conformity with the following European Directives

89 / 336 / EEC	Electromagnetic Compatibility Directive
73 / 023 / EEC	Low Voltage Directive
93 / 68 / EEC	Council directive (E.C Marking)
2002/96/ EEC	Waste of electrical and electronical equipments
2002/95/ EEC	Restriction of Hazardous substances

The standards, normative documents, and/or specifications to which the products comply are :

NF EN 61000-6-2	EMC / Generic immunity standard - Industrial environments
NF EN 61000-6-3	EMC / Generic emission standard / Light industry
NF EN 61010-1	Safety requirements for electrical equipment for measurement, control and laboratory use
NF EN 61326 Class A emission)	EMC/ Electrical equipment for measurement, control and laboratory use

Mr J.Y. GUEGAN, Président Directeur Général — Annecy, le 06/10/2009

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