

If not indicated otherwise in the legends, the illustrations in this document correspond to gauges with the DN 16 ISO-KF vacuum connection. They apply other vacuum connections by analogy.

We reserve the right to make technical changes without prior notice.

All dimensions in mm.

Intended Use

The temperature controlled SKY™ Capacitance Diaphragm Gauges of the CDG045 and CDG045-H series are intended for absolute pressure measurement of gases in the pressure ranges specified in section "Validity".

The gauges can be operated in connection with an INFICON Vacuum Gauge Controller or another appropriate controller.

Functional Principle

The SKY™ Capacitance Diaphragm Gauges consist of a capacitive sensor element made of aluminum oxide ceramic and electronics which convert the capacitance change into a DC voltage output signal.

The output signal is linear to the measured pressure and independent of the gas type.¹⁾

The sensor is heated and its temperature kept constant at 45 °C to prevent contamination by process products and by products.

Trademarks

SKY™ INFICON GmbH
VCR® Swagelok Marketing Co.

Safety

Symbols Used

DANGER
Information on preventing any kind of physical injury.

WARNING
Information on preventing extensive equipment and environmental damage.

Caution
Information on correct handling or use. Disregard can lead to malfunctions or minor equipment damage.

Personnel Qualifications

Skilled personnel
All work described in this document may only be carried out by persons who have suitable technical training and the necessary experience or who have been instructed by the end-user of the product.

General Safety Instructions

- Adhere to the applicable regulations and take the necessary precautions for the process media used. Consider possible reactions with the product materials.
- Adhere to the applicable regulations and take the necessary precautions for all work you are going to do and consider the safety instructions in this document.
- Before beginning to work, find out whether any vacuum components are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Communicate the safety instructions to all other users.

Liability and Warranty

INFICON assumes no liability and the warranty becomes null and void if the end-user or third parties

- disregard the information in this document
- use the product in a non-conforming manner
- make any kind of interventions (modifications, alterations etc.) on the product
- use the product with accessories not listed in the product documentation.

The end-user assumes the responsibility in conjunction with the process media used.

Technical Data

Measurement range	→ "Validity"
Accuracy	0.15% of reading
Resolution	
360-X1X ... 362-X1X	0.0015% F.S.
364-X1X, 365-X1X	0.0025% F.S.
371-030 ... 371-033	0.0025% F.S.
Temperature effect on zero	
360-X1X ... 364-X1X	0.0025% F.S./ °C
365-X1X	0.0050% F.S./ °C
371-030, 371-032	0.0025% F.S./ °C
371-031, 371-033	0.0050% F.S./ °C
Temperature effect on span	
360-X1X ... 365-X1X	0.01% of reading/ °C
371-030 ... 371-033	0.01% of reading/ °C
Gas type dependence	none ¹⁾

Output signal (measuring signal)	
Measurement range	0 ... +10.0 V
Voltage range	-11.0 V ... +11.0 V
Relationship voltage-pressure	linear ¹⁾
Output impedance	200 Ω (short-circuit proof)
Minimum loaded impedance	10 kΩ
Response time	
360-X1X ... 362-X1X	30 ms
364-X1X, 365-X1X	100 ms
371-030 ... 371-033	30 ms

Gauge identification	Resistance 13.2 kΩ referred to supply common
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Supply

DANGER
 The gauge may only be connected to power supplies, instruments or control devices that conform to the requirements of a grounded protective extra-low voltage (SELV-E according to EN 61010). The connection to the gauge has to be fused.²⁾

Supply voltage at the gauge	
at pin 7	15 VDC ±5%
or pin 11	18.0 ... 26.4 VDC

Power consumption (depending on supply voltage)	
during heat-up	9 ... 19 W
at operating temperature	4 ... 5 W
Internal fuse	1 AT, slow, automatic reset (Polifuse)

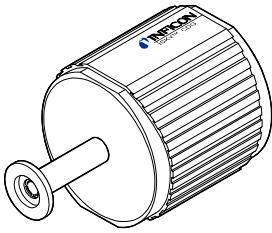
The gauge is protected against polarity change of the supply voltage.

Electrical connector	D-Sub, 15-pin, male, screwlock UNC 4-40
Sensor cable	5 conductors plus shielding
Cable length	≤50 m (5x0.50 mm ²)
For longer cables, bigger conductor cross-sections are required ($R_{conductor} \leq 1.0 \Omega$).	

Grounding concept	
Vacuum connection – signal common	→ "Electrical Connection" conducted separately; for differential measurement
Supply common – signal common	

SKY™ Capacitance Diaphragm Gauge

CDG045
CDG045-H



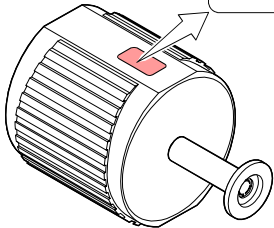
Operating Manual
Incl. Declaration of Conformity

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Product Identification

In all communications with INFICON, please specify the information given on the product nameplate. For convenient reference transfer this information into the diagram below.

INFICON AG, LI-9496 Balzers
Model: -----
PN:-----
SN:-----
----- V ----- W



Validity

This document applies to products with the following part numbers:

CDG045:

0 ⇒ Torr	1 ⇒ Pa
2 ⇒ mbar	
0 ⇒ ½"-Rohr	1 ⇒ DN 16 ISO-KF
2 ⇒ DN 16 CF-R	3 ⇒ 8 VCR
360-010	
0 ⇒ 10 ⁻¹ ... 1000 Torr (F.S.)	1 ⇒ 10 ⁻² ... 100 Torr (F.S.)
2 ⇒ 10 ⁻³ ... 10 Torr (F.S.)	4 ⇒ 10 ⁻⁴ ... 1 Torr (F.S.)
5 ⇒ 10 ⁻⁵ ... 0.1 Torr (F.S.)	
0 ⇒ 1.33×10 ¹ ... 133322 Pa (F.S.)	1 ⇒ 1.33×10 ⁰ ... 13332.2 Pa (F.S.)
2 ⇒ 1.33×10 ⁻¹ ... 1333.22 Pa (F.S.)	4 ⇒ 1.33×10 ⁻² ... 133.322 Pa (F.S.)
5 ⇒ 1.33×10 ⁻³ ... 13.3322 Pa (F.S.)	
0 ⇒ 1.1×10 ⁻¹ ... 1100 mbar (F.S.)	1 ⇒ 10 ⁻² ... 100 mbar (F.S.)
2 ⇒ 10 ⁻³ ... 10 mbar (F.S.)	4 ⇒ 10 ⁻⁴ ... 1 mbar (F.S.)
5 ⇒ 10 ⁻⁵ ... 0.1 mbar (F.S.)	

CDG045-H High Speed:

371-030	(10 ⁻⁴ ... 1 Torr (F.S.))	DN 16 ISO-KF
371-031	(10 ⁻⁵ ... 0.1 Torr (F.S.))	DN 16 ISO-KF
371-032	(10 ⁻⁴ ... 1 Torr (F.S.))	8 VCR
371-033	(10 ⁻⁵ ... 0.1 Torr (F.S.))	8 VCR

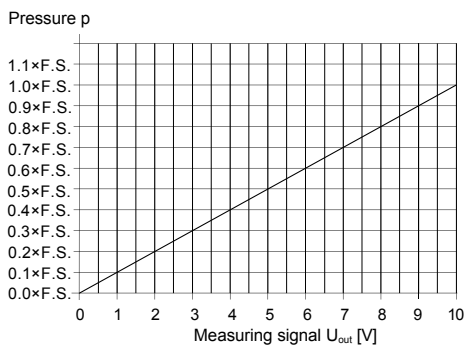
The part number (PN) can be taken from the product nameplate.

¹⁾ For $p < 1$ mbar and $T_{Gauge} \neq T_{Vacuum}$ the linearity of a temperature controlled gauge is influenced by the thermal transpiration (gas type dependent) at the maximum in the same order of magnitude as the zero point stability. See K. F. Poulter et al., Vacuum 33, 331 (1983); W. Jitschin and P. Röhl, J. Vac. Sci. Technol. A, Vol. 5, No. 3, 1987.

²⁾ INFICON controllers fulfill these requirements.

Materials exposed to the vacuum Flange, tube, protective chamber, plasma shield Sensor and diaphragm Sensor – diaphragm connection Ceramic - metal connection	stainless steel 316L ceramic (Al ₂ O ₃ ≥99.5%) glass ceramics solder AgCu hard solder, Vacon 70 (28% Ni, 23% Co, 49% Fe)
Internal volume	7 cm ³
Admissible pressure 360-X1X	≤2250 Torr (absolute) ≤300 kPa (absolute) ≤3 bar (absolute)
361-X1X ... 364-X1X	≤1500 Torr (absolute) ≤200 kPa (absolute) ≤2 bar (absolute)
365-X1X	≤1000 Torr (absolute) ≤133.3 kPa (absolute) ≤1.33 bar (absolute)
371-030, 371-032 371-031, 371-033	≤1500 Torr (absolute) ≤1000 Torr (absolute)
Admissible temperatures Operation	+15 ... +40 °C
Vacuum connection	≤90 °C
Storage	-40 ... +65 °C
Relative humidity	≤80% at temperatures ≤+31 °C decreasing to 50% at +40 °C
Mounting orientation Use	any → "Installation" indoors only, altitude up to 2000 m
Type of protection	IP 30

Relationship Measuring Signal – Pressure



$$p = (U_{out} / 10 \text{ V}) \times p(\text{F.S.})$$

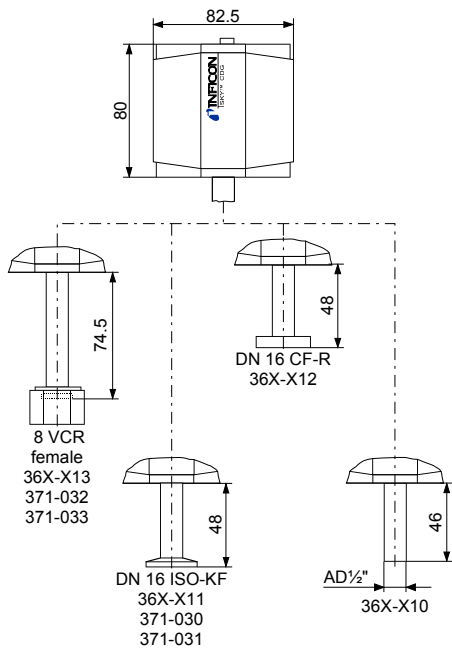
Example: Gauge with 10 Torr F.S.
Measuring signal U_{out} = 6 V

$$p = (6 \text{ V} / 10 \text{ V}) \times 10 \text{ Torr} \\ = 0.6 \times 10 \text{ Torr} = \mathbf{6 \text{ Torr}}$$

Conversion Torr ↔ Pascal

	Torr	mbar ³⁾	Pa ³⁾
c	1.00	1013.25 / 760 = 1.3332...	101325 / 760 = 133.3224...

Dimensions [mm]



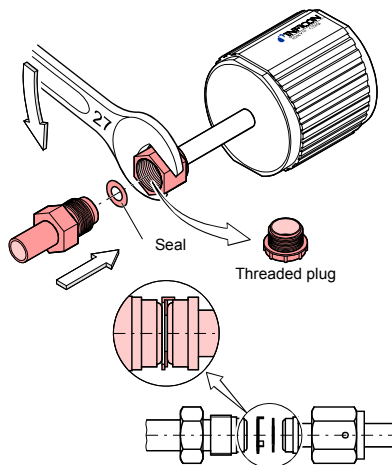
Weight	
36X-X10	600 g
36X-X11	590 g
36X-X12	620 g
36X-X13	610 g
371-032, 371-033	610 g
371-030, 371-031	590 g

Caution

Caution: dirt sensitive area
Touching the product or parts thereof with bare hands increases the desorption rate.
Always wear clean, lint-free gloves and use clean tools when working in this area.

The gauge may be mounted in any orientation. However, it should be mounted so that no vibrations occur and that no particles and condensates can penetrate into the measuring chamber. If adjustment should be possible after the gauge has been installed, be sure to install it so that potentiometers <zero coarse> and <zero fine> can be accessed with a screw driver.

Remove the protective lid or the threaded plug and connect the product to the vacuum system.



Installation

Vacuum Connection

DANGER

Caution: overpressure in the vacuum system >750 Torr, 100000 Pa, 1 bar
Injury caused by released parts and harm caused by escaping process gases can result if clamps are opened while the vacuum system is pressurized.
Do not open any clamps while the vacuum system is pressurized. Use the type clamps which are suited to overpressure.

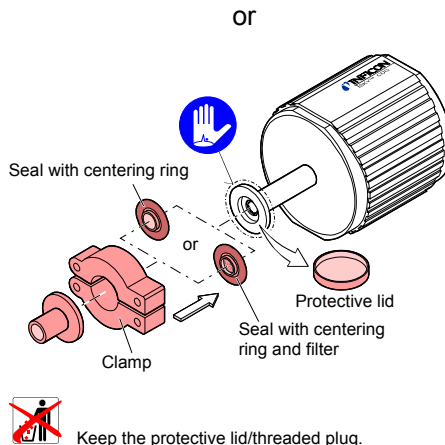
DANGER

Caution: protective ground
Products that are not correctly connected to ground can be extremely hazardous in the event of a fault.
Electrically connect the gauge to the grounded vacuum chamber. This connection must conform to the requirements of a protective connection according to EN 61010:

- CF and 8 VCR flanges fulfill this requirement.
- For gauges with a KF flange, use a conductive metallic clamping ring.
- For gauges with a 1/2" tube, take appropriate measures to fulfill this requirement.


Caution

Caution: vacuum component
Dirt and damages impair the function of the vacuum component.
When handling vacuum components, take appropriate measures to ensure cleanliness and prevent damages.

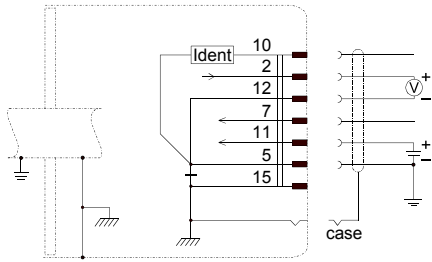


³⁾ Source: NPL (National Physical Laboratory)
Guide to the Measurement of Pressure and Vacuum
ISBN 0904457x / 1998.

Electrical Connection

 Make sure the vacuum connection is properly made (→ "Vacuum Connection").

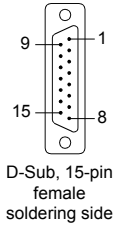
1 If no sensor cable is available, make one according to the following diagram.




Pin assignment

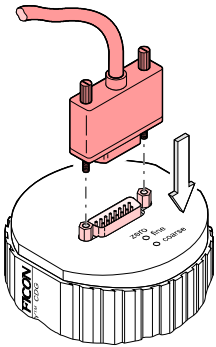
Pin 2	Signal output (Measuring signal)
Pin 5	Supply common
Pin 7	Supply (+15 V)
Pin 10	Identification *)
Pin 11	Supply (+18 ... +26.4 V)
Pin 12	Signal common
Pin 15	Housing
case	Connector housing

*) → "Technical Data"



-  Connect only one supply voltage (+15 V or +18 ... +26.4 V).
- Pins 1, 3, 4, 6, 8, 9, 13, 14 are not assigned in the gauge.

2 Connect the sensor cable to the gauge.



3 Secure the cable socket to the gauge connector with the lock screws.

4 Connect the sensor cable to the controller.

Operation

Put the gauge into operation. If you are operating the gauge with an INFICON Vacuum Gauge Controller, adjust the measurement range (→ [1, 2]).

Allow for a warm-up time of at least 1 hour, or for high precision measurements, of at least 2 hours.

Gas type dependence

The measured value is independent of the gas type.¹⁾

Zeroing the Gauge

Before operating the gauge for the first time, adjust the zero. Due to long time operation or contamination, a zero drift could occur and periodic zeroing may become necessary. Adjust the zero at the ambient temperature at which the gauge is normally operated.

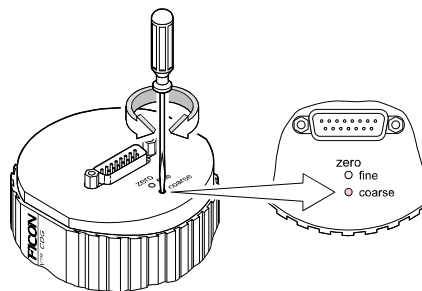
1 Evacuate the gauge to a pressure in accordance with the table below:

	Recommended maximum pressure for zero adjustment		
360-X1X	<5×10 ⁻² Torr	<6.65×10 ⁰ Pa	<5×10 ⁻² mbar
361-X1X	<5×10 ⁻³ Torr	<6.65×10 ⁻¹ Pa	<5×10 ⁻³ mbar
362-X1X	<5×10 ⁻⁴ Torr	<6.65×10 ⁻² Pa	<5×10 ⁻⁴ mbar
364-X1X	<5×10 ⁻⁵ Torr	<6.65×10 ⁻³ Pa	<5×10 ⁻⁵ mbar
365-X1X	<5×10 ⁻⁶ Torr	<6.65×10 ⁻⁴ Pa	<5×10 ⁻⁶ mbar
371-030	<5×10 ⁻⁵ Torr		
371-031	<5×10 ⁻⁶ Torr		
371-032	<5×10 ⁻⁵ Torr		
371-033	<5×10 ⁻⁶ Torr		

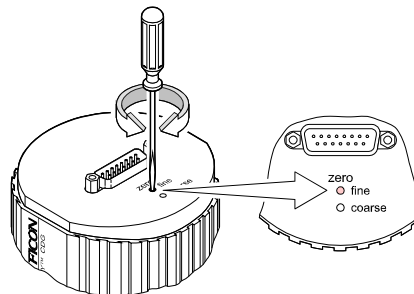
2 Operate the gauge for 1 to 2 hours (until the reading is stable).

3 Connect a reliable, accurate, correctly calibrated instrument with at least 4 digits to the (measuring) signal output of the gauge.

4 Only initial operation:
To compensate for the influence of the mounting orientation, adjust the output signal to -0.2 ... +0.2 VDC via the <zero coarse> potentiometer.



5 Using a screwdriver (1.5 mm), adjust <zero fine> so that the output signal is 0.000 VDC.



If you are using the INFICON Vacuum Gauge Controller, you can adjust the zero on the controller (→ [1, 2]).

Caution

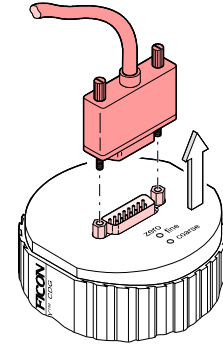


Caution: dirt sensitive area
Touching the product or parts thereof with bare hands increases the desorption rate.
Always wear clean, lint-free gloves and use clean tools when working in this area.

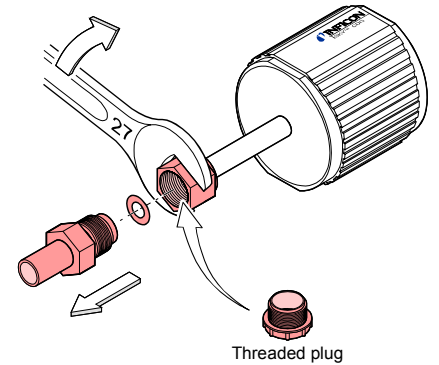
1 Vent the vacuum system.

2 Turn the gauge off.

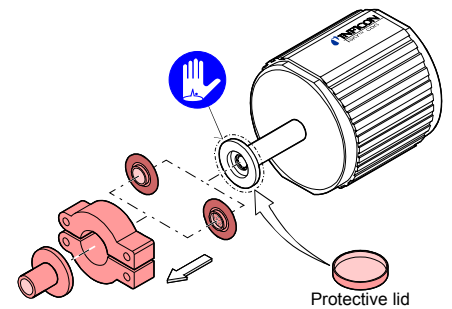
3 Loosen the lock screws and unplug the sensor cable.



4 Remove the gauge from the vacuum system.



or



Deinstallation

STOP DANGER



Caution: contaminated parts

Contaminated parts can be detrimental to health and environment.

Before beginning to work, find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Caution



Caution: vacuum component

Dirt and damages impair the function of the vacuum component.

When handling vacuum components, take appropriate measures to ensure cleanliness and prevent damages.

Maintenance, Repair

Under clean operating conditions, the product requires no maintenance.




Gauge failures due to contamination are not covered by the warranty.

INFICON assumes no liability and the warranty becomes null and void if any repair work is carried out by the end-user or third parties.

Returning the Product


WARNING

 Caution: forwarding contaminated products Contaminated products (e.g. radioactive, toxic, caustic or microbiological hazard) can be detrimental to health and environment. Products returned to INFICON should preferably be free of harmful substances. Adhere to the forwarding regulations of all involved countries and forwarding companies and enclose a duly completed declaration of contamination.


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 declaration of contamination are returned to the sender at his own expense.

Disposal

DANGER

 Caution: contaminated parts Contaminated parts can be detrimental to health and environment. Before beginning to work, find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

WARNING

 Caution: substances detrimental to the environment Products or parts thereof (mechanical and electric components, operating fluids etc.) can be detrimental to the environment. Dispose of such substances in accordance with the 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 national regulations, separated according to their materials, and disposed of.
- Other components
Such components must be separated according to their materials and recycled.

Further Information


- [1] www.inficon.com
Operating Manual
Single-Channel Controller VGC401
tinb01e1
INFICON AG, LI-9496 Balzers, Liechtenstein
- [2] www.inficon.com
Operating Manual
Vacuum Gauge Controller VGC032
tinb02e1
INFICON AG, LI-9496 Balzers, Liechtenstein


Declaration of Contamination

The service, repair, and/or disposal of vacuum equipment and components will only be carried out if a correctly completed declaration has been submitted. Non-completion will result in delay. This declaration may only be completed (in block letters) and signed by authorized and qualified staff.

- Description of product**
Type _____
Part number _____
Serial number _____
- Reason for return**

- Operating fluid(s) used**
(Must be drained before shipping.)

- Used in copper process**
no yes  Seal product in plastic bag and mark it with a corresponding label.
- Process related contamination of product:**

toxic	no <input type="checkbox"/> 1)	yes <input type="checkbox"/>	
corrosive	no <input type="checkbox"/> 1)	yes <input type="checkbox"/>	
biological hazard	no <input type="checkbox"/>	yes <input type="checkbox"/> 2)	
explosive	no <input type="checkbox"/>	yes <input type="checkbox"/> 2)	
radioactive	no <input type="checkbox"/>	yes <input type="checkbox"/> 2)	
other harmful substances	no <input type="checkbox"/> 1)	yes <input type="checkbox"/>	

1) or not containing any amount of hazardous residues that exceed the permissible exposure limits
 2) Products thus contaminated will not be accepted without written evidence of decontamination.

The product is free of any substances which are damaging to health. yes
- Harmful substances, gases and/or by-products**
Please list all substances, gases, and by-products which the product may have come into contact with:

Trade/product name manufacturer	Chemical name (or symbol)

Precautions associated with substance	Action if human contact
- Legally binding declaration:**
We hereby declare that the information on this form is complete and accurate and that we will assume any further costs that may arise. The contaminated product will be dispatched in accordance with the applicable regulations.
 Organization/company _____
 Address _____
 Post code, place _____
 Phone _____ Fax _____
 Email _____
 Name _____
 Company stamp _____

This form can be downloaded from our website.
Copies: Original for addressee
1 copy for accompanying documents
1 copy for file of sender

Declaration of Conformity



We, INFICON, hereby declare that the equipment mentioned below complies with the provisions of the Directive relating to electrical equipment designed for use within certain voltage limits 73/23/EEC and the Directive relating to electromagnetic compatibility 89/336/EEC.

SKY™ Capacitance Diaphragm Gauge

CDG045
CDG045-H

Part numbers

360-010	360-110	360-210	361-010
360-011	360-111	360-211	361-011
360-012	360-112	360-212	361-012
360-013	360-113	360-213	361-013
361-110	361-210	362-010	362-110
361-111	361-211	362-011	362-111
361-112	361-212	362-012	362-112
361-113	361-213	362-013	362-113
362-210	364-010	364-110	364-210
362-211	364-011	364-111	364-211
362-212	364-012	364-112	364-212
362-213	364-013	364-113	364-213
365-010	365-110	365-210	371-030
365-011	365-111	365-211	371-031
365-012	365-112	365-212	371-032
365-013	365-113	365-213	371-033

Standards

Harmonized and international/national standards and specifications:

- EN 61010 (Safety requirements for electrical equipment for measurement, control and laboratory use)
- EN 50081-1 (Electromagnetic compatibility: generic emission standard)
- EN 50082-2 (Electromagnetic compatibility: generic immunity standard)

Signatures

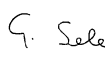
INFICON AG, Balzers

31 March 2003



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Product Marketing
Management

1 April 2003



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Technical Support Manager
Quality Representative



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