


## InstruTech® Quick Product Selection Guide - Vacuum Gauge Modules

Products	Vacuum Gauge Technology	Measurement Range	Controller	Display	Display Units	Analog Output	Setpoint Relay	Serial Comm.
<b>IGM401 Hornet™</b> 	Bayard-Alpert Hot Cathode Ionization Gauge	$1.0 \times 10^{-9}$ to $5 \times 10^{-2}$ Torr $1.3 \times 10^{-9}$ to $6.7 \times 10^{-2}$ mbar $1.3 \times 10^{-7}$ to 6.7 Pa	Built-in	OLED	Torr, mbar, Pa	1	1	RS485
<b>IGM402 Hornet™</b> 	Bayard-Alpert Hot Cathode IG with Dual convection Full Range Gauge	$1.0 \times 10^{-9}$ to 1,000 Torr $1.3 \times 10^{-9}$ to 1,333 mbar $1.3 \times 10^{-7}$ Pa to 133 kPa	Built-in	OLED	Torr, mbar Pa / Kpa	3	3	RS485
<b>WGM701 WASP™</b> 	Cold Cathode Pirani Full Range Gauge	$7.6 \times 10^{-10}$ to 760 Torr $1 \times 10^{-9}$ to 1000 mbar $1 \times 10^{-7}$ Pa to 101 kPa	Built-in	None	N/A	1	None	None
<b>CCM502 Hornet™</b> 	Cold Cathode Inverted Magnetron	$7.6 \times 10^{-10}$ to $7.6 \times 10^{-3}$ Torr $1.0 \times 10^{-9}$ to $1 \times 10^{-2}$ mbar $1.0 \times 10^{-7}$ to 1 Pa	Built-in	None	N/A	1	None	None
<b>CCM501 Hornet™</b> 	Cold Cathode Double Inverted Magnetron	$1.0 \times 10^{-9}$ to $1 \times 10^{-2}$ Torr $1.3 \times 10^{-9}$ to $1.3 \times 10^{-2}$ mbar $1.3 \times 10^{-7}$ to 1.3 Pa	Built-in	OLED	Torr, mbar, Pa	1	1	RS485
<b>CVM211 Stinger™</b> 	Convection Enhanced Pirani	$1 \times 10^{-4}$ to 1,000 Torr $1.3 \times 10^{-4}$ to 1,333 mbar $1.3 \times 10^{-2}$ Pa to 133 kPa	Built-in	LED	Torr / mTorr bar / mbar	1	1	none
<b>CVM201 Super Bee™</b> 	Convection Enhanced Pirani	$1 \times 10^{-4}$ to 1,000 Torr $1.3 \times 10^{-4}$ to 1,333 mbar $1.3 \times 10^{-2}$ Pa to 133 kPa	Built-in	OLED	Torr / mTorr bar / mbar Pa / kPa	1	2	RS232 & RS485
<b>PCM301 Busy Bee™</b> 	Pirani Capacitance Gauge	$3.8 \times 10^{-5}$ to 1,125 Torr $5.0 \times 10^{-5}$ to 1,500 mbar $5.0 \times 10^{-3}$ Pa to 150 kPa	Built-in	backlit LCD	Torr	1	2	None
<b>CDM900 Micro BEE™</b> 	Capacitance Diaphragm	10 to 1000 Torr Full Scale	Built-in	None	None	1	None	None
<b>VSM100 Mini BEE™</b> 	Vacuum Switch - Absolute Vacuum Switch- Differential	20 to 970 Torr -99 to + 46 Torr	Built-in	None	None	1	None	None

## InstruTech® Quick Product Selection Guide - Vacuum Gauge Sensors and Controllers

Product	Vacuum Gauge Technology	Measurement Range	Compatible Controller	Display	Display Units	Analog Output	Setpoint Relay	Serial Com
<b>BA600</b> 	Bayard-Alpert Hot Cathode Mini Ionization (IG) Sensor	$1.0 \times 10^{-9}$ to $5 \times 10^{-2}$ Torr $1.3 \times 10^{-9}$ to $6.7 \times 10^{-2}$ mbar $1.3 \times 10^{-7}$ to 6.7 Pa	B-RAX	Sensor only See B-RAX	None	None	None	None
<b>BA601/BA602/BA603</b> 	Nude / Glass Hot Cathode Bayard-Alpert IG Sensor	$2.0 \times 10^{-11}$ to $1 \times 10^{-3}$ Torr $2.7 \times 10^{-11}$ to $1.3 \times 10^{-3}$ mbar $2.7 \times 10^{-9}$ to $1.3 \times 10^{-1}$ Pa	FlexRax B-RAX	Sensor only See FlexRax or B-RAX	None	None	None	None
<b>CC605/CC606</b> 	Cold Cathode Inverted Magnetron Sensor	$7.5 \times 10^{-11}$ to $3.75 \times 10^{-3}$ Torr $1.0 \times 10^{-10}$ to $5 \times 10^{-3}$ mbar $1.0 \times 10^{-8}$ to $5 \times 10^{-1}$ Pa	B-RAX	Sensor only See B-RAX	None	None	None	None
<b>CVG101 Worker Bee™</b> 	Convection Enhanced Pirani	$1.0 \times 10^{-4}$ to 1,000 Torr $1.3 \times 10^{-4}$ to 1,333 mbar $1.3 \times 10^{-2}$ Pa to 133 kPa	VGC301 B-RAX FlexRax	Sensor only See VGC301 B-RAX or FlexRax	None	None	None	None
<b>FlexRax® 4000</b> 	Multi-Gauge Controller - operates up to 4 IG, 4 CG and 2 CDG	$2.0 \times 10^{-11}$ to 1,000 Torr $2.7 \times 10^{-11}$ to 1,333 mbar $2.7 \times 10^{-9}$ Pa to 133 kPa	N/A	Up to 10 channels Backlit LCD	Torr, mbar, Pa	up to 8	up to 16	RS232 & RS485
<b>B-RAX™ 3000 Series</b> 	3 Channel Controller - operates 1 IG and 2 CG or 1 IG, 1 CG and 1 CDG	$2.0 \times 10^{-11}$ to 1,000 Torr $2.7 \times 10^{-11}$ to 1,333 mbar $2.7 \times 10^{-9}$ Pa to 133 kPa	N/A	3 Channel OLED	Torr, mbar, Pa	3	6	RS232 & RS485
<b>VGC301</b> 	Single Channel Convection Gauge Controller for CVG101	$1.0 \times 10^{-4}$ to 1,000 Torr $1.3 \times 10^{-4}$ to 1,333 mbar $1.3 \times 10^{-2}$ Pa to 133 kPa	N/A	1 Channel OLED	Torr / mTorr bar / mbar Pa / kPa	1	2	RS232 & RS485
<b>AGC302</b> 	Single Channel Active Gauge Controller For all Modules	Dependent on active gauge connected	N/A	1 Channel OLED	Torr, mbar, Pa	1	2	RS232 & RS485



**InstruTech®**

## **Series 400 Hornet™ Hot Cathode Bayard-Alpert Miniature-Ionization Vacuum Gauge**

### **Wide measurement range**

$1 \times 10^{-9}$  to  $5 \times 10^{-2}$  Torr  
 $1.3 \times 10^{-9}$  to  $6.7 \times 10^{-2}$  mbar  
 $1.3 \times 10^{-7}$  to 6.7 Pa

### **Full range measurement from**

$1 \times 10^{-9}$  Torr to atmosphere when  
used with the B-RAX or the FlexRax  
controllers and a convection gauge

**Ionization gauge designed specifically  
for use with InstruTech's B-RAX or  
FlexRax vacuum gauge controllers**

**Dual hot filament design, rugged  
and compact metal construction**

**Significant cost savings compared to  
other vacuum gauge measurement  
systems**

**Built-in Electrometer results in  
significant controller and cabling  
cost reduction**



### **Description**

The IGM400 *Hornet*™ is a hot cathode ionization gauge module specifically designed for use with InstruTech's B-RAX™ or FlexRax™ vacuum gauge controllers.

All display and control functions are performed remotely by the B-RAX or the FlexRax controller.

### **The InstruTech IGM400 Hornet Ionization Gauge**

The IGM400 *Hornet* ionization vacuum gauge module (IGM) provides the basic signal conditioning required to turn the gauge into a complete measuring instrument.

InstruTech continuously strives to enhance the design, reduce cost and improve the performance and reliability of the *Hornet* IGM. The electrometer circuit auto zeroes to ensure that the readings are not subject to temperature drift, eliminating the need for unnecessary and expensive circuitry which further reduces the cost.

The IGM400 *Hornet* is functional only when used with the B-RAX or the FlexRax vacuum gauge controller. This allows the user to remotely operate the IGM400 *Hornet* from the B-RAX or the FlexRax controller.

All operations including filament on/off, degas, and change of emission current is controlled from the B-RAX or the FlexRax.

The emission current can be set to automatically switch between 4 mA and 100  $\mu$ A. This results in optimal and stable pressure readings over the entire measurement range from low to high vacuum.

The IGM400 *Hornet* gauge tube assembly is constructed of a compact all metal design with dual yttria coated Iridium or optional dual tungsten filaments.

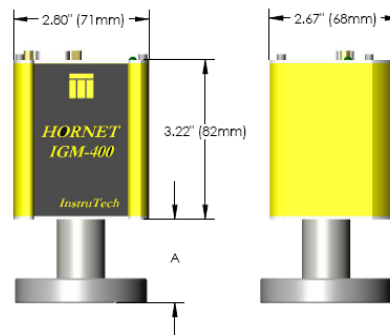
For general vacuum applications, dual yttria coated filaments are offered for use with air and inert gases such as N<sub>2</sub>, argon, etc. Dual tungsten filaments are available for use with gases that may not be compatible with yttria coated filaments.

The gauge sensor assembly can be easily replaced in the field.

## Specifications

measurement range	$1 \times 10^{-9}$ to $5 \times 10^{-2}$ Torr / $1.3 \times 10^{-9}$ to $6.7 \times 10^{-2}$ mbar / $1.3 \times 10^{-7}$ to 6.7 Pa
accuracy - N <sub>2</sub> (typical)	$1 \times 10^{-8}$ to $5 \times 10^{-2}$ Torr; $\pm 15\%$ of reading
repeatability - (typical)	$\pm 5\%$ of reading
materials exposed to gases	dual Filaments: yttria coated iridium or optional tungsten Ion collector: tungsten Grid: 304 Stainless Steel Others: 316/304 SS, glass, nickel
sensitivity	factory pre-set. Also user adjustable from 2 to 99 (set by the B-RAX or the FlexRax)
x-ray limit	$< 5 \times 10^{-10}$ Torr, $< 6.7 \times 10^{-10}$ mbar, $< 6.7 \times 10^{-8}$ Pa
emission current	100 $\mu$ A, 4 mA, or automatic switching between 100 $\mu$ A and 4 mA
degas	3 W, electron bombardment
overpressure protection	gauge is auto turned off at factory default setting of $5 \times 10^{-2}$ Torr B-RAX or FlexRax can also be set up to auto filament turn on/off using a convection gauge
filament status	filament on/off status is determined by LED on the IGM400 and also display messages and available user interface options on the B-RAX and FlexRax controllers
internal gauge volume	1.0 in <sup>3</sup> (16.4 cm <sup>3</sup> )
temperature	operating; 0 to + 40 °C storage; -40 to + 70 °C
bakeout temperature	200 °C (sensor only - electronics removed)
humidity	0 to 95% relative humidity, non-condensing
weight	0.6 lb. (0.27 kg) with NW25 KF flange
housing (electronics)	aluminum extrusion
mounting orientation	any
setpoint relay	relays available from the B-RAX or the FlexRax
input signal	all IGM400 operations controlled from the B-RAX or the FlexRax
filament selection	user selectable between filament 1 and 2 - command signal sent from the B-RAX or FlexRax
input power	powered by B-RAX or the FlexRax
connector/cabling	InstruTech cable/connector assembly for connection to B-RAX or the FlexRax
CE compliance	EMC Directive 2014/30/EU, EN55011, EN61000-6-2, EN61000-6-4, EN61326-1, EN61010-1
Environmental	RoHS compliant

Fitting	dimension A
NW16KF	1.45 in. (37mm)
NW25KF	1.45 in. (37mm)
NW40KF	1.45 in. (37mm)
1 1/3 in. Mini-CF	1.85 in. (47 mm)
2 3/4 in. Conflat®	1.70 in. (43 mm)
3/4 in. Tube	2.16 in. (55 mm)
1/2 in. VCR	2.58 in. (65 mm)



## Ordering Information

## Part Numbers

IGM400 Fittings / Flanges	With Yttria Filaments	With Tungsten Filaments	Replacement / Spare Sensor - Yttria	Replacement / Spare Sensor - Tungsten
NW16KF	IGM400YBX	IGM400TBX	IG4YB	IG4TB
NW25KF	IGM400YCX	IGM 400TCX	IG4YC	IG4TC
NW40KF	IGM400YDX	IGM400TDX	IG4YD	IG4TD
1 1/3 in. Mini-CF/NW16CF Mini-Conflat®	IGM400YEX	IGM400TEX	IG4YE	IG4TE
2 3/4 in. CF / NW35CF Conflat®	IGM400YFX	IGM400TFX	IG4YF	IG4TF
3/4 in. Tube (3/4 in. O.D. O-ring compression)	IGM400YAX	IGM400TAX	IG4YA	IG4TA
1/2 in. Cajon® 8VCR® female	IGM400YHX	IGM400THX	IG4YH	IG4TH

**B-RAX or FlexRax Controller & Gauge Cables** - see B-RAX or FlexRax controller data sheet

Conflat® is a registered trademark of Varian, Inc. / Agilent Technologies, Lexington, MA.

Swagelok®, Cajon®, VCR® are registered trademarks of the Swagelok Company, Solon, OH.



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**InstruTech®**

## **Series 401 Hornet™ Hot Cathode Bayard-Alpert Miniature-Ionization Vacuum Gauge**

**Wide measurement range**  
 $1 \times 10^{-9}$  to  $5 \times 10^{-2}$  Torr  
 $1.3 \times 10^{-9}$  to  $6.7 \times 10^{-2}$  mbar  
 $1.3 \times 10^{-7}$  to 6.7 Pa

**Dual hot cathode design,  
 rugged and compact metal  
 construction**

**Built-in digital display, set-point relay,  
 log-linear analog output and RS485  
 serial communication, are all  
 standard features of the Hornet™**

**Bright digital OLED graphical display  
 allows for wide angle, greater  
 viewing distance**

**Also a lower cost, direct drop-in plug-  
 compatible replacement for the  
 Granville-Phillips® Micro-Ion®  
 module**

**Significant cost savings for you -  
 use your existing control hardware,  
 cables and software when replacing  
 Micro-Ion® without need to change  
 your vacuum system control**



### **IGM401 sensor**

The IGM401 *Hornet* ionization gauge sensor assembly is a compact, all metal design with either dual yttria coated iridium or tungsten filaments available.

For general vacuum applications, dual yttria coated filaments are offered for use with air and inert gases such as N<sub>2</sub>, argon, etc. Dual tungsten filaments are available for use with gases that may not be compatible with yttria coated filaments.

The gauge sensor assembly can be easily replaced in the field.

### **IGM401 Built-in Controller & Display**

The IGM401 *Hornet* ionization vacuum gauge module (IGM) provides the basic signal conditioning required to turn the gauge into a complete measuring instrument. The built-in controller is offered with an easy to read, bright OLED display providing full programmability and a convenient user interface for setup and operation of the vacuum gauge.

Emission current can be set to automatically switch between 100  $\mu$ A and 4 mA. This results in optimal and stable pressure readings over the entire measurement range from low to high vacuum.

### **Lower cost without sacrificing quality or functionality**

InstruTech continuously strives to enhance the design, reduce cost and improve the performance and reliability of the *Hornet* IGM. The electrometer circuit auto zeroes to ensure that the readings are not subject to temperature drift, eliminating the need for unnecessary, expensive circuitry which further reduces the cost.

Service screens allow monitoring of filament operation. Error messages are displayed for several common fault conditions.

Filament voltage and current, emission current and ion current can be monitored in real time using the research mode display screen. Sensitivity and degas time maybe adjusted by the user.

A programmable setpoint relay can also be toggled manually to allow testing for correct external system control wiring.

The *Hornet* operating system enables the user to select from 16 commonly used gases eliminating the need to manually apply correction factors to the displayed pressure reading.

### **Also a direct drop-in plug-compatible replacement for the Micro-Ion®**

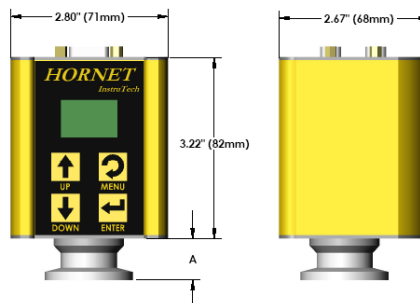
The IGM401 *Hornet* module will also directly replace various Granville-Phillips® 354 Micro-Ion® products. Measurement performance throughout the range of  $1 \times 10^{-9}$  to  $5 \times 10^{-2}$  Torr is equal to or better than similar vacuum gauge products in the marketplace.

An analog output voltage signal proportional to displayed pressure, one setpoint relay and RS485 serial communication are all included in the IGM401. All control functions are identical to corresponding 354 Micro-Ion® functions including software commands when using the RS485 serial interface.

## Specifications

measurement range	$1 \times 10^{-9}$ to $5 \times 10^{-2}$ Torr / $1.3 \times 10^{-9}$ to $6.7 \times 10^{-2}$ mbar / $1.3 \times 10^{-7}$ to 6.7 Pa
accuracy - N <sub>2</sub> (typical)	$1 \times 10^{-8}$ to $5 \times 10^{-2}$ Torr; $\pm 15\%$ of reading
repeatability - (typical)	$\pm 5\%$ of reading
display	bright OLED display, 3 digits plus 1 digit exponent, user-selectable units of Torr, mbar, or Pa
materials exposed to gases	dual filaments: yttria coated iridium or tungsten ion collector: tungsten Grid: 304 Stainless Steel Others: 316/304 SS, glass, nickel
sensitivity	factory pre-set; also user adjustable between 2 to 99
x-ray limit	$< 5 \times 10^{-10}$ Torr, $< 6.7 \times 10^{-10}$ mbar, $< 6.7 \times 10^{-8}$ Pa
emission current	100 $\mu$ A, 4 mA, or automatically switch between 100 $\mu$ A and 4 mA (Auto-Ranging)
degas	3 W, electron bombardment
overpressure protection (IG)	gauge turns off at factory default setting of $5 \times 10^{-2}$ Torr; also user adjustable below 50 mTorr
internal gauge volume	1.0 in <sup>3</sup> (16.4 cm <sup>3</sup> )
temperature	0 to + 40 °C operating; -40 to + 70 °C storage
bakeout temperature	200 °C (sensor only - electronics removed)
humidity	0 to 95% relative humidity, non-condensing
weight	0.6 lb. (0.27 kg) with NW25 KF flange
housing (electronics)	aluminum extrusion
mounting orientation	any
serial communications	RS485 - ASCII protocol; minimum command interval: 50 ms
analog output	log-linear 0 to 9 Vdc, 1 V/decade
setpoint relay	one single-pole, double-throw (SPDT), 1 A at 30 Vdc resistive, or ac non-inductive
status outputs	degas and filament on/off status are determined by either front panel displayed messages, via an open collector transistor output or RS485 serial communications
input signal	degas, filament on/off and emission current are set by either continuous continuity to ground using digital inputs, RS485 serial communications or manually using front panel push buttons
filament selection	filament 1 or 2 selectable via front panel push buttons or RS485 commands
input power	20 to 28 Vdc, 30 W protected against power reversal and transient over-voltages
connectors	9-pin D-sub male for analog and 9-pin D-sub female for RS485
CE compliance	EMC Directive 2014/30/EU, EN55011, EN61000-6-2, EN61000-6-4, EN61326-1, EN61010-1
environmental	RoHS compliant

Fitting	dimension A
NW16KF	1.45 in. (37mm)
NW25KF	1.45 in. (37mm)
NW40KF	1.45 in. (37mm)
1 1/3 in. Mini-CF	1.85 in. (47 mm)
2 3/4 in. Conflat®	1.70 in. (43 mm)
3/4 in. Tube	2.16 in. (55 mm)
1/2 in. VCR	2.58 in. (65 mm)



## Ordering Information

## Part Numbers

IGM401 Fittings / Flanges	With Yttria Filaments	With Tungsten Filaments	Replacement / Spare Sensor - Yttria	Replacement / Spare Sensor - Tungsten
NW16KF	IGM401YBD	IGM401TBD	IG4YB	IG4TB
NW25KF	IGM401YCD	IGM401TCD	IG4YC	IG4TC
NW40KF	IGM401YDD	IGM401TDD	IG4YD	IG4TD
1 1/3 in. Mini-CF/NW 16CF Mini- Conflat®	IGM401YED	IGM401TED	IG4YE	IG4TE
2 3/4 in. CF / NW35CF Conflat®	IGM401YFD	IGM401TFD	IG4YF	IG4TF
3/4 in. Tube (3/4 in. O.D. O-ring compression)	IGM401YAD	IGM401TAD	IG4YA	IG4TA
1/2 in. Cajon® 8VCR® female	IGM401YHD	IGM401THD	IG4YH	IG4TH

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Conflat® is a registered trademark of Varian, Inc. / Agilent Technologies, Lexington, MA.

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**InstruTech®**

## **Series 402 Hornet™ Hot Cathode Miniature-Ionization Vacuum Gauge with Dual Convection**

*Hot Cathode Bayard-Alpert Ionization gauge with space-saving built-in controller and display operates 3 different gauges*

*Full range measurements from  $1 \times 10^{-9}$  to 1,000 Torr plus monitoring of your foreline*

*Low cost of ownership: Significant cost reduction in controller, space, cabling costs and sensor replacement*

*Built-in bright digital OLED display with wide viewing angle, RS485 digital interface, 3 setpoint relays and 3 log-linear analog outputs*

*Dual hot filament design, rugged and compact metal construction*

*The first modular ionization vacuum gauge capable of operating two convection gauges*



**IGM402 Ionization Gauge with Dual Convection**

### **InstruTech IGM402 Hornet™ Modules**

#### **Technology**

**Gauge** The IGM402 *Hornet* ionization vacuum gauge module provides the basic signal conditioning required to turn the gauge into a complete measuring instrument. It incorporates numerous design features to enhance performance and reduce cost. The electrometer circuit auto zeroes to ensure that the readings are not subject to temperature drift, eliminating the need for unnecessary, expensive circuitry which further reduces the cost.

**Multiple Gauges** The IGM402 *Hornet* is capable of operating two external convection vacuum gauges simultaneously.

**Full Range Measurement** The IGM402 *Hornet* can combine the vacuum measurement from the ion gauge and a convection gauge to provide full range measurements from  $1 \times 10^{-9}$  Torr to 1,000 Torr, or simply operate the ion gauge and the two convection gauges as individual gauges.

**Display** The standard built-in bright OLED display provides a convenient user interface for setup and operation of the vacuum gauges. The display screen can show all three measurements on the same screen or display them sequentially. Service screens allow monitoring of filament operation. Error messages are displayed for several common fault conditions.

**Operation** The operation of the gauge including degas, filament on/off and emission current is set by the front panel push buttons, digital inputs or RS485 commands.

**Sensor** For general vacuum applications, dual yttria coated filaments are offered for use with air and inert gases such as  $N_2$ , argon, etc. Dual tungsten filaments are available for use with gases that may not be compatible with yttria coated filaments.

#### **Low Cost of Ownership**

**Controller** The compact modular design with the built-in controller and display operates three different gauges without requiring expensive external controllers.

**Space** No rack space required. The modular design negates the need for expensive and limited rack space.

**Cabling Cost** The cabling cost to connect a nude/glass ionization gauge to a rack-mount controller can be excessive and installation is time consuming. With the IGM402 no ion gauge cable is required and one 10 ft. convection gauge cable is included.

**Sensor Replacement** Many full range combination gauges provide measurements from atmosphere to high vacuum with multiple sensors built into one assembly. A sensor failure may require replacement of the entire sensor assembly often approaching 50% of the initial cost of the vacuum gauge itself.

The IGM402 *Hornet* provides an alternative to these other gauges by combining the vacuum measurements from the ion gauge and one of the convection gauges to provide a full range gauge. A sensor replacement requires only the replacement of the damaged sensor and not all the other sensors at once.

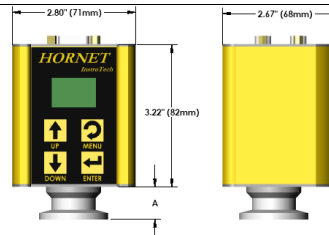
The IGM402 *Hornet* sensor assembly can be easily replaced in the field.

**Additional Point of Use** In addition to the ion gauge and one convection gauge, the IGM402 *Hornet* can provide vacuum measurements from a second convection gauge without the need for another expensive controller. This results in significant cost savings for monitoring the foreline or an additional point of use.

## Specifications

measurement range:	ionization (IG)	$1 \times 10^{-9}$ to $5 \times 10^{-2}$ Torr / $1.3 \times 10^{-9}$ to $6.7 \times 10^{-2}$ mbar / $1.3 \times 10^{-7}$ to 6.7 Pa
	convection (CG)	$1 \times 10^{-4}$ to 1,000 Torr / $1.3 \times 10^{-4}$ to 1,333 mbar / $1.3 \times 10^{-2}$ Pa to 133 kPa
	used as a full range gauge (IG+CG)	$1 \times 10^{-9}$ to 1,000 Torr / $1.3 \times 10^{-9}$ to 1,333 mbar / $1.3 \times 10^{-7}$ Pa to 133 kPa
accuracy - N <sub>2</sub> (typical)		$1 \times 10^{-8}$ to $1 \times 10^{-3}$ Torr; $\pm 15\%$ of reading $1 \times 10^{-3}$ to 400 Torr; $\pm 10\%$ of reading, 400 to 1,000 Torr; $\pm 2.5\%$ of reading
repeatability - (typical)		$1 \times 10^{-8}$ to $1 \times 10^{-3}$ Torr; $\pm 5\%$ of reading, $1 \times 10^{-3}$ to 1,000 Torr; $\pm 2\%$ of reading
display		bright OLED display, 3 digits plus 1 digit exponent, user-selectable Torr, mbar, or Pa
functionality		ionization gauge can operate up to 2 convection gauges
materials exposed to gases		dual filaments: yttria coated iridium or optional tungsten Ion collector: tungsten Grid: 304 Stainless Steel Others: 316/304 SS, glass, nickel
sensitivity		factory pre-set. Also user adjustable between 2 to 99
x-ray limit		$< 5 \times 10^{-10}$ Torr, $< 6.7 \times 10^{-10}$ mbar, $< 6.7 \times 10^{-8}$ Pa
emission current		100 $\mu$ A, 4 mA
degas		3 W, electron bombardment
internal gauge volume		1.0 in <sup>3</sup> (16.4 cm <sup>3</sup> )
overpressure protection		IG filament turns off at factory default of $5 \times 10^{-2}$ Torr; also user adjustable below 50 mTorr
temperature		operating; 0 to + 40 °C storage; -40 to + 70 °C
bakeout temperature		200 °C (sensor only - electronics removed)
humidity		0 to 95% relative humidity, non-condensing
weight		0.6 lb. (0.27 kg) with NW25 KF flange
housing (electronics)		aluminum extrusion
mounting orientation		any
serial communications		RS485 - User selectable ASCII protocol, or BINARY protocol using InstruTech CRC8, minimum command interval: 50 ms for both protocols
analog outputs (3 total)	IG IG+CG CG	one log-linear 0 to 9 Vdc, 1 V/decade, or one log-linear 0.5 to 7 Vdc, 0.5 V/decade, and two log-linear 1 to 8 Vdc, 1 V/decade or non-linear 0.375 to 5.659 Vdc
setpoint relays (3 total)		three single-pole, double-throw (SPDT), 1A at 30 Vdc resistive, or ac non-inductive
status outputs		degas & filament on/off status via display messages, open collector transistor or RS485
input signal		degas and filament on/off & emission current are set by continuity to ground using digital inputs, RS485 or manually using front panel push button
filament selection		filament 1 or 2 selectable via front panel push buttons or RS485 commands
input power		20 to 28 Vdc, 30 W protected against power reversal and transient over-voltages
connectors		(2) 9-pin D-Sub, (2) terminal blocks, (2) convection gauge connectors
convection gauge compatibility		InstruTech CVG101 Worker Bee™ or Granville-Phillips® 275 Convector®
CE compliance		EMC Directive 2014/30/EU, EN55011, EN61000-6-2, EN61000-6-4, EN61326-1, EN61010-1
environmental		RoHS

Fitting	dimension A
NW16KF	1.45 in. (37mm)
NW25KF	1.45 in. (37mm)
NW40KF	1.45 in. (37mm)
1 1/3 in. Mini-CF	1.85 in. (47 mm)
2 3/4 in. Conflat®	1.70 in. (43 mm)
3/4 in. Tube	2.16 in. (55 mm)
1/2 in. VCR	2.58 in. (65 mm)



## Ordering Information

## Part Numbers

IGM402 Fittings / Flanges	With Yttria Filaments	With Tungsten Filaments	Convection Gauge Cable Assembly	Replacement / Spare IG Sensor Yttria	Tungsten
NW16KF	IGM402YBD	IGM402TBD	HB431-1-3F (3 ft.)	IG4YB	IG4TB
NW25KF	IGM402YCD	IGM402TCD	HB431-1-10F (10 ft.)	IG4YC	IG4TC
NW40KF	IGM402YDD	IGM402TDD	HB431-1-25F (25 ft.)	IG4YD	IG4TD
1 1/3 in. Mini-CF / NW 16CF Mini- Conflat®	IGM402YED	IGM402TED	HB431-1-50F (50 ft.)	IG4YE	IG4TE
2 3/4 in. CF / NW35CF Conflat®	IGM402YFD	IGM402TFD	>50 ft. Consult Factory	IG4YF	IG4TF
3/4 in. Tube (3/4 in. O.D. O-ring compression)	IGM402YAD	IGM402TAD		IG4YA	IG4TA
1/2 in. Cajon® 8VCR® female	IGM402YHD	IGM402THD		IG4YH	IG4TH

**Note:** CVG101 Convection Gauges must be ordered separately. Please see part numbers in CVG101 data sheet.

Granville-Phillips® and Convector® are registered trademarks of MKS Instruments, Andover, MA.  
Conflat® is a registered trademark of Varian, Inc. / Agilent Technologies, Lexington, MA.

Swagelok®, Cajon®, VCR® are registered trademarks of the Swagelok Company, Solon, OH.



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**InstruTech®**

## **Series 701 Wasp™ Cold Cathode Inverted Magnetron / Pirani Miniature Full Range Vacuum Gauge**

### **Wide measurement range**

**7.6 x 10<sup>-10</sup> to 760 Torr**

**1 x 10<sup>-9</sup> to 1000 mbar**

**1 x 10<sup>-7</sup> Pa to 101 kPa**

**Patented ultra-low magnetic stray field expands applications suitability**

**Prolonged lifetime in harsh environments**

**Built-in Controller with digital input sensor control and log-linear analog output**

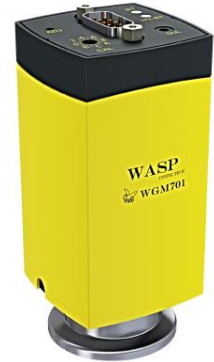
**Unique interchangeable dual chamber sensor design provides for virtually zero maintenance and easy sensor replacement**

**Improved sensor signal to noise ratio provides stable and optimal performance throughout the measurement range**

**Corrosion resistant feed through**

**Compact small footprint**

**Reliable fast sensor (anode) activation**



### **WGM701 Wasp**

The WGM701 Wasp™ vacuum gauge module combines Cold Cathode Inverted Magnetron technology with a pirani sensor to provide reliable and continuous pressure measurements from atmosphere to high vacuum.

The sensor assembly is constructed of a compact metal design resulting in a simple yet rugged sensor suitable for numerous industrial applications. Additionally, a sensor activation aid mounted on the anode improves the time it takes to activate the cold cathode sensor.

The patented ultra-low magnetic stray field design expands the use of this technology beyond the traditional applications when using a cold cathode technology. i.e., the WGM701 can be used in combination with instruments sensitive to external magnetic fields generated by conventional vacuum gauges utilizing a cold cathode sensor.

The low current collector option is recommended for use in

heavy gases such as Argon to prevent self-sputtering while the high current version is recommended for gases such as N<sub>2</sub> /air.

A unique interchangeable dual chamber inside the sensor assembly avoids cleaning cycles and reduces maintenance, making the WGM701 the most robust and economical vacuum gauge of its kind.

The WGM701 provides the basic signal conditioning required to turn the sensor into a complete vacuum pressure measurement instrument. The built-in controller provides a log-linear analog output for the measured pressure as well as a sensor status output. The cold cathode sensor is automatically activated once the pressure measured by the pirani sensor has indicated a low enough pressure level of 7.6 x 10<sup>-3</sup> Torr.

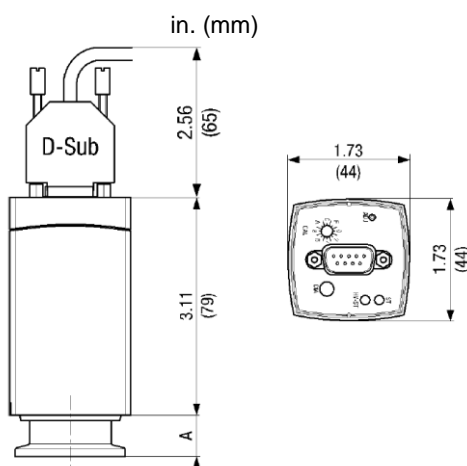
The combination of superior sensor design and enhanced signal processing provides optimal and stable pressure readings over the entire measurement range.

### **Specifications**

measurement range	7.6 x 10 <sup>-10</sup> to 760 Torr / 1 x 10 <sup>-9</sup> to 1,000 mbar / 1 x 10 <sup>-7</sup> Pa to 101 kPa		
accuracy - N <sub>2</sub> (typical)	7.6 x 10 <sup>-9</sup> to 7.6 x 10 <sup>-3</sup> Torr: ± 30% of reading		
	7.6 x 10 <sup>-3</sup> to 75 Torr: ± 15% of reading		
	75 to 760 Torr: ± 50 % of reading		
repeatability - (typical)	7.6 x 10 <sup>-9</sup> to 75 Torr: ± 5% of reading		
materials exposed to gases	pirani sensor: tungsten cold cathode anode: molybdenum others: Ni alloy, Al <sub>2</sub> O <sub>3</sub> , stainless steel, glass		
internal gauge volume	1.391 in <sup>3</sup> (22.8 cm <sup>3</sup> )		
admissible pressure	145 psi, 10 bar abs (limited to inert gases < 50 °C)		
temperature	operating: + 5 to + 55 °C storage: -40 to + 70 °C		
humidity (30 days a year)	7.6x10 <sup>-8</sup> ... 7.6 x10 <sup>-3</sup> Torr		
	0 to 95% relative humidity, non-condensing		
	7.6x10 <sup>-9</sup> ... 7.6 x10 <sup>-3</sup> Torr		
	0 to 70% relative humidity, non-condensing		
bakeout temperature (at flange)	150 °C (sensor only - electronics removed)		

weight	0.61 lb. (0.28 kg) with NW25 KF flange
housing (electronics)	aluminum extrusion
mounting orientation	any
analog output	log-linear 0.5 to 7 Vdc, 0.5 V/decade
error signal	analog output switches to $\geq 10$ V
response time:	$p = 7.6 \times 10^{-9}$ Torr ~1 sec $p > 7.6 \times 10^{-7}$ Torr <100 msec
status output	cold cathode sensor on/off status is determined by open collector transistor (ground emitter) rated at 30 V max. $V_{CE}$ , 100 mA $I_C$ max. Transistor off = Sensor off, Transistor on = Sensor on
input power	14.5 to 30 Vdc, 2 W protected against power reversal and transient over-voltages
supply voltage ripple	$\leq 1$ Vp-p
high voltage in measuring chamber	operating voltage (anode): $\leq 3.3$ KV sensor activation voltage (anode): $\leq 4.5$ KV
current in measuring chamber	low current collector version: $\leq 100$ $\mu$ A high current collector version: $\leq 500$ $\mu$ A
connector	9-pin D-sub male
CE compliance	EMC (EN61000-6-2, EN61000-6-3, EN61010-1, EN61326-1)
environmental	RoHS compliant

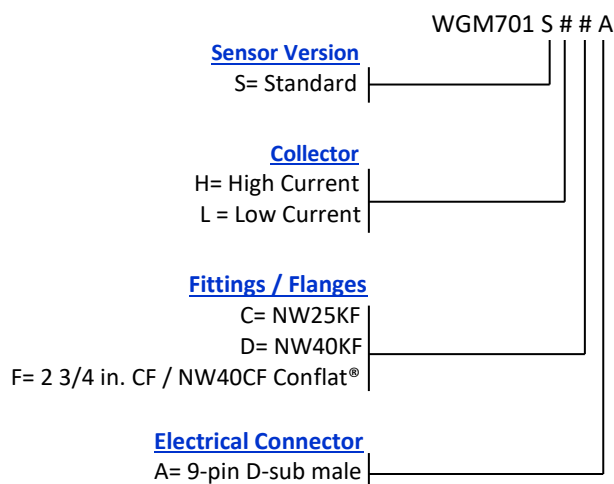
Fitting	dimension A
NW25KF	0.59 in. (15 mm)
NW40KF	0.67 in. (17 mm)
2 3/4 in. Conflat®	0.91 in. (23 mm)



### Ordering Information

### WGM701 Part Number

### Spare Parts / Accessories Part Numbers



WGM701 Spare Sensor, NW25KF	WG7SC
WGM701 Spare Sensor, NW40KF	WG7SD
WGM701 Spare Sensor, 2 3/4 in. CF / NW40CF Conflat	WG7SF
Spare Ionization Chamber	002588
Sensor (anode) activation aid (set of 10 pcs)	002587
Tool set for removing/installing sensor activation aid	002586
Centering ring with fine filter, NW25KF	002585

Example: WGM701SHDA (WGM701 with standard sensor, high current collector, NW40KF fitting, 9-pin D-Sub connector)



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**InstruTech®**

## ***Series 500 Hornet™ Cold Cathode Miniature-Ionization Vacuum Gauge***

### **Wide measurement range**

$1 \times 10^{-9}$  to  $1 \times 10^{-2}$  Torr  
 $1.3 \times 10^{-9}$  to  $1.3 \times 10^{-2}$  mbar  
 $1.3 \times 10^{-7}$  to 1.3 Pa

*Full range measurement from  $1 \times 10^{-9}$  Torr to atmosphere when used with the B-RAX or the FlexRax controllers and a convection gauge*

**Rugged and compact Double-Inverted Magnetron design improves sensor sensitivity and performance**

*Improved sensor signal to noise ratio provides stable and optimal performance throughout the measurement range*

**Ionization gauge designed specifically for use with InstruTech's B-RAX or FlexRax vacuum gauge controllers**

*Built-in Electrometer results in significant controller and cabling cost reduction*



### ***Description***

The CCM500 *Hornet*™ is a cold cathode ionization vacuum gauge module specifically designed for use with InstruTech's B-RAX™ or FlexRax™ vacuum gauge controllers.

All display and control functions are performed remotely by the B-RAX or the FlexRax controller.

### ***The InstruTech CCM500 Hornet Ionization Gauge***

The CCM500 *Hornet* ionization vacuum gauge module provides the basic signal conditioning required to turn the gauge into a complete measuring instrument.

The CCM500 *Hornet Cold Cathode* ionization gauge sensor assembly is constructed of a compact metal design resulting in a simple yet rugged sensor suitable for numerous industrial applications.

The Double-Inverted magnetron design places two opposing magnetic fields over the anode (sensor) to enhance the generations of ions. This nearly doubles the electron currents, maximizing the generation of ions and improving sensitivity and signal-to-noise ratio.

The sensor assembly can be easily disassembled and cleaned allowing long term use with minimal down time.

InstruTech has made numerous design enhancements to the CCM500 *Hornet* to reduce cost and improve performance.

The electrometer auto zeroes to ensure that the readings are not subject to temperature drift. This eliminates the need for unnecessary and expensive circuitry which further reduces the cost.

The CCM500 *Hornet* is functional only when used with the B-RAX or the FlexRax vacuum gauge controller. This allows the user to remotely operate the CCM500 *Hornet* from the B-RAX or the FlexRax controller.

All operations including sensor on/off is controlled from the B-RAX or the FlexRax.

Anode voltage and ion current can be monitored in real time on the research screen of the B-RAX or the FlexRax controller. Sensitivity may be adjusted by the user.

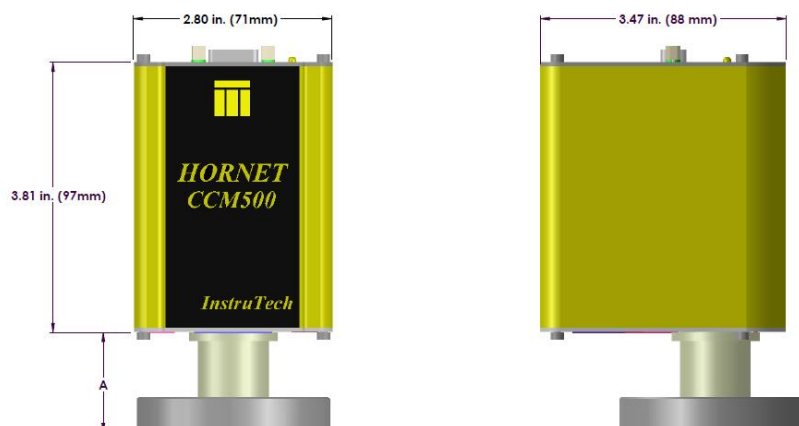
The combination of superior sensor design and enhanced signal processing provides optimal and stable pressure readings over the entire measurement range from low to high vacuum.



## Specifications

measurement range	$1 \times 10^{-9}$ to $1 \times 10^{-2}$ Torr / $1.3 \times 10^{-9}$ to $1.3 \times 10^{-2}$ mbar / $1.3 \times 10^{-7}$ to 1.3 Pa
accuracy - N <sub>2</sub> (typical)	$1 \times 10^{-8}$ to $1 \times 10^{-2}$ Torr; $\pm 30\%$ of reading
repeatability - (typical)	$\pm 5\%$ of reading
materials exposed to gases	304 stainless steel, ceramic, Viton® O-ring
sensitivity	factory preset to 10 Torr <sup>-1</sup> (also user adjustable between 2 to 99)
overpressure protection	gauge turns off at factory default setting of $1 \times 10^{-2}$ Torr
internal gauge volume	1.965 in <sup>3</sup> (32.2 cm <sup>3</sup> )
temperature	operating; 0 to +40 °C storage; -40 to +70 °C
bakeout temperature	150 °C (sensor only - electronics removed), limit to 5 hours with magnets installed
humidity	0 to 95% relative humidity, non-condensing
weight	1.7 lb. (0.77 kg) with NW25 KF flange
housing (electronics)	aluminum extrusion
mounting orientation	any
analog output	analog output is available at the B-RAX or the FlexRax
setpoint relay	relays available at the B-RAX or FlexRax
status outputs	anode (sensor) on/off status is determined by LED on the CCM500 and also display messages and available user interface options on the B-RAX and FlexRax controllers
input control signal	all CCM500 operations controlled from the B-RAX or the FlexRax
input power	powered by either the B-RAX or FlexRax controller
connector/cabling	InstruTech cable/connector assembly for connection to either B-RAX or FlexRax
CE compliance	EMC Directive 2004/108/EC, EN61326-1, EN55011 Low Voltage Directive 2006/95/EC, EN61010-1
environmental	RoHS compliant

Fitting	dimension A
1 in. Tube	2.56 in. (65 mm)
NW16KF	2.63 in. (67 mm)
NW25KF	2.63 in. (67 mm)
NW40KF	2.82 in. (72 mm)
1 1/3 in. Mini-CF	2.11 in. (54 mm)
2 3/4 in. Conflat®	2.63 in. (67 mm)



## Ordering Information

## Part Numbers

CCM500 Fittings / Flanges	Cold Cathode Module	Replacement Sensor
1 in. Tube (1 in. O.D. O-ring compression)	CCM500TX	CC5T
NW16KF	CCM500BX	CC5B
NW25KF	CCM500CX	CC5C
NW40KF	CCM500DX	CC5D
1 1/3 in. Mini-CF/NW16CF Mini-Conflat®	CCM500EX	CC5E
2 3/4 in. CF / NW35CF Conflat®	CCM500FX	CC5F

## B-RAX or FlexRax Controller & Gauge Cables

see B-RAX or FlexRax controller data sheet

Viton® is a registered trademark of Dupont, Wilmington, DE.

Conflat® is a registered trademark of Varian, Inc. / Agilent Technologies, Lexington, MA.



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**InstruTech®**

## ***Series 501 Hornet™ Cold Cathode Miniature-Ionization Vacuum Gauge***

### **Wide measurement range**

$1 \times 10^{-9}$  to  $1 \times 10^{-2}$  Torr  
 $1.3 \times 10^{-9}$  to  $1.3 \times 10^{-2}$  mbar  
 $1.3 \times 10^{-7}$  to 1.3 Pa

### ***Double-Inverted Magnetron Cold***

***Cathode sensor, rugged and compact metal construction***

**Double-Inverted Magnetron improves sensor sensitivity and performance**

***Improved sensor signal to noise ratio provides stable and optimal performance throughout the measurement range***

**Built-in digital display, set-point relay, log-linear analog output and RS485 serial communication, are all standard features of the Hornet™**

***Bright digital OLED graphical display provides for a wide viewing angle***



### ***CCM501 sensor***

The CCM501 Hornet™ Cold Cathode ionization gauge sensor assembly is constructed of a compact metal design resulting in a simple yet rugged sensor suitable for numerous industrial applications.

The Double-Inverted magnetron design places two opposing magnetic fields over the anode (sensor) to enhance the generations of ions. This nearly doubles the electron currents, maximizing the generation of ions and improving sensitivity and signal-to-noise ratio.

The sensor assembly can be easily disassembled and cleaned allowing long term use with minimal down time.

### ***CCM501 Built-in Controller & Display***

The CCM501 Hornet ionization vacuum gauge module provides the basic signal conditioning required to turn the sensor into a complete vacuum pressure measurement instrument.

The built-in controller is offered with a standard bright OLED display providing full programmability and a convenient user interface for setup and operation of the vacuum gauge.

The standard CCM501 model also provides one analog output with two different scaling selections, one setpoint relay and RS485 serial communications. This provides great flexibility for various process control schemes.

### ***Lower cost without sacrificing quality or functionality***

InstruTech has made numerous design enhancements to reduce cost and improve performance. The electrometer auto zeroes to ensure that the readings are not subject to temperature drift. This eliminates the need for unnecessary and expensive circuitry which further reduces the cost.

Service screens allow monitoring of sensor operation. Error messages will be displayed for all fault conditions.

Setpoint relay can be manually toggled to test for correct external circuit wiring.

Anode voltage and ion current can be monitored in real time on the research screen. Sensitivity may be adjusted by the user.

The display enables the user to select from 16 commonly used gases eliminating the need to apply correction factors to the displayed pressure readings.

The combination of superior sensor design and enhanced signal processing provides optimal and stable pressure readings over the entire measurement range from low to high vacuum.

## Specifications

measurement range	$1 \times 10^{-9}$ to $1 \times 10^{-2}$ Torr / $1.3 \times 10^{-9}$ to $1.3 \times 10^{-2}$ mbar / $1.3 \times 10^{-7}$ to 1.3 Pa
accuracy - N <sub>2</sub> (typical)	$1 \times 10^{-8}$ to $1 \times 10^{-2}$ Torr; $\pm 30\%$ of reading
repeatability - (typical)	$\pm 5\%$ of reading
display	bright OLED display, 2 digits plus 1 digit exponent, user-selectable Torr, mbar, or Pa
materials exposed to gases	304 stainless steel, ceramic, Viton® O-ring
sensitivity	factory preset to 10 Torr <sup>-1</sup> (also user adjustable between 2 to 99)
overpressure protection	gauge turns off at factory default setting of $1 \times 10^{-2}$ Torr
internal gauge volume	1.965 in <sup>3</sup> (32.2 cm <sup>3</sup> )
temperature	operating; 0 to + 40 °C storage; -40 to + 70 °C
bakeout temperature	150 °C (sensor only - electronics removed), limit to 5 hours with magnets installed
humidity	0 to 95% relative humidity, non-condensing
weight	1.7 lb. (0.77 kg) with NW25 KF flange
housing (electronics)	aluminum extrusion
mounting orientation	any
serial communications	RS485 - ASCII protocol; minimum command interval: 50 ms
analog output	user selectable scaling; log-linear 0 to 8 Vdc, 1 V/decade or 1.8 to 8.7 Vdc, 0.8 V/decade
setpoint relay	one single-pole, double-throw (SPDT), 1 A at 30 Vdc resistive, or ac non-inductive
status outputs	sensor on/off status is determined by display messages, via open collector transistor or RS485 serial communications
input signal	sensor enable (anode voltage turned on) is set by continuity to ground using digital input, RS485 commands or manually using front panel programming soft-keys
input power	20 to 28 Vdc, 7.2 W protected against power reversal and transient over-voltages
connectors	9-pin D-sub male for analog and 15-pin D-sub male for RS485
CE compliance	EMC Directive 2004/108/EC, EN61326-1, EN55011 Low Voltage Directive 2006/95/EC, EN61010-1
environmental	RoHS compliant

Fitting	dimension A
1 in. Tube	2.56 in. (65 mm)
NW16KF	2.63 in. (67 mm)
NW25KF	2.63 in. (67 mm)
NW40KF	2.82 in. (72 mm)
1 1/3 in. Mini-CF	2.11 in. (54 mm)
2 3/4 in. Conflat®	2.63 in. (67 mm)



## Ordering Information

## Part Numbers

CCM501 Fittings / Flanges	Cold Cathode Module	Replacement / Spare Sensor
1 in. Tube (1 in. O.D. O-ring compression)	CCM501TD	CC5T
NW16KF	CCM501BD	CC5B
NW25KF	CCM501CD	CC5C
NW40KF	CCM501DD	CC5D
1 1/3 in. Mini-CF/NW16CF Mini-Conflat®	CCM501ED	CC5E
2 3/4 in. CF / NW35CF Conflat®	CCM501FD	CC5F

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Conflat® is a registered trademark of Varian, Inc. / Agilent Technologies, Lexington, MA.



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**InstruTech®**

## ***Series 502 Hornet™ Cold Cathode Inverted Magnetron Miniature-Ionization Vacuum Gauge***

**Wide measurement range**  
 $7.6 \times 10^{-10}$  to  $7.6 \times 10^{-3}$  Torr  
 $1 \times 10^{-9}$  to  $1 \times 10^{-2}$  mbar  
 $1 \times 10^{-7}$  to 1 Pa

**Patented ultra-low magnetic stray field**  
 expands applications suitability

**Prolonged lifetime in harsh environments**

**Built-in Controller with digital input sensor**  
 control and log-linear analog output

**Unique interchangeable dual chamber**  
 sensor design provides for virtually zero  
 maintenance and easy sensor replacement

**Improved sensor signal to noise ratio**  
 provides stable and optimal performance  
 throughout the measurement range

**Corrosion resistant feed through**

**Compact small footprint**

**Reliable fast sensor(anode) activation**



### ***CCM502 Hornet***

The CCM502 *Hornet™ Cold Cathode* ionization gauge sensor assembly is constructed of a compact metal design resulting in a simple yet rugged sensor suitable for numerous industrial applications. Additionally, a sensor activation aid mounted on the anode improves the time it takes to activate the cold cathode sensor.

The patented ultra-low magnetic stray field design expands the use of this technology beyond the traditional cold cathode applications. i.e., the CCM502 can be used in combination with instruments sensitive to external magnetic fields generated by conventional cold cathode gauges. A unique interchangeable dual chamber inside the sensor assembly avoids cleaning cycles and reduces maintenance, making the Hornet 502 the most robust and economical vacuum gauge of its kind.

The low current collector option is recommended for use in heavy gases such as Argon to prevent self-sputtering while the high current version is recommended for gases such as N<sub>2</sub> /air, etc.

The CCM502 *Hornet* ionization vacuum gauge module provides the basic signal conditioning required to turn the sensor into a complete vacuum pressure measurement instrument.

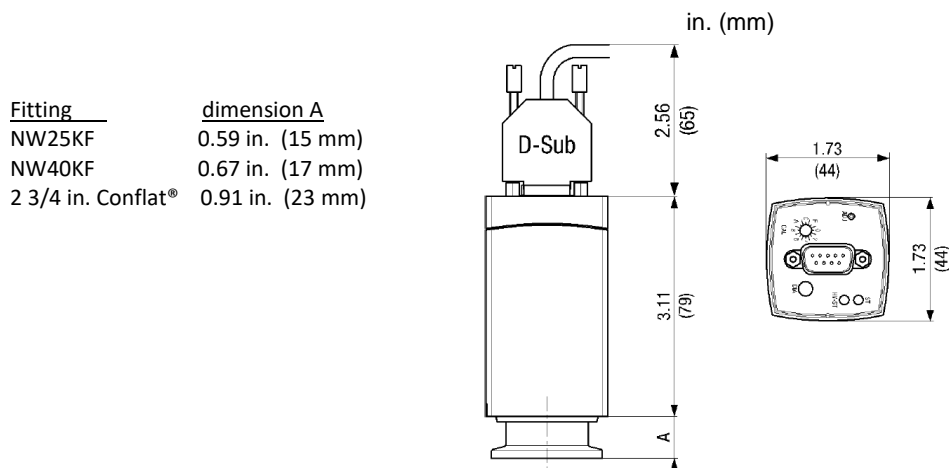
The built-in controller provides digital input control capability for sensor activation. Additionally, it provides one log-linear analog output for the measured pressure and a sensor status output providing flexibility for various process control schemes.

The combination of superior sensor design and enhanced signal processing provides optimal and stable pressure readings over the entire measurement range from low to high vacuum.

### ***Specifications***

measurement range	$7.6 \times 10^{-10}$ to $7.6 \times 10^{-3}$ Torr / $1 \times 10^{-9}$ to $1 \times 10^{-2}$ mbar / $1 \times 10^{-7}$ to 1 Pa	
accuracy - N <sub>2</sub> (typical)	$7.6 \times 10^{-9}$ to $7.6 \times 10^{-3}$ Torr: $\pm 30\%$ of reading	
repeatability - (typical)	$7.6 \times 10^{-9}$ to $7.6 \times 10^{-3}$ Torr: $\pm 5\%$ of reading	
materials exposed to gases	anode: molybdenum	others: Ni alloy, Al <sub>2</sub> O <sub>3</sub> , stainless steel, glass
internal gauge volume	1.391 in <sup>3</sup> (22.8 cm <sup>3</sup> )	
admissible pressure	145 psi, 10 bar absolute (limited to inert gases < 50 °C)	
temperature	operating: + 5 to + 55 °C	storage: -40 to + 70 °C
bakeout temperature (at flange)	150 °C (sensor only - electronics removed)	
humidity (30 days a year)		
7.6×10 <sup>-8</sup> ... 7.6 ×10 <sup>-3</sup> Torr	0 to 95% relative humidity, non-condensing	
7.6×10 <sup>-9</sup> ... 7.6 ×10 <sup>-3</sup> Torr	0 to 70% relative humidity, non-condensing	
weight	0.61 lb. (0.28 kg) with NW25 KF flange	
housing (electronics)	aluminum extrusion	
mounting orientation	any	
input signal	sensor enable (anode voltage turned on) is set by continuity to ground	

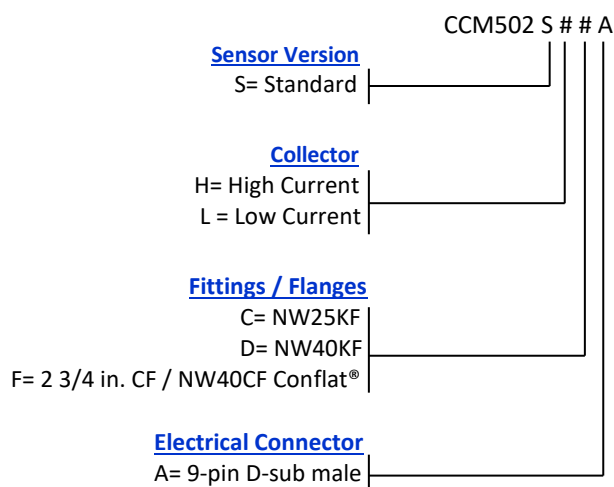
analog output	log-linear 0 to 8 Vdc, 1 V/decade
error signal	analog output switches to $\geq 10$ V
response time	
$p = 7.6 \times 10^{-9}$ Torr	$\sim 1$ sec
$p > 7.6 \times 10^{-7}$ Torr	$< 100$ msec
status output	sensor on/off status is determined by open collector transistor (ground emitter) rated at 30 V max. $V_{CE}$ , 100 mA max. $I_C$ . Transistor off = Sensor off, Transistor on = Sensor on
input power	14.5 to 30 Vdc, 2 W protected against power reversal and transient over-voltages
supply voltage ripple	$\leq 1$ Vp-p
high voltage in measuring chamber	operating voltage (anode): $\leq 3.3$ KV sensor activation voltage (anode): $\leq 4.5$ KV
current in measuring chamber	low current collector version: $\leq 100 \mu A$ high current collector version: $\leq 500 \mu A$
connector	9-pin D-sub male
CE compliance	EMC (EN61000-6-2, EN61000-6-3, EN61010-1, EN61326-1)
environmental	RoHS compliant



### Ordering Information

### CCM502 Part Number

### Spare Parts / Accessories Part Numbers



CCM502 Spare Sensor, NW25KF	CC5SC
CCM502 Spare Sensor, NW40KF	CC5SD
CCM502 Spare Sensor, 2 3/4 in. CF / NW40CF Conflat	CC5SF
Spare Ionization Chamber	002588
Sensor (anode) activation aid (set of 10 pcs)	002587
Tool set for removing/installing sensor activation aid	002586
Centering ring with fine filter, NW25KF	002585

Example: CCM502SHDA (CCM502 with standard sensor, high current collector, NW40KF fitting, 9-pin D-Sub connector)



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**InstruTech®**

## **Series 211 Stinger™ Convection Vacuum Gauge Measurement Unit & Display - bar/mbar**

- **Wide measurement range**  
 $1.3 \times 10^{-4}$  to 1,333 mbar  
 $1 \times 10^{-4}$  to 1,000 Torr
- **Built-in digital display with  
analog output and setpoint relay**
- **Wider measuring range and  
better accuracy than TC gauges**
- **Also a lower cost, plug-compatible  
direct drop-in replacement for  
the most basic Granville-Phillips®  
Mini-Convectron® models**

*Monitor your vacuum system  
from atmosphere to  $1.3 \times 10^{-4}$   
mbar with a single gauge*

*Easy setup and operation.*

*Upgrade your vacuum system and  
process performance*

*Significant savings for you  
No changes to your process  
Use your existing hardware,  
cables, and software*



### **CVM211 Sensor**

The sensor inside the CVM211 *Stinger*™ module incorporates numerous design enhancements compared to other traditional convection vacuum gauges.

Temperature compensation has been moved out of the vacuum environment and placed around the outside of the vacuum gauge tube. This has eliminated a dozen or so unnecessary parts and welds, significantly increasing the reliability, providing optimal vacuum measurement while reducing cost. The improved mechanical strength results in a highly robust vacuum gauge less susceptible to mechanical shock and vibration.

Other design features include reduced internal volume and significant reduction of internal surface area resulting in faster pump-down and less outgassing. A fine mesh screen in the gauge inlet port helps prevent particulate contamination from entering the gauge. The gauge is shielded against RF interference.

These, and other, design features add up to a highly reliable vacuum gauge with significant cost savings that are passed on to the user.

### **CVM211 Built-in Controller & Display**

InstruTech's CVM211 *Stinger* module provides the necessary signal conditioning to turn the convection gauge into a complete vacuum measuring instrument.

The CVM211 *Stinger* module provides one log-linear or non-linear analog output and one setpoint relay. In addition, a built-in display provides the measured pressure values and provides a convenient user interface for setup and operation of the vacuum gauge.

### **Low-cost upgrade for thermocouple TC vacuum gauges**

The CVM211 *Stinger* provides a wider measuring range than traditional thermocouple vacuum gauges - from  $1.3 \times 10^{-4}$  mbar to above atmosphere - so you can monitor your entire pump-down and vent cycle.

The CVM211 *Stinger* convection enhanced Pirani gauge is more accurate than a thermocouple gauge, especially at lower pressures. And depending on your gauge/readout configuration, the cost of a *Stinger* is about the same cost of a TC gauge system.

### **Also a direct drop-in replacement for Mini-Convectron®**

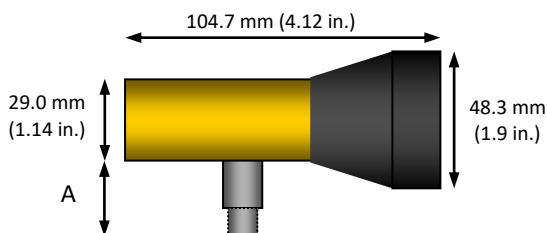
The CVM211 *Stinger* can also directly replace the most basic Granville-Phillips® Mini-Convectron® modules, at significantly lower cost. The InstruTech *Stinger* provides equivalent or better performance throughout the range of  $1.3 \times 10^{-4}$  to 1,333 mbar.

The 9-pin D-sub connector has the same pinouts and signals as the corresponding Mini-Convectrons®. The non-linear analog signal and setpoint relay are identical to their corresponding Mini-Convectron® functions. With *Stinger*'s performance, more robust design, longevity, smaller size, and lower cost, your process will only improve.

*Guided by our vast experience and vacuum measurement know how, InstruTech sensors are specifically designed for optimum reliability and performance. Whether you're looking to reduce costs or improve your process, the CVM211 Stinger offers a cost-effective solution for your vacuum gauging needs.*

## Specifications

measurement range	$1.3 \times 10^{-4}$ to 1,333 mbar / $1 \times 10^{-4}$ to 1,000 Torr / $1.3 \times 10^{-2}$ Pa to 133 kPa
accuracy - N <sub>2</sub> (typical)	$1.3 \times 10^{-4}$ to $1.3 \times 10^{-3}$ mbar; $0.1 \times 10^{-3}$ mbar resolution $1.3 \times 10^{-3}$ to 530 mbar; $\pm 10\%$ of reading 530 to 1,333 mbar; $\pm 2.5\%$ of reading
repeatability - (typical)	$\pm 2\%$ of reading
display	3 digit LED from 1.33 bar to $10.0 \times 10^{-3}$ mbar 2 digit LED from $(9.9 \text{ to } 1.0) \times (10^{-3} \text{ mbar})$ , 1 digit LED from $(0.9 \text{ to } 0.1) \times (10^{-3} \text{ mbar})$
materials exposed to gases	gold-plated tungsten, 304 & 316 stainless steel, glass, nickel, Teflon®
internal volume	26 cm <sup>3</sup> (1.589 in <sup>3</sup> )
internal surface area	59.7 cm <sup>2</sup> (9.25 in <sup>2</sup> )
weight	136 g (4.8 oz.)
housing (electronics)	molded plastic
operating temperature	0 to +40 °C
storage temperature	-40 to +70 °C
bakeout temperature	+70 °C max
humidity	0 to 95% relative humidity, non-condensing
mounting orientation	horizontal recommended (orientation has no effect on measurements below 1 mbar)
analog output	log-linear 1 to 8 Vdc, 1 V/decade, or non-linear analog S-curve 0.375 to 5.659 Vdc
input power	12 to 28 Vdc, 2 W protected against power reversal and transient over-voltages
setpoint relay	one, single-pole double-throw relay (SPDT), 1 A at 30 Vdc resistive, or ac non-inductive
connector	9-pin D-sub male
CE compliance	EMC Directive 2014/30/EU, EN55011, EN61000-6-2, EN61000-6-4, EN61326-1, EN61010-1
environmental	RoHS compliant



fitting	dimension A
1/8 in. NPT male - 1/2 in. tube	1.00 in. (25.4 mm)
NW16KF	1.30 in. (33.0 mm)
NW25KF	1.30 in. (33.0 mm)
NW40KF	1.30 in. (33.0 mm)
1 1/3 in. Mini-Conflat®	1.08 in. (27.4 mm)
2 3/4 in. Conflat®	1.47 in. (37.3 mm)
1/4 in. Cajon® 4VCR®	1.86 in. (47.2 mm)
1/2 in. Cajon® 8VCR®	1.75 in. (44.5 mm)

## Ordering Information

Ordering Information	Part Number with log-linear analog output	Part Number with non-linear analog output
<b>CVM211 Fittings / Flanges</b>		
Combination 1/8 in. NPT male - 1/2 in. tube (use 1/8 in. NPT male or 1/2 in. O.D. O-ring compression)	CVM211GAA-B-L	CVM211GAA-B-NL
NW16KF	CVM211GBA-B-L	CVM211GBA-B-NL
NW25KF	CVM211GCA-B-L	CVM211GCA-B-NL
NW40KF	CVM211GDA-B-L	CVM211GDA-B-NL
1 1/3 in. Mini-CF / NW16CF Mini-Conflat®	CVM211GEA-B-L	CVM211GEA-B-NL
2 3/4 in. CF / NW35CF Conflat®	CVM211GFA-B-L	CVM211GFA-B-NL
1/4 in. Cajon® 4VCR® female	CVM211GGA-B-L	CVM211GGA-B-NL
1/2 in. Cajon® 8VCR® female	CVM211GHA-B-L	CVM211GHA-B-NL

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**InstruTech®**

## Series 201 Super Bee™ Convection Vacuum Gauge

**Wide measurement range**  
 $1 \times 10^{-4}$  to 1,000 Torr  
 $1.3 \times 10^{-4}$  to 1,333 mbar  
 $1.3 \times 10^{-2}$  Pa to 133 kPa

**Built-in digital OLED display, two setpoint relays, linear, log-linear, non-linear analog outputs, and RS232/485 communications are all included in the standard module**

**Also a lower cost, direct drop-in plug-compatible replacement for the Granville-Phillips® Mini-Convector® module**

**Monitor your vacuum system from atmosphere to  $1 \times 10^{-4}$  Torr with a single gauge**

**Bright, sharp and clear digital OLED graphical display is extremely easy to read and allows for a wide viewing angle**

**Significant savings for you  
 No changes to your process  
 Use your existing hardware, cables, and software**



### CVM201 Sensor

The sensor inside CVM201 Super Bee™ module incorporates numerous design enhancements compared to other traditional convection vacuum gauges.

Temperature compensation has been moved out of the vacuum environment and placed around the outside of the vacuum gauge tube. This has eliminated a dozen or so unnecessary parts and welds, significantly increasing the reliability, providing optimal vacuum measurement while reducing cost. The improved mechanical strength results in a highly robust vacuum gauge less susceptible to mechanical shock and vibration. Other design features include reduced internal volume and significant reduction of internal surface area resulting in faster pump-down and less outgassing. A fine mesh screen in the gauge inlet port helps prevent particulate contamination from entering the gauge. The gauge is shielded against RF interference.

These, and other, design features add up to a highly reliable convection enhanced Pirani vacuum gauge with significant cost savings that are passed on to the user.

### CVM201 Built-in Controller with OLED Display

The InstruTech CVM201 Super Bee provides the basic signal conditioning required to turn the gauge into a complete measuring instrument. Similar feature filled design philosophy is incorporated into the module electronics. The CVM201 Super Bee provides non-linear or log-linear and linear analog outputs, two setpoint relays and RS232/485 serial communications. A built-in OLED digital display provides the measured pressure values and provides for a convenient user interface for setup and operation of the vacuum gauge.

The biggest cost savings is from manufacturing a single model, with all possible options, instead of making dozens of different pc boards and models. And you don't have to give up one feature to get another you want.

*Guided by our vast experience and vacuum measurement know how, InstruTech sensors are specifically designed for optimum reliability and performance. Whether you're looking to reduce costs or improve your process, the CVM201 Super Bee offers a cost-effective solution for your vacuum gauging needs.*

### Also a direct drop-in plug-compatible replacement for the Mini-Convector®

The InstruTech CVM201 Super Bee module will also directly replace most Granville-Phillips® Mini-Convector® modules. The InstruTech Super Bee provides equivalent or better performance throughout the range of  $1 \times 10^{-4}$  to 1,000 Torr.

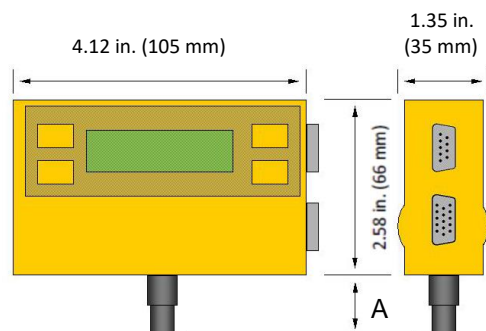
Linear and non-linear analog signals, digital interfaces, and setpoint relays are all included in the standard InstruTech module. All are identical to their corresponding Mini-Convector® functions. Software commands are the same.

*One InstruTech CVM201 Super Bee can directly replace dozens of different Mini-Convector® configurations, reducing the number of spares you need to keep on hand.*

The 9-pin D-sub and 15 pin D-sub connectors have the same pinouts and signals as the corresponding Mini-Convector®. With Super Bee's performance, more robust design, longevity, and lower cost, your process will only improve.

## Specifications

measurement range	$1 \times 10^{-4}$ to 1,000 Torr / $1.3 \times 10^{-4}$ to 1,333 mbar / $1.3 \times 10^{-2}$ Pa to 133 kPa
accuracy - N <sub>2</sub> (typical)	$1 \times 10^{-4}$ to $1 \times 10^{-3}$ Torr; 0.1 mTorr resolution $1 \times 10^{-3}$ to 400 Torr; $\pm 10\%$ of reading 400 to 1,000 Torr; $\pm 2.5\%$ of reading
repeatability - (typical)	$\pm 2\%$ of reading
display	bright OLED, 4 digits, user-selectable Torr, mbar, or Pa (4 digits from 1100 Torr to 1000 Torr), (3 digits from 999 Torr to 10.0 mTorr), (2 digits from 9.9 mTorr to 1.0 mTorr), (1 digit from 0.9 mTorr to 0.1 mTorr)
materials exposed to gases	gold-plated tungsten, 304 & 316 stainless steel, glass, nickel, Teflon®
internal volume	1.589 in <sup>3</sup> (26 cm <sup>3</sup> )
internal surface area	9.25 in <sup>2</sup> (59.7 cm <sup>2</sup> )
weight	12 oz. (340 g)
housing (electronics)	aluminum extrusion
operating temperature	0 to +40 °C
storage temperature	-40 to +70 °C
bakeout temperature	150 °C max (gauge only - electronics removed)
humidity	0 to 95% relative humidity, non-condensing
mounting orientation	horizontal recommended (orientation has no effect on measurements below 1 Torr)
analog outputs	1) log-linear 1 to 8 Vdc, 1 V/decade or non-linear S-curve 0.375 to 5.659 Vdc, and 2) linear 0 to 10 Vdc
serial communications	RS485 / RS232 - ASCII protocol
input power	12 to 28 Vdc, 2 W protected against power reversal and transient over-voltages
setpoint relays	two, single-pole double-throw relays (SPDT), 1 A at 30 Vdc resistive, or ac non-inductive
connectors	9-pin D-sub male and 15-pin high-density D-sub male
CE compliance	EMC Directive 2014/30/EU, EN55011, EN61000-6-2, EN61000-6-4, EN61326-1, EN61010-1
environmental	RoHS compliant



fitting	dimension A
1/8 in. NPT male -1/2 in. tube	0.86 in. (21.8 mm)
NW16KF	1.16 in. (29.5 mm)
NW25KF	1.16 in. (29.5 mm)
NW40KF	1.16 in. (29.5 mm)
1 1/3 in. Mini-Conflat®	1.34 in. (34.0 mm)
2 3/4 in. Conflat®	1.34 in. (34.0 mm)
1/4 in. Cajon® 4VCR®	1.72 in. (43.7 mm)
1/2 in. Cajon® 8VCR®	1.61 in. (40.9 mm)

## Ordering Information

## Part Number

### CVM201 Fittings / Flanges

Combination 1/8 in. NPT male - 1/2 in. tube (use 1/8 in. NPT male or 1/2 in. O.D. O-ring compression)	CVM201GAA
NW16KF	CVM201GBA
NW25KF	CVM201GCA
NW40KF	CVM201GDA
1 1/3 in. Mini-CF / NW16CF Mini-Conflat®	CVM201GEA
2 3/4 in. CF / NW35CF Conflat®	CVM201GFA
1/4 in. Cajon® 4VCR® female	CVM201GGA
1/2 in. Cajon® 8VCR® female	CVM201GHA

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**InstruTech®**

## Series 301 Busy Bee™ Pirani Capacitance Vacuum Gauge

### Wide measurement range

3.8 x 10<sup>-5</sup> to 1,125 Torr

5 x 10<sup>-5</sup> to 1,500 mbar

5 x 10<sup>-3</sup> Pa to 150 kPa

Pirani sensor combined with robust ceramic capacitance diaphragm gauge provides gas independent measurements above 7.6 Torr

Gas independent measurements above 7.6 Torr allows for safe venting of any gas mixture

*Built-in backlit display, two setpoint relays, log-linear analog output and an optional atmospheric switch*

*Accurate and repeatable for reliable and fast atmospheric pressure readings*

*Can be mounted in any orientation*

*Sensor with on-board calibration data can be easily replaced in the field*



### PCM301 Busy Bee

The PCM301 Busy Bee™ module is ideal for applications from medium vacuum to above atmosphere. The unit combines pirani technology with a ceramic capacitance diaphragm sensor to provide repeatable and accurate pressure measurements. Above 7.6 Torr, the instrument is gas type independent which allows for safe venting with any gas mixture.

The instrument is offered standard with a built-in backlit display and two set point relays providing flexibility for a variety of process control schemes. It can be mounted in any orientation for easy adaption of any tool design.

The PCM301 Busy Bee pirani capacitance vacuum gauge

module provides the basic signal conditioning required to turn the sensor into a complete vacuum pressure measurement instrument.

At low pressures, only the signal of the pirani sensor is used for pressure measurements while at high pressures, only the signal of the diaphragm capacitive sensor is utilized. To determine the output signal in the intermediate range, both signals are used proportionally to accurately determine the pressure throughout the measurement range of the device.

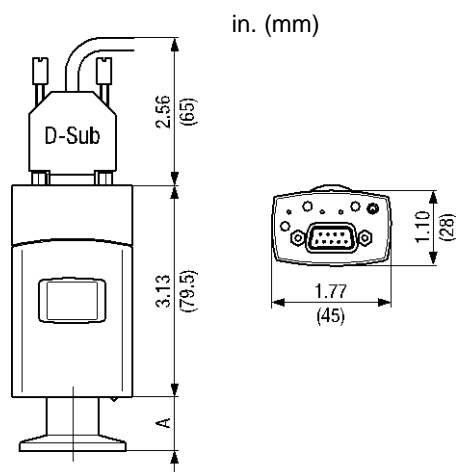
The combination of superior sensor design and enhanced signal processing provides optimal and stable pressure readings over the entire measurement range.

### Specifications

measurement range	3.8 x 10 <sup>-5</sup> to 1,125 Torr / 5 x 10 <sup>-5</sup> to 1,500 mbar / 5 x 10 <sup>-3</sup> Pa to 150 kPa
accuracy - N <sub>2</sub> (typical)	3.8 x 10 <sup>-4</sup> to 7.6 x 10 <sup>-4</sup> Torr: ± 50% of reading 7.6 x 10 <sup>-4</sup> to 75 Torr: ± 15% of reading 75 to 715 Torr: ± 5% of reading 715 to 790 Torr: ± 2.5% of reading
repeatability - (typical)	7.6 x 10 <sup>-4</sup> to 825 Torr: ± 2% of reading
materials exposed to gases	W, Ni, NiFe, Al <sub>2</sub> O <sub>3</sub> , SnAg, stainless steel, glass
internal gauge volume	1/8 in. NPT: 0.32 in <sup>3</sup> (5.2 cm <sup>3</sup> ), KF16: 0.29 in <sup>3</sup> (4.7 cm <sup>3</sup> ), KF25 & 4 VCR: 0.34 in <sup>3</sup> (5.5 cm <sup>3</sup> ) 1.33 in. Mini-CF: 0.49 in <sup>3</sup> (8 cm <sup>3</sup> ), 8 VCR: 0.43 in <sup>3</sup> (7 cm <sup>3</sup> ) 16KF long tube: 0.88 in <sup>3</sup> (14.5 cm <sup>3</sup> ), 1.33 in. Mini-CF long tube: 0.85 in <sup>3</sup> (14 cm <sup>3</sup> )
admissible pressure	≤ 72.5 psi (5 bar) absolute
temperature	operating: + 10 to + 50 °C storage: -20 to + 65 °C
bakeout temperature	≤ 80 °C at flange ≤ 250 °C at flange with the long tube option
weight	4 to 4.5 oz. (115 to 130 g)
housing (electronics)	aluminum extrusion
mounting orientation	any
analog output	log-linear 0 to 8 Vdc, 1 V/decade
error signal	analog output switches to 0 V
response time	< 30 ms

input power	15 to 30 Vdc, $\leq 2.5$ W protected against power reversal
supply voltage ripple	$\leq 1$ p-p
setpoint relays	2 Solid State, normally open, potential free, $<30$ V (ac) / (dc), $\leq 0.3$ A resistive
setpoint relay hysteresis	10% of threshold
setpoint relay range (N <sub>2</sub> )	$3.8 \times 10^{-5}$ to 1,125 Torr
connector	9-pin D-sub male
CE compliance	EMC (EN61000-6-2, EN61000-6-3, EN61010)
environmental	RoHS compliant

Fitting	dimension A
1/8 in. NPT	1.41 in. (36 mm)
NW16KF	0.57 in. (14.5 mm)
NW25KF	0.85 in. (21.5 mm)
1 1/3 in. Mini-CF	1.22 in. (30.9 mm)
1/4 in. Cajon 4VCR	1.68 in. (42.7 mm)
1/2 in. Cajon 8VCR	1.82 in. (46.3 mm)
NW16KF w. Long Tube	5.15 in. (130.8 mm)
1 1/3 in. Mini-CF w. Long Tube	5.13 in. (130.2 mm)



#### Ordering Information

#### PCM301 Part Number

#### Spare Parts / Accessories Part Numbers

	PCM301 T U T # # A
<b>Sensor Material</b>	
T = Tungsten	
<b>Display Units of Measure</b>	
T = Torr	
<b>Fitting / Flanges</b>	
A = 1/8 in. NPT Male	
B = NW16KF	
C = NW25KF	
E = 1 1/3 in. Mini-CF (NW16CF)	
G = 4VCR Female	
H = 8VCR Female	
I = 16KF with Long Tube	
J = 1 1/3 in. Mini-CF with Long Tube	
<b>Electronics</b>	
C = 2 set-point relays (absolute P.)	
D = 2 setpoint relays ( 1 for absolute press. and 1 for atmospheric switch)	
<b>Electrical Connector</b>	
A = 9-pin D-sub male	

PCM301 Spare Sensor, 1/8 in. NPT Male	PC3A
PCM301 Spare Sensor, NW16KF	PC3B
PCM301 Spare Sensor, NW25KF	PC3C
PCM301 Spare Sensor, 1 1/3 in. Mini-CF	PC3E
PCM301 Spare Sensor, 4 VCR Female	PC3G
PCM301 Spare Sensor, 8 VCR Female	PC3H
PCM301 Spare Sensor, 16KF Long Tube	PC3BL
PCM301 Spare Sensor, 1 1/3 in. Mini-CF Long Tube	PC3EL
Centering ring with fine filter, NW16 KF	002628

Example: PCM301TUTBCA (PCM301 tungsten pirani sensor, Torr display, NW16KF fitting, two setpoint relays, 9-pin D-Sub Connector)



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**InstruTech®**

## Series 900 Micro Bee™ Capacitance Diaphragm Vacuum Gauge

**Gas Independent Vacuum Gauge**

*Outstanding stability with consistent long term performance*

**Full scale ranges from 10 to 1000 Torr**

*Elegant cost effective design  
0.5% and 1% accuracy models*

**Ceramic Sensor**

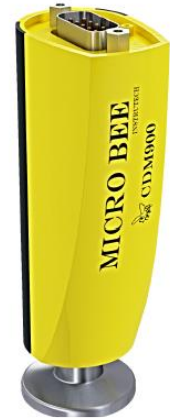
*Chemical Resistance  
No span adjustment required  
No zero adjust in clean applications*

**Prolonged lifetime in harsh environments**

*Corrosion resistant feed through*

**Built-in Controller with 0 to 10 Vdc analog output as well as remote zero adjust capability**

*Super compact size and digital electronics provides great flexibility in any system integration*



### CDM900 Micro Bee

The CDM900 Micro Bee™ Capacitance Diaphragm vacuum gauge is an economical, gas type independent absolute pressure sensor. The CDM900 provides excellent long term stability and performance.

The sensor assembly is constructed of a compact ceramic and metal design resulting in a simple yet rugged sensor suitable for numerous industrial applications.

The ceramic sensor provides outstanding span and zero stability allowing many years of maintenance free operation.

The corrosion resistant sensor material provides excellent temperature compensation capability, thus enhancing the reliability of the pressure measurements.

The CDM900 Micro Bee vacuum gauge module provides the basic signal conditioning required to turn the sensor into a complete vacuum pressure measurement instrument. The combination of superior sensor design and enhanced signal processing provides optimal and stable pressure readings by the instrument.

The built-in controller provides a 0 to 10 Vdc analog output for pressure measurements and allows for local or remote zeroing of the instrument.

### Specifications

full scale (F.S.) ranges - Torr	1000, 500, 200, 100, 50, 20, 10		
lowest reading	0.05% of F.S.		
accuracy (1)	model A: 1% of reading	model B: 0.5% of reading	
temperature effect on zero	0.02% F.S./ °C		
temperature effect on span	0.02% of reading/°C		
resolution	0.05% F.S.		
long term stability	0.5% F.S./yr		
temperature compensated range	+10 to +50 °C		
materials exposed to gases			
sensor, feedthrough	aluminum oxide ceramic (Al <sub>2</sub> O <sub>3</sub> )		
flange, tube	stainless steel AISI 316L		
internal gauge volume	1/2 in. Tube: 0.219 in <sup>3</sup> (3.6 cm <sup>3</sup> )	KF16: 0.226 in <sup>3</sup> (3.7 cm <sup>3</sup> )	4 VCR & 8 VCR: 0.342 in <sup>3</sup> (5.6 cm <sup>3</sup> )
temperature	operating: 0 to + 70 °C	storage: -20 to + 85 °C	
bakeout temperature (at flange)	≤ 110 °C (non-operating)		
admissible pressure (absolute)	≥ 500 Torr F.S. = 58 psi (4 bar), 50 to 200 Torr F.S. = 43.5 psi (3 bar), 10 to 20 Torr F.S. = 29 psi (2 bar)		

humidity	0 to 80% relative humidity, non-condensing
weight	4 to 5.7 oz. ( 115 to 160 g ) , flange/fitting dependent
housing (electronics)	aluminum extrusion
mounting orientation	any
analog output	linear 0 to 10 Vdc
max output signal	+ 10.24 Vdc
response time	100 msec (from 10% to 90% F.S.)
input power	13 to 30 Vdc, 0.3 W protected against power reversal
supply voltage ripple	≤50 mVpp
connector	9-pin D-sub male
CE compliance	EMC (EN61000-6-2, EN61000-6-3, EN61010-1)
environmental	RoHS compliant

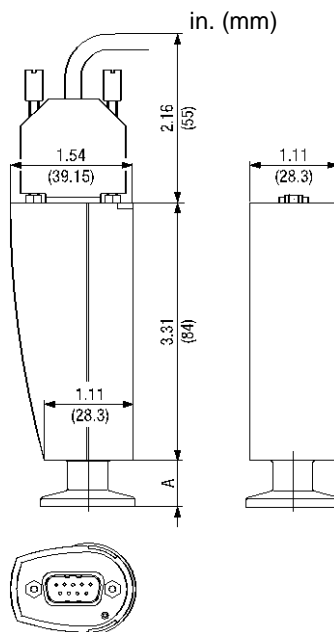
1) Non-linearity, hysteresis, repeatability at 25 Deg °C ambient temperature without temperature effects after 2 hours operation

#### Fitting

1/2 in. Tube  
 NW16KF  
 NW25KF  
 1 1/3 in. Mini-CF  
 1/4 in. Cajon 4VCR  
 1/2 in. Cajon 8VCR

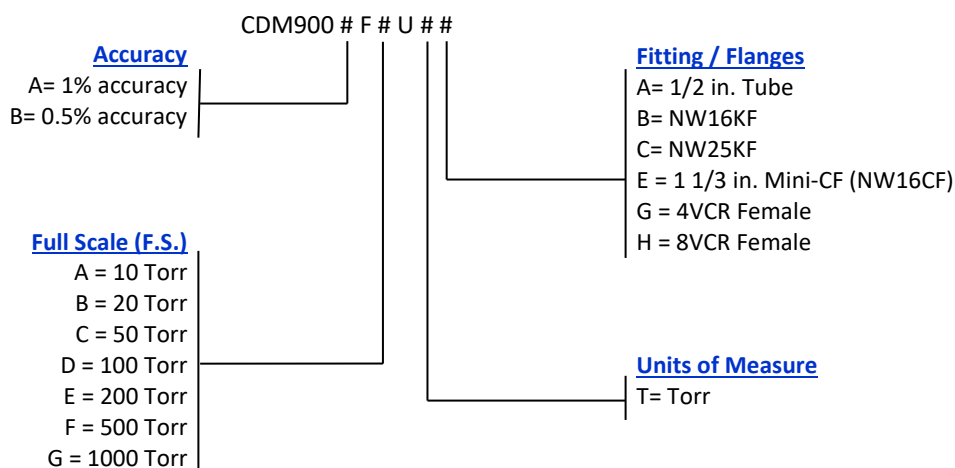
#### dimension A

0.59 in. (15.0 mm)  
 1.20 in. (30.7 mm)  
 1.39 in. (35.5 mm)  
 1.28 in. (31.1 mm)  
 2.43 in. (61.8 mm)  
 1.77 in. (45.0 mm)



#### Ordering Information

#### CDM900 Part Number



Example: CDM900BFAUTB (CDM900, 0.5% accuracy, 10 Torr F.S., Torr units of measure, NW16KF fitting )

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**InstruTech®**

## Series 100 Mini Bee™ Absolute and Differential Vacuum Switches

**Accurate and reliable pressure detection**

**Absolute setpoint range between 20 to 970 Torr, relay energized when pressure drops below setpoint**

**Differential setpoint range between -99 to +46 Torr relative to atmosphere, relay energized when differential pressure setpoint reached**

**No maintenance required in clean applications**

**Easy installation with preset set points**

**Compact design**

**Robust corrosion resistant design, cleanroom compliant**



### VSM100 Mini Bee

The VSM100 *Mini Bee*™ is a cleanroom compliant all stainless steel corrosion resistant vacuum switch. It is a high-accuracy, temperature compensated sensor designed for accurate and reliable pressure detection in vacuum applications including pressure interlocks.

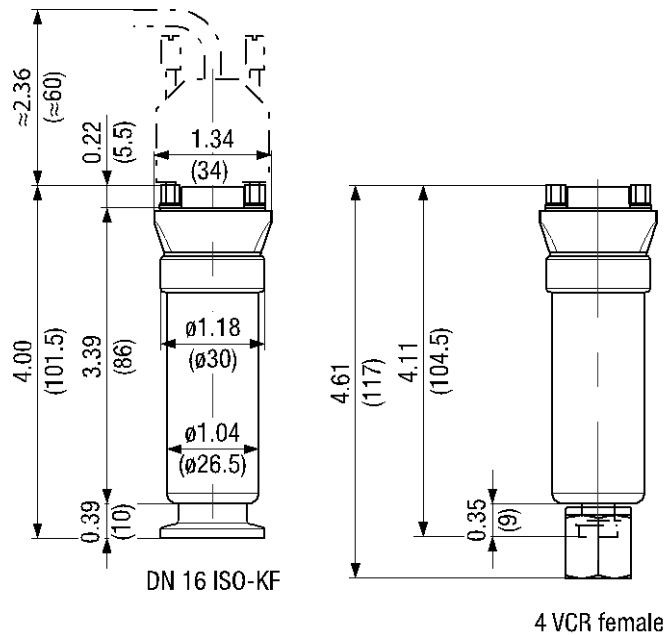
The *Mini Bee* is available in an absolute and differential configuration. The absolute switch has a full scale rating of 1000 Torr and the setpoint relay can be preset to any user specified value from 20 to 970 Torr. The differential switch setpoint can be preset set from 99 Torr below atmospheric pressure up to 46 Torr above atmosphere pressure.

Specifications		VSM100A absolute vacuum switch	VSM100D differential vacuum switch
full Scale		1,000 Torr absolute	150 Torr differential
differential range		N/A	-100 to +50 Torr (relative to atm.)
setpoint range		20 to 970 Torr	-99 to + 46 Torr (relative to atm.)
setpoint accuracy		0.5% F.S.	0.5% F.S.
setpoint contact rating		≤30 V (dc) / 1 A (dc) ≤30 V (ac) / 0.3 A (ac)	≤30 V (dc) / 1 A (dc) ≤30 V (ac) / 0.3 A (ac)
temperature effect on zero & span		≤ ±0.02% F.S. / °C	≤ ±0.02% F.S. / °C
response time		≤ 45 ms	≤ 45 ms
hysteresis		2 % F.S. above setpoint	2 % F.S. above setpoint
materials exposed to vacuum		stainless steel	stainless steel
internal volume	NW16KF	0.17 in <sup>3</sup> (2.81 cm <sup>3</sup> )	0.17 in <sup>3</sup> (2.81 cm <sup>3</sup> )
	4VCR	0.057 in <sup>3</sup> (0.93 cm <sup>3</sup> )	0.057 in <sup>3</sup> (0.93 cm <sup>3</sup> )
weight		4.94 oz. (140 g)	4.94 oz. (140 g)
operating temperature		0 to +70 °C	0 to +70 °C
storage temperature		-40 to 80 °C	-40 to 80 °C
admissible pressure (absolute)		72.5 psi (5 bar)	29 psi (2 bar)
mounting orientation		any	any
input power		14 to 30 Vdc, 0.5 W	14 to 30 Vdc, 0.5 W
CE compliance		EN 61000-4-3:2006 EN 61010-1:2010	EN 61000-4-3:2006 EN 61010-1:2010
environmental		RoHS	RoHS



## Dimensions

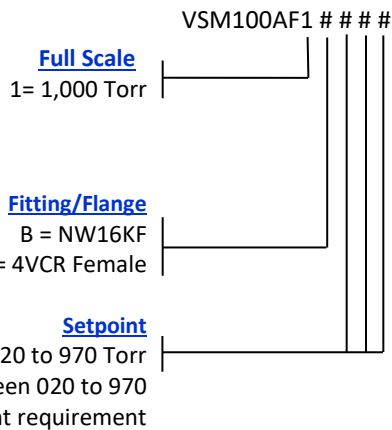
in. (mm)



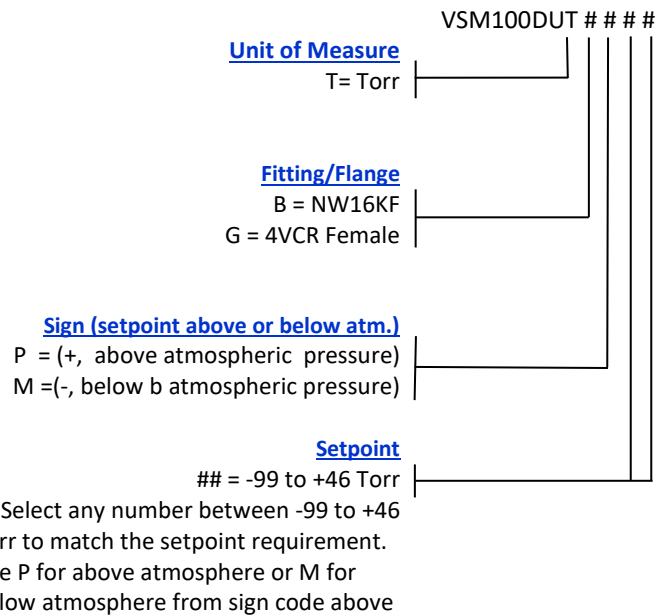
### Ordering Information

#### VSM100A Absolute Vacuum Switch

#### VSM100D Differential Vacuum Switch



Example: VSM100AF1G030 (Absolute vacuum switch with 4VCR fitting, setpoint at 30 Torr)



Example: VSM100DUTGP40 (Differential vacuum switch, Torr, 4VCR fitting, setpoint 40 Torr above atmospheric pressure)



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InstruTech®

### Series 600 Hot Cathode Bayard-Alpert Ionization Vacuum Gauges

- ◆ **BA600 Mini IG: Electron Bombardment (EB) degas design**  
 $1 \times 10^{-9}$  to  $5 \times 10^{-2}$  Torr Measurement Range
- ◆ **BA601 UHV Nude: Electron Bombardment (EB) degas design**  
 $2 \times 10^{-11}$  to  $1 \times 10^{-3}$  Torr Measurement Range
- ◆ **BA602/BA603: Resistive degas ( $I^2R$ ) design**  
 $4 \times 10^{-10}$  to  $1 \times 10^{-3}$  Torr Measurement Range
- ◆ **Wide range of emission currents (100  $\mu$ A to 10 mA)**
- ◆ **All 4 models can be degassed using electron bombardment, BA602/BA603 can also be degassed using resistive degas ( $I^2R$ )**



#### Description

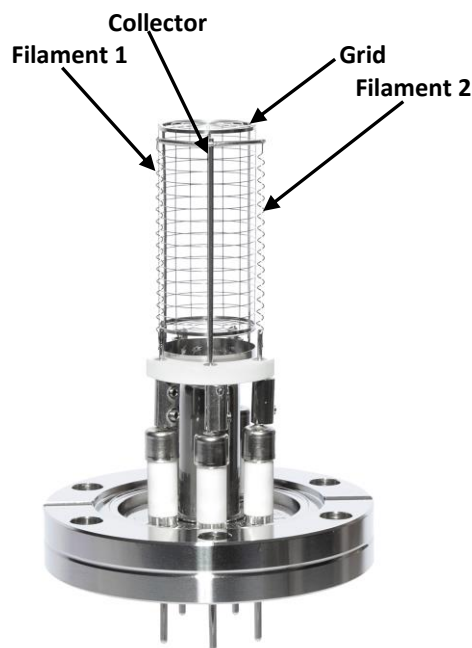
The hot cathode Bayard-Alpert ionization vacuum gauge (IG) operates by ionizing the gas inside the gauge and then measuring the number of ions generated. The ions are then collected giving a measurement of the density or pressure of the gas inside the transducer.

The various electrodes used in the transducer design are a collector surrounded by a circular grid with one or two filaments outside the grid. An electric current is passed through the filament to cause the filament temperature to increase. As the filament temperature is increased, electrons are emitted from the filament surface. The bias voltage between the filament and the grid will accelerate the electrons toward the grid. Most electrons will pass through the grid volume and exit the other side of the grid and then be drawn back into the grid for another traversal through the grid volume. Eventually, most electrons will impact the grid surface generating a current between the filament and the grid which is referred to as the emission current.





The electronic controller is designed to maintain a constant, selectable emission current which is independent of pressure. While an electron is traversing inside the grid volume, it may collide with a gas molecule and ionize it which removes an electron. The ionized gas molecule, which now has a positive charge because it is missing an electron, will be attracted to the collector which is at ground potential. A current will be generated by the flow of ions to the collector which is known as the ion or collector current. The Controller's electrometer will measure the small ion current generated and a pressure, which is proportional to the ion current is calculated.

The InstruTech series 600 Bayard-Alpert ionization vacuum gauges are offered in four different configurations:  
BA600 is a EB-degas metal enclosed miniature ionization vacuum gauge capable of pressure measurements as low as  $1 \times 10^{-9}$  Torr.  
BA601 is a EB-degas UHV nude ionization vacuum gauge capable of pressure measurements as low as  $2 \times 10^{-11}$  Torr.  
BA602 is a Resistive degas ( $I^2R$ ) nude ionization vacuum gauge capable of pressure measurements as low as  $4 \times 10^{-10}$  Torr.  
BA603 is a Resistive degas ( $I^2R$ ) glass enclosed ionization vacuum gauge capable of pressure measurements as low as  $4 \times 10^{-10}$  Torr.

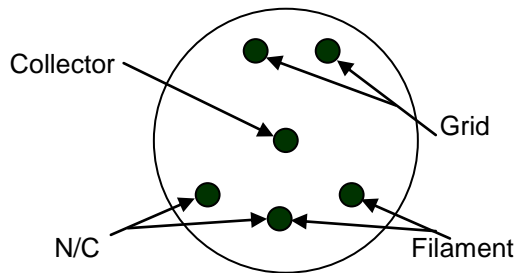
For general vacuum applications, yttria coated iridium filaments are offered for use with air and inert gases such as  $N_2$ , argon, etc. Tungsten filaments are available for use with gases not compatible with yttria coated iridium filaments. The BA601/602/603 vacuum gauges can be operated using InstruTech's controllers or other manufacturer brands capable of operating such B-A gauges.



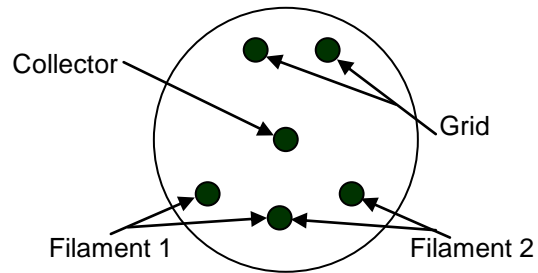
## Specifications

Data	BA600	BA601	BA602	BA603
				
measurement range Torr mbar Pa	$1 \times 10^{-9}$ to $5 \times 10^{-2}$ $1.3 \times 10^{-9}$ to $6.7 \times 10^{-2}$ $1.3 \times 10^{-7}$ to 6.7	$2 \times 10^{-11}$ to $1 \times 10^{-3}$ $2.7 \times 10^{-11}$ to $1.3 \times 10^{-3}$ $2.7 \times 10^{-9}$ to $1.3 \times 10^{-1}$	$4 \times 10^{-10}$ to $1 \times 10^{-3}$ $5.3 \times 10^{-10}$ to $1.3 \times 10^{-3}$ $5.3 \times 10^{-8}$ to $1.3 \times 10^{-1}$	$4 \times 10^{-10}$ to $1 \times 10^{-3}$ $5.3 \times 10^{-10}$ to $1.3 \times 10^{-3}$ $5.3 \times 10^{-8}$ to $1.3 \times 10^{-1}$
accuracy - N <sub>2</sub> (typical)	± 15% over the range of $1 \times 10^{-8}$ to $5 \times 10^{-2}$ Torr	± 20%	± 20%	± 20%
repeatability - N <sub>2</sub> (typical)	± 5% in the range of $1 \times 10^{-8}$ to $5 \times 10^{-2}$ Torr	± 5%	± 5%	± 5%
X-ray limit	$5 \times 10^{-10}$ Torr	$2 \times 10^{-11}$ Torr	$4 \times 10^{-10}$ Torr	$4 \times 10^{-10}$ Torr
sensitivity - N <sub>2</sub>	10 Torr <sup>-1</sup> nominal	25 Torr <sup>-1</sup>	10 Torr <sup>-1</sup>	10 Torr <sup>-1</sup>
degas - electron bombardment	3 W max	40 W max	70 W nominal, 100 W max	100 W max
degas - resistance heated I <sup>2</sup> R	N/A	N/A	6.3 to 7.5 Vac at 10 A	6.3 to 7.5 Vac at 10 A
filament current	2.0 to 2.5 A	2.5 to 3.5 A	4 to 6 A	4 to 6 A
filament voltage	1.5 to 2 Vdc	3 to 5 Vdc	3 to 5 Vdc	3 to 5 Vdc
filament potential	+30 Vdc	+30 Vdc	+30 Vdc	+30 Vdc
grid potential	+180 Vdc	+180 Vdc	+180 Vdc	+180 Vdc
collector potential	0 V	0 V	0 V	0 V
bakeout temperature	200 °C	450 °C	450 °C	450 °C
collector	tungsten, 0.010 in. diameter	tungsten, 0.005 in. diameter	tungsten, 0.010 in. diameter	tungsten, 0.010 in. diameter
filament material	dual yttria coated iridium	dual yttria coated iridium or dual tungsten	single/dual hairpin type yttria coated iridium or dual tungsten	single hairpin type yttria coated iridium or dual tungsten
grid	etched Stainless Steel	photo etched closed end stainless steel cage grid	non-sag double helical, 0.025 in. tungsten grid	non-sag double helical, 0.025 in. tungsten grid
insulator	glass	ceramic	ceramic	glass to metal
mounting orientation	any	any	any	any
glass envelope	N/A	N/A	N/A	2 1/4 in. dia x 5 in. long
length	2.70 in. to 3.80 in. overall depending on fitting	4 1/8 in. overall, 3 in. insertion	4 1/8 in. overall, 3 in. insertion	6 in. overall
fitting	NW16KF NW25KF NW40KF 1 1/3 in. (16CF) Mini-CF 2 3/4 in. (35CF) Conflat® 3/4 in. Tubular 1/2 in. Cajon® 8VCR®	2 3/4 in. CF / NW35CF Conflat®	2 3/4 in. CF / NW35CF Conflat®	3/4 in. Kovar metal port 1 in. Kovar metal port 3/4 in. glass port 1 in. glass port NW25KF NW40KF, 1 1/3 in. (16CF) Mini-CF 2 3/4 in. (35CF) Conflat®
Compatible InstruTech Controller	B-RAX 3400	B-RAX 3400 FlexRax 4000	B-RAX 3300 FlexRax 4000	B-RAX 3300 FlexRax 4000

**Nude B-A Gauge  
Pin Pattern**

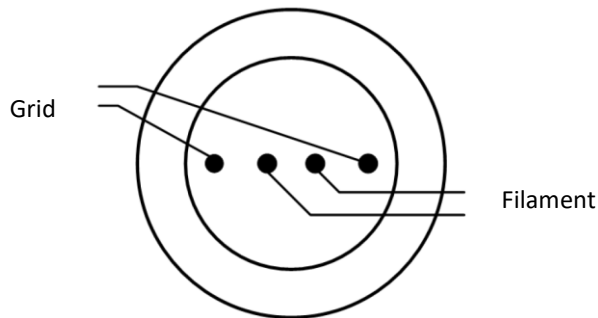


**Base View**  
BA602  
I<sup>2</sup>R - single filament



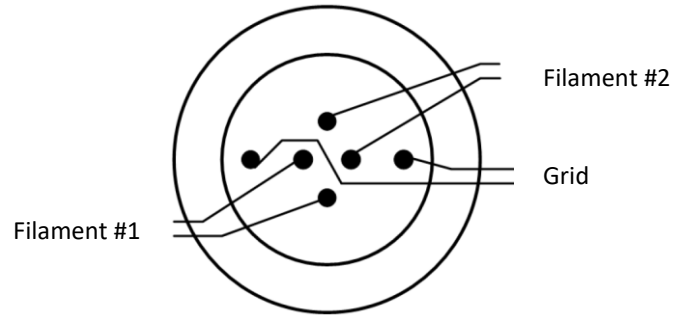
**Base View**  
BA601/BA602  
EB degas - dual filament  
I<sup>2</sup>R degas - dual filament

**Glass B-A Gauge  
Pin Pattern**



**Base View**  
BA603  
single filament

**Glass B-A Gauge  
Pin Pattern**



**Base View**  
BA603  
dual filament

**Nude Gauge Filament Assemblies**



BA601 dual yttria coated  
Iridium filament



BA601 dual  
tungsten filament



BA602 single hairpin  
yttria coated Iridium filament



BA602 dual hairpin  
yttria coated Iridium filament



BA602 dual tungsten filament

**BA600 Mini IG - Electron bombardment degas**

3/4 in. Tube (3/4 in. O.D. O-ring compression)	BA600DYA
NW16KF	BA600DYB
NW25KF	BA600DYC
NW40KF	BA600DYD
1 1/3 in. Mini-CF/NW 16CF Mini- Conflat®	BA600DYE
2 3/4 in. CF / NW35CF Conflat®	BA600DYF
1/2 in. Cajon® 8VCR® female	BA600DYH

**BA601 UHV Nude IG - Electron bombardment degas**

Nude IG - UHV EB-degas, dual yttria coated iridium filament, 2 3/4 in. Conflat®	BA601DY
Nude IG - UHV EB-degas, dual tungsten filament, 2 3/4 in. Conflat®	BA601DT
Dual yttria coated Iridium replacement filament assembly	BA1DY
Dual tungsten replacement filament assembly	BA2DT

**BA602 Nude IG - Resistive degas (I<sup>2</sup>R)**

Nude IG - I <sup>2</sup> R, single hairpin yttria coated iridium filament, 2 3/4 in. Conflat®	BA602SY
Nude IG - I <sup>2</sup> R, dual hairpin yttria coated iridium filament, 2 3/4 in. Conflat®	BA602DY
Nude IG - I <sup>2</sup> R, dual tungsten filament, 2 3/4 in. Conflat®	BA602DT
Single yttria coated Iridium replacement filament assembly	BA2SY
Dual yttria coated Iridium replacement filament assembly	BA2DY
Dual tungsten replacement filament assembly	BA2DT

**BA603 Glass IG - Resistive degas (I<sup>2</sup>R) with single hairpin yttria coated iridium filament**

Glass IG - I <sup>2</sup> R, single hairpin yttria coated iridium filament, 3/4 in. Kovar metal inlet port	BA603SYA
Glass IG - I <sup>2</sup> R, single hairpin yttria coated iridium filament, 1 in. Kovar metal inlet port	BA603SYT
Glass IG - I <sup>2</sup> R, single hairpin yttria coated iridium filament, 3/4 in. glass inlet port	BA603SYG
Glass IG - I <sup>2</sup> R, single hairpin yttria coated iridium filament, 1 in. glass inlet port	BA603SYH
Glass IG - I <sup>2</sup> R, single hairpin yttria coated iridium filament, NW25KF	BA603SYC
Glass IG - I <sup>2</sup> R, single hairpin yttria coated iridium filament, NW40KF	BA603SYD
Glass IG - I <sup>2</sup> R, single hairpin yttria coated iridium filament, 1 1/3 in. Mini-CF/NW16CF Mini-Conflat®	BA603SYE
Glass IG - I <sup>2</sup> R, single hairpin yttria coated iridium filament, 2 3/4 in. CF / NW35CF Conflat®	BA603SYF

**BA603 Glass IG - Resistive degas (I<sup>2</sup>R) with dual tungsten filaments**

Glass IG - I <sup>2</sup> R, dual tungsten filaments, 3/4 in. Kovar metal inlet port	BA603DTA
Glass IG - I <sup>2</sup> R, dual tungsten filaments, 1 in. Kovar metal inlet port	BA603DTT
Glass IG - I <sup>2</sup> R, dual tungsten filaments, 3/4 in. glass inlet port	BA603DTG
Glass IG - I <sup>2</sup> R, dual tungsten filaments, 1 in. glass inlet port	BA603DTH
Glass IG - I <sup>2</sup> R, dual tungsten filaments, NW25KF	BA603DTC
Glass IG - I <sup>2</sup> R, dual tungsten filaments, NW40KF	BA603DTD
Glass IG - I <sup>2</sup> R, dual tungsten filaments, 1 1/3 in. Mini-CF/NW16CF Mini-Conflat®	BA603DTE
Glass IG - I <sup>2</sup> R, dual tungsten filaments, 2 3/4 in. CF / NW35CF Conflat®	BA603DTF

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**InstruTech®**

## Series 600 Cold Cathode Inverted Magnetron Ionization Vacuum Gauge

### Wide measurement range

#### Model CC605

$1.5 \times 10^{-9}$  to  $3.75 \times 10^{-3}$  Torr

$2 \times 10^{-9}$  to  $5 \times 10^{-3}$  mbar

$2 \times 10^{-7}$  to  $5 \times 10^{-1}$  Pa

#### Model CC606 - UHV range

$7.5 \times 10^{-11}$  to  $3.75 \times 10^{-3}$  Torr

$1 \times 10^{-10}$  to  $5 \times 10^{-3}$  mbar

$1 \times 10^{-8}$  to  $5 \times 10^{-1}$  Pa

*Inverted Magnetron Cold Cathode sensor,  
rugged and compact metal construction*

*Corrosion resistant ceramic feed through*

*Prolonged lifetime in harsh environments*

*Compact small footprint*

*Cleanable sensor*



### CC600 Cold Cathode

The series 600 *Cold Cathode* ionization gauge sensor assembly is constructed of a compact metal design resulting in a simple yet rugged sensor suitable for numerous industrial applications. Two different gauge configurations are available. Model CC605 utilizes an elastomer internal seal while the CC606 uses a metal seal allowing pressure measurements in the UHV range.

The sensor assembly can be easily disassembled and cleaned allowing long term use with minimal down time. A sensor activation aid mounted on the anode improves the

time it takes to activate the cold cathode sensor.

The series 600 Cold Cathode require the InstruTech B-RAX 3500 Controller to operate. The Controller displays the pressure and provides numerous outputs including analog output, digital I/O and serial communications.

When used with the B-RAX 3500 Controller, the combination of superior sensor design and enhanced signal processing provides optimal and stable pressure readings over the entire measurement range from low to high vacuum.

### Specifications

#### measurement range

CC605  $1.5 \times 10^{-9}$  to  $3.75 \times 10^{-3}$  Torr /  $2 \times 10^{-9}$  to  $5 \times 10^{-3}$  mbar /  $2 \times 10^{-7}$  to  $5 \times 10^{-1}$  Pa

CC606  $7.5 \times 10^{-11}$  to  $3.75 \times 10^{-3}$  Torr /  $1 \times 10^{-10}$  to  $5 \times 10^{-3}$  mbar /  $1 \times 10^{-8}$  to  $5 \times 10^{-1}$  Pa

#### accuracy - N<sub>2</sub> (typical)

CC605  $1.5 \times 10^{-8}$  to  $3.75 \times 10^{-3}$  Torr:  $\pm 30\%$  of reading when used with B-RAX 3500 Controller

CC606  $7.5 \times 10^{-10}$  to  $3.75 \times 10^{-3}$  Torr:  $\pm 30\%$  of reading when used with B-RAX 3500 Controller

#### repeatability - (typical)

CC605  $1.5 \times 10^{-8}$  to  $3.75 \times 10^{-3}$  Torr:  $\pm 30\%$  of reading when used with B-RAX 3500 Controller

CC606  $7.5 \times 10^{-10}$  to  $3.75 \times 10^{-3}$  Torr:  $\pm 30\%$  of reading when used with B-RAX 3500 Controller

#### materials exposed to gases

CC605 anode: molybdenum internal seal: FPM others: Al<sub>2</sub>O<sub>3</sub>, stainless steel

CC606 anode: molybdenum internal seal: Ag others: Al<sub>2</sub>O<sub>3</sub>, stainless steel

#### internal gauge volume

1.22 in<sup>3</sup> (20 cm<sup>3</sup>)

#### admissible pressure

130 psi, 9 bar absolute (limited to inert gases < 55 °C)

#### operating temperature

CC605

CC606

with standard cable + 5 to + 80 °C

+ 5 to + 80 °C

with high temperature cable + 5 to + 150 °C

+ 5 to + 250 °C

#### bakeout temperature

+ 150 °C

+ 250 °C

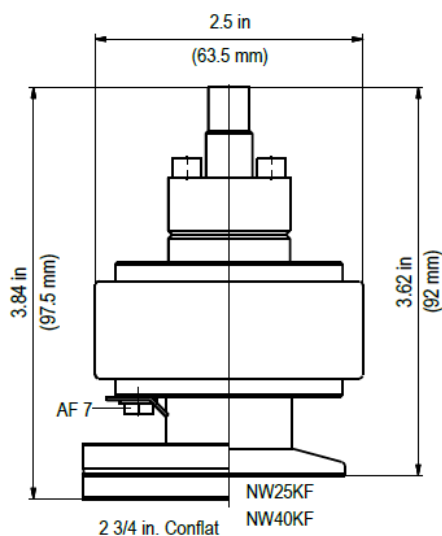
#### storage temperature

- 40 to + 80 °C

- 40 to + 80 °C

humidity	max. 80% at temperatures up to +31 °C, decreasing to 50% at +40 °C
weight	1.32 lb. (600 g) with NW25KF and NW40KF flange 1.87 lb. (850 g) with 2.75 in. Conflat flange
mounting orientation	any
high voltage in measuring chamber	≤3.3 kV
current in measuring chamber	≤ 700 μA
connector	SHV (coaxial cable)
input power	provided from B-RAX 3500 Controller
output signal	provided from B-RAX 3500 Controller
CE compliance	when used with B-RAX 3500 Controller: EMC Directive 2014/30/EU, EN55011, EN61000-6-2, EN61000-6-4, EN61326-1, EN61010-1
environmental	RoHS compliant

#### dimension



#### Ordering Information

#### Part Numbers

##### CC605 Cold Cathode Sensor

NW25KF	CC605SC
NW40KF	CC605SD
2 3/4 in. CF / NW40CF Conflat®	CC605SF
Maintenance kit (FPM O-ring, inner ring, ignition aid)	002943
Repair kit (anode assembly, FPM O-ring, inner ring, ignition aid)	002944
Tool set for removing / installing sensor ignition aid	002586

##### CC606 Cold Cathode Sensor - UHV

NW40KF	CC606SD
2 3/4 in. CF / NW40CF Conflat®	CC606SF
Maintenance kit (metal seal, centering ring, ignition aid, washer)	002945
Repair kit (Anode assembly, metal seal, centering ring, ignition aid, washer)	002946
Tool set for removing / installing sensor ignition aid	002586

**Cables:** For connection to the B-RAX 3500 Controller please see cables listed in the B-RAX Controller data sheet.



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**InstruTech®**

## **Series 101 Worker Bee™ Convection Vacuum Gauge**

**Wide measuring range**  
 **$1 \times 10^{-4}$  to 1,000 Torr**  
 **$1.3 \times 10^{-4}$  to 1,333 mbar**  
 **$1.3 \times 10^{-2}$  Pa to 133 kPa**

***A single vacuum gauge can monitor  
your vacuum system pump-down and  
venting***

**Wider measuring range and better  
accuracy than thermocouple gauges**

***Upgrade your vacuum system and  
process performance***

**Also a lower cost, plug-compatible,  
direct drop-in replacement gauge  
for Granville-Phillips® Convector®  
and gauges**

***Significant savings for you**  
**No changes to your system**  
**Use your existing Convector®  
controllers, cables, and modules***



### **The InstruTech CVG101 Sensor**

The CVG101 Worker Bee™ convection vacuum gauge sensor incorporates numerous design enhancements compared to other traditional convection vacuum gauges.

Temperature compensation has been moved out of the vacuum environment and placed around the outside of the vacuum gauge tube. This has eliminated a dozen or so unnecessary parts and welds, significantly increasing the reliability, providing optimal vacuum measurement while reducing cost. The improved mechanical strength results in a highly robust vacuum gauge less susceptible to mechanical shock and vibration.

Other design features include reduced internal volume and significant reduction of internal surface area resulting in faster pump-down and less outgassing. A fine mesh screen in the gauge inlet port helps prevent particulate contamination from entering the gauge. The gauge is shielded against RF interference.

These, and other, design features add up to a highly reliable vacuum gauge with significant cost savings that are passed on to the user.

### **Upgrade for thermocouple TC vacuum gauges**

The CVG101 Worker Bee provides a wider measuring range than traditional thermocouple vacuum gauges - from  $1 \times 10^{-4}$  Torr to above atmosphere - so you can monitor your entire pump-down and vent cycle.

The CVG101 Worker Bee convection enhanced Pirani gauge is more accurate than a thermocouple gauge, especially at lower pressures.

### **Also a Low cost drop-in replacement for the Convector® Gauge**

The CVG101 Worker Bee can also directly replace the Granville-Phillips® Convector® sensor, at significantly lower cost.

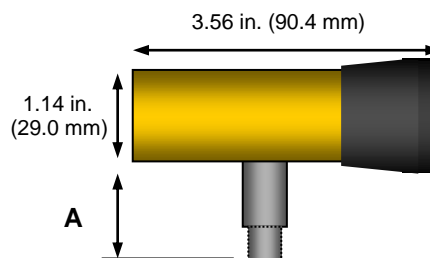
The InstruTech CVG101 Worker Bee convection vacuum gauge provides equivalent or better performance throughout the range of  $1 \times 10^{-4}$  to 1,000 Torr. Only the same, equivalent, or better materials are used in the vacuum environment. Clean assembly procedures assure compatibility with today's contamination-sensitive processes. All tooling that comes in contact with vacuum surfaces of the InstruTech gauge are of very low vapor pressure materials.

The sensor connector has the same pinouts and signal as the corresponding Convector®. It is directly interchangeable with your existing Convector® controllers, cables, so you don't need to change any wiring, hardware, or process recipes. With Worker Bee's performance, more robust design, longevity, and lower cost, your process will only improve.

***Guided by our vast experience and vacuum measurement know how, InstruTech sensors are specifically designed for optimum reliability and performance. Whether you're looking to reduce costs or improve your process, the CVG101 Worker Bee offers a cost-effective solution for your vacuum gauging needs.***

## Specifications

measurement range	1 x 10 <sup>-4</sup> to 1,000 Torr 1.3 x 10 <sup>-4</sup> to 1,333 mbar 1.3 x 10 <sup>-2</sup> Pa to 133 kPa
accuracy - N <sub>2</sub> (typical)	1 x 10 <sup>-4</sup> to 1 x 10 <sup>-3</sup> Torr; 0.1 mTorr resolution 1 x 10 <sup>-3</sup> to 400 Torr; ± 10% of reading 400 to 1,000 Torr; ±2.5% of reading
repeatability - (typical)	± 2% of reading
operating temperature	0 to 50 °C
bakeout temperature	150 °C max, non-operating, with electronics cable detached
humidity	0 to 95% relative humidity, non-condensing
mounting orientation	horizontal recommended (orientation has no effect on measurements below 1 Torr)
materials exposed to vacuum	gold-plated tungsten, 304 & 316 stainless steel, glass, nickel, Teflon®
internal volume	1.589 in <sup>3</sup> (26 cm <sup>3</sup> )
internal surface area	9.25 in <sup>2</sup> (59.7 cm <sup>2</sup> )
leak integrity	< 1 x 10 <sup>-9</sup> atm cc/sec He
weight	3 oz. (85 g)
RF/EMI protection	CE compliant
environmental	RoHS compliant



	fitting	dimension A
mounting orientation	1/8 in. NPT male - 1/2 in. tube	1.00 in. (25.4 mm)
materials exposed to vacuum	NW16KF	1.30 in. (33.0 mm)
	NW25KF	1.30 in. (33.0 mm)
	NW40KF	1.30 in. (33.0 mm)
internal volume	1 1/3 in. Mini-Conflat®	1.08 in. (27.4 mm)
internal surface area	2 3/4 in. Conflat®	1.47 in. (37.3 mm)
leak integrity	1/4 in. Cajon® 4VCR®	1.86 in. (47.2 mm)
weight	1/2 in. Cajon® 8VCR®	1.75 in. (44.5 mm)
RF/EMI protection		
environmental		

## Ordering Information

InstruTech CVG101 P/N

Equivalent Convector® P/N

### Standard Gauges

Combination 1/8 in. NPT male - 1/2 in. tube (use 1/8" NPT male or 1/2" O.D. O-ring compression)	CVG101GA	275071
NW16KF	CVG101GB	275203
NW25KF	CVG101GC	275196
NW40KF	CVG101GD	275316
1 1/3 in. Mini-CF / NW16CF Mini-Conflat®	CVG101GE	275256
2 3/4 in. CF / NW35CF Conflat®	CVG101GF	275238
1/4 in. Cajon® 4VCR® female	CVG101GG	275185
1/2 in. Cajon® 8VCR® female	CVG101GH	275282

### Gauges for Mini-Convector® Modules

1/8 in. NPT male - 1/2 in. tube	CVG102GA	275810
NW16KF	CVG102GB	275816
NW25KF	CVG102GC	275817
NW40KF	CVG102GD	275818
1 1/3 in. Mini-CF / NW16CF Mini-Conflat®	CVG102GE	275813
2 3/4 in. CF / NW35CF Conflat®	CVG102GF	275814
1/4 in. Cajon® 4VCR® female	CVG102GG	275811
1/2 in. Cajon® 8VCR® female	CVG102GH	275864

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# InstruTech®

## *FlexRax® 4000 Multi-Gauge Vacuum Measurement Controller*

- ◆ Measurement range from  $2 \times 10^{-11}$  to 1,000 Torr
- ◆ Capable of operating up to 4 ionization and 4 convection gauges simultaneously as well as display pressures from up to 2 capacitance diaphragm gauges
- ◆ Capable of providing up to 8 analog outputs, 16 setpoint relays and RS485 / RS232 interface
- ◆ Windows® Embedded Compact operating system provides reliable and stable instrument operation (operating system updates is not required)



### **Description**

The *FlexRax®* is a 19-inch wide, 2U, full-rack vacuum gauge controller capable of operating multiple vacuum gauges simultaneously. The type and number of gauges operated will depend on user specified option cards installed at the factory. This results in significant cost savings since the user can specify a *FlexRax* configuration to operate only the gauges required for the application. Furthermore, the user can easily install additional option cards in the field for future expansion of gauges to operate.

*FlexRax* can operate up to 10 vacuum gauges simultaneously as listed below:

- Up to a total of four ionization gauges (IG) configurable for:
  - A) Up to two classic size BA600 series Bayard-Alpert (B-A) glass or nude ionization gauges or other equivalent brands of glass/nude B-A IG
  - B) Up to two InstruTech® IGM400 Hot Cathode or two CCM500 cold cathode IG modules
- Up to four CVG101 convection gauges (CG)
- Up to two analog input signals from other devices such as capacitance diaphragm gauges (CDG) or InstruTech *CVM201*, *CVM211*, *IGM401* and *CCM501* gauge modules

### **Compatible Vacuum Gauges**



**BA601**



**BA602**



**BA603**



**IGM400**  
Hot Cathode



**CCM500**  
Cold Cathode



**CVG101**  
Convection

### **Features**

Easy to read LCD with backlighting provides sharp contrast with wide viewing angle. The instrument can be configured to display up to 6 gauges in a single screen or assign any number of gauges to various screens for auto-scrolling of display. The state of all setpoint relays and engineering units of measure will be displayed on the main screen. Filament operation including filament current, filament voltage, emission current and ion current can be displayed in real time to allow monitoring of filament condition. The system can be personalized by assigning specific names to individual gauges or use the factory default gauge symbols. Error messages will be displayed for all fault conditions.

High efficiency power supply design and effective thermal management techniques are used to enable operation of the *FlexRax* without the need for air movement devices such as troublesome fans often required in even single ionization gauge power supplies. Filament switching control from the *FlexRax* combined with capability to operate two conventional B-A ionization gauges *simultaneously*, offers the user low cost of ownership and unparalleled ease of use.

## Specifications

measurement range: (vacuum gauge dependent)	<p>BA601 EB-degas B-A UHV nude ionization gauge: <math>2 \times 10^{-11}</math> to <math>1 \times 10^{-3}</math> Torr</p> <p>BA602 and BA603 I<sup>2</sup>R degas B-A nude or glass ionization gauge: <math>4 \times 10^{-10}</math> to <math>1 \times 10^{-3}</math> Torr</p> <p>IGM400 hot cathode ionization gauge: <math>1 \times 10^{-9}</math> to <math>5 \times 10^{-2}</math> Torr</p> <p>CCM500 cold cathode ionization gauge: <math>1 \times 10^{-9}</math> to <math>1 \times 10^{-2}</math> Torr</p> <p>Convection gauges: <math>1 \times 10^{-4}</math> to 1,000 Torr</p>
units of measure	Torr, mbar, Pa - user selectable
function: ionization gauge (4 max)	powers & operates up to two BA600 series nude/glass or equivalent brands of B-A hot cathode IG powers & operates up to two IGM400 hot cathode or CCM500 cold cathode ion gauge modules
convection gauge (4 max)	powers & operates up to four <i>Worker Bee</i> ™ CVG101 or Granville-Phillips® Convectron® convection gauge transducers
capacitance diaphragm gauge (2 max)	accepts analog input signals from CDGs or other InstruTech vacuum gauge modules (external power source for these type auxiliary devices will be required)
IG filament/sensor control - on /off	front panel push buttons, automatic using convection gauges, digital input or serial communication
IG filament switching	filament 1 or 2 selection using front panel push buttons
IG emission current	100 $\mu$ A, 4 mA, 10 mA or automatic switching between 100 $\mu$ A and 4 mA
IG degas	BA602/603: nominal 40 W resistive (I <sup>2</sup> R), BA601: 40 W electron bombardment (EB), IGM400: 3 W EB
IG overpressure protection	<p>turns off ion gauge filament/sensor at the following default settings:</p> <p>BA601, BA602, BA603: <math>1 \times 10^{-3}</math> Torr at 100 <math>\mu</math>A emission current, <math>5 \times 10^{-4}</math> Torr at 4 mA emission current, <math>1 \times 10^{-4}</math> Torr at 10 mA emission current</p> <p>IGM400 hot cathode: <math>5 \times 10^{-2}</math> Torr at 100 <math>\mu</math>A and <math>1 \times 10^{-3}</math> Torr at 4 mA emission current</p> <p>CCM500 cold cathode: <math>1 \times 10^{-2}</math> Torr</p>
setpoint relays	<p>up to 16 user programmable single-pole, double-throw (SPDT), 2A at 30 Vdc, 2A at 250 Vac, resistive load, assignable to any of the gauges</p> <p>(Note- Contact rating applies to units shipped after Feb 28, 2017. See User Manual for older units specs)</p>
analog output	<p>up to 8 analog outputs can be assigned to any of the gauges.</p> <p>IG: Log linear 0 to 10 Vdc, 1 V/decade, various scaling selections also provides analog output compatibility with Granville-Phillips® (GP) controller models 307, 350, and 358</p> <p>IG: Log Linear 1.7 V to 9.3 Vdc (nominal 1.8 to 8.7 Vdc) 0.8 V/decade</p> <p>IG: Linear 0 to 10 Vdc (useable over 3 decades, compatible with GP 307, 350 &amp; 358)</p> <p>Wide range combination IG + CG: Log linear 0.5 to 7 Vdc, 0.5 V/decade</p> <p>CG: Log linear 0 to 7 Vdc or 1 to 8 Vdc, 1 V/decade, or Linear 0 to 10 Vdc, or Non-Linear</p>
analog input  (or use, alternatively, for remote IG filament/sensor turn on)	accepts up to two 0-10 Vdc analog inputs from 100 mTorr, 1, 10, 100, 1000 Torr F.S. CDG or analog inputs from InstruTech gauges CDM900, CVM201, CVM211, IGM401, CCM501, CCM502, PCM301. alternatively, analog input can be used as digital input for remote IG sensor turn on by applying a continuous ground or remove ground for remote IG sensor turn off
serial communications	RS485 / RS232 - ASCII protocol (RS232 protocol compatible with GP 307 controller)
source power	100-240 Vac, 50/60Hz, nominal, universal input power - 600 VA operating
temperature	operating: 0 to + 40 °C storage: -40 to + 70 °C
humidity	0 to 95% relative humidity, non-condensing
weight	14 lb. (6.4 kg)
CE compliance	EMC Directive 2004/108/EC, EN61326-1, EN55011 Low Voltage Directive 2006/95/EC, EN61010-1
environmental	RoHS compliant

## Typical Display Configurations



Six gauge display



Four gauge display



Three gauge display

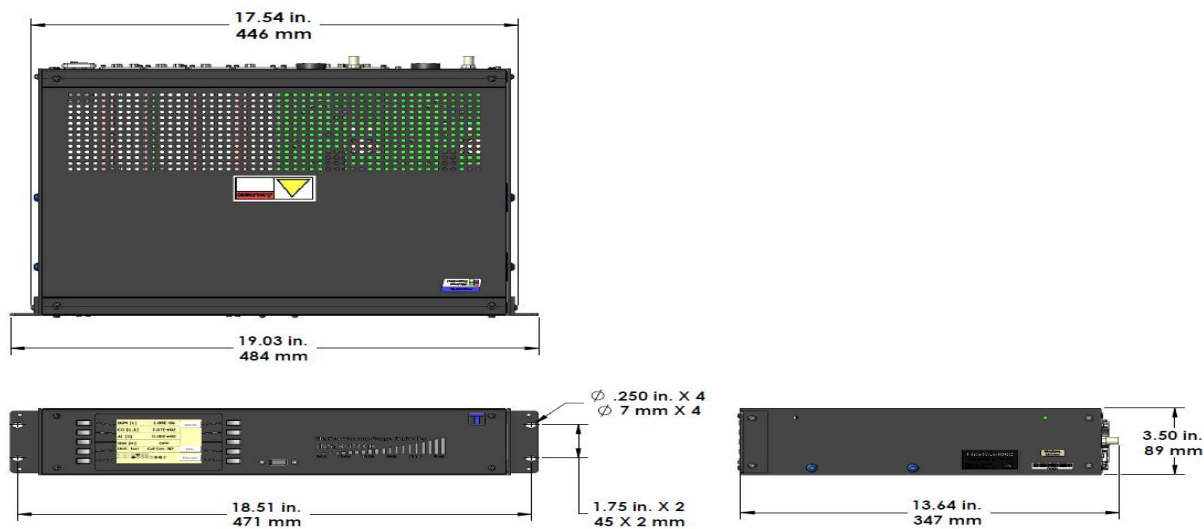


One gauge display - auto scroll one gauge at a time

## Controls & Connections



## Outline Drawing





## Ordering Information

## FlexRax Part Numbers

### Option cards selection

#### slot 1

IC = IC4000 option card (operates 2 convection and 1 InstruTech IGM400 or CCM500 ion gauge)

AI4 = AI4000-4 option card (provides 4 setpoint relays, 4 analog outputs, 1 analog input)

AI8 = AI4000-8 option card (provides 8 setpoint relays, 4 analog outputs, 1 analog input)

X = None

#### slot 2

Same options listed for slot 1 above.

Select one of the following: IC, AI4, AI8 or X

#### slot 3

AI4 = AI4000-4 option card (provides 4 setpoint relays, 4 analog outputs, 1 analog input)

AI8 = AI4000-8 option card (provides 8 setpoint relays, 4 analog outputs, 1 analog input)

None

#### slot 4

Same options listed for slot 3 above.

Select one of the following: AI4, AI8 or X

#### slot 5

IR = IR4000 option card (operates one I<sup>2</sup>R degas nude or glass B-A ionization gauge)

IE = IE4000 option card (operates one EB degas nude UHV B-A ionization gauge)

X = None

#### slot 6

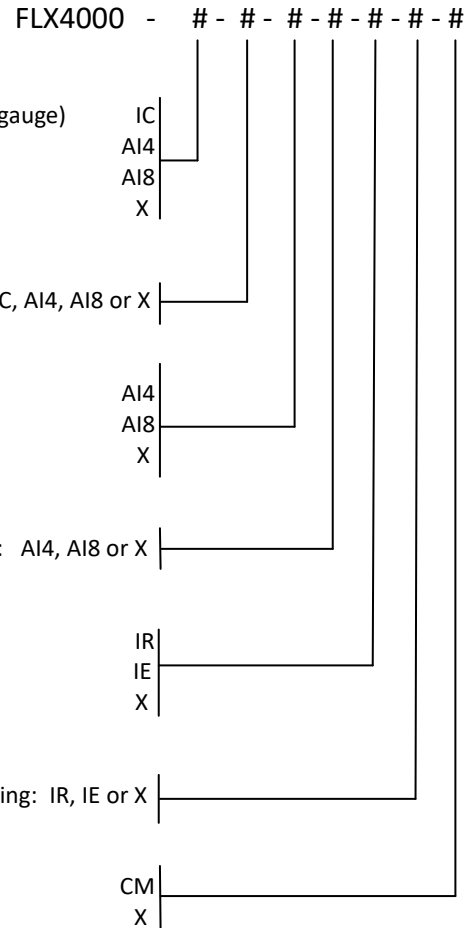
Same options listed for slot 5 above.

Select one of the following: IR, IE or X

#### slot 7

CM = CM4000 option card (provides RS485/RS232 serial communications)

X = None



\* Maximum of two IC and two AI4 or AI8 option cards per FlexRax controller.

Example: FLX4000-IC-IC-AI8-X-IR-IR-CM operates up to four convection gauges, up to two IGM400/CCM500 InstruTech IG modules and two I<sup>2</sup>R nude or glass IGs. It also provides 8 setpoint relays, 4 analog outputs and RS232/RS485 serial communications.

## Ordering Information

## Gauge Cable Assembly Part Numbers

Gauge Cable Length	BA601/602 Nude IG Bakeable Cable 200 °C*	BA601/BA602 Nude IG	BA603 Glass IG	IGM400/CCM500 Miniature IG	CVG101 Convection
10 ft. (3 m)	IRNBD441-1-10F	IRN441-1-10F	IRG441-1-10F	BXC400-1-10F	CB421-1-10F
25 ft. (8 m)	IRNBD441-1-25F	IRN441-1-25F	IRG441-1-25F	BXC400-1-25F	CB421-1-25F
50 ft. (15 m)	IRNBD441-1-50F	IRN441-1-50F	IRG441-1-50F	BXC400-1-50F	CB421-1-50F
>50 ft. consult factory	consult factory	consult factory	consult factory	consult factory	consult factory

\* The IRNBD441 bakeable Nude IG cable is provided with push-on sockets for connection to the Nude gauge pins (BA601/BA602 pins) and is bakeable to 200 °C. All other cables listed above are rated for 50 °C ambient temperature. All IG cables listed above can be used with either single or dual filament ion gauges and filament switching is controlled from the FlexRax controller.



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InstruTech®





















## Series 3000 - The **New** Generation of B-RAX™ Vacuum Gauge Controllers

- ◆ 3 Channel Controller for one ionization and two convection gauges or one ionization, one convection and one alternate capacitance diaphragm gauge
- ◆ Various pressure measurement ranges from  $2 \times 10^{-11}$  to 1,000 Torr
- ◆ 3 analog outputs, 6 setpoint relays, RS232/RS485 serial communications, remote Digital I/O
- ◆ Compact space saving half rack design, bench top or panel/rack mount instrument
- ◆ Outstanding product warranty of 5 years



### Description

The InstruTech series 3000 B-RAX is a highly versatile vacuum gauge controller capable of operating one hot or cold cathode ionization gauge (IG) and up to two CVG101 convection vacuum gauge sensors (CG), or one IG, one CG and one alternate gauge such as a capacitance diaphragm gauge (CDG). The ionization gauge on/off, degas functions and emission current selection can be controlled via front panel soft-keys, remote input signals (Digital I/O), or serial communications. IG sensor can also be automatically turned on/off using the measurements from one of the user selectable convection or alternate gauges. When using hot cathode IGs, the B-RAX can be set to automatically switch (auto-ranging) between various emission currents. This results in optimal and stable pressure readings over the entire measurement range from low to high vacuum. High efficiency power supply design and effective thermal management techniques are used to enable operation of the B-RAX without the need for air movement devices such as troublesome fans. The state of all setpoint relays, emission current, filament in use and error messages for all fault conditions are displayed on the easy to read OLED set-up screen. Filament operation including filament current, filament voltage, emission current and ion current can be displayed in real time to allow monitoring of filament condition.

B-RAX Controller	Ionization Gauge (IG) Compatibility		Convection Gauge (CG) Compatibility
<b>B-RAX 3500</b> 	One CC606 UHV Cold Cathode ( $7.5 \times 10^{-11}$ to $3.75 \times 10^{-3}$ Torr) 	or One CC605 Cold Cathode ( $1.5 \times 10^{-9}$ to $3.75 \times 10^{-3}$ Torr) 	Up to two CVG101 Convection Gauges ( $1 \times 10^{-4}$ to 1,000 Torr)  
<b>B-RAX 3400</b> 	One BA601 UHV Nude EB Hot Cathode ( $2 \times 10^{-11}$ to $1 \times 10^{-3}$ Torr) 	or One BA600 Mini IG Hot Cathode ( $1 \times 10^{-9}$ to $5 \times 10^{-2}$ Torr) 	Up to two CVG101 Convection Gauges ( $1 \times 10^{-4}$ to 1,000 Torr)  
<b>B-RAX 3300</b> 	One BA602 Nude I <sup>2</sup> R Hot Cathode ( $4 \times 10^{-10}$ to $1 \times 10^{-3}$ Torr) 	or One BA603 Glass I <sup>2</sup> R Hot Cathode ( $4 \times 10^{-10}$ to $1 \times 10^{-3}$ Torr) 	Up to two CVG101 Convection Gauges ( $1 \times 10^{-4}$ to 1,000 Torr)  
<b>B-RAX 3200</b> 	One IGM400 Hot Cathode ( $1 \times 10^{-9}$ to $5 \times 10^{-2}$ Torr) 	or One CCM500 Cold Cathode ( $1 \times 10^{-9}$ to $1 \times 10^{-2}$ Torr) 	Up to two CVG101 Convection Gauges ( $1 \times 10^{-4}$ to 1,000 Torr)  



## Specifications

measurement range: **B-RAX 3500:**  $7.5 \times 10^{-11}$  to 1,000 Torr when used with the CC606 UHV cold cathode IG and CVG101 CG  
**B-RAX 3500:**  $1.5 \times 10^{-9}$  to 1,000 Torr when used with the CC605 cold cathode IG and CVG101 CG

**B-RAX 3400:**  $2 \times 10^{-11}$  to 1,000 Torr when used with the BA601 UHV hot cathode IG and CVG101 CG  
**B-RAX 3400:**  $1 \times 10^{-9}$  to 1,000 Torr when used with the BA600 hot cathode Mini IG and CVG101 CG

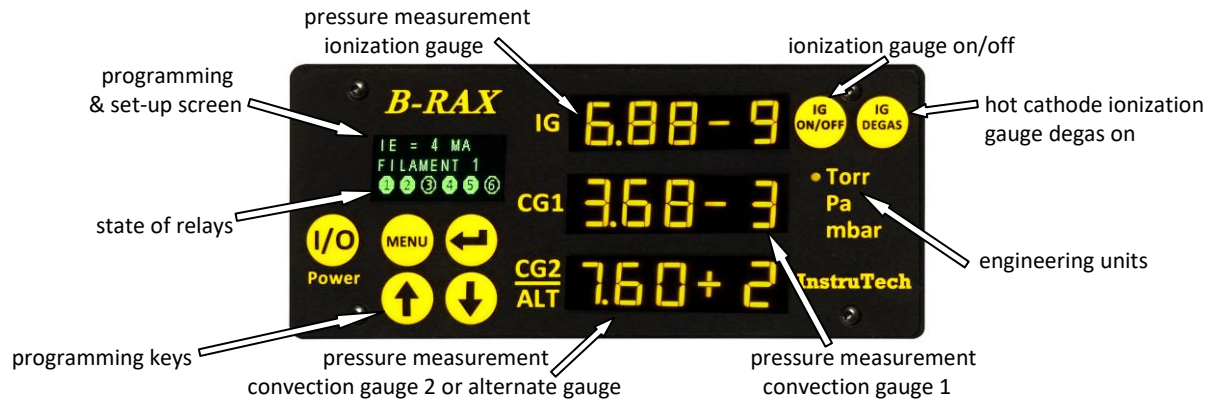
**B-RAX 3300:**  $4 \times 10^{-10}$  to 1,000 Torr when used with the BA602/603 hot cathode IG and CVG101 CG

**B-RAX 3200:**  $1 \times 10^{-9}$  to 1,000 Torr when used with the IGM400 hot cathode IG and CVG101 CG  
**B-RAX 3200:**  $1 \times 10^{-9}$  to 1,000 Torr when used with the CCM500 cold cathode IG and CVG101 CG

display	pressure indication	LED - 3 independent pressure display channels - 3 digit plus 2 digit exponent per channel
	programming & set-up screen	OLED - displays state of all setpoint relays, IG emission current, error messages for fault conditions
units of measure		Torr, mbar, Pa - user selectable
functionality	IG	powers & operates one of the InstruTech ionization vacuum gauges listed above <b>B-RAX 3400/3300</b> are also capable of operating other equivalent brands of nude/glass B-A hot cathode IG
	CG	powers & operates up to 2 InstruTech CVG101 convection or Granville-Phillips® (GP) Convectron® gauges
	alternate gauge	displays pressure from one alternate gauge such as a capacitance diaphragm gauge (CDG) or other InstruTech modules using the analog input (external power source for these alternate auxiliary devices will be required)
IG sensor control		IG sensor on/off, degas on/off and emission current (hot cathode IG) can all be controlled via front panel soft-keys, remote input signals (digital I/O) or serial communications. IG sensor can also be automatically turned on/off using the measurements from one of the user selectable convection or alternate gauges.
IG remote input signals (digital I/O)		IG sensor on/off, degas on/off and emission current (hot cathode IG) can also be set by applying momentary continuity to ground. Also the 9-pin D-sub remote input DIGITAL I/O connector provides pin-pin compatible signals with the GP 358 controller as well as compatible signals with the GP 307.
setpoint relays / relay contact rating		six single-pole, double-throw (SPDT) / 5 A at 30 Vdc, 5 A at 250 Vac, resistive load, user assignable to any of the gauges ( <b>Note-</b> Contact rating applies to units shipped after Nov 1, 2015, See User Manual for older units)
analog output		three analog outputs, user assignable to any of the gauges:
	IG	log linear 0 to 10 Vdc, 1 V/decade, various scaling selections also provide analog output compatibility with Granville-Phillips® controller models 307, 350 and 358 controllers, or log Linear 1.7 V to 9.3 Vdc (nominal 1.8 to 8.7 Vdc) 0.8 V/decade, or linear 0 to 10 Vdc (useable over 3 decades, also compatible with GP 307 controller)
	combination IG + CG or IG + Alternate Gauge	log linear 0.5 to 7 Vdc, 0.5 V/decade
	CG	log linear 1 to 8 Vdc, 1 V/decade, or 0 to 7 Vdc, 1 V/decade (also compatible with GP 307, 350, 358), or non-linear analog S-curve 0.375 to 5.659 Vdc, or linear 0 to 10 Vdc (useable over 3 decades)
analog input	CDG InstruTech modules	0-10 Vdc analog input signal from CDM900 or other brands of CDG when used as an alternate gauge to CG2, or analog input from InstruTech gauges: CCM501,CCM502,CVM201,CVM211,IGM401,IGM402,PCM301,WGM701
serial communications		RS485 / RS232 - ASCII protocol - (command protocol provides compatibility with GP 307 and GP 358 controller GP350 command protocol compatibility is also available for all models except B-RAX 3500)
status output		IG sensor on/off status message is displayed on the front panel, by serial communications and by SPDT relay (DIGITAL I/O Connector) rated at 1 A at 30 Vdc resistive, or 1 A at 30 Vac non-inductive.  IG degas on/off status or IG error conditions are displayed on the front panel, by serial communications and by an open collector transistor output (ground emitter) rated at 40 V max. VCE, 50 mA IC max.
IG hot cathode filament switching		user selectable between filament 1 or 2 using the front panel soft-keys or RS232/485 serial communications
IG hot cathode emission current		<b>B-RAX 3400/3300:</b> 100 $\mu$ A, 4 mA, 10 mA or automatic switching (auto ranging) between 100 $\mu$ A, 4 mA, 10 mA <b>B-RAX 3200:</b> 100 $\mu$ A, 4 mA, or automatic switching (auto ranging) between 100 $\mu$ A and 4 mA
IG hot cathode degas		<b>B-RAX 3400:</b> 40 W, electron bombardment (EB) when used with BA601, 3 W, EB when used with BA600 <b>B-RAX 3300:</b> 40 W, resistive ( $I^2R$ ) <b>B-RAX 3200:</b> 3 W, EB <b>B-RAX 3500:</b> N/A
IG overpressure protection		IG sensor turns off if pressure exceeds maximum allowable pressure limit of IG
temperature		operating: 0 to + 40 °C storage: -40 to + 70 °C
humidity		0 to 95% relative humidity, non-condensing
weight		1.7 lb. (0.7 kg)

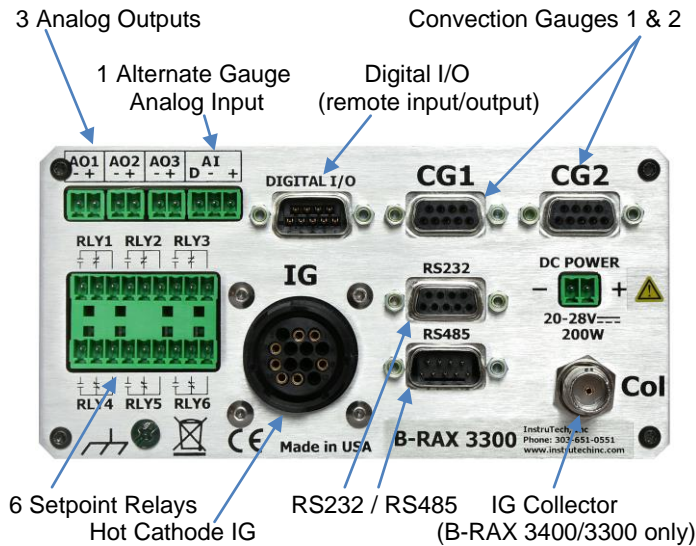
housing	aluminum extrusion - black powder paint finish
input power	<b>B-RAX 3400/3300:</b> 20 - 28 Vdc, 200 W when used with BA601, BA602 and BA603 IG <b>B-RAX 3400:</b> 20 - 28 Vdc, 36 W when used with BA600 Mini IG <b>B-RAX 3200:</b> 20 - 28 Vdc, 36 W <b>B-RAX 3500:</b> 20 - 28 Vdc, 12 W B-RAX circuitry is protected against power reversal and transient over-voltages
connectors	IG & CG digital I/O 9-pin D-sub male serial communications RS232: 9-pin D-sub female, RS485: 9-pin D-sub male analog I/O, setpoint relays, power pluggable terminal block (mating connectors included)
CE compliance	EMC Directive 2014/30/EU, EN55011, EN61000-6-2, EN61000-6-4, EN61326-1, EN61010-1
environmental	RoHS Directive 2011/65/EU

## Front Panel Operation



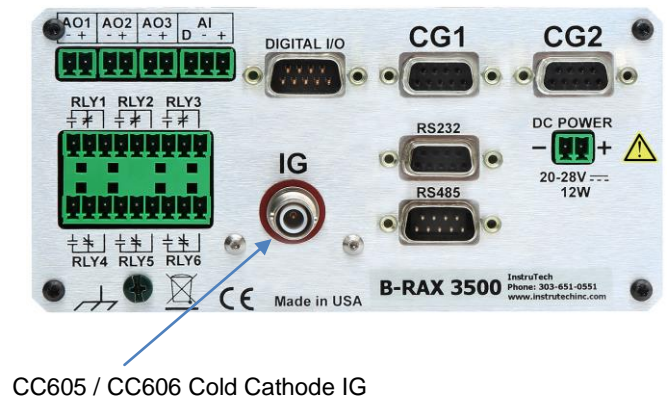
## Electrical Connections

### B-RAX 3400, B-RAX 3300, B-RAX 3200



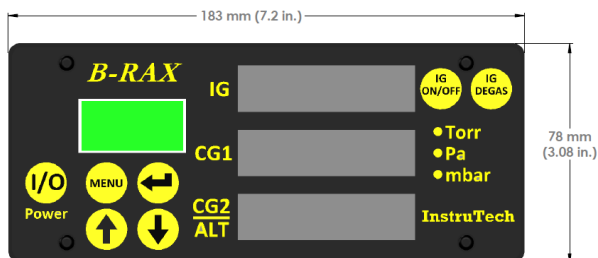
### B-RAX 3500

All connections are the same as the B-RAX 3400/3300/3200 except IG (Note IG Collector is removed below)

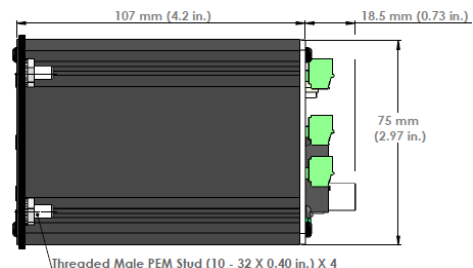


## Outline Drawing

### Front View



### Side View



## Ordering Information

## Part Numbers

### B-RAX Vacuum Gauge Controller

3 channel pressure display vacuum gauge controller. Operates one ionization gauge (IG) plus up to two convection gauges (CG), or one IG, one CG and one analog input from an alternate gauge such as a CDG. Includes 6 setpoint relays, 3 analog outputs, Digital I/O, RS232/RS485 serial communications.



B-RAX 3500: Operates one CC605 or one CC606 cold cathode IG plus up to two CGs

B-RAX 3400: Operates one BA601 UHV nude EB-degas IG or one BA600 hot cathode Mini IG plus up to two CGs

B-RAX 3300: Operates one BA602 nude or BA603 glass I<sup>2</sup>R hot cathode IG plus up to two CGs

B-RAX 3200: Operates one IGM400 hot cathode IG or one CCM500 cold cathode IG plus up to two CGs

B-RAX 3500

B-RAX 3400

B-RAX 3300

B-RAX 3200

### Optional 24 Vdc Power Supply for B-RAX

Connector: 2-pin pluggable terminal block to mate with the B-RAX  
Compliance: CE, RoHS, UL (US/Canada), CCC (China)  
Power Input: 100 - 240 Vac, 50-60 Hz  
Power Output: PS330: 24 Vdc @ 9.16 A (220 W) see selection details below  
PS301: 24 Vdc @ 2.5 A (60 W) see selection details below



For B-RAX 3400 / 3300 when used with BA601, BA602 and BA603 IG (Power cord with North American 115 Vac plug included)

For B-RAX 3400 / 3300 when used with BA601, BA602 and BA603 IG (No power cord included\*)

For B-RAX 3400 when used with BA600 Mini IG, B-RAX 3500, B-RAX 3200 (Power cord with North American 115 Vac plug included)

For B-RAX 3400 when used with BA600 Mini IG, B-RAX 3500, B-RAX 3200 (No power cord included\*)

PS330-UA

PS330-UX

PS301-UA

PS301-UX

\* The conventional IEC60320 AC receptacle allows use with any user supplied AC mains power cord set available worldwide.

Gauge Cable	BA601/602 IG B-RAX 3400/3300 Bakeable, 200 °C	BA601/602 IG B-RAX 3400 B-RAX 3300	BA603 IG B-RAX 3300	BA600 IG B-RAX 3400	IGM400 IG CCM500 IG B-RAX 3200	CC605/CC606 IG B-RAX 3500 Bakeable, 250 °C	CC605 IG CC606 IG B-RAX 3500	CVG101 CG All B-RAX Models
10 ft. (3 m)	IRNBD441-1-10F	IRN441-1-10F	IRG441-1-10F	HMG441-1-10F	BXC400-1-10F	CCPB641-1-10F	CCP641-1-10F	CB421-1-10F
25 ft. (8 m)	IRNBD441-1-25F	IRN441-1-25F	IRG441-1-25F	HMG441-1-25F	BXC400-1-25F	CCPB641-1-25F	CCP641-1-25F	CB421-1-25F
50 ft. (15 m)	IRNBD441-1-50F	IRN441-1-50F	IRG441-1-50F	HMG441-1-50F	BXC400-1-50F	CCPB641-1-50F	CCP641-1-50F	CB421-1-50F
>50 ft.	Consult factory							

Note: The IRNBD441 bakeable Nude IG cable is provided with push-on sockets for connection to the Nude gauge pins (BA601/602 pins) and is bakeable to 200 °C. All other cables for hot cathode and convection gauges listed above are rated for 50 °C ambient temperature. All IG cables for hot cathode gauges listed above can be used with either single or dual filament ion gauges and filament switching is controlled from the B-RAX controller. The CCPB641 bakeable cold cathode IG cable is bakeable to 250 °C while the CCP641 cold cathode IG cable is rated to 80 °C.

### Optional Rack Mount Adapter Aluminum - black powder paint finish

Rack Mount adapter panel for installation of one B-RAX as a left-mount or right-mount in a 2U, 19 inch wide rack.

000849



Rack Mount adapter panel for installation of two B-RAX side-by-side in a 2U, 19 inch wide rack.

001007



BA600, BA601, BA602, BA603, IGM400, CCM500, CC605, CC606 ionization gauges

See data sheets for these IG products

CVG101 convection gauge

See CVG101 Worker Bee™ convection gauge data sheet

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InstruTech®

## Series 301 Convection Vacuum Gauge Controller

- ◆ Wide measuring range lets you monitor your vacuum system from  $1 \times 10^{-4}$  to 1,000 Torr with a single gauge
- ◆ Includes two setpoint relays, user-selectable analog output, and RS232 / RS485 serial communications
- ◆ Analog output is configurable as a non-linear S-curve, log-linear, or user-scalable linear voltage signal
- ◆ Space-saving 1/8-DIN panel mount housing easily adapts to instrument or rack-mount panel installations



### Description

The VGC301 vacuum gauge controller is a convenient and inexpensive power supply and readout instrument for a CVG101 *Worker Bee*™ convection vacuum gauge sensor. The 1/8-DIN housing can be used as a bench top or a panel mount instrument. The VGC301 is powered by user supplied 12 to 28 Vdc, 2 W, or by InstruTech series PS301 optional power supplies.

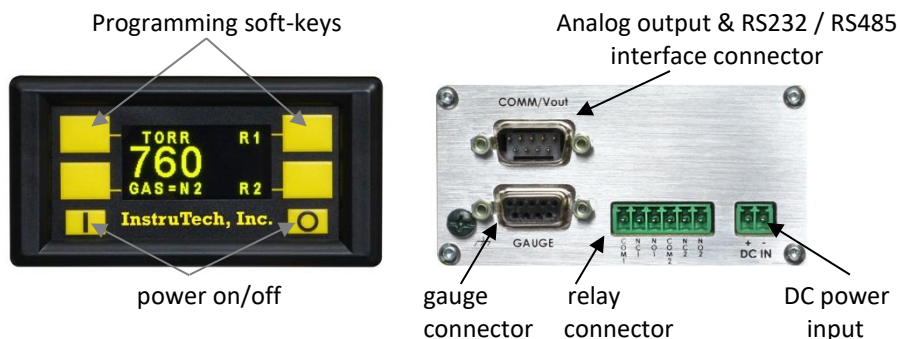
**Compatibility:** Signals and relay functions are the same as found on similar convection gauge controllers from other manufacturers. The VGC301 controller, CVG101 vacuum gauge sensor and cable can be directly interchanged with Granville-Phillips® 375 and 475 controllers, 275 Convectron® gauge and gauge cable (Remote interface, relay, and power connectors are different).

### Specifications

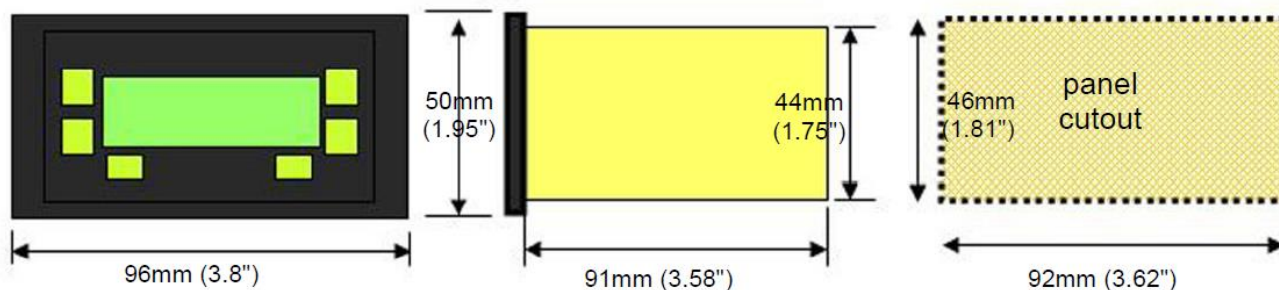
measurement range	$1 \times 10^{-4}$ to 1,000 Torr / $1.3 \times 10^{-4}$ to 1,333 mbar / $1.3 \times 10^{-2}$ Pa to 133 kPa
display	Bright OLED, 4 digits, user-selectable Torr, mbar, or Pa (4 digits from 1100 Torr to 1000 Torr), (3 digits from 999 Torr to 10.0 mTorr), (2 digits from 9.9 mTorr to 1.0 mTorr ), (1 digit from 0.9 mTorr to 0.1 mTorr)
display update rate	0.5 sec
weight	9 oz. (250 g)
operating temperature	0 to +40 °C
storage temperature	-40 to +70 °C
humidity	0 to 95% relative humidity, non-condensing
analog output (user-selectable)	a) log-linear 0 to 7 Vdc or 1 to 8 Vdc, 1 V/decade, or b) linear 0 to 10 Vdc, or c) non-linear S-curve 0.375 to 5.659 Vdc, or d) non-linear S-curve 0 to 9 Vdc
serial communications	RS232 and 2 wire/4 wire RS485 - ASCII protocol
housing	1/8-DIN panel-mount enclosure (aluminum extrusion)
input power	12-28 Vdc, 2 W protected against power reversal and transient over-voltages
setpoint relays	two single-pole double-throw relays (SPDT), 1 A at 30 Vdc resistive, or ac non-inductive
connectors	gauge: 9-pin D-sub female (mating connector provided as part of the gauge cable) analog output and serial communications interface: 9-pin D-sub male relay outputs: 6-pin pluggable terminal block (mating connector included) power: 2-pin pluggable terminal block (mating connector included)
CE compliance	EMC Directive 2014/30/EU, EN55011, EN61000-6-2, EN61000-6-4, EN61326-1, EN61010-1
environmental	RoHS compliant



## Controls & Connections



## Outline Drawing



## Ordering Information

## Part Numbers

**VGC301 Controller** (Power On/Off buttons enabled. Must Push On/Off buttons to turn controller on/off). VGC301A

**VGC301 Controller** (Power On/Off buttons disabled. Controller turns on automatically when power is applied). VGC301B

### Optional Power Supply for VGC301

Input: 100 - 240 Vac, 50-60 Hz

Output: + 24 Vdc

Cable Length: 6 ft. (2 m)

(see PS301 data sheet for more details)



with North American AC Plug: PS301-A  
with universal European AC Plug: PS301-EU  
with UK AC Plug: PS301-UK  
with China AC Plug: PS301-C  
with Australian AC Plug: PS301-SP



This variation of the PS301 power supply may be used when an AC plug that is not listed above is required. The conventional IEC60320 AC power entry receptacle allows use with any user supplied AC mains power cord set available worldwide. PS301-UX

### Vacuum Gauge Cable

For connecting the CVG101 Worker Bee™ vacuum gauge sensor to the VGC301 controller



10 ft. (3 m): CB421-1-10F  
25 ft. (8 m): CB421-1-25F  
50 ft. (15 m): CB421-1-50F  
over 50 ft. or custom lengths: Consult Factory

### InstruTech CVG101 Worker Bee™

Convection Vacuum Gauge Sensor



See CVG101 Worker Bee™ convection gauge data sheet

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**InstruTech®**

## Series 302 Active Vacuum Gauge Controller

- ◆ Vacuum gauge readout and power supply for InstruTech active vacuum gauge modules
- ◆ Analog output, RS232, USB and RS485 serial communications
- ◆ Two setpoint relays
- ◆ Space-saving 1/8-DIN panel mount housing easily adapts to instrument or rack-mount panel installations



### Description

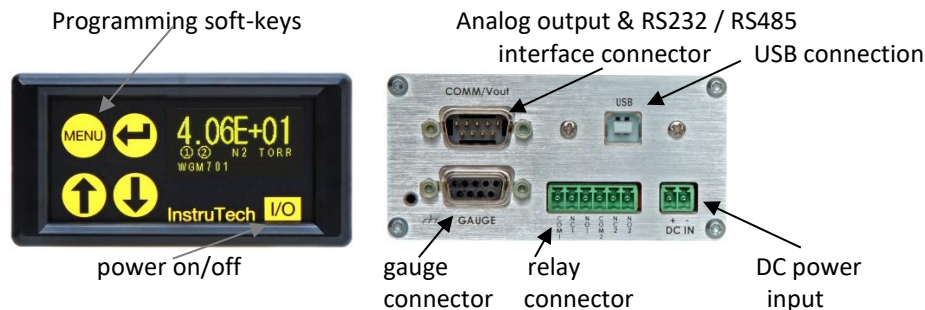
The AGC302 vacuum gauge controller is a power supply and readout instrument offered specifically for the InstruTech active vacuum gauge series WGM701 pirani-cold cathode combination gauge, CCM502 cold cathode gauge, PCM301 pirani-capacitance combination gauge, CDM900 capacitance diaphragm gauge (CDG) and other brands of CDGs. Note that the vacuum gauges listed above do not necessarily require the AGC302 to operate. These gauges provide analog output signals that can be directly interfaced with user's control system. As such, AGC302 is recommended only when a bench top, panel or rack mount display installation is required.

Furthermore, the AGC302 controller can be used to provide two setpoint relays as well as serial communications for these types of devices. If needed, AGC302 can also be used with other InstruTech active gauges such as the CVM201, CVM211 convection or CCM501, IGM401, IGM402 ionization gauges although these gauges are provided with their own integrated displays. The controller is powered by user supplied 20 to 28 Vdc, or by InstruTech PS301 optional power supply. The controller provides power to the InstruTech active gauges operating on 24 Vdc including the CDM900 CDG, however other brands of CDGs operating on  $\pm 15$  Vdc power require an external power supply provided by the user.

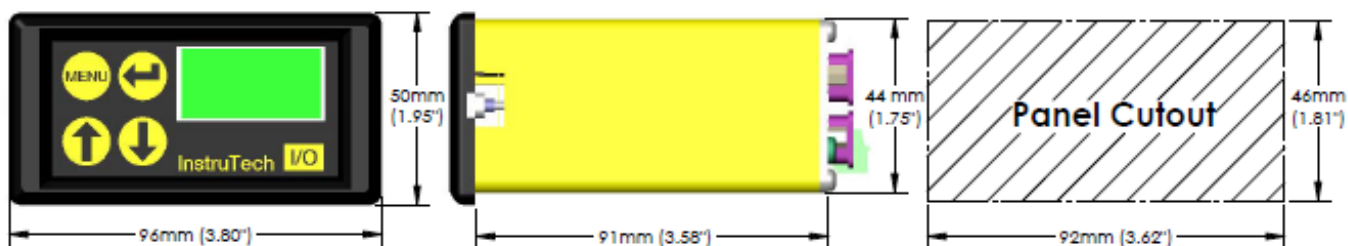
### Specifications

measurement range	dependent on active vacuum gauge device connected (see vacuum gauge data sheets)	
display	bright OLED, 3 digit plus 2 digit exponent, user-selectable Torr, mbar or Pa	
display update rate	0.5 sec	
weight	9 oz. (250 g)	
temperature	operating: 0 to +40 °C	storage: -40 to +70 °C
humidity	0 to 95% relative humidity, non-condensing	
input signal	analog input from one of the following active vacuum gauge devices: full range cold cathode-pirani combination gauge: WGM701 cold cathode gauge: CCM502 pirani-capacitance combination gauge: PCM301 capacitance diaphragm gauge: CDM900 or other brands of CDGs	
analog output	retransmit analog input from the active vacuum gauge device connected	
serial communications	RS232 and RS485 - ASCII protocol	
housing	1/8-DIN panel-mount enclosure (aluminum extrusion)	
input power	20-28 Vdc, 2 W plus the wattage required for the active vacuum gauge connected protected against power reversal and transient over-voltages	
setpoint relays	two single-pole double-throw relays (SPDT) / 5 A at 30 Vdc, 5 A at 250 Vac, resistive load	
connectors	gauge: 9-pin D-sub female (mating connector provided as part of the gauge cable) analog output: 9-pin D-sub male RS232 serial communications: 9-pin D-sub male or USB RS485 serial communications: 9-pin D-sub male relay outputs: 6-pin pluggable terminal block (mating connector included) power: 2-pin pluggable terminal block (mating connector included)	
CE compliance	EMC Directive 2014/30/EU, EN55011, EN61000-6-2, EN61000-6-4, EN61326-1, EN61010-1	
environmental	RoHS compliant	

## Controls & Connections



## Outline Drawing



## Ordering Information

## Part Numbers

### AGC302 Active Vacuum Gauge Controller

AGC302

**Optional power supply for AGC302 when used with WGM701, CCM501, CCM502, PCM301, CDM900, CVM201, CVM211 active gauges.**

Input: 100 - 240 Vac, 50-60 Hz

Output: + 24 Vdc / 18 W

Cable Length: 6 ft. (2 m)



with North American AC Plug: PS301-A  
with universal European AC Plug: PS301-EU  
with UK AC Plug: PS301-UK  
with China AC Plug: PS301-C  
with Australian AC Plug: PS301-SP

**Optional power supply for AGC302 when used with the above active gauges as well as IGM401, IGM402 and CDGs requiring power higher than 18 W at 24 Vdc. User supplied AC power cord required.**

Input: 100 - 240 Vac, 50-60 Hz

Output: + 24 Vdc / 60 W

Cable Length: 6 ft. (2 m)



This variation of the PS301 power supply is also used when an AC plug that is not listed above is required. The conventional IEC60320 AC power entry receptacle allows use with any user supplied AC mains power cord set available worldwide.

PS301-UX

Vacuum Gauge Cable	For WGM701, CCM502, CCM501, IGM401, IGM402	For PCM301, CVM201, CVM211	For CDM900
10 ft. (3 m)	WRG741-1-10F	PCG341-1-10F	CDG941-1-10F
25 ft. (8 m)	WRG741-1-25F	PCG341-1-25F	CDG941-1-25F
50 ft. (15 m)	WRG741-1-50F	PCG341-1-50F	CDG941-1-50F
>50 ft. consult factory	consult factory	consult factory	consult factory

Note. If you intend to use the CVM201/CVM211 with the AGC302, consider using the more economical CVG101 convection gauge tube with the VGC301 controller instead.

**Vacuum Gauges:** For vacuum gauge part numbers and specifications see individual data sheets for these devices you intend to connect to the AGC302 controller.



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