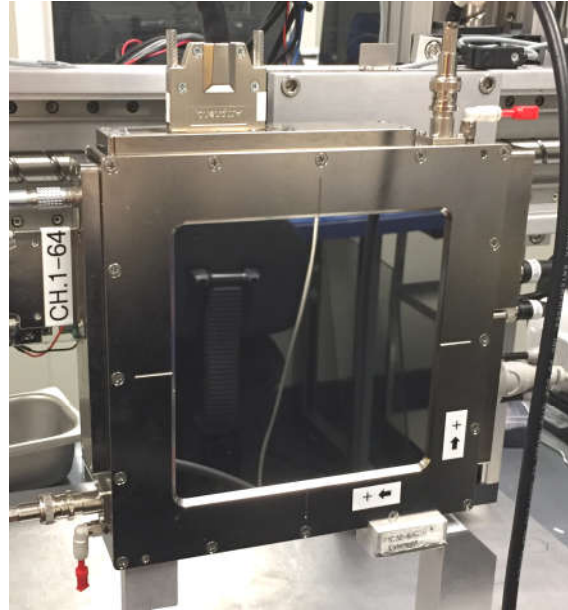


Compact High-Resolution Position Sensing Transmission Ionization Chamber

Features

- 64 mm x 64 mm sensitive area
- Ionization chamber with 64 by 64 strip readout for position and shape monitoring
- Minimum scattering due to thin films of low-Z material
- Small beamline length (32 mm)
- Very small electrode gaps for low recombination
- Polyimide film electrode substrates for radiation hardness
- Gold coated strip electrodes as standard for enhanced long-term reliability
- Electrode patterns laser-cut for high geometric precision
- Operable with atmospheric pressure air chamber gas or flow-through gas
- Integrated temperature, pressure and humidity sensing
- Integrated desiccant for fill gas
- HV loopback
- Compatible with I128M readout electronics



Applications	<ul style="list-style-type: none"> • Particle therapy beam monitoring for small spot, high current beams • Flash therapy experiments • On-line beam trajectory monitoring • General high energy ion beam diagnostics
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Specifications	
Beam compatibility	
Species	Protons, deuterons, fully-stripped carbon
Energy range	30 MeV/nucleon to 500 MeV / nucleon
Beam current density range	Up to 20 nA cm ⁻² (particle current)
Sensor	
Type	Parallel plate dual ionization chamber with multi-strip cathodes
High voltage	500-1000 V nominal (1660 to 3330 V cm ⁻¹); maximum 1500 V
Sensitive area	64 mm by 64 mm

Datasheet**IC64-6**

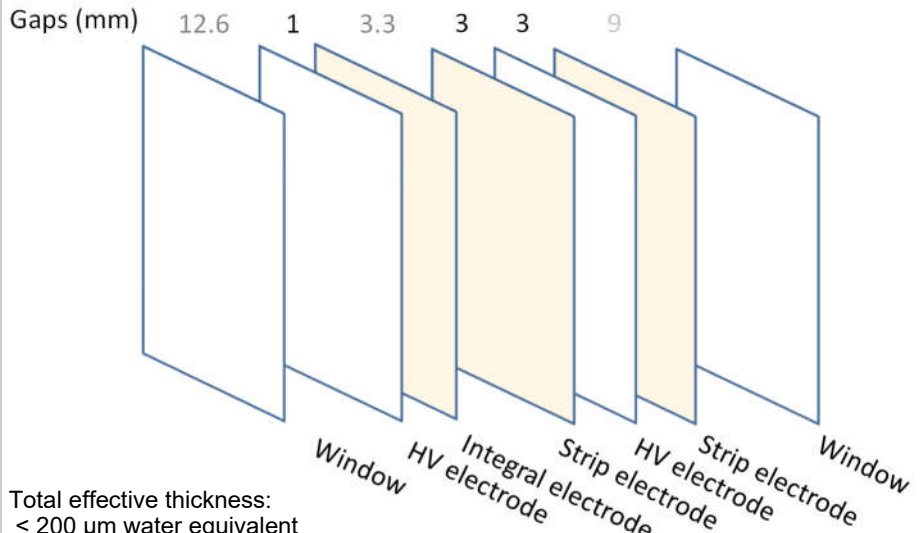
Sensor (cont)	
Sensitive volume	Active volume 1: HV electrode 1 to integral dose electrode. 1 mm spacing. Active volume 2: Strip electrode 1 to HV electrode 2. 3 mm spacing. Active volume 3: HV electrode 2 to strip electrode 2. 3 mm spacing.
Strip geometry	64 strips 1.00 mm pitch (50 μ m inter-strip gaps typical)
Gain uniformity	Better than +/-2% for beams within the sensitive area (integral readout). Better than +/-2% for beams within the sensitive area (sum of position peaks from strip readouts).
Position accuracy	Integral linearity better than 50 μ m maximum deviation relative over the sensitive area.
Position resolution	Depends on signal to noise ratio; 10's of μ m achievable provided beam covers more than one strip.
Fiducials	Electrode strips tolerance build-up relative to fiducial features on body +/- 0.3 mm nominal, < +/- 0.1 mm typical .
Chamber gas	
Operating gas	Dry atmospheric air, or flow of any clean ionization chamber gas (Ar/CO ₂ , N ₂ etc)
Flow gas connections	To suit 1/8" tube push fit
Sensors	Built-in sensing of temperature, pressure and humidity of the fill gas.
Desiccant	For use when chamber is closed to atmosphere. Desiccant sachet. Sachet can be changed with chamber in situ.
Mechanical	
Insertion length	32 mm window to window, 37 mm housing face to face.
Overall size	260 mm by 230 mm by 37 mm approx including cable strain relief brackets (see figures)
Weight	1.3 kg (2.8 lb) excluding any added mounting brackets.
Operating environment	Clean and dust-free, 0 to 35 C (15 to 25 C recommended , < 70% humidity, non-condensing, vibration < 0.05 g all axes (1 to 50 Hz) Temperature and pressure compensation of chamber gain must be performed. Audio noise and vibration should be minimized to the fullest extent in the 10 to 200 Hz range for optimum performance.
Shipping and storage environment	-10 to 50 C, < 80% humidity, non-condensing, vibration < 1g all axes, 1 to 20 Hz



Beam scattering

Layers in beam path

1	12.5 μm	Polyimide foil aluminized both sides 0.1 μm (window)
2	12.6 mm	Fill gas (inactive gap)
3	12.5 μm	Polyimide foil aluminized both sides 0.1 μm (HV electrode)
4	1.0 mm	Fill gas (active gap)
5a	0.03 μm	Gold plating (integral plane electrode)
5b	25 μm	Polyimide foil
5c	0.03 μm	Gold plating (ground plane)
6	3.3 mm	Fill gas (inactive gap)
7a	0.03 μm	Gold plating (ground plane)
7b	25 μm	Polyimide foil
7c	0.03 μm	Gold plating (strip electrode)
8	3.0 mm	Fill gas (active gap)
9	12.5 μm	Polyimide foil aluminized both sides 0.1 μm (HV electrode)
10	3.0 mm	Fill gas (active gap)
11a	0.03 μm	Gold plating (strip electrode)
11b	25 μm	Polyimide foil
11c	0.03 μm	Gold plating (ground plane)
12	9.0 mm	Fill gas (inactive gap)
13	12.5 μm	Polyimide foil aluminized both sides 0.1 μm (window)



Total effective thickness:
 < 200 μm water equivalent
 including air filling.

CAUTION



Do not expose the device to ionizing radiation beams unless all connections to readout electronics and bias supplies are made, or otherwise grounded. Charge build-up and subsequent arcing damage can occur.



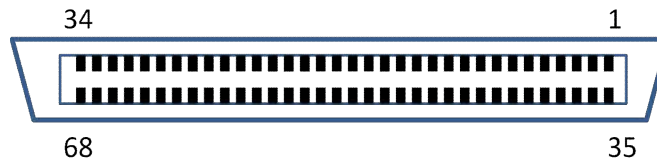
Connectors

Strip readout

Two Centronics VHDCI 68 way receptacle (SCPI-style) for strip current signal s. Gold-plated contacts. Mating connector Molex VHDCI 0.8MM plug. Strain relief tie-downs provided.

VHDCI # 1 axis A / VHDCI #2 axis B

Top row				Bottom row			
1	Gnd	18	Strip 16	35	Gnd	52	Strip 48
2	Strip 32	19	Strip 15	36	Strip 64	53	Strip 46
3	Strip 31	20	Strip 14	37	Strip 63	54	Strip 46
4	Strip 30	21	Strip 13	38	Strip 62	55	Strip 45
5	Strip 29	22	Strip 12	39	Strip 61	56	Strip 44
6	Strip 28	23	Strip 11	40	Strip 60	57	Strip 43
7	Strip 27	24	Strip 10	41	Strip 59	58	Strip 42
8	Strip 26	25	Strip 09	42	Strip 58	59	Strip 41
9	Strip 25	26	Strip 08	43	Strip 57	60	Strip 40
10	Strip 24	27	Strip 07	44	Strip 56	61	Strip 39
11	Strip 23	28	Strip 06	45	Strip 55	62	Strip 38
12	Strip 22	29	Strip 05	46	Strip 54	63	Strip 37
13	Strip 21	30	Strip 04	47	Strip 53	64	Strip 36
14	Strip 20	31	Strip 03	48	Strip 52	65	Strip 35
15	Strip 19	32	Strip 02	49	Strip 51	66	Strip 34
16	Strip 18	33	Strip 01	50	Strip 50	67	Strip 33
17	Strip 17	34	Shield	51	Strip 49	68	Shield



Connector shell is common with shield.

When viewing schematic drawings, note that channels are numbered 10 to 163 on this connector..

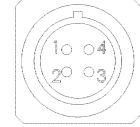
The pin arrangement is directly compatible with a pin to pin 68-way cable connection to an I128M electrometer. One axis will read out on I128M channels 1-64, the other on channels 65-128.



Connectors

Integral plane readout Lemo four-way female type 0B (EPG.0B.304.HLN). To mate with Lemo FGG.0B.304.CLAD52Z or similar.

1	Signal	3	n/c
2	AGnd	4	Chassis



HV in SHV jack

HV out SHV jack

Monitor (default option) DSub male 9-pin

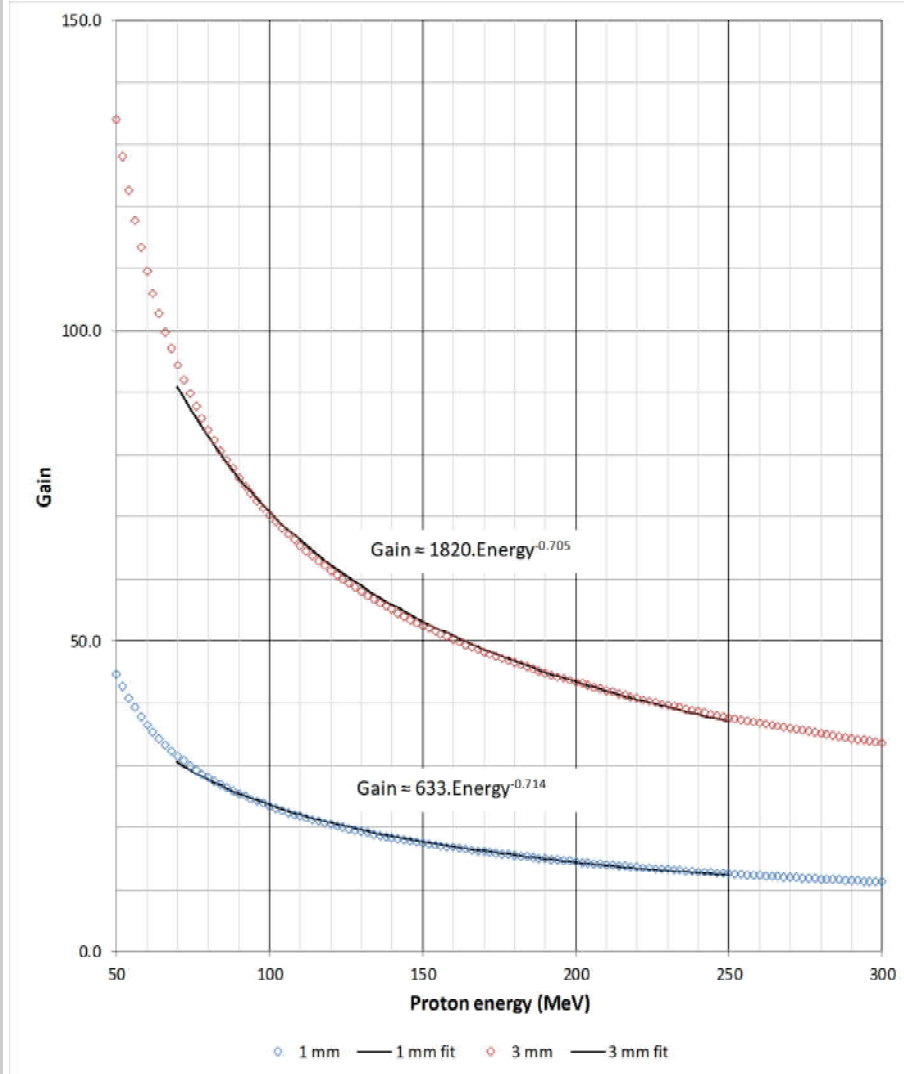
1	Chassis	6	Analog out +
2	Analog out -	7	Signal select bit 0
3	Signal select bit 1	8	Device ID2
4	Device ID1	9	+5V in
5	DGnd		



Calibration

Gain curves

Approximate gain curves for air filling at standard ambient temperature and pressure for protons . The fitting curves are approximate for the energy range 70 to 250 MeV.



Note: Critical dosimetry measurements must use accurate gain values referenced to traceable standards, and regularly validated.



Calibration (cont)

Readout MUX

Digital bit pattern (TTL levels) to select analog sensor voltage that is switched to pins 6, 2 of monitor connector.

<i>Bit 1</i>	<i>Bit 0</i>	<i>Selected sensor</i>
0	0	Temperature (V_{measT})
0	1	Pressure (V_{measP})
1	0	Relative humidity (V_{measH})
1	1	Reference voltage (V_{ref})

Temperature

Temperature(centigrade) = $100 \cdot V_{measT}$
 Temperature(Kelvin) = Temperature(centigrade) + 273.2

Pressure

Pressure(psi) = $18.75 \cdot (V_{measP} / V_{ref} - 0.1)$
 Pressure(mbar) = Pressure(psi) * 68.95
 Pressure(Pa) = Pressure(psi) * 6895

Humidity

Relative humidity (%) = $157 \cdot (V_{measH} / V_{ref}) - 23.8$

Gain correction

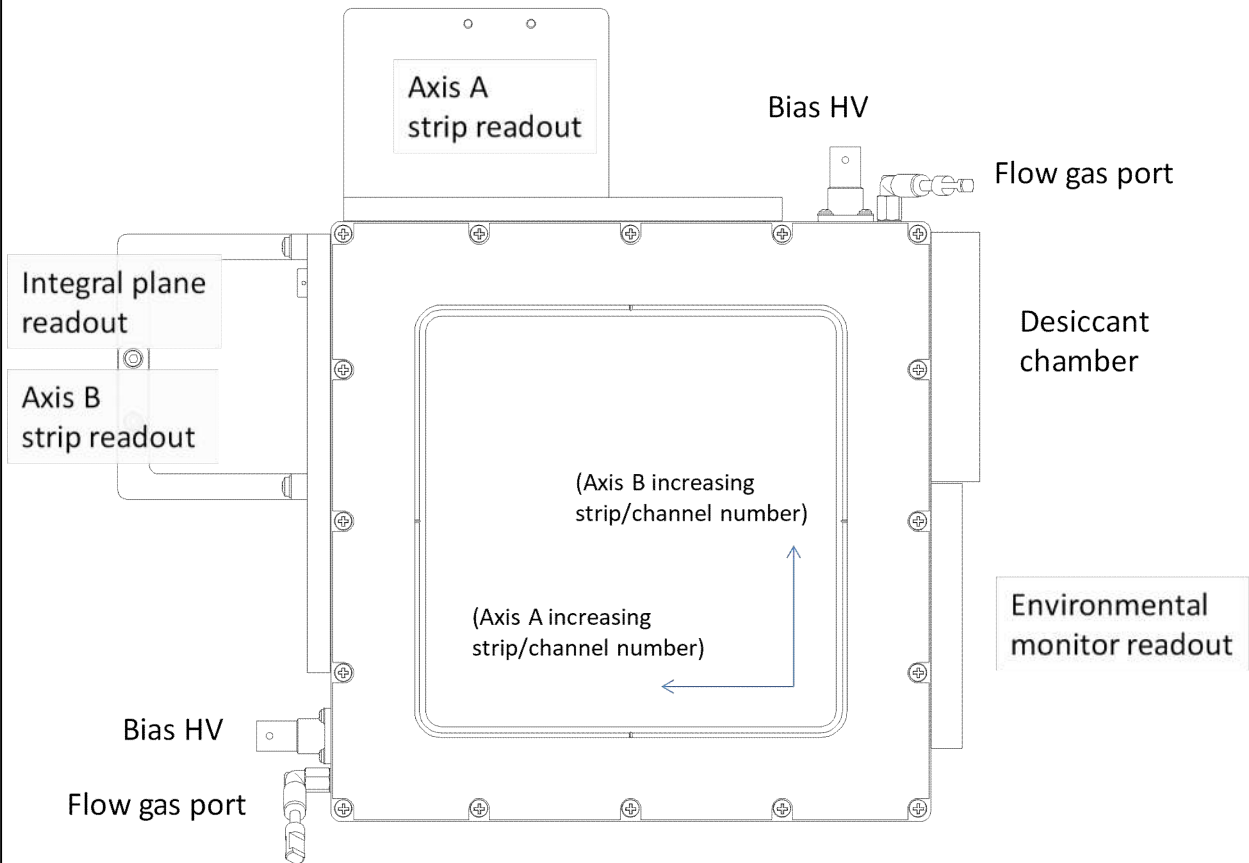
Nominal gain at standard ambient temperature and pressure (Temperature_{SATP} = 298.15 K, Pressure_{SATP} = 100000 Pa), must be corrected for measured temperature and pressure:

$$\text{Gain} = \text{Gain}_{\text{SATP}} / [(\text{Pressure}_{\text{SATP}} / \text{Pressure(Pa)}) * (\text{Temperature(Kelvin)} / \text{Temperature}_{\text{SATP}})]$$

For nominal gains established at other reference temperature and pressure, substitute the appropriate reference values in the equation.



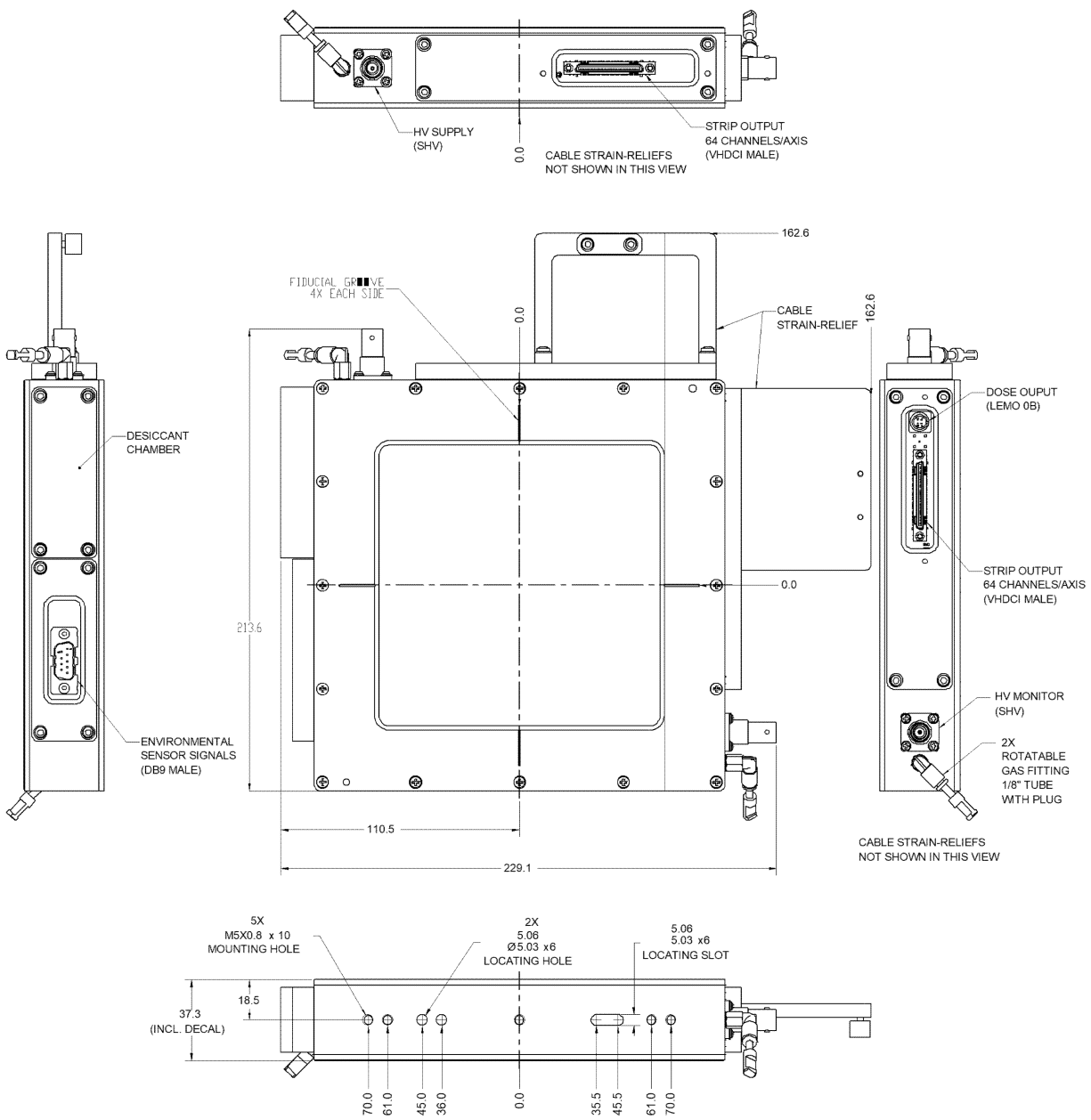
Layout



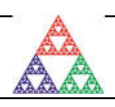
The decal is applied to the side shown above. Designation of axes as X /Y, or horizontal / vertical is arbitrary, as it depends upon the orientation of the IC with respect to the beamline, and of the beam-line relative to any other reference coordinate system.

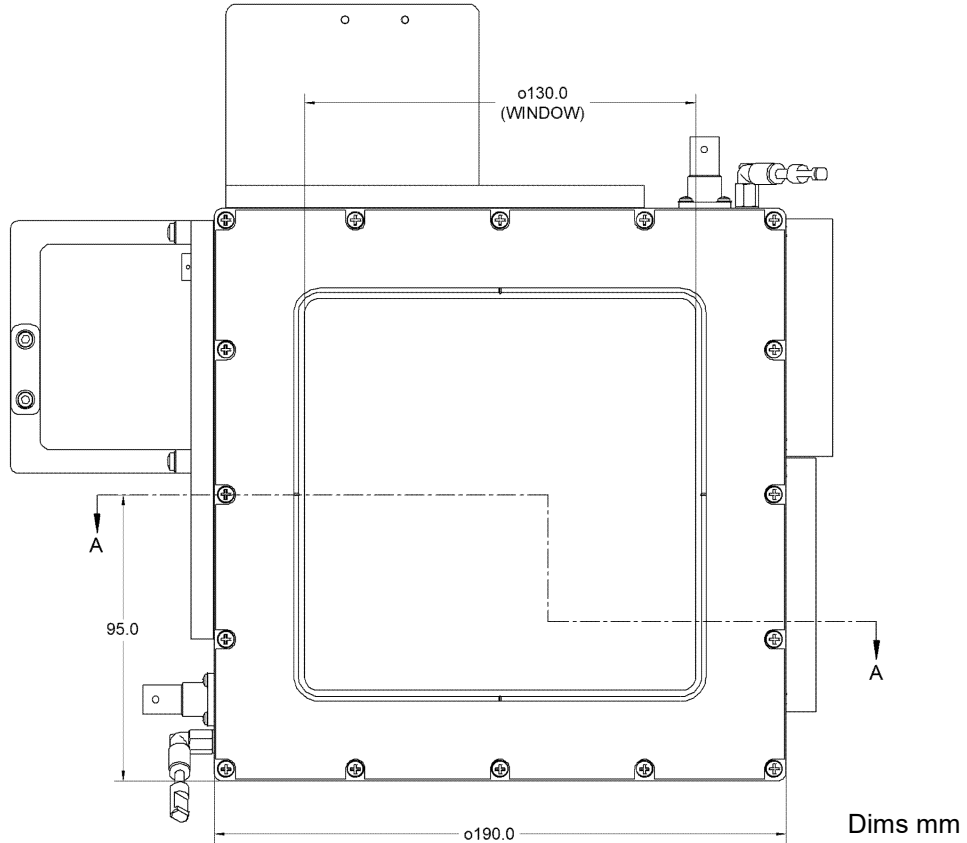
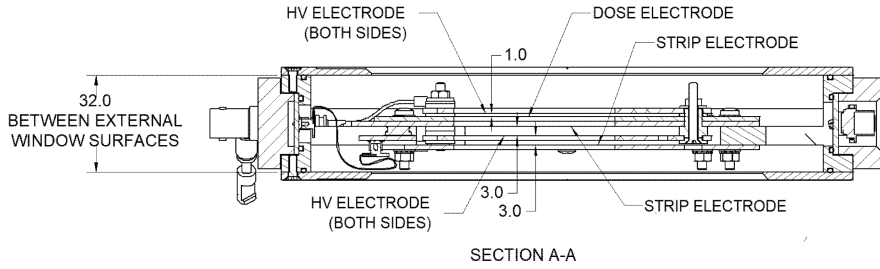
The IC64-6 has no preferred beam entrance side. According to orientation, the beam will either pass first through the integral section then the position readout sections, or vice versa. Assuming that the chamber is standing vertically on the mounting face as shown, a beam entering into the page on the figure passes first through the horizontal sensing gap (axis 1, strips running up and down the page), and second through the vertical sensing gap (axis 2, strips running across the page), then the integral gap.





Dims mm





Ordering information

IC64-6	Thin film ionization chamber with 6.4 by 6.4 cm sensitive area, gold readout electrodes, integral plane section, 64 by 64 strip X and Y position readout sections.
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The information herein is believed accurate at time of publication, but no specific warranty is given regarding its use. All specifications are subject to change.

All trademarks and names acknowledged.

IC64-6_DS_190702

