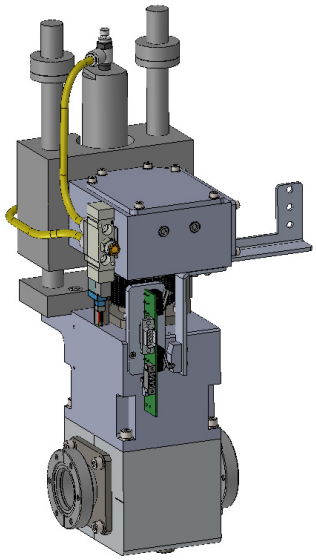
Datasheet **BPM16-38**

Beam Position Monitor
For High Energy Particle Beams

Features

- 16 by 16 strip ionization chamber sensor
- High vacuum compatible
- Small insertion length (152.4 mm)
- Robust thin steel foil vacuum windows
- Very low gas-load on beamline
- Pneumatic actuator to move sensor completely out of beam path when not in use
- Operable with atmospheric pressure chamber gas or flow-through gas
- Operable in any orientation
- Interchangeable beamline flanges
- Compatible with industry standard I3200 readout electronics



Applications	• Particle therapy high energy transfer line diagnostics • General high energy ion beamline diagnostics
Options	• Beamline flange type, CF (Conflat(™)) or KF

Specifications

Beam compatibility	
Species	Positive ions including protons, deuterons, helium, carbon
Energy range	30 MeV/nucleon to 500 MeV / nucleon
Beam current density	10 pA cm-2 to 20 nA cm-2 (particle current)

Sensor	
Type	Parallel plate dual ionization chamber with multistrip cathodes
High voltage	1000 V nominal, maximum 2000 V
Sensitive area	38 mm by 38 mm (or as limited by beam pipe aperture)
Sensitive volume	6.0 mm anode – cathode gaps
Strip geometry	Equal width 2.38 mm on 2.534 mm pitch

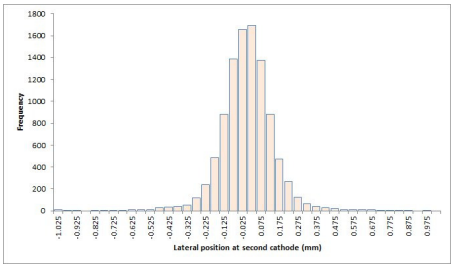
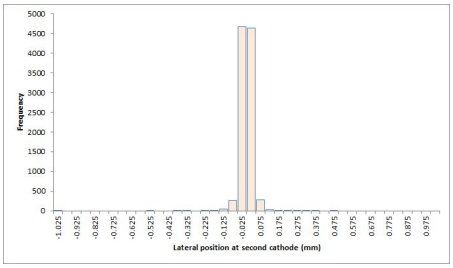
Specifications (continued)

Vacuum	
Vacuum compatibility	High vacuum (1 e-8 mbar). Maximum bakeout 70 C (with forced gas cooling flow to sensor volume). Leak tested in manufacture to 1e-9 mbar l s-1.
Vacuum materials	Stainless steel, aluminium alloy, Viton O ring seals.
Bellows type	Edge-welded stainless steel; rated lifetime 100,000 cycles.
Vacuum windows	50 µm stainless steel foil, diffusion bonded.

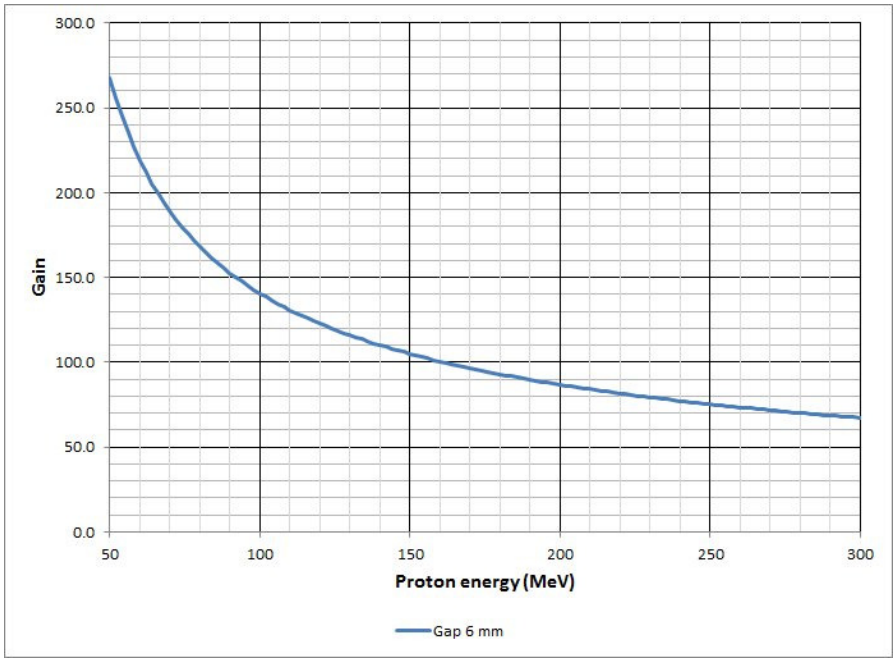
Actuator	
Travel	58 mm
Solenoid valve	24 VDC coil, 50 mA. DC level to hold sensor out of beam
Pneumatic pressure	75 psi minimum, 110 psi maximum CDA or nitrogen. Lubricated CDA recommended for maximum cylinder life.
Default position	Solenoid unpowered—sensor out of beam (actuator extended). If pneumatic pressure is lost with device under vacuum, then vacuum force will tend to move sensor into beam.
Limit sensing	Microswitch sensing of fully in and fully out position for control Independent redundant microswitches for safety system connection
Position reproducibility	Sensor positioning in beam reproduces to +/- 0.1 mm in motion direction, +/- 0.25 mm in transverse direction, referenced to mounting surface
Position accuracy	Sensor positioning in beam within +/- 0.25 mm in motion direction, +/- 0.25 mm in transverse direction, referenced to mounting surface

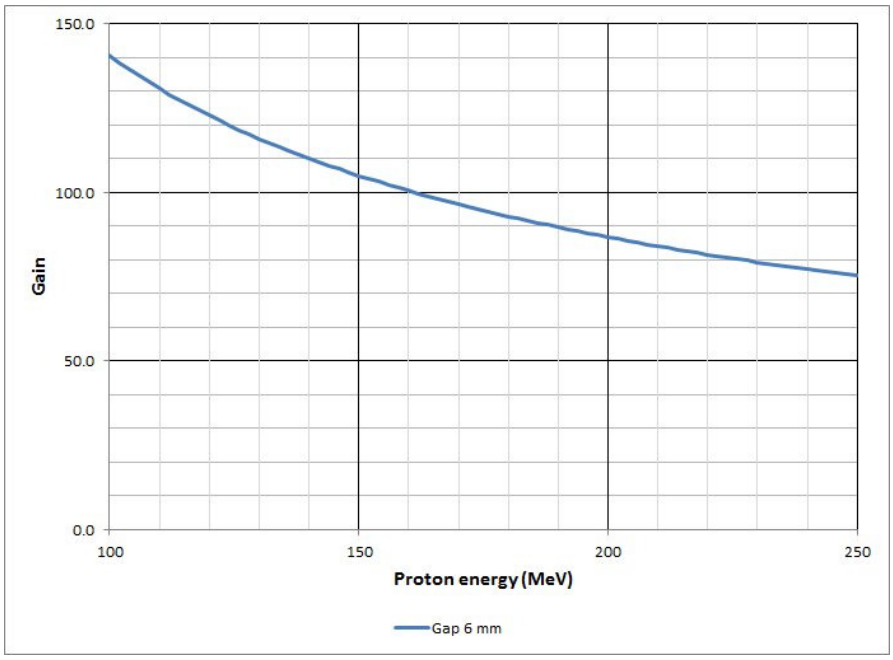
Specifications (continued)

Mechanical	
Insertion length	152.4 mm flange face to flange face (6”)
Orientation	Operable in any orientation. Vertical orientation (actuator above beampipe) recommended for best position reproducibility.
Flange type	-CF version: 2.75 “ CF (Conflat (TM)) non-rotatable, 6 x 1/4-28 UNF tapped holes. -KF version DN40KF. Enquire for other flange types.
Weight	12 kg (26.4 lb)
Operating environment	Clean and dust-free, 0 to 35 C (15 to 25 C recommended , < 70% humidity, non-condensing, vibration < 0.1g all axes (0.1 to 100 Hz)
Shipping and storage environment	Vacuum flanges blanked off -10 to 50 C, < 80% humidity, non-condensing, vibration < 1g all axes, 0.1 to 100 Hz

Beam scattering	
Layers in beam path (sensor in)	1 50 µm stainless foil 2 10.8 mm fill gas 3a 152 µm FR4 fibreglass epoxy 3b 17.3 um copper with gold flash 4 6 mm fill gas 5a 17.3 µm copper with gold flash 5b 152 µm FR4 fibreglass epoxy 5c 17.3 µm copper with gold flash 6 6 mm fill gas 7a 17.3 µm copper with gold flash 7b 152 µm FR4 fibreglass epoxy 8 10.8 mm fill gas 9 50 µm stainless foil
Lateral scattering	Beam spreading of a zero size beam, at the second cathode readout plane, due to the BPM materials (SRIM calculation).   50 MeV protons: 112 µm one sigma 230 MeV protons: 30 µm one sigma **Note**: it is not recommended to make measurements downstream of the BPM when it is in the beam, due to scattering.

Gain calibration	
	Approximate gain curve at standard ambient temperature and pressure for protons in air, 6 mm electrode gaps.





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

Connectors

Horizontal sensing strips (if BPM actuator vertical)

DSub 25 pin male (moving connection)

1	Strip X02 (18)	14	Strip X01 (17)
2	Strip X03 (19)	15	n/c
3	Strip X04 (20)	16	AGND
4	Strip X05 (21)	17	AGND
5	Strip X06 (22)	18	AGND
6	Strip X07 (23)	19	AGND
7	Strip X08 (24)	20	AGND
8	Strip X09 (25)	21	AGND
9	Strip X10 (26)	22	AGND
10	Strip X11 (27)	23	AGND
11	Strip X12 (28)	24	Strip X16 (32)
12	Strip X13 (29)	25	Strip X15 (31)
13	Strip X14 (30)		

Numbers in parenthesis are I3200 channel numbers when using pin to pin cables. Strip X01 is on the left looking along the beam if the beam enters on the face with the signal connectors.

Vertical sensing strips (if BPM actuator vertical)

DSub 25 pin male (moving connection)

1	Strip Y02 (2)	14	Strip Y01 (1)
2	Strip Y03 (3)	15	n/c
3	Strip Y04 (4)	16	AGND
4	Strip Y05 (5)	17	AGND
5	Strip Y06 (6)	18	AGND
6	Strip Y07 (7)	19	AGND
7	Strip Y08 (8)	20	AGND
8	Strip Y09 (9)	21	AGND
9	Strip Y10 (10)	22	AGND
10	Strip Y11 (11)	23	AGND
11	Strip Y12 (12)	24	Strip X16 (16)
12	Strip Y13 (13)	25	Strip X15 (17)
13	Strip Y14 (14)		

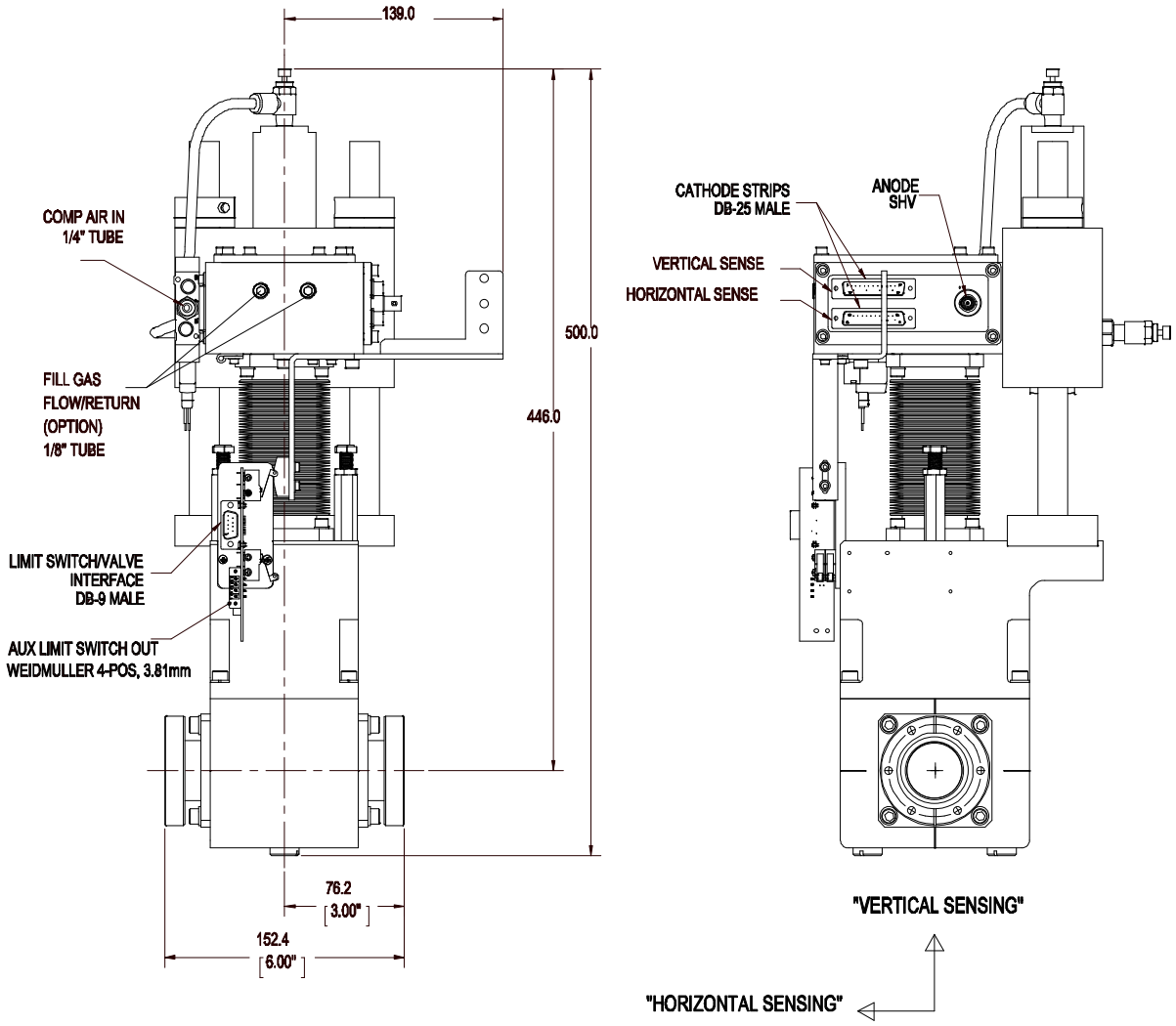
Numbers in parenthesis are I3200 channel numbers when using pin to pin cables. Strip Y01 is on the bottom if the BPM actuator is pointing vertically upwards

Connectors

<table>
<tr><td>Actuator control</td><td>9 pin DSub male (non-moving connection)
<table>
<tr><td>1</td><td>24 VDC switched in Solenoid drive</td><td>6</td><td>Limit switch common</td></tr>
<tr><td>2</td><td>Solenoid rtn</td><td>7</td><td>Limit switch “in” n/o</td></tr>
<tr><td>3</td><td>n/c</td><td>8</td><td>n/c</td></tr>
<tr><td>4</td><td>n/c</td><td>9</td><td>n/c</td></tr>
<tr><td>5</td><td>Limit switch “out” n/o</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Redundant limit switch readout</td><td>Weidmuller 4 pin header 3.81 mm (non-moving connection)
<table>
<tr><td>1</td><td>Redundant limit switch “in” common</td></tr>
<tr><td>2</td><td>Redundant limit switch “in” n/o</td></tr>
<tr><td>3</td><td>Redundant limit switch “out” common</td></tr>
<tr><td>4</td><td>Redundant limit switch “out” n/o</td></tr>
</table></td></tr>
<tr><td>HV in</td><td>SHV (moving connection)</td></tr>
</table>

Gas connectors

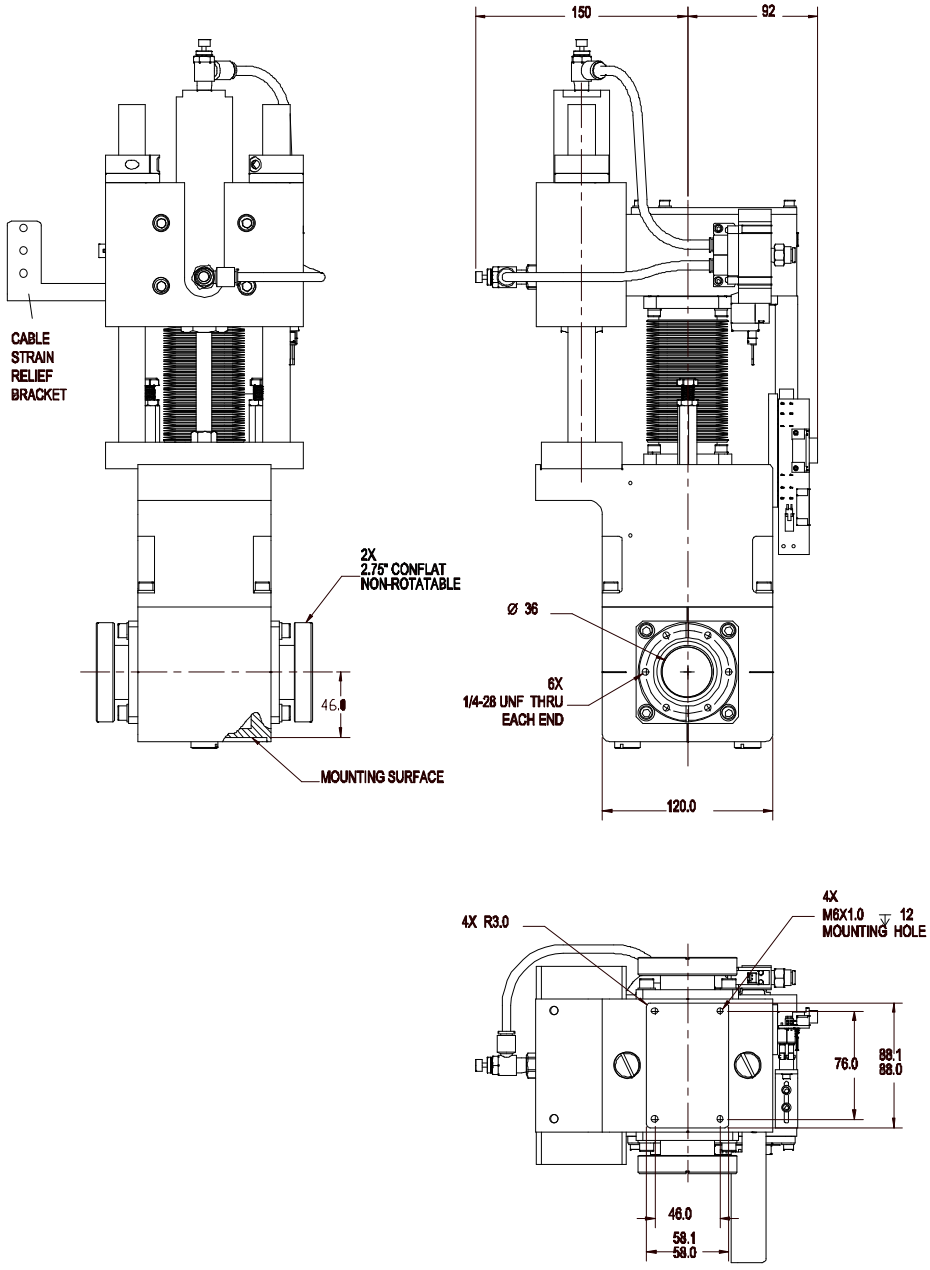
Pneumatic pressure in	Push fit connection for 1/4” od flexible plastic hose (moving connection)
Fill gas flow / return (option)	Two swage connections for 1/8” od flexible hose (moving connection) Input flow gas is routed by internal pipe to ionization chamber volume



Version with CF flanges
Shown with sensor out of beam path (actuator extended) Dims mm

Ordering information

BPM38HV	Beam Position Monitor, high vacuum compatible with 38 mm sensing area.
-CF	2.75” CF (Conflat(™)) flanges
-KF	KF40 flanges.
-FLO	Provision for flow gas filling.



Version with CF flanges
Shown with sensor out of beam path (actuator extended)

Dims mm

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