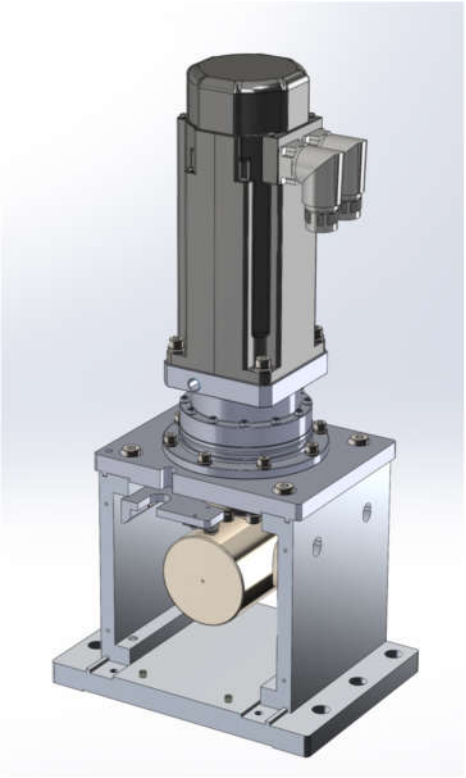
Datasheet FS-78

Fast Proton Beam Shutter



Features

- Physical blocking of proton beam
- Proton energies up to 250 MeV are stopped
- Closes or opens in less than 100 msec
- Operates in air
- Compatible with PX-3 ionization chamber

Applications	• Proton therapy systems • Beam shutter for nozzle systems • Additional beam shutoff means • Beam stop to allow beam tuning
Options	• Integrated PX-3 ionization chamber and I128 electrometer

Specifications

Beam compatibility	
Species	Protons
Energy range	30 MeV to 250 MeV
Beam power handling	Up to 10 W continuous Up to 100 W for 100 sec with 200 sec cooldown Up to 1 kW for 10 sec with 200 sec cooldown.
Beam stopping material	Nickel-plated OFHC copper cylinder 114 mm long and 68 mm diameter mounted on fast rotary actuator. Beam aperture 36 mm diameter, parallel sides. Minimum stopping length 78 mm.
Recommended beam size	7 mm sigma maximum, both axes

Specifications (continued)

General	
System configuration	Shutter and motor assembly, remote cabinet for motor control and user interface connections, interconnecting cables.
Motion amplifier	Kollmorgen AKD-1206 AC servo unit
Speed	Fully open to fully closed < 100 ms Fully closed to fully open < 100 ms
Design lifetime	> 1,000,000 cycles
Orientation	Any orientation (suitable for gantry operation)
Position sensing	Magnetic sensor contact closures for shutter open position, closed position, redundant closed position. Independent of motion control.
Cable length	Interconnecting cables between shutter and cabinet included, 5.0 m standard length. Customer-specific length options available from 2.0 m to 20 m, 1.0 m increments.
Power	120 - 240 VAC 50/60 Hz, 10A.
Mechanical (shutter)	
Insertion length	160 mm
Overall size	160 mm by 216 mm by 457 mm approx (see figures)
Weight	15 kg (33 lb)
Operating environment	Clean and dust-free, 0 to 35 C (15 to 25 C recommended , < 70% humidity, non-condensing, vibration < 0.05g all axes (1 to 50 Hz)
Shipping and storage environment	-10 to 50 C, < 80% humidity, non-condensing, vibration < 2g all axes, 1 to 100 Hz
Mechanical (electronics cabinet)	
Cabinet contents	6U 19” cabinet (Hammond RCHS190107BK1) containing the motion amplifier unit, cooling fan, power distribution, low voltage power supplies, user interface connection points and space for adding additional units such as I128 electromerer for PX-3 ionization chamber readout.
Overall size	318 mm x 534 mm x 445 mm (h x w x d)
Weight	22.5 kg (50 lb)
Operating environment	(as for shutter), in addition leave 10 cm clear at sides for airflow.
Shipping and storage environment	(as for shutter)

Datasheet FS-78

Control interfaces on electronics cabinet

Control interface	DSub 25 pin female connector. TTL levels. *Controls:* - Enable amplifier (TTL high enables, TTL low disables) - Home motion (TTL high for 0.5 sec homes) - Move to shutter closed state (TTL rising edge to close) - Move to shutter open state (TTL rising edge to open) *Readbacks:* - Enabled state readback (TTL high = enabled) - Motion is homed state (TTL high = enabled) - In motion (TTL high = motion completed, TTL low = in motion) - Shutter closed sensor (TTL high = at shuttered position, TTL low = not at shuttered position) - Shutter open sensor (TTL high = at open position, TTL low = not at open position)
Diagnostic interface	RJ-45 jack. Ethernet communications. Diagnostic-level communication to Kollmorgen amplifier. Note: The FS-78 is supplied with motion settings optimized for maximum performance. No user tuning is required for normal operation.

Connectors on electronics cabinet

Control interface: DSub 25-way female

1	n/c	14	n/c
2	n/c	15	DGnd
3	n/c	16	n/c
4	n/c	17	n/c
5	Amplifier enabled sense	18	DGnd
6	n/c	19	Enable command
7	n/c	20	Home motion command
8	n/c	21	n/c
9	DGnd	22	Set to closed command
10	Set to open command	23	n/c
11	Open position sense	24	Closed position sense
12	Motion state sense	25	Homed sense
13	DGnd		

Diagnostic interface: Standard RJ-45 Ethernet jack

Independent closed position sense: Three-pin connector round, locking, Amphenol C091 31W003 100 2.

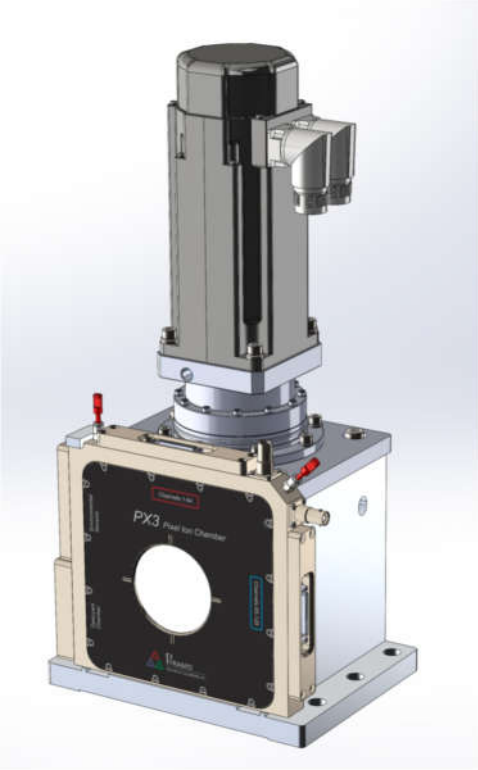
1	Closed position sense
2	n/c
3	DGnd

Connectors on electronics cabinet (continued)

Power inlet	Power inlet IEC C14 (rear panel)
System connections	HD15 (Kollmorgen X10 motor feedback) - cable supplied Terminal block (Kollmorgen X2 motor current and brake lines) - cable supplied DSub 25 pin male (connection to I128, PX-3 ionization chamber configuration only).

Ionization chamber option

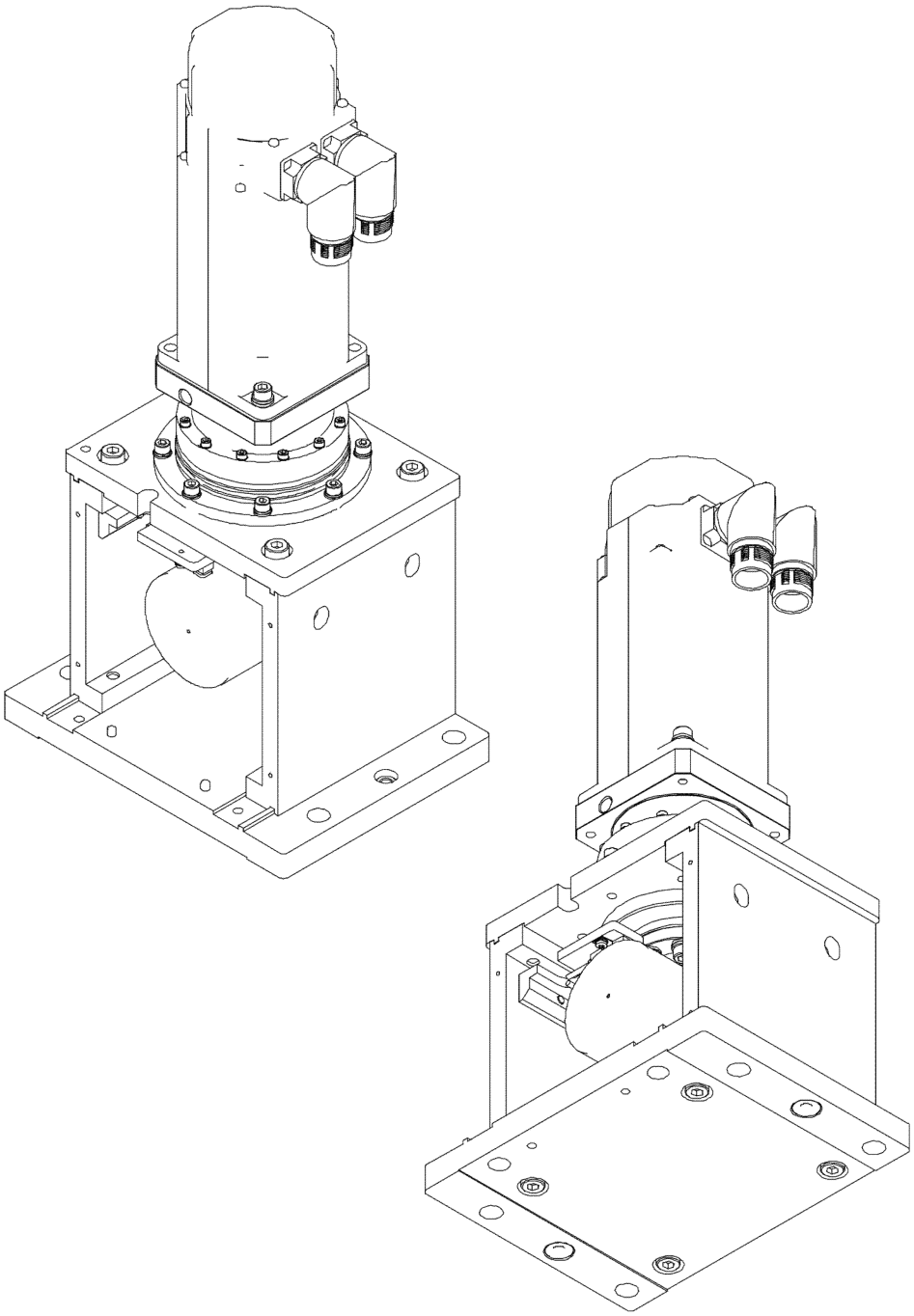
PX-3 option	The FS-78 provides a location to mount a PX-3 pixelated ionization chamber on its upstream side. This provides a system for proton therapy where the beam can be stopped from reaching a patient while final beam tuning is performed using PX-3 data.
Connections and cables	Option is supplied with all connecting cables and adaptors between shutter assembly and electronics.



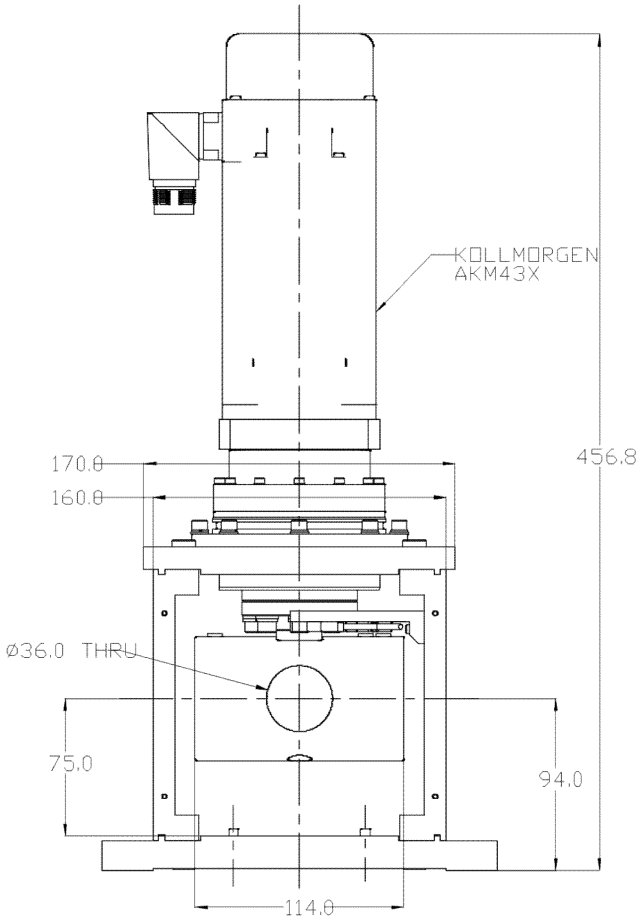
Ordering information

FS-78	Fast beam shutter (shutter assembly only)
FS-78-SYS##	FS-78 shutter system including electronics cabinet and ## meter long connecting cables.
FS-78-SYS##-PX3	FS-78 shutter system plus PX-3 ionization chamber including electronics cabinet with I128-XP20 electrometer and ## meter long connecting cables.

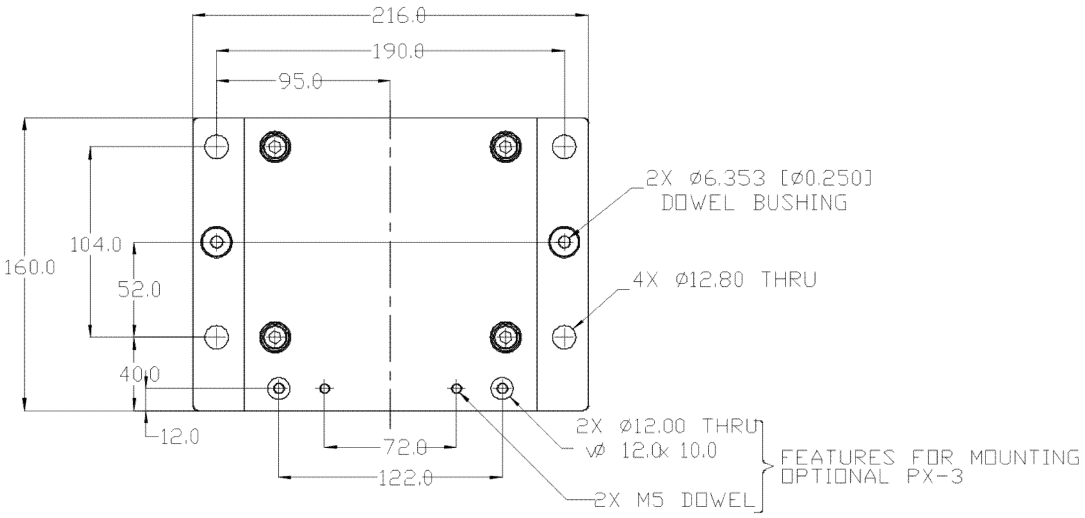
Example: FS-78-SYS07 Fast beam shutter system with 7.0 m connecting cables



CAUTION: The FS-78 shutter cylinder will become activated due to exposure to high energy proton beams. This does not affect performance, and will decay over time, but the device must be radiation surveyed by an authorized person and suitably packaged before moving it out of a controlled area. After exposure to an intense beam, a 30 minute radiation cool-down followed by radiation survey is recommended before handling. Do not handle more than necessary until radiation levels are below allowed limits..

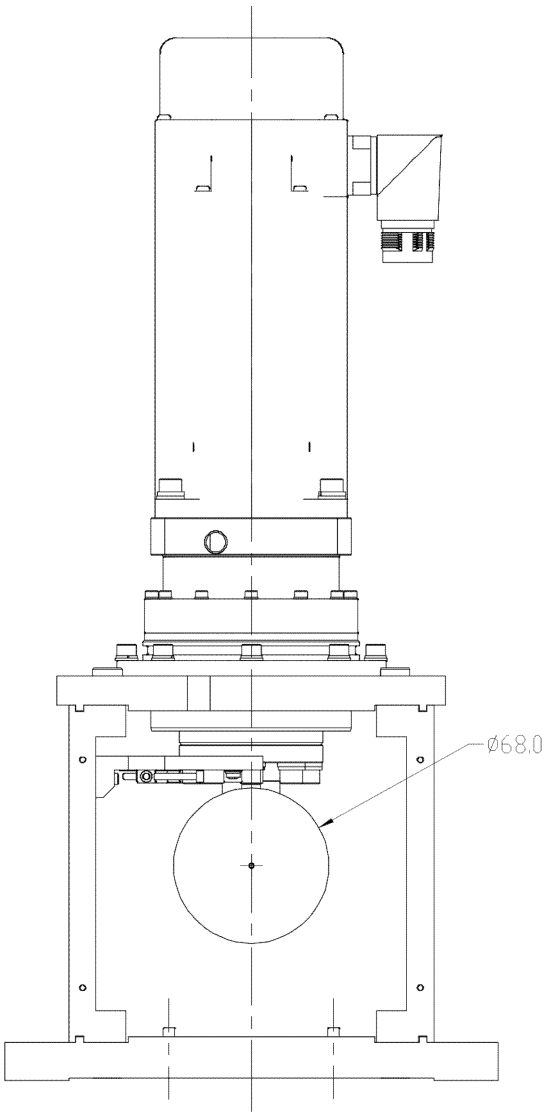


CYLINDER IN BEAM-PASS-THRU POSITION

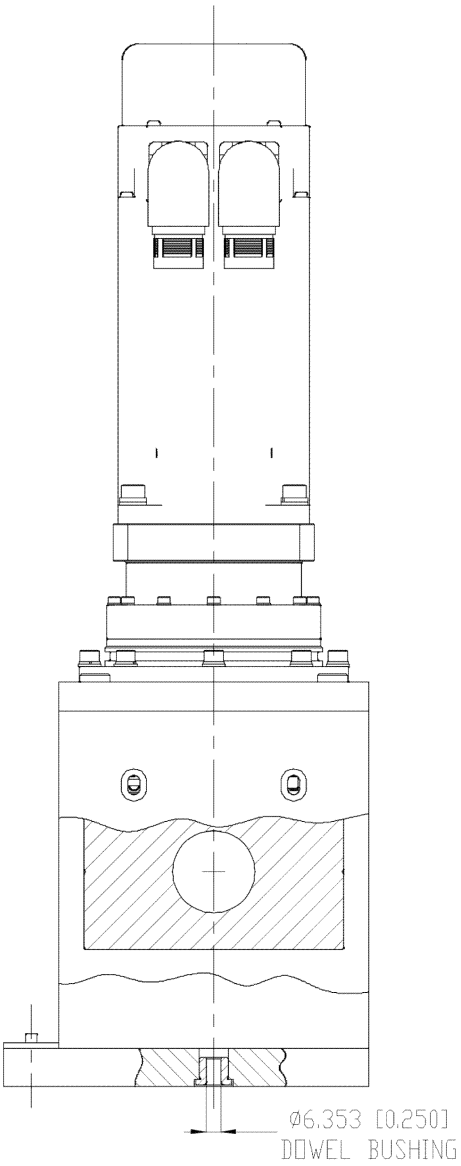


Alternative mounting features available on FS-78 on request.

Dims mm



CYLINDER IN BEAM-STOP POSITION



CYLINDER IN BEAM-STOP POSITION

Dims mm

Pyramid Technical Consultants, Inc.,
1050 Waltham Street Suite 200
Lexington MA 02421 USA
Tel: +1 781 402 1700 (USA),
+44 1273 492001(UK)

Email: support@ptcusa.com **www.ptcusa.com**

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