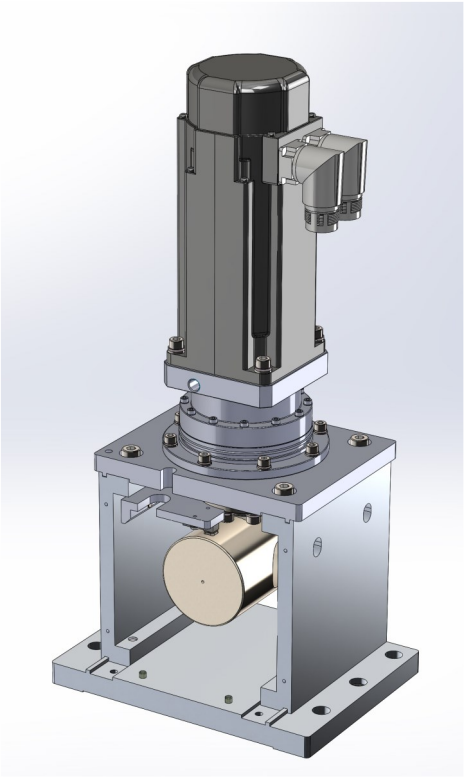
Fast Proton Beam Shutter



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 ICQ-3 or 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 ICQ-3 ionization chamber and FX4 or PX-3 ionization chamber and IX256 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
Beam stopping material	Nickel-plated OFHC copper cylinder 114 mm long and 68 mm diameter mounted on fast rotary actuator. Beam aperture 38 mm diameter, parallel sides.
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	5U 19” cabinet (Hammond RCHV1900817BK1) 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 FX4 or IX256 electrometers for ICQ-3 or PX-3 ionization chamber readout.
Overall size	273 x 537 x 469 mm (H x W x D)
Weight (approx.)	25 kg (55 lb)
Operating environment	(as for shutter), in addition leave 10 cm clear at sides for airflow.
Shipping and storage environment	(as for shutter)

Control interfaces on electronics cabinet

Control interface	Through MX1: - Refer to User Manual for instructions
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 perfor-

Connectors on electronics cabinet

Confirmation Switches — 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		

Ethernet — Standard RJ-45 Ethernet jack

Motor Power

-Br	n/c	U	Motor power phase U
+Br	n/c	V	Motor power phase V
PE	Ground	W	Motor power phase W

Connectors on electronics cabinet (continued)

Motor Encoder	HD15 (Kollmorgen X10 motor feedback) - cable supplied
Sensors (optional with detector)	DB9 Connector - environmental sensors for ICQ-3 or PX-3
High Voltage Out (optional with detector)	SHV Connector - for supplying ion chamber bias voltage
High Voltage Readback (optional with detector)	SHV Connector - for supply ion chamber bias voltage readback
MX-1	For connection to MX-1 device. Cable provided to connect externally to embedded MX-1 device.
Power inlet	Power inlet IEC C14 (rear panel)

Ionization chamber option

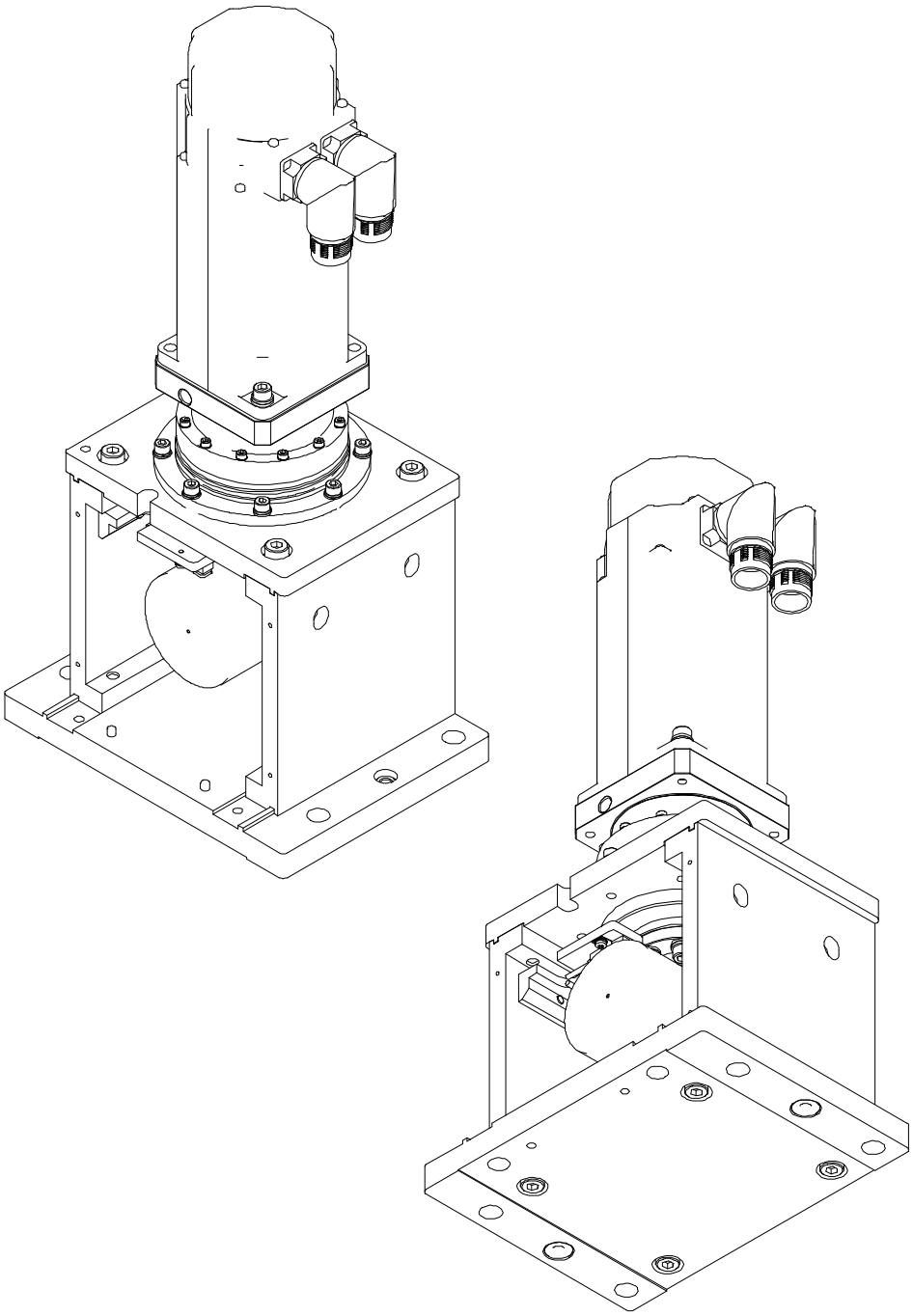
PX-3 option	The FS-78 provides a location to mount a PX-3 pixelated ionization chamber on its upstream side. This provides a system for proton therapy where the beam can be stopped from reaching a patient while final beam tuning is performed using PX-3 data.
ICQ-3 option	The FS-78 provides a location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

ICQ-3 option shown.

Ordering information

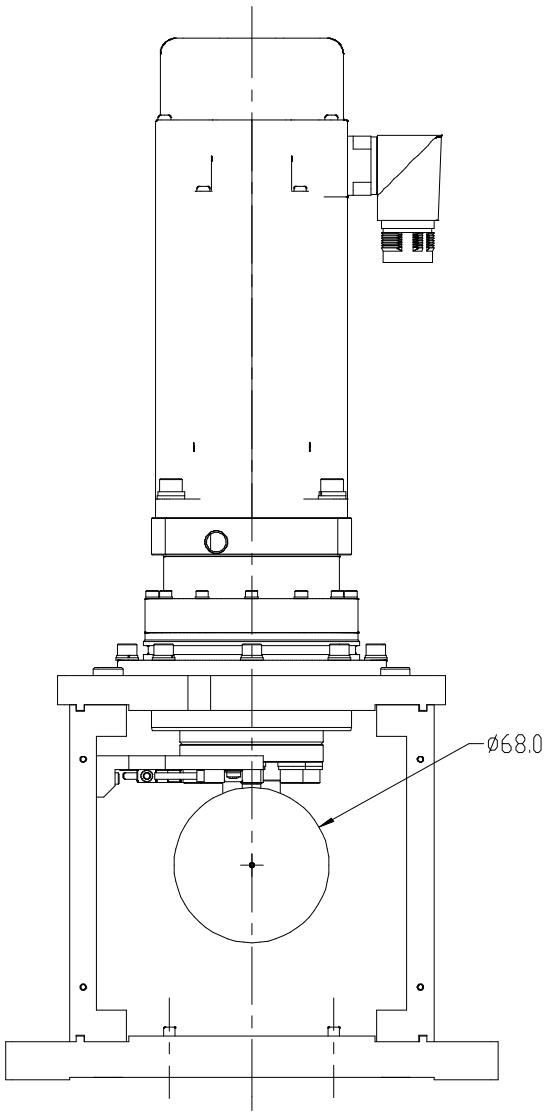
FS-78	Fast beam shutter (shutter assembly only)
FS-78-SYS##	FS-78 shutter system including electronics cabinet and ## meter long connecting cables.
FS-78-SYS##-PX3	FS-78 shutter system plus PX-3 ionization chamber including electronics cabinet with IX256 electrometer and ## meter long connecting cables.
FS-78-SYS##-ICQ3	FS-78 shutter system plus ICQ-3 ionization chamber including electronics cabinet with FX4 electrometer and ## meter long connecting cables.

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

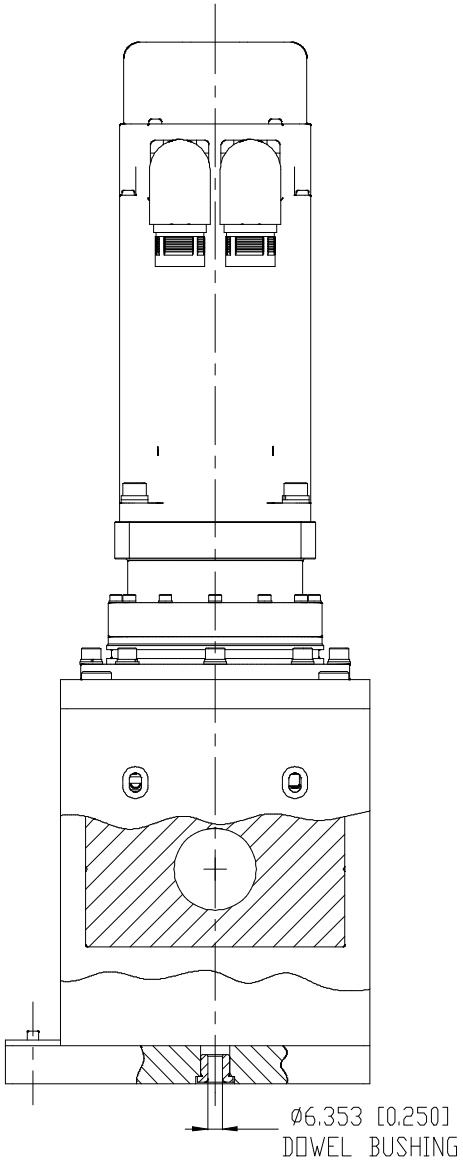


CAUTION: The FS-78 shutter cylinder will become activated due to exposure to high energy proton beams. This does not affect performance, and will decay over time, but the device must be radiation surveyed by an authorized person and suitably packaged before moving it out of a controlled area.
After exposure 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..

FS-78 Beam-Stop Position



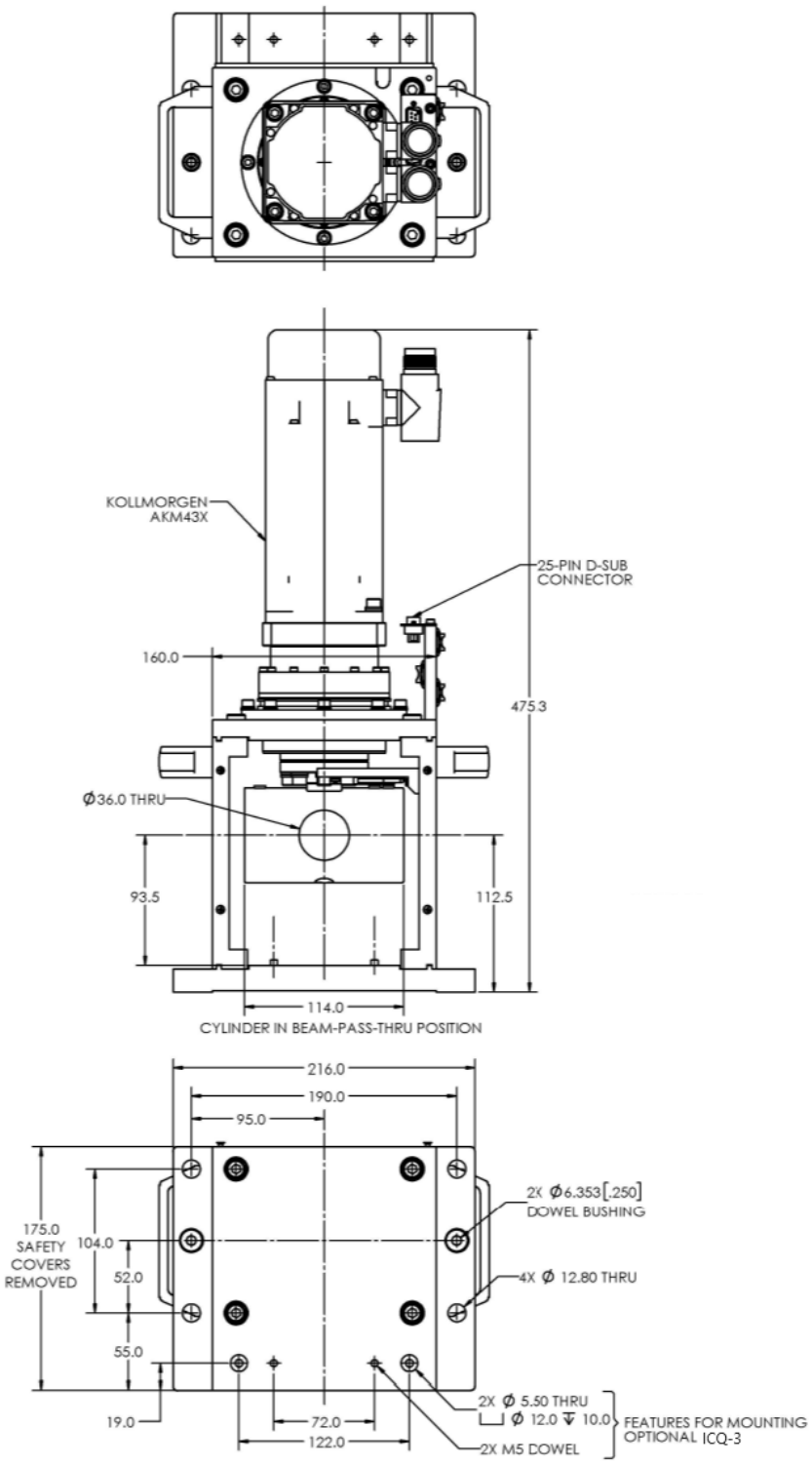
CYLINDER IN BEAM-STOP POSITION



CYLINDER IN BEAM-STOP POSITION

Dims mm

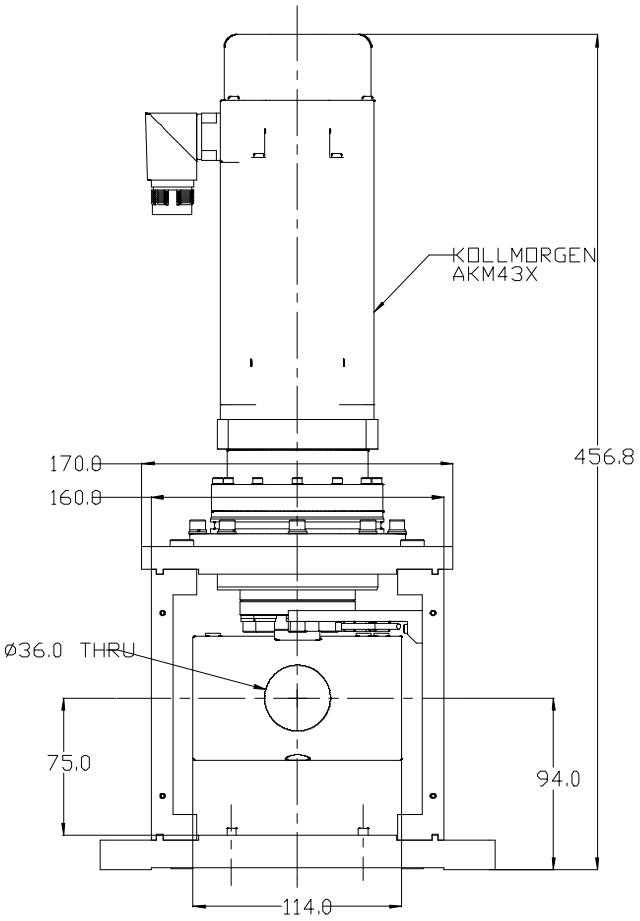
FS-78 Dimensions with ICQ-3 Mounting Option



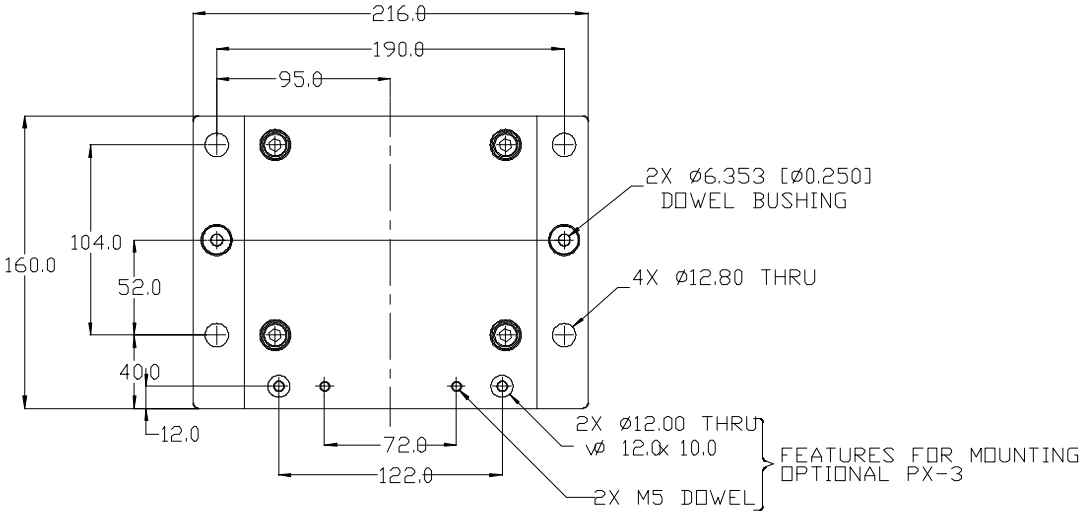
Alternative mounting features available on FS-78 on request.

Dims mm

FS-78 Dimensions with PX-3 Mounting Option



CYLINDER IN BEAM-PASS-THRU POSITION



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Dims mm

DATASHEET

FS-78

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