

Powersmiths Rotatable IR Port (IRP)* Family Installation and Operation Instructions

Important Safety Instructions

Arc Flash explosions have the potential to produce powerful blasts dependant on the available power and the Current Interrupt Capacity of the source (kAIC rating) with core arc temperatures potentially exceeding 15,000° C; there are currently no known IR viewing ports that can withstand these conditions.

The Powersmiths IR Rotatable Port is not intended to protect the user from an ARC Flash incident, (which is mainly (99.999%) caused by externally induced trigger incidents such as opening panels, doors, tools, etc.), but to exclude the need for internal access to live equipment, thus virtually eliminating operator induced trigger events by facilitating thermographic maintenance inspections from outside the equipment enclosure.

This equipment is intended for installation on equipment in indoor applications only. When installed in the field it is important that the installer ensure that all power is removed from the subject equipment. Failure to observe these cautions could result in serious injury or death. Powersmiths International accepts no liability from damages arising from the use, application or installation of this product.

DANGER



HAZARD OF ELECTRIC SHOCK OR ARC FLASH

This equipment to be installed only by suitably qualified personnel

Use appropriate personal protective equipment (PPE) and follow local code safe electrical work practices (e.g. NFPA 70E/CSA Z426)

Ensure power is OFF and locked out before working on electrical equipment

Ensure all covers and doors are in a closed condition prior to reapplying power

Overview

The Powersmiths Rotatable IR Port is an external view port mounted to the exterior wall of the equipment enclosure providing a safe and fast means for thermographic imaging or viewing of the interior components facilitating an effective preventative maintenance program. The rotating capability of the port proscribes a large conical 360° viewing area which extends from close to the vertical enclosure walls to deep within the cabinet compared to only a narrow conical view from a fixed port. It is designed to eliminate the risk of operator induced triggers causing Electrical Shock and Arc Flash hazards associated with traditional IR inspections which require the removal of a panel or opening of a cover or door.

The unit basically comprises three components as follows:

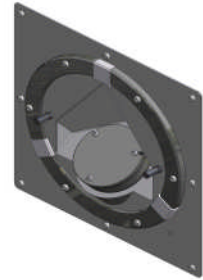
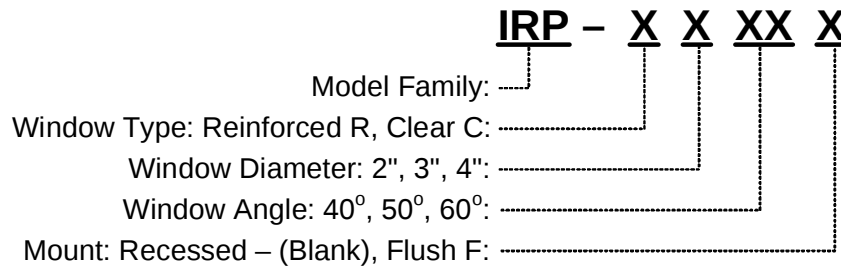
- A fixed base mounted to the enclosure wall in which a rectangular cut-out is prepared
- A Rotatable (360°) assembly mounted to the base via a bezel
- An IR viewing window mounted to rotatable assembly for the actual thermographic imaging

The user operates the device by placing the imaging device (e.g. IR camera or IR Thermometer) against the viewing Window and rotating it to 'see' the selected areas within the enclosure.

The units are UL and cUL Recognized with a variety of models available for specific applications ranging from small transformer enclosures through large Switchgear assemblies to whole Electro-mechanical rooms for both OEM and Field installations. The Ports are also available with clear crystals supporting both IR and visual observation and opaque reinforced membranes for IR only, the latter having the advantage of being more robust and better suited to industrial environments with a better than 25 year expected service life.

Description

Models



- **Window Type:** Reinforced membrane for IR only inspections or Clear crystal for visual or IR inspections but not recommended for industrial environments
- **Window Diameter:** Viewing window diameter available in 2" (50mm), 3" (75mm) and 4" (100mm)
- **Window Angle:** The optimal window angle depends on the application (see following Model Selection)
Note: The 40 degree models are not available with the flush mount base due to the viewing restriction at the mounting base at more extreme vertical angles
- **Mount:** The recessed mount protrudes within the enclosure (OEM applications) and the flush mount is flush with the mounting panel and has no internal protrusion (Field or OEM applications)

*Note: The recessed mount models are intended for **OEM** applications due to potential degradation of mechanical and electrical clearances which requires evaluation by the original equipment manufacturer; the flush mount unit is intended for both OEM and field installations where there is no protrusion of the unit into the enclosure to which it is mounted.*

Table of Models with Part Numbers and Description

Model*	Part Number	Description
IRP-R240	212-002415-124	2" Window at 40° with Reinforced Window for IR Inspections only
IRP-C240	212-002415-154	2" Window at 40° with Transparent Window for visual and IR Inspections
IRP-R250*	212-002415-125	2" Window at 50° with Reinforced Window for IR Inspections only
IRP-C250*	212-002415-155	2" Window at 50° with Transparent Window for visual and IR Inspections
IRP-R340	212-002415-134	3" Window at 40° with Reinforced Window for IR Inspections only
IRP-C340	212-002415-164	3" Window at 40° with Transparent Window for visual and IR Inspections
IRP-R350*	212-002415-135	3" Window at 50° with Reinforced Window for IR Inspections only
IRP-C350*	212-002415-165	3" Window at 50° with Transparent Window for visual and IR Inspections
IRP-R360*	212-002415-136	3" Window at 60° with Reinforced Window for IR Inspections only
IRP-C360*	212-002415-166	3" Window at 60° with Transparent Window for visual and IR Inspections
IRP-R460*	212-002415-146	4" Window at 60° with Reinforced Window for IR Inspections only
IRP-C460*	212-002415-176	4" Window at 60° with Transparent Window for visual and IR Inspections
<i>*Note: Available with flush mount base by adding "F" to the model number</i>		

Model Selection Criteria

The selection of the appropriate model may be based on the following criteria.

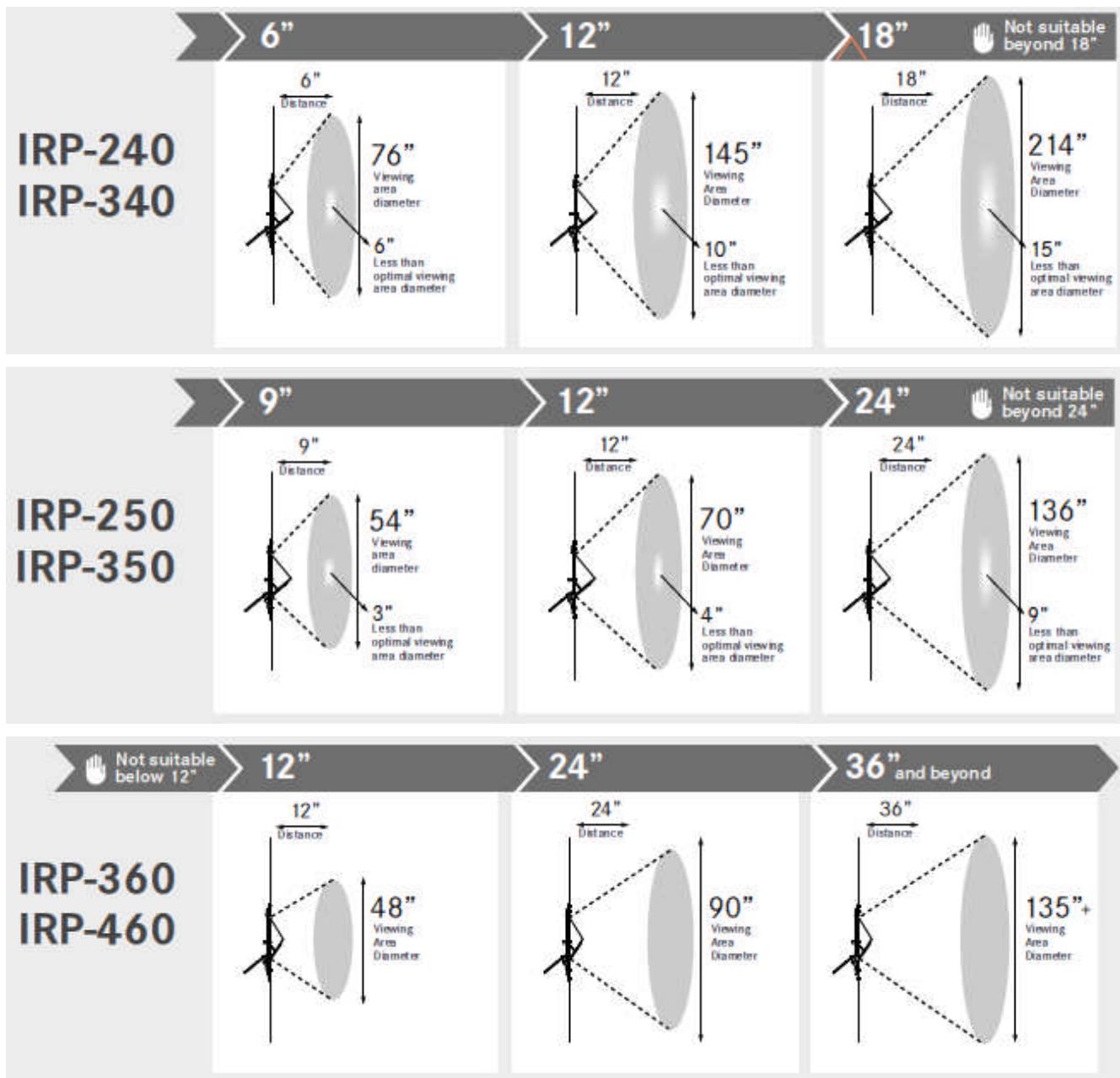
- Diameter of the viewing Window matched to size of the imaging device or size constraints
- The viewing Window type: Reinforced (R) for IR only inspections or Clear (C) which facilitates both visual and IR inspections but is not recommended for industrial environments
- The angle of the window for required viewable area with distance from window
- Flush mount base (no protrusion into enclosure) and required for field installations

The following table and figure shows the approximate viewable area by Model projected onto an imaginary plane based on distance from the port mounting surface.

Visual Guides to Model selection

The following illustrations provide a graphic view with regards the approximate viewing area by model type. Some points to consider are:

- A larger window diameter helps the operator to better “see” a wider area inside the cabinet as it allows the imaging device to be angled relative to window surface
- The 40 degree models are better suited for applications requiring a very close view to the vertical cover of the enclosure but can limit the view in the horizontal direction and is mainly suitable for smaller transformer enclosures
- The 50 degree models provide the best compromise between the vertical and horizontal views for most applications for equipment such as mid to larger transformer enclosures or switchgear
- The 60 degree models are best suited for larger enclosures or mechanical rooms where the compromise is the limit of the viewing area close to the vertical front mounting surface, hence it is suitable for viewing surfaces greater than 18” from the vertical



Engineering Guides to Model selection

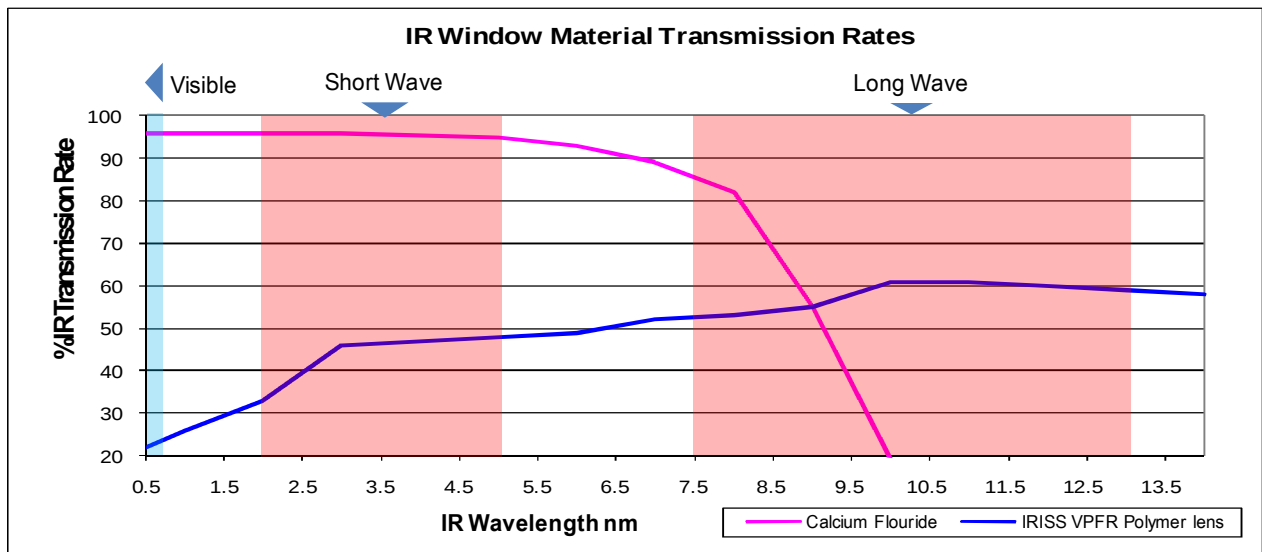
Table of Approximate Viewable Area by Model and Distance from Port																
Model	Distance from IR Port in inches (mm)															
	6"			9"			12"			18"			24"			
	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	
IRP-_240	76	6	3	111	8	4	145	10	4	214	15	5	284	19	6	
IRP-_340	(191)	(15)	(8)	(282)	(20)	(10)	(30)	(25)	(10)	(544)	(38)	(13)	(721)	(48)	(15)	
IRP-_250	37	2	0	54	3	0	70	4	0	103	6	0	136	9	0	
IRP-_350	(94)	(5)		(137)	(8)		(178)	(10)		(262)	(15)		(345)	(23)		
IRP-_360	27	0	0	37	0	0	48	0	0	69	0	0	90	0	0	
IRP-_460	(69)			(94)			(122)			(175)			(229)			

The diagram consists of two parts. The left part is a top-down view showing a large square labeled 'LESS-THAN OPTIMAL VIEWING AREA'. Inside this square is a red dashed circle labeled 'OPTIMAL VIEWING AREA (C)'. At the center of this circle is a small red circle labeled 'NO VIEWING AREA (A)'. Surrounding the center circle is a red dashed circle labeled 'LESS-THAN OPTIMAL VIEWING AREA (B)'. Dimensions X, Y, and Z are indicated at the bottom left. The right part is a side view showing a 'MOUNTING PLANE' with a 'WINDOW SIZE' and a 'DISTANCE' from the 'PROJECTED VIEWING AREA ONTO VIRTUAL PLANE'. It shows viewing angles of 60° and 90°.

Note that the figure shows both optimal (60° angle) and less optimal (90° angle) viewing areas projected onto a virtual plane (representing the internal equipment) at specified distances based on the imaging device placed flat against the membrane (Note angling the imaging device will also expand viewing area). "0" means no "blind" area.

Lens Transmission Characteristics

The following graph shows the IR window attenuation relative to the wave length for the clear crystal lens and the opaque reinforced polymer lens. Note that the recommended lens is the reinforced polymer type which has excellent lifetime performance (> 25 years) and good transmission properties well into the Infrared long wave spectrum which matches modern IR imaging devices (cameras) which typically operate about 9.5 nano-meters but is opaque in the visible spectrum. The clear crystal lens does provide a visual view but is limited in the long wave spectrum, has a very limited life (become opaque in a few years) and is quite fragile (does not pass UL 746 impact but nevertheless is UL Recognized due to an explicit exception for this type of material); hence it is not recommended in industrial environments.



Installation

Guidelines

Successful application of the Rotatable IR Port requires both the selection of the right Model and the correct placement of the unit. The following notes may be helpful in the process:

- For use on a flat surface not less than 0.07" thickness on a Type 1 enclosure only
- Select the Recessed or the Flush Mount model noting that the recessed mount model is intended only for OEM applications
Note: More than one device may be required for large equipment assemblies with even the judicious application of fixed Windows to cover blind spots not viewable with a single Rotatable Port
- Identify the areas within the enclosure that require thermographic inspection and select the IRP model for the application noting the projected viewing area for each model from the provided data
- Select a suitable operator accessible spot on the enclosure (panels, doors, etc on the front sides or rear) to mount the device and check that the Rotatable Port can be positioned to "see" the required terminals/device
- The "Flush" mount model is used to avoid protrusion of the Port with the recessed model into the cabinet/enclosure which may compromise electrical clearances
- Minimum Clearances from Live Terminals to the Port assembly must comply with local electrical codes, eg. NEC (USA) or CE Code (Canada) with some examples summarized below:
 - Low Voltage to 600 V: 1" (25 mm):
 - Medium Voltage*: ≤ 4.16 kV: 3" (76 mm)
 ≤ 13.8 kV: 5" (128 mm)
 ≤ 23 kV: 7.5" (191 mm)
 ≤ 34.5 kV: 13" (330 mm)

**Note that the given clearances may need to be larger based on the required BIL of the equipment.*

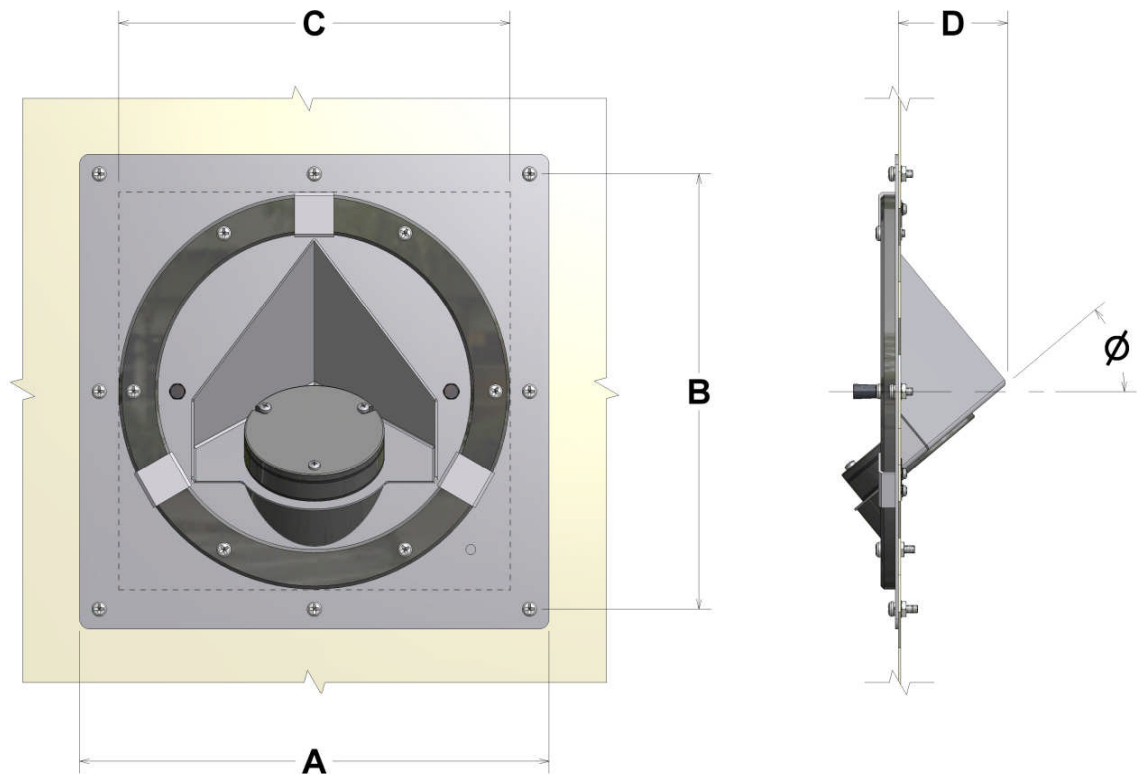
Mounting Dimensions

The following tables and figures detail the dimensional and mounting information for each IRP model. Refer to the specific model being employed.

Note the “_” refers to either the Reinforced or Clear viewing membrane but does not affect dimensions.

Table of Dimensions of Recessed Mounted Models (inches (mm), degrees)*

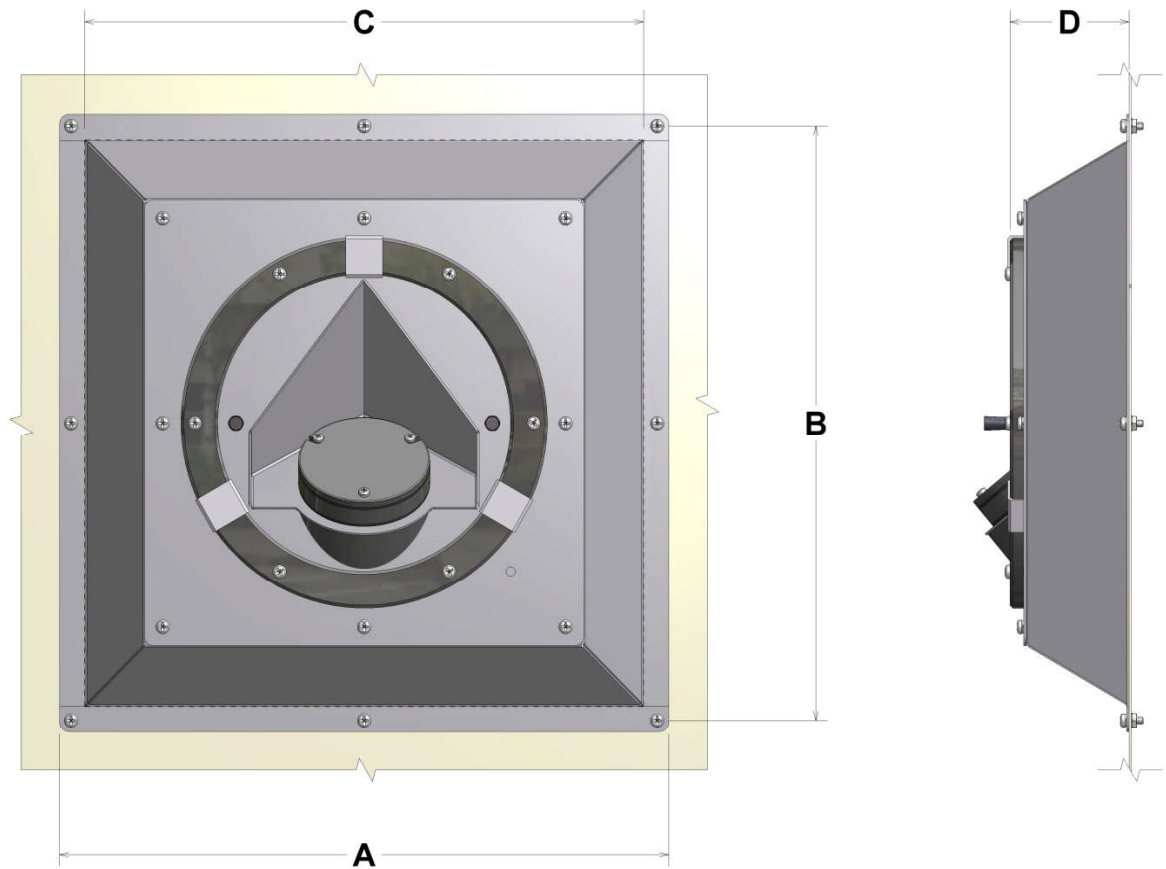
Models	A (Outside)	B (Screw centers)	C (Cut-out)	D (Depth)	Θ (Angle)
IRP-_240	12 (305)	11 (279)	10 (254)	2.8 (71)	40
IRP-_250	12 (305)	11 (279)	10 (254)	2.3 (58)	50
IRP-_340	14 (365)	13 (330)	12 (305)	3.6 (91)	40
IRP-_350	14 (365)	13 (330)	12 (305)	3.0 (75)	50
IRP-_360	14 (365)	13 (330)	12 (305)	3.1 (77)	60
IRP-_460	14 (365)	13 (330)	12 (305)	3.1 (77)	60



**Note: OEM applications only*

Table of Dimensions of Flush Mounted Units (inches (mm), degrees)*

Models	A (Outside)	B (Screw centers)	C (Cut-out)	D (Height)	Θ (Angle)
IRP- 250F	16.6 (422)	16 (406)	15.3 (387)	2.9 (73)	50
IRP- 350F	19.5 (495)	18.8 (476)	18.0 (457)	3.67 (93)	50
IRP- 360F IRP- 460F	19.5 (495)	18.8 (476)	18.0 (457)	3.67 (93)	60



**Note: Either Field or OEM applications*

Mounting

CAUTION



HAZARD OF ELECTRIC SHOCK OR ARC FLASH

Refer to and follow the "Safety Instructions" listed at the beginning of this manual before attempting any work on installed electrical equipment

CAUTION: FOR YOUR SAFETY: IT IS IMPERATIVE THAT POWER BE PROVEN DISCONNECTED BEFORE ANY WORK ON OR PHYSICAL CONTACT TO ELECTRICAL EQUIPMENT IS ATTEMPTED.

DO NOT ASSUME BUT CHECK ACROSS THE LINES AND TO GROUND WITH A SUITABLE METER AND ENSURE THAT THE SOURCE DISCONNECTION DEVICES ARE SECURELY LOCKED OUT.

The physical installation of the unit requires that a rectangular hole be cut in the enclosure wall at the required location and screw mounting holes drilled to match to IRP Model being applied and attachment with # 10 hardware provided.

The following details the procedure:

- Using the dimension tables identify the mounting dimensions for the model being used
- Remove target panel from the non-powered equipment if not already done
- Measure and cut-out to the required dimensions using appropriate tools
It is recommended that raw metal be protected by paint to avoid corrosion
- Mount the Rotatable Port using #10 hardware as follows:
#10 Screw with lock washer under head to IRP module, target panel then locknut
- Connect the Ground Stud to a suitable chassis ground point using # 10 cable prior to reinstalling the panel
Note: The ground wire may be omitted if the IRP is attached to a metallic panel using a toothed lock washer both under the screw head and under the nut
- Check the assembly is properly installed and rotates freely, then reinstall the panel
Note: It is recommended that a sketch or photographic be made of the internal equipment or a photograph taken indentifying the various components/features to be inspected for future reference

Operation

Operation of the unit essentially involves the placement of a suitable imaging device close to or against the viewing Window whilst rotating the Port through 360° to 'see' all points within the enclosure.

Note: It may be necessary to tilt the imaging device relative to the window surface to increase the viewing area if it does not have a wide enough viewing angle. For example, the calculations assume that the imaging device has a ± 30 degree viewing angle and a device with a ± 15 degree viewing angle will require an additional 15 degree tilt to achieve assumed viewing angle.

Detailed instructions follow:

- Open the viewing Window by unscrewing all four cover attachment screws three complete turns and slide the three toggle screws away from the cover then rotate cover counter-clockwise
- Examine the viewing Window membrane for any signs of visible damage prior to use
Note: Do not use a unit that is damaged but arrange a replacement before use
- Place Imaging Device close to or against the viewing Window and capture the image for the location
Rotate the Port and repeat for each required location to cover the complete view of the internal points required
- When finished imaging, close cover, re-engage screws and lightly tighten
This device is incomplete without the cover fitted in place when not in use

**Note: Refer to the transmission characteristics provided prior in this manual for transmissibility characteristics for the required correction factors.*

Maintenance

The unit is essentially maintenance free requiring no regular maintenance apart from removing excessive dust accumulation and checking the condition of the viewing crystal prior to use.

Recommended Checks

The following are recommended prior to and after each use:

- Prior to each use check the condition of the viewing membrane to ensure that it is undamaged and intact
- Ensure that the protective cover is secured in place when not in use

Note: Replacement viewing Windows are available from Powersmiths International; refer to contact information at the beginning of this document.

Certifications

The family of products are UL Recognized Components (per UL50) for US and Canada suitable for both OEM and Field installations (see appropriate models).



UL File: E329179