Optimal radiation protection for interventional radiology

PORTEGRA2 Systems
For many years, MAVIG has been the first choice for many practices and hospitals for ceiling support and radiation protection systems. The quality of MAVIG systems and their optimized design is suited for use in both hospital or radiological practices. The systems feature maximum safety and high flexibility.

The MAVIG life cycle testing ensures 100 percent quality of all products delivered. The products are furthermore UL and CE certified. MAVIG is ISO EN 13485-2003 certified by the TÜV product service.

The Portegra2 system is the innovative solution for the protection of the head, eyes, thyroid gland, upper arms and extremities from scattered radiation.
xsafety

designed by MAVIG
Maximum versatility with Portegra2

- Radiation Exposure 6
- Modular Units 10
- Safety 12
- Tracks 14
- Columns 18
- Support Arms 20
Effectively Reducing the Dosage

In recent years, the frequency and duration of diagnostic and therapeutic procedures in interventional radiography has increased dramatically. Along with these developments, the concern for radiation exposure, not only to the patient population, but also to physicians and medical staff routinely exposed to high radiation doses, has become a major issue.

Regarding radiation exposure to staff, the X-ray Ordinance, which does not apply for patients, requires compliance with body dose limit values. A distinction is made here between the limit values for the effective dose over the calendar year, partial body exposure, and the sum of the effective doses measured over all calendar years (work lifetime dosage).

The X-ray Ordinance specifies that, even below the limit values, the radiation exposure to staff must be minimized.

Minimum requirements ask for “permanently” installed equipment for the protection of staff who are exposed to radiation. Protective x-ray clothing only shields the torso, while the head and extremities remain unprotected. Wearing protective clothing, due to its inherent weight, also leads to the physical stressing of the person concerned.

As a rule, dosimeters are worn underneath the protective apron, so that the measured values remain low.

For partial body doses, however, the situation is different: (See results in graph).

Test setup: Utilizing a patient-equivalent Anderson phantom and assuming a fluoroscopy time of five hours per week with conventional angiography, including DSA series, distance from the central beam was 0.7 m (28 in.) and the field diameter 30 cm (12 in.). We present the results with the kind permission of the authors.
### Annual Dosage

#### Upper body

<table>
<thead>
<tr>
<th>with protective apron</th>
<th>without protective system</th>
<th>with MAVIG protective system</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25 mm Pb</td>
<td>20 mSv</td>
<td>4.8 mSv</td>
</tr>
<tr>
<td>0.35 mm Pb</td>
<td>10 mSv</td>
<td>3.8 mSv</td>
</tr>
<tr>
<td>0.5 mm Pb</td>
<td>5 mSv</td>
<td>3.2 mSv</td>
</tr>
</tbody>
</table>

#### Upper arm

<table>
<thead>
<tr>
<th>without protective system</th>
<th>with MAVIG protective system</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 mSv*</td>
<td>8 mSv</td>
</tr>
</tbody>
</table>
The results of the study clearly indicate that the permissible limit values for the head, the lens of the eye and the extremities were exceeded. Furthermore, the average fluoroscopy duration of five hours per week (assumed) is very low with regard to the intensive capacity utilization in modern radiology.

The installation of a suitable protective system (ceiling-suspended lead acrylic shield and lower body protection with shield) led to drastic reduction of exposure for the staff – the measured values confirm an exposure level well below the specified limit values!
With permanently installed and correctly used equipment (i.e. lead acrylic shield plus table-mounted lower body protector exposure for staff is minimized.

In selecting of the protective equipment, for the entire range of applications the most important criterion is the simple, safe and precise handling by the staff. Note: In an emergency, it is important that radiation protection equipment can be removed quickly – this requirement is well met by the MAVIG suspension systems.

In addition, for rooms in which a ceiling-suspended system can not be installed or for tables with no possibility for adaptation with under-table radiation protection, MAVIG offers several other product lines to help the staff effectively reduce the dosage.

**MAVIG x-ray protection system effectively reduces secondary radiation – to levels well below the specified limit values.**
GD75 dual monitor support, can be retrofitted for ceiling track 335

Ceiling track 335

Cable spooler

Radiation protection shields

Lamps

Portegra2 360° column with carriage (trolley)

Portegra2 Twin column with carriage (trolley)

Portegra2 extension-spring-arm combination

Radiation protection shields

Lamps
The modular System for every Application
Safety Features of the Portegra2 Systems

The Portegra2 system offers numerous safety features:

- One-piece, steel-manufactured ceiling column resists even the most violent impacts.
- Strengthened wall thickness at the mounting post
- Maximum load capacity of 18 kg (40 lbs.) on each mounting post
- Patented ceiling anchor
- Steel extension-/spring-arm, ensures high stability even after a collision

Attractively designed synthetic covers protect and blend in with surrounding equipment.

Patented by MAVIG:
The brake provides additional safety for track-guided systems. During the intervention, the system always remains at the required position. The brake rod linkage is an additional anchoring on the carriage and secures the system. Stationary systems are equipped with an additional safety chain, securing ceiling suspension – even after a collision has occurred.

Other related features:

- UL listing and CE certification
- User-friendly smooth-edge design
- Extended spring arm load ranges
- Easy spring tension adjustment

Smooth running
The system can be easily and precisely positioned wherever needed.

MAVIG Portegra2 360° column
The lower post allows 360° rotation. The upper post is electrified and allows 330° rotation.
SAFETY

Many years of experience and development work have gone into the precise safety features of the Portegra2 system. Installation and use remain as simple as ever.

Covers
Plastic covers absorb the impact energy in case of a collision with other equipment.

Patented by MAVIG:
The improved MAVIG spring arm with internal steel cable and defined fracture points provide maximum safety, even after many years of hard use.

Patented by MAVIG:
A safety collar prevents loosening of the connection. The patented internal safety spring prevents fatigue of the connection and ensures smooth performance over many years.

Patented by MAVIG – second level lock:
an innovative safety notch prevents undesired loosening of the adapted components.

Safety
MAVIG life-cycle testing before market launch ensures the highest level of safety. Our tests simulate all conceivable routine situations and clearly exceed the criteria of standards set for the industry.
**Cable holders**
Cable holders keep the cables of the accessory equipments where it should be.

**Mobility**
The carriage travels smoothly over the entire length of the ceiling track.

A built-in brake reliably holds the adaptive components where needed.

**Cable spooler**
The automatic cable spooler is used with lamps. Cables are neatly rolled out and up, according to where the system is positioned within the ceiling track.
The Versatile Ceiling Track

The MAVIG ceiling track has set a new standard for system supports in hospitals and radiological practices. Wherever ceiling-guided accessories, such as radiation protection shields, lamps, injectors or other equipment are utilized, MAVIG ceiling tracks are used – worldwide.

The ceiling track is nearly universal. The unique profile structure ensures the smooth running of the carriage, while adjustable cross-struts simplify the system installation.

Medical staff and patients benefit from the flexibility in the positioning of the systems. Without physical effort, the system can be positioned and, in case of emergency, quickly removed. The carriage will always glide smoothly, even after many years of hard routine use.
Installation:
Thanks to adjustable cross-struts, the MAVIG ceiling track can be installed easily.

Uniquely calculated construction of the patented ceiling track ensures greater stability of the aluminium profile.
Maximum Safety and High Flexibility

Various accessories can be combined using several carriages in one MAVIG ceiling track.

MAVIG ceiling tracks are available in lengths of 250 cm (98 in.) and 400 cm (157 in.). Other lengths can be individually manufactured upon request.
Brake
Standard for all support systems with carriage. Holds the carriage in a fixed position inside the ceiling track. Provides additional safety for the application.

Portegra 2 360° column with carriage (trolley)
360° rotation at the lower post. Upper fixed post electrified. Load capacity 18 kg (40 lbs.) each.

Portegra 2 Twin column with carriage (trolley)
One electrified post, one standard post at the same height. Load capacity 18 kg (40 lbs.) each.

Columns for installation in MAVIG ceiling tracks

Solid for Maximum

Many years of development have lead to MAVIG’s unique steel-construction columns. The well proven construction,
Construction Safety

sturdy design and numerous tests ensure the highest level of safety available.

MAVIG Mounting plate
Enables simple installation between two unistrut® supports, or directly to the ceiling. Dimensions: 40 x 70 cm (16 x 28 in.).
For a Wide Range of Applications

The MAVIG Portegra2 support arms offer maximum flexibility. Radiation protection shields, lamps, monitors, injectors and other accessories can be attached and positioned as required. The high-quality, stable system is therefore optimally designed for use in hospitals and radiological practices.

The extension-/spring-arm combination offers a new range of load-bearing capacities. Fine adjustments to the components is possible with great precision. This larger range of movement is a result of the length of the extension arm, 75 cm (30 in.), and the length of the spring arm, 90 cm (36 in.).

<table>
<thead>
<tr>
<th>Load Capacities of the Spring Arms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 to 3.5 kg (2.0 to 8.0 lbs.)</td>
</tr>
<tr>
<td>3.5 to 7.0 kg (8.0 to 15.0 lbs.)</td>
</tr>
<tr>
<td>7.0 to 12.0 kg (15.0 to 26.0 lbs.)</td>
</tr>
<tr>
<td>12.0 to 18.0 kg (26.0 to 40.0 lbs.)</td>
</tr>
</tbody>
</table>
The extension-spring-arm combination offers both numerable heights and turning circles for any kind of situation.

A sophisticated safety collar with patented features provides enduring performance and, if requested, a 360° rotation block.

Patented:
an internal steel cable and defined fracture points provide maximum safety, even after many years of hard use.

Shock-absorbing covers provide protection from impact of collision.

The dimensions and angles of movement provided by the support arms ensure that x-ray protection and other devices can be optimally positioned at all times.

All dimensions are in mm
Easy and Simple Operation for Safe X-ray Protection

All lead acrylic x-ray protective shields have a lead equivalent of 0.5 mm. Not only do they provide optimized protection, their elaborate safety features are also very impressive.

Our shields provide excellent high-optical transmittance. Rounded corners & edges and shatter-proof construction minimize the risk of injury. In an emergency, the shields can be removed quickly and easily.

A safety lock provides additional safety, preventing unwanted separation of the shield from the spring arm.

The specially developed MAVIG connecting element provides tested performance during the entire life cycle.

The radiation protective shield can be guided smoothly, and positioned with the handle. The handle is height-adjustable, removable and can be sterilized.
The shield is bearing-mounted, allowing it to be rotated and adjusted to many angles.

A disposable gamma-sterile cover to be placed around the radiation protective shield with patient contour cutout is also available.
PT 6290/6272
Lead acrylic shield, 61 x 76 cm (W x H) (24 x 30 in.), lead equivalent 0.5 mm, centrically guided by connecting element, shield with patient contour cutout for positioning over the patient.

PT 6290/6272 with additional protective strips

PT 6262 A
Laterally guided lead acrylic shield, lead equivalent 0.5 mm, flexible radiation protective strips encased in hygienic covers. Available in sizes: 30 x 40 cm (W x H) (12 x 16 in.), 40 x 50 cm (W x H) (16 x 20 in.), 35 x 76 cm (W x H) (14 x 30 in.)
**Versatile Protection**

The high-quality lead acrylic shields are centrically mounted in six different versions or laterally mounted as standard. Other sizes are available upon request.

**PT 6294/6274**
Lead acrylic shield, 40 x 50 cm (W x H) (16 x 20 in.), lead equivalent 0.5 mm, centrically guided via connecting element

**PT 6272/SHB**
Laterally guided lead acrylic shield with patient contour cutout, 76 x 61 cm (W x H) (24 x 30 in.), lead equivalent 0.5 mm

**PT 6294/6274 with additional protective strips**
Modern technology enables optimal examination and operation conditions: plastic depth illumination, daylight characteristics, reduction of heat dissipation to an absolute minimum, high-contrast RA 96 color reproduction, and recognition of the finest color nuances in tissue.

Computer-optimized reflector system
Computer-designed biconvex scatter lenses with microstructure, together with the reflector system, enhance the contrast effect of the OR lamp and ensure homogeneity and the lowest possible modeling in the illuminated fields.

Ease of maintenance and simple handling
The lamp housing can be opened with only a few grips. You can access all system components and, thanks to their modular technology, replace them without problem. Light bulbs can be changed in only seconds! The operation of all lamp functions is optimally integrated and simplifies daily routine.

Streamlining
The streamlined form of all lamp housings and the minimum surface area prevents the accumulation of heat in the head area.
The lamps are optionally available with a removable and sterilizable handle.
Focusing (M130F, M2 and M3DF)
When focusing, an exact adaptation of the light field is made to the size of the wound field in order to obtain optimal point-wise depth illumination. The user-friendly focusing is done by rotating the collar on the lamp's handle.

Cold-light
Dielectrically coated cold-light filters and cold-light reflectors reduce heat emission in the head area of the operator, and reduce temperature-rise in the illuminated wound field to a minimum.

Outstanding color reproduction = R96 light system
With a previously unobtainable color reproduction (Ra = 96 and R9>90), you can now effortlessly recognize the finest color nuances in tissue, especially within the colors red and yellow. The color spectrum of the wound field is displayed naturally and with high contrast. This means visibly better detail recognition.

Light field convergence (M3F and M3DF)
The illuminated fields of the separate reflectors converge to show the entire illuminated area. The illuminated fields overlap by rotating lamp's handle.
## Technical data M130F

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Illuminance (Lux)</td>
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<tr>
<td>Color rendering index R(a) at 4300 Kelvin</td>
<td>96</td>
</tr>
<tr>
<td>Color rendering index R(9) at 4300 Kelvin</td>
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<tr>
<td>Focusable illuminated section size</td>
<td>140-250</td>
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<tr>
<td>Color temperature (Kelvin)</td>
<td>4300</td>
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<tr>
<td>Radiation intensity in field at 100,000 Lux</td>
<td>370 W/m²</td>
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<tr>
<td>Total power input</td>
<td>50 VA</td>
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<td>Number of light elements: halogen 22.8 V/24 V</td>
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<tr>
<td>Working range (mm)</td>
<td>700-1400</td>
</tr>
</tbody>
</table>

## M130F – Uniflex R96
Examination lamp for diagnosis and minor surgery

Power supply: 230 V, 115 V or 24 V.
Internal converter with 230 V and 115 V.

## Technical data M2F

<table>
<thead>
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<th>Parameter</th>
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<tbody>
<tr>
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<tr>
<td>Focusable illuminated section size</td>
<td>140-240</td>
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<tr>
<td>Color temperature (Kelvin)</td>
<td>4300</td>
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<tr>
<td>Radiation intensity in field at 100,000 Lux</td>
<td>170 W/m²</td>
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<tr>
<td>Temperature rise in head area</td>
<td>2° C</td>
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<tr>
<td>Total power input</td>
<td>80 VA</td>
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<tr>
<td>Number of light elements: halogen 22.8 V/24 V</td>
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</tr>
<tr>
<td>Working range (mm)</td>
<td>700-1400</td>
</tr>
</tbody>
</table>

## M2F
Examination lamp and small OR lamp

Power supply: 230 V, 115 V or 24 V.
External converter with 230V and 115 V.

## Technical data M3F M3DF

<table>
<thead>
<tr>
<th>Parameter</th>
<th>M3F</th>
<th>M3DF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illuminance (Lux)</td>
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<td>130.000</td>
</tr>
<tr>
<td>Color rendering index R(a) at 4300 Kelvin</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>Color rendering index R(9) at 4300 Kelvin</td>
<td>&gt;=90</td>
<td>&gt;=90</td>
</tr>
<tr>
<td>Focusable illuminated section size</td>
<td>170-280</td>
<td>120-300</td>
</tr>
<tr>
<td>Color temperature (Kelvin)</td>
<td>4300</td>
<td>4300</td>
</tr>
<tr>
<td>Radiation intensity in field at 100,000 Lux</td>
<td>370 W/m²</td>
<td>370 W/m²</td>
</tr>
<tr>
<td>Temperature rise in head area</td>
<td>2° C</td>
<td>2° C</td>
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<tr>
<td>Total power input</td>
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<tr>
<td>Number of light elements: halogen 22.8 V/24 V</td>
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</tr>
<tr>
<td>Working range (mm)</td>
<td>700-1400</td>
<td>600-1500</td>
</tr>
</tbody>
</table>

## M3F or M3DF
OR lamp with three reflectors

Power supply: 230 V, 115 V or 24 V.
External converter with 230 V and 115 V.
Fast and Simple Positioning

The Portegra2 system features high loading capacity. It offers great mobility, as many devices can be securely suspended from the ceiling, thus eliminating annoying and dangerous stumbling hazards.

The world’s leading manufacturers of injectors rely on MAVIG support systems. Customized ceiling supports offer the right solution for every application.
GD4020 single LCD holder
Flexible holder for an LCD display.

Variable adjustments allow wide angles of inclination.

In the event of collisions, the monitor retracts.

The GD75 dual monitor support can be retrofitted into the ceiling track.
Lower body protection systems are an integral part of every radiation protection concept for interventional radiology. They reduce secondary radiation substantially. Optimal protection is ensured only with the combination of ceiling-suspended radiation protection and lower body protection with upper shield. The ceiling-suspended system and the examiner’s shield then protect the examiner against secondary radiation emanating from the body of the patient. The lower body protection absorbs radiation underneath the table and shields the lower extremities and genital area of the examiner.

When the table is tipped, the strips compensate for this and ensure optimal protection at every angle of inclination.
Thanks to numerous buttons, the length of the strips can be adjusted individually.

The hygienic pouch can be easily handled.

For tables not permitting lower body protection adaptation via accessory rails, MAVIG offers special solutions.

MAVIG’s mobile solutions can be used where tables do not allow direct fixture (see pp. 36ff.).
UT60
The UT60 is comprised of two separate parts or two parts to be used in conjunction with each other: the protection adapter at the table column and the swiveling components, which adapt to the table’s angle of inclination.
- overlapping flexible radiation protection strips in hygienically pure cover
- lead equivalent 0.5 mm

UT68
The UT68 has the same specifications as the UT69, but without the intermediate articulated joint and additional lateral lead strips.

UT69
The UT69 offers maximum flexibility and protection, thanks to the intermediate articulated joint and additional lateral lead strips. The shield can be removed quickly in case of emergency or for comfortable patient positioning.
- overlapping flexible radiation protection strips in hygienically pure cover
- lead strips height 90 cm (35 in.)
- width 65 cm (25 in.) + 17 cm (7 in.) (additional strips)
- two shields, with 17 cm (7 in.) or 25 cm (10 in.) height
- lead equivalent 0.5 mm
- practical wall fixtures included
Mobile Protective Shields for

Lead acrylic glass

The modern material offers optimal transparency. Compared with conventional lead glass, it’s highly shatter-proof which dramatically reduces the risk of injury in case of a breakage. All lead acrylic shields from MAVIG have a lead equivalent of 0.5 mm.

WD300

The slightly curved shield impresses with its distortion-free vision and its fit, which perfectly merges with the anatomy of the examiner.

WD308

The rectangular lead acrylic shield is available in any required height. Custom widths are also available upon request.

The shields are constructed of lead acrylic glass and transparent over the entire height.

WD300

The form and height of the cutouts can be ordered to meet individual requirements.

WD308

High security against tilting, thanks to sophisticated, static base legs.

WD308

Sleek design saves space and prevents stumbling hazards.

WD300

The unique shield is especially suited for applications in interventional radiology.

WD300

The slightly curved lead acrylic shield is suited to the body’s shape and offers maximum mobility.

WD308

The cutouts can easily be covered with lead rubber strips. This offers a shield with continuous radiation protection.
Flexible Use

The lead acrylic shields are available in any height required.
The mobile lower body protection is used when under table radiation protection is required, although the table does not offer any option for accessory rails.

Overlapping flexible strips ensure optimal protection and extend the operating range of the examiner.

High variability thanks to the removable shield.

Stable base legs offer the examiner a large operating range and require very little space.

The sleek and maneuverable system is statically secure and offers lots of space.

WD306
This model is optimally designed for spatial shielding. Available in larger widths to meet customer requirements.

Stable grips simplify the handling.

WD260
The lower body protection functions perfectly together with the ceiling-suspended radiation protection equipment.

WD260
Stable grips simplify the handling.
The mobile bed screens can easily be moved by anyone, especially helpful in neo-natology or intensive care wards. This versatile screen efficiently reduces exposure to secondary radiation. A spring-driven support simplifies height adjustment. The MAVIG protective material is flexible, which prevents damage, even in case of collisions.
WD255
This economical solution is an ideal workplace shielding. The wall is available with or without viewing window, e.g. with a 30 x 40 cm (12 x 16 in.) lead glass panel. Available in different widths and heights.

WD257
A classic model in interventional radiology: the lead acrylic glass panel is easily height-adjustable and retracts almost completely inside its steel base.

Lead equivalent:
Steel body: 1.0 mm
Lead acrylic glass: 0.5 mm

Dimensions:
Steel body:
width 78 cm (31 in.), height 107 cm (42 in.)
Lead acrylic glass: width 70 cm (27.5 in.)
Overall height: 115 cm (45 in.) to 190 cm (75 in.)

WD257
The WD257 shield is height-adjustable between 115 cm (46 in.) and 190 cm (75 in.).

WD257
Sleek construction and stable base legs save space and ensure safety.
**WD302**

The out-adjustable shield with contour cut can be placed over the body of the patient, effectively reducing secondary radiation emanating from the patient’s body.

**Dimensions:**
- Steel body: width 77.5 cm (30.5 in.), height 90 cm (35 in.)
- Lead acrylic glass: width 70/110 cm (27.5/43.5 in.)
- Overall height: 140 cm (55 in.) to 190 cm (75 in.)

**WD304**

The mobile radiation protection has the same characteristics as the WD302 shield. In addition, it offers an under-table protection consisting of flexible overlapping radiation protective strips with a lead equivalent of 0.5 mm.

**Dimensions:**
- Steel body: width 77.5 cm (30.5 in.), height 79 cm (31 in.)
- Lead acrylic glass: width 70/110 cm (27.5/43 in.)
- Overall height: 135 cm (53 in.) to 165 cm (65 in.)
- Strips: width 50 cm (20 in.), height 64 cm (25 in.)
**A**

- Flange diameter: 150 mm diameter
- Max. load-bearing capacity: 18 kg (40 lbs.) (depending on spring arm)
- Max. net load: 18 kg (40 lbs.) (depending on spring arm)
- Max. 13 kg (29 lbs.) weight (depending on length of column)
- 10 kg (22 lbs.) weight

**B**

- Flange diameter: 150 mm diameter
- Max. load-bearing capacity: 18 kg (40 lbs.) (depending on spring arm)
- Max. net load: 18 kg (40 lbs.) (depending on spring arm)
- Max. 13 kg (29 lbs.) weight (depending on length of column)
- 10 kg (22 lbs.) weight
- 10 kg (22 lbs.) weight
Legend
A Portegra2 ceiling column with extension-/spring-arm
B 360° Portegra2 ceiling column with extension-/spring-arm
C MAVIG ceiling track 335
D Portegra2 Twin ceiling column and 360° column (with carriage or stationary mounting)
E Drill scheme for Portegra2 stationary column
F Portegra2 extension-spring-arm mobility

Example of column height
All dimensions are in mm
1 inch = 2.54 cm