



AQUATICA™

Digital

Learn more about ports

Learn More about Ports:

The following document is intended to shed some light on the sometimes-confusing quest for the correct type of port to use with certain lenses or in certain photography scenarios.

There are two types of ports that are used in underwater photography – flat and dome ports. Both come in various diameters or lengths and both have specific duties to perform. With a total of seven ports at your disposal, the Aquatica port system is prepared for any task at hand. However, traveling with that many ports would be unrealistic, so a careful examination of your needs will help sort out the best port options for you.

While many interesting lenses are available for use in underwater photography, in most instances a single flat port and a dome port will be sufficient for handling lenses from a 4.5mm fisheye to 200mm macro lens, even with accessories mounted on them. This is accomplished by inserting extension rings between the port and the housing, which is explained thoroughly in the “Extensions” section of our website.

For our investigation of ports, let's start with the senior member of underwater photography, the flat port. The flat port is by far the oldest type of port and the very first images taken underwater were made through a port with a flat lens. In a nutshell, a flat port works on the same principle as a regular diving mask, a flat lens with air space on one side and water on the other. This flat lens becomes a barrier element between two mediums of different density, which in turn, creates refraction. In layman's terms, it acts as a magnifier, giving roughly a 25% bigger image or narrower field of view if you prefer (see illustration # 01). This refraction phenomenon is what was tricking us into thinking that our subjects were bigger and/or closer than they were in reality the first time we went underwater wearing a mask (remember this little detail when positioning your strobes, (for more info read the [learn more about strobe arms](#) in the TLC section). Refraction in itself is not all that bad when shooting with a macro lens since it does give you magnification, a welcome feature when shooting close up images. This extra magnification can also translate in a longer working distance, which will be appreciated by shy critters.

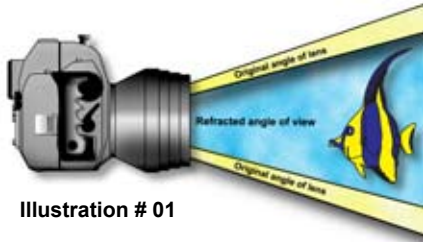


Illustration # 01

Aquatica offers three different flat ports, all of which have the same flat frontal glass element made of BK-7 coated glass. Therefore, all have the same optical performance and all three can be matched to various extension rings. Of the three macro port, only one, the # 18426, on the far left has a focusing knob, a useful feature in low visibility or when working at very high magnifications. When teleconverters, diopters or extension tubes are mounted on the lens, they increase magnification dramatically, but have a tendency to lower the performance of any autofocus system.



Even though today's cameras keep improving their autofocus systems with every generation, it is still a good idea to equip yourself with a proper focusing light. A focus light will enhance the AF performance of any camera when shooting the typical macro scene by lighting up the low contrast area. Additionally it will make framing and if needed, manual focusing, much easier. the Aquatica Aqua View finder seen here on a housing, will help greatly in these critical focusing situations as well.



While refraction magnification is appreciated when you are trying to achieve close up images, it is not so welcome when the goal is to capture images of large expanses, such as a whole reef, large animals or shipwrecks. Having an expensive ultra wide angle lens' field of view and performance reduced does not thrill anyone. **(See illustration # 02)**

This is where the hemispherical dome port comes into play. When such a port is immersed in water, the difference between the air space inside the dome and the curved surface in contact with water will form a natural optical element called a Plano Concave as seen in **illustration # 03** this type of optical phenomenon has a very practical perk, it's the ability to maintain the original field of view of the lens behind the dome. As a side effect, it also creates an optical image that will end up being projected fairly close in front of the dome **(See dome virtual image illustration # 04)**. In other words, a subject which would physically be a few meters away would suddenly appear to the camera (not to you) as almost right in front of the camera housing, so your lens will need to be able to focus at that now very, very close image. Say, for example, you are using our ever popular 8" diameter dome port. With this port, the projected image would hover around 16" from where your camera sensor is, which explains why some lenses struggle behind a dome underwater, since not every lens has the capability of focusing at such close distances. When focusing this close with a lens is not possible, a close up lens (AKA diopter) should be used to allow the lens to focus closer.

This brings us to another set of important questions about dome ports: What effect does diameter size have on the port and how can I select the ones that is right for me? Well the truth of the matter is that the smaller the diameter of a dome, the closer the virtually projected images will appear to the camera, and the lens behind the dome will need to be able to focus at that closer distances. Additionally, the closer you are to a subject, the less depth of field you have to bring everything in sharp focus. That said the smaller a dome the easier it will be to pack in your suitcase, so you must prioritize what is important to you before selecting your port.

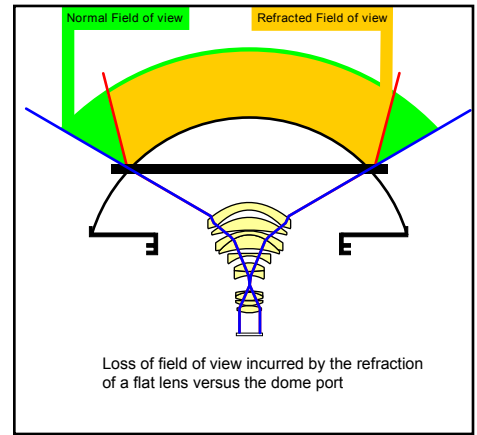


Illustration # 02

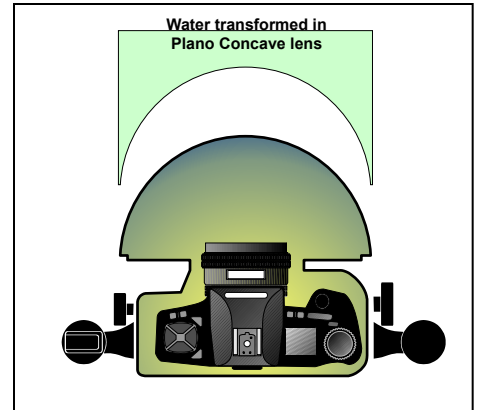


Illustration # 03

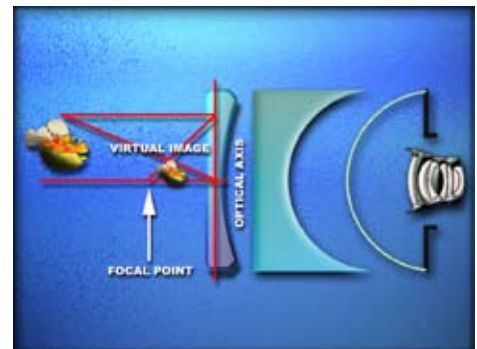


Illustration # 04

Two types of materials are used for the optical lenses of domes; mineral BK-7 glass or optical grade acrylic. A glass port has a higher transmission index and is much tougher to scratch than acrylic. It is also coated for both protections from reflections and from abrasions. Acrylic is much more economical, and, its material density is fortunately, close to being the same as water. This means that, while more susceptible to external abrasion marks, the marks are unlikely to show up in the picture as they will fill up with water and all but the deepest and largest of scratches will blend in with the water. Acrylic can also be polished easily in the field with popular off the shelf Acrylic polishing products.

As you can see there are pros and cons for each material. No matter which size or material you decide to go with, remember that all domes can be used in conjunction with extension rings to relocate the optical center of the dome with that of the lens when used at its widest position.

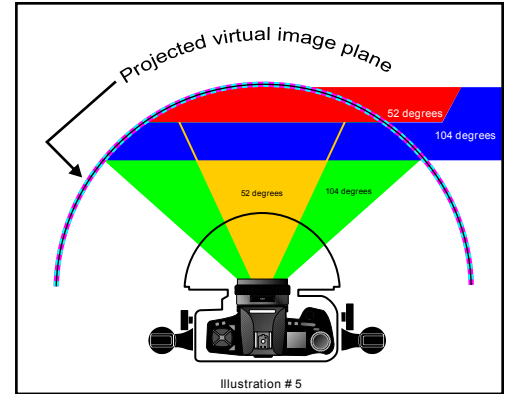
Wide angle lenses can be separated in three categories, fisheye lenses, ultra wide angle lenses, and moderate wide angle lenses. Fisheye lenses, due to their peculiar optical formula that give up to 180 degree field of view are simple to put behind a dome because the curved images they give lend themselves to the principles of dome port optics. The rectilinear ultra wide angle lens of 90 degree field of view and plus are the most demanding when it comes to port selection, the field of view of these super wide lenses require tremendous depth of field to bring the virtual image in focus, the closer is a virtual images, the closer the lens need to focus and the more difficult it becomes to get the curved virtual image in sharp focus across the plane.

A traditional lens is designed to focus on a flat plane, the curved nature of the virtual image is what makes it difficult to render properly on the sensor, the larger the dome, the further located the virtual image will be, and the less depth of field will be required to get the whole image area sharp.

Lastly, we have the moderate wide angle lenses of less than 90 degrees of field of view, these lens will behave properly behind somewhat smaller domes simply because their narrower field of view makes it easier to get the proper depth of field (*see illustration # 05*) In this illustration you can see that the moderate wide angle with only 52 degrees of field of view does not require as much depth of field (*the red area*) as the super wide angle with it 104 degrees of field of view (*blue area*).

It is useful to note that the larger domes will accommodate pretty much all types of wide angle and fisheyes lenses, while the smaller domes require specific lenses.

The 9.25" Megadome port is our largest port with a 9.25" / 235mm diameter. The BK-7 mineral glass used in its construction gives it maximum light transmission, and it is coated both for resistance to scratches and against reflections. A large dome diameter is welcome when using rectilinear ultra wide angle lenses, especially when used with full frame cameras, because the image is projected at a longer distance than it would on smaller dome and this improves the images corner drastically.



Larger domes are more efficient in getting over/under photographs. Since the virtually projected images is located further away, attaining the proper depth of field required to make the image sharper from front to back is much easier. In the case of the glass domes, water droplets will shed much faster than they would on an acrylic dome port, consequently lowering the chances of getting the pictures ruined by remaining droplets on the surface of the dome.

The 8" dome port, our longest active port at AQUATICA, is made of optical grade acrylic and has proven its value time after time since its introduction over a quarter of a century ago. Wide enough to accommodate the widest of rectilinear lenses, its economical price and ease of maintenance in rugged environments makes it our best selling dome port. It remains a good contender for over/under images due to its large diameter. The optional dome shade can be easily removed to accommodate a radical 180 degrees circular fisheye. This is the recommended dome for ultra wide angle, but will also accept and yield excellent images with moderate wide angle and fisheye lenses as well.

The 6" dome port is a compact dome port made of optical grade acrylic, designed to accommodate moderate rectilinear wide angle lenses. Like the larger 8" dome, it's very economical and the ease of maintenance in rugged environments makes it popular with the travelling photographer. The over/under type of images are more difficult to achieve with this smaller port than with the 8", and when shooting them you are somewhat restricted to fisheye lenses. However, fisheye lenses are by no means limited to shooting over/under images, and can be used to shoot exceptional wide angle images underwater. The dome shade is removable, which allows lenses as short as a 4.5mm circular 180 degrees fisheye to be used without obstruction. The 6" dome is also a smart choice for an entry-level photographer, as it will accommodate most of the moderate kit lenses that come with a camera, as well as the fisheye lenses.

The Minidome 100 is a 4" dome port made of BK-7 mineral glass and is coated against reflection and protected against scratches. Designed to take full advantage of the close focusing capability of the modern fisheye lenses, its diminutive frontal signature means that you can move in closer to your subject and subsequently be able to better position your strobes for lighting at such close quarters. The small diameter also makes it a highly specialized port that is designed to be used exclusively with fisheye lenses. This small dome port can be coupled with a port extension ring to accommodate a fisheye lens equipped with a teleconverter. This unorthodox approach takes advantage of the extreme close focusing ability of the lens, and the magnification added from the teleconverter coupled with the immense field of view still available at close distances, gives a forced perspective of the subject that results in dramatic images.

So, to recap, remember that a larger radius dome will behave much better with ultra wide angle rectilinear lenses than smaller domes will, medium sized dome ports are better suited for less extreme lenses, and that small domes are really meant to be used exclusively with fisheye lenses. As for a flat port, remember that the water conditions and the magnification of the lenses used will define whether or not to select a flat macro port with manual focusing capability.

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