

Auto Mechanic Borescopes

Benefits and Characteristics



Oasis Scientific

[A Brief History of Borescopes: Page 1](#)

[Articulating Borescopes: Page 2](#)

[How to Choose an Articulating Borescopes: Page 3](#)

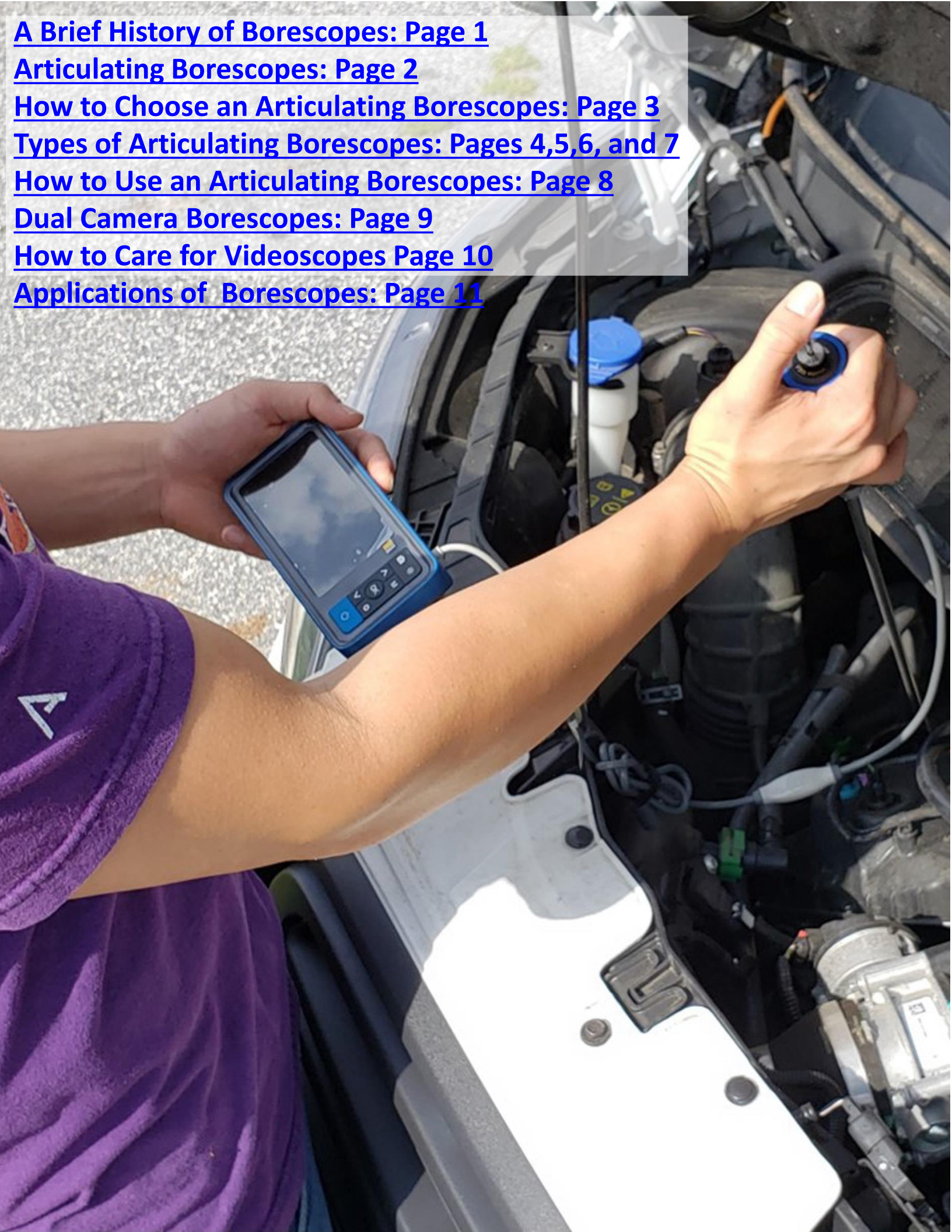
[Types of Articulating Borescopes: Pages 4,5,6, and 7](#)

[How to Use an Articulating Borescopes: Page 8](#)

[Dual Camera Borescopes: Page 9](#)

[How to Care for Videoscopes Page 10](#)

[Applications of Borescopes: Page 11](#)



Borescopes: A Brief History



Throughout the years, people have tried to modify their borescopes to view angles that they normally could not see with forward facing cameras.

Mechanics would use 90 degree dental cameras, manufacturers of scopes would add mirror attachments, and dual cameras were made which featured a second camera on the side of the probe. What was needed was a camera that could be bent back to “look over the shoulder” inside enclosures, and to offer a more complete and panoramic view for the inspection.

Articulating Borescopes are a newer addition to videoscopes and were created to solve problems that your standard borescope could not.

Initially many articulating borescopes were used as endoscopes in the medical industry, and eventually became available for industrial use. Earlier models had limited bending radiuses and were often very expensive. A borescope was generally considered an investment, and something only companies and organizations could buy and pay to have maintained. Nowadays, they are a consumer product and affordable to individuals. Technological advances have improved the camera’s functions, and image quality. Varieties in design, length, size, and function now provide an articulating borescope for almost any application.



Articulating Borescopes



articulate verb

ar·tic·u·late |

är-'ti-kyə-,lāt

to become united or connected by
or as if by a joint

angulate verb

an·gu·late

aNGgyə,lāt

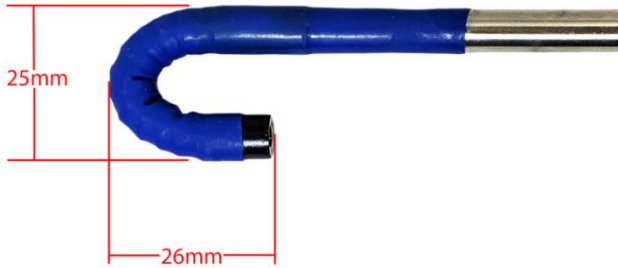
hold, bend, or distort (especially a
part of the body) so as to form an
angle or angles. Used as a
technical term in some cases.

An articulating borescope (i.e. angulating borescope, bending borescope, steerable borescope, pivoting camera) is an inspection optical device or video camera equipped with a bendable probe tip. The probe tip can be controlled to point or bend to different directions. This is a huge advantage when a technician or engineer wants to inspect tight and hard-to-reach areas inside a complex structure, such as automotive and turbine engines, or HVAC units.



How to Choose an Articulating Borescope

When searching for an articulating borescope for your applications, one should pay attention to the following technical specifications and features to make sure that borescope will meet your needs.



Diameter of the probe (from 2mm to 14mm)

Length of the probe

Focus range of the probe camera

Field of view (FOV)

Bending directions

Maximum bending angles

Bending radius

Lighting of the probe

Materials of the probe camera and insertion tube

Display device or/and video output methods

Picture

Pricing for high-quality, lower cost borescope range: Sorted by bending directions. The prices range from \$200 to \$10,000 depending on probe diameter, articulation ability, display etc.



Types of Articulation Borescopes

We can classify articulating borescopes into four types according to how many directions the probe tip can bend to:

One-Way Articulation Borescopes



A one way articulating borescope bends in one direction, and would require rotation or manipulation for viewing at different panoramic degrees. Sometimes a swivel control can provide this type of sweep for multiple viewing angles.



Two-Way Articulation Borescopes

Two Way Articulating Borescopes turn back in two opposite directions. Manipulation or swivel controls can also be featured on borescopes for more maneuverability.

Four-Way Articulation Borescopes

Four Way Articulating Borescopes bend back in four directions and give you a north, south, east, and west bend.



Joystick Borescopes

Joystick Borescopes (All-Way Articulation)

All way articulation borescopes are usually joystick controlled and can bend back and sweep and any angle.



Manual mechanical joystick articulation borescopes

Electrical motorized joystick articulation borescopes

MANUAL AND MOTORIZED ARTICULATING BORESCOPIES

Manual Articulation Borescopes have a cable that extends the length of the borescope probe. Depending on what direction you pull the joystick, the corresponding cable will be pulled in response, articulating the camera tip. This type of articulation gives you a more hands-on control of the articulating as you can feel the torque or force being applied as one controls the angle within the enclosure. This type of articulation is more ideal for shorter length probes, normally shorter than 3 meters. Disadvantages to this type of articulating instrument is that if there is a break anywhere in the cable, articulation operation can be affected directly.

Electrical Motorized Articulation Borescopes are driven by radio or microcontrol to the servo (robotically and remotely controlled tip). A signal from the control center or handle sends a signal to the camera tip controlling the articulation. The advantage to this is that there is not a lot of strain to the probe as there is no manual strain (from a pulley system, etc.) to the probe with the exception of the articulating tip.

Mechanically driven borescopes can also provide articulation for probes that are much longer in their probe length due to they do not need stress on the cable to turn them back. Disadvantages would be that function would rely on the health of the tip and the lifespan of the radio control and articulation in the tip itself. In addition, one cannot physically “feel” the stress of the probe as you can with shorter probes with manually controlled probes, making stress on the probe by the user undetectable. A mechanically-controlled probe would be more ideal for more intricate, smaller diameter, extended length probe applications.

In either Motorized or Manual, or regardless of the degree of articulation, it is important that the operation of the borescope is done gently to ensure the short and long-term life of this instrument. Borescopes are made to be durable but given electronic, camera, and delicate parts, are considerably more delicate than the standard set of tools in your kit.

- **Battery Life:** If your borescope is a stand-alone unit, you must consider your battery life. Most borescopes either have a rechargeable lithium battery, disposable batteries, and in some cases, both which control different components. Make sure your equipment is charged, changed according to the instructions prior to each use.
- **Diameter and Length:** The diameter of your borescope is important when considering the size of the enclosure's entry point the maximum bending angle should be considered when calculating how much the probe can be bent within an enclosure. Of course, length should be considered when knowing how far you need to extend inside a subject of inspection. Always consider your application and stay below your entry point and bending angle, but also consider that it is better to not go to far below those parameters. Smaller diameter and longer lengths present challenges with camera size (visual quality and lighting), as well as more delicate parts, and compromises in user-friendly control. Longer probes are more difficult to maneuver.
- **Rigid / Flexible Probe:** Borescopes can also be characterized by the flexibility of their probes. Most articulating borescopes are flexible, but there are some are exceptions. While having a hard rigid shaft, they may have a flexible tip that articulates. Some challenges arise for flexible borescopes in more open enclosures where rigidity is required, but this can be remedied with either semi-rigid type borescopes, and guide tubes for extended lengths.

Types of Articulation Borescopes

Display and Viewing

USB Borescopes: Are used like external web cameras and are connected to computers through the USB port. With the aid of software or an app, your computer screen, phone, or tablet becomes the viewing screen for your camera. Some devices require a wifi adapter to connect the scope.



LCD Borescopes: Many digital borescopes are equipped with a built-in LCD screen for making viewing easier and compact. Many have a built in SD card for recording photos and videos as well as ways to adjust the light intensity.



Optical Borescopes: Some borescopes still have the traditional design with an eyepiece for viewing and most likely use fiber optics for transmitting light.



How to Use an Articulating Borescope?

Normally, articulating borescopes are more expensive than their non-articulation counterparts due to their complicated internal structure and many small parts inside the control units.

With small moving parts involved during operation, articulating borescopes are prone to be damaged and they are less durable. So it is important to follow proper procedures to use your articulating borescopes. maintain and store them properly to extend their lifetime.



- Before using your articulating borescope, carefully inspect it for any defects or damages. Charge the unit if needed.
- Keep the articulation probe tube as straight and extended as possible. A coiled tube will reduce the bending angle, and trying to forcefully steer the borescope while coiled tube may damage the internal articulation mechanism.
- Insert the probe tip and tube slowly. Do not use too much force. Observe during insertion process.
- Articulate slowly with care to do detailed examination.
- If locking the bending angle is needed. Remember to unlock it after using the feature. Especially remember to turn the bending angle to straight before you pull out the probe.
- Pull out the insertion tube slowly and gently. Do not forcefully pull the insertion tube, and make sure the probe tip is returned to 0 degree position.
- Avoid high temperature. Most articulating borescopes are not designed for temperature higher than 160F.

Dual Camera Borescopes



Some bores as well as their enclosures are smaller and may not accommodate an articulating scope. In this case, if a side-facing view is needed, it would be better to consider a dual camera borescope which has two cameras. Dual Cameras allow the advantage of having a front facing camera and another camera on the side which provides a 90 ° angle.





How to Care for Videoscopes

- After each use, clean the probe camera with lens cleaning wipe or soft fabric to remove stains and oil/water residues
- Clean the insertion tube with soft cloths to make sure it is free of dirt and oils.
- Take out battery if the borescope will not be used for long time (weeks).
- Put the articulating borescope in its storage case with the articulating probe in its natural relaxed position
- Store the whole unit with case in a cool, dry and safe place.
- Do not force the articulation beyond its natural point which will cause stress, wear, and possible breakage.
- When possible, do not perform inspections in a high-temperature environment. Heat can severely damage your camera and probe. If one must inspect in heat, do not exceed 140 degrees F. High-Temperature borescopes are available for these types of applications.

Multiple Applications of Borescopes



Borescopes can be used in many situations where a visual inspection or visual examination is needed.

The current main markets are:

Aviation aircraft, for both general aviation, business aviation, commercial aviation and military

Power generation and electricity

Energy, gas and oil

Automotive, motorcycles, and boat

MRO services

Industrial facility and building maintenance

Manufacturing, metal machining, tube and pipe

Mining

HVAC

Related Articles:

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