LEBANON CAMERA CLUB

Using Legacy Lenses on a Digital Camera

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Legacy Lenses on a Digital Camera

Motivation

Note: The physical Nikon F and Pentax K mounts are still used on their modern digital cameras, although legacy automatic aperture control and screw drive autofocus are no longer supported.

- Legacy lenses
  - Lenses from the film era → often with an obsolete mount
    - 35mm: Canon FD, Contax/Yashica C/Y, Konica AR, Leica R
    - 35mm: Minolta MC/MD, Nikon F, Olympus OM, Pentax (M42, K)
    - Medium format: Bronica (6×6, 6×4.5), Mamiya (6×7, 6×4.5), Pentax (6×7)

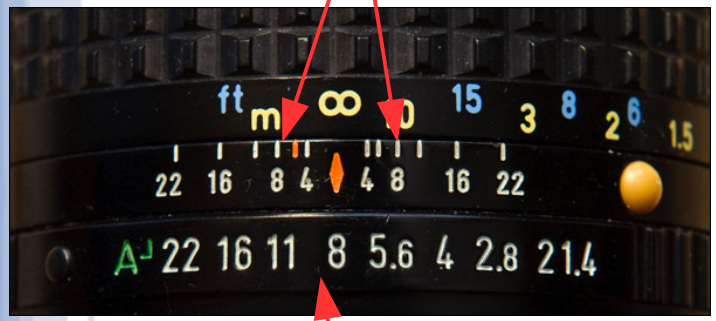
Legacy Lenses on a Digital Camera

Motivation

Note: Focus throw is the amount of rotation of the focus mechanism to go from minimum focus distance to infinity focus. Autofocus lenses often reduce throw to achieve faster focus.

- Legacy lenses
  - Advantages
    - Inexpensive → already have them, find them in a thrift shop
    - Better manual focusing → smooth action, longer focus throw
    - More compact → simpler optical design takes up less space
    - Aperture ring and depth of field markings
    - Unique design → STF (Smooth Trans Focus), many aperture blades

depth of field markings

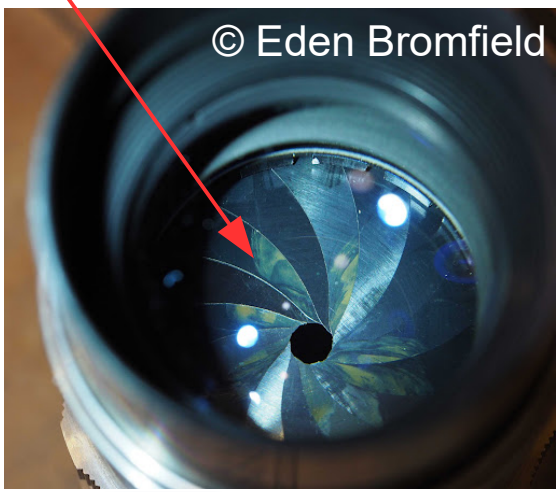


aperture ring

super blurred background

Minolta A-mount 135mm STF

15 aperture blades



Meyer Optik Trioplan 100mm

Legacy Lenses on a Digital Camera

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    - Aperture ring
    - Unique design → STF (Smooth Trans Focus), many aperture blades
    - Unique bokeh (out of focus rendering) → swirly, soap bubble

Helios 44mm swirly bokeh

Meyer Optik Trioplan 100mm soap bubble bokeh

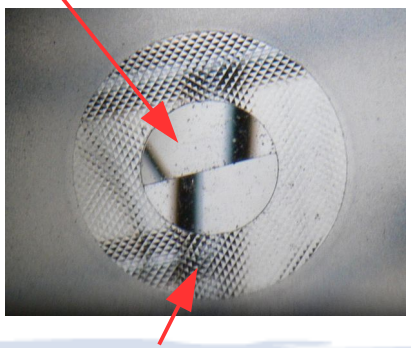
Legacy Lenses on a Digital Camera

Motivation

Note: Film cameras often had a split prism and microprism ring in the viewfinder to assist focusing. DSLR digital cameras may not have any focusing aids—mirrorless cameras may offer focus peaking as an aid.

- Legacy lenses
  - Disadvantages
    - Manual focus only → digital cameras may not have focusing aids
    - Stop down metering → manually stop down lens to meter (and shoot)
    - No communication with the camera → camera doesn't record aperture
    - Lack of sharpness → poor design, manufacture, or accidental abuse
    - Lens aberrations → chromatic (CA), spherical, purple fringing
    - Lens fungus, element separation (cemented elements come apart)
    - Aperture issues → sticky, oily
    - Poor or failing lens coatings → loss of contrast

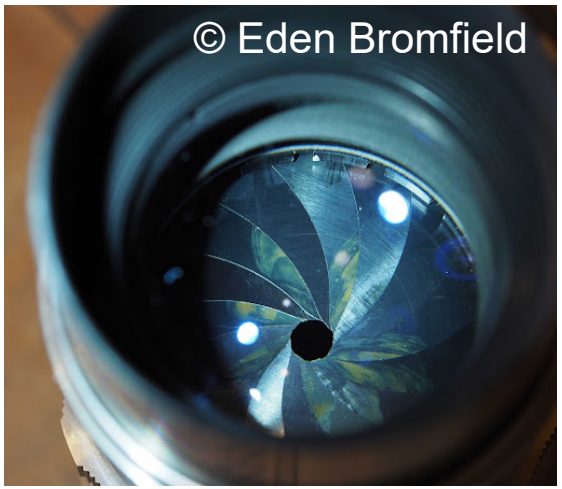
split prism



microprism ring

chromatic aberration

lens fungus



oil on aperture blades

Legacy Lenses on a Digital Camera

Motivation

- Legacy lenses
  - Where to buy?
    - Perfect Image → Lancaster (I have no experience with their used gear)
    - Adorama → New York City (I have no experience with their used gear)
    - B&H Photo Video → New York City (I've bought a couple of lenses)
    - eBay → Online (be careful of private party descriptions, check ratings)
    - KEH → Online (excellent rating system, I've always been satisfied)

perfectimagecamera.com

adorama.com

bhphotovideo.com

ebay.com

keh.com

Legacy Lenses on a Digital Camera

Lens adapters

Note: Bayonet mounts allow for much faster lens changes, without any chance of cross threading the lens.

- Lens mount
  - Means of attaching interchangeable lenses
    - Every camera body manufacturer has a proprietary mount
    - Main mount types: screw and bayonet

Pentax screw mount (M42)

Minolta MC bayonet mount

Legacy Lenses on a Digital Camera

Lens adapters

- Lens mount
  - Throat
    - Diameter of the camera body opening
    - Larger format → larger opening (DSLR throat usually for full frame sensor)

Note: Olympus Micro Four Thirds cameras have a much smaller sensor → 17.3 x 13 mm as opposed to a full frame sensor size of 36 x 24 mm. Thus the throat size can be smaller: 38 mm.

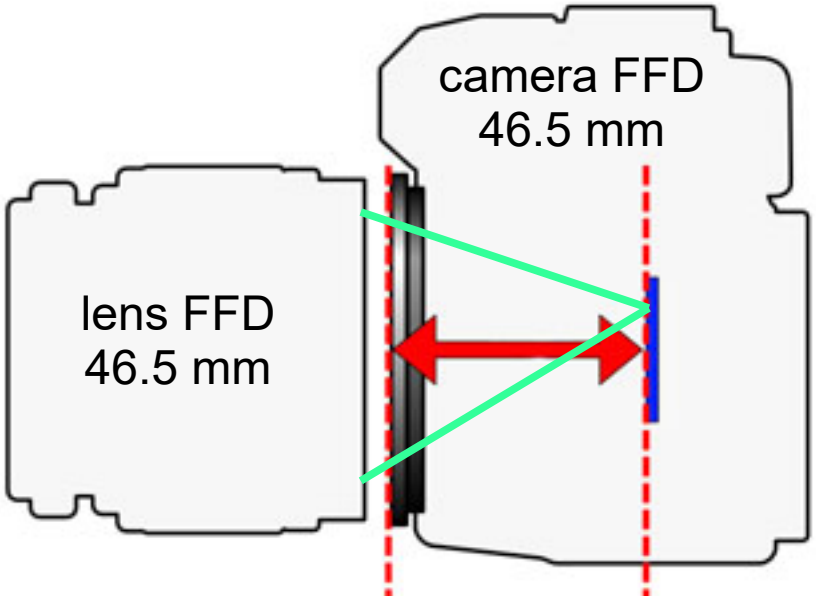
Mount	Throat (mm)	Body Type
Canon EF	54	Film & DSLR
Exakta	46	Film SLR
Minolta MC/MD	44.97	Film SLR
Nikon F	44	Film & DSLR
M42 (screw)	42	Film SLR
Canon RF	54	Mirrorless
Olympus M4/3	38	Mirrorless
Nikon Z	55	Mirrorless
Sony E	46.1	Mirrorless
Pentax 6×7	72	Med. Format

Legacy Lenses on a Digital Camera

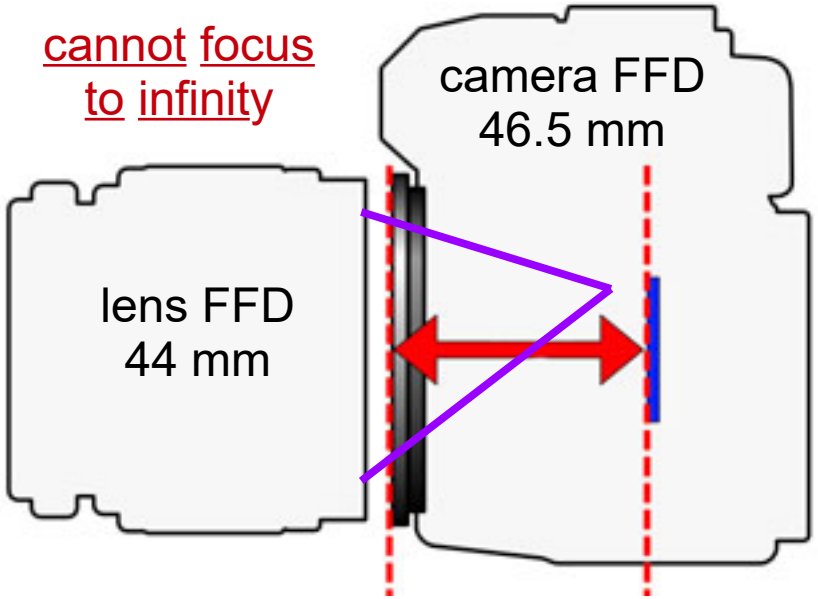
Lens adapters

Note: Precise infinity focus refers to achieving infinity focus at the infinity mark on the lens, which is usually a hard stop for the focusing ring.

- Lens mount
  - Flange focal distance (FFD)
    - Distance from the mounting flange to the film/sensor plane
    - Lens and body must match to achieve precise infinity focus



FFDs match → infinity focus is on sensor plane



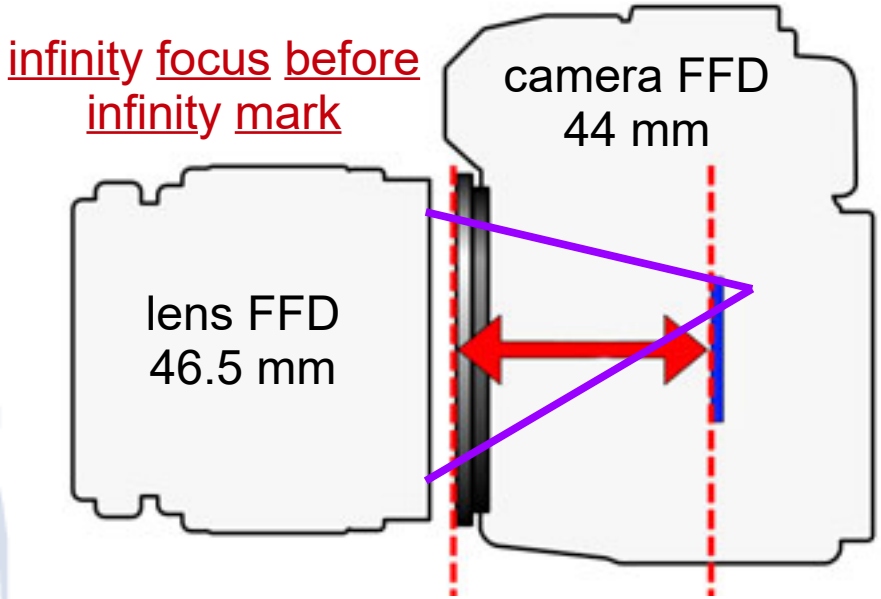
lens FFD shorter than camera FFD → infinity focus in front of sensor plane

Legacy Lenses on a Digital Camera

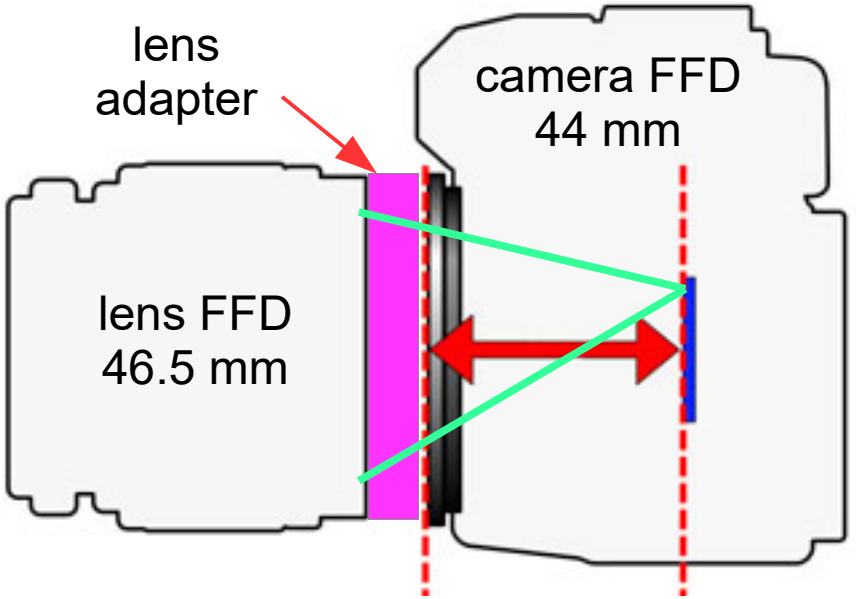
Lens adapters

Note: If a company makes lenses for many camera bodies the lens FFD is designed to be long enough so that adapters can be made, or the lens can be made with dedicated mount versions → Kilfitt, Tamron, Sigma, Tokina, etc.

- Lens mount
  - Flange focal distance (FFD)
    - Distance from the mounting flange to the film/sensor plane
    - Lens and body must match to achieve precise infinity focus
    - Lens FFD > camera FFD → simple (lens-less) adapter may be possible



lens FFD longer than camera FFD → infinity focus is behind sensor plane



adapter makes FFDs the same → infinity focus is on sensor plane

Legacy Lenses on a Digital Camera

Lens adapters

Note: If the lens FFD is close to the camera FFD then the throat diameter may determine whether a simple adapter is possible. Nikon F lenses (44 mm throat) can be adapted for use on Canon EF bodies (54 mm throat).

- Lens mount
  - Flange focal distance (FFD)
    - Distance from the mounting flange to the film/sensor plane
    - Lens and body must match to achieve precise infinity focus
    - Lens FFD > camera FFD → simple adapter may be possible

adapter with lens → needed because lens FFD is shorter than camera FFD (may not be optically ideal)

Note: Mirrorless cameras have very short FFDs because they don't need space for the moving mirror → they are ideal for adapting legacy lenses

Mount	FFD (mm)	Body Type
Canon EF	44	Film & DSLR
Exakta	44.7	Film SLR
Minolta MC/MD	43.5	Film SLR
Nikon F	46.5	Film & DSLR
M42 (screw)	45.46	Film SLR
Canon RF	20	Mirrorless
Olympus M4/3	19.25	Mirrorless
Nikon Z	16	Mirrorless
Sony E	18	Mirrorless
Pentax 6×7	84.95	Med. Format

Legacy Lenses on a Digital Camera

Lens adapters

Note: DSLR manufacturers who also make mirrorless cameras normally create a sophisticated adapter to permit DSLR lenses to work on their mirrorless bodies → doesn't force users to buy all new lenses.

- Types
  - Mechanical
    - Allows physical mounting of the lens
    - May support mechanical communication with a film SLR body
    - Most likely no communication with the body of a digital camera
  - Mechanical & electrical
    - Allows communication of lens settings with a digital camera body
    - May allow autofocus for lenses with built-in focusing motors
    - Usually made to permit DSLR lenses to function on a mirrorless body
  - Where to buy?
    - B&H Photo Video → New York City (hundreds of adapters available)
    - Amazon → Online (many available, some from unknown Chinese companies)

bhphotovideo.com

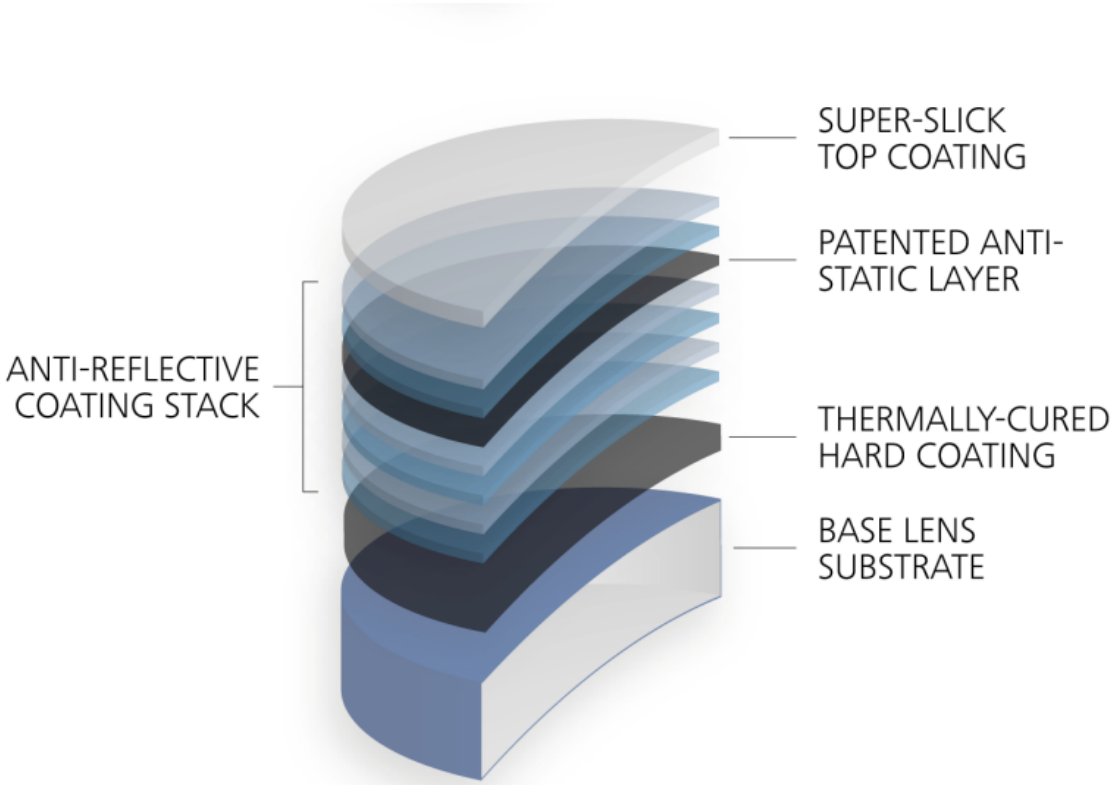
amazon

amazon.com

Legacy Lenses on a Digital Camera

Lens coatings

- Chemical compounds applied to lens surfaces
  - Extremely thin layers
    - Magnesium fluoride
    - Silicon monoxide
- Purpose
  - Protective
    - Anti-smudge
    - Anti-scratch
    - Anti-dust

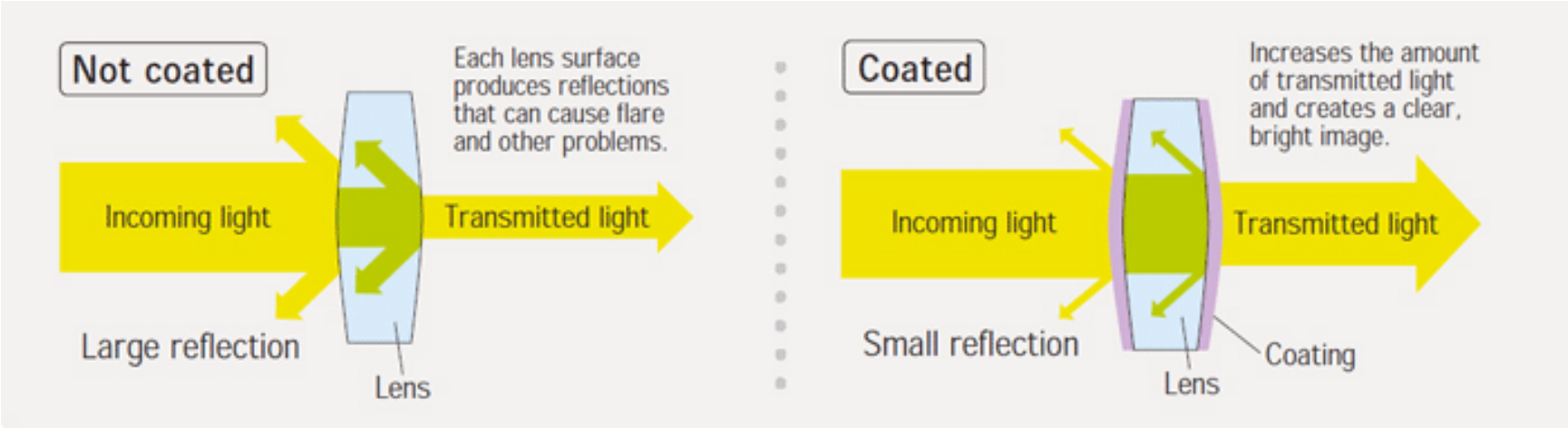


Zeiss multi-layer coatings for eyeglass lenses, similar to the coatings for camera lenses

Legacy Lenses on a Digital Camera

Lens coatings

- Purpose
  - Anti-reflection
    - Want all light to pass through the lens, not reflect off element surfaces
    - Reflected light reduces contrast, increases flare and ghosting
    - The more lens elements in a lens the more critical the coatings



Legacy Lenses on a Digital Camera

Lens coatings

Note: Lens single-coating was invented in 1935 by Zeiss. However, the number of lenses available with a coating was limited until after World War II.

- Types
  - Uncoated → 4% to 8% reflection per surface
    - Prior to 1945
    - White appearance
  - Single-coated → 2% to 4% reflection per surface
    - 1945 to 1970's
    - Yellow or blue appearance

© Markus Keinath

uncoated lens (coating removed)

© Gabriel Bouvigne

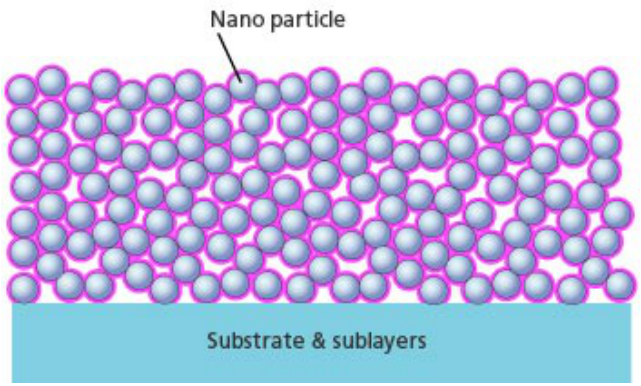
single-coated lens

Legacy Lenses on a Digital Camera

Lens coatings

- Types
  - Multi-coated → 0.5% to 1% reflection per surface
    - 1970's to present
    - Green or purple appearance
    - Pentax SMC (Super Multi Coated), Zeiss T*
  - Nano-coated → 0.05% to .1% reflection per surface
    - Mid 2000's to present
    - Green or purple appearance
    - Canon SWC, Nikon Nano Crystal Coating, Olympus ZERO

multi-coated lens



Nano Crystal Coating lens

Legacy Lenses on a Digital Camera

Lens coatings

Note: Not all lens element surfaces are normally coated, or some may be single-coated and others multi-coated (some elements may be in contact with others so they do not need coating). 'Fully multi-coated' is common for telescopes and binoculars, but not camera lenses.

- Effectiveness
  - Uncoated lenses
    - Limited to 3 or 4 elements due to excessive reflections
  - Single-coated
    - New designs used 6 elements to improve image quality
  - Multi-coated
    - Can use 10 or more elements due to reduced reflections
    - Total transmittance for good multi-coating is 99% to 99.5%
  - Nano-coated
    - Used on top-tier lenses for improved image quality
    - Total transmittance close to 99.5%
    - Highest contrast and “micro contrast” (contrast in the small details)

Legacy Lenses on a Digital Camera

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