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THORLABS

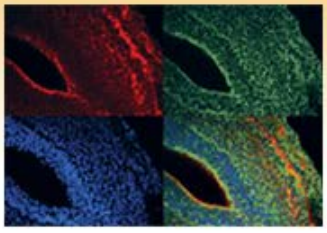
# N40XW-PF - July 06, 2020

Item # N40XW-PF was discontinued on July 06, 2020. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

## MICROSCOPE OBJECTIVES, WATER DIPPING OR IMMERSION

- **Especially Suited for Multiphoton Imaging**
- **Numerical Aperture Options: 0.30 to 1.15**
- **Working Distance Options: 0.59 to 5.5 mm**
- **Options for UV to NIR Wavelengths**

**N25X-APO-MP**
1.1 NA, 2.0 mm WD

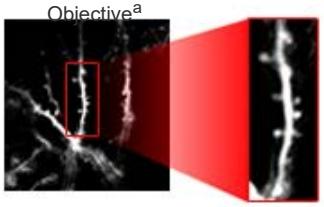


Deep Tissue Imaging of Mouse Embryo Section with the N20X-PFH Objective[a]

**N16XLWD-PF**
0.8 NA, 3.0 mm WD

**TL20X-MPL**
0.6 NA, 5.5 mm WD

**N20X-PFH**
1.0 NA, 2.0 mm WD



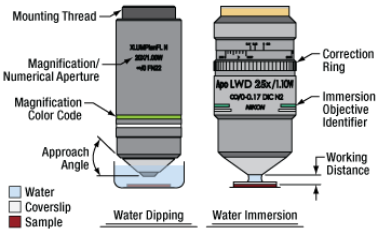
Dendridic Spine Image Collected with the N60X-NIR Objective at a Laser Wavelength of 1040 nm[b]

a. This mouse embryo sample is courtesy of Dr. Rieko Ajima, National Cancer Institute, Frederick, MD.

## OVERVIEW

### Features

- High Numerical Apertures with Long Working Distances
- Infinity-Corrected Apochromatic or Plan Fluorite Designs




Click for Details
Examples of Water Dipping and Water Immersion Designs
(See *Objective Tutorial* Tab for More Information About Microscope Objective Types)

Thorlabs offers a selection of water dipping and water immersion objectives at several magnifications that are designed for physiology applications. With high performance across broad spectral ranges, these objectives are especially suitable for transmitting excitation and emmission signals in multiphoton microscopy and other imaging techniques used for life science. The apochromatic and plan fluorite objectives sold below are corrected for chromatic aberrations at multiple wavelengths to provide sharp focus across wavelength ranges from the UV to NIR.

The long working distances (WD) and steep approach angles at the tips of these objectives provide ample space for additional optics or tools such as micromanipulators often used in electrophysiology. The high numerical apertures (NA) of these objectives allow for excitation light to be focused to a small volume, which leads to better axial and lateral resolution. For signal collection, the high NA helps to maximize intensity by capturing photons that are scattered through tissue.

| Objective Lens Selection Guide |
|---|
| **Objectives** |
| Super Apochromatic Microscope Objectives |
| Microscopy Objectives, Dry |
| Microscopy Objectives, Oil Immersion |
| Physiology Objectives, Water Dipping or Immersion |
| Phase Contrast Objectives |
| Long Working Distance Objectives |
| Reflective Microscopy Objectives |
| UV Focusing Objectives |
| VIS and NIR Focusing Objectives |
| **Scan Lenses and Tube Lenses** |
| Scan Lenses |
| F-Theta Scan Lenses |
| Infinity-Corrected Tube Lenses |

### Did You Know?

Multiple optical elements, including the microscope objective, tube lens, and eyepieces, together define the magnification of a system. See the *Magnification & FOV* tab to learn more.

Each water dipping objective is intended to be used without a coverslip (cover glass) and with the tip of the objective dipped into water surrounding the sample, either creating a meniscus or completely submerged. Water immersion objectives should be used with a coverslip that has a drop of water on top to create a meniscus between the objective tip and coverslip. The N25X-APO-MP and N25X-APO-MP1300 objectives have a correction collar that allows them to be used either with or without a coverslip. The diagram above provides a description of typical features on water dipping and immersion objectives.

These objectives feature M25 x 0.75 or M32 x 0.75 threading and 60 mm or 75 mm parfocal lengths. Thorlabs also offers a PLE153 Parfocal Length Extender for increasing the parfocal length of objectives with M25 x 0.75 threading from 60 mm to 75 mm.

## SPECS

| Magnification | 10X | 16X | 20X | | 25X | | 40X | | | 60X |
|---|---|---|---|---|---|---|---|---|---|---|
| Item # | N10XW-PF | N16XLWD-PF | TL20X-MPL | N20X-PFH | N25X-APO-MP | N25X-APO-MP1300 | N40XLWD-NIR | N40X-NIR | N40XW-PF | N60X-NIR |
| Manufacturer | Nikon | | Thorlabs | Olympus | Nikon | | | | | |
| Manufacturer Part # | MRH07120 | MRP07220 | TL20X-MPL | 1-U2B965 | MRD77220 | MRD77225 | MRD77410 | MRD07420 | MRF07420 | MRD07620 |
| Objective Class | Plan Fluorite | Plan Fluorite | Apochromat | Plan Fluorite | Apochromat | Apochromat | Apochromat | Apochromat | Plan Fluorite | Apochromat |
| Numerical Aperture (NA) | 0.30 | 0.80 | 0.60 | 1.00 | 1.10 | | 1.15 | 0.80 | | 1.00 |
| Effective Focal Length (EFL) | 20 mm | 12.5 mm | 10.0 mm | 9.0 mm | 8.0 mm | | 5.0 mm | 5.0 mm | | 3.3 mm |
| Entrance Pupil[a] | Ø12 mm | Ø7.5 mm | Ø12 mm | Ø18 mm | Ø17.6 mm | | Ø11.5 mm | Ø8.0 mm | | Ø6.7 mm |
| Working Distance | 3.5 mm | 3.0 mm | 5.5 mm | 2.00 mm | 2.0 mm | | 0.59 - 0.61 mm | 3.5 mm | 2.0 mm | 2.8 mm |
| Parfocal Length | 60 mm | 75 mm | 58.4 mm | 75 mm | 75 mm | | 60 mm | | | |
| Design Tube Lens Focal Length[b] | 200 mm | | | 180 mm | 200 mm | | | | | |
| Coverslip Correction[c] | N/A | | | | 0 - 0.17 mm | | 0.15 - 0.19 mm | N/A | | |
| Immersion | Water Dipping | | | | Water Dipping or Water Immersion (Coverslip) | | Water Immersion (Coverslip) | Water Dipping | | |
| Wavelength Range | 360 - 1500 nm | 380 - 1100 nm | 400 - 900 nm | 400 - 900 nm | 380 - 1050 nm | 420 - 1400 nm | 360 - 1100 nm | 380 - 1100 nm | 360 - 1050 nm | 380 - 1100 nm |
| Threading | M25 x 0.75 | M32 x 0.75 | M25 x 0.75 | M25 x 0.75 | M32 x 0.75 | | M25 x 0.75 | | | |
| Thread Depth | 5.1 mm | 5.0 mm | 3.6 mm | 5.8 mm | 4.7 mm | | 5.1 mm | | | |
| Temperature Range[d] | -18 - 60 °C (0 - 140 °F) | | N/A | | -18 - 60 °C (0 - 140 °F) | | | | | |

- a. Entrance pupil diameter (EP) is defined at the back aperture of the objective and calculated as EP=2*NA*EFL.
- b. For information on compatibility between tube lenses and objectives, see the *Magnification & FOV* tab.
- c. A coverslip correction given as a range of thicknesses indicates that the objective has a correction ring (see the *Objective Tutorial* Tab for details).
- d. Temperature range indicates the recommended usage range for these objectives. These objectives are not recommended for use in extreme temperatures. All specifications for Nikon objectives are measured at 23 °C (73 °F).

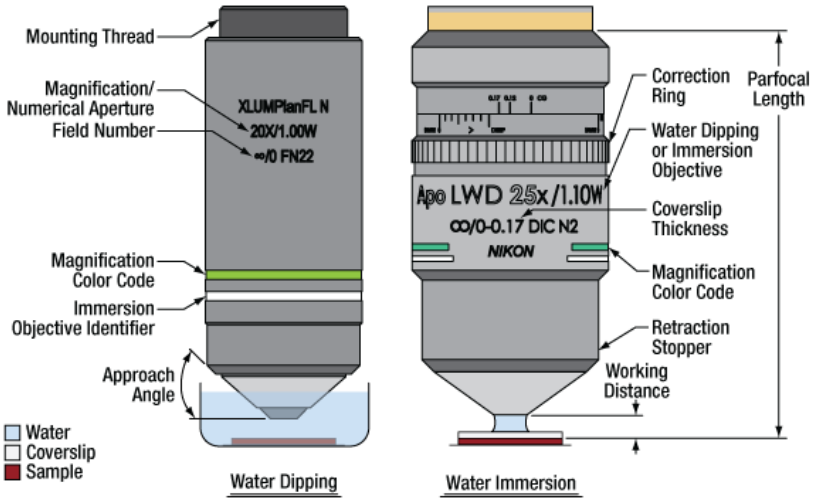
## Types of Objectives

Thorlabs offers several types of watter dipping and immersion objectives. This guide describes the features and benefits of each type of objective.

**Water-Immersion (Coverslip) or Water-Dipping Objectives**

This designation refers to the medium that should be present between the front of the objective and the specimen. Water-immersion (coverslip) objectives are designed to work best with a drop of water and a coverslip between the objective and the specimen, while water-dipping objectives are designed to interface directly with the specimen.

### Objective Identification




Note: These microscope objectives serve only as examples. The format of the engraved specifications will vary between objectives and manufacturers.

**Immersion Media Color Codes** More [+]

**Magnification Color Codes** More [+]

**Plan Fluorite Objectives**

"Plan" designates that these objectives produce a flat image across the field of view. Plan fluorite objectives, also referred to as plan semi-apochromats, plan fluorescence objectives, or plan fluors, are corrected for chromatic aberrations at two to four wavelengths and spherical aberrations at three to four wavelengths. Plan fluorite objectives work well for color photomicrography.

**Plan Apochromat Objectives**

"Apochromat" refers to the correction for chromatic aberration featured in the lens design. These objectives feature sophisticated designs and are corrected for chromatic corrections at four to five wavelengths and spherical aberrations at three to four wavelengths.

## Glossary of Terms

**Magnification**

The magnification of an objective is the tube lens focal length ($L$) divided by the objective's focal length ($F$):

$$M = L / F .$$

The total magnification of the system is the magnification of the objective multiplied by the magnification of the eyepiece or camera tube. The specified magnification on the microscope objective housing is accurate as long as the objective is used with a compatible tube lens focal length.

**Numerical Aperture (NA)**

Numerical aperture, a measure of the acceptance angle of an objective, is a dimensionless quantity. It is commonly expressed as

$$NA = n_i \times sin\theta_a$$

where $\theta_a$ is the maximum 1/2 acceptance angle of the objective, and $n_i$ is the index of refraction of the immersion medium. This medium is typically air, but may also be water, oil, or other substances.

**Parfocal Length**

Also referred to as the parfocal distance, this is the length from the top of the objective (at the base of the mounting thread) to the bottom of the coverslip (or top of the specimen in the case of objectives that are intended to be used without a coverslip). For instances in which the parfocal length needs to be increased, parfocal length extenders are available.

**Working Distance**

This is the distance between the front element of the objective and the specimen, depending on the design of the objective. The coverslip thickness specification engraved on the objective designates whether a coverslip should be used.

**Field Number**
The field number corresponds to the size of the field of view (in millimeters) multiplied by the objective's magnification.

$$FN = \text{Field of View Diameter} \times \text{Magnification}$$

**Coverslip Correction and Correction Collar (Ring)**
A typical coverslip (cover glass) is designed to be 0.17 mm thick, but due to variance in the manufacturing process the actual thickness may be different. The correction collar present on select objectives is used to compensate for coverslips of different thickness by adjusting the relative position of internal optical elements. Note that many objectives do not have a variable coverslip correction (for example, an objective could be designed for use with only a standard 0.17 mm thick coverglass), in which case the objectives have no correction collar.

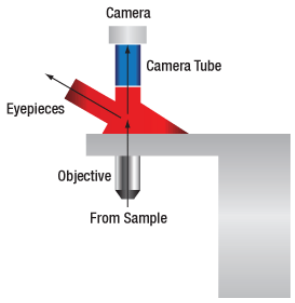
MAGNIFICATION & FOV

# Magnification and Sample Area Calculations

## Magnification

**Magnification and FOV Calculator**

The magnification of a system is the multiplicative product of the magnification of each optical element in the system. Optical elements that produce magnification include objectives, camera tubes, and trinocular eyepieces, as shown in the drawing to the right. It is important to note that the magnification quoted in these products' specifications is usually only valid when all optical elements are made by the same manufacturer. If this is not the case, then the magnification of the system can still be calculated, but an effective objective magnification should be calculated first, as described below.




When viewing an image with a camera, the system magnification is the product of the objective and camera tube magnifications. When viewing an image with trinoculars, the system magnification is the product of the objective and eyepiece magnifications.

To adapt the examples shown here to your own microscope, please use our Magnification and FOV Calculator, which is available for download by clicking on the red button above. Note the calculator is an Excel spreadsheet that uses macros. In order to use the calculator, macros must be enabled. To enable macros, click the "Enable Content" button in the yellow message bar upon opening the file.

*Example 1: Camera Magnification*
When imaging a sample with a camera, the image is magnified by the objective and the camera tube. If using a 20X Nikon objective and a 0.75X Nikon camera tube, then the image at the camera has 20X × 0.75X = 15X magnification.

*Example 2: Trinocular Magnification*
When imaging a sample through trinoculars, the image is magnified by the objective and the eyepieces in the trinoculars. If using a 20X Nikon objective and Nikon trinoculars with 10X eyepieces, then the image at the eyepieces has 20X × 10X = 200X magnification. Note that the image at the eyepieces does not pass through the camera tube, as shown by the drawing to the right.

| Manufacturer | Tube Lens Focal Length |
|---|---|
| Leica | f = 200 mm |
| Mitutoyo | f = 200 mm |
| Nikon | f = 200 mm |
| Olympus | f = 180 mm |
| Thorlabs | f = 200 mm |
| Zeiss | f = 165 mm |

The rows highlighted in green denote manufacturers that do not use f = 200 mm tube lenses.

## Using an Objective with a Microscope from a Different Manufacturer

Magnification is not a fundamental value: it is a derived value, calculated by assuming a specific tube lens focal length. Each microscope manufacturer has adopted a different focal length for their tube lens, as shown by the table to the right. Hence, when combining optical elements from different manufacturers, it is necessary to calculate an *effective* magnification for the objective, which is then used to calculate the magnification of the system.

The effective magnification of an objective is given by Equation 1:

$$\text{Effective Objective Magnification} = \text{Design Magnification} \times \frac{f_{\text{Tube Lens in Microscope}}\ (\text{mm})}{f_{\text{Design Tube Lens of Objective}}\ (\text{mm})} \qquad \text{(Eq. 1)}$$

Here, the Design Magnification is the magnification printed on the objective, $f_{\text{Tube Lens in Microscope}}$ is the focal length of the tube lens in the microscope you are using, and $f_{\text{Design Tube Lens of Objective}}$ is the tube lens focal length that the objective manufacturer used to calculate the Design Magnification. These focal lengths are given by the table to the right.

Note that Leica, Mitutoyo, Nikon, and Thorlabs use the same tube lens focal length; if combining elements from any of these manufacturers, no conversion is needed. Once the effective objective magnification is calculated, the magnification of the system can be calculated as before.

*Example 3: Trinocular Magnification (Different Manufacturers)*

When imaging a sample through trinoculars, the image is magnified by the objective and the eyepieces in the trinoculars. This example will use a 20X Olympus objective and Nikon trinoculars with 10X eyepieces.

Following Equation 1 and the table to the right, we calculate the effective magnification of an Olympus objective in a Nikon microscope:

$$Effective\ Objective\ Magnification = 20\text{X} \times \frac{200\ \text{mm}}{180\ \text{mm}} = 22.2\text{X}$$

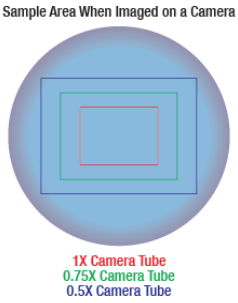
The effective magnification of the Olympus objective is 22.2X and the trinoculars have 10X eyepieces, so the image at the eyepieces has 22.2X × 10X = 222X magnification.

## Sample Area When Imaged on a Camera

When imaging a sample with a camera, the dimensions of the sample area are determined by the dimensions of the camera sensor and the system magnification, as shown by Equation 2.

$$Sample\ Area\ (\text{mm} \times \text{mm}) = \frac{Camera\ Sensor\ Width\ (\text{mm})}{System\ Magnification} \times \frac{Camera\ Sensor\ Height\ (\text{mm})}{System\ Magnification} \qquad \text{(Eq. 2)}$$

The camera sensor dimensions can be obtained from the manufacturer, while the system magnification is the multiplicative product of the objective magnification and the camera tube magnification (see Example 1). If needed, the objective magnification can be adjusted as shown in Example 3.




As the magnification increases, the resolution improves, but the field of view also decreases. The dependence of the field of view on magnification is shown in the schematic to the right.

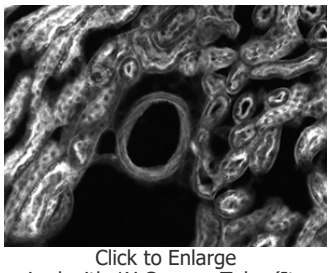
*Example 4: Sample Area*

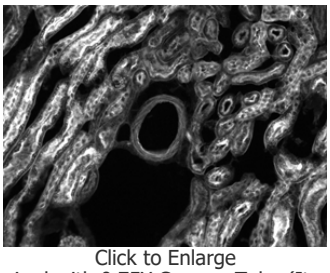
The dimensions of the camera sensor in Thorlabs' 1501M-USB Scientific Camera are 8.98 mm × 6.71 mm. If this camera is used with the Nikon objective and trinoculars from Example 1, which have a system magnification of 15X, then the image area is:

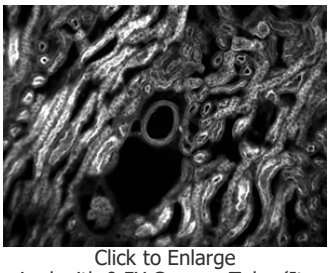
$$Sample\ Area\ (\text{mm} \times \text{mm}) = \frac{8.98\ \text{mm}}{15\text{X}} \times \frac{6.71\ \text{mm}}{15\text{X}} = 599\ \mu\text{m} \times 447\ \mu\text{m}$$

## Sample Area Examples

The images of a mouse kidney below were all acquired using the same objective and the same camera. However, the camera tubes used were different. Read from left to right, they demonstrate that decreasing the camera tube magnification enlarges the field of view at the expense of the size of the details in the image.


Click to Enlarge
Acquired with 1X Camera Tube (Item # WFA4100)


Click to Enlarge
Acquired with 0.75X Camera Tube (Item # WFA4101)

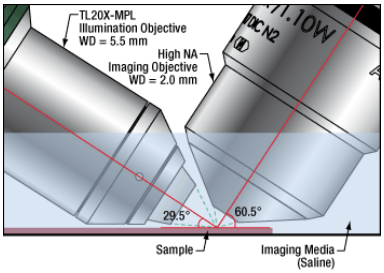

Click to Enlarge
Acquired with 0.5X Camera Tube (Item # WFA4102)

## Thorlabs Excitation Water Dipping Objective for Light Sheet Microscopy

- Designed as an Excitation Objective for Lattice Light Sheet Microscopy
- Infinity-Corrected Apochromatic Design
- 20X Magnification When Used With a 200 mm Tube Lens
- Water-Tight Seal for Water Dipping
- M25 x 0.75 Threading

| Protective Accessories[a] | |
|---|---|
| **Objective** | **Objective Case** |
| **TL20X-MPL** | Lid: OC2M32<br>Canister: OC24 |

- a. Included with Each TL20X-MPL



Click to Enlarge
The TL20X-MPL objective in a light sheet microscopy set up. The steep housing angle and long working

Thorlabs' TL20X-MPL Water Dipping Objective is designed primarily as an excitation objective especially suited for lattice light sheet multiphoton microscopy and other applications with tightly confined space near the focus region. With a long working distance, narrow diameter, and steep approach angle at the distal tip, this objective provides the minimized footprint needed in many physiology applications where other optics or tools are manipulated near the sample.

distance (WD) allow for positioning in tight imaging areas.

The example diagram to the right illustrates how the TL20X-MPL objective can be used for excitation in Bessel beam lattice light sheet multiphoton microscopy. The long 5.5 mm working distance provides the space needed when orienting the TL20X-MPL objective next to an imaging objective and is beneficial for producing the large excitation sheet required for lattice light sheet microscopy.

The TL20X-MPL objective provides 20X magnification and has the longest working distance of our available water dipping or immersion objectives. The apochromatic design provides excellent color correction from 400 nm to 900 nm. This objective provides diffraction limited performance across the defined wavelength range with slight refocus on the order of 1 µm required through the visible spectrum; click the blue info icon (i) in the table below to view performance data for this lens.

The lenses in this objective are sealed with a specialized two-part epoxy that is safe for use with biological samples. The TL20X-MPL objective features M25 x 0.75 threading and is compatible with our
DIY Cerna® Systems. Thorlabs offers a selection of M25 x 0.75 adapters for converting to other thread standards.

| Item # | Wavelength Range | M | WD | EFL | NA | EP[a] | PFL | Performance Graphs | Coverslip Correction | Immersion Method | Objective Threading |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **TL20X-MPL** | 400 - 900 nm | 20X | 5.5 mm | 10.0 mm | 0.60 | 12 mm | 58.4 mm | i | N/A | Water Dipping | M25 x 0.75 3.6 mm Depth |

- a. Entrance pupil diameter (EP) is defined at the back aperture of the objective and calculated as EP=2*NA*EFL.

M = Magnification
WD = Working Distance
EFL = Effective Focal Length

NA = Numerical Aperture
EP = Entrance Pupil Diameter
PFL = Parfocal Length

| Part Number | Description | Price | Availability |
|---|---|---|---|
| **TL20X-MPL** | **20X Thorlabs Water Dipping Excitation Objective, 0.60 NA, 5.5 mm WD** | **$4,100.00** | **Today** |

## Nikon Apochromatic Water Dipping or Immersion Objectives

- Ideal for Multiphoton Imaging and Life Science Applications
- Infinity-Corrected Apochromatic Design
- Magnifications Specified When Used With a 200 mm Tube Lens
- M32 x 0.75 or M25 x 0.75 Threading

| Protective Accessories | |
|---|---|
| **Objective** | **Objective Case** |
| **N25X-APO-MP** | Lid: OC2M32 Canister: OC24 |
| **N25X-APO-MP1300** | |
| **N40XLWD-NIR** | Lid: OC2M25 Canister: OC24 |
| **N40X-NIR** | |
| **N40X-NIR** | |

These Nikon Apochromatic Water Dipping Objectives provide 20X, 40X, or 60X magnification. Their designation as apochromatic indicates that these objectives provide excellent color correction throughout their defined wavelength ranges including at near-infrared (NIR) wavelengths. These objectives are suitable for fluorescence microscopy, brightfield microscopy, and DIC microscopy including NIR DIC.

The N25X-APO-MP and N25X-APO-MP1300 objectives feature a rotating coverslip correction collar to correct aberration for coverslips that are 0 to 0.17 mm thick, with 0 mm indicating that these can be used as water dipping objectives without a coverslip. The N40XLWD-NIR objective features a correction collar for coverslips that are 0.15 - 0.91 mm thick. All three of these objectives also feature spring-loaded retractable housing designs to protect the optics and sample from collision damage.

| Item # | Wavelength Range | M | WD | EFL | NA | EP[a] | PFL | Coverslip Correction[b] | Immersion Method | Objective Threading |
|---|---|---|---|---|---|---|---|---|---|---|
| **N25X-APO-MP** | 380 - 1050 nm | 25X | 2.0 mm | 8.0 mm | 1.10 | 17.6 mm | 75 mm | 0 - 0.17 mm | Water Dipping or Water Immersion (Coverslip) | M32 x 0.75 4.7 mm Depth |
| **N25X-APO-MP1300** | 420 - 1400 nm | | | | | | | | | |
| **N40XLWD-NIR** | 360 - 1100 nm | 40X | 0.59 - 0.61 mm | 5.0 mm | 1.15 | 11.5 mm | 60 mm | 0.15 - 0.91 mm | Water Immersion (Coverslip) | M25 x 0.75 5.1 mm Depth |
| **N40X-NIR** | 380 - 1100 nm | | 3.5 mm | 5.0 mm | 0.80 | 8.0 mm | | N/A | Water Dipping | |
| **N60X-NIR** | | 60X | 2.8 mm | 3.3 mm | 1.0 | 6.7 mm | | | | |

- a. Entrance pupil diameter (EP) is defined at the back aperture of the objective and calculated as EP=2*NA*EFL.
- b. A coverslip correction given as a range of thicknesses indicates that the objective has a correction ring (see *Objective Tutorial* for details).

M = Magnification
WD = Working Distance
EFL = Effective Focal Length

NA = Numerical Aperture
EP = Entrance Pupil Diameter
PFL = Parfocal Length

| Part Number | Description | Price | Availability |
|---|---|---|---|
| N25X-APO-MP | Customer Inspired!&nbsp25X Nikon CFI APO LWD Objective, 380 - 1050 nm, 1.10 NA, 2.0 mm WD | $30,799.40 | Today |
| N25X-APO-MP1300 | Customer Inspired!&nbsp25X Nikon CFI APO LWD Objective, 420 - 1400 nm, 1.10 NA, 2.0 mm WD | $33,493.78 | Today |
| N40XLWD-NIR | 40X Nikon CFI APO LWD NIR Objective, 1.15 NA, 0.59 - 0.61 mm WD | $17,381.52 | Today |
| N40X-NIR | 40X Nikon CFI APO NIR Objective, 0.80 NA, 3.5 mm WD | $3,135.14 | Today |
| N60X-NIR | 60X Nikon CFI APO NIR Objective, 1.0 NA, 2.8 mm WD | $4,996.67 | Today |

## Nikon Plan Fluorite Water Dipping Objectives

- Ideal for Multiphoton Imaging and Life Science Applications
- Infinity-Corrected Plan Fluorite Design
- Magnifications Specified When Used With a 200 mm Tube Lens
- M32 x 0.75 or M25 x 0.75 Threading

| Protective Accessories | |
|---|---|
| Objective | Objective Case |
| N10XW-PF | Lid: OC2M25<br>Canister: OC24 |
| N16XLWD-PF | Lid: OC2M32<br>Canister: OC24 |
| N40XW-PF | Lid: OC2M25<br>Canister: OC24 |

These Nikon Plan Fluorite Water Dipping Objectives provide 10X, 16X, or 40X magnification. Their designation as plan fluorite indicates that these objectives produce a flat plane of focus and are corrected for spherical and chromatic aberrations at multiple wavelengths. All of these objectives are excellent for fluorescence microscopy, brightfield microscopy, and DIC microscopy, while the N10XW-PF and N40XW-PF objectives are corrected for wavelengths down to 360 nm, making them suitable for UV fluorescence.

The N40XW-PF objective features a spring-loaded retractable housing design to protect the optics and sample from collision damage.

| Item # | Wavelength Range | M | WD | EFL | NA | EP[a] | PFL | Coverslip Correction | Immersion Method | Objective Threading |
|---|---|---|---|---|---|---|---|---|---|---|
| N10XW-PF | 360 - 1500 nm | 10X | 3.5 mm | 20 mm | 0.30 | 12.0 mm | 60 mm | N/A | Water Dipping | M25 x 0.75<br>5.1 mm Depth |
| N16XLWD-PF | 380 - 1100 nm | 16X | 3.0 mm | 12.5 mm | 0.80 | 7.5 mm | 75 mm | | | M32 x 0.75<br>5.0 mm Depth |
| N40XW-PF | 360 - 1050 nm | 40X | 2.0 mm | 5.0 mm | 0.80 | 8.0 mm | 60 mm | | | M25 x 0.75<br>5.1 mm Depth |

- a. Entrance pupil diameter (EP) is defined at the back aperture of the objective and calculated as EP=2*NA*EFL.

M = Magnification
WD = Working Distance
EFL = Effective Focal Length

NA = Numerical Aperture
EP = Entrance Pupil Diameter
PFL = Parfocal Length

| Part Number | Description | Price | Availability |
|---|---|---|---|
| N10XW-PF | Customer Inspired!&nbsp10X Nikon CFI Plan Fluorite Objective, 0.30 NA, 3.5 mm WD | $1,617.77 | Today |
| N16XLWD-PF | 16X Nikon CFI LWD Plan Fluorite Objective, 0.80 NA, 3.0 mm WD | $7,484.20 | Today |
| N40XW-PF | Customer Inspired!&nbsp40X Nikon CFI Plan Fluorite Objective, 0.80 NA, 2.0 mm WD | $3,021.81 | Lead Time |

## Olympus Plan Fluorite Water Dipping Objective

- Ideal for Fluorescence Microscopy and Life Science Applications
- Infinity-Corrected Plan Fluorite Design

| Protective Accessories | |
|---|---|

- 20X Magnification When Used With a 180 mm Tube Lens
- M25 x 0.75 Threading

| Objective | Objective Case |
|---|---|
| N20X-PFH | Lid: OC2M25<br>Canister: OC24 |

This Olympus Plan Fluorite Water Dipping Objective provides 20X magnification and features axial color correction for 400 to 900 nm. The designation as plan fluorite indicates that this objective produces a flat plane of focus and are corrected for spherical and chromatic aberrations at multiple wavelengths. This objective is excellent for fluorescence microscopy, brightfield microscopy, and DIC microscopy.

The N20X-PFH has a large entrance pupil diameter (EP) and is designed for a tube lens with focal length 180 mm.

| Item # | Wavelength Range | M | WD | EFL | NA | EP[a] | PFL | Coverslip Correction | Immersion Method | Objective Threading |
|---|---|---|---|---|---|---|---|---|---|---|
| N20X-PFH | 400 - 900 nm | 20X | 2.00 mm | 9.0 mm | 1.00 | 18 mm | 75 mm | N/A | Water Dipping | M25 x 0.75<br>5.8 mm Depth |

- a. Entrance pupil diameter (EP) is defined at the back aperture of the objective and calculated as EP = 2 x NA x EFL.

M = Magnification
WD = Working Distance
EFL = Effective Focal Length

NA = Numerical Aperture
EP = Entrance Pupil Diameter
PFL = Parfocal Length

| Part Number | Description | Price | Availability |
|---|---|---|---|
| N20X-PFH | 20X Olympus XLUMPLFLN Objective, 1.00 NA, 2.0 mm WD | $9,105.70 | Today |