

# EPU-D

versions 1.0 - 1.20  
Release Notes

**PN 307152**

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# 1 Introduction

## 1.1 Purpose

This document describes the Thermo Scientific EPU-D software releases.

## 1.2 Audience and scope

These release notes are intended for users of the Thermo Scientific EPU-D software and those who manage the installation of Thermo Scientific EPU-D software on the microscope computer.

This document describes the content of the most recent and few historic EPU-D releases.

## 1.3 Hardware Requirements

The EPU-D software can be used on the Microscope PC of Thermo Scientific and FEI TEM systems that are equipped with the MicroED Package and a compatible camera. See the release specific chapters below for a specification of the supported TEM Server software versions and cameras.

## 1.4 System, software and configuration compatibility

The following tables show the compatible microscope software versions, the preferred EPU-D software versions per microscope software version, and the system configuration compatibility.

Although the EPU-D software is backward compatible with a limited range of microscope software versions, some of the new features and improvements may be available only for the most recent supported microscope software version(s).

### 1.4.1 Preferred EPU-D version per microscope software version

| Titan       | Talos       | EPU-D | Remarks |
|-------------|-------------|-------|---------|
| 3.16 – 3.21 | 2.16 – 2.21 | 1.20  |         |
| 3.15        | 2.15        | 1.19  |         |
| 3.14        | 2.14        | 1.18  |         |
| 3.13        | 2.13        | 1.17  |         |
| 3.12        | 2.12        | 1.16  |         |
| 3.11        | 2.11        | 1.15  |         |
| 3.10        | 2.10        | 1.14  |         |
| 3.9         | 2.9         | 1.13  |         |
| 3.8         | 2.8         | 1.12  |         |
| 3.7         | 2.7         | 1.11  |         |
| 3.6         | 2.6         | 1.10  |         |
| 3.5         | 2.5         | 1.9   |         |
| 3.4         | 2.4         | 1.8.1 |         |
| 3.3         | 2.3         | 1.7   |         |
| 3.2         | 2.2         | 1.6   |         |
| 3.0 – 3.1   | 2.0 – 2.1   | 1.5   |         |
| 2.15        | 1.15        | 1.8.1 |         |

## 1.4.2 Compatible microscope software versions per EPU-D version

| EPU-D | Titan             | Talos             | Remarks  |
|-------|-------------------|-------------------|--|
| 1.20  | 3.16 – 3.21       | 2.16 – 2.21       |  |
| 1.19  | 3.15 – 3.20       | 2.15 – 2.20       |  |
| 1.18  | 3.14 – 3.19       | 2.14 – 2.19       |  |
| 1.17  | 3.13 – 3.18       | 2.13 – 2.18       |  |
| 1.16  | 3.12 – 3.17       | 2.12 – 2.17       |  |
| 1.15  | 3.11 – 3.16       | 2.11 – 2.16       |  |
| 1.14  | 3.10 – 3.15       | 2.10 – 2.15       |  |
| 1.13  | 3.9 – 3.14        | 2.9 – 2.14        |  |
| 1.12  | 3.8 – 3.13        | 2.8 – 2.13        |  |
| 1.11  | 3.7 – 3.12        | 2.7 – 2.12        |  |
| 1.10  | 3.6 – 3.11        | 2.6 – 2.11        |  |
| 1.9   | 3.5 – 3.10        | 2.5 – 2.10        |  |
| 1.8.1 | 2.15<br>3.4 – 3.9 | 1.15<br>2.4 – 2.9 | Preferred over EPU-D 1.8                       |
| 1.8   | 2.15<br>3.4 – 3.9 | 1.15<br>2.4 – 2.9 |  |
| 1.7   | 2.15<br>3.3 – 3.8 | 1.15<br>2.3 – 2.8 |  |
| 1.6   | 2.15<br>3.2 – 3.7 | 1.15<br>2.2 – 2.7 |  |
| 1.5   | 2.15 - 3.6        | 1.15 - 2.6        |  |
| 1.4   | 2.15 - 3.5        | 1.15 - 2.5        |  |
| 1.3   | 2.15 - 3.4        | 1.15 - 2.4        |  |
| 1.2   | 2.15 - 3.3        | 1.15 - 2.3        |  |
| 1.1   | —                 | 1.15 - 2.2        | Not available for systems with Titan software. |
| 1.0   | —                 | 1.15 - 2.1        | Not available for systems with Titan software. |

### 1.4.3 Compatible cameras for EPU-D

| Camera, Sensor Package and Options | EPU-D         | Remarks   |
|------------------------------------|---------------|---|
| Ceta-D                             | 1.0 and later | Preferred Sensor Package. Included in the Micro-ED package.   |
| Ceta-16M                           | 1.0 and later |   |
| Ceta Speed Enhancement (Ceta-2)    | 1.0 and later | The Speed Enhancement option is compatible with EPU-D, but EPU-D does not use the additional functionalities and performance of the Speed Enhancement option. |



## 2 EPU-D 1.20

The EPU-D 1.20 release does not introduce new features or major improvements. It maintains compatibility with new Titan and Talos software versions.

### 2.1 Mandatory and Breaking Changes

*None Identified.*

### 2.2 New features

*No (major) items.*

### 2.3 Improvements

*No (major) items.*

## 3 EPU-D 1.19

The EPU-D 1.19 release does not introduce new features or major improvements. It maintains compatibility with new Titan and Talos software versions.

### 3.1 Mandatory and Breaking Changes

*None Identified.*

### 3.2 New features

*No (major) items.*

### 3.3 Improvements

*No (major) items.*

## 4 EPU-D 1.18

The EPU-D 1.18 release does not introduce new features or major improvements. It maintains compatibility with new Titan and Talos software versions.

### 4.1 Mandatory and Breaking Changes

*None Identified.*

### 4.2 New features

*No (major) items.*

### 4.3 Improvements

*No (major) items.*

### 4.4 Solved issues

| ID       | Description   | Remarks |
|----------|---|---------|
| MED-1186 | Grid square preset magnification is reset to Atlas magnification.<br>This issue has been solved in EPU-D 1.17 | --      |

## 5 EPU-D 1.17

The EPU-D 1.17 release does not introduce new features or major improvements. It maintains compatibility with new Titan and Talos software versions.

### 5.1 Mandatory and Breaking Changes

*None Identified.*

### 5.2 New features

*No (major) items.*

### 5.3 Improvements

*No (major) items.*

## 6 EPU-D 1.16

The EPU-D 1.16 release does not introduce new features or major improvements. It maintains compatibility with new Titan and Talos software versions.

### 6.1 Mandatory and Breaking Changes

*None Identified.*

### 6.2 New features

*No (major) items.*

### 6.3 Improvements

*No (major) items.*

## 7 EPU-D 1.15

The EPU-D 1.15 release does not introduce new features or major improvements. It maintains compatibility with new Titan and Talos software versions.

### 7.1 Mandatory and Breaking Changes

*None Identified.*

### 7.2 New features

*No (major) items.*

### 7.3 Improvements

*No (major) items.*

## 8 EPU-D 1.14

The EPU-D 1.14 release does not introduce new features, but carries some improvements. This release also maintains compatibility with new Titan and Talos software versions.

### 8.1 Mandatory and Breaking Changes

*None Identified.*

### 8.2 New features

*No (major) items.*

### 8.3 Improvements

- **Acquisition and Optics Settings task:** The ribbon is now much cleaner. Some parameters have been removed; others moved to the ribbon's expandable menu.
- The default path for data storage is drive D (if available).

## 9 EPU-D 1.13

The EPU-D 1.13 release does not introduce new features or major improvements. This release serves only to maintain compatibility with new Titan and Talos software versions.

### 9.1 New features

*No (major) items.*

### 9.2 Improvements

*No (major) items.*

### 9.3 Solved issues

*No (major) items.*



## 10 EPU-D 1.12

The EPU-D 1.12 release does not introduce new features or major improvements. This release serves only to maintain compatibility with new Titan and Talos software versions.

### 10.1 Mandatory and Breaking Changes

*None Identified.*

### 10.2 New features

*No (major) items.*

### 10.3 Improvements

*No (major) items.*

### 10.4 Solved issues

*No (major) items.*

## 11 EPU-D 1.11

The EPU-D 1.11 release does not introduce new features or major improvements. This release serves only to maintain compatibility with new Titan and Talos software versions.

### 11.1 Mandatory and Breaking Changes

*None Identified.*

### 11.2 New features

*No (major) items.*

### 11.3 Improvements

*No (major) items.*

### 11.4 Solved issues

*No (major) items.*

## 12 EPU-D 1.10

The EPU-D 1.10 release does not introduce new features or major improvements. This release serves only to maintain compatibility with new Titan and Talos software versions.

### 12.1 Mandatory and Breaking Changes

*None Identified.*

### 12.2 New features

*No (major) items.*

### 12.3 Improvements

*No (major) items.*

### 12.4 Solved issues

*No (major) items.*

## 13 EPU-D 1.9

The EPU-D 1.9 release does not introduce new features or major improvements. This release serves only to maintain compatibility with new Titan and Talos software versions.

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**Note** As of this release, EPU-D is no longer compatible with Windows 7 based microscope software.

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### 13.1 Mandatory and Breaking Changes

*None Identified.*

### 13.2 New features

*No (major) items.*

### 13.3 Improvements

*No (major) items.*

### 13.4 Solved issues

*No (major) items.*

## 14 EPU-D 1.8.0 / 1.8.1

The EPU-D 1.8 release contains a limited number of improvements. This release serves mostly to maintain compatibility with new Titan and Talos software versions.

### 14.1 Mandatory and Breaking Changes

*None Identified.*

### 14.2 New features

*No (major) items.*

### 14.3 Improvements

#### General:

The lens normalizations are improved, so that the center spot no longer drifts away from the beam stop position.

#### Automated Acquisition

The result of the Optimized Position calibration is now also used for Batch Acquisition. A delay is added to improve the stability.

### 14.4 Solved issues

| ID       | Description                             | Remarks |
|----------|---|---------|
| MED-1114 | SMV meta data: resolution is incorrect. | --      |
| MED-1137 | SMV scale bar is incorrect.             | --      |

#### Solved in EPU-D 1.8.1

| ID                   | Description                                      | Remarks   |
|----------------------|--|---|
| EPU-7370 / TOMO-3838 | Process keeps running when application is closed | Issue in shared software component for EPU, EPU-D and Tomography. |

## 15 EPU-D 1.7

The EPU-D 1.7 release does not introduce new features or major improvements. This release serves only to maintain compatibility with new Titan and Talos software versions.

### 15.1 Mandatory and Breaking Changes

*None Identified.*

### 15.2 New features

*No (major) items.*

### 15.3 Improvements

#### **General**

The User Interface styling is updated.

*The screenshots in the User Manual are not updated.*

#### **EPU-D > Data Acquisition**

The MRC Header of the acquired tilt series images now contains the tilt speed.

### 15.4 Solved issues

*No (major) items.*

## 16 EPU-D 1.6

The EPU-D 1.6 release does not introduce new features or major improvements. This release serves only to maintain compatibility with new Titan and Talos software versions.

### 16.1 Mandatory and Breaking Changes

*None Identified.*

### 16.2 New features

*No (major) items.*

### 16.3 Improvements

*No (major) items.*

### 16.4 Solved issues

*No (major) items.*

## 17 EPU-D 1.5

The EPU-D 1.5 release does not introduce new features or major improvements. This release serves only to maintain compatibility with new Titan and Talos software versions.

### 17.1 Mandatory and Breaking Changes

*None Identified.*

### 17.2 New features

#### **Automated Acquisition:**

The *MRC2014 FEI2 Extended Header* image format is introduced.

*Not all new metadata fields are filled yet.*

### 17.3 Improvements

*No (major) items.*

### 17.4 Solved issues

*No (major) items.*



## 18 EPU-D 1.4

EPU-D 1.4 introduces video playback and export functionalities.

### 18.1 Mandatory and Breaking Changes

*None Identified.*

### 18.2 New features

#### **EPU-D > Session Setup**

Tilt Series can now be stored as SMV files.

#### **EPU-D > Batch Positions**

The Image Display can now toggle between Diffraction and TEM Imaging mode.

#### **EPU-D > Batch Positions and Automated Acquisition**

- The Image Display can now show the Tilt Axis.
- An acquired Tilt Series can now be played back as a video.
- An acquired Tilt Series can now be exported as an H.264 MPEG4 video.

### 18.3 Improvements

*No (major) items.*

### 18.4 Solved issues

*No (major) items.*

## 19 EPU-D 1.3

EPU-D 1.3 introduces the Screening and Batch mode functionalities.

### 19.1 Mandatory and Breaking Changes

*None Identified.*

### 19.2 New features

#### Preparation > Acquisition and Optics Presets

The Diffraction Acquisition preset has the following new features:

- **Image Display:** Hover with the mouse cursor over the acquired preview image to inspect the resolution and intensity for the pixel where the mouse cursor is located.
- The **Camera Settings > Exp. time** has a minimum value that corresponds to the maximum frame rate of the camera. If a shorter duration is specified, then the field is invalidated and highlighted with a red salience. If Preview is selected before the invalid value is corrected, then the EPU-D automatically restores the previous value before the *Preview* is acquired.

#### Atlas > Atlas and Screening

- If the microscope has an Autoloader, then the new Screening task is available. The Screening task automatically acquires Atlases for a selection of multiple specimens in the Autoloader.
- If no Autoloader is present, then the Atlas task is available to acquire an Atlas from the specimen on the stage.

- **EPU-D > Session Setup**

**Batch** mode is added.

In Batch mode, EPU-D automatically acquires Tilt Series from multiple prepared locations on the specimen. For location reference and confirmation of the position, the last image of each Tilt Series is a TEM image at 0 degrees tilt.

In this release, the Batch mode functionality is in a Beta phase. Significant improvements are scheduled for future releases.

### 19.3 Improvements

#### General

EPU-D now logs high-level usage events to **Health Monitor** for Service diagnostics.

#### Preparation > Acquisition and Optics Presets

- The *Search* Preset is renamed to *Search / Auto Eucentric*.
- **C2 Aperture** can be selected in every preset, except in the *Imaging Acquisition* Preset. The *Imaging Acquisition* Preset uses the same C2 aperture as the *Diffraction Acquisition* Preset.

**EPU-D > Automated Acquisition**

The Histogram > Contrast-Brightness-Gamma adjustment is improved for a higher quality display during live view of the Tilt Series acquisition. Any adjustments to contrast, brightness and/or gamma only apply to the Image Display. The recorded diffraction images are not affected.

**19.4 Solved issues**

| ID      | Description   | Remarks |
|---------|---|---------|
| MED-497 | <b>Optimized position can conflict with image shift calibration</b><br>The Image Shift calibration resets the optimized position for every probe mode to 0 before performing the calibration. If the Acquisition and Optics Presets do not all use the same Nanoprobe or Microprobe mode, then the optimized position is applied in only in one of the first two steps of the calibration, which may lead to inaccurate calibration results | --      |

## 20 EPU-D 1.2

EPU-D 1.2 introduces the Optimized Position Calibration and support for Titan Family systems.

### 20.1 Mandatory and Breaking Changes

*None Identified.*

### 20.2 New features

#### General

A 30-day Trial License is available.

#### Preparation > Optimized Position

The Optimized Position calibration compensates for an offset between the tilt axis of the stage and the optical center of the aligned column.

#### EPU-D > Session Setup

Acquired images can be saved as a single stacked MRC image file per Tilt Series.

### 20.3 Improvements

#### General

At startup, EPU-D verifies that Tomography and/or EPU software are not also running.

#### Image Display > Show Resolution Rings

The color of the Resolution Rings is changed from red to green to improve visibility.

#### EPU-D > Automated Acquisition

- **Auto Eucentric:** the execution of the Auto Eucentric function can be stopped.
- **Name:** if the Name for a Tilt Series is generated automatically by EPU-D, then it will be updated for every new Tilt Series acquisition.

### 20.4 Solved issues

| ID      | Description  | Remarks |
|---------|--|---------|
| MED-471 | Falcon camera is inserted after acquisition is started | --      |

## 21 EPU-D 1.1

Besides functional and performance improvements, EPU-D 1.1 features multiple new features to make the preparation, acquisition and inspection of high-quality diffraction images faster and easier.

### 21.1 Mandatory and Breaking Changes

*None Identified.*

### 21.2 New features

#### Image Display

- **Resolution Rings:** this Image Display overlay gives a quick overview of the resolution of the diffraction pattern. This overlay can easily be centered with the diffraction pattern.
- **Diffraction Ruler:** this Image Display overlay enables an easy method to measure the resolution of a particular bright spot.
- **Frame Slider:** after the acquisition of a Tilt Series is completed, the Frame Slider enables inspection of the acquired images.

#### Atlas:

An automatic check validates the integrity of a loaded Atlas.

#### Automated Acquisition

- **Name:** each Tilt Series must have a unique name. This name is included of the file-path for the acquired images.
- **Auto Eucentric:** automatically sets the specimen to eucentric height, using the stage tilt method.
- **Histogram > Reset Auto Levels:** reverts custom contrast, brightness and gamma to the values that are calculated by the auto-level algorithm.

### 21.3 Improvements

#### Automated Acquisition:

The automatic contrast-brightness is improved.

### 21.4 Solved issues

#### 21.4.1 EPU-D 1.1 - Solved Issues

| ID      | Description   | Remarks |
|---------|---|---------|
| MED-498 | Atlas does not use optimized position                       | --      |
| MED-545 | Pixel size calculation in live acquisition was not accurate | --      |

## 22 EPU-D 1.0

This is the first release of the EPU-D software. The EPU-D software is a new product in the range of Thermo Scientific TEM Cryo-EM application software products, which currently includes EPU and Tomography.

The major items for this release are:

- Support for:
  - All Talos systems with Talos 1.15.X, 2.0.X or 2.1.X software and the MicroED Package. Titan systems are not supported yet.
  - All Ceta camera configurations.
- Common TEM Cryo-EM application software User Interface look&feel and functionalities.
- Similar application flow as the TEM Cryo-EM application software products:
  - Startup checks to verify that the system is in a suitable status for successful use of the EPU-D software.
  - Define, archive and load *Acquisition and Optics Presets* for the preparation and execution of an Automated Acquisition session.
  - Perform calibrations if necessary.  
For this release, only the *Image Shift Calibration* is available in EPU-D.

### Note

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The *Optimized Position Calibration* is not yet available in EPU-D.

EPU-D reads the result of the Optimized Position Calibration in the Tomography software.

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If Tomography is not available on the system, then EPU-D uses a default value that works well for most MicroED experiments. If a calibrated value is necessary to achieve high quality results, then please contact a Thermo Fisher Scientific service representative.

- Acquire an overview (*Atlas*) of the specimen.
- Define and execute an *Automated Acquisition* session.  
During the Automated Acquisition:
  - The specimen is tilted in a single, smooth movement while the camera acquires and stores images at small, regular tilt intervals.
  - The User Interface displays a live image feed, so the diffraction pattern quality can be monitored.
- Automated insert/retract of the Beam Stop to protect the camera sensor package from local over-exposure.

### 22.1 Mandatory and Breaking Changes

This is the first release of the EPU-D software. There are no mandatory or breaking changes relative to a preceding version.

### 22.2 New features

This is the first release of the EPU-D software. There are no new features relative to a preceding version.

The EPU-D software is part of the TEM Cryo-EM range of software applications. For EPU-D, the following features and functionalities are newly developed:

- Automated insert/retract of the Beam Stop.
- Support for Ceta cameras with Ceta-D Sensor Package.
- Support for Diffraction Mode.
- Continuous image acquisition, synchronized with a single, smooth move across a specified tilt range.
- Mouse gestures to adjust the contrast, brightness and gamma values in the live image display during automated acquisition.

## 22.3 Improvements

This is the first release of the EPU-D software. There are no improvements relative to a preceding version.

## 23 Known Issues

The most recent release of EPU-D has the following Known Issues.

Historic Known Issues that are solved in a released software version are not listed.

| ID   | Issue Description and Workaround |
|------|----------------------------------|
| None | —                                |
|      | —                                |

## 24 Copyright, Limited Rights and Revision History

### Copyright

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### Revision Table

| Revision | Date     | Description of Changes        |
|----------|----------|-------------------------------|
| 1.0      | JUL-2019 | Initial version for EPU-D 1.0 |
| 1.1      | OCT-2019 | Update for EPU-D 1.1          |
| 1.2      | JAN-2020 | Update for EPU-D 1.2          |
| 1.3      | APR-2020 | Update for EPU-D 1.3          |
| 1.4      | JUL-2020 | Update for EPU-D 1.4          |
| 1.5      | SEP-2020 | Update for EPU-D 1.5          |
| 1.6      | JAN-2021 | Update for EPU-D 1.6          |
| 1.7      | MAR-2021 | Update for EPU-D 1.7          |
| 1.8      | JUN-2021 | Update for EPU-D 1.8          |
| 1.8.1    | AUG-2021 | Update for EPU-D 1.8.1        |
| 1.9      | OCT-2021 | Update for EPU-D 1.9          |
| 1.10     | JAN-2022 | Update for EPU-D 1.10         |
| 1.11     | APR-2022 | Update for EPU-D 1.11         |
| 1.12     | AUG-2022 | Update for EPU-D 1.12         |
| 1.13     | SEP-2022 | Update for EPU-D 1.13         |
| 1.14     | JAN-2023 | Update for EPU-D 1.14         |



| <b>Revision</b> | <b>Date</b> | <b>Description of Changes</b> |
|-----------------|-------------|-------------------------------|
| 1.15            | MAR-2023    | Update for EPU-D 1.15         |
| 1.16            | JUL-2023    | Update for EPU-D 1.16         |
| 1.17            | OCT-2023    | Update for EPU-D 1.17         |
| 1.18            | JAN-2024    | Update for EPU-D 1.18         |
| 1.19            | APR-2024    | Update for EPU-D 1.19         |
| 1.20            | JUL-2024    | Update for EPU-D 1.20         |

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