

Time-of-Flight Microscope PickUp-ToF

(Release R001)



Manual

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User manual for the PickUp-ToF Release 001].
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2 Introduction

2.1 General Information

This manual is intended to assist users in the installation, operation and maintenance of Release Version 001 of the Surface Concept Time-of-Flight Microscope PickUp-ToF. It is divided into 5 chapters.

2.2 Safety Instructions

Please read this manual carefully before performing any electrical or electronic operations and strictly follow the safety rules given within this manual.

The following symbols appear throughout the manual:



The “note symbol” marks text passages that contain important information/hints about the operation of the device. Follow this information to ensure a proper operation of the device.



The “caution symbol” marks warnings, which are given to prevent an accidentally damaging of the device. Do **NOT** ignore these warnings and follow them strictly. Otherwise no guarantee is given for arose damages.



The “high voltage symbol” marks warnings, given in context with the description of the operation/use of high voltage supplies and/or high voltage carrying parts. Hazardous voltages are present that can cause serious or fatal injuries. Therefore only persons with the appropriate training are allowed to carry out the installation, adjustment and repair work.

2.3 General Overview

The Surface Concept PickUp-ToF is a compact bold-on Time of Flight Microscope on a CF100 mounting flange. It can be equipped with different types of detectors to cope with a large variety of applications (e.g. MCP based detectors with metal anode for counting and time resolved spectroscopy or delayline detectors for time resolved spatial resolved imaging).

3 Installation

3.1 Initial Inspection

Visual inspection of the system is required to ensure that no damage has occurred during shipping. If there are any signs of damage, please contact SURFACE CONCEPT immediately. Please check the delivery according to the packing list (see Table 1) for completeness.

- 1x PickUp-ToF R001 (delivered under vacuum)
- 1x Filterbox with 12pin plug and 8m cabling for HV supply of electrostatic elements of the PickUp-ToF
- 2x SHV cables for detector supply (8m)
- 1x BNC cable for interlock connection (8m)
- 1x BNC noise filter element
- 1x Resistor connector

Table 1: Packing list for the PickUp-ToF R001

3.2 Installation

3.2.1 Mounting the PickUp-ToF

The PickUp-ToF is transported under vacuum. Proceed as follows, to install it into your vacuum chamber:

- Vent the transport container **carefully** with N₂.
- Release the M8 screws of the vacuum container and pull out the PickUp-ToF **carefully**.



The electrostatic elements as well as the microchannel plates of the MCP detector should be protected from exposure to particle contamination. Particles that stick to the MCP plates of the detector can be removed by using a single-hair brush carefully and/or with dry nitrogen. Reading the instructions “microchannel plates” in the detector manual is strongly recommended.

- Install the PickUp-ToF into your vacuum chamber.

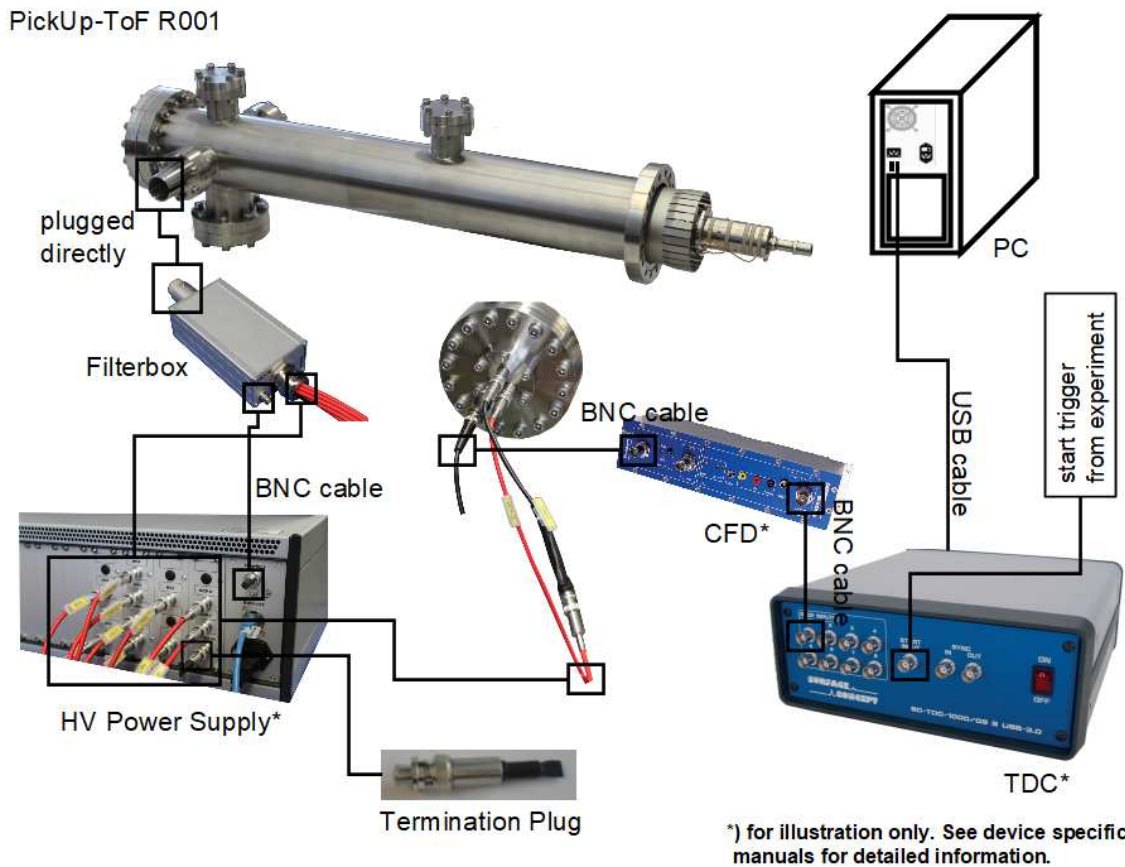
- Keep the vacuum container in case that the PickUp-ToF or the detector must be sent back for repair. It can also be used to store the PickUp-ToF or the detector when not installed in a vacuum chamber.



Note
 The PickUp-ToF should be kept under vacuum all the time.
 The best long term storage environment is an oil free vacuum in the 1E-2mbar range or better.
 The transport container is not designed for a long term storage of the detector. A storage time of one month should not be exceeded.
 The transport housing should be evacuated regularly with a period of at least one month, in case that the transport housing must be used for a longer storage time.

3.2.2 Cabling and High Voltage

The general connection schema of the PickUp-ToF including its readout package is shown in Figure 1.



PickUp-ToF R001 – Detector Connection Schema

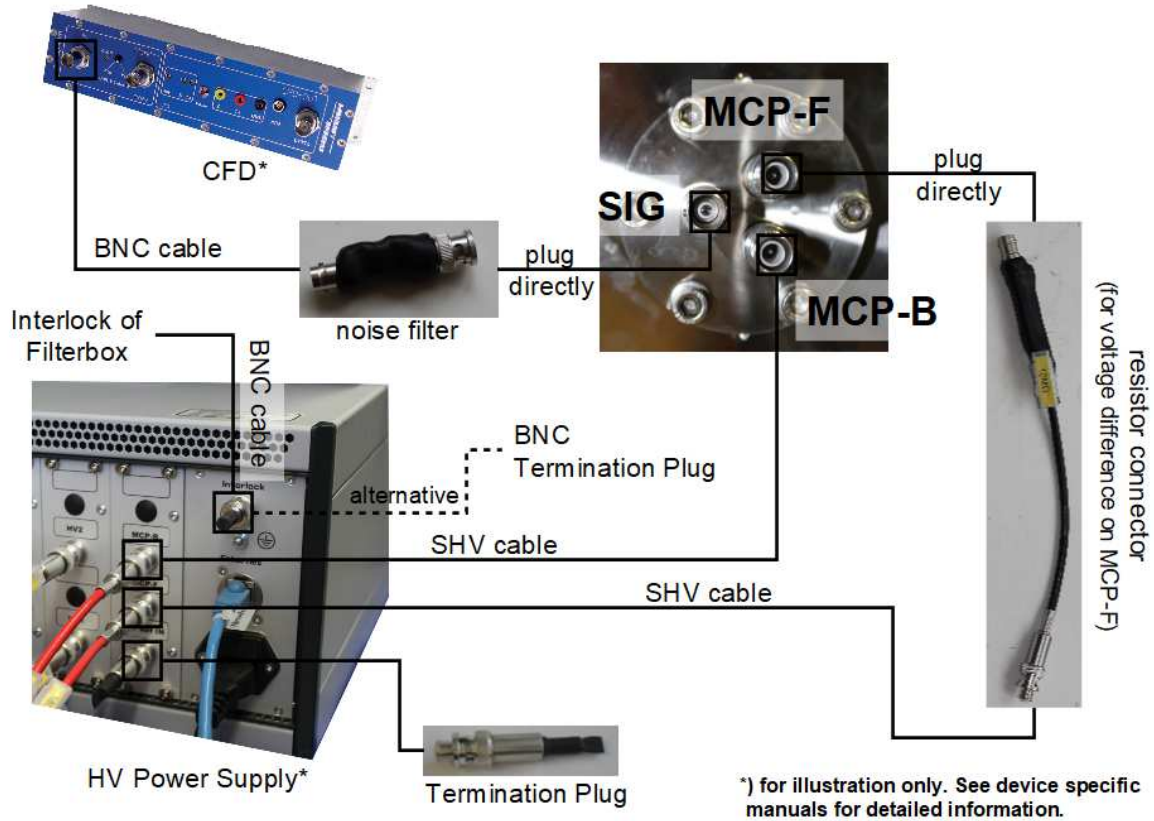


Figure 1: Connection schema of the PickUp-ToF, its detector and its readout and supply package



Finish the complete cabling before switching on the devices and switch off all devices first before performing any changes to the cabling.

- Plug the 12pin filterbox to the 12pin feedthrough of the PickUp-ToF.
- Connect the 8 SHV cables of the filterbox to the 19" HVPS. The single HV outputs as well as the cables are marked correspondingly. Respect the correct assignment of the cables to the 19" HVPS.
- Use the 8m BNC cable to connect the BNC "Interlock" socket of the filterbox with the BNC "Interlock" socket of the 19" HVPS. Alternatively one can connect the BNC termination plug to the BNC "Interlock" socket of the 19" HVPS and skip the 8m BNC cable. In this case the BNC "Interlock" socket of the filterbox can be left open.



The interlock connection between filterbox and HVPS blocks the switching on of the HVPS as long as the filterbox is not connected to the 12pin feedthrough. The BNC termination plug can be used to bridge this security element, allowing to switch on the HVPS even without the filterbox connected.

- There is a CF40 flange with 2 SHV feedthroughs for high voltage supply of the detector and 1 BNC feedthrough for signal readout (named "MCP-F", "MCP-B" and "SIG").

- Connect the 10M Ω resistor connector to the SHV feedthrough “MCP-F” first and then connect its end to the “MCP-F” socket of the 19” HVPS (using one of the two 8m SHV cables).
- Connect the SHV feedthrough “MCP-B” to the “MCP-B” socket of the 19” HVPS (using the other 8m SHV cable).
- Connect the small BNC noise filter element to the BNC feedthrough “SIG” first and then connect its end to the input of the CFD using the short BNC cable.
- Connect the output of the CFD to the TDC.
- Connect the power cable to the main connector of the 19” HVPS and the TDC and use the USB cable to connect the TDC to the PC. Do not use PC front panel USB connectors; they are often restricted in performance.
- Terminate the “HV Ref IN” socket of the 19” HVPS with the SHV termination plug (part of the delivery).
- The “HV Ref IN” socket can also be used to apply a reference voltage to the detector operation voltage later on.
- See the manual for the high voltage power supply for more detailed information.



In cases that no reference voltage is applied to the HV Ref IN connector of the 19” HVPS, the termination plug must be used to ground this potential. Otherwise this HV module is not functioning as the reference potential is missing.

The exact operation voltage of the detector is given in the specification sheet. It is given in reference to the “MCP-F” potential (which corresponds to the HV Ref IN potential).



See the manuals for the detector, the CFD, the TDC and for the 19” HVPS for more detailed information.

- To perform time measurements with respect to an external clock, provide start pulses to the start input of the TDC. Use the corresponding BNC socket of the TDC (see the TDC manual for the specific connection schema of the TDC).

3.2.3 Software Interface and Installation

All operation functions for data readout of the TDC are encapsulated in a dynamic linked library (scTDC1.dll). Data processing and presentation on the PC is realized by a stand-alone application (TdcTimeHistsGUI) based on Python 3, which needs to be installed to run the software.

The remote control of the 19” HVPS is realized via an Ethernet interface and a binary encoded TCP/IP protocol. See the documentation of the SC_HV_binary_protocol for further details. There is also a java based stand alone software for device control and voltage readout, which needs Java 8 to be installed.

The delivery package includes a storage medium with the TDC hardware driver, a SDK for the scTDC1.dll library, and stand-alone applications based on Python and Java.

Insert the storage medium to your PC and install the hardware driver. See the Software Installation manual for further details.

Read-out of the PickUp-ToF is done via the USB port of the TDC. The specific PC system requirements can be found in the corresponding TDC manual.

For Linux Users, please see specific installation instructions on the storage device.

4 Device Layout & Operation

4.1 PickUp-ToF – Operation Voltages

There are 2 defined lens settings available for the PickUp-ToF to be operated in two different operation modes. The first mode has a higher, the second mode a lower operation voltage for the collector. These two settings are given below in Table 2.

Lens Name	HV Channel/ cable label	OperationVoltage (Mode 1)	Operation Voltage (Mode 2)
Trans1a	HV3a/ HV3(1)	400V	400V
Collector	HV2	200V	50V
ToF	HV1	50V	50V
Trans1b	HV4a/ HV4(1)	400V	400V
DetFoc	HV6	250V (5* ToF Voltage)	250V (5* ToF Voltage)
Trans2a	HV3b/ HV3(2)	800V	800V
Trans2b	HV4b/ HV4(2)	800V	800V
Focus	HV5	2000V	1500V

Table 2: PickUp-ToF Operation Voltages

4.2 PickUp-ToF – Schematic Lens Setup and Trajectory Simulation

Figure 2 shows schematic lens setup of the PickUp-ToF as well as the result of trajectory simulation for the operation mode 1. Arrows with the same color mark identical potentials.

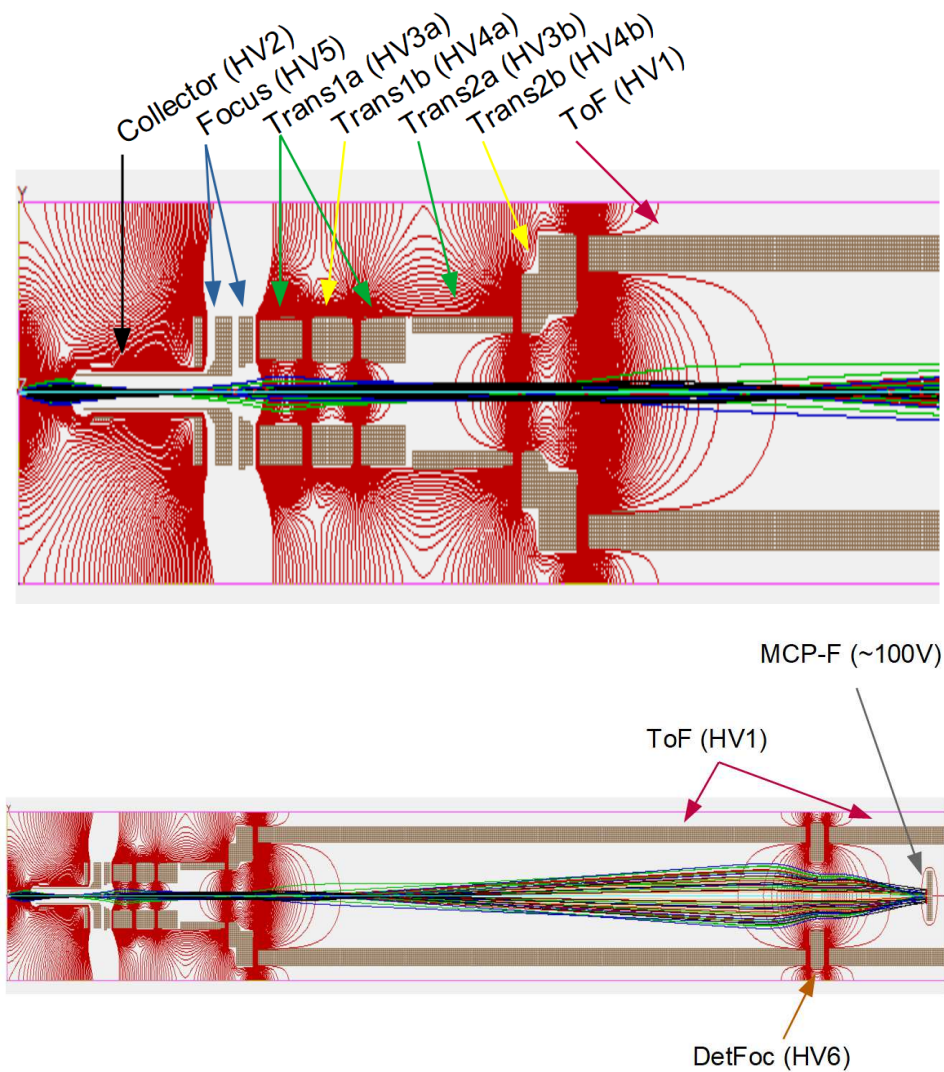
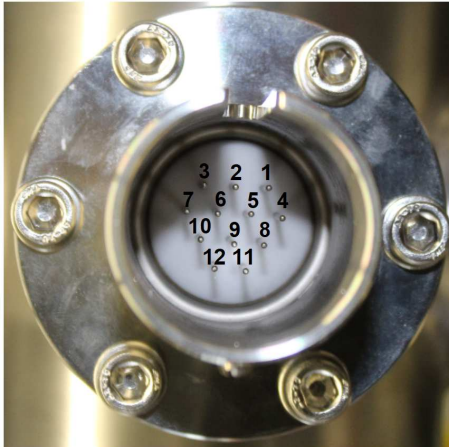


Figure 2: Schematic lens setup of the PickUp-ToF with results of trajectory simulation

4.3 PickUp-ToF – Connection Ports

The PickUp-ToF comes with a 12pin feedthrough for high voltage supply of the electrostatic lenses (see Figure 3). The detector itself has its own feedthroughs for HV supply and signal readout (see the detector manual for detailed information).



	HV channel/ cable label	lens name
1.	HV3a/ HV3(1)	Trans1a
2.	HV2	Collector
3.	HV1	ToF
4.	HV4a/ HV4(1)	Trans1b
5.	Interlock	
6.	Interlock	
7.	N/A	
8.	HV6	DetFoc
9.	N/A	
10.	HV3b/ HV3(2)	Trans2a
11.	HV4b/ HV4(2)	Trans2b
12.	HV5	Focus

Figure 3: Pin assignment of the 12pin feedthrough

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EU Declaration of Conformity

Manufacturer **Surface Concept GmbH**
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Product: PickUp-ToF

The above named products comply with the following European directive:

89/336/EEC	Electromagnetic Compability Directive, amended by 91/263/ EEC and 92/31/ EEC and 93/68/EEC
73/23/EEC	Low Voltage Equipment Directive, amended by 93/68/EEC

The compliance of the above named product to which this declaration relates is in conformity with the following standards or other normative documents where relevant:

EN 61000-6-2:2005+AC:2005	Electromagnetic compatibility (EMC): Generic standards - Immunity for industrial environments
EN 61000-6-4:2007+A1:2011	Electromagnetic compatibility (EMC): Generic standards - Emission standard for industrial environments
EN 61010-1: 2010	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use

For and on behalf of **Surface Concept GmbH**

Mainz,.....01.10.2019.....
(Date)

Legal signature.....
(Dr. Andreas Oelsner)

This declaration does not represent a commitment to features or capabilities of the instrument. The safety notes and regulations given in the product related documentation must be observed at all times.