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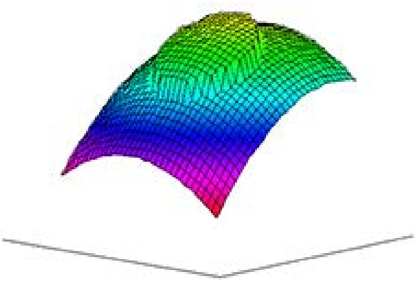
THORLABS

CC200A - MAR 15, 2019

Item # CC200A was discontinued on March 15, 2019. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

- **Automated, Compact Interferometer Controlled through USB Port**
- **Precise, Fast Measurements of Radius of Curvature, Apex Offset, and Fiber Height**
- **User-Friendly Software Compatible with Windows® 7, 8, or 10**

3D View Provides Intuitive Understanding of Geometry



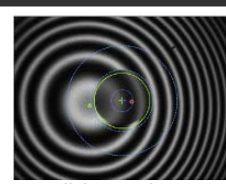
Pass/Fail Limit Regions Streamline Production Line Integration

CC6000

OVERVIEW

Features

- Automated, Non-Contact Analysis of Single-Fiber Connector End Faces
- Quickly Measure Radius of Curvature, Apex Offset of Polish, and Fiber Undercut or Protrusion
- Minimal Need for Refocusing Coupled with No Regularly Moving Components
- Software can be Installed on PC (Not Included) with Windows® 7 or Higher
- Interchangeable Mounts for Ø1.25 mm to Ø2.50 mm Ferrule, PC or APC, Single-Fiber Connectors



Click to Enlarge
The included software's Live View allows a user to adjust focus in real time for maximum contrast, ensuring high accuracy and quick measurement time.

Click to Enlarge
This portable interferometer, with integrated carrying handle, is designed for use in production as well as the field.

Thorlabs' Vytran® Connect-Chek™ Interferometer automatically and precisely measures radius of curvature, apex offset of polish, and fiber undercut or protrusion on any PC or APC, single-fiber connector. The CC6000 interferometer uses a non-contact tilted-phase-analysis technique for fast, reliable measurements of connector end faces. This compact interferometer has a carrying handle and must be attached to a desktop or laptop computer (not included) with a standard USB 2.0 port for operation. The included CC6000 software, which is used to control the interferometer, can be installed on a computer with the minimum

Item #	CC6000		
Measurement Specifications	**Range**	**Repeatability**[a]	**Reproducibility**[b]
Radius of Curvature	3 - 50 mm	1%	2%
Apex Offset	0 µm - 100 µm	2 µm	4 µm
Spherical Fiber Height	±160 nm	5 nm	10 nm
Interferometer Specifications			
Dimensions (L x W x H)	13.9" x 8.8" x 5.9"		

requirements in the table below. Designed for use in both the factory and the field, this interferometer provides crucial quality information needed to assure long-term performance of fiber optic connectors. One CC250P Mount for Ø2.50 mm PC Connectors and one RT250P Reference Tool for calibrating the CC250P mount are included with the CC6000 interferometer; mounts and reference tools that enable measurement of other PC or APC, single-fiber connectors are available separately below. When used with an appropriate mount for APC connectors, the CC6000 interferometer is also capable of measuring the APC angle and key error.

Light Source	LED (660 nm)
Camera Sensor	CCD, 5.79 mm x 4.89 mm Sensing Area
Measurement Lateral Resolution	1 µm
Magnification	10X Objective
Field of View (H x V)	358 µm x 336 µm
Computer Minimum Requirements	
Speed	Pentium IV 1.5 GHz
USB	2.0
Operating System	Microsoft® Windows® 7
RAM	1 GB

- Defined as the 1σ variance for 50 consecutive undisturbed measurements..
- Defined as the 1σ variance for 50 consecutive measurements with connector reinsertion between each measurement.

Software Interface

The user-friendly software allows anyone with minimal experience to accurately measure the end face geometry of a fiber optic connector. After performing a non-contact interferometric measurement of the fiber optic connector end face, the CC6000 interferometer will automatically generate a 3D image showing the measured radius of curvature, apex offset, and fiber height. This immediate visual feedback on the endface geometry of the connector aids users in understanding quality control and quality assurance issues, allowing them to get the most from their high performance fiber optic connectors. The software's user interface is simple and easy to learn, with every option visible under intuitive Menu Tabs. Measure, Setup, Calibration, or History windows can be brought up with a few clicks. Preset scan criteria can be loaded to allow pass/fail measurements of PC connectors using IEC, Telcordia, or your own custom standards. Data can be saved to an Excel file in any directory locally or on a network and is also saved on a SQL database. See the *Software* tab for more details.

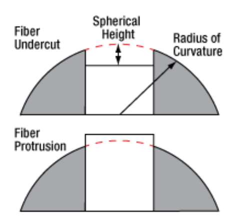
Tilted Phase Analysis

The CC6000 Connect-Chek™ interferometer uses a unique tilted phase analysis, in which the connector is held at a slight tilted angle so that interferometry produces circular fringes across the connector end face. This interferometry provides all the information needed to measure the connector without the need for costly phase-shifting devices. After a simple calibration to measure the tilt, the spherical radius of curvature, spherical fiber height, and apex offset of the connector are calculated using advanced algorithms (see the *Measurement* tab for more details). An added advantage of tilted phase analysis is that any small angle is suitable, so no mechanical adjustments are required. This lack of mechanical adjustment enables the measurements to be as fast as 1 second and the device to be easily maintained.

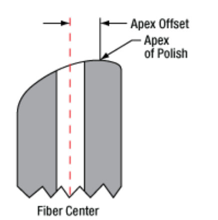
MEASUREMENT

Single-Fiber Measurement

Interferometry creates a circular fringe pattern on the connector, which may be visualized as a topographical map of the surface. Each fringe is a half-wavelength distance above or below adjacent fringes, showing the height difference across the surface. Definitions and measurement methods for each of the measured values are described below. For more information on reading interferograms, see the *Interferograms* tab.



Click for Details
Diagram showing radius of curvature and spherical fiber height.



Click to Enlarge
Diagram showing apex offset of polish.

Radius of Curvature

Radius of curvature is the average curvature radius (in mm) of the connector end face. It is defined as the radius of the best-fit curvature over the specified fitting area, calculated by using a least-squares method. Although typically a sphere is the best-fit model, an ellipsoid may be used for high or low radius of curvature.

The spherical radius of curvature is directly correlated to the diameter and spacing of the circular fringe patterns generated by the interferometer.

Spherical Fiber Height

Fiber height is the amount of undercut or protrusion (in nm) of the fiber in the connector. It is defined as the difference between the height at the center of the fiber and the spherically projected height of the ferrule at the same location.

When the connector is tilted slightly off axis, any changes in the circular fringe pattern at the boundary between fiber and ferrule is an indication of fiber protrusion or undercut. These changes are proportional to a change in fiber height, allowing the unique algorithms of the CC6000 software to take advantage of this information to measure the spherical fiber height.

Apex Offset

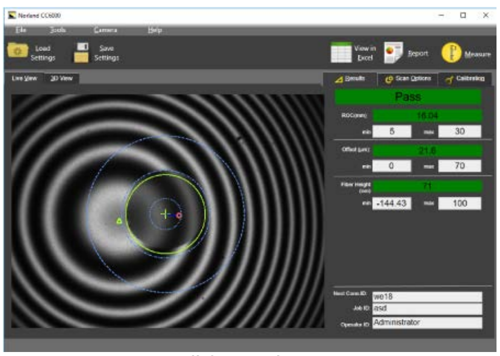
The apex offset is defined as the difference between the apex of the ferrule's spherical end face and the center of the fiber. As seen in the image to the right, the apex offset can be quantified as a linear distance offset (in µm).

When the connector is perpendicular to the optical path, as in a traditional interferometer, the apex offset is the distance from the center of the fiber to the highest point of the polish. The CC6000 interferometer is able to calculate the apex offset of the polish even in the preset tilted position of the connector. Rotating the connector will not change the offset measurements because the center of the fiber is the center of rotation for the ferrule. If the connector is held in a tilted position relative to the optical path, the apex offset is the distance from the center of rotation to the highest point of the polish.

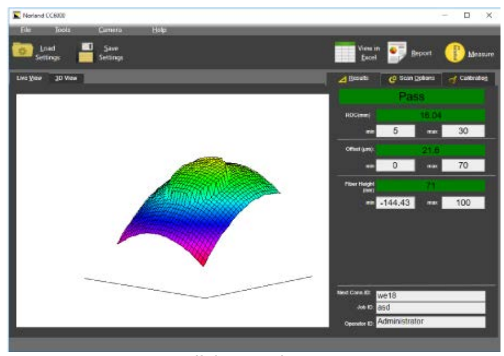
SOFTWARE

The CC6000 Portable Interferometer includes a measurement software program that must be installed and run on computers with Windows® 7, 8, or 10 and a USB 2.0 port. The software is navigated with an intuitive structure of menus and tabs, keeping essential tools in the forefront. Measurements can be taken in as little as 1 second, displaying "Pass" or "Fail" above the measured values for efficient production line use. Alternatively, for more detailed examination, a user can switch to the 3D view and show results in Scale Mode to see indicators showing the pass/fail limits. Administrator-level users have control of almost all software functions, including calibration capabilities and program configurations. Operator-level users can load pre-set configurations by clicking on the Load Settings button. By default, the data is saved to an Excel file in any directory locally or on a network, and also saved to a SQL database. Measurements for each connector can then be selected in the software for printing in a custom report. Below are a several sample screenshots showing some of the key features of the CC6000 software.

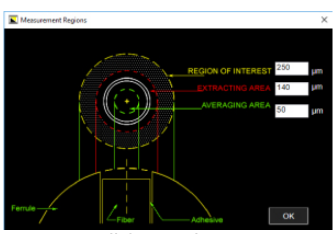
Software Features



Click to Enlarge
Live View
The Live View tab shows the interferogram generated by the CC6000 light source, with key measurement regions, fiber center, and apex of polish overlayed. This tab is used for focusing the interferometer prior to measurements.



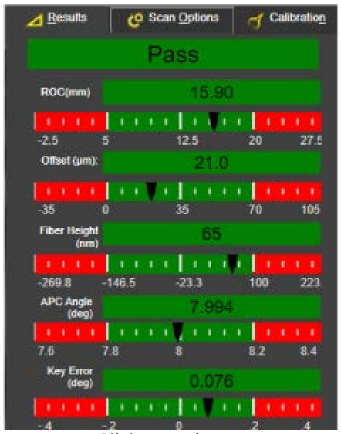
Click to Enlarge
3D View
The 3D View tab displays a software-computed model of the connector end face, generated from the measured connector parameters. This 3D view can be rotated and zoomed, enabling an interactive, intuitive perception of the connector end face.



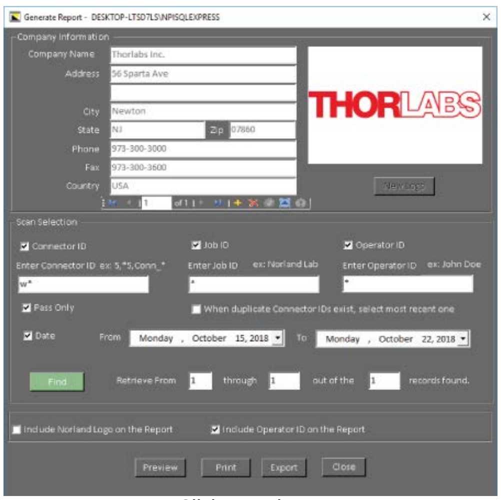
Click to Enlarge
Measurement Regions Control
Users have a high level of customization regarding the measurement process, including configuration of the regions used for measurement, as shown above.

Click to Enlarge
Results Tab, Value Mode (APC Connector)
This value-based display of the results allows for a quick reading; criteria that pass will be green, while those that fail will be shown in

red.



Click to Enlarge
Results Tab, Scale Mode (APC Connector)
This scale-based display of the results enables quick visual assessment of the results with respect to their limits; users may see the trend of successive measurements and adjust their process to prevent failed connectors.



Click to Enlarge
Generate Report Window
Printed reports can be customized with company information, logo, and operator ID. The range of scans to be printed can be selected using a variety of fields such as connector ID, operator ID, and date.

Click to Enlarge
Sample Report
Each printed report contains a 3D view of the connector, the key measurement parameters, and various additional information as determined by the user.

FRONT & BACK PANELS

Front and Back Panels

Click to Enlarge
Front Panel

Click to Enlarge
Back Panel

Front Panel	
Callout	**Description**
F1	Power On/Off Status Lamp
F2	Power Switch
F3	Connector Fixture

Back Panel	
Callout	**Description**
B1	Ferrules Material Switch (1 - Ceramic, 2 - Metal), Provides Coarse Brightness Adjustment
B2	Illumination Gain Adjuster,

F4	Connector FIxture Locking Lever
F5	Focus Adjustment

	Provides Fine Brightness Adjustment
B3	+12 VDC Power Input
B4	USB 2.0 Type B Port

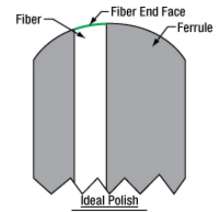
INTERFEROGRAMS

Reading Fiber Optic Interferograms

Inspection interferometers split light from a source between a reference flat and a surface under test. By recombining the beams of the reference arm and sample arm, an interference pattern is created allowing imperfections in a fiber tip to be inspected without making physical contact.

When produced perfectly, fibers are polished to match the height, curvature, and angle of their ferrule tip. With no imperfections, the fiber end face will seamlessly match the rest of the ferrule tip. This interferogram will be a bullseye of alternating constructive and destructive interference, or fringes (Figure 1). The location of the fiber end is marked in green on the fiber schematics and circled in green on the interferograms. Note that the fiber is not perfectly centered in the ferrule. There will be a small offset between the fiber center and the apex of polish; often, an off-center fiber can make disturbances in the interferogram easier to see, as the fiber interacts with more fringes.

Deviations from an ideal polish will result in visible distortions within the green-circled region of the interferogram. If a fiber end protrudes past the surface of the ferrule, the interferogram will show a distortion that advances the fringe pattern away from the ferrule's apex of curvature (Figure 2). If a fiber end is undercut, the interferogram will show a distortion with retreats from the apex of curvature (Figure 3). An undercut fiber could collect dust, which will either absorb or scatter light, causing dots to appear in the interferogram (Figure 4). If a fiber end has shattered in the polishing process, the interferogram will be highly irregular (Figure 5).



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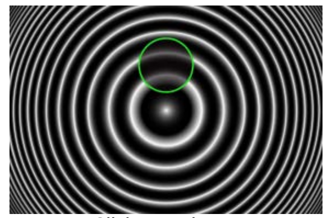
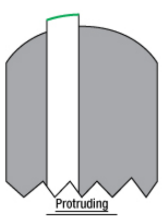

Click to Enlarge

Figure 1: At left is shown a cross section of a ferrule with an ideally polished fiber. A representation of the interferogram created by this fiber can be seen to the right. In these images, the fiber end face is marked in green. Note how the fringes are uninterrupted when passing over the fiber end face.



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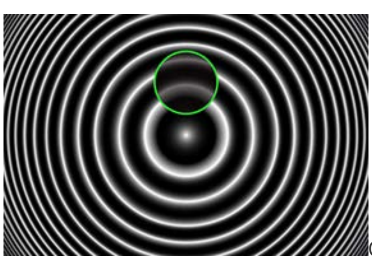
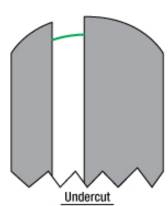

Click to Enlarge

Figure 2: At left is shown a cross section of a ferrule with a polished fiber protruding from its ferrule. A representation of the interferogram created by this fiber can be seen to the right. In these images, the fiber end face is marked in green. Note how the



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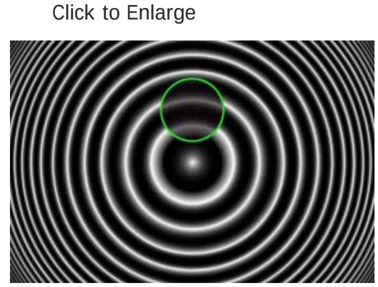
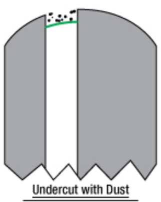


Figure 3: At left is shown a cross section of a ferrule with an undercut fiber. A representation of the

fringes are warped away from the apex of curvature when passing over the fiber end face.

Click to Enlarge

interferogram created by this fiber can be seen to the right. In these images, the fiber end face is marked in green. Note how the fringes are warped toward the apex of curvature when passing over the fiber end face.



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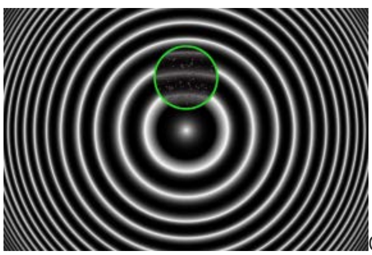
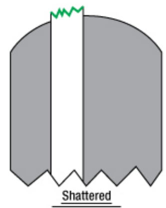


Click to Enlarge

Figure 4: At left is shown a cross section of a ferrule with an undercut fiber where dust has gathered in the cavity. A representation of the interferogram created by this fiber can be seen to the right. In these images, the fiber end face is marked in green. Note how dark and light spots now appear across the fiber face due to the dust absorbing and scattering light.



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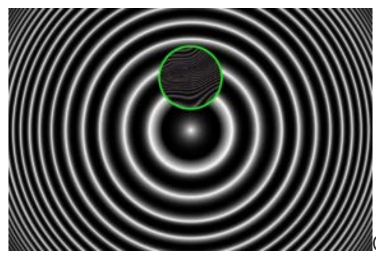

Click to Enlarge

Figure 5: At left is shown a cross section of a ferrule with a shattered protruding fiber. A representation of the interferogram created by this fiber can be seen to the right. In these images, the fiber end face is marked in green. Every shatter will be different; it is important to note that the interferogram will have multiple reflective faces causing the fringes to look very incongruous.

Connect-Chek™ Portable Interferometer

- Robust, Compact Construction
- Integrated Carrying Handle for Ease of Transport
- Recalibration Only Needed after Attaching Mount
- Additional Mounts and Reference Tools Sold Below

The CC6000 Portable Interferometer is a compact unit for non-contact analysis of connector end face geometry. It is shipped with all the items described to the right, allowing for measurements of 2.5 mm PC connectors once connected to a computer (not included) with the minimum requirements described in the *Overview* tab. To measure a wide variety of other connector types, additional locking V-groove mounts must be purchased, for which a corresponding reference tool is needed for calibration (see table below). The CC6000 interferometer will measure the radius of curvature, apex offset, and fiber height of all connectors. For APC connectors, the CC6000 interferometer can also measure the APC angle and the key error.

The CC6000 interferometer is designed for accurate measurements in production or field environments. Precision offset measurements are facilitated by our locking v-groove mount (sold below) which holds the connector in an exact, repeatable position during calibration and measurement. The system has been optimized to provide maximum stability, eliminating the need for recalibration except when reattaching or exchanging mounts. Refocusing is also reduced with no regularly moving components and limited exposure of optical components to environmental contamination.

Components Included

- CC6000 Connector End Face Geometry Interferometer
- External Power Supply
- Region-Specific Power Cord
- End Face Geometry Measurement Software*
- Operation Manual
- CC250P Mount for Ø2.5 mm PC Connectors
- RT250P Reference Tool for Calibration of Mount
- Fiber Connector Cleaner

Optional Purchases

- Locking V-Groove Mounts
- Reference Tools

*Computer with USB 2.0 port required for operation (not included). See minimum requirements in the *Overview* tab.

Part Number	Description	Price	Availability
CC6000	**Portable Connector End Face Geometry Interferometer**	**$15,444.85**	**Today**

Locking V-Groove Mounts

- Mounts for Connectors with Ø1.25 to Ø2.5 mm Ferrules
- Each Mount Requires Calibration with Reference Tool (Sold Separately Below)
- Locking V-Groove Design Ensures Stable, Repeatable Connection

The Locking V-Groove Mounts sold below can be swapped out for the Ø2.5 mm PC mount that comes standard with the CC6000 portable interferometer, allowing a wide variety of connectors to be tested with the CC6000 interferometer. For each insertion of a mount, a calibration must be performed using the corresponding reference tool sold below. Once this calibration is performed on a mount, the measurements can be accurately calculated for all connectors measured in that mount.
The table to the right provides a guide for choosing the right mount and reference tool for each type of connector. For more help, contact Tech Support.

Mount and Reference Tool Selection Guide		
Locking V-Groove Mount Item #	**Compatible Connector Type**	**Required Reference Tool Item #**
CC125LP	Ø1.25 mm Ferrule LC/PC Connectors	RT125P
CCDUPLP	Ø1.25 mm Ferrule Duplex LC/PC Connectors	RT125P
CCLMFA	Ø1.25 mm Ferrule LC/MU/F3000 APC Connectors	RT125A
CC125LAF	Ø1.25 mm Ferrule LC/APC Connectors (Flex Mount)	RT125A
CC125LA	Ø1.25 mm Ferrule Luxcis APC Connectors	RT125LA
CC158P	Ø1.58 mm Ferrule PC Connectors	RT158P
CC200P	Ø2.00 mm Ferrule PC Connectors	RT200P
CC200A	Ø2.00 mm Ferrule APC Connectors	RT200A
CC250P	Ø2.50 mm Ferrule PC Connectors	RT250P
CCDUPSP	Ø2.50 mm Ferrule Duplex SC/PC Connectors	RT250P
CC250A	Ø2.50 mm Ferrule FC/APC Connectors	RT250SA
CCE20A	Ø2.50 mm Ferrule E2000 APC Connectors	RT250SA
CC250SA	Ø2.50 mm Ferrule SC/APC Connectors	RT250SA
CC250SAF	Ø2.50 mm Ferrule SC/APC Connectors (Flex Mount)	RT250SA
CC250SA9	Ø2.50 mm Ferrule 9° SC/APC Connectors	RT250SA9

Part Number	Description	Price	Availability

CC125LP	Locking V-Groove Mount for Ø1.25 mm LC/PC Connectors	$1,024.85	5-8 Days
CCDUPLP	Locking V-Groove Mount for Duplex LC/PC Connectors	$1,591.35	5-8 Days
CCLMFA	Locking V-Groove Mount for LC/MU/F3000 APC Connectors	$1,081.50	Lead Time
CC125LAF	Locking V-Groove Flex Mount for Ø1.25 mm LC/APC Connectors	$1,545.00	5-8 Days
CC125LA	Locking V-Groove Mount for Ø1.25 mm Luxcis APC Connectors	$1,545.00	5-8 Days
CC158P	Locking V-Groove Mount for Ø1.58 mm PC Connectors	$973.35	5-8 Days
CC200P	Locking V-Groove Mount for Ø2.00 mm PC Connectors	$973.35	5-8 Days
CC200A	Locking V-Groove Mount for Ø2.00 mm APC Connectors	$1,545.00	Lead Time
CCDUPSP	Locking V-Groove Mount for Duplex SC/PC Connectors	$1,591.35	5-8 Days
CC250P	Locking V-Groove Mount for Ø2.50 mm PC Connectors	$973.35	5-8 Days
CC250A	Locking V-Groove Mount for Ø2.50 mm FC/APC Connectors	$1,081.50	5-8 Days
CCE20A	Locking V-Groove Mount for E2000 APC Connectors	$1,081.50	5-8 Days
CC250SAF	Locking V-Groove Flex Mount for Ø2.50 mm SC/APC Connectors	$1,081.50	5-8 Days
CC250SA	Locking V-Groove Mount for Ø2.50 mm SC/APC Connectors	$1,236.00	5-8 Days
CC250SA9	Locking V-Groove Mount for Ø2.50 mm 9° SC/APC Connectors	$2,060.00	5-8 Days

Reference Tools

- Reference Tools for Calibrating Locking V-Groove Mounts
- Simple, Accurate Calibration Process

The Reference Tools sold below are designed to be used for calibration of the locking V-groove mounts used with the CC6000 interferometer (sold above). The RT250P reference tool is shipped with the CC6000 interferometer for use with the default CC250P mount. The table above serves as a guide for purchasing the appropriate reference tool for any additional mounts purchased. For more help, contact Tech Support.

Part Number	Description	Price	Availability
RT125P	CC6000 Interferometer Reference Tool for Ø1.25 mm PC Connectors	$360.50	5-8 Days
RT125A	CC6000 Interferometer Reference Tool for Ø1.25 mm APC Connectors	$360.50	5-8 Days
RT125LA	CC6000 Interferometer Reference Tool for Ø1.25 mm Luxcis APC Connectors	$360.50	5-8 Days
RT158P	CC6000 Interferometer Reference Tool for Ø1.58 mm PC Connectors	$360.50	5-8 Days
RT200P	CC6000 Interferometer Reference Tool for Ø2.00 mm PC Connectors	$360.50	5-8 Days
RT200A	CC6000 Interferometer Reference Tool for Ø2.00 mm APC Connectors	$360.50	Lead Time
RT250P	CC6000 Interferometer Reference Tool for Ø2.50 mm PC Connectors	$360.50	5-8 Days
RT250SA	CC6000 Interferometer Reference Tool for Ø2.50 mm APC Connectors	$360.50	5-8 Days
RT250SA9	CC6000 Interferometer Reference Tool for Ø2.50 mm 9° SC/APC Connectors	$360.50	5-8 Days