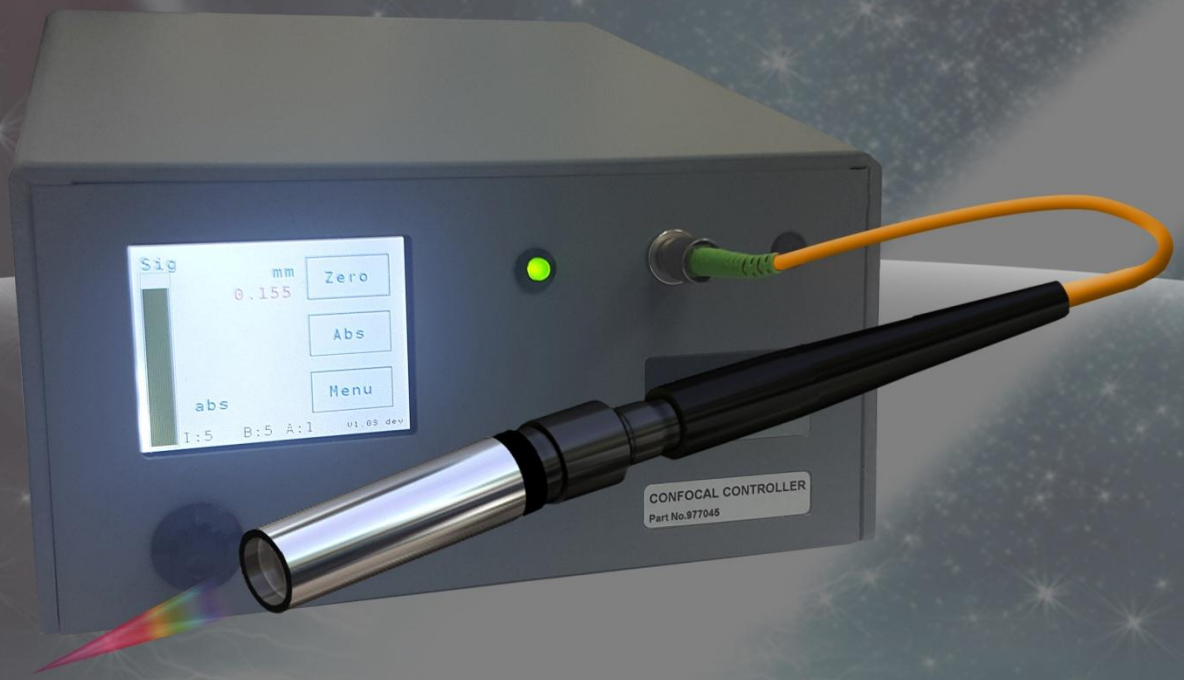
Solartron Metrology

# Confocal System




## User Manual

AMETEK®
ULTRA PRECISION TECHNOLOGIES

# Contents

# 1. Introduction

The Solartron Metrology Confocal System comprises an optical electronic controller (Controller) and a confocal “optical head” (head). The two are connected with a fibre optic cable.

This integrates as a module into the Orbit3 System via the OrbitLibrary (Available from our website in the Orbit3 Support Pack for Windows Installer)

There are two standard head options with measuring ranges of 1.5 mm and 5 mm; either head type can be connected to the controller and selected via the controller operator interface.

NOTE Confocal measurement devices operate best on polished or glassy surfaces, and may not be suitable for machined surfaces.

# 2. Safety Summary

| | |
|---|---|
| **WARNING** statements identify conditions or practices that could result in personal injury or loss of life.<br><br>**CAUTION** statements identify conditions or practices that could result in damage to the equipment or other property<br><br>**Symbols in this manual**<br><br>  <br>Indicates cautionary or other information | **Warnings and Cautions**<br><br>**Warning**: Though this is Not a laser product is does use a high power LED which focuses, Do not shine directly into eyes.<br><br>**Warning**: Do not operate in an explosive atmosphere.<br><br>**Warning**: This equipment is not intended for safety critical applications<br><br>**Warning**: Do not exceed maximum ratings as specified in this document under individual modules.<br><br>**Caution: Low Voltage**<br>This equipment operates below the SELV and is therefore outside the scope of the Low Voltage Directive<br><br>**Service and Repair**<br>  <br>CAUTION: This equipment contains no user serviceable parts. Return to supplier for all service and repair |

All of the Products are CE marked and comply with EN61000-6-3 Electrical Emissions and EN61000-6-2 Electrical Immunity and EN61326-1.

## 3. Trademarks and Copyrights

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Orbit® is a registered trademark of Solartron Metrology Ltd.

## 4. Contact Information

For updated information, troubleshooting guide and to see our full range of products, visit our website: www.solartronmetrology.com

## 5. Documentation cross reference

| | |
|---|---|
| 503301 | User Manual for Confocal System (this document) |
| 503268 | Confocal Datasheet |
| 503306 | Optical Fibre Care Leaflet |
| 520439 | Orbit3 Support pack for Windows: *Contains both software and manuals for the Orbit system* |
| 502990 | Orbit3 System manual: *Contains Orbit 3 system hardware information* |

## 6. Glossary

Terms used in this manual

| | |
|---|---|
| Display | The Liquid Crystal Display & Touchscreen on the front of the controller displaying information and providing an interface for the user to setup the device. |
| Orbit Interface | The Confocal controller has an orbit connector on the back for connecting the device to orbit networks with the provided cable. |
| Head | The confocal head is the measurement probe attached to the fibre that focuses light and receives the reflection. |
| Ethernet Interface | This is the RJ45 connector on the back used for upgrade and support. |
| Fibre Connector | These are the points the optical fibres screw into. |
| Optical Fibre | This is an orange multimode fibre with connections on each end used to connect the head to the controller. |
| Normal | 90 Degrees to the measurement surface. |

## 7. CONTROLLER

The controller provides a controlled light source, performs the signal acquisition and computes the measurement parameters, distance or thickness. This information is then shown on the integral display and transmitted via the Solartron Orbit network. An Ethernet interface is provided for firmware updates and can be used for diagnostic purposes when measuring difficult surfaces.
The controller can take different range probes in a selection of different ways.

### *7.1. Front of controller*
The front panel comprises the following

Two fibre optic connections for optical head(s)
Power on and booting led indicator
Integral Touch Screen

Functions of the integral touch screen are covered later in this manual.

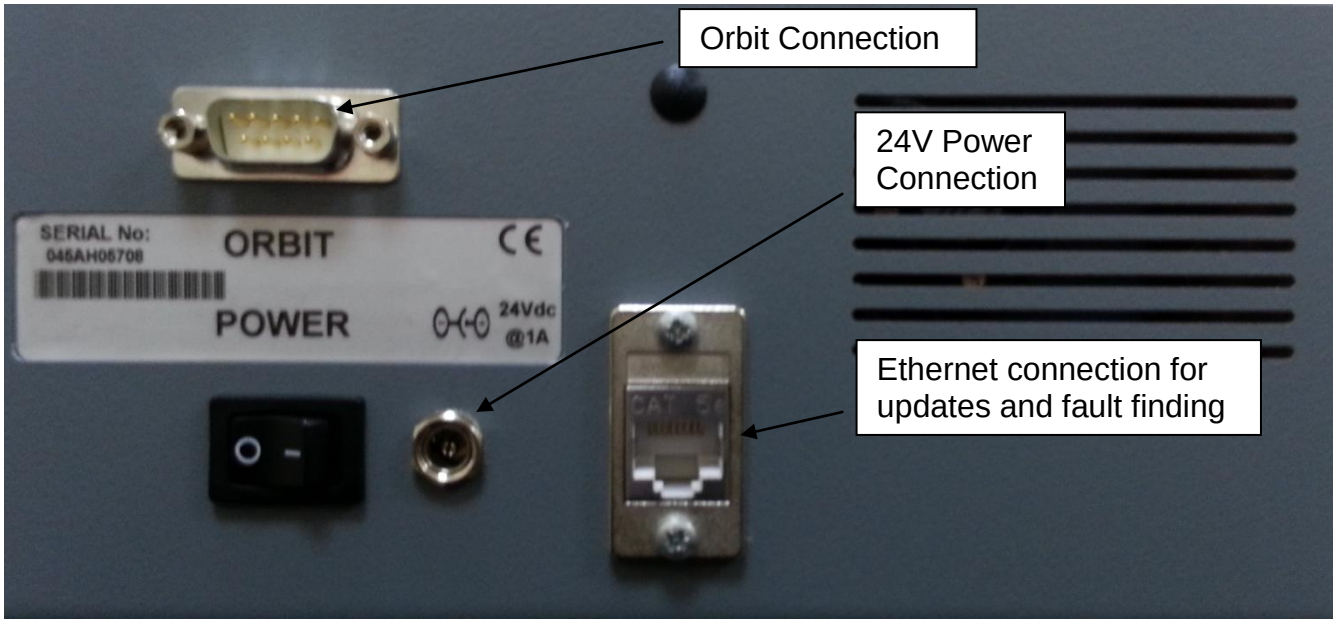
### *7.2. Rear of the controller*
The rear of the Controller has a power socket (+24 VDC), power switch, 9 way Orbit Connector and an Ethernet interface.

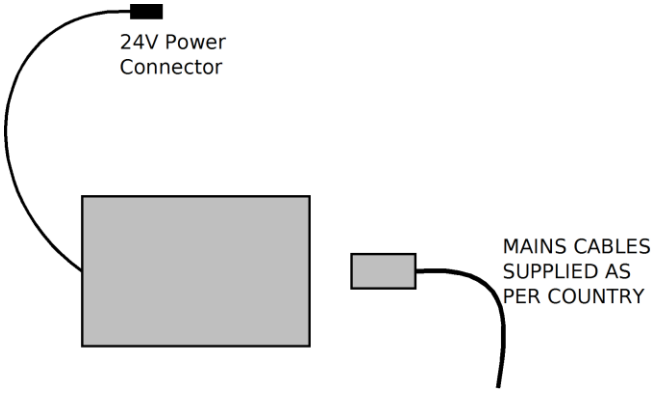
### *7.3. Specifications*
See Product Datasheet.

### *7.4. Installation*
This section describes the installation and connections for the unit.

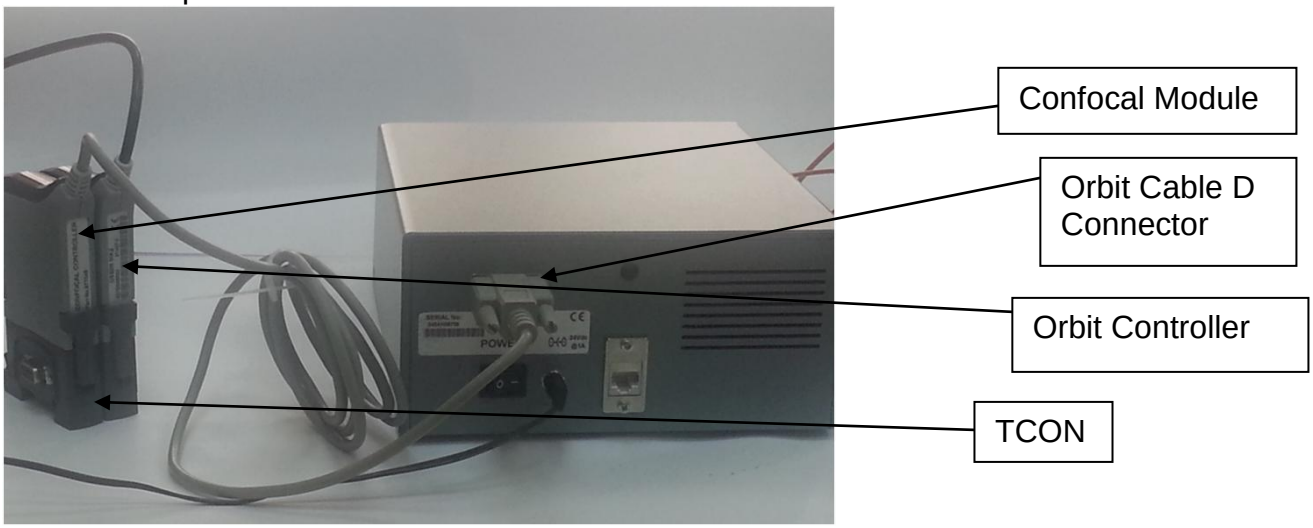
Note. The confocal controller is not sealed and care should be taken when installing in environments where contamination can come into contact with the unit.

### 7.4.1. Electrical Connections



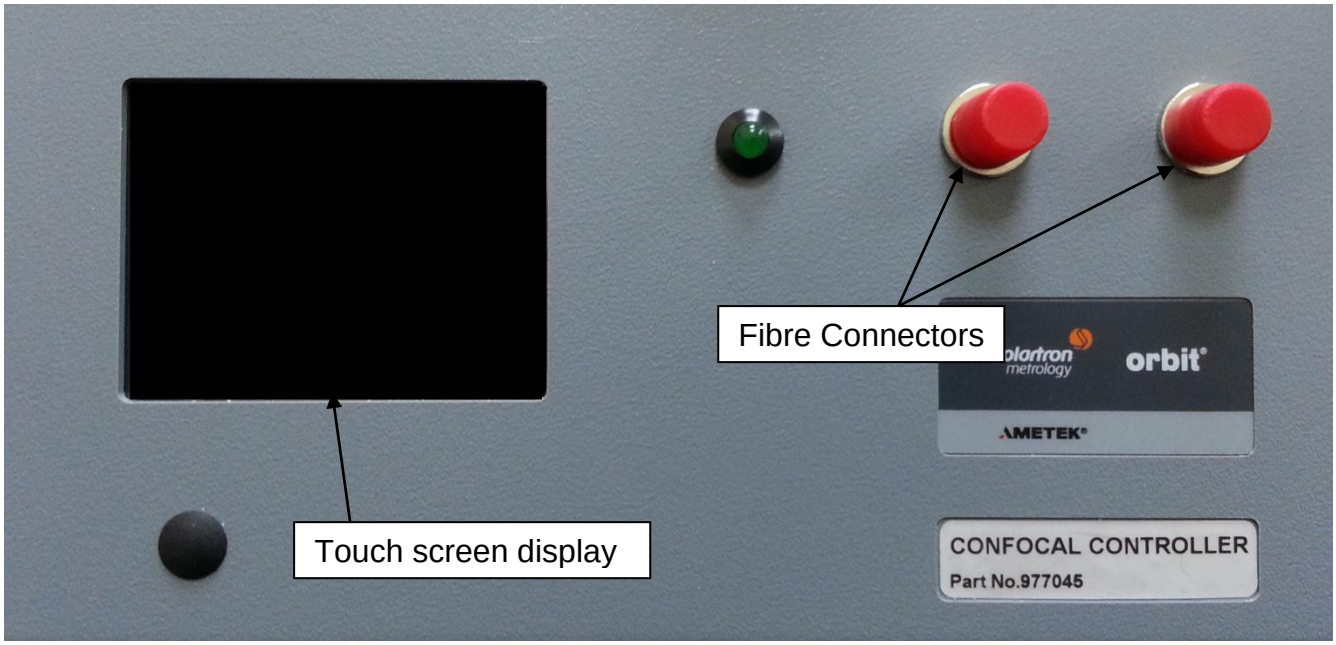




1. Connect the 24 V power supply connector to the confocal unit and plug power block into the mains cable provided.
2. Connect the Orbit cable D Connector to the back of the unit and screw in, connect the other end with the orbit module into a TCON connected to an orbit controller as shown in the picture below.




Note. The Ethernet connection is not required unless upgrading.

### 7.4.2. Fibre Connection




1. Remove the dust cap from the Fibre Connector on the controller (pull off).
2. Unscrew the dust cap from the wide connector end of the optical fibre.
3. Plug the optical fibre plug into the fibre connector on the front of the controller taking care to ensure the bar plug goes into the slot, tighten till pinch tight.
4. Unscrew the dust cap from the other end of the fibre.
5. Pull the dust cover from the end of the confocal head (probe).
6. Plug the optical fibre plug into the fibre connector on the head taking care to ensure the bar plug goes into the slot, tighten until ‘pinch tight’.

If two probes are required, repeat with the second connector on the panel. If 2 probes are not required, the second channel should have its dust cap in place.

# 8. OPTICAL MEASURING HEAD

The optical measuring head is a passive device that receives light via an optical fibre from the controller, transmits the light onto the target to be measured, collects the reflected light and transmits the reflected light back to the controller.

The head must be treated with care do not expose the head to dust, dirt or moisture. The front window of the head may be replaced by the factory for a nominal charge, should it become damaged.

Optimum performance is achieved with the 1.5 mm measuring range head and this is advised for metallic surfaces.

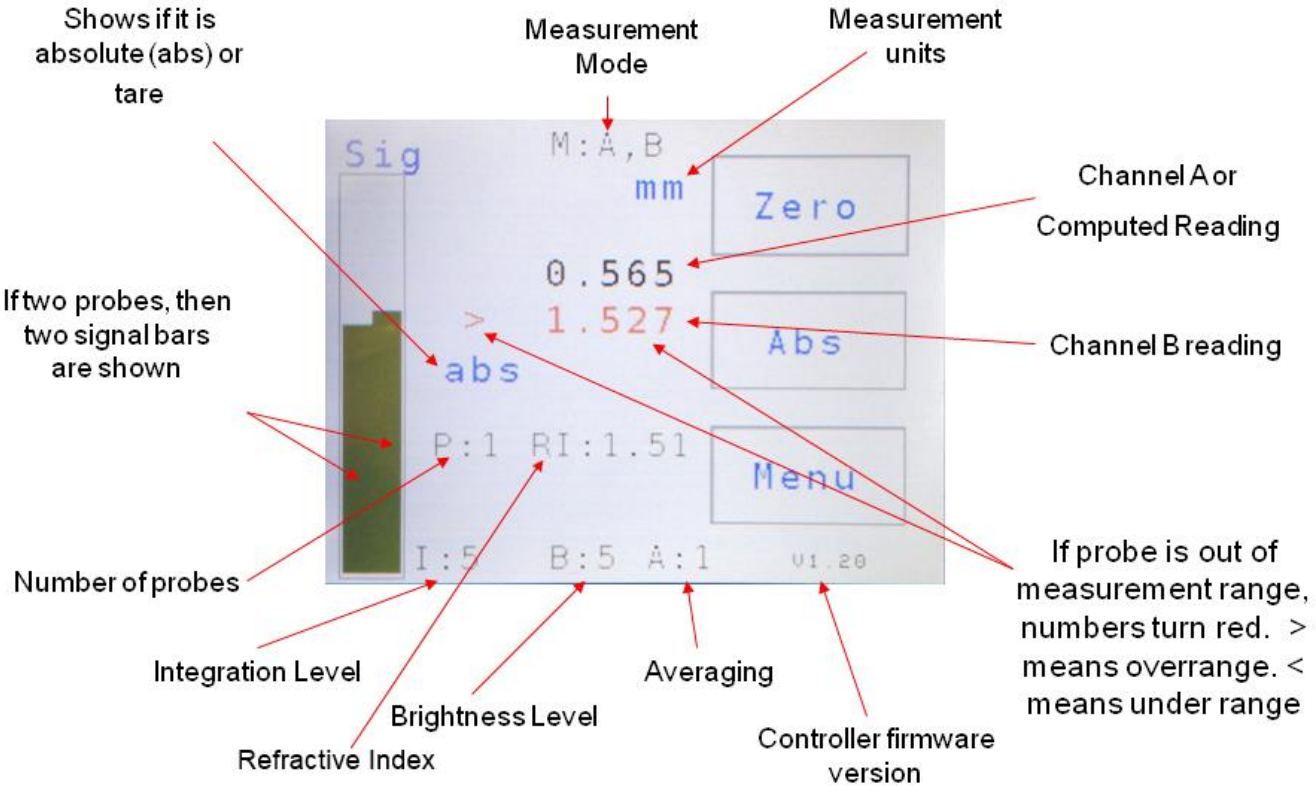
## *8.1. Optical Fibre*

The optical fibre is a multimode fibre type (APC+FC 50/125/900/2900). The fibre should be treated with care, protect then ends with covers when not connected to the optical head or the controller. Do not bend less than 25 mm radius. Failure to observe these points will result in degraded performance.

Should the fibre be left uncovered, ensure that it is cleaned gently with high grade IPA and wiped with a lint free cloth.

## 9. MAIN DISPLAY SCREEN

The confocal system has a display with touch screen. The main display provides the Reading, Signal strength, and current settings, as labelled below.




## 10. FUNCTIONS and CONTROL

The system is set up entirely through the touch screen (in some cases Orbit can be used to set/change the controller setup).

### *10.1. Light source brightness*

There are eight levels of light source brightness that can be selected. The less reflective the surface being measured the higher the brightness required. For typical shiny metallic surfaces use setting 1 or 2; for glass use setting 5 or 6.

Note it is preferable to change the brightness rather than the integration (exposure).

The controller shows the level of the reflected signal on the LCD screen. This is represented as a bar on the left hand side; adjust the brightness to attempt 50% of the bar or better if possible. For dual systems a dual bar is shown, ideally adjust the brightness so that both signals are between 30% and 70%.

Brightness is set via the touch screen following the menu options.

MENU > BRIGHT (Select level 1 to 8 by tapping the graduated bar).

Brightness can also be set via Orbit.

### *10.2. Integration time*

The integration time in ms is the period over which the controller camera looks at the signal coming back from the head. The longer the integration time, the higher the signal. Integration can be used to boost a small signal.
(Note it is preferable to use brightness to adjust for poor reflection where possible, as increased integration time affects the performance.

There are four integration time settings, 5 ms, 10 ms, 20 ms and 50 ms.

The higher the integration time, the slower the system update rate.

The max update rates are shown below:

| Integration Time (ms) | Update Rate (Hz) |
|---|---|
| 5 | 80 |
| 10 | 50 |
| 20 | 25 |
| 50 | 10 |

Integration Time is set via the touch screen following the menu options.

MENU > INT. (Select level by tapping the graduated bar).

Integration time can also be set via Orbit.

### *10.3. Averaging*

The averaging can be adjusted from its default (16) to provide greater accuracy and stability or to achieve a greater bandwidth.
Available averaging options are: 1,2,4,8,16,32,64,128, and 256 reads. (averaging is carried out directly on the spectrum and is a cumulate moving average).
Averaging is set via the touch screen using the following menu options:
MENU > AVG. (Select the level by tapping the graduated bar).

Averaging can also be set via Orbit.

### *10.4. Measurement Mode*

Different measurement modes are selectable depending on the requirement of the surface, accuracy and calculation.
Available Modes:

| Mode | Description |
|---|---|
| High Precision | 80 Hz Bandwidth, Widest range of surfaces, Highest precision measurement. |

| | |
|---|---|
| A,B | 60 Hz Bandwidth, 2 Peak readings displayed either using 1 probe through a transparent medium or 2 probes reading opposite each other from different ends of the spectrum. |
| B-A | 60 Hz Bandwidth, Thickness of a transparent medium (using 1 probe to measure both sides). |
| A+B | 60 Hz Bandwidth Thickness of an object using 2 probes (1 probe on each side). |

Measurement Mode is set via the touch screen using the following menu options:
MENU > MODE (use UP and DOWN to select the mode and OK to confirm).

Measurement mode can also be set via Orbit.

### *10.5. Probe Menus*

As the confocal unit can support different range probes, they can be selected on the probe menus.
When using the Confocal system in thickness mode (through a transparent medium), Probe 2 should be set to none and a refractive index should be selected.
When using the Confocal system in thickness mode with 2 probes the Probe 2 must be set to the correct probe type (refractive index will automatically not be used).

Note probe selection isn't available through the orbit interface.

Probes may be selected via the touch screen using the following menu options:
MENU > NEXT > PROBE1
Or
MENU > NEXT > PROBE2
Use UP and DOWN to select the mode and OK to confirm selection.

### *10.6. Refractive index*

When measuring transparent surfaces in thickness (B-A and A,B) modes, it is necessary to correct for refractive index. Currently the confocal system contains refractive index corrections for:

- Schott K7 Crown Glass
- Perspex (C5O2H8) (also known as Acrylic,Altuglas,Oroglas,Optix,Plaskolite, Plexiglas, Lucite, Acrylite)
- Polycarbonate.

Other refractive index tables can be loaded if needed (contact Solartron Sales if this is required).

(Note refractive index selection isn't available through the orbit interface)

The refractive index can be selected via the touch screen using the following menu options:
MENU > NEXT > REFIDX
Use UP and DOWN to select the refractive index and OK to confirm selection.

### *10.7. Units of measure*

The Confocal system supports mm, inches and mils. These can be selected on the device through the touch screen using the following options:

MENU > NEXT > UNITS (Select the units required from the radio buttons and click ok)

# 11. Orbit®

The Solartron confocal system is an orbit product which can be directly connected into orbit TCONs and read using the Solartron Orbit Library (freely available on the www.solartronmetrology.com website) via an orbit controller.

Various device properties can be read/set through the orbit interface (Reading, Measurement Mode, Integration, Averaging, Brightness).

# 12. Confocal Care & Troubleshooting

## *12.1. Overview*

Unlike contact probes which can physically displace a small amount of dust or residue non contact probes are affected by dust. To get an accurate measurement, it is necessary to ensure that both the system and parts are clean and that the device is set up appropriately.

Confocal measurement technologies are not affected by ambient light. Therefore, room lighting should not cause issues when measuring a part.

Confocal system cables and connectors should be covered with dust covers if they are not connected. Should you experience issues measuring a part, following these steps may help.

When cleaning any part of the confocal system, it is recommended to use a high grade IPA as a solvent and a lint free cloth.

## *12.2. Cleaning the fibres*

The fibre optic cables can easily get dirty; this dirt is not often visible without a microscope. Dirty fibres may appear to give a reading or have a signal, as the dirt can reflect light within the confocal system or block it outright.
The fibre can be cleaned using the following procedure:

- Unscrew the fibre from the probe.
- Gently wipe the fibre with a lint free cloth dipped in IPA (High grade IPA is required, as lower grade IPA leaves a residue).
- Gently dry the fibre using a lint free cloth.
- Visually check there is no dirt in the probe connector.
- Re-plug the fibre connector into the probe ensuring that the connector locates correctly before screwing it up.
- Unscrew the fibre from the Confocal Controller.
- Gently wipe the fibre with a lint free cloth dipped in IPA (High grade IPA is required, as lower grade IPA leaves a residue).
- Gently dry the fibre using a lint free cloth.

Re-plug the fibre connector into the Controller ensuring that the connector locates correctly before screwing it up.

## *12.3. Clean Probe Head*

Ensure the probe head is clean by gently wiping with some high grade IPA, then drying with a lint free cloth.

### *12.4. Clean Part Surface*

Where contact probes can displace a small amount of dust, non contact probes do not. As such, it is necessary to ensure the part is clean when measuring with any laser or confocal product (dust particles can be of the order of tens of microns in diameter and with a small spot size this can introduce serious errors if the part is not clean).

Ensure the surface is cleaned in a manner that will not leave particles or residue.

### *12.5. Problems Reading*

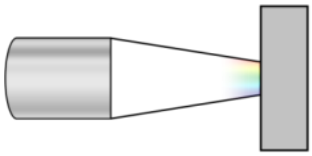
If you are having problems getting a reading on a surface this may be for a number of reasons:

- Dirt or grease (even from hands) on the optical fibres causes internal reflections or blocks light. Ensure fibres, lenses and couplers are clean (see cleaning section above).
- Surface Finish – if the surface finished is machined (even finely machined) it causes inaccuracy in confocal measurement devices, and as the head is moved either across or toward a surface, signal intensity may vary massively due to filtering/reflection effects.
- Angle – confocal probes are designed to focus normally to the measurement surface, as the angle moves away from the normal, signal drops off (the angle at which no signal is received is detailed in the specification for the probe being used).
- Material/ light levels – if there is no/low signal or the signal level is saturating, it may be necessary to adjust the brightness setting from the confocal menu. The integration time may be adjusted if further sensitivity is required (for bandwidth performance reasons, we advise changing brightness before integration).
- Measurement mode – unless you have bandwidth reasons to the contrary we advise using the High Precision reading modes, as these are most tolerant of material and surface finish.

## 13. Setup and measurement

Once the confocal is connected as detailed above, it can be setup.
Setup varies with how the confocal system is used. For further details on the different modes and performance, see the confocal datasheet.

### *13.1. Single head distance measurement*

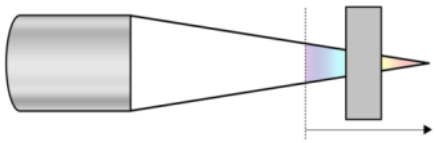


Probe 2 should be set to none:
MENU->NEXT->Probe2 (none)

Measurement mode should be set to High Precision:
MENU->MODE (High Precision)

The head should be setup at the normal to the piece being measured (this will result is the best possible signal. If signal is still low turn the brightness up.
The target signal strength should be 50-80%.

### *13.2. Single head measurement of a transparent object*



This is used for either measuring both sides of a transparent object or the thickness (note: if the transparent object is thicker than the range of the probe, then the Single head distance measurement instructions should be used).

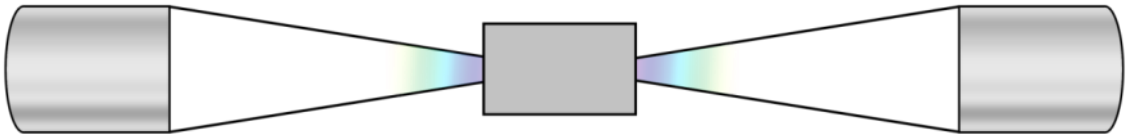
For transparent surfaces a brightness level of at least 6 is normally required though this can be turned up as necessary:
MENU->BRIGHT (6)

Probe 2 should be set to none:
MENU->NEXT->Probe2 (none)

Measurement mode should be set to A,B Or B-A:
MENU->MODE (B-A)

The head should be normal to the piece being measured, the head should be moved towards the piece until the displayed reading text is black and valid (ie not under ‘<’or over ‘>’ range) and there is a valid green signal on each channel.
Adjust brightness and integration if necessary to achieve a signal strength of between 50-80%.

### *13.3. 2 Head thickness mode*



This is used when 2 confocal probes are used in opposition to each other for measuring changes in thickness.
Probe 2 should be set the probe range being used.
MENU->NEXT->Probe2 (eg 5 mm)

Measurement mode should be set to A+B:
MENU->MODE (A+B)

Ensure the device is in ABS (No zero) mode before setting up.

Both heads should be normal to the piece being measured. First, move the second probe in (initially it will show as probe A until the second probe has a valid reading) till the probe reads in excess of ½ the stroke. Then move the first probe in until it is just reading (it must remain at less than ½ the stroke. The probe separation must remain at least 20% different for the readings to be valid.

The readings can now be zeroed.

## 14. Firmware Upgrades

Should a firmware upgrade be required to access new features, this can be achieved with the unit plugged into an Ethernet connection (DHCP Required), and an orbit connection, both connections are required or the device will not update.
The update can then be applied using the confocal updater application. Note the normal orbit updater cannot update confocal devices, as these require an Ethernet based update as well as the standard orbit update.

## 15. Return of goods

Devices returned for service/repair/recalibration should be shipped prepaid by your distributor or if purchased direct from Solartron Metrology, to the relevant Sales Office.
The shipping container should be marked 'For the Attention of the Customer Service Department'.
The following should accompany the device(s):

1. Contact details of company/person returning device including shipping instructions
2. A statement of service required
3. Description of the fault and the circumstances of the failure, including application, environment and length of time in service.

Alternatively there is a returns form available o our web site, follow link to 'Service Repair and Recalibration.
Please note: A standard assessment charge is applicable on all non-warranty devices returned for repair. Customer damage and any device found, upon inspection, to have no fault will be considered non warranty. Please contact the Sales Office or Distributor for warranty terms, service options and standard charges. Adherence to these procedures will expedite handling of the returned device and will prevent unnecessary additional charges for inspection and testing to determine the condition. Solartron Metrology reserves the right to repair or replace goods returned under warranty. All repairs are guaranteed for 3 months unless otherwise stated. Solartron Metrology reserves the right to make changes without further notice to any products herein to improve reliability, function or design. Solartron Metrology does not assume any liability arising out of the application or use of any product or circuit described herein or in any other associated document, neither does it convey any licence under patent rights nor the rights of others.

## 16. Revision History

| REVISION | DATE | COMMENTS |
|---|---|---|
| 1 | 10/08/15 | Initial issue |
| 2 | 29/10/15 | Updated mode and bandwidth information, probe information and typographical changes. |
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