ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

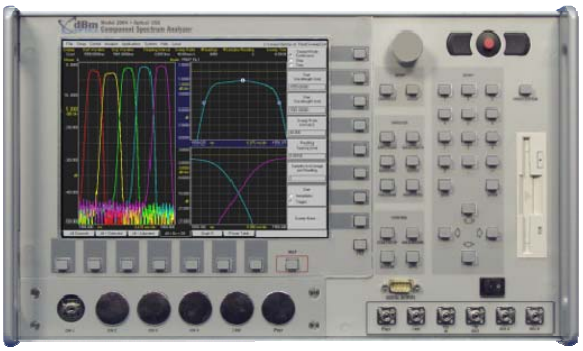
- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *dBm Optics 2004* at our website: ***Click HERE***

Optical
Component Spectrum Analyzer™ System



Operations Manual
Models 2004, 2112, 2124, 2160

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Warranty

dBm Optics, Inc. guarantees its Component Spectrum Analyzers® to be free of material and workmanship defects for one year from the date of shipment. This warranty is in lieu of all other guarantees expressed or implied and does not cover incidental or consequential loss.

Copyright 1998-2008, dBm Optics, Inc. All rights reserved. dBm Optics, Component Spectrum Analyzer, µ-Fine, Real-Time Reference and Beam-Block Shutter and all other dBm Optics product names are trademarks or registered trademarks in the U.S.A. or other countries. All other trademarks mentioned herein are the property of their respective companies. Products described in this catalog may be covered by one or more patents in the U.S.A. and in other countries. Information in this manual is subject to change without notice.



dBm Optics, Inc.
300 S. Public Road
Lafayette, CO 80026
Phone: 303-464-1919
Toll-free phone (U.S. only): 1-800-944-7885
E-mail: info@dbmoptics.com
Website: www.dbmoptics.com

CSA Manual
Part No. 22-002004
Version 10.2

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Contents

Safety ..... **a**
Warning Labels ..... a
Environmental Concerns ..... a
Lasers and Eye Safety ..... b

Introduction ..... **①**

Welcome to dBm Optics ..... **②**
2000 Series Optical Component Spectrum Analyzer ..... ②
Suggestions for Using the Operations Manual ..... ②
Additional Documentation ..... ④
Application Notes ..... ④
Optical Assistant ..... ⑤
dBm Catalog/CSA Brochure ..... ⑤

Unpacking ..... **⑦**
Initial Inspections ..... ⑦
Contents ..... ⑦
Repairs and Returns ..... ⑦

Connectors ..... **⑧**
Making Connections ..... ⑧
Cleaning Procedures ..... ⑨

Options, Accessories and Specifications ..... **A**

Quick-Start Guide ..... **I**

Using the CSA to Measure IL, PDL and ORL ..... **II**

Getting Started **1**

Front Panels **2**
Model 2004 – Front Panel 2
Model 2112 and Model 2124 – Front Panels 3
Model 2160 – Front Panel 3

Graphic Display **4**
Graphs 4
Graph Types 5

Rear Panels **10**
Model 2004 – Rear Panel 10

Connecting and Turning on the CSA **11**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Connecting and Turning on the Extender Chassis 12

Making Measurements 13
Measurement Worksheet 14
Insertion Loss vs. Wavelength 14
Continuous Sweep Example 14
Remote Commands for Continuous Sweep 15
Basic Front Panel Procedures for Continuous Sweep Measurements 15
Step Sweep Example 17
Remote Commands for Step Sweep Measurements 17
Basic Front Panel Procedures for Step Sweep Measurements 19
Time Sweep Measurements 21
Insertion Loss vs. Time 21
Remote Commands for Time Sweep Measurements 21
Basic Front Panel Procedures for Time Sweep Measurements 22
PDL Measurements 23
Matrix Method 23
All States Method 23
N States Method 23

Front Panel Operations (Overview) 25

Front Panel Overview 26
Keypad 28
Softkey Panel Display 29
\Softkey Panel Type 29
Softkeys 30
Softkey Panel Name 30
Display Format Tabs 30
Display Format Tab Selector Keys 30
Function Shortcut Buttons 30
Rotary Knob 31
Button-Style Pointer/Mouse 31
View Area 31
Status Area 31

File Button Functions 33
Saving Files 35
Copying Files 36
Deleting Files 37
Renaming Files 37
Changing the CSV File Format 37
Print/Save Function 38
Print/Save Shortcut Button 38
Print/Save Softkey Panel 38

Channels Button Functions 39
Frequently Used Features (Channels Button Functions) 41
Hiding or Showing Traces 41
Setting the Measurement Range: Fast/Medium/Slow/Fixed/Stitching 41
Setting Active Channels in the Channel Table 42
Dark Current Calibration 42
Selecting Measurement Power Units 43
Setting the Channel Analog Filter 43
Wavelength Correction Enabled 43
Adding Traces 44
Splitter Calibration 45

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Sweep Button Functions 47

Sweep Button Softkey Panels 49
Setting up a Continuous Sweep 51
Setting up a Step Sweep 53
Setting up a Time Sweep Measurement 55

Amplitude Button Functions 57

Amplitude Button Softkey Panels 58
Setting the Amplitude Reference Level 58
Setting the Amplitude Scale per Division 58
Setting the Amplitude Range 59
Next Trace Type 59
Selecting a Graph 59
AutoScale the Current View 59
Setting the Auto Ref Level 59
Setting the Reference Position 60

Wavelength/Time Button Functions 61

Wavelength / Time Softkey Panel 62
Setting the Center 63
Setting the Center Wavelength – Continuous and Step Sweep Modes 63
Setting the Center Time Axis 63
Setting the Span 63
Setting the Span – Continuous and Step Sweep Modes 63
Setting the Span – Time Sweep Mode 63
Setting the Start/Stop Wavelengths or (Time Axes) 63
Setting the Start/Stop Wavelengths – Continuous and Step Sweep Modes 64
Setting the Center Wavelength – Time Sweep Mode 64
Use Sweep Wavelength Softkey and Use Sweep Time Softkey 64
Using Sweep Wavelength--Continuous and Step Sweep Modes 64
Using Sweep Time – Time Sweep Mode 65
Selecting a Graph 65
Setting the Wavelength or Frequency Units 65
Setting the Time Axis Units 66
Setting the TLS Wavelength Offset 66

Markers Button Functions 67
Types of Markers 69
Selecting a Graph 69
Selecting a Trace 69
Selecting a Marker 69
Normal Marker Mode 69
Placing Normal Markers On The Graph 70
Bandwidth Marker Mode 70
Delta Marker Mode 70
Interpolation 71
Peak Search 71
Marker to Center 71
Marker at the Reference Level 71
Marker Parameters 72

Traces Button Functions 73

Traces Softkey Panels 74
Selecting a Trace 74

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Pan/Zoom Button Functions 75
Pan/Zoom Softkey Panels 76
Properties Button Functions 77
Properties Softkey Panels 78
Setting the Display Parameters 79
Start/Stop Button Functions 83
Starting a Measurement Sequence 83
Stopping a Measurement Sequence 83
System Button Functions 85
Restoring the Factory Preset Values 87
Setting the Digital Outputs 87
Viewing Installed Options 87
Setting the CSA Date/Time 87
Serial Communications Setup 88
GPIB Communications Setup 88
Ethernet Communications Setup 88
GPIB Control Setup 89
Setting SCPI Display Enable 89
Setting the Shutter State 89
Executing a Firmware Upgrade 89
Executing a Soft Reboot 89
Applications Button Functions 91
PDL Measurement Applications 93
All States PDL Method 93
Mueller-Matrix PDL Method 93
PDL Trace Selection 94
Mueller Polarization States 95
PDL and Wavelength Accuracy 96
PDL Reference Sets 96
Optical Return Loss Applications 96
Creating an ORL Reference Data Set 96
Measuring ORL 98
Help Button Functions 99
Firmware Versions 99
Event Log 99
Firmware Versions 100
Event Log 100
Traces Softkey Functions 101
Traces Softkey Panels 102
Applications and Specifications 103
Definition of Terms 104
Considerations and Implications 109
Technology Overview 110
Filtering 110
Continuous Sweep 110
Step Sweep 111
Time Sweep Measurement 111

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Sweep Initiation 112
Full or Partial Handshake 112
Partial Handshake from the TLS to the CSA 112
Partial Handshake from the CSA to the TLS 112
Full Handshake--TLS Initiates 113
Full Handshake- CSA Initiates 114
Triggering Considerations 115
Edge Triggering 115
Contributing Factors in Wavelength Error 116
Setting up a CSA Sweep 117
Channel Setup 117
Sweep Setup 120
General Mathematical and Timing Considerations 123
Setting up the TLS or Other Source 123
Minimum Wavelength 123
Maximum Wavelength 124
TLS Output Connection 124
TLS Input Trigger Designation 124
Initiation Destination 124
TLS Input Connection 124
TLS Output Trigger Designation 124

Real-Time Referencing 125
Splitter WDSR and PDSR 125
Wavelength Reference Option 401 and Precision Wavelength Reference Option 410 126
Front Panel Operation for Wavelength Reference 126
SCPI Operation for Wavelength Reference 127
Front Panel Error Messages for Wavelength Reference 128
Analog Output Option 222 129
Optical Return Loss (ORL) Option 940 131
ORL Summary 131
ORL Calibration 132
Taking an ORL Sweep 134

Calibration 135
Optical Wavelength Calibration 135
Dark Current Calibration 135
Optical Power Calibration 135

Photodiode Measurements 137
Model 280 137
Model 288 137
Initial Firmware Release 137
Input Ranges 137
Input Select 138
Input Polarity 138
Bias Voltage 139
Output Units 139
Stitching 139
Measure PD Offset 139

Operations from a PC 143

PC Operation Overview 144
GPIB Cable Length 144
CSA SCPI-Like Commands 144
CSA Firmware Version 144
Command Responses 144

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Channel Addressing 145
Channel Lists 145
Drives, Filenames and Extensions 145
Wavelength and Frequency 146
<TraceSpec> 146
Comma-Separated Variable (CSV) Format 147
Binary Data Set (BDS) Format 147
Binary Data Format (Version 3.0) 148
Binary Data Format (Version 2) 149
Measurement Data Format (Version 2, 3.0) 150

Command Summary 151
Device Specific Commands 151
COMMON COMMANDS 155

Device Specific Commands 157

Common Commands 180

Appendix A 182
Appendix A: Measurement Worksheet 183

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Safety

To ensure thorough understanding of all functions and to ensure efficient use of this product. please read the manual carefully before using. Note that dBm Optics, Inc. bears absolutely no responsibility for the result of operation caused due to incorrect or inappropriate use of this product.

Warning Labels

Warning labels are applied to the CSA in locations where specific dangers exist. Pay careful attention to these labels during handling. Do not remove or tear these labels. If you have any questions regarding warning labels, please contact us.

Symbols in this manual, on or inside the unit mean:

	**Laser Hazard**
	**Electrical Hazard**
	**Caution! Hazard** (Refer to accompanying documentation for more information.)

Environmental Concerns

To maximize the long-term performance and overall testing accuracy of this instrument, the following environmental safeguards should be considered.

1) Avoid dust and direct sunlight. The optical performance of the unit may be compromised by long-term exposure to direct sunlight and dust.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2) Avoid excess vibration that might compromise the mechanical integrity of the unit.

3) Avoid exposing the unit to situations or environments that may result in contact with corrosive gasses.

4) Do not block fan vents. If unit is racked, make sure it has proper ventilation.

5) The recommended operating temperature is 10-35º C.

6) Allow 30 minutes for full specs for warm-up if instrument is maintained at room temperature. If unit has been exposed to storage temperature extremes, allow for an additional hour for each 10º C.

7) Keep original packing material for transport or shipment. If original packing is not available, call dBm Optics to have a factory-approved shipping case delivered to you.

8) It is recommended that the optical connectors be cleaned before every connection. If optical performance is degraded, it may be improved by properly cleaning the optical connectors. (See Connectors for more detailed instruction.)

9) Periodic inspection of the fiber for scratching or pits is important for the integrity of the measurements.

Lasers and Eye Safety

The dBm Component Spectrum Analyzer itself may contain lasers or other high-powered optical sources. Whether it does or not, it is designed for use with those devices, and the documentation which came with the optical source being utilized should be reviewed. Laser radiation emitted from a TLS or other laser source may be harmful. Always follow these precautions:

1) Avoid direct exposure to the beam.

2) Always wear protective goggles or eyeglasses appropriate for working with laser light.

3) Avoid looking at the beam directly.

4) Be aware of the warning and safety labels.

5) To completely shut off electrical power to the unit, disconnect the power cord from the product.

6) Do not open the laser system. The are no user-serviceable parts inside the unit.



Unauthorized opening of the CSA will void the warranty and may result in burns, electric shock, misalignment of the CSA cavity and/or irreparable damage to the internal components.

Contact the CDRH (Center for Devices and Radiological Health) at http://www.fda.gov/cdrh/ for information on laser types and classifications and the precautions necessary. OSHA (Occupational Safety & Health Administration) may also be contacted for more information at http://www.osha.gov/.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Introduction

This section provides a general overview of the dBm Component Spectrum Analyzer. Included in this section is a description of the proper procedure for removing the CSA from its shipping container; suggestions for making fiber optic connections; and a listing of options and accessories that are available.

This section includes the following:

Welcome to dBm Optics
- 2000 Series Optical Component Spectrum Analyzer
- Suggestions for Using the Operations Manual
- Additional Documentation
  - Application Notes
  - Optical Assistant
  - dBm Catalog/CSA Brochure

Unpacking
- Initial Inspections
- Contents
- Repairs and Returns

Connectors
- Making Connections
- Cleaning Procedures

Options, Accessories and Specifications

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Welcome to dBm Optics

Cutting-edge optical applications demand accurate measurements based on a stable light source with high wavelength resolution and the ability to measure these signals rapidly and with high measurement integrity. dBm's founders and key employees hail from the industry leaders including Keithley, ILX Lightwave, Melles Griot, Fluke, Analog Devices, Quadtech, Lucent and New Focus. The management team has over 100 years combined management experience in fiber optics and test & measurement, and hold many related patents. dBm's success has been based on a focused commitment to solving the problems of passive optical component testing.

dBm strives to provide the industry with leading technology at an affordable price. Customer service is a priority, so if you experience any difficulty with your instrument or require assistance please contact us by phone at (800) 944-7885 (toll-free in the U.S.) or at (303) 464-1919; on the web at www.dbmoptics.com; or by e-mail at info@dbmoptics.com.

Direct contact numbers to dBm Optics' Applications personnel will be provided for use during system installation. Please call or e-mail with any questions.

2000 Series Optical Component Spectrum Analyzer

The dBm 2000 Series CSA provides a fast, accurate passive component measurement system for a wide variety of testing scenarios. It offers 100,000 readings per second per channel and operates with step tunable lasers, continuous sweep tunable lasers and with fixed wavelength sources. The dBm CSA offers over 66 dB dynamic range at full speed; over 100 dB total dynamic range; and less than 0.005 dB polarization dependency and connection variation.

These outstanding specifications provide the optimal testing environment for components such as optical switches, photodiodes, multiplexers, deep well filters, broadband passives and more. The dBm CSA is simple to set up and offers easy access to complex data analysis. Leading measurement technology provides high speed functioning, error reduction, accurate readings, and broad range data collection at a lower cost than other manufacturers' comparable equipment.

NOTE:

For the purposes of this manual, it is assumed that all measurements will be made as a function of wavelength and logarithmic power (dBm) and that all corresponding parameters will have similar units unless otherwise noted.

Suggestions for Using the Operations Manual

The Operations Manual has been optimized for electronic viewing and is hyperlinked for your convenience. The Table of Contents is highly detailed to list the functions of the Component Spectrum Analyzer (CSA). It contains a direct link for each function to the area in the manual offering a detailed explanation.

This document is divided into six sections: Introduction; Getting Started; Applications and Specifications; Front Panel Operations; Operations from a PC; and the Appendix. The Introduction provides general information about the instrument and outlines the cautions and procedures to be followed during initial operations. Getting Started describes the different components of the CSA, where they are located, and how they function. This section also

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

provides information on how to set up the instrument for the first time and step-by-step, detailed procedures for performing basic measurements.

Section Three, Applications and Specifications, contains definitions, instrument capabilities, and technical information. The Considerations and Implications subsection provides detail regarding choosing parameters for measurements that will maximize performance and reduce error. We recommend reviewing this section to more fully understand the technology and mathematics behind the results obtained by the CSA.

Sections Four and Five contain the bulk of the procedural information for operating the CSA. Section Four, Front Panel Operations, describes and familiarizes the user with the features and terminology of the front panel. The latter part of the section is organized around the buttons on the front panel.

Section Five, Operations from a PC, describes the general considerations for SCPI-like commands (such as channel addressing and syntax) and details the commands and their functions. There are two GPIB subsections, one for Device Specific Commands and one for Common Commands. The commands are alphabetized within the section (and also in the hyperlinked Table of Contents). The easiest way to locate a command is to go to the Table of Contents and link directly.

The Appendix contains a Measurement Worksheet that can be useful in organizing information before beginning a measurement. This Measurement Worksheet can be printed out and used to facilitate initial setup.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Additional Documentation

Application Notes

Application notes are available to users in electronic or paper format. A partial list of these is shown below. To access the application notes, see the CSA User CD (shipped with the CSA) or contact your dBm sales or applications representative.

Application Notes

001	PDL Measurement with 952 Option
002	Operating with New Focus 6428
003	Using dBm Level Trigger Box Accessory
004	Transferring Large Data Sets
005	Typical Optical Switch Performance Data
006	Wavelength Testing Using Gas Cells
007	SREAL (BDS) File Converter
008	PDL Measurement with 953 Option
009	Using FTP with the CSA
010	Minimizing FC-APC Connector Variation
011	Wavelength Accuracy with the TLS-650 Tunable Laser
013	Using SCPIComm
014	Using the CSA in a DHCP Network
015	Demux Application Parameter Details
016	Measuring Low Value of PDSR
019	Signal Filtering on the 202
020	Using the CSA Explorer
021	Measuring PDCW, PDBW
022	Interferometric Dispersion Measurement
023	The 6 State Matrix PDL Measurement
024	Comprehensive PDL Analysis in MUX, Filters and Gratings
025	Upgrading CSA System Firmware
026	Introduction to Chromatic Dispersion
027	Introduction to Jones Calculus
028	Introduction to Polarization Mode Dispersion
029	Using PDL Measurement to Identify Stress-Induced Birefringence
030	Using ORL Measurement to Identify Interconnect Problems
031	Stitching
032	Measuring Deep Well Devices
033	Working with the New Focus 6528
035	Electrical Characteristics and Operation of the 288 PD Card

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Optical Assistant

This software tool, designed for optical test and design engineers, is available free of charge on the CSA User CD or can be obtained from a dBm Optics applications or sales representative.

dBm Catalog/CSA Brochure

The CSA section of the dBm catalog contains considerable information on the capabilities and specifications of the CSA system.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

This page intentionally left blank.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Unpacking

Initial Inspections

While unpacking the unit, carefully inspect all shipping materials and instrumentation for signs of damage. If you notice that any packaging (or the unit itself) appears to be damaged, immediately call the shipping company. The shipping company is responsible for assuring that the unit arrives in good working order. If, after contacting the shipper, you are unable to resolve the issue, call dBm for additional assistance. Retain all packing materials until an initial equipment test is performed. If there are any problems with setup, the packing materials will be required to return the unit. See Repairs and Returns for more information.

Contents

Please verify that you received the following components in your shipment. The exact model and accessory information can be found on your shipping receipt. Your dBm CSA contains the following:

1) Component Spectrum Analyzer

2) AC Power Cord

3) BNC Trigger Cable

4) CD with Operations Manual, Optical Assistant, Web Site and LabView® Driver

5) Optical patch cable for DUT connection

6) Bulkhead adapter for use with above

Additional items may be included depending on the options ordered with the unit.

Repairs and Returns

If the CSA appears to have been damaged during shipping, immediately contact the shipping company to obtain their insurance and compensation protocols. After a compensatory agreement has been reached with the shipper, call dBm in order to obtain the required RMA number and return shipping address.

It is recommended the original shipping materials be stored in the event that the unit needs to be moved or sent back to dBm for repair or upgrade. If the unit seems to be malfunctioning for reasons unrelated to shipment, please contact the Applications Department of dBm Optics at (800) 944-7885 (in the United States) or at (303) 464-1919. When you call you will receive the required RMA number and the return shipping address. Our goal is complete customer satisfaction. If you have any questions or concerns regarding the CSA, please do not hesitate to contact us.

If you have more than one CSA, we recommend returning additional transport cases to dBm Optics. Contact your sales or applications representative for a free shipping label.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Connectors

The proprietary Connection Desensitizer™ (built into the connector mechanisms of the dBm CSA measurement channels) has the ability to minimize much of the error associated with optical connections. The desensitizer reduces unwanted measurement changes resulting from repeated connect/disconnects, stress on incoming fibers, and bare fiber adaptor rotations. This technology alleviates many test interconnect errors, but it is essential that connectors be properly and consistently cleaned and utilized.

Attention to such details can help to avoid errors during testing procedures and serious, costly damage to the CSA. Failure to consistently monitor connection protocol can cause permanent damage the CSA, other instruments and the connectors themselves. Review the next sections on Making Connections and Cleaning Procedures for a complete discussion regarding these considerations.

Making Connections

The type of input connections utilized will depend upon the particular CSA model you have purchased and upon any subsequent field changes that are made to the connection types. (See the Options and Accessories section for more information regarding alternate connector types. In general, the following guidelines apply:

1) Every time a connection is made the endface should be swiped with a CLETOP-type (or equivalent type) fiber cleaner (following the written instructions provided with the cleaning device). This simple and consistent maintenance can help prevent measurement errors and expensive damage.

2) Frequently inspect fiber optic ends using a fiber microscope. Continued normal usage may result in dirt accumulation or damage to the fiber ends or to the Connection Desensitizer™. If PDL measurements are being taken, inspections should be made with every connection.

3) When deposits are seen on the fiber endface and the CLETOP-type fiber cleaner does not remove them, clean the fiber optic ends using the steps listed in the Cleaning Procedures section.

4) Verify that the type of connector or fiber being utilized is compatible with the CSA's input mechanisms. This helps to reduce incidental contact at the face of the connector and protect the connection sleeve as well.

5) If the connector is keyed, make sure it is inserted with the proper rotational angle into the device to avoid damaging equipment.

6) Do not make connections too tight. Forcing the connectors may result in misalignment and/or damage to the fiber faces or connectors.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Cleaning Procedures

Taking the time to care for connectors can save a lot of time and money because measurement error and damage to connectors and fibers are often caused by improper care and use of fibers. Some damage to fiber optic connectors is not visible without magnification but can result in large testing errors and subsequent destruction of other instrumentation. If measurements are producing unexpected or unwarranted errors, the cleanliness of the connector and the connection itself is a good place to begin troubleshooting. Stray particles of dirt or fingerprints can significantly reduce the optimal performance of the instrument. Follow these simple cleaning procedures frequently:

1) Using a clean cotton swab and a pure grade of isopropyl alcohol or glycol and water mix, gently wipe off the endface and ferrule.

2) Dry them with filtered, non-residue compressed air or a dry swab. Allowing the endface to air-dry risks leaving dissolved oils on the face which can interfere with connection integrity and measurement accuracy.

3) When reinserting the cable into the connector, insert it gently and in as straight a line as possible to avoid scraping materials from inside the connector onto the endface.

4) **It is not uncommon for a cable or connector to require more than one cleaning.** Often the first cleaning is useful for removing large particles of dirt or grit, and the second cleaning can then wipe the endface clean.

5) The second cleaning should be harder, with a scrubbing action. Do not scrub during the first cleaning, as any dirt particles may be ground into the endface and cause damage and scraping.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

This page intentionally left blank.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Options, Accessories and Specifications

Please contact us at 303-464-1919 if you have any questions regarding the options, accessories or specifications for the Model 2004 CSA.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Model 2004: Component Spectrum Analyzer®
Options and Ordering Information

2004	Component Spectrum Analyzer® mainframe
2112	12-channel expansion chassis
2124	24-channel expansion chassis
2160	60-channel expansion chassis
201	Power meter module, 800-1700 nm
202	Precision power meter module, 800-1700 nm
210	Remote power meter module, 800-1700 nm
222	Precision power meter module, 800-1700 nm, analog output
280	Photodiode measurement module
288	Photodiode measurement module, 8 channels
301	Real-time power reference measurement module
310	Optical shutter/automatic dark calibration
501	Bare fiber adapter, low stress, easy alignment
402Q	Precision wavelength reference module (extended range); 5 pm accuracy; 5 pm repeatability
402T	Precision wavelength reference module; 5 pm accuracy; 5 pm repeatability
410Q	Precision wavelength reference module (extended range); 1 pm accuracy; 1 pm repeatability
410T	Precision wavelength reference module; 1 pm accuracy; 1 pm repeatability
502	Bare fiber to FC adapter
684LN	Internal tunable laser source, low noise, 1260-1340 nm
684HP	Internal tunable laser source, high power, 1260-1340 nm
686LN	Internal tunable laser source, low noise, 1410-1510 nm
686HP	Internal tunable laser source, high power, 1410-1510 nm
688LN	Internal tunable laser source, low noise, 1510-1620 nm
688HP	Internal tunable laser source, high power, 1520-1630 nm
689LN	Internal tunable laser source, low noise, 1630-1660 nm
689HP	Internal tunable laser source, high power, 1630-1660 nm
692	Laser diode sources (1-5 sources). Specify 1-5 of the most common sources: 980 FBG; 1310 DFB; 1480 DFB; 1490 DFB; 1550 DFB; any wavelength from 1519-1630 nm DFB; 980 FP; 1310 FP; 1490 FP; 1550 FP
701	Rack slide kit for 2004 and 2160
702	Rack ear kit for 2004 and 2160 (requires user-supplied rack shelf)
703	Rack slide kit for 2112 and 2124
704	Rack ear kit for 2112 & 2124 (requires user-supplied rack shelf)
720	Extender interface kit (free with second 2124 or 2160)
731	Expand data memory; +500 MB
740	Internal GPIB controller (required to automatically control external TLS or external polarization controller)
921	Internal variable attenuator, 0-20 dB, SM output
940	Internal optical return loss (ORL) module
953I-13	Internal automatic matrix method PDL/IL measurement (4- and 6-state polarization controller), 1310 nm version
953I-15	Internal automatic matrix method PDL/IL measurement (4- and 6-state polarization controller), 1550 nm version
956	Automated matrix method PDL/IL measurement
957I	Internal polarization scrambler
962	Built-in source split with shutters for 2 DUTs
963	Built-in source split with shutters for 3 DUTs
972	Built-in source split with switches for 2 DUTs
973	Built-in source split with switches for 3 DUTs
982	Built-in source split for 2 DUTs
983	Built-in source split for 3 DUTs

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Model 2004: Component Spectrum Analyzer®
Mainframe Specifications

	Model 2004	Models 2112 and 2124	Model 2160
Channels per mainframe	1-4 channels per mainframe[1]	1-12 or 1-24 channels per extender	1-60 channels per extender
Channels per system	Model 2004 mainframe can be linked to one Model 2112 extender or one Model 2124 extender. Model 2004 can be linked to multiple Model 2160 extenders. Total channels supported is > 200. Channels may be added onsite by qualified personnel.		
Input connections	Selectable from among the following when ordering[2]: Model FC: FC/APC Model BF: Bare fiber interface Model UNIV: Universal to DUT connection		
Return loss	> 55 dB		
Wavelength range	800-1700 nm overall (see detail specs for performance over wavelength)		
Speed per channel (averaging)	Variable measurement speed from 100K rps to 0.1 rps		
System speed (burst mode)	100 K rps times number of channels		
System speed (real-time transmit mode)	100 K rps times number of channels. Transmitting to host with Ethernet is 3 Mbytes/second (dedicated link); with GPIB, 1.7 Mbytes/second into a PC.		
Multiple channel speed	100 K rps per channel (regardless of number of channels)		
Trigger latency[3]	< 40 ns		
Units	pW, nW, µW, mW, W; dBm, dB		
Display	10.4" graphical display; SVGA (800 x 600), TFT LCD color		
Data storage	Memory for > 100K readings per channel on all channels real-time storage. 100 billion measurements capacity on built-in hard drive.		
Triggering	Software synchronous trigger or external synchronous trigger		
Interfaces	IEEE-488, 100-BaseT Ethernet and RS-232 standard		
Command set	IEEE-488.2 compliant (SCPI-like)		
Power	110-240 VAC, ±10%, 700 VA max, 50-60 Hz. No switch or fuse change.		
Ambient temperature	10 ºC to 35 ºC (50 ºF to 95 ºF). 0 ºC to 40 ºC (32 ºF to 104 ºF), contact factory.		
Storage temperature	-40 ºC to 70 ºC (-40 ºF to 158 ºF)		
Humidity	< 95% non-condensing 0 ºC to 35 ºC (32 ºF to 95 ºF)		
Warm-up time	< 30 minutes to full specification; useable immediately after turn-on		
Certificate of calibration	Included		
Recalibration period	1 year		
Warranty period	Standard warranty is 4 years. (Options 402, 410, 953I, switch modules and tunable laser source modules carry a one-year warranty.)		
Mounting	Benchtop or rack mount		
Size	16.8" w x 20.5" h x 10.5" h (42.6 cm x 52.0 cm x 26.7 cm)	16.8" w x 20.5" d x 5.25" h (42.6 cm x 52.0 cm x 13.3 cm)	16.8" w x 20.5" d x 10.5" h (42.6 cm x 52.0 cm x 26.7 cm)
Weight	29 lbs (19 kg) with 4 channels, Option 301 Power Reference and Option 401 Wavelength Reference	24 lbs (11 kg) with 1 channel; < 35 lbs (16 kg) with 24 channels	52 lbs (24 kg) with 1 channel; < 78 lbs (36 kg) with 60 channels

[1]Up to 6 channels without Option 301 (Power Reference) and Option 401 (Wavelength Reference)
[2]Additional connectors available
[3]Trigger latency defined as total time from trigger edge to initiation of measurement

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Power Meter Modules
Option 202, Option 201, Option 210, Option 310, Option 301
Specifications

Sensitivity and Noise

Range	Fixed Range	Measurement		Measurement Resolution [1]		Precision Power Meter Module (Option 202) Noise RMS [2]						Power Meter Module (Option 201) Noise RMS [2]					
						5 secs [7]		100 ms [8]		10 µs (full speed) [9]		5 secs [7]		100 ms [8]		10 µs (full speed) [9]	
		W	dBm	W	dBm	±W	±dBm	±W	±dBm	±W	±dBm	±W	±dBm	±W	dBm	±W	±dBm
Fast 10 mW	10 mW	10 mW	10	200 nW	-37	50 nW	-43	100 nW	-41	400 nW	-34	100 nW	-41	200 nW	-37	800 nW	-31
	1 mW	1 mW	0	20 nW	-47	8 nW	-51	20 nW	-50	40 nW	-44	20 nW	-47	40 nW	-44	80 nW	-41
	100 µW	100 µW	-10	2 nW	-57	2 nW	-57	2 nW	-57	8 nW	-51	4 nW	-54	4 nW	-54	16 nW	-48
Fast 100 µW	100 µW	100 µW	-10	2 nW	-57	1 nW	-60	1 nW	-60	4 nW	-54	4 nW	-54	4 nW	-54	16 nW	-48
	10 µW	10 µW	-20	200 pW	-67	30 pW	-75	40 pW	-74	800 pW	-61	400 pW	-64	400 pW	-64	4 nW	-54
	1 µW	1 µW	-30	20 pW	-77	20 pW	-77	20 pW	-77	300 pW	-65	200 pW	-67	200 pW	-67	2 nW	-57
Fast 1 µW	1 µW	1 µW	-30	20 pW	-77	10 pW	-80	6 pW	-82	100 pW	-70	50 pW	-73	50 pW	-73	500 pW	-63
	100 nW	100 nW	-40	2 pW	-87	2 pW	-87	3 pW	-85	40 pW	-74	20 pW	-77	50 pW	-73	500 pW	-63
	10 nW	10 nW	-50	0.2 pW	-97	1 pW	-90	2 pW	-87	40 pW	-74	20 pW	-77	50 pW	-73	500 pW	-63
Fast 10 nW	10 nW	10 nW	-50	0.2 pW	-97	1 pW	-90	2 pW	-87	4 pW	-84	20 pW	-77	50 pW	-73	500 pW	-63
	1 nW	1 nW	-60	0.02 pW	-107	1 pW	-90	2 pW	-87	3 pW	-85	20 pW	-77	50 pW	-73	500 pW	-63
	100 pW	100 pW	-70	2 fW	-117	1 pW	-90	2 pW	-87	2 pW	-87	20 pW	-77	50 pW	-73	500 pW	-63
Fast 100 pW	100 pW	100 pW	-70	2 fW	-117	300 fW	-95	300 fW	-95	300 fW	-95	20 pW	-77	50 pW	- 73	500 pW	-63

Accuracy [1, 6]

Absolute uncertainty at reference conditions [4]:	2.5%
Absolute operational uncertainty [5]:	5%
Relative uncertainty:	<1% + noise (per table above)

Measurement Speed

Auto-Range Mode	Full Measurement Range	Reading Time with Averaging of:		
		1 Reading	2,000 Readings	500,000 Readings
Fast 10 mW - 2 nW	10 dBm to -57 dBm	10 µs	20 ms	5.00 s
Fast 100 µW - 20 pW	-10 dBm to -77 dBm	10 µs	20 ms	5.00 s
Fast 1 µW - 200 fW	-30 dBm to -97 dBm	10 µs	20 ms	5.00 s
Fast 10 nW - 2 fW	-50 dBm to -107 dBm	10 µs	20 ms	5.00 s
Fast 1 nW - 0.5 fW	-60 dBm to -117 dBm	10 µs	20 ms	5.00 s
Med 10 mW - 20 pW	10 dBm to -77 dBm	1 ms	21 ms	5.00 s
Med 10 mW - 200 fW	10 dBm to -97 dBm	10 ms	30 ms	5.01 s
Slow 10 mW - 2 fW	10 dBm to -107 dBm	1.5 s	1.52 s	6.52 s
Slow 10 mW - 0.5 fW	10 dBm to -117 dBm	5 s	5.02 s	10.02 s

Connections*

Model	Description
1.5 UNIV	Universal 1.5 mm ferrule interface
2.5 UNIV	Universal 2.5 mm ferrule interface
BF	Bare fiber interface
FC	FC connector interface
LC	LC connector interface
MU	MU connector interface
SC	SC connector interface
ST	ST connector interface
SMA	SMA connector interface

*Select when ordering. Additional connectors may be available. Input connection can be changed in the field.

(Continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Power Meter Modules
Option 202, Option 201, Option 210, Option 310, Option 301
Specifications *(Continued)*

Analog Output

Analog output available (Option 222)

Polarization Uncertainty of Measurement

< ±0.0015 dB typical; 0.0035 dB guaranteed for precision power meter module (Option 202) < ±0.0050 dB for power meter module (Option 201)

Return Loss

> 55 dB

Remote Power Meter Module (Option 210)

Input configurations: 3 mm free space; 1 mm free space; FC, SC, ST, UC Universal connector or BF (bare fiber)
Input orientation: End (axial) entry or side entry
Cable length: 1 meter standard; call factory for additional lengths

[1] From 1500 to 1620 nm. For 1400-1635, add 3 dBm; for 800 nm-1650 nm, add 10 dB noise and resolution specs (or multiply to W by 10). Assume automatic or manual dark calibration performed.
[2] Peak noise is typically 3 to 3.5 times the RMS figure. Noise figures are typical performance.
[3] Per "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results;" NIST Technical Note #1297
[4] Wavelength = 1310, 1520-1625 nm, $T_{(ambient)}$ = 23C ± 2C, 1.1 mm diameter beam, 30 µW
[5] Wavelength = 800-1650 nm, $T_{(ambient)}$ = 10 to 35C, Fiber with N.A. <0.3, -70 dBm to +3 dBm (total wavelength range 800 nm-1700 nm)
[6] Above 5 dBm, accuracy is typical
[7] Maximum variation ± for 4 measurements, filter on
[8] Maximum variation ± for 50 measurements, filter on
[9] Maximum variation ± for 10,000 measurements, filter on
[10] Includes the time to change range and take readings. All readings equally spaced.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Photodiode Measurement Modules (Internal)
Option 280, Option 288
Specifications

(For use in measuring responsivity or current from external photodiode)

General Specifications

Measurement rate	100,000 readings per second (10 µs measurement time)
Measurement modes	Current measurement; voltage measurement
Photodiode bias supply voltage range	0 to 10V
Photodiode bias supply voltage resolution	5 mW resolution
Photodiode bias supply voltage noise	< 50 µV DC to 20 KHz
Display, absolute measurement	Displays 1 mV per mA measured from photodiode with no user calibration applied. Display in linear (mW) or log (dBm).
Display, relative measurement (Pref ON)	Displays the cal factor of mA per mW applied. Display in log (dB).
Math	Both dB and linear offset functions available standard
PD calibration factors	Selectable from front panel; GPIB, Ethernet, or RS-232
Triggering	Selectable through CSA mainframe. < 40 ns maximum trigger misalignment.
Maximum input	±40 V peak (no damage)
Channels	1 channel for Option 280; 8 channels for Option 288
Input connection	12-pin circular connector

Voltage Mode Specifications

Range	Resolution	Noise @ 10 µs[1]
10 V	200 µV	< 1 mV
1 V	200 µV	< 200 µV

[1] Peak-to-peak noise

PD Current Mode Specifications

Range	Resolution	Noise @ 100 ms [1]	Noise @ 10 µs[1]	Equiv Optical Power (direct)		Equiv Optical Power (10% tap)	
1A	20 µA	< 20 µA	< 80 µA	30 dBm	1W	40 dBm	10 W
100 mA	2 µA	< 2 µA	< 8 µA	20 dBm	100 mW	30 dBm	1 W
10 mA	200 nA	< 200 nA	< 800 nA	10 dBm	10 mW	20 dBm	100 mW
1 mA	20 nA	< 20 nA	< 80 nA	0 dBm	1 mW	10 dBm	10 mW
100 µA	2 nA	< 2 nA	< 8 nA	-10 dBm	100 µW	0 dBm	1 mW
10 µA	200 pA	<200 pA	< 800 pA	-20 dBm	10 µW	-10 dBm	100 µW
1 µA	20 pA	< 20 pA	< 80 pA	-30 dBm	1 µW	-20 dBm	10 µW
100 nA	2 pA	< 2 pA	< 40 pA	-40 dBm	100 nW	-30 dBm	1 µW
10 nA	200 fA	< 200 fA	< 4 pA	-50 dBm	10 nW	-40 dBm	100 nW

[1] Peak-to-peak noise

Response Time Specifications

Range	Response with 1 pF PD Capacitance
1A	~ 20 KHz
100 mA	~ 20 KHz
10 mA	~ 20 KHz
1 mA	~ 20 KHz
100 µA	~ 7.5 KHz
10 µA	~ 7.5 KHz
1 µA	~ 0.1 KHz
100 nA	~ 0.1 KHz
10 nA	~ 0.01 KHz

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Wavelength Reference Module Options (Internal)
Options 410Q, 410T, 402Q, 402T
Specifications

	410Q	410T	402Q	402T
Description	Precision wavelength reference module (extended range)	Precision wavelength reference module	Precision wavelength reference module (extended range)	Precision wavelength reference module
Absolute wavelength accuracy	< ±1 pm	< ±1 pm	< ±5 pm	< ±5 pm
Repeatability	< ±1 pm	< ±1 pm	< ±5 pm	< ±5 pm
Wavelength range	1260-1640 nm	1510-1648 nm full accuracy; wider wavelength range at reduced accuracy	1260-1640 nm	1510-1648 nm full accuracy; wider wavelength range at reduced accuracy
Minimum sweep range	Sweep to include at least 1 nm from at least one of these wavelength ranges: 1520-1532 1536-1550 1563-1573 1576-1590 1595-1608 1610-1638			
Maximum wavelength error that can be corrected	The "Wavelength Offset Wizard" corrects beginning-of-sweep wavelength errors up to 5 nm. The wizard should be used if the initial wavelength error of the sweep is > 200 pm.			
Maximum sweep rate	100 nm/second guaranteed; 120 nm/second typical			
Mode hop correction	Automatic: Finds, characterizes and corrects for single or multiple mode hops encountered during the sweep.			
Optical input power	> -15 dBm into "TLS IN" port typical			
Wavelength resolution	0.01 pm			
Wavelength correction	Each power/IL/ORL/PDL measurement point wavelength is automatically connected to the actual wavelength			
Wavelength sweep rate	Full specifications generally apply to TLS at its maximum sweep rate. At slower rates, some TLS become substantially unstable and can even sweep backwards for short periods of time.			
Tunable laser source	Tested with tunable laser sources from dBm Optics, Agilent, Santec and New Focus, operating at maximum speed (100 nm/second for the New Focus 8700). Others may work; contact dBm Optics' Applications Engineering for additional information.			
Data available	Wavelength axis automatically corrected when wavelength correction is enabled. Data trace showing wavelength correction applied (TLS wavelength error) may be displayed.			

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Tunable Laser Sources (Internal)
680 Series
Specifications

	684		686		688		689	
	LN	HP	LN	HP	LN	HP	LN	HP
Tuning range	1260-1340 nm		1410-1510 nm		1520-1630 nm		1630-1660 nm	
Tuning range, mode-hop free	1260-1340 nm		1410-1510 nm		1510-1620	1520-1630	1630-1660 nm	
Output power	0 dBm	+6 dBm	0 dBm	+6 dBm	0 dBm	+8 dBm	0 dBm	+4 dBm
Signal to source spontaneous emission ratio (SSE) [5,7]	70 dB	40 dB	70 dB	40 dB	70 dB	40 dB	70 dB	40 dB
Signal to total source spontaneous emission ratio (STSE) [6,7]	55 dB	15 dB	55 dB	15 dB	55 dB	15 dB	55 dB	15 dB
Tuning speed	2 to 2000 nm/s (±1%)							
Wavelength resolution [2]	0.08 pm (10 MHz)							
Absolute wavelength accuracy [1]	< ±1 pm with precision wavelength reference (Option 410) < ±5 pm with wavelength reference (Option 402) < ±30 pm in fixed wavelength mode < ±1 nm in swept mode							
Wavelength repeatability [2]	< ±1 pm with precision wavelength reference (Option 410) < ±5 pm with wavelength reference (Option 402) < ±100 pm without							
Wavelength stability [3]	< ±2.5 pm							
Tuning linearity [1]	< ±1 pm with precision wavelength reference (Option 410) < ±5 pm with wavelength reference (Option 402) < ±80 nm in swept mode							
Linewidth	< 100 kHz (30 kHz chirp) instantaneous							
Side mode suppression (SMSR) [4,7]	> 50 dBc typical							
Optical shutter	> 80 dB extinction available with integrated optical shutter/automatic dark calibration (Option 310)							
RIN	-140 dBc (0.1 GHz to 1.0 GHz); -150 dBc/Hz (1 GHz to 2.5 GHz) typical							
Connector	FC/APC standard; FC/APC-PM available							
Trigger output	+5 volt trigger at beginning of continuous sweep							
Remote interfaces	GPIB (IEEE 488); Ethernet; USB Flash Drive							
Power	90-240 VAC							
Environmental: Operating	+10 ºC to +32 ºC (+55 ºF to +90 ºF); < 80% RH non-condensing							
Environmental: Storage	-20 ºC to +70 ºC (-4 ºF to +158 ºF); < 80% RH non-condensing							
Size	16.8" width x 16.4" depth x 5.25" height (42.6 cm x 41 cm x 10.5 cm)							
Weight	6 lbs (2.7 kg)							
Shock/vibration	ISTB Procedure 2B; 100G non-operating							
Laser safety	Class 3B (FDA 21 CFR 1040.10); Class 3A (IEC 825-1; 1993)							

NOTE: All specifications measured with one-hour warm up and constant temperature 23 ºC (±2 ºC).

CAUTION: Viewing the laser output with certain optical instruments (e.g., eye loupes, magnifiers, microscopes) within a distance of 100 mm may pose an eye hazard.

[1] Using installed wavelength correction option if noted, see Option 402 for specifications or Option 410 for operating parameters
[2] 1 pm in step mode
[3] In fixed wavelength mode
[4] 0.1 nm bandwidth; signal to max ASE; 1-3 nm from carrier
[5] 0.2 nm bandwidth; signal to max ASE; > 5 nm from carrier
[6] Signal to total ASE > 0.5 nm from carrier

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Polarization Controller (Internal)
Option 953I-13, Option 953I-15
Specifications

	953I-13	953I-15
Description	Internal 4- and 6-state polarization controller; 1310 nm version	Internal 4- and 6-state polarization controller; 1550 nm version
Insertion loss	1.0 dB typical	1.0 dB typical
Insertion loss variation	0.1 dB max for all SOP states	0.1 dB max for all SOP states
Wavelength dependent loss	< 0.6 dB 1260-1360 nm	< 0.6 dB 1530-1565 nm
Return loss	55 dB min	55 dB min
SOP repeatability	±0.1 degrees on Poincaré sphere	±0.1 degrees on Poincaré sphere
Rotation angle wavelength dependence	-0.068 degrees/nm	-0.068 degrees/nm
SOP switching speed	250 µs max	250 µs max
States generated	-45, 0, 45, 90, RHC, LHC	-45, 0, 45, 90, RHC, LHC
Maximum optical power	300 mW min	300 mW min
Wavelength	1260-1360 nm	1480-1620 nm

Polarization Scrambler (Internal)
Option 957-I
Specifications

Description	Internal polarization scrambler
Insertion loss	< 0.05 dB
Output degree of polarization	< 5%
Insertion los variation	< 0.01 dB
Scrambling base frequency	700 KHz

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

This page intentionally left blank.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Quick-Start Guide

This Quick-Start Guide will enable you to make basic measurements with the dBm Optics Component Spectrum Analyzer® (CSA). This Quick-Start Guide is not meant to replace the in-depth information contained elsewhere in this manual. There are many functions and features that are completely ignored in this Quick-Start Guide. For example, elsewhere in this manual you will find information for analog and digital filtering, ranges and averaging—all of which can improve measurement quality. In addition, there are many useful tools available on the CSA that will greatly enhance the analysis of a device's performance; tools such as additional traces, markers functions, applications and display options to name a few. These are explained in the additional sections of this operating manual. By reviewing this manual in full you will familiarize yourself not only with the procedural steps necessary to perform the various measurements, but with the applications and theories behind these measurements as well.

If you have additional questions, please contact Applications Engineering at 303-464-1919 or by email at applications@dbmoptics.com.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using the CSA to Measure IL, PDL and ORL

	CSA with Internal Polarization Controller and GPIB-connected TLS	CSA with 8169A External Polarization Controller and GPIB-connected TLS
Connections	For accurate IL and PDL measurements, it is critical for the optical connections to be clean. To ensure clean connections, visually inspect every connector before connection. For example, dirty or scratched optical connectors can easily add 0.2 dB IL and 0.08 dB PDL (or more).	
1) Electrical Connections	**A)** Power to all instruments **B)** Trigger cable from TLS trigger out to CSA measurement start **C)** GPIB cable from the rear panel of the CSA's **GPIB EXT. DEVICE CONTROLLER** to TLS	**A)** Power to all instruments **B)** Trigger cable from TLS trigger out to CSA measurement start **C)** GPIB cable from the rear panel of the CSA's **GPIB EXT. DEVICE CONTROLLER** to TLS and to polarization controller
2) Optical Connections	**A)** TLS to **TLS IN** on CSA using slow axis aligned PM fiber **B)** SM patch cord from Pref to Channel 5 on CSA **C)** (If using WaveRef I Model 401) SM patch cord to Wavelength Reference on CSA **D)** SM patch cord from **TO DUT** to Channel 1	**A)** TLS to polarization controller **B)** Polarization controller to **TLS IN** on CSA **C)** SM patch cord to Pref on CSA **D)** SM patch cord to wavelength reference on CSA **E)** SM patch cord from **TO DUT** to Channel 1

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

	CSA with Internal Polarization Controller and GPIB-connected TLS	CSA with 8169A External Polarization Controller and GPIB-connected TLS
Prior to Measurement		
1) Set TLS	**A)** Press the **SWEEP** button **B)** Verify that **CONTINUOUS** is selected under **SWEEP MODE** **C)** Press **MORE…** **D)** Press **TLS SETUP** **E)** Press **TLS A SETUP…**; set GPIB address to match TLS **F)** Press **SELECT TLS A**. The CSA will find the TLS, display the model, and set minimum and maximum wavelengths. Set TLS output on and power as desired (often at maximum).	
2) Set Sweep Parameters	**A)** Press the **SWEEP** button **B)** Enter **START WAVELENGTH** (1525 nm typical) **C)** Enter **STOP WAVELENGTH** (1620 nm typical) **D)** Enter **SWEEP RATE** (New Focus or dBm Optics TLS to 100 nm/second; Agilent TLS to fastest valid sweep rate) **E)** Enter **READING SPACING** (0.010 nm typical) **F)** Toggle the **START** option to **TRIGGER** **G)** All other settings to default	
3) Set Measurement Ranges	**A)** Press the **CHANNELS** button **B)** Press **EDIT CHANNELS…** and look at the measurement ranges to verify that the desired ranges are selected for each channel. If you are not sure of the appropriate ranges to use: **i)** Press **SELECT/DESELECT ALL CHANNELS** **ii)** Press **AUTO-SET SELECTED CHANNELS MEASUREMENT RANGE** **C)** Run a sweep by pressing the **START/STOP** button. Ensure data looks appropriate.	
4) Perform Dark Current Calibration	**A)** Press the **CHANNELS** button **B)** Press **DO DARK CURRENT ZERO**	
5) Specify Polarization Controller	**A)** Press the **APPS** button **B)** Press **PDL MEASUREMENT SETUP…** **C)** Press **SETUP…** **D)** Toggle **CONTROL MODE** until **INTERNAL** is selected	**A)** Press the **APPS** button **B)** Press **PDL MEASUREMENT SETUP…** **C)** Press **SETUP…** **D)** Toggle **CONTROL MODE** until **8169A** is selected
6) Verify CSA Communicates with Polarization Controller	**N/A**	**A)** Press the **APPS** button **B)** Press **PDL MEASUREMENT SETUP…** **C)** Press **MAXIMIZE POWER THROUGH POLARIZER**. If polarization controller does not respond, check GPIB address (steps below) and try again. **i)** Press the **SYSTEM** button **ii)** Press **COMMUNICATIONS SETUP…** **iii)** Press **GPIB CONTROL SETUP…** **iv)** Enter value in **POL. CONTROLLER GPIB ADDRESS**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

	CSA with Internal Polarization Controller and GPIB-connected TLS	CSA with 8169A External Polarization Controller and GPIB-connected TLS
Measurements		
1. Measure IL	**A)** Optically connect **TO DUT** to the device under test and connect output of DUT to Channel 1 through Channel N. **B)** Specify dB mode by pressing the **CHANNELS** button and selecting **dB** under **POWER MODE**. **C)** Press the **START/STOP** button to initiate sweep. Accurate IL data should now be displayed.	
2. Measure IL and PDL	**A)** Perform all steps under 1 above. **B)** Make sure that a PDL trace is added for each channel on which you want to measure PDL. To do this: **i)** Press the **CHANNELS** button **ii)** Press **EDIT CHANNELS…** **iii)** Press **MORE…** **iv)** Press **PDL TRACES…(& PDBW, PDBW)** **v)** Press **SELECT NEXT TRACE** **vi)** Toggle **PDL TRACE ON/OFF** until desired setup is attained **C)** Press the **START/STOP** button to initiate sweep. Accurate IL and PDL data should now be displayed.	
3. Measure IL, PDL, and ORL	**A)** Perform all step under 1 above. **B)** Perform all steps under 2 above. **C)** Connect patch cable from ORL output to Channel 4. **D)** Turn on ORL Option: **i)** Press the **APPS** button **ii)** Press **ORL…** **iii)** Toggle the **ORL** softkey until **ON** is selected (If this option is not available, you will need to recalibrate ORL reference data—see below.) **E)** Press the **START/STOP** button to initiate sweep. Accurate IL, PDL and ORL data should now be displayed. You may need to perform an ORL calibration (see next page).	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

	CSA with Internal Polarization Controller and GPIB-connected TLS	CSA with 8169A External Polarization Controller and GPIB-connected TLS
Additional Corrections		
Splitter Cal (SplitCal)	Perform a new Splitter Cal reference (SplitCal) if you use a different set of patch cords to connect the DUT to the instrument and/or it has been some time since the last SplitCal. To perform a new Splitter Cal (SplitCal): **1)** Set up a continuous wavelength sweep using the maximum wavelength range that will be used (see #2 under "Prior to Measurement" in this guide) **2)** Press the **CHANNELS** button **3)** Press **POWER MODE SETUP & CAL…** **4)** Press **SPLITCAL SETUP**… **5)** Press **CLEAR CHANNEL SPLITCAL DATA** **6)** Connect a patch cord from **TO DUT** to the first channel **7)** Press **ADD SCAN** **8)** Press **ACQUIRE NOW**. Confirm that SplitCal values are reasonable; typically between 0-2 dB. **9)** Initiate a sweep by pressing the **START/STOP** button **10)** Ensure that the readings are very stable and flat across wavelength. Typical variation should be in the range of milli-dB's. If very high accuracy is required on multiple channels, repeat these steps for each of the other channels. Repeat the previous steps while setting the **SELECTED CHANNEL** (in the Add Scan section) to each channel in sequence and setting **DEFAULT SPLITCAL** to **DISABLED.**	
PDL Reference Set: Using 4-sweep Vector Reference for PDL	Perform a PDL Reference Set if you are trying to measure very low values of PDL, very high accuracies of PDL (< 0.05 dB), or if you are using additional optics to deliver light from the **TO DUT** output to the DUT that have significant PDL values that need to be corrected for. Follow these steps to perform a PDL Reference Set: **1)** Connect patch cable from **TO DUT** output to **CH 1**. Use all optics that will be in path for actual measurement. Everything upstream of the DUT that is in the optical path for the calibration will be calibrated out. **2)** Make sure that the sweep settings are set to desired wavelength and sweep rate for upcoming IL/PDL trace. Also make sure that the PDL trace is turned on for the desired measurement channel(s). **3)** Press the **APPS** button **4)** Press **PDL MEASUREMENT SETUP…** **5)** Press **START MEASURE PDL REF SET** **6)** Press **BACK…** **7)** Press **PDL MEASUREMENT SETUP…** **8)** Toggle **PDL REF SET** until **USE** is selected	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

<table>
<tr><th></th><th>CSA with Internal
Polarization Controller
and GPIB-connected TLS</th><th>CSA with 8169A External
Polarization Controller
and GPIB-connected TLS</th></tr>
<tr><td>Using Both SplitCal and PDL Reference Set</td><td colspan="2">1) Perform PDL Ref set first on Channel 1
2) Perform Splitter Cal on each subsequent channel. Make sure measurements are using PDL Ref Set.

NOTE: No SplitCal for Channel 1. The PDL Ref set will act as the SplitCal for Channel 1.</td></tr>
<tr><td>Recalibrate and Use ORL Reference Data</td><td colspan="2">Perform this step if the ORL option is not available or if the ORL reference data obtained is not accurate. There are two steps to recalibrating ORL reference data: 1) calibrating zero light level data and 2) calibrating gain data.

NOTE: Make sure that the sweep settings are set to desired wavelength and speed for upcoming ORL trace. Make sure that the measurement range is set to the appropriate level for ORL (usually -30 to -84 dBm).

NOTE: Depending on software version, power mode may need to be set to dB. To do this, press the CHANNELS button and then toggle the POWER MODE softkey to select dB.

1) <u>Step 1: Calibrate Zero Light Level Data</u>

A) Press the APPS button
B) Press ORL…
C) Press EDIT/VIEW ORL ZERO REF DATA…
D) Press CLEAR ORL REF DATA (If CLEAR ORL REF DATA is grayed out, there is no ORL ref data stored to be cleared)
E) Attach calibration fiber (simple FC-PC terminated patch cable connected to the output of the CSA). Mandrel-wrap the output fiber so that no light is getting to output connector. This is the zero ORL known state.
F) Run a measurement (by pressing the START/STOP button) to get valid data on screen for this state.
G) Press SAVE ORL ZERO REF SWEEP DATA TO FILE

2) <u>Step 2: Calibrate Gain Data</u>

A) Unwrap the fiber so that light is getting to the connector (PC connector). This is now the -14.7 dB ORL known state.
B) Run a measurement (by pressing the START/STOP button) with the fiber in this state
C) Press BACK…
D) Press EDIT/VIEW ORL GAIN REF DATA…
E) Press COMPUTE & SAVE ORL GAIN REF SWEEP DATA TO FILE
F) Press the APPS button
G) Press ORL…
H) Toggle ORL to ON. The CSA is now ready to measure accurate ORL sweeps.
I) Verify this calibration. With the calibration fiber still attached, press the START/STOP button. ORL sweep should yield a sweep that is very close to -14.7 dB.</td></tr>
</table>

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

	CSA with Internal Polarization Controller and GPIB-connected TLS	CSA with 8169A External Polarization Controller and GPIB-connected TLS
Maximize Power Through Polarizer	**N/A**	Maximize power through polarizer if power through the polarization controller is low. To determine if power is low, look at the power on the reference channel, Channel 5. If the power on Channel 5 is more than 8 dB below the TLS output, perform a new maximize. To maximize power through the polarizer: **1)** Press the **APPS** button **2)** Press **PDL MEASUREMENT SETUP…** **3)** Press **MAXIMIZE POWER THROUGH POLARIZER**
Dark Current Calibration	Dark current calibration should be performed if dynamic range is being limited by noise floor on channel cards. Dark current calibration should be performed regularly if deep measurements are being made or if values of ORL greater than 40-50 dB are being measured. To perform dark current calibration, press the **CHANNELS** button and then press **DO DARK CURRENT ZERO**.	
Viewing Tips	**1)** Select 1, 2 or 3 graphs to be shown simultaneously by using the view buttons located beneath the screen. Typically, a two-graph setup is desired for the simultaneous measurement of IL, PDL and ORL (IL and ORL in one graph and PDL in the other). **2)** Keeping the auto reference level turn on will keep the data selected in the viewable area of the screen. To set the auto reference: **A)** Press **AMPLITUDE** **B)** **AUTO REFERENCE LEVEL** (set to **MAX**, **AVERAGE** or **OFF**) **3)** A certain trace type can be selected to be displayed on screen (IL only, PDL only, All, etc.). To do this: **A)** Press the **AMPLITUDE** button **B)** Press **NEXT TRACE TYPE** **4)** The traces function is very helpful in reading and understanding data. **A)** Press the **TRACES** button **B)** Press **SELECT NEXT TRACE** **C)** The selected trace turns white and the flag on the top of the screen shows statistical information about this trace.	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

This page intentionally left blank.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Getting Started

The CSA can be operated either by direct interface with the front panel or through remote operation using a PC and SCPI-like commands (Standard Commands for Programmable Instruments) from RS-232, GPIB or Ethernet. The following section provides a brief overview of the features and functions of the dBm CSA. For a more detailed discussion of testing procedures, see Front Panel Operations or Operations from a PC.

The following sections are included in this chapter. Direct links are provided below:

Front Panels
- Model 2004 – Front Panel
- Model 2112 and Model 2124 – Front Panels
- Model 2160 – Front Panel

Graphic Display

Rear Panels
- Model 2004 – Rear Panel

Connecting and Turning on the CSA

Connecting and Turning on the Extender Chassis

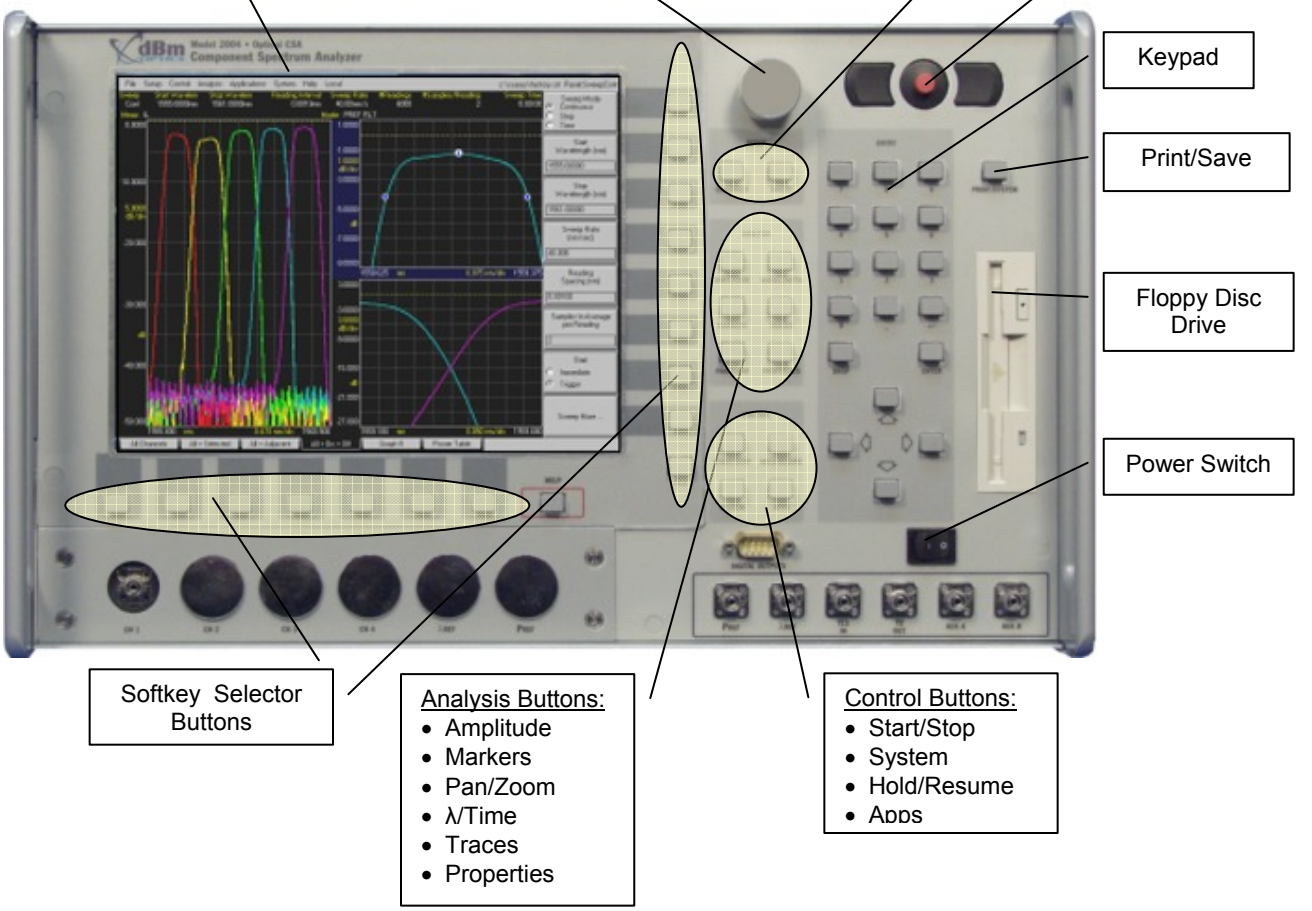
Making Measurements
- Measurement Worksheet
- Insertion Loss vs. Wavelength
- Continuous Sweep Example
  - Remote Commands for Continuous Sweep
  - Basic Front Panel Procedures for Continuous Sweep Measurements
- Step Sweep Example
  - Remote Commands for Step Sweep Measurements
  - Basic Front Panel Procedures for Step Sweep Measurements
- Time Sweep Measurements
  - Insertion Loss vs. Time
  - Remote Commands for Time Sweep Measurements
  - Basic Front Panel Procedures for Time Sweep Measurements
- PDL Measurements
  - Matrix Method
  - All States Method
  - N States Method

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Front Panels

Model 2004 – Front Panel

Most measurement and analytical procedures of the dBm Component Spectrum Analyzer® can be accomplished using the front panel. The front panel is composed of the display; panel shortcut function keys; tab and softkey buttons; a disc drive and various data input devices.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Model 2112 and Model 2124 – Front Panels

12- and 24-Channel Expansion Chassis – Front Panel



Model 2160 – Front Panel

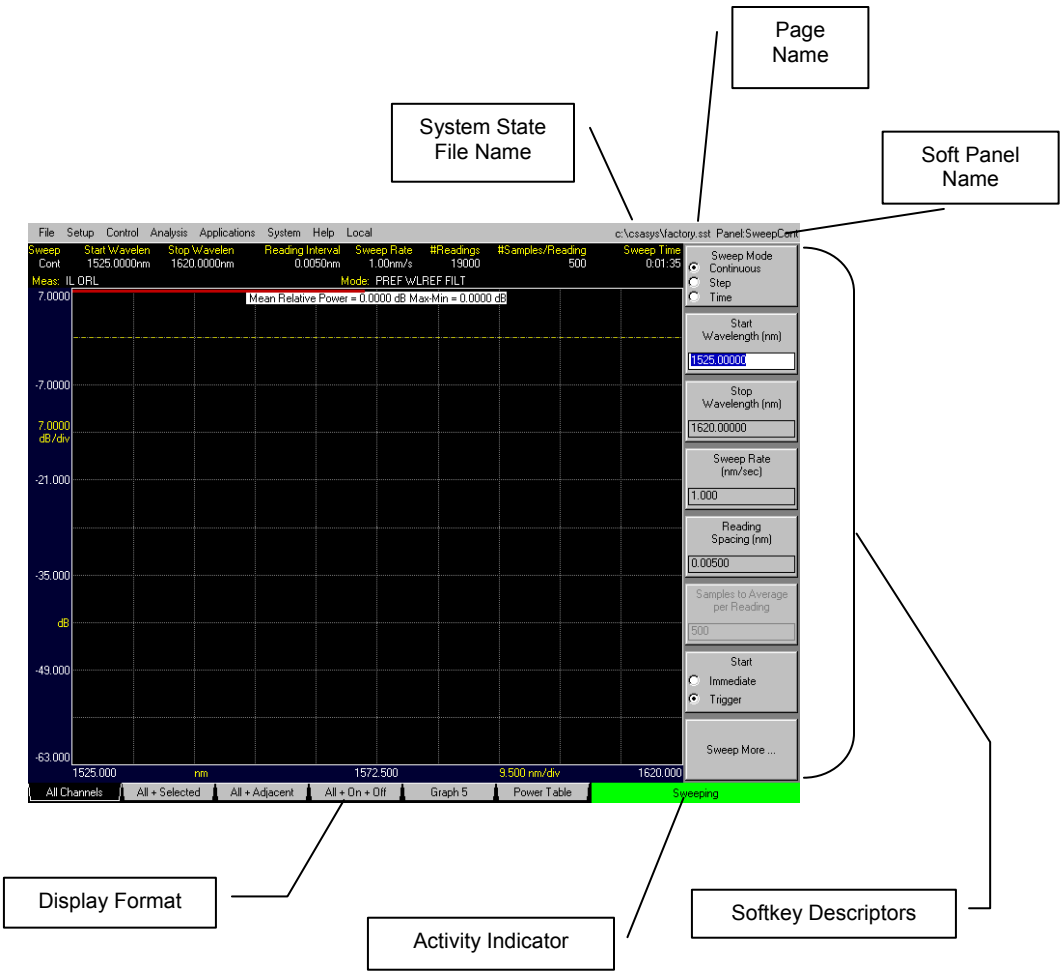
60-Channel Expansion Chassis – Front Panel



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Graphic Display

The display area of the front panel is an LCD composed of the menu bar, the softkeys, panel name, tabbed notebooks and the view area. The view area may contain multiple graphs or tables, depending upon the function being utilized. The user may choose a function by making a selection from the menu bar using the internal mouse pointer or an external mouse, pressing the softkey selectors to the right of the display, pressing the panel shortcut keys or typing a command into a remote PC. The display changes based on the measurement or analysis being performed and upon the active notebook tab.



Graphs

Each graph type has a practical limit to the number of channels displayed at once. The limit is not enforced by software so that the user may determine the limit. Some options are: split the screen into multiple axes; choose another trace type and choose another view.

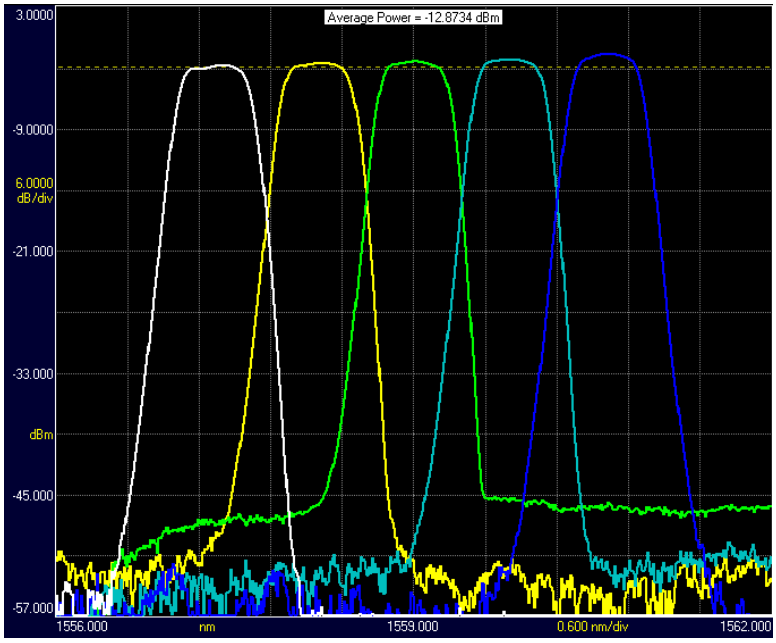
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Graph Types

There are six ways to show the data on the display: 1 Graph; 2 Graphs; 3 Graphs; All + Selected; All + Adjacent; and Power Table. A description of each type follows.

Single Graph Displayed

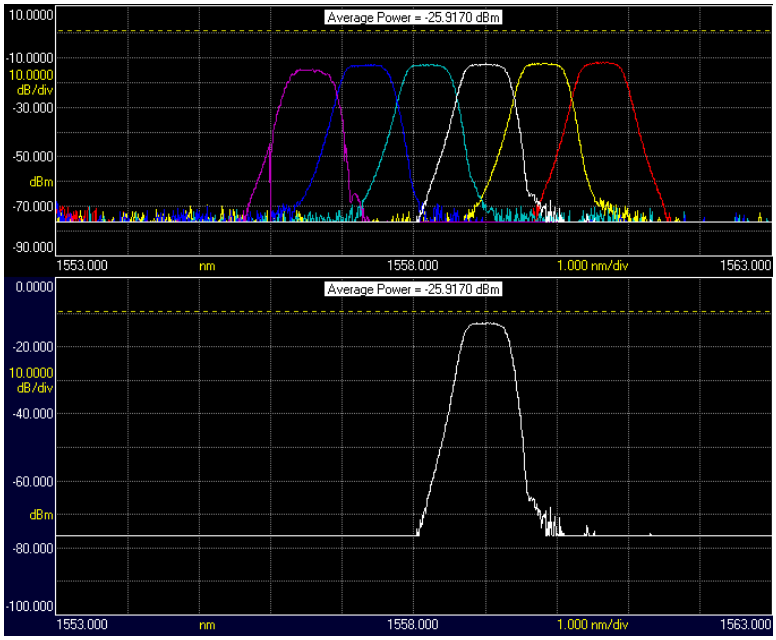
This display provides a generic output useful for any application that presents all of the active channels at one time. This type of view allows the most resolution for power and wavelength/time on a single graph.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Two Graphs Simultaneously Displayed

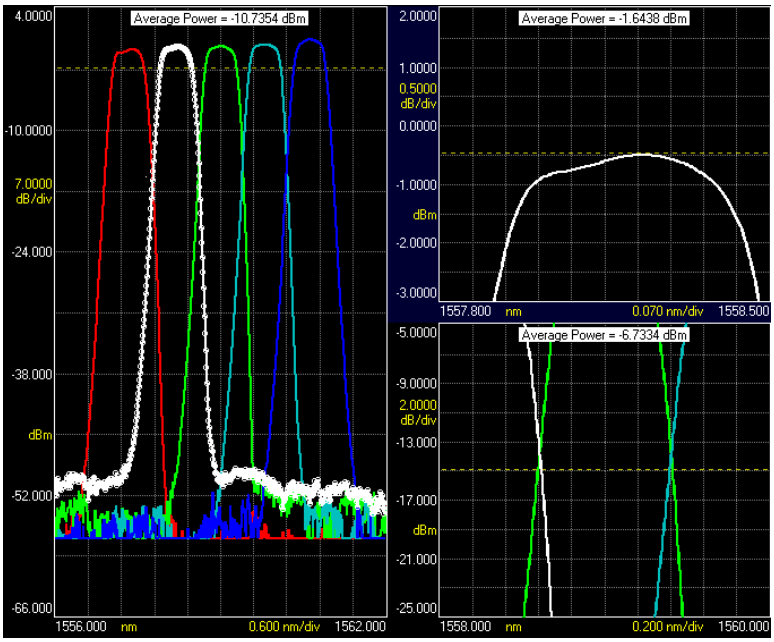
This view shows two different simultaneous plots. One plot graphs the traces for all of the active channels. The other plot allows the user to isolate one particular channel out of the entire range of channels to view separately. This type of view is useful for large channel count applications where a visual check of an individual channel is needed.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Three Graphs Simultaneously Displayed

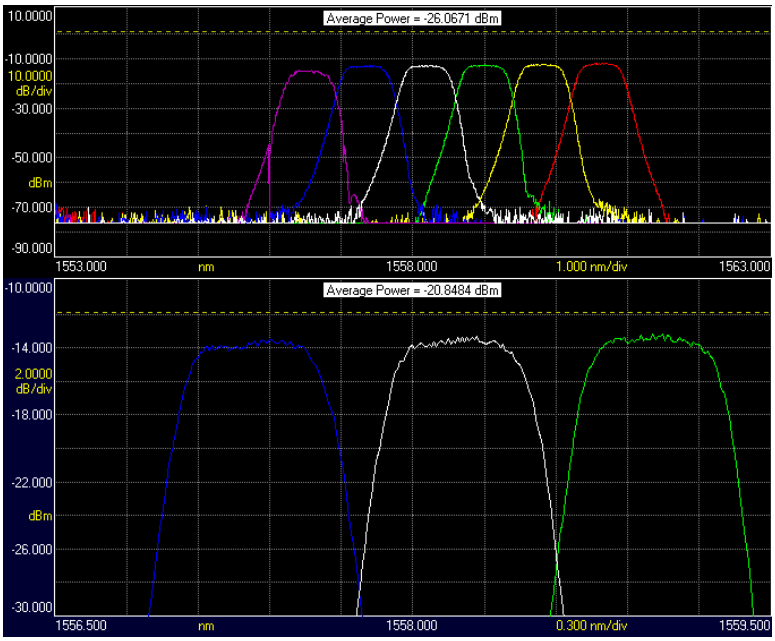
This option allows the user to view three separate portions of the entire channel set. Each plot contains information from all of the channels, but each plot can be set up with independent parameters and ranges. This type of view is especially useful for switch testing.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

All + Adjacent

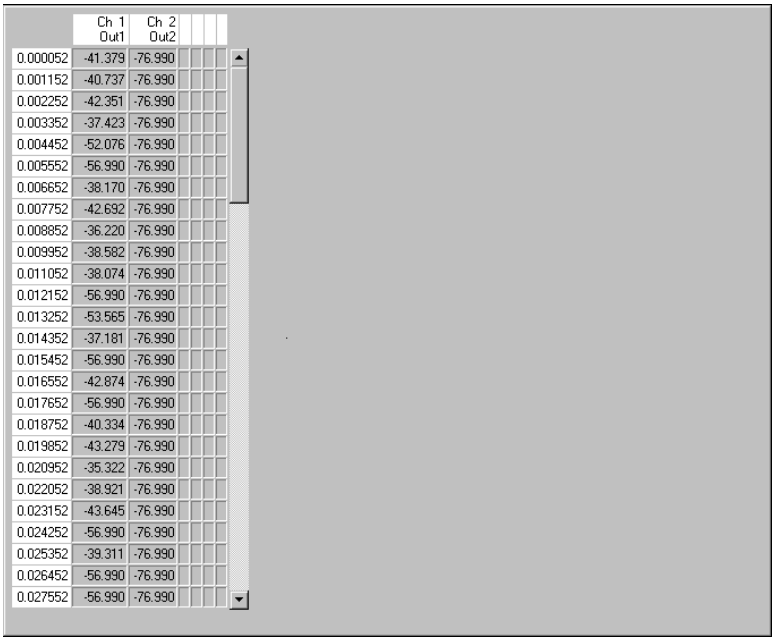
This view shows two different simultaneous plots. One plot graphs the traces for all of the active channels. The second plot allows three consecutive channels to be isolated and viewed separately. This of view is especially useful for MUX/DeMUX testing and provides an opportunity to evaluate cross talk characteristics.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Power Table

This is the actual data taken from the channel cards for all active channels. The power table is limited to display up to 100 readings. If the seep data contains more than 100 readings then the data is decimated to fit in the table. The power table is limited to display of 6 traces of data.



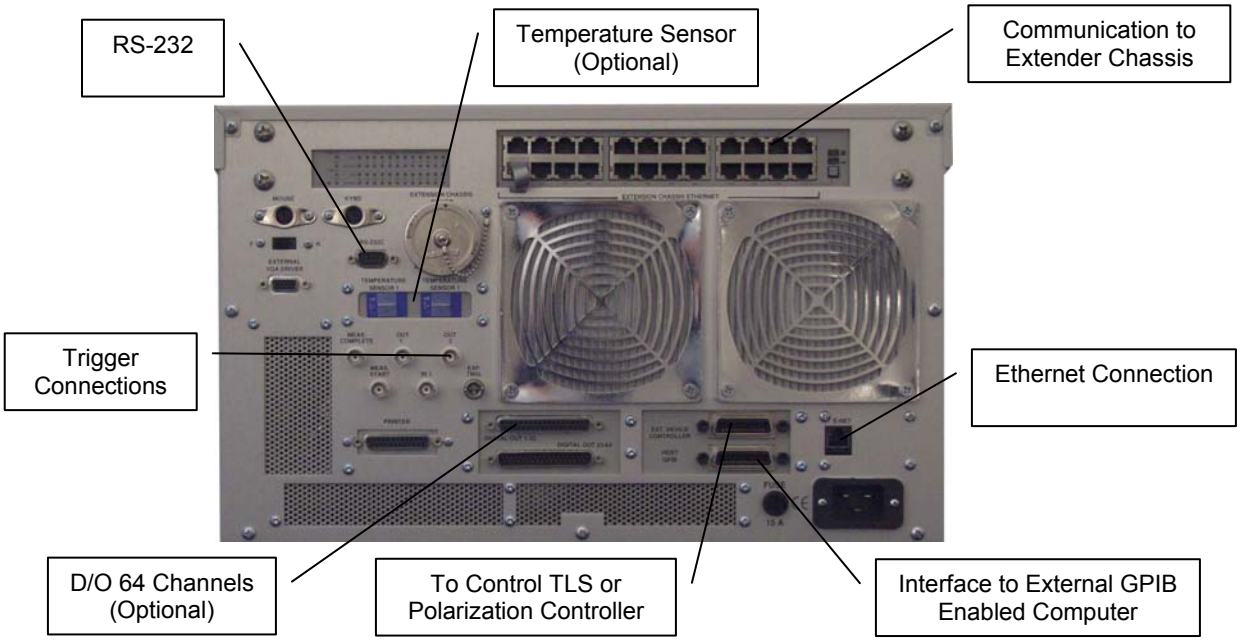
	Ch 1 Out1	Ch 2 Out2
0.000052	-41.379	-76.990
0.001152	-40.737	-76.990
0.002252	-42.351	-76.990
0.003352	-37.423	-76.990
0.004452	-52.076	-76.990
0.005552	-56.990	-76.990
0.006652	-38.170	-76.990
0.007752	-42.692	-76.990
0.008852	-36.220	-76.990
0.009952	-38.582	-76.990
0.011052	-38.074	-76.990
0.012152	-56.990	-76.990
0.013252	-53.565	-76.990
0.014352	-37.181	-76.990
0.015452	-56.990	-76.990
0.016552	-42.874	-76.990
0.017652	-56.990	-76.990
0.018752	-40.334	-76.990
0.019852	-43.279	-76.990
0.020952	-35.322	-76.990
0.022052	-38.921	-76.990
0.023152	-43.645	-76.990
0.024252	-56.990	-76.990
0.025352	-39.311	-76.990
0.026452	-56.990	-76.990
0.027552	-56.990	-76.990

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Rear Panels

The rear panel contains all of the inputs for operation and testing. It may look different that the photographs below based upon the model and options you have purchased. In general, the rear panel contains all of the electrical interfaces for other instruments and auxiliary functions.

Model 2004 – Rear Panel



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Connecting and Turning on the CSA

1) Locate the AC power cord and plug it into the rear panel of the CSA.

2) Plug the other end of the cord into a grounded outlet: 120 Volt (US); 220-240 Volt (European); or 100 Volt (Japan).

> **NOTE:**
>
> This is a sensitive electronic instrument, therefore utilizing a surge protector or UPS in conjunction with this device is recommended.

3) Flip on the power switch located near the lower right corner of the front panel of the CSA.

> **NOTE:**
>
> The startup sequence takes approximately 30 seconds.

4) Plug in and power up the TLS (or other fixed wavelength source).

> **NOTE:**
>
> The startup sequence for a TLS can take from one to several minutes.

5) Connect the supplied BNC cable into the TLS **TRIGGER OUTPUT**.

6) Connect the other side of the BNC cable to the CSA **MEAS. START** BNC port on the rear panel.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Connecting and Turning on the Extender Chassis

1) Power off the CSA and the extender chassis (2112, 2124 and 2160).

2) Plug in an Ethernet cable (communication cable) into the hub labeled LAN – EXTENSION CHASSIS ETHERNET at the rear of the CSA 2004. (Any slot except #24.)

3) Plug the other end of the communication cable into the Ethernet port labeled **MAINFRAME** on the rear panel of the extender chassis.

4) Set the thumbwheel switch on the back of the extender chassis to 01.

5) If more than one expansion chassis is present, ensure the thumbwheel settings are unique.

6) Connect the trigger cable to the rear panel of the extender chassis labeled EXPANSION TRIGGER IN.

7) Plug the other end of the trigger cable to the rear panel of the CSA labeled **EXP. TRIG**.

8) Turn on the power to the CSA 2004, wait for the CSA GUI software to start, then turn on the Expansion Chassis. It will take 1-2 minutes for the channels in the Expansion Chassis to be recognized.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Making Measurements

The CSA operates in three basic modes and makes three basic measurements, resulting in tremendous flexibility and functionality. In addition to basic Insertion Loss measurements, the CSA is capable of making polarization dependent loss (PDL) and optical return loss (ORL) measurements. Each measurement can be made in each of the three modes of the CSA: time, continuous sweep and step sweep. Each mode has a slightly different application that may be tailored to a particular device or a particular measurement. Application-specific software can perform advanced parameter analysis within each mode.

Insertion loss is the fundamental measurement upon which most other optical measurements are based and is inherently a relative measurement (relative to the input power). There are several ways to make relative measurements and many of them are supported in the CSA. The most useful of the referencing modes in the real-time reference. This setup uses one channel to make a reference measurement and all other measurements are referenced against that channel. The advantage to this measurement is that it adjusts for changes to the input optical power whereas other measurement techniques do not. This method does require an internal splitter so the input power can be monitored. If a perfect splitter existed, subtracting the reference power from the actual power through the device or DUT would result in Insertion Loss. But because there are no perfect splitters, some understanding of splitters is important. Splitter performance is discussed in the Real-Time Referencing section of this manual.

Because it is possible to enter values and request scans that produce impractical or misleading data, it is important to have some understanding of the calculations behind the outputs and the purpose for each measurement. Please refer to the Operational Modes section for more detail.

NOTE: Triggering

The CSA can adapt to almost any triggering scheme. Data collection efficiency, and reduction of measurement error, is limited mostly by the capabilities of the TLS. Therefore, begin selecting which measurement setup to use by first evaluating the triggering scheme of the laser. If given a choice between having the TLS initiate the sequence or the CSA, it is recommended that the TLS provide the initial triggering signal.

If you are having any trouble with your TLS, please contact us. We have experience with virtually all TLS models and can often speed your time to measurements.

NOTE: Measurement Units

For the purposes of this manual it is assumed that all measurements will be made as a function of wavelength and logarithmic power (dBm) and that all corresponding parameters will have similar units.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

NOTE: Multiple Device Triggering

Single TLS-sourced measurement scenarios have been referred to thus far. Using a TLS is a very typical scenario, but multiple TLS's and other devices can be used (including fixed wavelength sources, polarization controllers, polarization scramblers or switches). Setting up triggering for other devices is similar to setting up triggering for a TLS.

Measurement Worksheet

The Appendix contains a Measurement Worksheet that provides a summary of the basic information required before beginning a step sweep or continuous sweep measurement. It may be useful to print out the worksheet and collect all of the necessary data before beginning to set up. The Operational Modes section of the manual contains information to assist in assigning the values for parameters.

Insertion Loss vs. Wavelength

There are two modes that will perform Insertion Loss over wavelength measurements: the sweep continuous and the sweep step modes. These modes are designed to be used with the two different types of Tunable Laser Sources (TLS's), allowing users to customize the test system to meet their particular requirements. Many TLS's offer unique capabilities that may be useful in a particular test, and to save cost many organizations have existing TLS's that can be made more useful with new measurement equipment.

To make a measurement of Insertion Loss versus wavelength, the CSA must coordinate the measurement with the TLS. This is accomplished by configuring the CSA and the TLS to the same parameters. To do this, press the **SWEEP** button, select **CONTINUOUS** or **STEP**, and then input the various parameters to configure the CSA. The parameters for the two wavelength sweeping modes are slightly different and are specific to the TLS's that will be used to make these measurements. In both cases the CSA should be set to reference to the splitter cal.

Continuous Sweep Example

During this measurement mode the TLS will be configured to sweep over a specific range (in wavelength or frequency) at a predetermined sweep speed. Because the TLS is moving gradually throughout that range and not settling on different values, the instruments need only communicate regarding when to begin measuring.

NOTE: Continuous Sweep Measurement Example

A one-channel sweep over a typical C-band component will be configured for the following examples. The TLS is initiating the sweep and has a rising edge trigger. There should be a cable running from the TLS's output trigger to the CSA trigger port labeled **MEAS START**.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Remote Commands for Continuous Sweep

```
:CONFig:TLS <MinWavelen> <MaxWavelen> <STARt | IN1 | NONE> <RISE |
FALL> <TlsTrigOutTimeToAction> <TRIGatstart  | NOTTrigatstart >
<MEAScomp | OUT1 | OUT2 | NONE > <RISE | FALL>
<TlsTrigInTimeToAction> <LINWavelen | LINFreq>

:CONFig:SWEEp:CONTinuous <ChanList> <StartWavelen> <StopWavelen>
<SweepRate> <ReadingSpacing> <USETrig | IMMEdiate> <MAXAverage |
NumAverage>  [<"FileSpec">]


:SWEEP:CONT?
```

or

```
:CONFig:TLS
:CONFig:SWEEp:CONTinuous
:INITialize       (to start the sweep)
*OPC?             (to poll when the sweep is done)
:FETCh?           (to get the data)
```

NOTE: TLS Configuration

For this particular measurement setup, it is essential to physically configure the TLS to trigger on the same wavelength at which the sweep begins. It is also necessary to verify that the TLS sweep parameters are identical to those of the CSA. Those critical parameters include **START λ**, **STOP λ**, **TRIGGER** and **SWEEP RATE**. Refer to the appropriate TLS manual for specific configuration instructions. If the TLS is connected via GPIB control to the CSA, then the TLS setup is completely automatic.

Example

```
:CONF:TLS 1510 1590 START RISE 0 TRIG NONE RISE 0 LINW

:CONF:SWEE:CONT 1 1549 1559 5 0.5 USET 10

:SWEEP:CONT?
```

Basic Front Panel Procedures for Continuous Sweep Measurements

1) Press the **SWEEP** button on the front panel of the CSA

2) Press the **SWEEP MODE** softkey until **CONTINUOUS** is selected.

3) Enter 1549 for the **START WAVELENGTH** and 1559 for the **STOP WAVELENGTH** by pressing the softkey buttons and entering in the numbers using the keypad on the front panel.

4) Enter 5 for **SWEEP RATE**, 0.5 for **READING SPACING**.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5) Press the **MORE…** softkey and toggle the **SAMPLES TO AVERAGE** softkey to select **USER SPECIFIED**. Press the **REPEAT SWEEP** softkey and select **NO**. Press the **BACK…** softkey.

6) Enter 10 for **SAMPLES TO AVERAGE PER READING**.

7) Toggle the **START** softkey until **TRIGGER** is selected.

8) Press the **MORE…** softkey. Press **TLS SETUP…** softkey. Press the **TLS/EXTERNAL DEVICE TRIGGER OUT SETUP…** softkey. This will bring up the softkey panel for the output connections for the laser.

9) Press **TLSA SETUP . . .** and then press **TRIGGER SETUP** and verify that the **TLS A→CSA TRIGGER** softkey is set to **MEAS START**. Check the CSA's rear-panel connections to verify they are consistent.

10) Press the **FIRST TRIGGER** softkey until **TLS A** is selected.

11) Toggle **TLS A→CSA TRIGGER** softkey to select a **RISING EDGE** trigger.

12) Enter the values for **MIN WAVELENGTH** and **MAX WAVELENGTH** by pressing the softkeys using the keypad to enter the values. If values are unavailable, then they may be left at their default settings of 800 and 1700.

13) Press the **START/STOP** button on the front panel to initiate the sweep.

14) Verify the measurement parameters in the TLS correspond to the values and configurations listed above. The CSA is waiting to begin measuring until the moment it receives a trigger from the TLS; it is initiated automatically when the TLS begins its sweep. When ready, press **START SWEEP** on the TLS.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Step Sweep Example

In this mode the TLS steps systematically and periodically to a longer wavelength throughout the specified range. The CSA keeps track of where the TLS is by synchronizing to the step trigger function of the TLS. Because the TLS is moving sequentially throughout the set wavelength span, the instruments need to communicate regarding when to begin the first and then subsequent step measurements.

NOTE: Step Sweep Example

A one-channel sweep over a typical C-band component will be configured for the following examples. The TLS is initiating the sweep and has a rising edge trigger. There should be a cable running from the **TLS OUTPUT TRIGGER** to the CSA port labeled **MEAS START**.

Remote Commands for Step Sweep Measurements

:CONFig:TLS <MinWavelen> <MaxWavelen> <STARTmeas | IN1 | NONE> <RISE | FALL> <TlsTrigOutTimeToAction> <TRIGatstart | NOTTrigatstart > <MEAScomp | OUT1 | OUT2 | NONE > <RISE | FALL> <TlsTrigInTimeToAction> <LINWavelen | LINFreq>

:CONFig:SWEEp:STEP <ChanList> <StartWavelen> <StopWavelen> <StepSize> <USETrig | USEDelay> <NumAverage> [<"FileSpec">]

:SWEEP:STEP?

or

```
:CONFig:TLS
:CONFig:SWEEp:STEP
:INITialize              (to start the sweep)
*OPC?                    (to poll when the sweep is done)
:FETCh?                  (to get the data)
```

NOTE: Step Sweep Trigger

For this particular measurement setup, it is essential to physically configure the TLS to trigger on the same wavelength at which the sweep begins. It is also necessary to verify that the TLS sweep parameters are identical to those of the CSA. Those critical parameters include **START λ**, **END λ**, **TRIGGER** and **STEP INTERVAL**. Refer to your TLS manual for specific configuration instructions.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Example

```
:CONF:TLS 1510 1590 START RISE 0 NOTR NONE RISE 0 LINW

:CONF:SWEE:STEP 1 1549 1559 0.5 USET 1000

:SWEEP:STEP?
```


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Basic Front Panel Procedures for Step Sweep Measurements

1) Press the **SWEEP** button on the front panel of the CSA.

2) Press the **SWEEP MODE** softkey until **STEP** is selected.
Enter 1549 for **START WAVELENGTH** and 1559 for **STOP WAVELENGTH** by pressing the softkeys and entering the numbers using the keypad on the front panel.

3) Enter 0.5 for **WAVELENGTH STEP SIZE** (in nm).

4) Enter 0.1 for **STEP DWELL TIME**.

5) Toggle the **START** softkey until **TRIGGER** mode is specified.

6) Press the **MORE…** softkey. Press the **SAMPLES TO AVERAGE** softkey and select **USER SPECIFIED**. Select **NO** for repeat sweep. Press the **BACK…** softkey.

7) Enter 1000 for **SAMPLES TO AVERAGE PER STEP.**

8) Press the **MORE…** softkey. Press **TUNABLE LASER SETUP…** softkey.

9) Press the **TLS / EXTERNAL DEVICE TRIGGER OUT SETUP…** softkey to bring up the softkey panel regarding the output connections for the laser.

10) Make sure **TLS TRIG OUT TO CSA START** is selected. Double-check the connections in the rear panel of the CSA to verify they are consistent with the choices here.

11) Toggle the **TLS TRIGGERS FIRST** softkey until **YES** is selected.

12) Toggle the **TLS TRIG OUT EDGE** softkey until **RISING EDGE** is selected.

13) Press **BACK …** when done. Because this is a partial handshake scenario, the parameters regarding **TLS/EXTERNAL DEVICE TRIGGER** in setup may be ignored. There are no CSA to laser connections for this situation.

14) Enter the values for **TLS SPEC MINIMUM AND MAXIMUM** wavelengths by pressing the softkeys next to the options and using the keypad to enter the values. If the values are not defined, then they may be left at their default settings of 800 and 1700.

15) Press the **START/STOP** button on the front panel to initiate the sweep.

16) Verify that the wavelength in the TLS corresponds to the values listed above. The CSA to begins measuring immediately. When ready, press **START SWEEP** on the TLS.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

This page intentionally left blank.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Time Sweep Measurements

Insertion Loss vs. Time

The time mode of operation is the easiest mode to set up and is useful for measuring many optical components as well as doing basic troubleshooting of optical setups. No coordination between external devices is required to configure the time mode of measurement, which can be very useful in determining system measurement issues. The CSA is set in this mode by default and by pressing the **START/STOP** button. Pressing the **SWEEP** button enables the sweep parameters to be adjusted. The time mode is very useful for troubleshooting because it does not require the use of a reference signal and is the most simple of the optical setups to configure. If referencing is used, the splitter cal mode can be used with no difference in the optical setup and a small difference in the CSA setup.

During this measurement mode the light source remains stable at one designated wavelength over a specified period of time. The CSA needs to be set up to reflect the number of readings taken and whether or not a specified reading interval is chosen for the given time span.

Remote Commands for Time Sweep Measurements

CONFig:MEASure <ChanList> <Wavelen> <NumReadings> <IMMEdiate | EXTTrig> <CONTinuous |<ReadingInterval>> | <MAXAverage | NumAverage> [<"FileSpec">]

:MEAS?

or

:CONFig:MEASure	
:INITialize	**(to start the sweep)**
***OPC?**	**(to poll when the sweep is done)**
:FETCh?	**(to get the data)**

Example

```
:CONF:MEAS 1 1550 1000 EXTT 128

:MEAS?
```


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Basic Front Panel Procedures for Time Sweep Measurements

1) Press the **SWEEP** button on the front panel of the CSA. The Sweep Softkey Panel will appear at the right side of the display.

2) Press the **SWEEP MODE** softkey until **TIME** is selected.

3) Enter 1550 for the **WAVELENGTH** value. (It is important to enter the correct wavelength so that measurement module responsivity may be properly applied.)

4) Enter in 1000 for **NUMBER OF READINGS.**

5) Select **CONTINUOUS** for **TIMING.**

6) Enter 10 for the **SAMPLES TO AVERAGE PER READING**.

7) Use the **START** softkey to select **IMMEDIATE** as the trigger mode.

8) Press the **MORE…**

9) Choose **USER SPECIFIED** under **SAMPLES TO AVERAGE** and **YES** or **NO** under **REPEATED SWEEP.**

10) Press the **START/STOP** button to initiate measurement.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PDL Measurements

PDL measurements add another dimension to the previously described measurements. Polarization, in general, can cause significant error in Insertion Loss measurements. PDL measurements can be made using two different methodologies: the first method is commonly called Matrix and the second method is referred to as the All States (or Min/Max method).

Matrix Method

The Matrix method takes advantage of a special case of the Jones matrix to determine Insertion Loss and Polarization Loss over wavelength. This method requires four known and orthogonal polarization states to be compared using Matrix math at each wavelength point to determine the Insertion Loss and PDL. This measurement can result in a fast PDL measurement over a wide wavelength range. This is achieved by using the CSA, a TLS and a Polarization State Controller. The CSA is capable of automating this measurement by communicating with the TLS and the Polarization State Controller to change polarization state while measuring wavelength sweeps of the TLS. Measuring PDL using this method requires slightly more than the time it takes to make four Insertion Loss sweeps, but this amount of time can be much shorter than using other methods of determining PDL.

Measurement challenges with this type of measurement arise in several areas. First, the Polarization State Controller usually uses a polarizer and partial wave plates to adjust the polarization state. TLS's typically have a characteristic polarization "wobble." This wobble is another cause of PDL error. There is also PDL in the optical path. The CSA has the capability to compensate or mitigate for the measurement error. All this can be accomplished using either 4- or 6-State Matrix measurements. These instruments typically have fairly large Insertion Loss changes with polarization state. Noise and wavelength coordination can also be causes of measurement error for PDL using this method.

All States Method

The All States method requires constant Insertion Loss measurement while the Poincare sphere is swept. Recording the minimum and the maximum Insertion Loss (or optical power of the sweep) will yield the PDL of the device. This is a very simple and direct way to make a measurement. The challenge with this method is to make sure that good coverage over the Poincare sphere is achieved. This is typically achieved by using a paddle-type polarization sweeper and sweeping over a long period of time. This type of instrument usually has good performance over a wide range of wavelength and has little change in Insertion Loss with polarization state, but a single measurement can take 10 seconds. To measure over wavelength can cause this method to become exceedingly long if a high-resolution scan is desired.

N States Method

The N States method is similar to the All States method except that multiple polarization states are created through the use of a polarization state controller. The user specifies

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

the number of states, N, over which to sweep. N sweeps are taken and the CSA keeps track of the maximum and minimum insertion loss as a function of time or wavelength. When the N sweeps are completed, the CSA computes insertion loss as the mean of the max and min data. PDL is computed as the difference between the max and min data. The greater the number of states N the more accurate the final result is likely to be due to better coverage over the Poincare Sphere.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Front Panel Operations (Overview)

The following section details the various parts and operational procedures of the front panel of the dBm CSA. This section describes the various menu selections and their designated keys are detailed and their functions are outlined. See Operations from a PC for information on how to operate the CSA remotely.

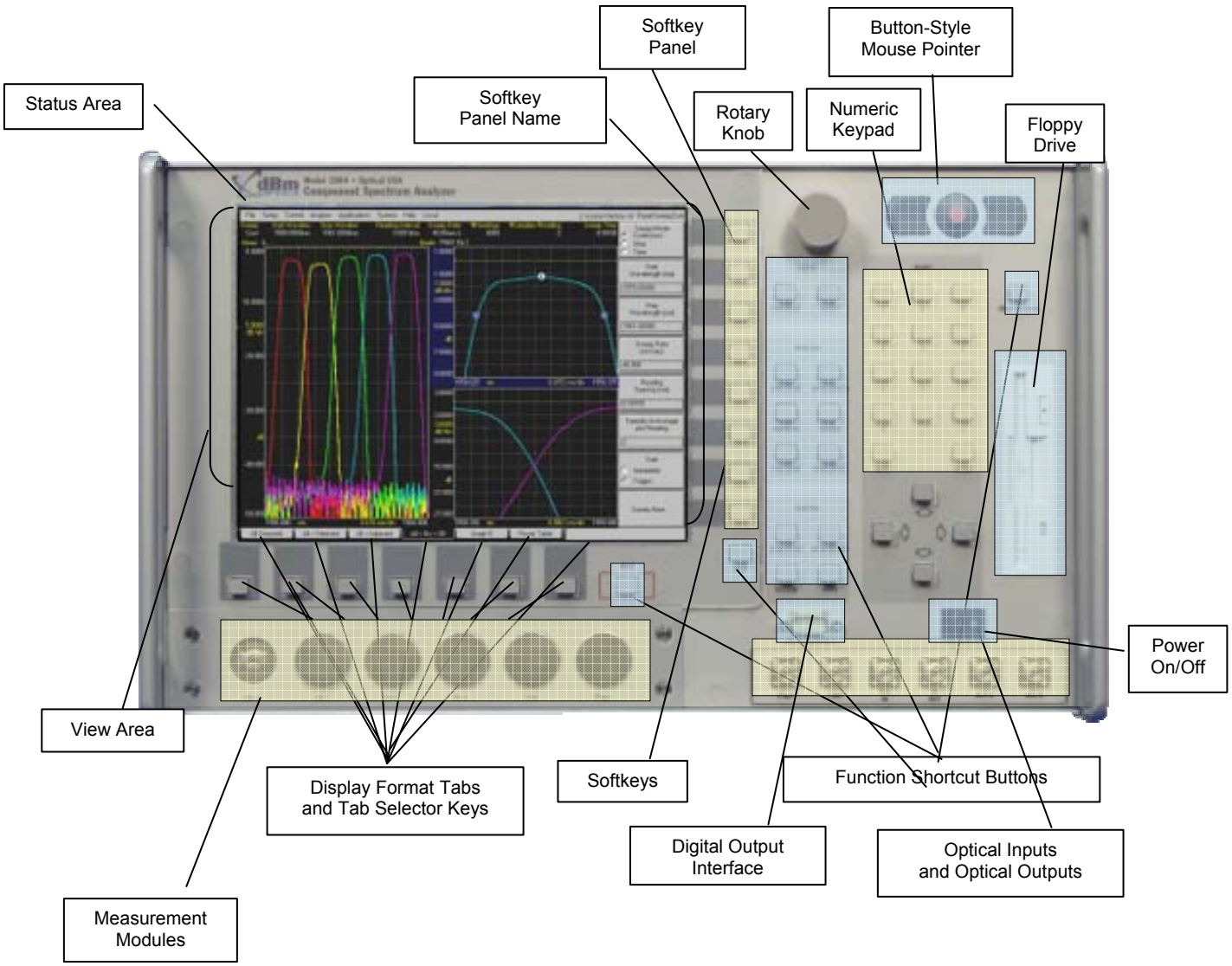
This section includes:

Front Panel Overview
- Keypad
- Softkey Panel Display
  - Softkey Panel Types
  - Softkeys
  - Softkey Panel Name
- Display Format Tabs
- Display Format Tab Selector Keys
- Function Shortcut Buttons
- Rotary Knob
- Button-Style Pointer/Mouse
- View Area
- Status Area

File Button Functions
- Extensions and Types of Files Utilized in the CSA
- Saving Files
- Copying Files
- Deleting Files
- Renaming Files
- Changing the CSV File Format
  - Print/Save Function
  - Print/Save Shortcut Button
  - Print/Save Softkey Panel

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Front Panel Overview



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Digital Output Interface	8-bit output interface when option is purchased.
Display Format Tabs	The tabs located along the bottom of the view area. The tab which is highlighted (darker in color) than the rest indicates the current display format selected.
Display Format Tab Selector Keys	The grey softkey buttons along the bottom of the view area corresponding to the display format tabs.
Floppy Drive	Standard 1.44 MB 3.5 inch floppy drive.
Function Shortcut Buttons	Sixteen buttons on the front panel that act as dedicated shortcut keys.
Keypad	Twelve buttons which support numeric entry.
Measurement Modules	The CSA can be configured with a variety of measurement modules from measuring optical power, current, voltage and wavelength.
Menu	The menu bar at the top of the display.
Optical Inputs and Outputs	Optical inputs and outputs for measurements.
Panel Name	The text in the upper right corner of the display
Power On/Off	Power button for the CSA.
Softkey Panel Display	The descriptive functions and choices along the right side of the view area.
Softkeys	The grey keys located to the right of the softkey panel display. They enable you to make choices from the softkey panels.
Status Area	The status display above the view area.
View Area	The graphical data display section.

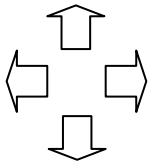
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Keypad

The keypad support numeric entry with an individual button for each character zero through nine; a button for the "**.**" symbol and a button for the "**+/-**" symbol.

Press the softkey to the right of a numeric field to select it for editing. When a numeric field is selected for editing, the background on which the number is displayed will change to white. The cursor is initially appear under the least significant digit.

The cursor can be moved from right to left with the horizontal arrow keys (located on the CSA's front panel). Use the vertical arrow keys to incrementally raise or lower the digit to the immediate left of the cursor. (See drawing to the right.)



The **BKSP** (backspace) button will erase the last character entered. The **ENTER** button submits the keyed-in data (or executes the chosen function). The **+/-** button will toggle the number in the display between positive and negative.

Four arrow buttons on the keypad provide an alternate method of moving the pointer on the display. The left and right arrow buttons auto repeat and move the cursor.

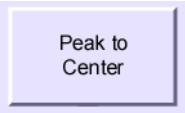
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Softkey Panel Display

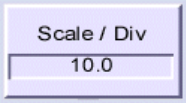
There are eight softkey descriptors along the right edge of the display.

Some softkey choices will be disabled. When a softkey is disabled, it will be grayed out and inactive. Pressing the softkey will do nothing. Softkeys are disabled when a required option is not installed or when the prerequisites for the softkey action are not satisfied.

\Softkey Panel Types



Type: Label
An action takes place when key is pressed.



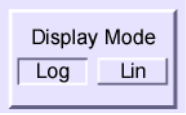
Type: Numeric Edit

Press the key; enter the number; press the **ENTER** button when done.



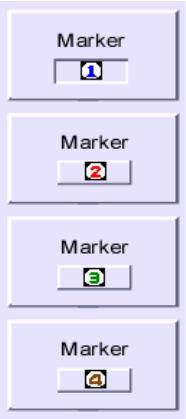
Type: Next

Opens another softkey panel or a dialog box.



Type: Toggle Button

Press softkey to cycle through the mutually exclusive options. The name in the depressed button gives the active state.



Type: Radio Button Group

These four softkeys work together as a radio button group. Press a key to select the one of the mutually exclusive options. In this example Marker 1 is the active state as shown by its depressed button.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Softkeys

The grey keys just right of the softkey panel display are called softkeys. These softkeys correspond with the items that appear in the softkey descriptor panel along the right edge of the display window. The function of each key varies as the softkey panels change.

The mouse or a keyboard (F1 to F8 keys) may also be used to make selections from the softkey panel choices. See the external PC-style keyboard section for more details.

Softkey Panel Name

The softkey panel name displays the name of the sofkey panel which is currently being displayed. This allows for easier troubleshooting and process verification. Each panel name is unique.

Display Format Tabs

The display format tabs offer different viewing options for the data. There are six choices: **1 GRAPH**; **2 GRAPHS**; **3 GRAPHS**; **ALL + SELECTED**; **ALL + ADJACENT**; and **POWER TABLE**. A view may contain one or more graphs and/or tables. (Refer to the traces/graphs section for more information regarding the options for viewing data.)

Select a view by using the display format tab selector keys, the mouse, or the keyboard Shift-F1 to Shift-F7 keys.

Display Format Tab Selector Keys

The grey softkey buttons along the bottom of the view area which correspond to the display format tabs.

Function Shortcut Buttons

Sixteen buttons on the font panel act as dedicated shortcut buttons. These buttons allow easy access to the most frequently utilized functions of the CSA. These keys are **CHANNELS; SWEEP; AMPLITUDE; λ OR TIME; MARKERS; TRACES; PAN/ZOOM; PROPERTIES; START/STOP; HOLD/RESUME; SYSTEM; APPS; FILE; PRINT/SAVE; AUTO MEASURE;** and **HELP.** Pressing these buttons brings up a softkey panel or performs an action.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Rotary Knob

The use of the rotary knob is context sensitive.

During numeric entry, moving the knob changes the number. Turn the knob slowly to increment the least significant digit above the cursor by one or to propagate carries and borrows. Turn it faster to increment by larger amounts.

When there is an active marker, the knob moves the marker left and right.

Button-Style Pointer/Mouse

This is a panel-mounted version of a button-pointer similar to those used on some notebook computers. It has left and right push buttons and functions in the same way as a two-button mouse. Except for numeric entry, it can be utilized to run the entire user interface.

> **NOTE: Operating the CSA's Mouse**
>
> Resting your hand on the top right corner of the CSA while operating the mouse with your thumb provides stability and makes the mouse easier to utilize.

View Area

The central part of the display is called the view area and will give a graphical or tabular representation of the spectral or time-based data outputs. The view area allows for manual analysis of data sets and can be configured to display subsets of the relevant data. The ability to choose which data is displayed allows for ease in analysis and aids in providing information with regards to component performance or failure analysis.

Status Area

The status area shows pertinent information and changes depending on which options and panel are operating. For example, the status area may show sweep setup parameters in one instance or marker values in another.

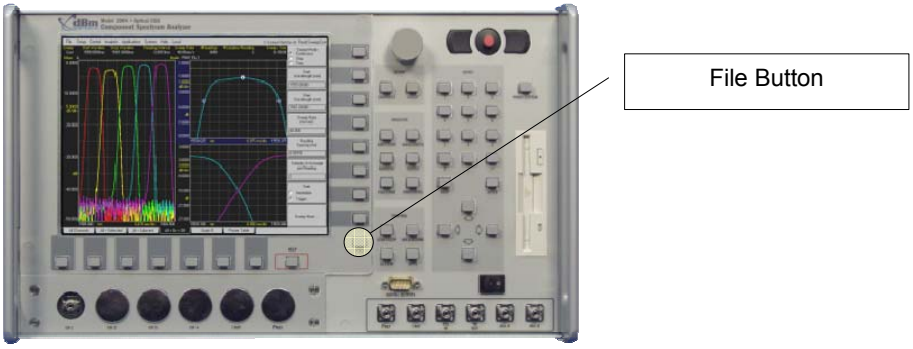
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

(This page intentionally left blank.)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

File Button Functions

The functions presented under the **FILE** button allow previously stored information to be opened and files to be saved to a specific location in a particular format. Files can be managed and data can be printed in a variety of formats. To access file functions, press the **FILE** shortcut button on the front of the CSA. Once the softkey panel appears, use the corresponding softkeys to make your selections.



This section includes:

Extensions and Types of Files Utilized in the CSA

Saving Files

Copying Files

Deleting Files

Renaming Files

Changing the CSV File Format
- Print/Save Function
- Print/Save Shortcut Button
- Print/Save Softkey Panel
- Print/Save Softkey Panel

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

This page intentionally left blank.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Extensions and Types of Files Utilized in the CSA

.bds	Binary Data Sets: Data set in binary format typically having smaller file size and faster transfer rates.
.csv	Comma Separated Variable: Data sets in ASCII characters directly importable to Excel.
.sst	System State: Setup files for all configured CSA parameters, such as sweep setups, channel configurations and amplitude and wavelength plot information.
.bmp	Bit Map: Saves data as a Windows image file.
.spc	Splitter calibration data file
.rep	Report data file

Saving Files

1) Press the file button on the front panel of the CSA.

2) Press the **SAVE DATA …** softkey. A file list and a keyboard dialog box will appear on the display.

3) Press the drive softkey to select the file location--either hard (inside of the CSA) or floppy (on the CSA front panel). The maximum file size for a floppy drive is 1400 KB. (NOTE: When toggling from floppy to hard expect a 7-second delay.)

4) Toggle the file type softkey to select either *.csv or *.bds.

5) If files have previously been saved, a file list of the type selected will be displayed. The file can be saved using a new name by typing in an existing filename or by clicking on a name from the file list. Use the pointer buttons to click on the desired file or use the Keypad to enter the file name.

6) Press the save data as softkey once the filename has been selected or typed. (If you select a previously stored file you will be asked to confirm the operation.) The file will be saved with the file extension selected.

7) Press **BACK** … when finished.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Copying Files

1) Press the file button on the front panel of the CSA.

2) Press the manage files … softkey button.

3) Press the copy … softkey. (A file list and a keyboard dialog box will appear on the display.

4) Press the drive softkey button to select the location in which the file to be copied is located--either hard (inside the CSA) or floppy (on the CSA front panel). The maximum file size for a floppy drive is 1400 KB. (NOTE: When toggling from floppy to hard expect a 7-second delay.)

5) Toggle the file type softkey to select the appropriate file type. (NOTE: [*.*] will return a list of all file types.)

6) By using the pointer buttons or the built-in mouse, select either a file from the list on the display or use the keypad to enter the file name. Then press the ok, copy file(s) to other drive softkey.

7) Press **BACK …** when finished.

NOTE:

When the file to be copied is located on the hard drive, selecting the **COPY** function copies the file to the floppy drive. Conversely, when the file to be copied is located on the floppy drive, selecting the **COPY** function copies the file to the hard drive.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Deleting Files

1) Press the file button on the front panel of the CSA.

2) Press the manage files … softkey.

3) Press the delete … softkey. A file list and a keyboard dialog box will appear on the display.

4) Press the drive softkey button to select the location of the file—either hard (inside of the CSA) or floppy (on the CSA front panel). The maximum file size for a floppy drive is 1400 KB. (NOTE: When toggling from floppy to hard expect a 7-second delay.)

5) Toggle the file type softkey to select the appropriate file type. (NOTE: [*.*] will return a list of all file types.)

6) Using the mouse, select either a file (or multiple files) from the list on the display or use the keypad to enter the file name. Then press the ok, delete file(s) softkey.

7) Press back … when finished.

Renaming Files

1) Press the file button on the front panel of the CSA.

2) Press the manage files … softkey.

3) Press the rename … softkey. A file list and a keyboard dialog box will appear on the display.

4) Press the drive softkey button to select the location of the file—either hard (inside of the CSA) or floppy (within another system).

5) Toggle the file type softkey to select the appropriate file type. (NOTE: [*.*] will return a list of all file types.)

6) By using the pointer buttons or the built-in mouse, select either a file from the list on the display or use the keypad to enter the file name. Then press the ok, rename file(s) softkey.

7) Press back … when finished.

Changing the CSV File Format

1) The CSV Header includes information on the status of the system such as firmware version, test parameters, CSA configuration and channel configuration.

2) Press the file button.

3) Press the save data … softkey.

4) Toggle the csv header softkey to choose between the on and off options.

5) When finished, press the back … softkey.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Print/Save Function

The Print/Save Function allows configuration of the printer and print functions. This is especially useful when developing procedures or recording results of a measurement. Two things can be accomplished under the Print/Save Function: 1) print to either the hard or floppy drive (bitmap) or 2) printing to a printer. There are two ways to initiate the print/save function: 1) by pressing the **PRINT/SAVE** shortcut button and 2) by using the print/save softkey panel.

Print/Save Shortcut Button

The print/save shortcut button is located in the upper right-hand corner of the CSA front panel. It is an action button (an action will be performed when the button is pressed). The print/save button will perform the appropriate action based upon the choices you have made in the print/save softkey panel.

Print/Save Softkey Panel

To bring up the various print and save options:

1) Press the **FILE** shortcut key on the front panel of the CSA.

2) Press the **PRINT/SAVE SCREEN SETUP…** softkey. The softkey panel will display as shown below.

Print Display	**PRINT DISPLAY** will print to a printer or drive, depending on which option is selected under the **PRINT TO** softkey (below).
Print Chart Only Entire Display SoftKey Panel	This softkey allows you to select the area to be printed/saved. You can print **CHART ONLY**, **ENTIRE DISPLAY** or the **SOFTKEY PANEL**.
Print To: Printer File	Selecting **PRINTER** will print the display on a printer (if one is connected) and **FILE** will save to either the hard or floppy drive, depending on your selection below.
Print Color As Shown Inverted	
File Resolution Low (LCD) High (Printer)	
Print File to Drive Hard Floppy	**PRINT FILE TO DRIVE** selects the location to which to save, either the **HARD** drive (CSA internal) or the **FLOPPY** drive (one the front panel of the CSA).
Back ...	**BACK…** will return you to the previous sofkey panel.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Channels Button Functions

The **CHANNELS** button gives access to one of the CSA's two primary measurement configuration areas. The **CHANNELS** button function defines which data is measured and how to measure it. Measurement ranges, channels, units, and zeroing are some of the parameters that are configured under **CHANNELS** functions. This section will describe most frequently used features under **CHANNELS** button functions.



This section includes:

Hiding or Showing Traces

Setting the Measurement Range: Fast/Medium/Slow/Fixed/Stitching

Setting Active Channels in the Channel Table

Dark Current Calibration

Selecting Measurement Power Units

Setting the Channel Analog Filter

Wavelength Correction Enabled

Adding Traces

Splitter Calibration

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

(This page intentionally left blank.)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Frequently Used Features (Channels Button Functions)

Hiding or Showing Traces

1) Press the **CHANNELS** button.

2) Press **EDIT CHANNELS …** softkey. The Channels Softkey Panel will appear along the right side of the display and the Active Channel Setup will appear in the middle of the display.

3) Press **BACK …** when finished.

Setting the Measurement Range: Fast/Medium/Slow/Fixed/Stitching

In general, the dynamic range for the current measurement or sweep should be maximized. Ideally, the maximum optical power during the measurement or sweep should be within a few dB of the maximum of the range.

1) Press the **CHANNELS** button

2) Press **EDIT CHANNELS …**

3) To set the range, use the built-in mouse or the **SELECT NEXT TRACE** softkey and highlight the desired channel(s) in the Active Channel Setup table.

> **NOTE:**
>
> When more than one channel is highlighted and a range is chosen, the range will be assigned to all of the highlighted channels and enhance readability of the display.

4) Press the **MANUAL-SET SELECTED CHANNELS MEASUREMENT RANGE …** softkey to bring up the first channels range softkey panel.

> **NOTE:**
>
> The most desirable range setting depends upon the type of measurement being taken and upon the application being evaluated. Fixed ranges are used mostly for troubleshooting purposes.

5) Press the **CHANNELS** button to return to the main channels softkey panel or select the next function from the front panel.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setting Active Channels in the Channel Table

1) Press the **CHANNELS** button.

2) Press the **EDIT CHANNELS …** softkey. The channels softkey panel will appear along the right side of the display and the Active Channel Setup will appear in the middle of the display.

3) Using a mouse, highlight the desired channel(s).

4) Press the **UPDATE** softkey to turn the update status on or off. (**UPDATE** enables or disables channel data update on the next sweep.)

5) Press the **VIEW** softkey to turn the view status on or off. (**VIEW** enables or disables whether or not the channel data will be viewed on the next sweep.)

> **NOTE:**
>
> Activated channels measure power and send this data to the front panel. It is recommended that unused channels be turned off (no view, no update) to improve overall system performance.

Dark Current Calibration

This function is available only when the OMU-310 Automatic Dark Current Option is installed. If there are any unconnected measurement channels, place caps over the inputs. If the –310 option is not installed, turn off the laser source prior to pressing the button.

1) Press the **CHANNELS** button.

2) Press the **DO DARK CURRENT ZERO** softkey.

3) A tab will appear at the bottom right of the screen which will display the progress of the calibration. When the calibration is finished, the tab will read DarkCal Success.

> **NOTE:**
>
> Pressing **DO DARK CURRENT CAL** enables the calibration procedure as long as a sweep is not in progress.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Selecting Measurement Power Units

1) Press the channels button.

2) Press the power mode setup & cal … softkey.

3) Press the absolute units … softkey.

4) Press set absolute power units…

5) Press the softkey button next to the desired units

Setting the Channel Analog Filter

1) Press channels button.

2) Press the filtering … softkey.

3) Toggle the all filters softkey to select on or off.

> **NOTE:**
>
> The analog filter setting applies to all channels.

Wavelength Correction Enabled

When either the 401 or 410 Wavelength Reference Option is installed, the **WAVELENGTH ENABLE** function turns on or off the wavelength reference module.

To enable wavelength referencing:

1) Press the channels button.

2) Press the Wavelength Correction softkey and select Enabled.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Adding Traces

Much of the power of the CSA is the ability to add and manipulate traces. The CSA can be configured to have a number of different traces, including:

MAX/MIN HOLD
PDL
PDCW
PDBW
MATH TRACES
SAVED TRACE
WAVELENGTH ERROR
SWEEP LINEARITY
RATE OF CHANGE
AVERAGE DATA IN ITU BANDPASS
DISPERSION (when the dispersion option is purchased)

Some of these trace types require the appropriate options to be installed, but they are all accessed similarly.

1) Press the **CHANNELS** button.

2) Press the **EDIT CHANNELS…** softkey.

3) Press the **MORE…** softkey.

4) Press the **SELECT NEXT TRACE** softkey to select (highlight in the Active Channel Setup on the display) the desired trace to be analyzed.

5) Once the trace is highlighted, press the softkey which corresponds to the analysis function to be performed. This will add a trace to the trace list (in the Active Channel Setup display). If the desired analysis function is not located on this softkey panel, pressing **MORE…** will display additional options.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Splitter Calibration

Splitter calibration (splitter cal) is an important function for measuring Insertion Loss (IL) with high accuracy. This function can compensate for Split Ratio Variability over wavelength. Splitter cal can be used to normalize the internal splitter within the CSA optical path and it can be used to compensate for external optics. It can be performed on any number of channels. For example, if an optical setup is using a 1x4 splitter with one of the outputs connected to the **PREF**, then the other outputs can be connected to measurement channels and each channel can have a unique splitter calibration. To perform a splitter cal:

1) Set up the desired measurement sweep. (See the section on sweeps for more details.)

2) Press the **CHANNELS** button.

3) Press the **POWER MODE SETUP & CAL…** softkey.

4) Press the **SPLITCALSETUP…** softkey.

5) Press the **CLEARCHANNEL SPLITCAL DATA** softkey. (This step assumes that the user would like to replace the entire SplitCal Data set. There are situations when this is not true.)

6) If more that one SplitCal Data set is stored in the CSA, then Step 4 (above) must be repeated for each channel. Use the **NEXT CHANNEL** softkey to select the next SplitCal Data set.

7) Press **ADD SCAN** to initiate a reference sweep and store the data in the SplitCal Data set for the channel displayed in the **NEXT CHANNEL** softkey.

8) Repeat on additional channels if needed.

NOTE:

When Splitter Cal is used in conjunction with PDL Ref Set, make sure that the Ref Set is performed first (and then perform the Splitter Cal second). Additionally, make sure that all measurement traces and sweep configurations are the same as those that will be used when making actual measurements.

NOTE:

The password to overwrite factory splitcal is 4213.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

This page intentionally left blank.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Sweep Button Functions

Sweep Functions is one of the CSA's two primary measurement configuration areas (the other is Channels Functions). Sweep Functions is the area where you configure sweep parameters. Under Sweep Functions you can select the start and stop parameters for sweeps, select the mode in which to operate, and select numbers of averages.



This section includes:

Sweep Softkey Panels

Setting up a Continuous Sweep

Setting up a Step Sweep

Setting up a Time Sweep Measurement

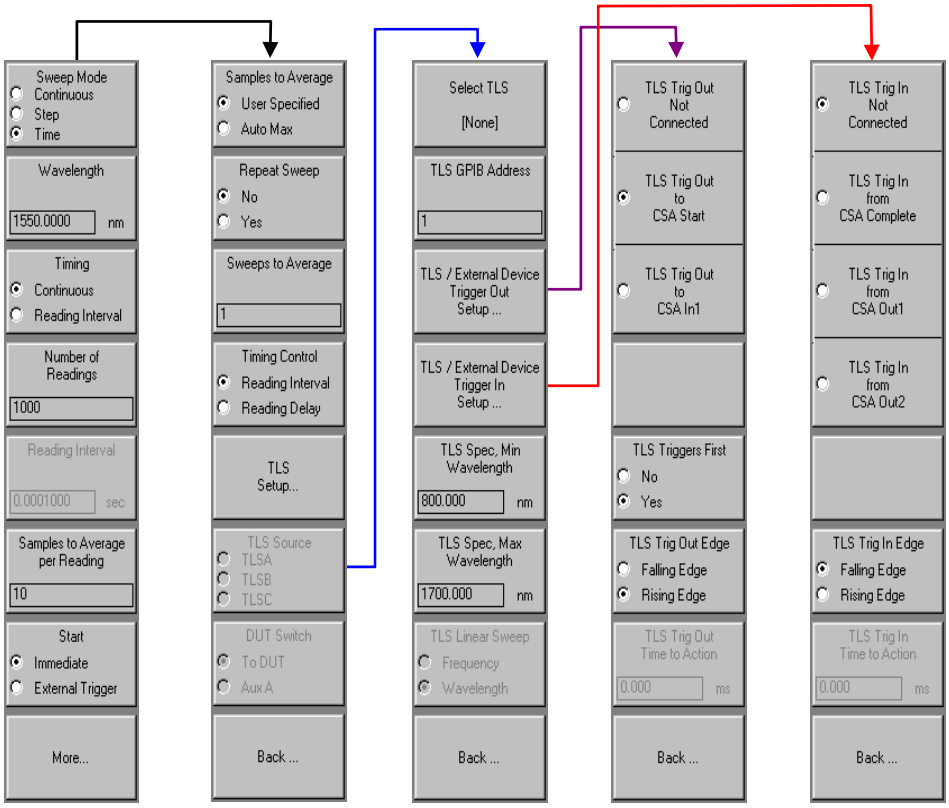
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

This page intentionally left blank.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Sweep Button Softkey Panels

Press the sweep button to bring up the first softkey panel.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

This page intentionally left blank.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setting up a Continuous Sweep

NOTE:

Detailed information about what each of the following parameters refers to and how to choose appropriate values for those parameters can be found in the Considerations and Implications section.

1) Press the **SWEEP** button.

2) Toggle the **SWEEP MODE** softkey until continuous is selected.

3) Enter a value for **START WAVELENGTH**.

4) Enter a value for **STOP WAVELENGTH**.

5) Enter a value for **SWEEP RAT**e.

6) Enter a value for **READING SPACING**.

7) Toggle the **START** softkey to select **IMMEDIATE** or **TRIGGER**. (Selecting **IMMEDIATE** will start the sweep immediately upon pressing the **START/STOP** button. Selecting **TRIGGER** will start the sweep after the **START/STOP** button is pressed and a trigger is received.)

8) Press the **MORE …** softkey.

9) Toggle the **SAMPLES TO AVERAGE** softkey to select **USER SPECIFIED** or **AUTO MAX**. (**AUTO MAX** sets samples to the maximum possible based on the other sweep setup parameters).

10) Toggle the **REPEAT SWEEP** softkey to select **YES** or **NO**. (If **NO** is selected, the CSA will sweep once per press of the **START/STOP** button. If **YES** is selected, the CSA will continue to sweep until the **START/STOP** button is pressed again.)

11) Press the **TUNABLE LASER SETUP …** softkey.

12) Press the **TLS / EXTERNAL DEVICE TRIGGER OUT SETUP…** softkey.

13) Use the softkey buttons to indicate where the TLS triggering output is connected. (Double-check the connections in the rear panel of the CSA.)

14) Use the **TLS TRIGGERS FIRST** softkey to specify whether the TLS or CSA will trigger first. (This only applies to the full handshake mode of operation.)

15) Use the **TLS TRIG OUT EDGE** softkey to indicate whether the trigger will initiate with a rising or falling edge. (See the Edge Triggering section for more information.)

16) Press **BACK** when done.

17) Press the **TLS / EXTERNAL DEVICE TRIGGER IN SETUP…** softkey.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

NOTE:

It is common for the trigger input for the TLS (if there is one) to not be connected to the CSA or to have a connection to the port on the rear panel of the CSA labeled **MEAS. COMPLETE**, **OUT 1**, and **OUT 2**. If there is a connection it will be to the BNC ports.

(The following applies only if you are trying to use the TLS input trigger.)
Use the softkey buttons to indicate how the TLS triggering input is connected. (Double-check the CSA's rear panel connections to reflect the appropriate setup choices.)

1) Use the **TLS TRIG IN EDGE** softkey to indicate whether the trigger will initiate with a rising edge or falling edge.

2) Press **BACK** when done.

3) Enter a **VALUE FOR TLS SPEC, MIN WAVELENGTH**.

4) Enter a **VALUE FOR TLS SPEC, MAX WAVELENGTH**.

5) Press **BACK …** when done or press the **START/STOP** button on the front panel to initiate the sweep.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setting up a Step Sweep

NOTE:

Detailed information about what each of the following parameters refers to and how to choose appropriate values for those parameters can be found in the Considerations and Implications section.

1) Press the **SWEEP** button on the front panel of the CSA.

2) Press the **SWEEP MODE** softkey until **STEP** is selected.

3) Enter a value for **START WAVELENGTH**.

4) Enter a value for **STOP WAVELENGTH**.

5) Enter a value for **WAVELENGTH STEP SIZE**.

6) Enter a value for **STEP DWELL TIME**.

7) Toggle the **START** *softkey* to select **DELAY** or **TRIGGER**. (Selecting **DELAY** will start the sweep either immediately or will start the sweep to a user-specified delay after pressing the **START/STOP** button. Selecting **TRIGGER** will start the sweep after the **START/STOP** button is pressed and a trigger is received.)

8) Press the **MORE …** softkey.

9) Toggle the **SAMPLES TO AVERAGE** softkey to select **USER SPECIFIED** or **AUTO MAX**.

10) Toggle the **REPEAT SWEEP** softkey to select **YES** or **NO**.

11) Press the **TUNABLE LASER SETUP…** softkey.

12) Press the **TLS / EXTERNAL DEVICE TRIGGER OUT SETUP …** softkey.

13) Use the softkeys next to the output triggering setups to indicate where the TLS triggering output is connected. (Double-check the connections made in the rear panel of the CSA.)

14) Use the **TLS TRIGGERS FIRST** softkey to select **YES** or **NO.**

15) Use the **TLS TRIG OUT EDGE** softkey to indicate whether the trigger will initiate with a **FALLING EDGE** or a **RISING EDGE**.

16) Press the **BACK …** softkey.

17) Press the **TLS / EXTERNAL DEVICE TRIGGER IN SETUP …** softkey.

18) Indicate how the TLS triggering input is connected by pressing the appropriate softkey. (Double-check the CSA's rear-panel connections to reflect the appropriate setup choices.)

19) Toggle the **TLS TRIG IN EDGE** to indicate whether the trigger will initiate with a **FALLING EDGE** or a **RISING EDGE**.

20) Press the **BACK …** softkey.

21) Enter a value for **TLS SPEC, MIN WAVELENGTH**.

22) Enter a value for **TLS SPEC, MAX WAVELENGTH**.

23) Press the **BACK …** softkey. (Or press the **START/STOP** button to initiate the sweep).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

NOTE:

The **SELECT TLS** softkey prompts the CSA to automatically attempt to communicate with the TLS. If the TLS is recognized, it will determine the parameter of the CSA to coincide with the TLS.

The **TLS GPIB ADDRESS** softkey is used to set the address of the TLS that the CSA is communicating with. The address must be set correctly or the CSA will not find the TLS.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setting up a Time Sweep Measurement

NOTE:

Detailed information about what each of the following parameters refers to and how to choose appropriate values for those parameters can be found in the Considerations Section.

1) Press the **SWEEP** button.

2) Toggle the **SWEEP MODE** softkey until **TIME** is selected.

3) Enter a value for wavelength.

4) Toggle the **TIMING** softkey to select either **CONTINUOUS** or **READING INTERVAL**.

NOTE:

Regarding **TIMING**, when **CONTINUOUS** is selected, each reading follows the previous as fast as possible. When **READING INTERVAL** is selected, a user-specified time interval between readings is used to determine sweep timing.)

If **READING INTERVAL** is selected for timing, enter a value (in seconds). Enter this value by using the **READING INTERVAL** softkey. This value may also be specified as a delay between readings. (See Step 10, below.)

If **CONTINUOUS** is selected for timing, enter a value for **SAMPLES TO AVERAGE PER READING** to specify the number of samples per reading.

If **AUTO MAX** is enabled, then **SAMPLES TO AVERAGE PER READING** will be computed by the CSA. (See Step 8, below.)

5) Enter a value for **SAMPLES TO AVERAGE PER READING** to be taken in the sweep.

6) Toggle the start softkey to select immediate or external trigger.

NOTE:

Selecting **IMMEDIATE** will start the sweep immediately upon pressing the **START/STOP** button. Selecting **EXTERNAL TRIGGER** will start the sweep after the **START/STOP** button is pressed and a trigger is received.

7) Press the **MORE…** softkey.

8) Toggle the **SAMPLES TO AVERAGE SOFTKEY** to select **USER SPECIFIED** or **AUTO MAX.**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

9) Toggle the **REPEAT SWEEP** softkey to select **YES** or **NO**.

10) Under the **TIMING CONTROL** softkey, select either **READING INTERVAL** (the time between the start of each reading) or **READING DELAY** (the delay from the *end* of the reading to the *beginning* of the next reading; i.e., "quiet time" between readings). Press **BACK…** and enter a numeric value for the selection (either **READING INTERVAL** or **DELAY BETWEEN READINGS** in seconds).

11) Press the **TUNABLE LASER SETUP…** softkey.

12) Press the **TLS / EXTERNAL DEVICE TRIGGER OUT SETUP…** softkey.

13) Double-check the TLS output connection in the rear panel of the CSA; then use the softkeys to select one of the following: **TLS TRIG OUT NOT CONNECTED**; **TLS TRIG OUT TO CSA START**; or **TLS TRIG OUT TO CSA IN1**.

14) Toggle the **TLS TRIGGERS FIRST** softkey and select **YES** or **NO**.

15) Toggle the **TLS TRIG OUT EDGE** softkey to select either a **FALLING EDGE** or a **RISING EDGE**.

16) Press the **BACK …** softkey.

17) Press the **TLS / EXTERNAL DEVICE TRIGGER IN SETUP …** softkey.

18) Double-check the TLS input connection in the rear panel of the CSA; then use the softkeys to select one of the following: **TLS TRIG IN NOT CONNECTED**; **TLS TRIG IN FROM CSA COMPLETE**; **TLS TRIG IN FROM CSA OUT1**; or **TLS TRIG IN FROM CSA OUT2.**

19) Toggle the **TLS TRIG IN EDGE** to indicate whether the trigger will initiate with a **FALLING EDGE** or a **RISING EDGE**.

20) Press the **BACK …** softkey.

21) Enter a value for **TLS SPEC, MIN WAVELENGTH**.

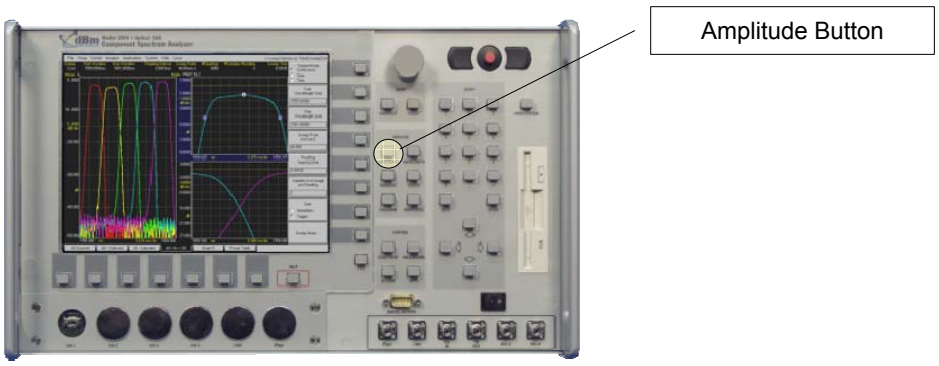
22) Enter a value for **TLS SPEC, MAX WAVELENGTH**.

23) Press the **BACK …** softkey. (Or press the **START/STOP** button to initiate the sweep).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Amplitude Button Functions

The Amplitude Functions are used to modify the Y-Axis of the graph(s). The display can also be configured to show a subset of the dataset collected during a sweep sequence.



This section includes:

Amplitude Softkey Panels

Setting the Amplitude Reference Level

Setting the Amplitude Scale per Division

Setting the Amplitude Range

Next Trace Type

Selecting a Graph

AutoScale the Current View

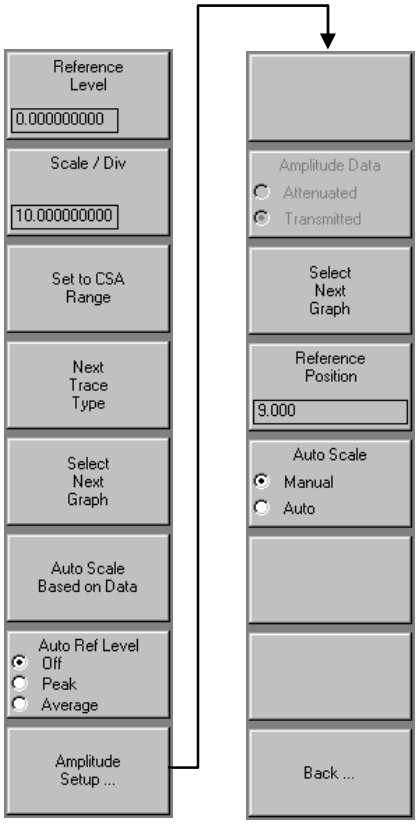
Setting the Auto Ref Level

Setting the Reference Position

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Amplitude Button Softkey Panels

Press the **AMPLITUDE** button to bring up the first softkey panel.



Setting the Amplitude Reference Level

This number sets the value for the reference level indicator line.

1) Press the **AMPLITUDE** button on the front panel of the CSA.

2) Press the **REFERENCE LEVEL** softkey and use the keypad on the front panel to enter a value.

Setting the Amplitude Scale per Division

This parameter determines the scale of each division on the display.

1) Press the **AMPLITUDE** button on the CSA's front panel.

2) Press the **SCALE / DIV** softkey and enter the value by using the keypad

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setting the Amplitude Range

This function allows any measurement that is made by the channel card to be displayed on the screen.

1) Press the **AMPLITUDE** button on the front panel.

2) Press the **SET TO CSA RANGE** softkey.

NOTE:

This button is an action key; therefore, as soon as it is pressed, the CSA will automatically adjust the range to cover the anticipated span of power.

Next Trace Type

Press **NEXT TRACE TYPE** softkey to toggle through the different traces groups to be displayed. Selections are all, IL, ORL,

Selecting a Graph

This function is used to select a single graph from a display that contains multiple graphs.

1) Press the **AMPLITUDE** button.

2) Press the **SELECT NEXT GRAPH** softkey to cycle through the graphs. The graph selected will be highlighted in blue.

AutoScale the Current View

This function automatically scales the y axis based on the selected trace. If there is no selected trace, this function will scale all of the active traces.

1) Press the **AMPLITUDE** button.

2) Press the **AUTO SCALE BASED ON DATA** softkey.

Setting the Auto Ref Level

This function set the selected data to the reference position on the display.

1) Press the **AMPLITUDE** button.

2) Toggle the **AUTO REF LEVEL** softkey to select **OFF**, **PEAK** or **AVERAGE**.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

NOTE:

This function operates only on the selected trace. If there is no selected trace or if **OFF** is selected, this function does nothing.

If **PEAK** is selected, the reference level is automatically set to the peak value of the selected trace.

If **AVERAGE** is selected, the reference level is automatically set to the average value of the selected trace.

Setting the Reference Position

This value determines where on the display the reference amplitude level is set. A value of zero refers to the bottom line and a value of ten refers to the top line. The value can be a fraction.

1) Press the **AMPLITUDE** button.

2) Press the **AMPLITUDE SETUP…** softkey.

3) Press the **REFERENCE POSITION** softkey (the values in the data entry box will be highlighted).

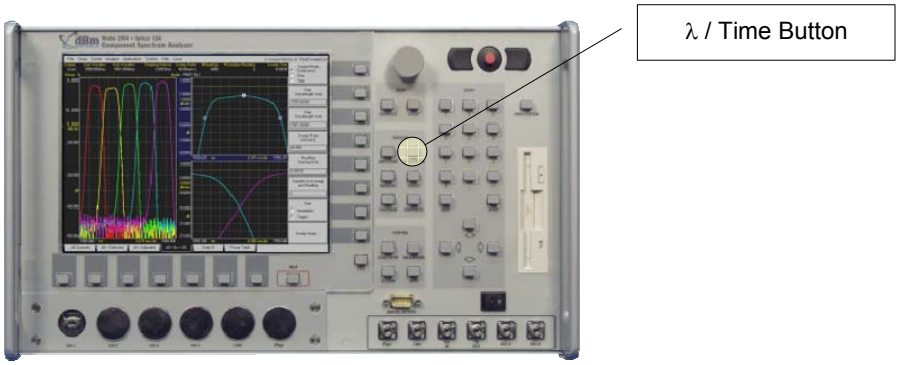
4) Enter a reference position value (from 0 to 10) by using the keypad.

5) Press **BACK…** when finished.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Wavelength/Time Button Functions

The λ/Time Button functions can be used to modify the X-Axis of the graph display (which is either time ***or*** wavelength—depending on which mode is selected for the CSA). The display can be configured to show a subset of the entire dataset collected during a sweep sequence.



This section includes:

Wavelength / Time Softkey Panel

Setting the Center
- Setting the Center Wavelength – Continuous and Step Sweep Modes
- Setting the Center Time Axis

Setting the Span
- Setting the Span – Continuous and Step Sweep Modes
- Setting the Span – Time Sweep Mode

Setting the Start/Stop Wavelengths or (Time Axes)
- Setting the Start/Stop Wavelengths – Continuous and Step Sweep Modes
- Setting the Center Wavelength – Time Sweep Mode

Using Sweep Wavelengths
- Using Sweep Wavelengths – Continuous and Step Sweep Modes
- Using Sweep Wavelengths – Time Sweep Mode
- Selecting a Graph

Setting the Wavelength or Frequency Units

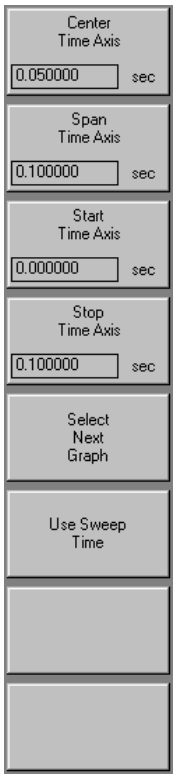
Setting the Time Axis Units

Setting the TLS Wavelength Offset

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Wavelength / Time Softkey Panel

Press the **λ / TIME** button to bring up the softkey panel.



NOTE:

During continuous or step sweep modes, pressing the **λ/TIME** key will bring up the Wavelength Softkey Panel**.**

During the time sweep mode, pressing the **λ/TIME** key will bring up the Time-Axis Softkey Panel.

These functions help determine the parameters of the x-axis of the display. When the center time axis or the span time axis is changed, the start time axis and the stop time axis are calculated. Conversely, when the start time axis or the stop axis is changed, the center time axis and span time axis are calculated.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setting the Center

This only applies to the continuous sweep mode. This function pans the graph left or right.

Setting the Center Wavelength – Continuous and Step Sweep Modes

1) Press the λ/time button the front panel.

2) Press the center wavelength softkey and enter a value using the keypad.

Setting the Center Time Axis

1) Press the λ/time button the front panel.

2) Press the center time axis softkey and enter a value using the keypad.

Setting the Span

This function changes the span of the x-axis.

Setting the Span – Continuous and Step Sweep Modes

1) Press the λ/time button on the front panel.

2) Press the span wavelength softkey. The values in the box next to the key will be highlighted.

3) Using the keypad on the front panel, enter a value for span.

Setting the Span – Time Sweep Mode

1) Press the λ/time button on the front panel.

2) Press the span time axis softkey. The values in the box next to the key will be highlighted.

3) Using the keypad on the front panel, enter a value for span.

Setting the Start/Stop Wavelengths or (Time Axes)

This function changes the low and the high values of the x-axis. These values set the minimum and maximum values of wavelength displayed along the x-axis for continuous and step measurements (or the minimum and maximum values of time in seconds for a time sweep measurement).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setting the Start/Stop Wavelengths – Continuous and Step Sweep Modes

1) Press the λ/time button.

2) Press the start wavelength softkey. The values in the data entry box next to that key will be highlighted.

3) Using the keypad on the front panel, enter the numbers.

4) Press the stop wavelength softkey. The values in the data entry box next to that key will be highlighted.
Using the keypad on the front panel, enter the numbers.

Setting the Center Wavelength – Time Sweep Mode

1) Press the **λ/TIME** button.

2) Press the **START TIME AXIS** softkey. The values in the data entry box next to that key will be highlighted.

3) Using the keypad on the front panel, enter the numbers.

4) Press the **STOP TIME AXIS** softkey. The values in the data entry box next to that key will be highlighted.

5) Using the keypad on the front panel, enter the numbers.

Use Sweep Wavelength Softkey and Use Sweep Time Softkey

Pressing this softkey(s) will configure the CSA to display all sweep data. It will reconfigure the display parameters to use the start and stop defined in the sweep function as the beginning and ending of the display.

> **NOTE:**
>
> This button is an action key; therefore, as soon as it is pressed, the CSA will automatically perform this function.

Using Sweep Wavelength--Continuous and Step Sweep Modes

In sweep modes the CSA automatically sets the high- and low-end values of the x-axis to reflect the values that were entered for start and stop wavelengths.

1) Press the **λ/TIME** button.

2) Press the **USE SWEEP WAVELENGTHS** softkey.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using Sweep Time – Time Sweep Mode

In time mode the CSA calculates the total elapsed time and sets the x-axis from zero to the final time.

1) Press the **λ/TIME** button.

2) Press the **USE SWEEP TIME** softkey.

Selecting a Graph

NOTE:

This function is only useful for displays containing multiple graphs. The tabs are **ALL + SELECTED**; **ALL + ADJACENT**; and **ALL + ON + OFF**. Press the corresponding tab key underneath the display to select.

NOTE:

Graphs are highlighted in blue as soon as they have been selected. Verify the graph to be changed is highlighted before making any changes.

1) Press the **λ/TIME** button on the front panel.

2) Press the softkey button next to **SELECT NEXT GRAPH** to open the softkey panel.

3) To activate and modify a graph, use the softkey button next to **CHART 1**, **CHART 2**, or **CHART 3**

4) Press **BACK TO PREVIOUS** when finished.

Setting the Wavelength or Frequency Units

NOTE:

This function is only utilized during sweep modes.

1) Press the **λ/TIME** button on the front panel.

2) Press the softkey button next to **WAVELENGTH SETUP** to open the softkey panel.

3) Press the softkey button next to **WAVELENGTH UNITS** to toggle between **nm** and **THz**.

4) Press **BACK TO WAVELENGTH** when finished.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setting the Time Axis Units

NOTE:

This function is only utilized in **TIME** sweep mode.

1) Press the λ/**TIME** button on the front panel. The Time-Axis Softkey Panel will appear at the right side of the display.
2) Press **TIME AXIS SETUP**
3) Toggle **TIME AXIS UNITS** to select **sec** or **min**
4) Press **BACK TO TIME AXIS** when finished

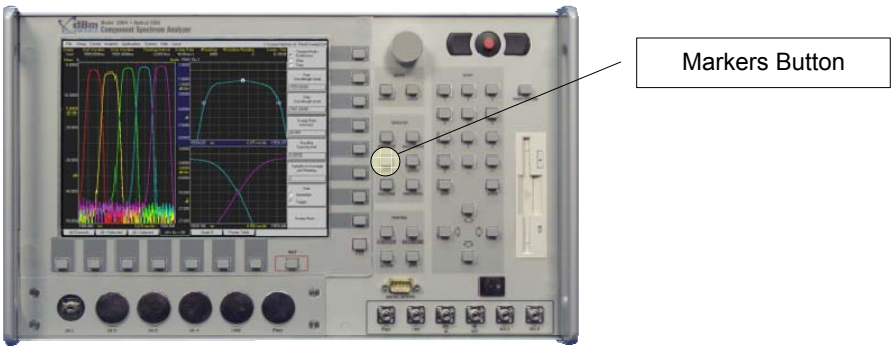
Setting the TLS Wavelength Offset

1) Press the λ/**TIME** button on the front panel. The Wavelength Softkey Panel will appear at the right side of the display.
2) Press **WAVELENGTH SETUP**
3) Press **TLS WAVELENGTH OFFSET**. The values in the data entry box will be highlighted.
4) Using the keypad on the front panel, enter the value. This function changes the recorded wavelengths in a sweep by the offset value's amount.
5) Press **BACK TO WAVELENGTH** when finished.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Markers Button Functions

Markers provide a means of graphically analyzing a CSA sweep. When a marker is on a trace, the marker status window shows the x-axis position (time or wavelength) and power at the graph point that the marker is on.



This section contains:

Types of Markers

Selecting a Graph

Selecting a Trace

Selecting a Marker

Normal Marker Mode
    Placing Normal Markers On The Graph

Bandwidth Marker Mode

Delta Marker Mode

Interpolation

Peak Search

Marker to Center

Marker at the Reference Level

Marker Parameters

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

(This page left intentionally blank.)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Types of Markers

There are three types of markers:

1) **Bandwidth markers** provide a means to measure bandwidth below a peak (local maxima) or above a valley (local minima) on the graph.
2) **Delta markers** provide a means to measure power or wavelength relative to a fixed point.
3) **Normal markers** are the most general-purpose marker facility.

Each of these marker types is discussed in the upcoming paragraphs.

Selecting a Graph

1) After running a sweep, select a graph on which to place markers.
2) Click on the leftmost four notebook tabs (**ALL CHANNELS**; **ALL + SELECTED**; **ALL + ADJACENT**; **ALL + ON + OFF**).

Selecting a Trace

A trace must be selected after selecting a graph. A trace can be selected either by clicking on it or by pressing the **SELECT TRACE …** softkey (see Trace Selection section).

Selecting a Marker

Once a trace has been selected, a marker may be selected.

1) Press markers.
2) Press select marker.
3) Select Marker 1 through 4 to place a marker on the selected trace.

Normal Marker Mode

NORMAL marker mode is entered by default when the **MARKERS** button is pressed. In normal markers any of the four markers may be placed on any trace and then moved to any location. The **MARKER STATUS** area displays the **X POSITION** (time or wavelength) and the **POWER** of the graph point that the marker is located on. **MARKERS 1** and **3** and **MARKERS 2** and **4** are treated as pairs. The difference between the pair is displayed when both markers are placed.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Placing Normal Markers On The Graph

1) Press the markers front panel button and then press the select marker softkey. A softkey panel will appear that will allow the user to select any of the four markers.

2) If the selected marker is not on already on a trace, it is placed near the center of the selected trace.

3) If the marker is already on a trace, it becomes the selected marker (its position on the trace does not change).

4) The selected marker can be moved left and right with the rotary knob.

A marker can also be moved by dragging it to the new position (on any trace) with the mouse.

To move the marker to a new position without a mouse, turn the marker **OFF**, select the new trace, and then re-select the marker.

Bandwidth Marker Mode

In bandwidth marker mode, the selected marker will have bandwidth markers placed automatically to the left and to the right at the specified level below or above the selected marker.

The bandwidth amplitude setting determines how far the threshold level is from the selected marker. The search mode setting determines if the threshold is below the selected marker (peak) or above the selected marker (valley). If no point is beyond the threshold, the bandwidth marker will not be displayed.

Selection and movement of bandwidth markers is done in the same manner as with normal markers. When a new marker is selected, bandwidth markers are removed from the previously selected marker and placed around the newly selected marker.

Delta Marker Mode

In delta marker mode, the position of each marker relative to the delta marker is displayed in the marker status window. Selection and movement of markers is the same in delta marker mode as in other modes--except for the placement of the delta marker.

The first time a marker is selected in delta marker mode, the marker and the delta marker are placed near the center of the trace. To relocate the delta marker, move the selected marker to the desired location and then press the turn of all markers softkey. Reselect the original marker and the delta marker will appear at the last location of the selected marker before the turn off all markers softkey was pressed.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Interpolation

Interpolation is disabled by default. When disabled, markers are placed on graph points only. Attempts to move the marker in between two graph points will result in it being placed at the closer of the two graph points.

When interpolation is enabled, a marker may be placed anywhere on the graph. interpolation is useful when the number of graph points displayed is much less than the number of horizontal pixels in the graph (approximately 600).

Peak Search

After selecting a marker, it is often desirable to place it on a peak or valley. The peak search softkey does that just. In addition to selecting the highest peak/lowest valley on the graph, the user may sequence through the peaks in order of height using the next peak down soft key. The user may also move to the next peak to the left or right of the selected marker using the next peak left and next peak right softkeys.

Marker to Center

This feature pans the view so the marker is centered in the view.

Marker at the Reference Level

This feature sets the reference level to the level of the marker.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Marker Parameters

Bandwidth Amplitude (dB)	Determines how far below a peak or above a valley the bandwidth markers are placed.
Excursion Threshold (dB)	Specifies how far a peak or valley must vary from the adjacent peak or valley to be considered a peak or valley.
Search Mode (peak or valley)	Determines if searches look for peaks or valleys. It also determines whether bandwidth markers are placed below (peak) or above (valley) the selected marker.
Bandwidth Markers (on/off)	Selects/deselects bandwidth marker mode.
Delta Markers (on/off)	Selects/deselects bandwidth marker mode.
Marker Search Threshold (dB)	When enabled, this parameter specifies the lower limit of marker searches; i.e., no points below this level will be searched for peaks or valleys.
Normal/Delta Marker Interpolation (on/off)	Enables/disables interpolation for normal markers and delta markers.
Bandwidth Marker Interpolation (on/off)	Enables/disables interpolation for bandwidth markers.
Use Marker Search Threshold (on/off)	Determines if marker search threshold is used.
Automatic Peak Search (on/off)	Determines if the selected marker is automatically placed on the highest peak/lowest valley after the sweep completes.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Traces Button Functions

The functions behind the Traces Button allow traces to be selected and determine which data should be displayed in the text box at the top of the graph display area.



This section includes:

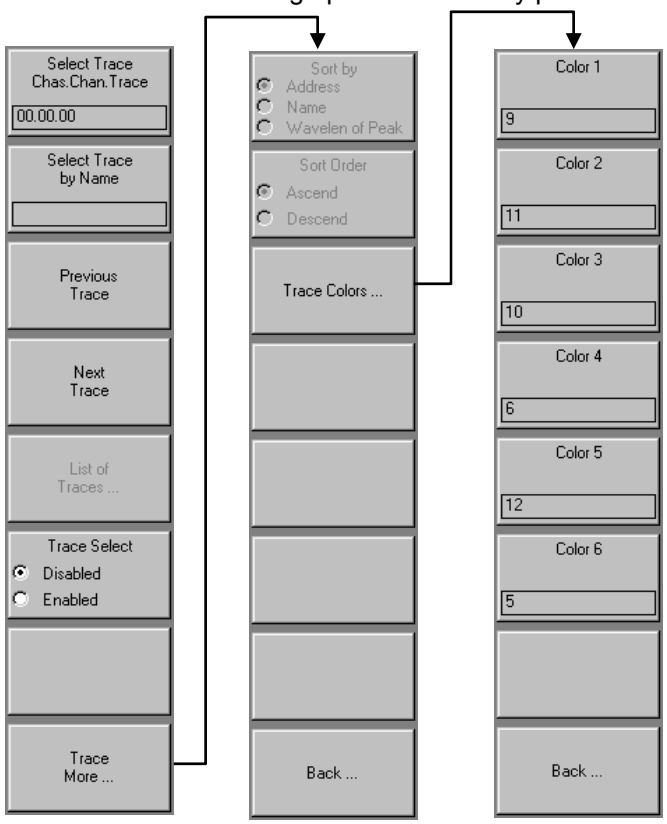
Traces Softkey Panels

Selecting a Trace

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Traces Softkey Panels

Press the **TRACES** button to bring up the first softkey panel.



Selecting a Trace

1) Press the traces button on the front panel.

2) Press the list of traces … softkey to view a list of traces. Press the list of traces … softkey again to hide the list.

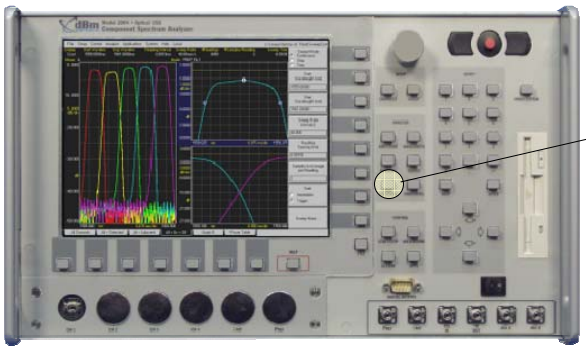
Option: Press the select **TRACE CHAS. CHAN. TRACE** softkey and use the keypad on the front panel to enter the parameter.

Option: Press the **SELECT TRACE BY NAME** softkey and use the keypad on the front panel to enter the parameter.

Option: Press the previous trace softkey or the next trace softkey to cycle through all of the available traces.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Pan/Zoom Button Functions



NOTE:

This feature set will be offered in future firmware releases.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Pan/Zoom Softkey Panels

Press the **PAN/ZOOM** button to bring up the softkey panel.

NOTE:

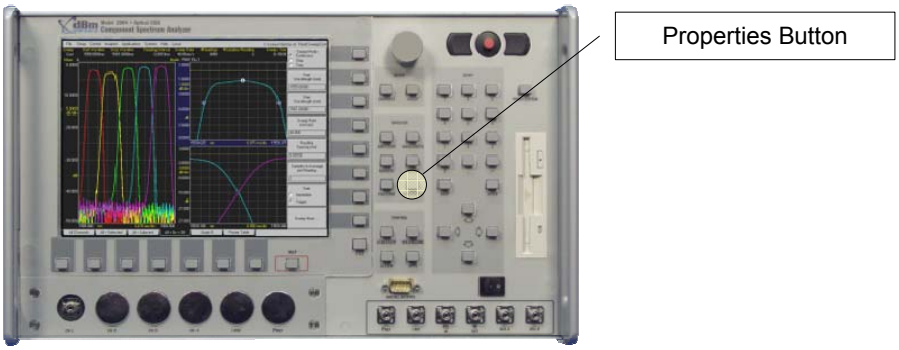
This feature set will be offered in future firmware releases.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Properties Button Functions

The functions under the Properties Button allow non-measurement related parameters to be adjusted. Examples of the types of parameters included in under the Properties Button are system time and date, gridlines, information bars and plot styles.



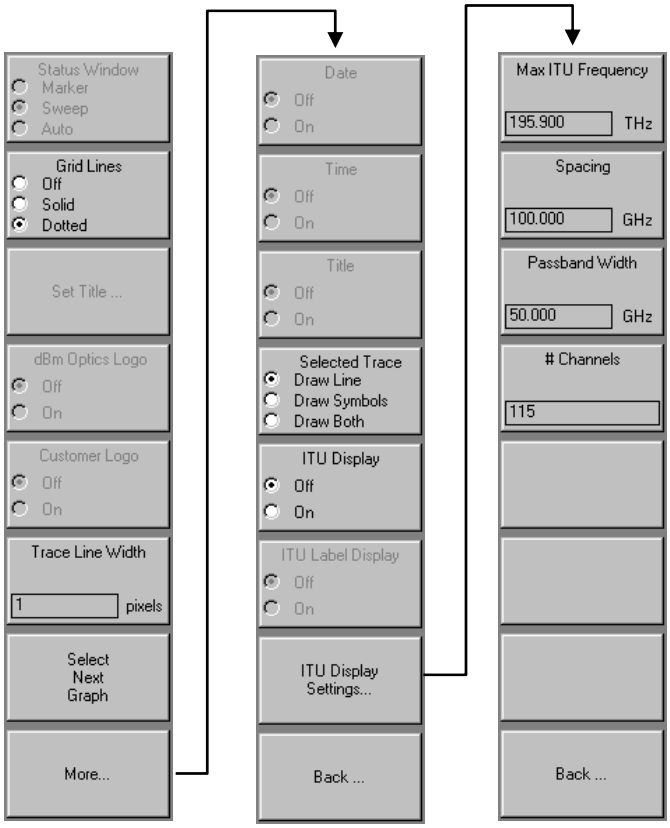
This section includes:

Properties Softkey Panels
Setting the Display Parameters

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

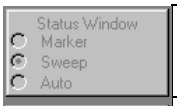
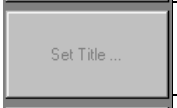
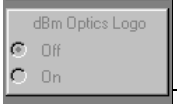
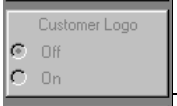
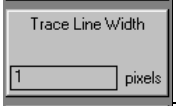
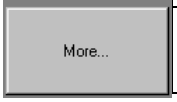
Properties Softkey Panels

Press the **PROPERTIES** button to bring up the first softkey panel.

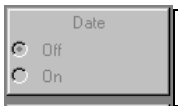
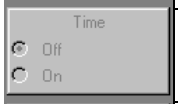
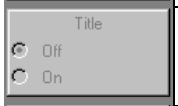
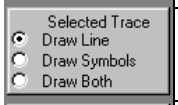
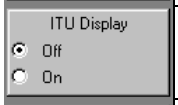
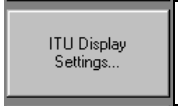
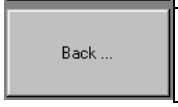


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setting the Display Parameters

	Toggles the status bar information (located along the top of the display) between markers, sweep and auto formats.
	Toggles the grid lines of the active graph between **OFF**, **SOLID**, and **DOTTED**. The properties selected here apply only to the active graph.
	(This feature will be offered in future firmware releases.)
	(This feature will be offered in future firmware releases.)
	(This feature will be offered in future firmware releases.)
	The value entered here will alter the thickness of all plot lines.
	Highlights a specific graph on the display. The graph is highlighted in blue when it is selected. This function only works when more than one graph is displayed.
	Takes the operator to the next Traces Softkey Panel (see below).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

	(This feature will be offered in future firmware releases.)
	(This feature will be offered in future firmware releases.)
	(This feature will be offered in future firmware releases.)
	**DRAW LINE** connects all data points with a line. **DRAW SYMBOLS** represents individual data points as a symbol. **DRAW BOTH** represents data as individual data points and connects those points with a continuous line.
	
	
	
	

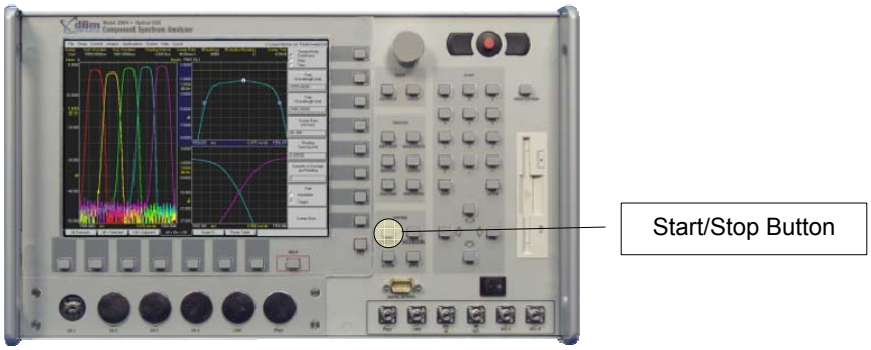
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Max ITU Frequency 195.900 THz	
Spacing 100.000 GHz	
Passband Width 50.000 GHz	
# Channels 115	
Back ...	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Start/Stop Button Functions



Starting a Measurement Sequence

The **START/STOP** button is an action button. This function enables the CSA to begin a measurement sequence. This can mean either initiating a sweep with the selected parameter or waiting for a trigger signal before beginning the sweep. Whether the CSA begins measuring or waits for a trigger depends upon the current handshake scenario.

Stopping a Measurement Sequence

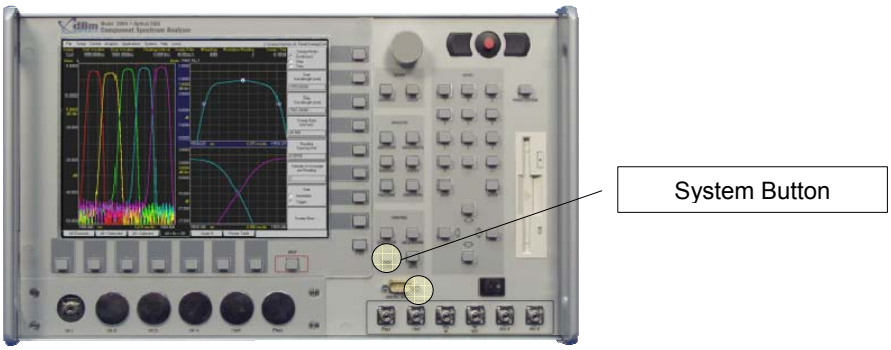
Press the **START/STOP** button on the front panel. Choosing this function ends the measurement sequence.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

(This page left intentionally blank.)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

System Button Functions



This section includes:

[Restoring the Factory Preset Values]

[Setting the Digital Outputs]

[Viewing Installed Options]

[Setting the CSA Date/Time]

[Serial Communications Setup]

[GPIB Communications Setup]

[Ethernet Communications Setup]

[GPIB Control Setup]

[Setting SCPI Display Enable]

[Setting the Shutter State]

[Executing a Firmware Upgrade]

[Executing a Soft Reboot]

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

(This page left intentionally blank.)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Restoring the Factory Preset Values

1) Press the system button on the front panel.

2) Press the factory preset… softkey.

3) The softkey panel will give you two choices: Restore Factory Presets? Yes, Continue or No, Cancel.

Setting the Digital Outputs

1) Press the system button on the front panel.

2) Press the digital output… softkey.

3) Press digital output set bit to set one of the 64 TTL digital output pins.

4) Press digital output clear bit to clear one of the 64 TTL digital output pins.

5) Press digital output test to test the 64 TTL digital output pins. A test sequence will run which will take several seconds to complete. This test will toggle all of the digital output pins in sequence leaving them all cleared at 0.

Viewing Installed Options

1) Press the system button on the front panel.

2) Press the view options … softkey.

3) Press more … to cycle through the list of installed options in the CSA. All of the options sofkeys will be disabled, preventing user modification of the options settings. Some options are automatically detected by the CSA, such as the wavelength reference card. Other options must be enabled by service personnel.

Setting the CSA Date/Time

1) Press the system button on the front panel.

2) Press the set date and time … softkey.

3) Press the date format to select mm-dd-yy or dd.mm.yy.

4) Press the time format to select 12 hour or 24 hour.

5) Press the change time/date … softkey to change the time or the date.

6) Enter the correct date and time using any of the hour, minute, second, day, month or year softkeys. Press set time/date to load the data into the CSA.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Serial Communications Setup

1) Press the **SYSTEM** button on the front panel.
2) Press the **COMMUNICATIONS SETUP …** softkey.
3) Press the **SERIAL SETUP …** softkey.
4) Select the desired baud rate.
5) Press the **TERMINATOR …** softkey and choose the desired terminator mode from the softkey list that appears: **NO TERMINATOR**; **CR TERMINATOR** (carriage return); **CR/LF TERMINATOR** (carriage return/line feed); or **LF TERMINATOR** (line feed).
6) Press **BACK …** when finished.
7) Press the **HANDSHAKE** softkey to indicate the current connections scenario.
8) Press **BACK …** when finished.

GPIB Communications Setup

1) Press the **SYSTEM** button.
2) Press the **COMMUNICATIONS SETUP …** softkey.
3) Press the **GPIB SETUP …** softkey.
4) Enter the GPIB address (1-31) by pressing the softkey next to the option and using the keypad to enter in the value.
5) Press a softkey to select a terminator option: **NO TERMINATOR**; **CR TERMINATOR** (carriage return); **CR/LF TERMINATOR** (carriage return/line feed); or **LF TERMINATOR** (line feed).
6) Select **EOI TERMINATOR** to **ON** or **OFF**.
7) Press **BACK…** when finished.

Ethernet Communications Setup

1) Press the **SYSTEM** button.
2) Press the **COMMUNICATIONS SETUP …** softkey.
3) Press the **ETHERNET SETUP …** softkey.
4) View the or enter the **ETHERNET ID** and the **IP ADDRESS** (if applicable) by pressing the softkey next to the option or using the keypad to enter the number.
5) Select the address type by selecting **IP**, **BOOTP** or **DHCP**.
6) Press the **TERMINATOR …** softkey select a terminator mode from the softkey list: **NO TERMINATOR**; **CR TERMINATOR** (carriage return); **CR/LF TERMINATOR** (carriage return/line feed); or **LF TERMINATOR** (line feed).
7) Press **BACK…** twice when finished.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

GPIB Control Setup

1) Press the **SYSTEM** button.
2) Press the **COMMUNICATIONS SETUP…** softkey.
3) Press the **GPIB CONTROL SETUP…** softkey.
4) Press the **POL. CONTROLLER GPIB ADDRESS** to set the GPIB address of the polarization controller. The default address of the controller is 24.
5) Press the **TLS GPIB ADDRESS** softkey to set the GPIB address of the external tunable laser.
6) Press **BACK …** when finished.

Setting SCPI Display Enable

1) Press the **SYSTEM** button.
2) Press the **COMMUNICATIONS SETUP…** softkey.
3) Toggle the **SCPI DISPLAY ENABLE** softkey to **ON**.

Setting the Shutter State

1) Press the **SYSTEM** button.
2) Toggle the **SHUTTER** softkey to **OPEN** or **CLOSE**. (The shutter is typically closed only to perform calibration functions.)

Executing a Firmware Upgrade

1) Press the **SYSTEM** button on the front panel.
2) Press the **MORE …** softkey.
3) Press the **UPGRADE SYSTEM FIRMWARE** softkey.
4) Press **UPGRADE SYSTEM FIRMWARE? YES, CONTINUE** to perform an immediate upgrade or press **NO, CANCEL** to cancel.
5) Press **BACK …** when finished.

Executing a Soft Reboot

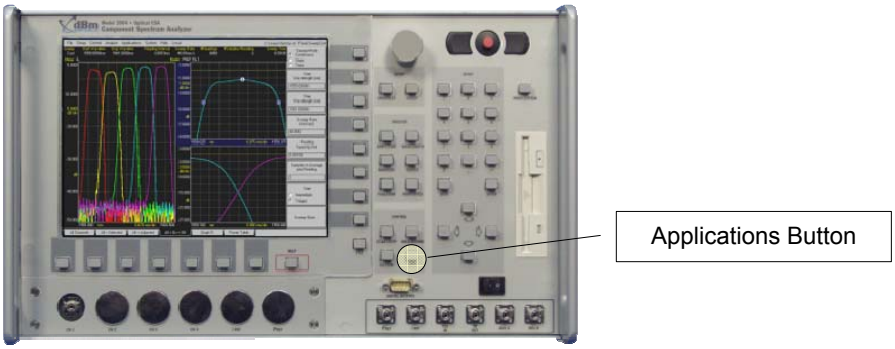
1) Press the **SYSTEM** button on the front panel.
2) Press the **MORE …** softkey.
3) Press the **REBOOT** softkey.
4) Press **REBOOT CSA? YES**, continue to perform an immediate soft reboot of the CSA or press **NO**, cancel to cancel.
5) Press **BACK** … when finished.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

(This page left intentionally blank.)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Applications Button Functions



This section includes:

PDL Measurement Applications
- All States PDL Method
- Mueller-Matrix PDL Method
  - Typical Measurement Setup
  - Polarization Controller Selection
- PDL Trace Selection
- Mueller Polarization States
- PDL and Wavelength Accuracy
- PDL Reference Sets

Optical Return Loss Applications
- Creating an ORL Reference Data Set
  - Saving ORL Zero Reference Data
  - Saving ORL Gain Reference Data
- Measuring ORL

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

(This page left intentionally blank.)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PDL Measurement Applications

There are two methods for measurement of polarization dependent loss (PDL): "All States PDL" and "Mueller-Matrix PDL." Each method has advantages and disadvantages. Both methods of PDL measurement can be made with the CSA. To get good measurement results in PDL, the following precautions should always be considered:

All optical interfaces must be clean. A small amount of dirt in an optical connection can add a surprisingly large PDL to the measurement setup.

Vibration of fibers should be minimized. It is common to tape fibers down to a solid mechanical surface. Mechanical vibration can cause variation in insertion loss in fiber, particularly when the fiber bend radius is small.

Use flat optical connections when connecting to the dBm optical power meter cards. Angled connections have a higher PDL.

Allow time for fiber relaxation to settle after the initial setup.

All States PDL Method

In this method, the state of polarization is continuously changing through use of a polarization scrambler (e.g., HP/Agilent ll896A). The optical parameters of interest, such as insertion loss, are measured over time. The maximum-minimum reading over time is computed as the polarization dependent variation. In addition to the normal precautions for accurate PDL measurement, the following precautions must also be followed:

1) The measurement reading rate and bandwidth must be significantly faster than the rate at which polarization is changing. If the reading rate or bandwidth is not high enough then the maximum or minimum readings may be missed and the result will read too low.

2) Noise in the system setup must be minimized. In this method the final result is a combination of system noise and PDL. Because there is always some non-zero noise in a measurement system, this measurement method will always result in a PDL measurement higher than the actual PDL.

This measurement method may only be used in time mode sweeps. There are no specific application keys or SCPI commands to aid in setup of measurements using this method.

Mueller-Matrix PDL Method

In the Mueller-Matrix PDL method, measurements are made in four specific states of polarization. Mueller-Matrix math is used to compute IL and PDL after the four sweeps are completed. A polarization controller such as the HP/Agilent 8169A is used. Since the state of polarization is not changing during each sweep, any sweep settings may be used. There is no limitation on reading rate or bandwidth, measurements may be made in time, step or swept mode.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Typical Measurement Setup

TLS -> Polarization Controller -> TLS IN
Pref -> Pref Card | Channel 5
[Wref -> Wref Card]
TO DUT -> device under test -> Channel N

It is recommended that power referencing be used in PDL measurements to minimize the impact of TLS or polarization controller variations during the sweep.

Polarization Controller Selection

1) Press the **APPS** button on the front panel of the CSA.
2) Press the **PDL MEASUREMENT SETUP** … softkey.
3) Press the **SETUP** … softkey.
4) The control mode softkey offers the following selections: **8169A** or **MANUAL**.

NOTE:

When **MANUAL** mode is selected, the user must also select **EXTERNAL TRIGGER** for start of sweep. This gives the user time to set the state of polarization on an external controller when the message **WAITING FOR TRIGGER** appears on the screen. After the state of polarization is set, the user then manually triggers the TLS initiating the sweep. This is done for each of the four sweeps.

PDL Trace Selection

The results of this measurement yield two traces for each channel setup for PDL measurement. Traces are selected in the active channel setup.

1) Press the **CHANNELS** button.

2) Press the **EDIT CHANNELS …** softkey. The Active Channel Setup grid will appear in the middle of the display.

3) To select/deselect channels for PDL measurement, highlight the desired channels using either the mouse; the **SELECT/DESELECT ALL CHANNELS** softkey; or the **SELECT NEXT TRACE** softkey.

4) Press the **MORE …** softkey and then the **PDL TRACES … (&PDCW, PDBW)** softkey to enable or disable PDL measurement on the selected channels.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

NOTE:

For PDL measurements to be enabled for a sweep, both the PDL trace and the base trace update setting must be **ON**. When a PDL measurement is enabled, "PDL" will be displayed in the sweep status screen. The **VIEW** setting controls whether or not the trace data is visible on the display screen.

SCPI Command

PDL Trace Selection:

```
:config:trace:pdl <chanlist> [<on|off>]
[<8169a|manual|internal>]
:config:trace:pdl?
:config:trace?
```

Mueller Polarization States

The polarization controller has three optical plates: a polarizer; a 1/4 wave plate; and a 1/2 wave plate. The **POLARIZER** setting is set first during the **MAXIMIZE POLARIZATION** operation. The four measurement states are:

Mueller-Matrix Polarization States

STATE	POLARIZER	QUARTER WAVE PLATE	HALF WAVE PLATE
1	P	P	P
2	P	P	P + 45°
3	P	P	P + 22.5°
4	P	P + 45°	P

(**P** is the polarizer setting after the maximize polarization operation.

The CSA sets state 4 first; then state 3; state 2; and, finally, state 1. This is because there may be channels that are not participating in the PDL measurement (in which case they will be measured in polarization state 1).

IL and PDL are computed as follows:

$IL = (T_1 + T_2) / 2$
$M_{01} = (T_1 - T_2) / 2$
$M_{02} = T_3 - M_{00}$
$M_{03} = M_{00} - T_4$
$A = [M_{01}^2 + M_{02}^2 + M_{03}^2]^{1/2}$
$PDL = (IL + A) / (IL - A)$

T1 to 4 are the insertion loss measurements made in **STATES 1 TO 4**.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The computations above are performed in linear units using dB2lin(). The results are then reported in dB units using lin2dB().

$dB2lin(x) = 10^{x/10}$
$lin2dB(x) = 10 \log_{10}(x)$

PDL and Wavelength Accuracy

To achieve best PDL measurement accuracy in step or continuous sweep modes, the Dynamic-λ™ Meter should be used. When the Dynamic-λ™ Meter is enabled during a PDL measurement, each of the four sweeps' wavelength results is interpolated to the nominal sweep wavelength settings. This minimizes the impact of wavelength jitter from sweep to sweep--adversely impacting the computed PDL and IL results. It is important that the measurement data be aligned in wavelength prior to the computations above.

PDL Reference Sets

In applications where maximum accuracy of PDL measurement is desired, a reference set of Matrix-PDL sweeps may be measured and stored. Subsequent PDL measurements will then be referenced against this PDL Ref Set. Before taking a PDL Ref Set, set up the system to measure PDL with the DUT. The more settings that are common between when the PDL Ref Set is stored and the actual settings that will be used, the better—particularly if sweeping over wavelength. Once the system is set up to measure PDL, replace the DUT with a patch cord.

Optical Return Loss Applications

Optical Return Loss (ORL) may be measured by the CSA if the ORL option has been installed. ORL is a measure of the back reflection of the DUT. The CSA measures the light back reflected into the **TO DUT** connection and computes ORL based upon the ORL reference data.

Creating an ORL Reference Data Set

An ORL reference data set must be loaded into the CSA before ORL can be measured. This is done automatically by the CSA at power on. An initial ORL reference data set is created at the factory when the unit initially ships. The user also has the ability to modify the data set.

Saving ORL Zero Reference Data

The ORL reference data set consists of measurements of “Zero ORL” and a “Reference ORL” to compute a gain factor. The zero is similar to Dark Cal on channel cards. It is a measurement of the signal level on the ORL Channel Card when there is no back reflection into the **TO DUT** connection. Zero back reflection can be done by making a patch cord with 100% loss. This can be done by taking the patch cord and wrapping it 8 times around a mandrel—thus called a mandrel wrap (about the diameter of a pencil). This patch cord is then connected to the

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ORL connection. The zero level signal measured by the ORL Channel is then a result of various parasitic optical paths inside the CSA and will vary optical power at **TLS IN**. All ORL measurements be made with Power Reference set to relative.

1) The ORL option must be installed in the CSA. Press system, view options… to see which options are installed.

2) The Power Reference 301 Module must be installed in the CSA.

3) A patch cord must be connected from the "ORL" output to one of the channel cards in the CSA mainframe, channel 1 to 6. That channel card must be selected as the ORL Channel. This can be done by pressing apps, orl… , orl channel.

4) ORL measurement must be off. Press apps, orl… , then orl off.

5) Set up a sweep: time, step or continuous sweep to measure ORL zero.

6) Set the measurement range on the ORL Channel and on the Pref Channel to minimize noise in the measurement. It can also be a good idea to apply smoothing to the sweep data to minimize noise stored in the Reference Data Set.

7) Run some sweeps with this setup until you are confident that you are getting a good ORL zero measurement.

8) Once good ORL zero sweep has been taken, press save orl zero ref sweep data to file. If time mode is used, a point will be added to the ORL Reference Data Set.

If step or sweep mode is used, and if the sweep wavelengths match the wavelengths already in the data set, then the data set zeros and gains will be updated.

If step or sweep mode is used and the sweep wavelengths do not match the wavelengths in the data set, then the data set will be cleared and replaced with the new sweep.

9) The ORL Reference Data Set can contain up to 1,000 data points and can be viewed by pressing view orl ref data. If no ORL Ref Data is loaded, then the view orl ref data softkey will be grayed out. If the sweep has more than 1,000 data points, the CSA will automatically reduce the size of the sweep data by averaging adjacent data points until the number of points is less than 1,000.

Saving ORL Gain Reference Data

ORL zero data must be saved prior to measuring the gain data. The ORL gain data is measured using a known reflectance device. A common device is a patch cord with a flat connection on one end. Such a flat connection typically has a back reflectance of –14.7 dB. Other known reflectance devices may be used if available.

1) The ORL option must be installed in the CSA. Press system, view options… to see which options are installed.

2) The Power Reference 301 Module must be installed in the CSA.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3) A patch cord must be connected from the “ORL” output to the ORL Channel. This should be the same channel as used above in saving the ORL zero data.

4) ORL measurement must be off. Press apps, orl… , then orl off.

5) Use the exact same sweep parameters as used for ORL zero, or use time mode sweeps to update the gain in the ORL Reference Data Set, point by point.

6) Adjust the measurement range on the ORL Channel because the signal level will now be much higher and might over range if not adjusted.

7) Run some sweeps with this setup until you are confident that you are getting a good ORL gain measurement.

8) Set the Reference Reflectance by pressing reference reflectance.

9) Once good ORL gain sweep has been taken, press compute & save orl gain ref sweep data to file. The sweep wavelength(s) must match entries in the ORL Reference Data Set. If so, then the gain will be computed based on the previously saved zero and the presently measured signal level. A typical gain level will be from 3.0 to 5.0 dB.

10) View the data in the ORL Reference Data Set by pressing view orl ref data.

11) Check that the CSA is measuring an ORL equal to the Reference Reflectance being used. Press apps, orl… , then orl to set ORL on. Press start to run another sweep and the result should be an ORL measurement that matches the Reference Reflectance.

Measuring ORL

The measurement of ORL is a measurement of the optical power back reflected into the **TO DUT** optical connection. The following is required to be able to make this measurement.

1) The ORL option must be installed in the CSA. Press **SYSTEM, VIEW OPTIONS…** to see which options are installed.

2) The Power Reference 301 Module option must be installed in the CSA.

3) A patch cord must be connected from the ORL output to one of the channel cards in the CSA mainframe, channel 1 to 6. That channel card must be selected as the ORL Channel. This can be done by pressing **APPS, ORL… , ORL CHANNEL.**

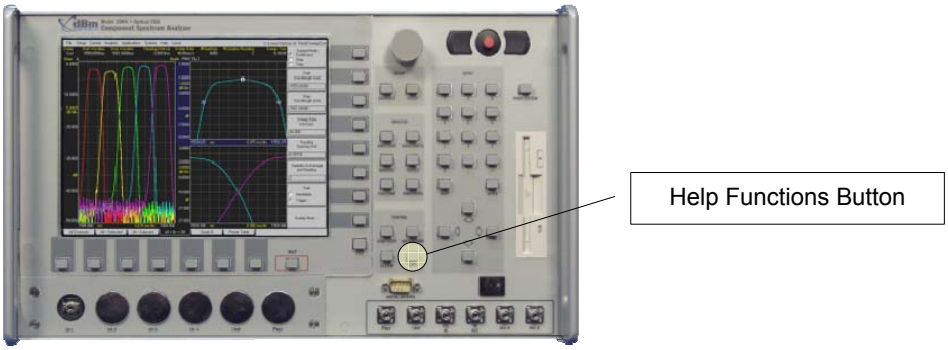
4) A valid ORL Reference Data Set must be loaded in the CSA.

5) ORL measurement must be enabled. Press **APPS, ORL…** , then **ORL.**

6) When these conditions are met, measurement data on the ORL Channel will be processed to provide ORL.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Help Button Functions



Firmware Versions

1) Press the **HELP** button.

2) Press the **FIRMWARE VERSIONS** softkey to display the firmware versions of the CSA firmware and serial number; extender chassis(s); channel cards and trigger board (internal).

Event Log

1) Press the **HELP** button.

2) Press the **EVENT LOG …** softkey and then press the **VIEW EVENT LOG** softkey to display events and error log entries since the last time the CSA Firmware was upgraded. This function only displays up to the first 64 kb of data in the log file. If the log file gets too large to view, use the **DELETE EVENT LOG** softkey. This is a good place to look when troubleshooting system operation (such as when a user is developing new SCPI control code for the CSA).

3) Press the **DELETE EVENT LOG** softkey to delete and empty the log file.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Firmware Versions

1) Press the **HELP** button.

2) Press the **FIRMWARE VERSIONS** softkey to display the firmware versions of the CSA firmware and serial number; extender chassis(s); channel cards and trigger board (internal).

Event Log

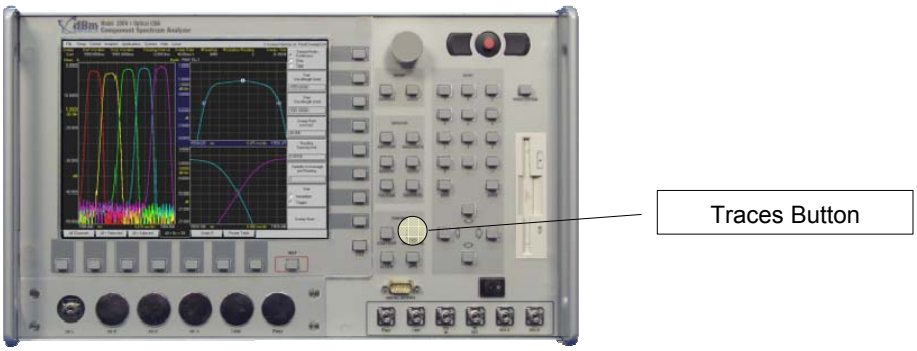
1) Press the **HELP** button.

2) Press the **EVENT LOG …** softkey and then press the **VIEW EVENT LOG** softkey to display events and error log entries since the last time the CSA Firmware was upgraded. This function only displays up to the first 64 kb of data in the log file. If the log file gets too large to view, use the **DELETE EVENT LOG** softkey. This is a good place to look when troubleshooting system operation (such as when a user is developing new SCPI control code for the CSA).

3) Press the **DELETE EVENT LOG** softkey to delete and empty the log file.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Traces Softkey Functions



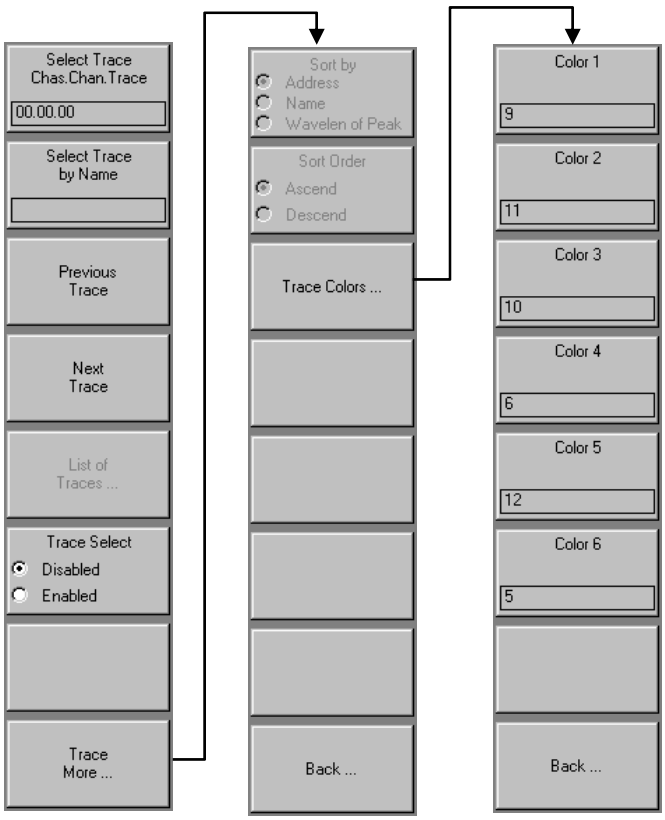
This section includes:

Traces Softkey Panels
Selecting a Trace

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Traces Softkey Panels

(Press the **TRACES** button to bring up the first softkey panel.)



\

This page intentionally left blank.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Applications and Specifications

This section provides information regarding explanations of various concepts used in the components testing field as well as tips for setting up measurement protocol for different applications. Also included is data regarding the dimensions of the instrument--technological capabilities and limitations. In addition, this section offers background information regarding terms, types of measurements and various calculations.

This section includes:

Definition of Terms
Dark Current

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Definition of Terms

Absolute Accuracy	Accuracy of measuring power as compared to National Standards. Includes any uncertainty associated with reference conditions and transfer standards.
Amplified Spontaneous Emission (ASE)	The nonstimulated emission of light produced by the decay of the upper level of a lasing transition. These emissions are typically unpolarized and have a wide spectral distribution. Amplified spontaneous emissions generally appear as noise during measurements and will effectively limit the overall dynamic range. See STSE for more information.
Bandwidth (BW)	This value, always cited in conjunction with a threshold, refers to the spectral range over which a device can be utilized. The most typical levels for effective bandwidth thresholds are -3 dB, -0.5 dB, -6 dB or -20 dB. The formula for bandwidth is shown below, where x dB is the reference attenuation level and λ is the wavelength at those corresponding maximum and minimum values. $BW = \lambda_{xdBmax} - \lambda_{xdBmin}$
Center Wavelength	The wavelength value at the peak power of a source.
Central Wavelength (λc)	This value, most meaningful for filters with symmetrical spectral traces, refers to the mean λ. It is not the same as center wavelength (see above), which refers to the value of maximum transmission. Instead central wavelength is calculated by the following equation $[(\lambda_{upper} + \lambda_{lower})/2]$, where the upper and lower values are measured at some specified level. In the rare instance where there is a perfectly symmetrical spectral distribution the central and center (or peak) wavelengths would be identical values.
Chromatic Dispersion	This coefficient is a combination of the material and waveguide dispersions in a fiber and is generally reported per unit length in ps/nm. Material dispersion is a distortion in a signal that occurs because the index of refraction for optical fiber materials is wavelength dependent. The geometric properties of the waveguide cause another wavelength dependent broadening of the pulse in response to the phase and group velocities.
Crosstalk	When leakage or coupling from other channels creates noise in the signal output. For optical multiplexers/demultiplexers, the typical measurement parameters are adjacent channel and non-adjacent channel crosstalk.
Dark Current	The current that flows in an active photodetector when there is no optical radiation applied on the detector.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Data Set	A set of multiple measurements taken during either a TLS continuous sweep over wavelength, a specified number of wavelength steps, or as a function of time (time sweep measurement). A Data Set includes all of the measurements acquired for all active channels between the time the operator triggers the CSA and when the CSA indicates it is done.
Directivity (Nearend Crosstalk)	In a multi-input device directivity refers to the rejection of external signals by the various input ports.
Dynamic Range	Refers to an instrument's ability to measure over a wide range of signal strengths and should be cited in conjunction with measurement speed or update rate. The dynamic range of the dBm CSA OMU-202 is 67 dB at full speed and 105 dB overall.
Flatness	The variation in loss over the channel's passband.
Full Width Half Maximum (FWHM)	This value is equal to the bandwidth at -3 dB.
Insertion Loss (IL)	Reduction in optical signal due to the presence of a device or component in the optical path.
Isolation (Crosstalk)	Isolation refers to the DUT's capacity to discriminate between external signals. This value, reported in dB, is the minimum value at which signals to or from other channels are rejected.
Linearity	In general, this term is used to refer to the difference between the expected changes in a performance parameter (e.g. power, wavelength) and the measured change in that parameter.
Linewidth (Δf)	The spectral bandwidth of an active device, typically expressed in Hertz and measured at -3 dB.
Measurement	A reading converted to scientific or engineering units such as mW, pW, or dBm. This is the value reported by the CSA into a file, onto the display or over external communications.
Nearend Crosstalk (Directivity)	In a multi-input device directivity refers to the rejection of external signals by the various input ports.
Noise	The unpredictable and undesirable variation in signals caused by devices within the system or introduced from outside the system. These distortions complicate analysis, limit the useable dynamic range of the system and tend to increase the signal power required to reduce noise disturbances.
Non-linearity	The generation of erroneous sum, difference and harmonic frequencies that occurs any time electromagnetic energy passes through a physical medium. This characteristic causes unexpected loss effects.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Optical Return Loss (ORL)	The ratio, expressed in dB, of the incident power to the reflected power. Any reflections occurring from the fiber end that is used as the radiation source are excluded from the return loss. $RL = 10 \log (P_{in} / P_{back})$
Polarization Dependent Loss (PDL)	The difference between the maximum and minimum values in attenuation caused by varying polarization states that are generated as light passes through a device. This value is reported in dB.
Polarization Mode Dispersion	Polarization mode dispersion (PMD) occurs when different planes of light inside a fiber travel at slightly different speeds, making it difficult to transmit data reliably at high speeds.
Power Range	The power range is the span defined by the highest measurable input power level, to the noise level that causes a noticeable change of displayed power level of a specified gain range or group of gain ranges.
P-P Noise	The total change in displayed power level from peak-to-peak, that is from the minimum to maximum power. The measurement result is obtained by: $Noise = P_{max} - P_{min}$ Expressed as peak-to-peak within a given time span, therefore automatically excluding any offset.
Pre-Trigger Adjustment	This value indicates the potential trigger error for the specific TLS or device being utilized. This error is the amount of time between the trigger that signals the start of the measurement and the moment when the instrument reaches the desired initial data point. This value can be taken from the written specifications listed in the device's manual or measured in the lab. This value should be reported in units of μsec +/- 10,000 (± 10 mseconds).
Reading	The averaged value of one or more samples. If the number of samples averaged per reading is one, the sample and reading have the same value. This is the value stored temporarily by the CSA and can average up to 1 million samples per reading.
Reference Conditions	The specific conditions present at the time calibration procedures were performed. These conditions can include: power level, beam diameter or fiber type, numerical aperture, wavelength spectral width, ambient temperature, pressure, and/or relative humidity. A reduction in measurement accuracy occurs as the conditions diverge from the reference.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Relative Accuracy	Accuracy of a measurement relative to another measurement. Many sources of error are systematic and can be eliminated when making relative measurements.
Relative Intensity Noise (RIN)	The inherent noise in laser amplitude that is a function of the average optical power produced by the laser; as current increases RIN decreases.
Repeatability	The degree to which a previous measurement can be duplicated.
Resolution Bandwidth (RBW)	The ability to resolve closely spaced λ in an optical spectrum analyzer. This term does not apply specifically to the CSA because we are relying on the line width of the tunable laser source to provide the necessary resolution. Line widths of most laser sources are on the order of hundreds of kilohertz or less than .001 picometers.
RMS Noise (Root Mean Square)	A statistical calculation where each value is squared, the mean of these squares is calculated, and the square root of that mean is then taken. In many systems, RMS noise is typically 1/3 times peak noise.
SCPI (Standard Commands for Programmable Instruments)	SCPI is the next evolution of the GPIB Communication protocol. This protocol initially started as the IEEE-488.1, which standardized mechanical, electrical and hardware protocols. IEEE-488.2 standardized error handling, data formats and status reporting. With the addition of SCPI, the command set has been further standardized. The CSA uses a SCPI-like command set. At dBm we felt that forcing the CSA to conform to the SCPI standard would make operation of the instrument unduly complex and cumbersome. We have a single command set that is not only used for the GPIB communication protocol but is also used for the RS-232 and Ethernet/IP protocol as well.
Sensitivity	The ability to measure optical signals of very low intensity. Sensitivity in an Optical Spectrum Analyzer is dependent upon resolution bandwidth. In both the dBm CSA and other Optical Spectrum Analyzers the measurement speed decreases in response to low intensity signals.
Slew Rate	The transition rate of power over time relative to the measurement range. In a sweeping TLS measurement system it manifests itself as the rate of change of the wavelength (nm/sec) of a source times the rate of change of attenuation over wavelength (Filter edge slope in dB/nm). The resulting comparison is Power vs. Time.
SMSR (Side Mode Suppression Ratio)	In a laser source the SMSR is defined as the ratio of the signal to the first side band of the signal.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SSE Ratio	The Ratio of the SSE compared to the Source Signal. Sources with higher SSE ratios in general will be able to measure higher dynamic ranges or in other words deeper well devices. SSE Ratio compares the SSE over an arbitrary band, usually 1 nm, to the total Power of the signal.
SSE (Source Spontaneous Emission)	In a TLS only a small portion of the signal is fed back into the laser, the residual ASE that is not suppressed in the cavity is called SSE. The effect of SSE is to limit the dynamic range of the overall measurement.
STSE (Source to Total Spontaneous Emission)	A characteristic of a TLS where there is a Source Spontaneous Emission is the integrated power of the signal to the integrated power of the spontaneous emission. The STSE ratio is similar to SSE ratio, but it is a more consistent way of comparing performance (because SSE ratio is dependent on the measurement aperture). STSE look at the overall performance of the measure source when measuring deep well devices. For broadband detection this is what actual performance you can expect.
System Speed Burst	Maximum data transfer rate, not including measurement time or processing time.
System Speed Real Time	Maximum data transfer, including processing time, measurement time and screen update or communication time.
Time Average	Average number of readings over a given period of time.
Trigger Jitter	Small spurious variations in a trigger signal, such as in pulse repetition rate, amplitude, frequency or phase, that stem from system or timing variations.
Uncertainty	The uncertainty in the calibration chain for the specified set of reference conditions. These uncertainties involve all of the error sources in that chain including those from NIST and from dBm's in-house calibration processes. (Note that in the CSA's specifications "accuracy" is used instead of "uncertainty"– adhering to common optical specification usage.
Wavelength Range	The range of wavelengths for which the device operates.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Considerations and Implications

This section contains information regarding the various measurement functions provided by the CSA, as well as some suggestions for choosing appropriate operational parameters. The CSA can be programmed to take massive amounts of data over extended periods of time--or to make a few measurements very quickly--but those particular settings may not be practical or useful for the application concerned. This section is designed to create awareness of the capabilities and limitations of the unit so expectations can be met and output is useful. The measurements are described in general terms and can be referred to whether the CSA is being used from the front panel or from a PC.

This section contains:

Technology Overview
Filtering
Continuous Sweep
Step Sweep
Time Sweep Measurement
Sweep Initiation
    Full or Partial Handshake
    Partial Handshake from the TLS to the CSA
    Partial Handshake from the CSA to the TLS
    Full Handshake--TLS Initiates
    Full Handshake- CSA Initiates
Triggering Considerations
    Edge Triggering
    Contributing Factors in Wavelength Error
        Sweep Nonlinearity
        Trigger Accuracy
Setting up a CSA Sweep
    Channel Setup
        Dynamic Range
        Wavelength Accuracy
        Channels
        Linear Gain
    Sweep Setup
        Measurement Resolution
            Dynamic Range
            Sweep Speed
            Measurement Speed
            Data Set Size
        Sweep Span
        Start Wavelength
        Stop Wavelength

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Technology Overview

The dBm Component Spectrum Analyzer can be used to measure and characterize components over a broad dynamic range and in a wide variety of applications. The CSA is capable of recording data in over 1000 channels and making a measurement every 10 microseconds. Data enters the instrument through dBm's proprietary Power Measurement Module attached to a channel card which consists of a detector, an amplifier, an A to D converter, a microcomputer and a storage system. power measurements can be made as a function of wavelength or time.

There are three basic types of measurements that can be performed using the CSA: continuous sweep, step sweep or time sweep. Each of these measurements can be initiated by the TLS (or other external device) or the CSA--and the user must specify which. Awareness of how the measurements are being taken and choosing parameters with those limitations in mind will result in the most useful information. Both the TLS and the CSA need to be set up before any measurements can be taken.

Filtering

Any time there is a filter in a circuit, there is a tradeoff between fast measurements and noise rejection. The CSA 201 and 202 precision measurement modules have been designed with an analog low-pass filter specific to each measurement range and a bandwidth that changes relative to the signal level. An additional filter can be switched on or off in the circuit. The bandwidth for the upper and lower measurement ranges are listed below:

Range	3 dB Bandwidth (Hz)	
	Filter Off	Filter On
+10 to -57dBm	7500	2500
-10 to -76 dBm	7500	2500
-30 to -80 dBm	250	250
-50 to -95 dBm	0.2	0.2

NOTE:

If higher bandwidth is desired, contact your dBm representative.

Continuous Sweep

Consider using this function when looking for the fastest measurement speeds or to reduce the impact of etalon-based optical noise. During the measurement setup the laser will be configured to sweep over a specific range in wavelength or frequency at a pre-determined sweep rate. The CSA calculates the wavelength as a function of the amount of time that has passed and the stated beginning wavelength. If the TLS and CSA are not properly synchronized or if TLS trigger latency and jitter are not compensated for, incorrect measurements will occur. (This situation can be remedied by adding the optional dBm Wavelength Reference Meter option to the measurement system. See the Wavelength Reference Meter section for more information.)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The CSA can sample every 10 microseconds and average up to 1 million of those samples per reading. For each channel the CSA can take >110,000 readings in a single sweep.

The required reading interval limits the number of samples to average. If the number of samples to average per reading takes so long that it overlaps the next reading interval, the number of samples is truncated. A continuous sweep measurement is useful for applications such as initial calibrations, optical alignment, component verification and final test.

Step Sweep

Consider using this function when dealing with a very large dynamic range of signal outputs or when a high level of accuracy is needed. All things being equal, a step sweep takes more time than a continuous sweep. During this measurement, the laser will step systematically and periodically to a higher wavelength throughout a designated range of wavelengths. After the laser has settled at each wavelength, the CSA will take measurements while the TLS stays for a time at that same value. When the measurements at that value are finished, the TLS will step up again and the CSA will collect data.

The CSA calculates the wavelength as a function of the number of steps taken, the step size and the start wavelength. If the TLS and CSA are not properly synchronized, then incorrect measurements will occur. (This situation can be remedied by adding the optional dBm Wavelength Reference Meter option to the measurement system. See the Wavelength Reference Meter section for more information.)

The CSA can sample every 10 microseconds and average up to 1 million of those samples per reading. Unlike a continuous sweep, the samples averaged to form a reading are being taken at the same wavelength as long as the laser has stabilized there. This factor increases the accuracy of the reading reported and can be useful for such applications as component characterization, specification verification and component qualification.

Requesting a large number to average provides an accurate value, depending upon the number of steps in the sweep, a large number to average may return an unreasonable sweep time. Similarly, if a small increment is specified for the step size with a large number to average, the subsequent required sweep time might be unreasonable.

Time Sweep Measurement

This function may be used when dealing with a large dynamic range of signal outputs and when trying to determine the stability of a device. In time sweep mode, the CSA can be thought of as an optical oscilloscope. During this measurement mode the light source remains set at one wavelength over a specified period of time. How many readings the CSA will take and how many samples to average for each reading may each be specified. The CSA assumes the wavelength is the same as the stated wavelength and that it remains stable throughout the measurement. It is important that the wavelength entered in the CSA be the same as that set in the light source so that the CSA channel cards can properly apply wavelength-dependent calibration factors to the measurement.

The CSA can sample every 10 microseconds and average up to 1 million of those samples per reading. Time sweep measurements are typically used for stability measurements, environmental testing, and to characterize the dynamic performance of switchable or VOA-type devices.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Sweep Initiation

The CSA looks for a trigger event to start the measurement process. Some TLS's don't have trigger functions. Other TLS's have unique trigger functions that require some conditioning. dBm Optics has developed solutions that enable the CSA to operate with these TLS's. Contact dBm for more information on how your TLS can be used in conjunction with the CSA.

Full or Partial Handshake

The simplest and most common triggering scenario is the partial handshake where the trigger is provided by the TLS. The term "handshake" refers to the sequence of triggers that are enabled during a measurement function. Each of these connections has the ability to trigger or signal an instrument about when to begin or end a measurement (or to convey information about current status). Depending on the TLS and the application, the TLS may be set up in a full or partial handshake scenario. A full handshake can be utilized with the TLS or the external device initiating all measurement sequences. The partial handshake is directionally defined and can run either from the TLS to the CSA or from the CSA to the TLS. This section describes the general functions of handshakes.

Partial Handshake from the TLS to the CSA

In this setup there is one-way communication from the TLS to the CSA. Therefore, some measurement parameters may include a time adjustment so that data is being recorded during the proper interval. In this scenario the time adjustment is associated with the TLS trigger. Time discrepancies are either due to inaccuracies in the triggering mechanism or jitter in the trigger itself. The TLS needs to keep offering a signal for the proper interval. In a typical step measurement the following signals and mechanisms take place:

1) The TLS steps to the next wavelength, stabilizes and then sends a trigger signal. (If the TLS triggers on step and not on stabilized output, the CSA must allow for a sufficient delay to allow the TLS to stabilize.)

2) When the CSA input receives the trigger signal from the TLS it begins taking measurements.

3) The TLS waits a preprogrammed interval of time and cycles to the next step.

4) If the CSA and TLS are not synchronized properly, the TLS may step to the next wavelength before the CSA is done measuring, or the CSA may stop measuring before the sweep in the TLS has ended. To avoid this, be sure to verify that the sweep parameters of the CSA and TLS are identical.

Partial Handshake from the CSA to the TLS

In this setup there is one-way communication from the CSA to the TLS. Some measurement parameters must include a delay so that signals and data collection are happening simultaneously. The CSA needs to know how much time to wait after telling the laser to step before it begins looking for data. A typical step measurement contains the following sequence:

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1) The CSA sends a trigger output indicating to the TLS that it is to step to the next wavelength.

2) The CSA waits a pre-programmed period of time (so that the laser can step and settle) and then begins taking measurements.

3) The CSA finishes it measurements.

4) The CSA sends its trigger again indicating that the TLS is to make its next step.

Full Handshake--TLS Initiates

In this setup there are triggers for both TLS and the CSA. The TLS initiates the measurement sequence and the CSA follows it. When measurements are taken using this setup, it is not necessary to program in delay times because the triggering itself indicates when measurements will happen. Once the TLS has completed its operation it will trigger the CSA to initiate its operation. When the CSA's operation is complete it will send a trigger to the TLS to initiate the next TLS operation and so on, until the measurement sequence is complete. This scenario is useful for step sweeping measurements.

The advantages to this communication scenario are that data will be collected as fast as possible and the efficiency will not exceed the instrument's ability to measure. New signals will not be sent and data will not be collected until both instruments are ready. A full handshake would be used only for step measurements. In a typical step measurement, the following triggers or signals are sent:

1) The TLS steps to the next wavelength, and when it has stabilized at the desired value it sets its output trigger line to **ACTIVE**.

2) The CSA input recognizes this trigger and begins taking measurements.

3) When the CSA has completed its measurements, it sets its own output trigger to **ACTIVE**.

4) The TLS receives this signal and switches its output to inactive. The CSA waits.

The TLS moves to the next step, and when it has stabilized it sets its output trigger to active again until it reaches the maximum wavelength.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Full Handshake- CSA Initiates

In this setup there are triggers for both the CSA and the TLS. The CSA initiates the measurement sequence. When measurements are taken using this setup, it is not necessary to program in delay times because the triggering itself indicates when measurements are happening. Once the CSA has completed will trigger the TLS to initiate its next operation. When the TLS's operation is complete it will send a trigger to the CSA to initiate the next CSA measurement operation (and so on) until the measurement sequence is complete. This scenario is useful for step sweeping measurements.

The advantages to this communication scenario are that data will be collected as fast as possible and the efficiency will not exceed the instrument's ability to measure. In other words, new signals will not be sent and data will not be collected until both instruments are ready. A full handshake is typically used for step or swept measurements. In a typical step measurement the following triggers or signals are sent:

1) The CSA sets its output as active, indicating to the TLS to step to the first wavelength.

2) When the TLS has stabilized at the desired value it, sets its output line active.

3) The CSA input recognizes this trigger, sets its output inactive and begins taking measurements.

4) When the CSA has completed its measurements it sets its output active again.

The TLS receives this signal steps again and the cycle repeats.

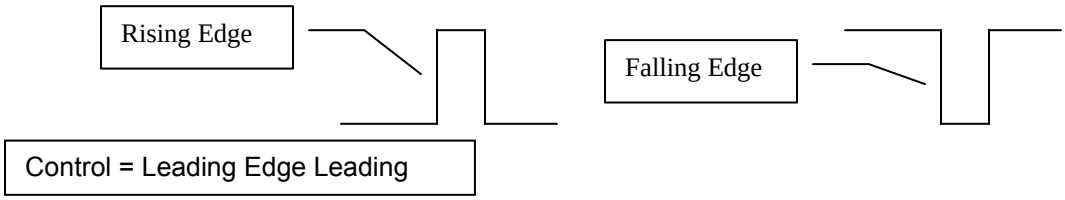
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Triggering Considerations

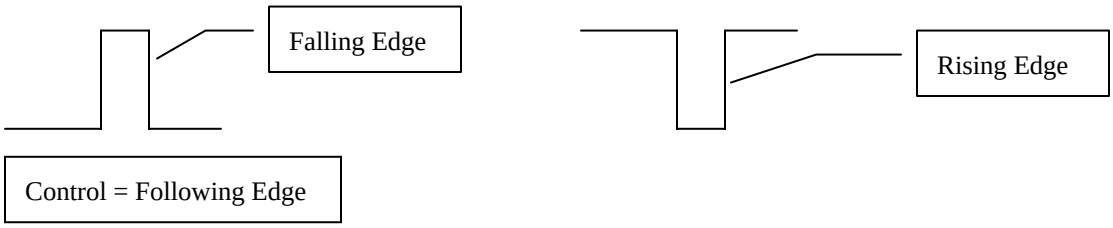
Edge Triggering

One way instruments communicate with each other is by sending electronic triggers (TTL). These signals are composed of both a leading and a following edge. When responding to a trigger, most instruments are activated as a result of the leading edge of the signal; in addition, instruments that send pulses to other devices usually generate trigger signals with precisely timed leading edges. The trailing edges generated by those same devices can have unpredictable variations. The edge of the signal that produces the actual trigger is referred to here as the control edge.

A signal whose control edge changes from lower voltage to a higher voltage is called a rising edge trigger. A signal whose control edge changes from higher voltage to a lower voltage is called a falling edge trigger. In the diagrams below the control edge is the leading edge:



A small number of instruments are set up such that the trailing edge of the signal is the control edge. It is important to verify which type of trigger your instrument is signaled by. See the diagrams below to view signals whose following edge is the control, notice the difference from the previous case:



When setting up the CSA and the TLS in both continuous and step modes, it is necessary to indicate whether the trigger is a rising or a falling edge. The control edge, whether leading or trailing, need not be specified. The following tunable lasers use these edge characteristics:

TLS	Edge Characteristic
Agilent 8164A	Rising
dBm 610/Koshin 601	Rising
New Focus 650/dBm 650	Rising

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Contributing Factors in Wavelength Error

Wavelength error is a critical issue in the continuous sweep mode. If the dBm Optics 401 or 410 Wavelength Reference Module is used, it corrects for wavelength errors created by the Tunable Laser Source trigger errors and nonlinearity. If not, the CSA relies on the stated sweep speed and time from trigger event to calculate the wavelength for sweeping lasers. In the step mode the fundamental limit of wavelength accuracy becomes the wavelength accuracy of the TLS. There are several factors that can contribute to wavelength error in a swept mode including trigger jitter, sweep nonlinearity and trigger accuracy.

Sweep Nonlinearity

Sweep nonlinearity during a continuous sweep refers to the unpredictable deviation in slope due to a variable rate of change in wavelength output from the TLS. Ideally the wavelength increases at a constant rate throughout the sweep. There are variations in the speed at which the wavelength increases over time. The dbm Optics Precision Wavelength Reference Module option corrects sweep nonlinearity.

Trigger Accuracy

Another factor to consider with regard to triggers is the timing accuracy involved. It is possible for a trigger, expected at time T_0, to occur either before or after that designated time. For example, if you were set up to do a sweep from 1561-1564 nm the first power measurement at T_0 would be recorded as being at 1561 nm. If the trigger signaling the CSA to begin measuring happens prior to T_0, then the first data point, though recorded as 1561 nm, may actually be at some smaller, unsettled value. If the trigger signaling the CSA happens after the TLS has begun sweeping then the wavelength at T_0 will be greater than expected.

To correct for this error, measure the delay. To measure the delay, a known wavelength artifact is needed (such as gas cell or a fiber Bragg grating). The difference between the expected reference wavelength and the measured wavelength is compared to determine the wavelength error offset. Contact the dBm Optics Applications Department for more information.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setting up a CSA Sweep

Two main areas control the setup of a complete measurement sequence: channels and sweep. The following sections highlight important information to keep in mind to optimize the measurement capabilities of the CSA.

Channel Setup

Channel setup is accessed by pressing the **CHANNELS** button on the front panel. Channel setup is the core of the CSA's measurement and analysis capabilities. Numerous parameters, traces and functions can be manipulated under channel setup.

Dynamic Range

In most applications it is important to maximize the dynamic range for each measurement. Typically, the optimum range for any given channel will be unique. (For example, a common setup for the CSA may be a 10 dBm to -57 dBm measurement range for Pref, -10 dBm to –76 dBm range for several measurement channels; and –30 dBm to –84 dBm range for an ORL channel.)

Wavelength Accuracy

For applications where wavelength accuracy is important, keep in mind that using different ranges can induce an analog bandwidth delay which will cause an effective offset of the wavelength. This offset changes based on the applied analog filtering and the selected range. In general, the lower the noise for the range, the more offset will be applied. When wavelength accuracy is important, it is best to use our A (10 dBm to –57) and B (-10 dBm to –76 dBm) ranges. This is because they have essentially no offset when configured with the analog filtering turned off. (Additional information on range bandwidth and offsets can be found in Application Note 19.)

Channels

The user may specify which channels will be active, their name, amplification range, the linear gain and the linear power offset. You need to assign which channels will be active for a measurement sequence; keep in mind that you may only configure channels which have been designated as active, and only active channels will record data. The physical channel port and the channel name do not have to correspond. Physical channel 2 can be named "Channel 57," or "Input," any other name the user wishes to assign.

Linear Gain

The linear gain is a value that determines the amplification percentage of all linear power measurements. This value is typically used to normalize all signals to the same power level. Linear power offset is a value that determines the correlation between photodiode current and output power. It allows the user to

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

manually adjust for dark current. Use this if you do not want to perform a dark current calibration.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Edit Channels...	Modify channel card measurement ranges; enable and configure traces;' add digital filtering (smoothing); set up trace math functions; edit channel names
Power Mode dB dBm mW	Set the CSA to measure and report data in relative or absolute power. Select whether absolute power is reported in dBm or mW (this changes the units in the CSA data files)
Power Mode Setup & Cal...	Set the units the CSA will report on the display screen; set up SplitCal functions
Filtering...	Allows control of digital filtering (smoothing) and analog filtering. Analog filtering is applied simultaneously to all measurement channels (choose on or off). Digital filtering (smoothing) is applied on a per channel basis.
Do Dark Current Zero	Initiate a Dark Current Zero. A Dark Current Zero corrects for drift of the internal photodiodes. If the Model 310 source shutter and the CSA optics are used, Dark Current Zero can be initiated directly—otherwise the light to the channel cards must be blocked. Perform a Dark Current Zero after startup and once the unit is warmed up. Perform Dark Current Zero regularly to ensure accuracy of measurements below 45 dBm.
Ultra Low Power Dark Cal	
Wavelength Correction Setup...	Enable/disable wavelength correction options (Model 401 and Model 410). When wavelength correction is disabled, the accuracy of continuously swept and stepped measurements are dependent on the accuracy of the TLS.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Sweep Setup

Sweep setup is the other main area which has implications on accuracy of the measurements. Sweep setup is accessed by pressing the **SWEEP** button.

Measurement Resolution

Measurement resolution can have an impact on dynamic range, sweep speed measurement speed and data set size:

Dynamic Range

Dynamic range can be affected due to averaging. In general, the more averaging the more dynamic range.

Sweep Speed

Resolution can affect sweep speed, but this is usually happens only when the laser is fast (100 nm/sec) and the desired resolution is greater than 1 pm.

Measurement Speed

Measurement speed can be affected when many calculations are required for a measurement like PDL or Trace Math. As data sets become large, there are more calculations that must be performed and this can cause a delay in completing a sweep. This becomes more prevalent as resolutions approach 1 p.m.

Data Set Size

The CSA measures fast, has the capability of generating multiple traces for each channel, and can be configured with any number of channels. For these reasons it is typical that multi-megabit files are created in a few seconds. Transferring this data can become the pacing factor in many systems.

Sweep Span

It is recommended to keep the sweep span to the shortest length that will accomplish the measurement goal. This will keep sweep time to a minimum.

Start Wavelength

This value, reported in nanometers, informs the CSA what the wavelength at time of trigger during a continuous and step measurement will be. During a time sweep measurement this value is called wavelength and remains constant throughout the scan. It is important that the proper wavelength be specified for time sweep measurements so that the correct wavelength compensation can be applied to the measurements.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Stop Wavelength

This value informs the CSA when to stop measuring; that is, what the wavelength will be at the end of a continuous sweep measurement, or what the wavelength of the last step will be for a step sweep measurement. This value does not exist for a time sweep measurement, as the wavelength (or frequency) remains constant throughout the scan. The CSA subtracts the start wavelength from the stop wavelength to determine the span length, and in a step measurement also divides the span length by the step size to evaluate how many steps it will be taking.

Sweep Rate

Sets the rate of change of wavelength in nm/sec for a continuous sweep measurement. There is no sweep rate for a time sweep or step sweep measurement.

Reading Interval

This value determines how much time there will be between each measurement reading.

Reading Spacing

This value, in nanometers, determines how much distance there will be between each wavelength or frequency reading for a swept measurement.

Step Size

This value, in nanometers, determines the difference between each reading for a step measurement.

Start

This parameter defines whether the CSA will begin measuring immediately upon receiving an internal command or wait until it is externally triggered to begin making its first measurement. Choosing the use trigger function instructs the CSA to begin measuring after it receives a pulse from an external device. Clicking on the immediate function causes the CSA to wait for the start button to be pushed on the front panel or for the appropriate begin sweep SCPI query. This is indicated on the front panel as immediate or trigger.

Number of Readings

This value, needed only for a time sweep measurement, determines the number of readings that will be taken during the measurement.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Timing

This selects whether reading interval is used or continuous timing is used in a time sweep measurement.

Triggers

The CSA has 2 trigger inputs called **MEAS START** and **IN1.** The CSA has 3 trigger outputs called **MEAS COMPLETE**, **OUT1** and **OUT2**.

Maximum Number to Average/Number to Average

A value may be entered for the **NUMBER OF SAMPLES TO AVERAGE** for each reading or the CSA may be requested to calculate the maximum value based upon other designated parameters.

The CSA averages between 1 to 1,000,000 samples per reading. When the **MAXAVERAGE** function is chosen for a continuous sweep, the CSA calculates the **MAXIMUM NUMBER TO AVERAGE** by the following:

Maximum Number to Average = Reading Spacing/(Sweep Rate * 10µs)
(Where 10 µs is the minimum sample time.)

The **SWEEP RATE**, **READING SPACING** and **GAIN RANGE** limit the calculated **MAXAVERAGE VALUE**.

When the **MAXAVERAGE** function for a time sweep measurement is chosen, the CSA calculates the **NUMAVG** by the following:

Maximum Number to Average = Reading Interval/10µs
(The absolute Maximum Number to Average is 1,000,000 samples.)

NOTE:

These formulas are approximate. There are situations where the minimum sample time is 10.5 µsec. The exact timing used by the CSA is displayed in the sweep status area at the top of the display.

Filespec

A filespec may be specified for each measurement mode using the SCPI :CONFig command. If a filespec is specified, measurement data will be saved to that file after each sweep. If the file already exists, the file will automatically be overwritten. The file may contain data from one sweep only.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

General Mathematical and Timing Considerations

If the specified wavelength span is not an integer multiple of the step size, then the number of readings or the number of steps will be truncated.

For instance, in a step measurement, if the span is from 1500-1530 nm and the requested step size is 10 nm, then 4 readings will be made at 1500, 1510, 1520 and 1530. If the requested step size is 11 nm, then only 3 readings will be made at 1500, 1511 and 1522.

The reading interval, as specified in a time sweep measurement or as calculated by the CSA for a continuous sweep or step sweep measurement, must be a multiple of 0.5 μs-- otherwise the interval time will be altered.

The CSA instrumentation produces timing waveforms that are based on a programmable counter-timer with a resolution of 0.5 μs, so not all reading intervals are supported. In time sweep measurements the desired reading interval may be specified.

The first reading time stamp is not exactly the same time as the input trigger; it is set to the actual measurement time.

The CSA determines the center time of each measurement, giving the most accurate representation of the time. If the CSA is set up such that there is only one sample per reading, then the reading center time of the first reading is 3 μs after the time of the trigger. Parameters such as number of samples per reading, measurement range and sweep rate can all affect the time or wavelength of the first reading. See the diagram below for a more detailed description of measurement timing.

What happens when the specified samples to average per reading is too large for the specified reading spacing and sweep rate?

In this case, the number of samples is truncated so the measurement can be taken at the specified reading spacing and sweep rate.

Setting up the TLS or Other Source

An optional (second) GPIB control card may be installed in the CSA for control of external instruments such as a TLS. The following tunable laser sources are currently supported: Agilent 81xx0 A/B; New Focus 64xx and 65xx; dBm Optics 610 and 650.

The TLS is selected under **TUNABLE LASER SETUP**. The **TLS GPIB ADDRESS** is specified first, then **SELECT TLS** is pressed. When automatic TLS control is enabled, many of the following items are automatically set.

Minimum Wavelength

Determine the lowest wavelength the laser is capable of and enter this value into the user interface TLS Setup Dialog Box or through the SCPI commands for :CONFig:TLS. This

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

value for the TLS is not the same as the Start Wavelength of the sweep. This number is the minimum specified wavelength of the TLS.

Maximum Wavelength

Determine the highest wavelength your laser is capable of and enter this value into the user interface TLS Setup Dialog Box or through the GPIB commands for :CONFig:TLS. This value for the TLS is not the same as the Stop Wavelength of the sweep. This number is the maximum specified wavelength of the TLS.

TLS Output Connection

This parameter indicates which BNC Input on the CSA the output line from the TLS is connected to.

TLS Input Trigger Designation

Specifying rise or fall determines what the TLS is expecting at its input port in order to begin sweeping or to make its next step. A TLS can be expecting either a rising or falling trigger. To determine a rising or falling trigger, consult the TLS's user manual.

Initiation Destination

This parameter identifies whether the TLS will trigger first or if the CSA will trigger first in full handshake operation. Selecting **TRIGATSTART** will cause the TLS to send out an initial trigger. Choosing **NOTRIGATSTART** will cause the CSA to trigger first.

TLS Input Connection

This parameter indicates which BNC Output on the CSA is in use for connecting to the TLS input.

TLS Output Trigger Designation

Choosing rise or fall specifies the form of the TLS output signal. As with the previous parameter, the relevant value depends upon whether the trigger edge is rising or falling. rise and fall indicate whether the CSA becomes active after it detects a rising signal or a falling signal.

In addition to choosing rise or fall, information needs to be provided regarding whether the TLS signal is an indication that it is stable at its next step or if it is in the process of moving to the next step. If the CSA is not automatically triggered by a signal then it can be set to trigger after a set delay. Enter that delay in milliseconds. This signal connects to the CSA's digital input meas start.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Real-Time Referencing

Splitter WDSR and PDSR

Wavelength Dependent Split Ratio and Polarization Dependent Split Ratio are two primary considerations for making a good real-time reference. If the wavelength of source light doesn't change, WDSR is less of an issue, but many devices require referencing over many different wavelengths (and the same is true for PDSR). In general, it is easier to correct for wavelength than to correct for polarization, so dBm Optics' approach is to optimize the splitters for the best PDSR performance. Because this means that the WDSR performance is compromised, the WDSR is corrected with a Split Ratio Correction Table (a table of split ratios vs. wavelengths) known as the Splitter Cal. The initial correction is done at dBm Optics and the customer may subsequently adjust the correction factor as system configurations and setups demand.

To make high-quality Insertion Loss measurements, a good real-time reference is necessary. From this basic measurement there is a myriad of supplemental measurements that are looked at. For example, measuring Insertion Loss over wavelength of a multiplexer will yield the following parameters: center wavelength, bandwidth, cross talk (both adjacent and total) and ripple. Making good Insertion Loss measurements is the key for most optical figures of merit. These parameters will be discussed in more depth later in this manual and in supplemental application notes. Additional information is also available in Fiber Optic Test and Measurement, Dennis Derickson, Editor, Prentice Hall.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Wavelength Reference Option 401 and Precision Wavelength Reference Option 410

The Wavelength Reference Option may be used in channel 6 of the CSA. It is used to correct deviations in wavelength which can occur due to timing or to correct wavelength inaccuracies in a Tunable Laser Source (TLS). It can only be used in continuous or step sweep modes. The wavelength reference card is calibrated from 1525 to 1630 nm. Part of the sweep must fall within this range for the card to successfully compute corrected wavelengths. If the card is not able to successfully compute corrected wavelengths, error messages will be displayed when operating from the front panel. (See the following section for a list of possible error messages.)

Wavelength Reference Options 401 and 410 operate with the following limits:

START ≤ **1627.5 nm**
STOP ≥ **1526.5 nm**
STOP – START ≥ **2.000 nm**
STEP SIZE ≤ **0.025 nm**

Several different wavelength reference gas cells are available to verify wavelength accuracy of the system. These are available from dBm Optics.

Wavelength correction is performed as long as the starting wavelength is below 1624 nm and the ending wavelength is above 1526 nm. Acceptable sweep rates are between nm/sec and 100 nm/sec. The maximum sweep width is 1280 to 1630 nm.

The maximum step rate is 100 steps/second (10 ms/step). The step settling time is 100 μs minimum.

When using the wavelength reference, the analog filter (accessible under the channel button) is turned on when a step measurement is specified.

Start is the wavelength at the time of the TLS trigger in continuous sweep mode.

Start is the first wavelength in step mode.

Front Panel Operation for Wavelength Reference

The wavelength reference may be enabled or disabled from the from panel by pressing the **CHANNELS** button and then toggling the **WAVELENGTH CORRECTION** softkey to either **OFF** or **ENABLED**. Enter the **WAVELENGTH CORRECTION SETUP…** softkey panel to configure the mode of the wavelength correction. Two types of wavelength correction are possible: gas cell or wavelength reference.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SCPI Operation for Wavelength Reference

:SYSTem:WReference:CONFig?

Only accepted when Wavelength Reference Module is installed.

:SYSTem:WReference:CONFig <Enable|Disable>

Enables/disables use of a Wavelength Reference channel.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Front Panel Error Messages for Wavelength Reference

NOTE:

Some of the error messages may be changed or may be improved as front panel firmware is upgraded. The following error messages are applicable for front panel firmware Versions >= 0.9.5.

WaveRef Card Comm Err	In versions ≤ 0.9.5, there is a bug in which a step size too small will generate this message. This indicates an internal communication error with the **WAVEREF** card.
WaveRef Compute Err	Error in **SWEEP** setup parameters.
Need FPGAver ≥ 23	Hardware upgrade required for **WAVEREF**. See [**SYSTEM**] [**FIRMWARE VERSIONS**] to see which **FPGA** firmware version is currently installed.
WaveRef Sweep Span too small	**STOP-START** wavelength is too small.
Measure Idle Timeout	During post-processing of **WAVEREF** data, one of the cards in the system is still busy when it should not be, preventing the processing from completing.
WaveRef ISA bus Err	Internal hardware error.
WaveRef Overflow Err	Initial optical wavelength signal into the **WAVEREF** card could not be locked, check signal level into **WAVEREF** card.
WaveRef #Readings Err	The number of readings computed by the **WAVEREF** card does not match the sweep setup parameters or is greater than 112,000. Check to be certain that the most recent **WAVEREF** firmware version is installed; check for proper input signal to the **WAVEREF** card; or check sweep setup parameters.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

WaveRef Wavelength Bounds Err	**WAVEREF** card error in computation of wavelengths. Check input signal to **WAVEREF** card; or check sweep setup parameters.
WaveRef Cal Data Err	Calibration data error in **WAVEREF** card—contact factory.
WaveRef Param Err	Error in **SWEEP** setup parameters.
WaveRef No RefX Data	Initial optical wavelength signal into the **WAVEREF** card could not be locked—check signal level into **WAVEREF** card.
Start Wavelength Err	Improper value used for start wavelength.
Er71 May Need to Upgrade Wref Firmware	**WAVEREF** card requires a firmware upgrade.

Analog Output Option 222

The 222 may be used in any of the six 2004 card slots. The analog output is the SMC connector located below the optical input connector on the 222. The 222 has the same optical performance specifications as the 202.

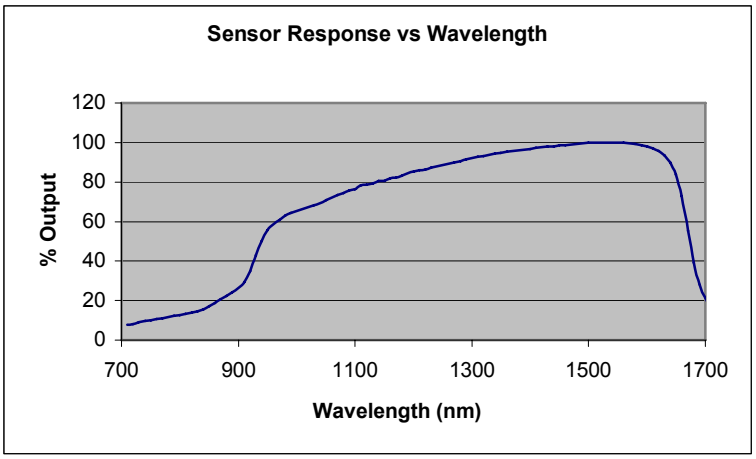
The analog output is always on. Its output is directly proportional to the optical input signal. For each of the fast ranges selected (see Front Panel Operation: Measurement Speed) the output will range from 0 to 2V (4V maximum). 0 V corresponds to no optical power input and 2V corresponds to a full power input signal for that range. The bandwidth of the analog output is the bandwidth of the fast range selected and is shown in the following table.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3 dB Bandwidth of the Analog Output

Fast Range	3 dB Bandwidth (Hz)	
	Filter Off	Filter On
+10 to -57dBm	7500	2500
-10 to -76 dBm	7500	2500
-30 to -80 dBm	250	250
-50 to -95 dBm	0.2	0.2

The analog output is not calibrated therefore its output will follow the optical sensor's response over wavelength. Following is a typical response curve for the sensor's output vs. wavelength.



For example, if the signal out of the analog output is 2 volts at 1550 nm, the same optical input power at 1100 nm would result in an analog output of 2V *0.76 or 1.52 volts.

Some possible applications for using the analog output are:

1) Viewing the optical signal in real time on scope or chart recorder

2) Positioning systems utilizing an optical signal for min/max

3) Polarization peaking

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Optical Return Loss (ORL) Option 940

ORL Summary

ORL is one of the basic optical measurement parameters for components in an optical system. It is a metric of how much light that goes into a component gets reflected or returns back upstream in the optical path. Reflected light can cause significant problems in optical systems by creating standing waves or by interfering with sources in the system—all of which are sources of noise. Isolators are designed to combat the problems associated with back reflections, but there are other issues associated with isolators (such as insertion loss and PDL). In general, it is better to have components with low back reflection than try to compensate.

The CSA is designed to be able to test ORL as a normal part of characterizing components. It requires the 940 Optical Return Loss Option and the 301 Power Reference Module. The 940 consists of a standard 202 Module Optics and additional software. The integration of the measurement with the standard sweeping of the CSA can be turned on and off, so this option can also act like a regular Insertion Loss channel when ORL measurements are not desired.

A CSA equipped with the **PREF** option and one channel to measure optical power are needed to perform ORL measurements. The factory default is for the ORL channel card to be installed in channel 4; however, it may be installed in any available slot in the CSA. The slot that the ORL channel card is installed in is specified under **APPS, ORL… , ORL CHANNEL**. (Additional information is available in dBm Optics' Application Note 18 and Application Note 30.)

NOTE:

Do not swap channels with CSA power turned on.

NOTE:

Inspect and clean all fibers before connecting.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ORL Calibration

ORL requires calibration before any valid measurements can be made. It is a three-step process: 1) set up the sweep; 2) perform a zero sweep; and 3) perform a gain ref sweep.

1) Turn on the laser source and the CSA and let them warm up for their specified warm-up times.

2) Connect the CSA ORL (or AUX A in some cases) output port to Channel 4 (or other measurement channel if ORL measurements are to be made from a different channel).

3) Connect the **TLS IN** input on the CSA's front panel to the TLS's optical output.

4) Connect the **PREF** output of the CSA to the **PREF** input on the CSA (Channel 5).

5) Press the **CHANNELS** button on the front panel of the CSA.

6) Toggle the **POWER MODE** softkey to select dB.

7) Perform a **DO DARK CURRENT ZERO** function.

8) Configure the sweep. This should be the same sweep parameters that will be used for testing the device.

9) Press the **APPS** button.

10) Press the **ORL…** softkey.

11) Set the ORL channel to Channel 4 (or the same channel used Step 2, above.)

12) Connect a zero back reflection artifact to the **TO DUT** output on the CSA. This can be accomplished by using a mandrel wrap (fiber wrapped around a #2 pencil eight or more times) for regular SMF-28 fiber. (Other methods for zero back reflections are available. Contact dBm Optics for more information.)

13) Press the **START/STOP** button.

14) Press the **EDIT/VIEW ORL ZERO REF DATA…** softkey. The data should read a low value. (Typical values with a good zero back reflection artifact should be in the –50 to –70 db range.)

15) When satisfied with the data, press the **SAVE ORL ZERO REF SWEEP DATA TO FILE** softkey.

16) Remove the mandrel wrap and put in a known back reflection artifact on the **TO DUT** output. A typical back reflection artifact is a regular flat connector. The value of a good, flat, clean SMF-28 FC/PC connector is -14.7 dB. (Other reflection artifacts are available. Contact dBm Optics for more information.)

17) Press the **START/STOP** button

18) Press the **EDIT/VIEW ORL GAIN REF DATA…** softkey. The data should be approximately 17 or 18 dB due to the additional loss of the splitter in the return signal path.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

19) Press the **REFERENCE REFLECTANCE** softkey and use the keypad to enter the value of the back reflection artifact into the field.

20) When satisfied with the data, press the **COMPUTE & SAVE ORL GAIN REF SWEEP DATA TO FILE** softkey.

21) Turn ORL to the **ON** position. (This option is found by pressing **BACK…** to return to the previous soft panel menu.)

22) Press the **START/STOP** button.

23) Trace 4 should read very close to -14.7 dB. (If it does not, check for cleanliness of the fiber endface and loose connectors in the system. Then return to Step 12 above.)

24) Remove the zero back reflection artifact from the **TO DUT** path. This concludes the ORL calibration process.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Taking an ORL Sweep

1) Turn on the Tunable Laser Source and the CSA and let them warm up for their specified warm-up times.

2) Connect the CSA's **TO DUT** output to the device under test's input and the device under test's output to **CHANNEL 1** of the CSA. (If **CHANNEL 1** does not have a card installed, choose another channel and record this channel number location).

3) Connect the **TLS IN** input on the CSA to the Tunable Laser Source's output.

4) Connect the **PREF OUTPUT** of the CSA to the **PREF INPUT CHANNEL 5**.

5) Connect the CSA's ORL output (or AUXA on some units) to the ORL measurement channel (normally channel 4).

6) Press the **CHANNELS** button located on the front panel of the CSA.

7) Select dB under **POWER MODE**.

8) Configure the sweep (insert link here).

9) Perform ORL calibration.

10) Press the **APPS** button.

11) Press the **ORL…** softkey.

12) Select ORL **ON**.

13) Set the **ORL CHANNEL TO CHANNEL 4** (or set it to the recorded channel from Step 5).

14) Press the **START/STOP** button (located on the front panel of the CSA) to perform the ORL measurement.

15) Select the trace recorded in step 5 above. This is the ORL of the device.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Calibration

The CSA measurement is traceable to national standards and physical constants; those national standards are maintained by the National Institute of Standards and Technology (NIST) in the United States. Calibrations of our transfer standards are performed by NIST at regular intervals. Calibration certificates give specific information about the tests that were performed and the traceable instrument or device that was used in the calibration process. Additional information is available through dBm Optics. Please feel free to call us (800) 944-7885 (toll-free in the U.S.) or 303-464-1919 for more details.

Optical Wavelength Calibration

The optical calibration of the CSA is based upon both physical constants and transfer standards. Physical constants provide the basis for all optical measurements in the system, whereas wavelength is cross-referenced to transfer standards. In the base system, wavelength measurement is dependent on the accuracy of the TLS in whatever mode you are operating. Refer to TLS specifications for accuracy. If you require more accuracy than the TLS can provide, two different Wavelength Reference Module options are available. Contact dBm Optics for more information.

Dark Current Calibration

Dark current calibration is a routine process that adjusts and sets the zero level of each gain range based upon the dark current present in the photodetector. All instrumentation has drift, and photodetectors have an additional characteristic called dark current. Every instrument that utilizes a photodetector experiences this phenomena and the CSA is no exception, although the CSA's precision temperature control makes this effect very small. Therefore, "zeroing" (or dark current calibration) is recommended. Periodic zeroing to compensate for this drift and the dark current offset is especially important for very low-level signals. When measuring in the bottom 10 dB of any particular range (or measuring light levels less than –45 dBm), dark current calibration becomes essential for obtaining accurate measurements. The 310 (the optional Automatic Dark Calibration Module) allows for a simple one-button-press dark current calibration. This is a fast and easy way to compensate for the drift and calculate the dark current offset.

The operational environment also plays an important role in the calibration process. Temperature changes, vibration and electrical noise all can effect measurements and calibration. If your environment has unusually large variations in temperature, vibration, or excessive electrical noise, more frequent zeroing may be necessary.

Optical Power Calibration

Yearly measurement module recalibration is recommended in order to maintain traceability and optimal measurement performance. Recalibration can be disruptive, particularly in production situations. Because dBm is committed to our customers' success, we offer several service options. We can provide many on-site and at-factory services including upgrade and repair. The CSA has also been developed with a modular design in order to maximize uptime and serviceability.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Photodiode Measurements

Model 280

This is a single-input photodiode card. This card is identical to the Model 288 (below) except that the hardware only provides for a single input. The card can measure input current or voltage.

Model 288

This is a single-ended, 8-input photodiode card. The card can measure input current or voltage.

Initial Firmware Release

The initial firmware release for the PD cards will be marked with a version number of 00.08. Do NOT attempt to upgrade the instrument with firmware versions <= 2.50 or else the PD card firmware may be overwritten. This initial release only supports ranges 3 to 7 below (marked with *).

Input Ranges

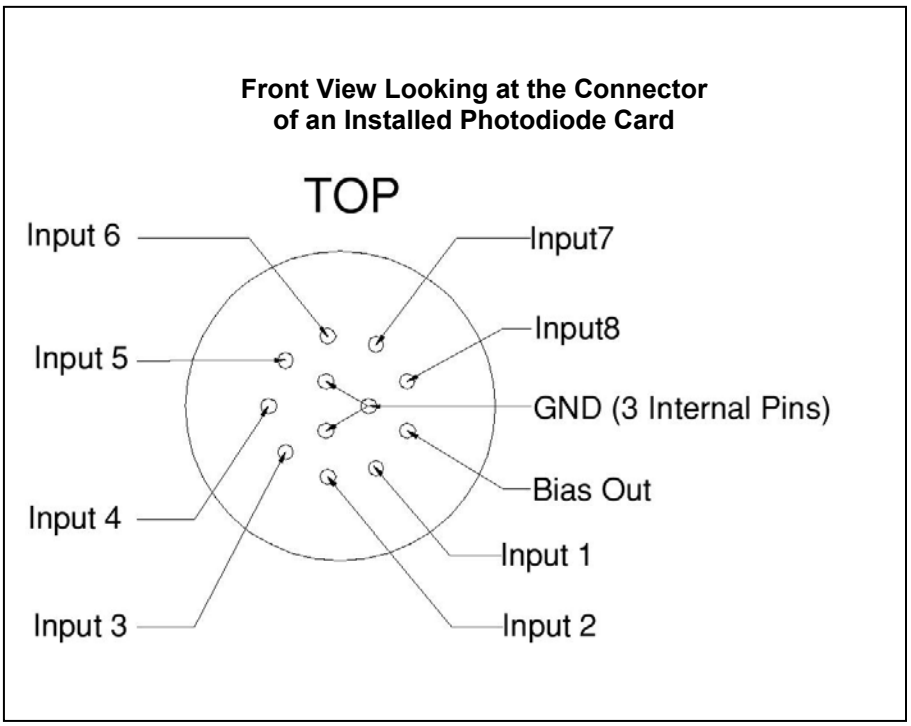
Current	Rng1	100 mA
	Rng2	10 mA
	Rng3	1 mA *
	Rng4	100 µA *
	Rng5	10 µA *
	Rng6	1 µA *
	Rng7	10 nA *
	Rng8	10 nA

Voltage	10.0 V

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Input Select

The diagram below shows the pin-out of the 280 and 288 connector (Input 1 to 8). Model 280 is hardwired for a single input (Input 1), regardless of software settings.



The mating part for this connector is manufactured by Hirose (part number HR10-10P-12P (110-0025-7) can be purchased from a number of different sources. (A common supplier that carries this part is Digi-Key, part number HR-102-ND).

Input Polarity

Since the inputs are single ended and the A/D converter is unipolar, the user must specify the polarity of the incoming signals.

Current	Common Cathode
	Common Anode

Voltage	Positive
	Negative

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Bias Voltage

The common input connection is driven to this voltage (relative to the input select input) and is typically used to bias a photodiode. When the bias voltage is set to 0.0 Volts, then the common input connection is shorted through a relay to ensure precise 0.000 Volt bias. Bias voltage is set to 0.0 for voltage input mode.

Bias Voltage Output (relative to inputs)	-10.0 to +10.0 V

Output Units

The following units are used regardless of the setting of “absolute units” on the instrument.

In current mode the units are mA.
In voltage mode the units are V.

If Power Reference is on (power mode dB) then a *divide* operation is performed (not subtraction) and the units are as follows.

The Power Reference card is a normal channel card.

In current mode the PD card units will be A/W.
In voltage mode the PD card units will be V (no Pref is performed).

If the Power Reference card is anything other than a normal channel card, then results will be undefined for the PD card.

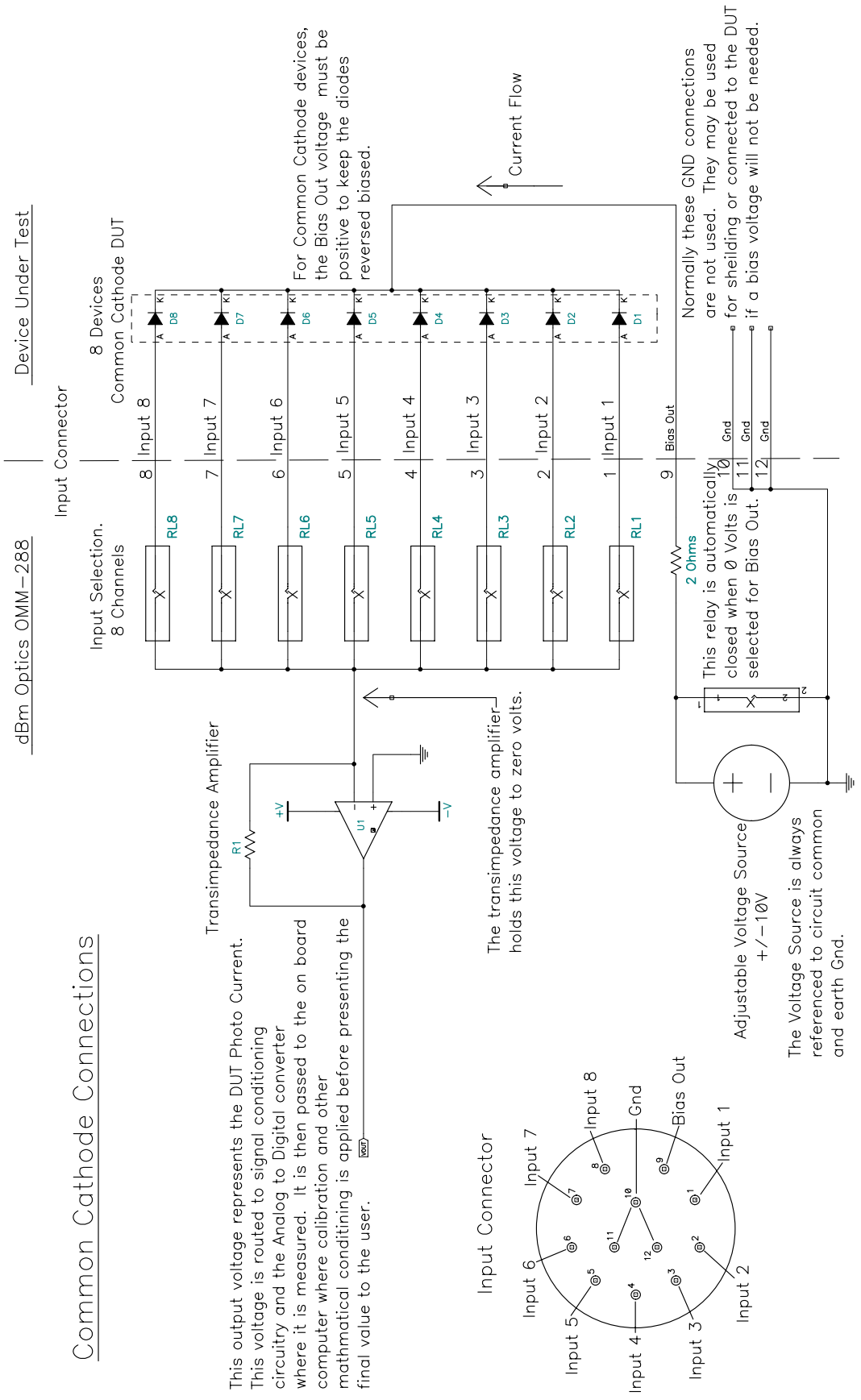
Stitching

Stitching ranges are NOT defined and will not work for the PD cards. This is because the transition levels between ranges are hardcoded in dBm units, not mA or V units.

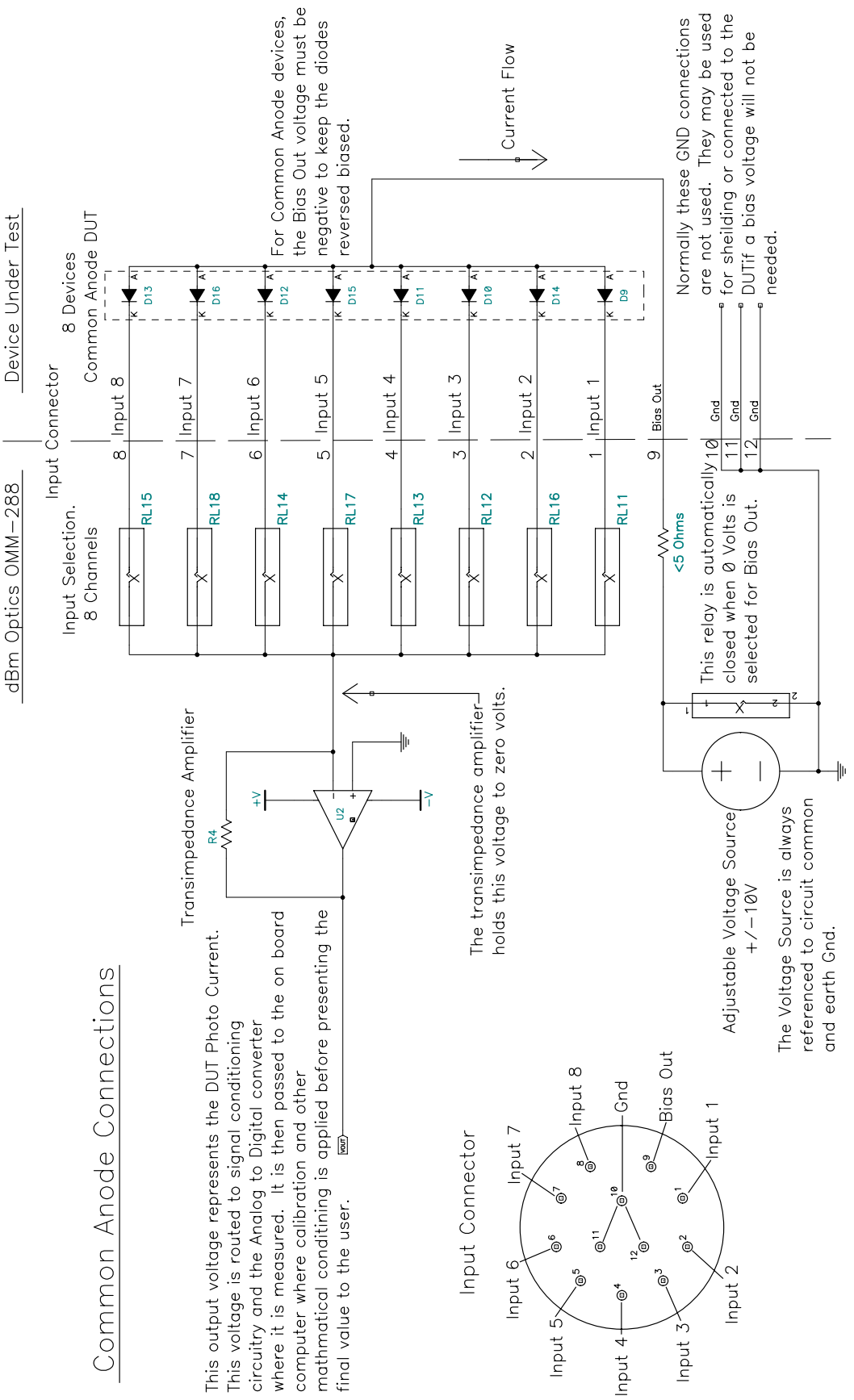
Measure PD Offset

The Measure PD Offset executes a time-mode measurement on the channels currently turned on. It is a single-sweep-time-mode measurement of 100,000 samples in 1 reading. If the shutter option is installed, the shutter is closed prior to the measurement, and restored after the measurement. Data from the sweep is used to update the linear offset for each PD card in the sweep. Calculate is automatically turned on if it was off. This is what a user would use to measure 'dark cal current' of a PD device connected to the PD card. To view the results of the measurement, just look at the linear offset for each channel in the Active Channel Setup view.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

(This page left intentionally blank.)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Operations from a PC

SCPI–like commands are used to control the CSA remotely via the Ethernet, GPIB or RS232 ports. When operating the CSA remotely, the front panel is operational and available for inputs. Any key-presses will change the CSA configuration unless a local lock out is performed. To initiate a lockout use ***LLO**. To remove the lockout, use ***GTL**. All commands are in human readable ASCII format and return a human readable ASCII formatted response (although some measurement data may be in binary format). Commands are terminated by a user-specified termination sequence (carriage return, line feed).

This section includes:

Getting Started
Device Dependent Commands
Common Commands

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PC Operation Overview

GPIB Cable Length

The length of the GPIB cable between the CSA and the PC is a significant determinant with regards to data transfer rates. Therefore, it is recommended that the shortest practical cable length for the setup and application be utilized. Research has demonstrated that given a total cable length of 2 meters or less, data transfer rates are 8 megabytes/second. With a total cable length of 3 meters or less, data transfer rates drop to 5 megabytes/second. The CSA contains a half-meter of internal cable.

CSA SCPI-Like Commands

SCPI–like commands are used to control the CSA remotely via the Ethernet, GPIB or RS232 ports. All commands are in human readable ASCII format and return a human readable ASCII formatted response, although some measurement data may be in binary format. Commands are terminated by a user specified termination sequence (carriage return, line feed) character(s) and executed one at a time.

CSA Firmware Version

This document corresponds with CSA Front Panel Firmware Version 3.98.

Command Responses

All commands return a response. The end of all responses contains a two-character status string. Five status strings are currently defined and have the following meanings:

=> The command completed successfully.

?> The command was not understood and not executed.

!> The command was understood but failed; bad parameters could be the cause.

~> A possibly lengthy command (such as :meas?, :sweep:step? or :sweep:continuous?) has begun execution.

NOTE:

This response is *not* the end of the command, only an acknowledgement that the command was received and understood.

<> The command executed with performance less than specified due to a configuration conflict.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Channel Addressing

Measurement channels are specified by prefixing a chassis identifier to a channel number. Chassis are specified using brackets and one or two digits from 0 thru 17. For example, [0] specifies the main chassis; [1] specifies the first extender chassis; [2] specifies the second extender chassis and so on. Channel numbers are specified using a one- or two-digit number from 1 thru 64. A complete channel address contains both the chassis ID and the channel number—for example, [2]33 refers to the 33rd channel in extender chassis 2. The chassis identifier may be omitted; and, if so, the chassis defaults to 0, the main chassis. For example, 4 specifies channel 4 of the main chassis.

Channel Lists

Channel lists are a sequence of channel addresses separated by commas and or dashes. The comma is used to continue a list with the next address and the dash is used to continue the list with all the addresses between the last and the next addresses.

NOTE:

A dash *cannot* be used to span chassis. Additionally, the keyword **ALL** is used to specify all the channels present in a chassis and the chassis identifier [**ALL**] is used to specify all chassis. These two used in combination, [**ALL**]**ALL**, can be used to specify all channels in the system.

Drives, Filenames and Extensions

Many of the commands read or write files as part of their operation. These commands take a `<filespec>` parameter. This is a DOS-style specification with a drive:filename.extension. Valid drive letters are “C” for the internal hard disk and “A” for the floppy disk. Both the drive and extension are optional. If a drive is not specified, the internal hard disk is used. If an extension is not specified then an appropriate one is assigned based on the command.

NOTE:

If a drive letter is specified, the filespec must be enclosed in quotes because colons are used to separate command arguments.

Examples of valid file specifications are:

Test1.dat	A file stored on the hard disk.
“C:test2.dat”	A file stored on the hard disk.
“A:test3.dat”	A file stored on the floppy disk.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

test4 A file stored on the hard disk.

The standard extensions for various types of files are:

.dat	Data files
.sst	Configuration files
.tif`	TIFF image file
.bmp	Windows bitmap image file
.txt	Text files
.csv	Comma Separated Value files
.bds	BDS (Binary Data Set) files

Wavelength and Frequency

Many commands accept wavelength or frequency as a parameter even though the parameter is identified as **<waveLen>**. The interpretation of the actual parameter value is based on the units selected (nm or THz).

<TraceSpec>

<TraceSpec> Traces are specified in the following format:

[chassis]channel.trace

chassis 0 = CSA

1..N = Extender Chassis

channel 1 to 6 CSA
1 to 24 Model 2124 Extender Chassis
1 to 60 Model 2160 Extender Chassis

trace 0 Base Channel Data, IL
1 Saved Trace
2 PDL Trace
3 Maxhold Trace
4 Minhold Trace
5 A-B Math Trace
6 GasCell Wavelength Error Trace

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

7	ITU Channel Average of IL
8	Reserved
9	ITU Channel Average of PDL
10	1st Difference Trace
11	Sweep Linearity Trace
12	PDCW
13	PDBW
14	CD, Chromatic Dispersion
15	GC, Group Delay
16	PMD, Polarization Mode Dispersion
17	TDA, Time Sweep Analysis

Comma-Separated Variable (CSV) Format

This format will allow simple data use by programs such as Excel. The format is ASCII. A header at the top is optional.

Binary Data Set (BDS) Format

Measurement results may be reported as binary data to reduce storage/communications requirements and increase throughput. Binary data may be directed to a file on the CSA for later retrieval or sent immediately back to the originator of the measurement over the communications channel. The binary data consists of a stream of bytes with no embedded “line terminators.” The byte stream is logically divided into 3 parts—a header, the measurement sweep values and the measurement data values.

To interpret the data, the PC program can either read in the data directly, or the user can utilize one of the utilities provided with the CSA, such as SCPIComm or the LabView driver. See application notes for more information regarding these programs.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Binary Data Format (Version 3.0)

Byte Offset	Number of Bytes	Name	Restoration Type	Description
0	1	Version	Integer*	Identifies the version of the format contained in the file.
1	1	Sub-Version	Integer*	With version 3 a subversion number was added, e.g. 3.x
2	1	Endian	Integer*	Identifies the byte order of multiple byte fields: 0 = Little Endian; 1 = Big Endian
3	1	Reading Units	Integer*	Identifies the engineering units (power) that are associated with the reading values [defined as enum eUnitsPwr]: 0 = (dBm_pwr) 1 = Watts (W_pwr) 2 = mWatts (mW_pwr) 3 = uWatts (uW_pwr) 4 = nWatts (nW_pwr) 5 = pWatts (W_pwr) 6 = (db_pwr)
4	1	Sweep Units	Integer*	Identifies the engineering units (wave length, frequency, or time) of the points (sweep values) at which readings are taken. [defined as enum eUnitsWave] 0 = wavelength in nanometers (nm_wav) 1 = frequency in THz (THz_wav) 2 = time in [microseconds?] (secs_wav)
5	4	Number of Readings per Trace	Integer*	This is the number of readings to be taken in the measurement
9	4	Number of Samples per Reading	Integer*	This is the number of samples to be included in each reading.
13	4	Number of Traces	Integer*	This is the number of Traces included in the data set, (N).
17	3 * N	Trace ID		Each Trace is identified by the chassis, slot and trace number. The first byte is the chassis, The second byte is the slot number, and the third byte is the trace number.
17 + 3*N	4*(N+1) * RDGS	Readings	Float***(4), Float*** (4*CHANS)	Measurement Data, See Measurement Data Format below.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Binary Data Format (Version 2)

Byte Offset	Number of Bytes	Name	Restoration Type	Description
0	1	Version	Integer*	Identifies the version of the format contained in the file. [The current version is 2]
1	1	Endian	Integer*	Identifies the byte order of multiple byte fields: 0 = Little Endian; 1 = Big Endian
2	1	Reading Units	Integer*	Identifies the engineering units (power) that are associated with the reading values [defined as enum eUnitsPwr]: 0 = (dBm_pwr) 1 = Watts (W_pwr) 2 = mWatts (mW_pwr) 3 = uWatts (uW_pwr) 4 = nWatts (nW_pwr) 5 = pWatts (W_pwr) 6 = (db_pwr)
3	1	Sweep Units	Integer*	Identifies the engineering units (wave length, frequency, or time) of the points (sweep values) at which readings are taken. [defined as enum eUnitsWave] 0 = wavelength in nanometers (nm_wav) 1 = frequency in THz (THz_wav) 2 = time in [microseconds?] (secs_wav)
4	4	Number of Readings	Integer*	This is the number of readings to be taken in the measurement
8	4	Number of Samples	Integer*	This is the number of samples to be included in each reading.
12	32	Channels Included	Binary**	This is an array of bit-maps. There is one bit-map for each chassis in the system. Each bit-map is 8 bytes long. Bit 0 of the first byte in the bit-map is the first channel of the chassis. Bit 0 of the second byte in the bit-map is the 9th channel of the chassis.
45	(4 + CHANS * 4) * RDGS	Readings	Float***(4), Float*** (4*CHANS)	Measurement Data, See Measurement Data Format below.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The following code example converts a 4 byte string to a float.

```
float DecodeFloat(char *string, int endian) {
  float F;
  char *c;

  c = (char *)&F;
  if (endian)
  {
    *c++ = string[3];  // big endian
    *c++ = string[2];
    *c++ = string[1];
    *c++ = string[0];
  }
  else
  {
    *c++ = string[0];  // little endian
    *c++ = string[1];
    *c++ = string[2];
    *c++ = string[3];
  }
  return F;
}
```

Measurement Data Format (Version 2, 3.0)

Consider the results of a measurement organized as a table as shown below.

Reading Number	Domain	Trace 1	Trace 2	Trace n
1	**Value 0**	**Value 1**	**Value 2**	**Value n**
2	**Value n+1**	**Value n+2**	**Value n+3**	**Value 2n+1**
k	**Value (k-1)(n+1)**	**Value (k-1)(n+1)+1**	**Value (k-1)(n+1)+2**	**Value k(n+1)-1**

Each entry in the table represents the value of a single reading (set of samples) or domain (x axis) entry. Each entry is a 4 byte floating point number whose order is given by the “Endian” field in the header. The number of entries in each column is specified by the “Number of Readings” field in the header. The units of this data is specified by the “Reading Units” field of the header.

The measurement domain is a floating point numbers. Each entry represents the value of the independent variable (wave length, frequency or time) at which a measurement is taken. The number of entries in the array is specified by the “Number of Readings” field in the header. Each entry is a 4 byte floating point number whose order is given by the “Endian” field in the header. The units of this data is specified by the “Domain Units” field of the header.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Command Summary

Device Specific Commands

:abort
:calculate <chanlist> <mode>
:calculate? <chanlist>
:calibrate:darkcurrent <mode> [<use|ignore>]
:calibrate:darkcurrent?
:config:calculate <chanlist> <gain> <offset>
:config:calculate? <chanlist>
:config:channel <chanlist> <range> [<"chan tag">]
:config:channel <chanlist> <range> [<"chan tag"> [<280|288> <input> <open|connected> <voltage> <positive|negative>]]
:config:channel <chanlist> <range> [<"chan tag"> [<280|288> <input> <open|connected> <current> <cathode|anode> <bias_voltage>]]
:config:channel? <chanlist>
:config:communications:tcp <ip_addrs|dhcp|bootp> <cr|crlf|lf|none>

:config:communications:tcp?
:config:communications:enet?
:config:communications:gpib <addrs> <cr|crlf|lf|none> <eoi>
:config:communication:gpib?
:config:communication:log <off|on>
:config:communication:log?
:config:communication:rs232 <baud> <cr|crlf|lf|none> <xonxoff|none>
:config:communication:rs232?
:config:conflict? <continuous|step|measure>
:config:data:border <msbfirst|lsbfirst>
:config:data:border?
:config:data:ascii <header|noheader>
:config:data:ascii?
:config:data:format <ascii|sreal> [<version x.xx>]
:config:data:format?
:config:data:pdlstates <off|on>
:config:data:pdlstates?
:config:measure <chanlist> <wavelen> <numreadings> <immediate|exttrig> <continuous|<reading interval>> <maxaverage|<num average>> [<filespec>]
:config:measure?
:config:orl <off|on> [<dut1 orl channel> [<dut2 orl channel>]]
:config:orl?
:config:orl:refsave <zero | gain | clear> [<ref reflectance (dB)>] [< dut number >]
:config:orl:ref? [< dut number >]
:config:osc:model <unit> <off|modelnumber>
:config:osc:model? <unit|all>
:config:osc:pref <dutport>
:config:osc:pref?
:config:osc:route <unit> <testport><dutport> [<testport><dutport> ...]
:config:osc:route:allowed? <unit|all>
:config:osc:route? <unit|all>
:config:pdcw <peak|valley> <exthresh> <srchthresh> <dbdown>
:config:pdcw?
:config:psc:half <angle>
:config:psc:half?

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:config:psc:pol <angle>
:config:psc:pol?
:config:psc:quarter <angle>
:config:psc:quarter?
:config:psc:sop <channel> <quarterstart> <quarterstop> <halfstart> <halfstop> <stepmax> <stepmin>
:config:psc:sop?
:config:sweep:continuous <chanlist> <start> <stop> <rate> <spacing> <usetrig|immediate> <maxaverage | <num average>> [<filespec>]
:config:sweep:continuous?
:config:sweep:dwell <dwell_time>
:config:sweep:dwell?
:config:sweep:file <file_spec>
:config:sweep:file?
:config:sweep:interval <reading_spacing>
:config:sweep:interval?
:config:sweep:maxaverage < on | off >
:config:sweep:maxaverage?
:config:sweep:mode <continuous|step|time>
:config:sweep:mode?
:config:sweep:rate <sweep_rate>
:config:sweep:rate?
:config:sweep:readings <num_readings>
:config:sweep:readings?
:config:sweep:samples <num_samples>
:config:sweep:samples?
:config:sweep:start <start_wavelength>
:config:sweep:start?
:config:sweep:step <chanlist> <start> <stop> <step> <usetrig|usedelay> <num average> [<filespec>]
:config:sweep:step?
:config:sweep:stop <stop_wavelength>
:config:sweep:stop?
:config:sweep:timing < continuous | interval >
:config:sweep:timing?
:config:sweep:trigger < USETrig | IMMEdiate >
:config:sweep:trigger?
:config:sweep:wavelen <wavelength>
:config:sweep:wavelen?
:config:switch:dut <todut | auxa>
:config:switch:dut?
:config:tls <minwavelen> <maxwavelen> <start|in1|none> <rising|falling> <tlstrigouttimetoaction> <trig@start|notrig@start> <meascomp|out1|out2|none> <rising|falling> <tlstrigintimetoaction> <linfreq|linwave>
:config:tls?
:config:tls:active <tlsa | tlsb | tlsc>
:config:tls:active?
:config:tls:control <none | newfocus | agilent | internal | santec> [<gpib address>]
:config:tls:control?
:config:tls:output <off | on>
:config:tls:output?
:config:tls:power <dbm>
:config:tls:power?
:config:tls:source <tlsin | auxa | auxb>
:config:tls:source?
:config:trace?

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:config:trace:channel <chanlist> <on|off>
:config:trace:channel?
:config:trace:diff <chanlist> <on|off> [<ref trace>]
:config:trace:gascell <chanlist> [<on|off> [<hcn|h2c2|gas3|co12|h2o> [<parab|lorentz> [<error|ref>]]]]
:config:trace:gascell?
:config:trace:itu <chanlist> [<on|off>] [<maxitufreq>] [<spacing>] [<width>] [<#channels>] [<il|pdl>]
:config:trace:itu?
:config:trace:math <chanlist> <a-b|off> [<b trace> [<a trace>]]
:config:trace:math?
:config:trace:maxhold <chanlist> [<on|off> [<ref trace>]]
:config:trace:maxhold?
:config:trace:minhold <chanlist> [<on|off> [<ref trace>]]
:config:trace:minhold?
:config:trace:pdbw <chanlist> [<on|off>]
:config:trace:pdbw?
:config:trace:pdcw <chanlist> [<on|off>]
:config:trace:pdcw?
:config:trace:pdl <chanlist> [<on|off>] [<8169a|manual|internal>]
:config:trace:pdl?
:config:trace:pdl:maximize
:config:trace:pdl:maximize:channel <channel>
:config:trace:pdl:maximize:channel?
:config:trace:pdl:refset <ignore | use | save>
:config:trace:pdl:refset?
:config:trace:pdl:states <n> [<matrix|allstates>]
:config:trace:pdl:states?
:config:trace:save <chanlist> [<on|off>] <trace number>
:config:trace:save?
:config:trace:smooth <all | <trace spec>> <off | <filter width>> <hamming | rectangle | triangle | hanning>
:config:trace:smooth?
:config:trace:update <all | <trace spec>> <off | on>
:config:trace:update? <all | <trace spec>>
:config:trace:view <all | <trace spec>> <off | on>
:config:trace:view? <all | <trace spec>>
:config:units:power <dbm|w|mw|uw|nw|pw|db|raw>
:config:units:power?
:config:units:temperature <c|f>
:config:units:temperature?
:config:units:wavelen <nm|thz>
:config:units:wavelen?
:date <mm/dd/yy>
:date?
:display:graph:x:scale:left <value>
:display:graph:x:scale:left?
:display:graph:x:scale:right <value>
:display:graph:x:scale:right?
:display:graph:y:scale:auto <once>
:display:graph:y:scale:pdivision <value>
:display:graph:y:scale:pdivision?
:display:graph:y:scale:rlevel <value>
:display:graph:y:scale:rlevel?
:display:select:graph <n>
:display:select:graph?
:display:select:view < 1graph | 2graphs | 3graphs | aselected | aadjacent >

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:display:select:view?
:fetch? [<filespec>]
:fetch:header?
:fetch:trace? <trace> [< max | min | mean | sdev >]
:initiate[:immediate]
:initiate:continuous <on|off>
:initiate:continuous?
:initiate:orlautoref
:measure:pdoffset
:measure:sop?
:measure:temperature?
:measure?
:output <1-8> <9-16> <16-24> <25-32> <32-40> <41-48> <49-56> <57-64>
:output?
:output:setbit <bit>
:output:clearbit <bit>
:output:test
:sweep:cont?
:sweep:step?
:system:channels?
:system:communications:enet:clear <host|chassis>
:system:communications:enet:status? <host|chassis>
:system:display <on|off>
:system:display?
:system:filter <on|off>
:system:filter?
:system:posetup <filespec|factory>
:system:posetup?
:system:relative:config <on|off>
:system:relative:config?
:system:relative:dualsweep <off|on>
:system:relative:dualsweep?
:system:relative:refsave <channelnumber>
:system:relative:splitref? <chassis> <channel>
:system:relative:splitref:addsweep <on|off> <chassis> <channel> <on|off>
:system:relative:splitref:addsweep?
:system:relative:splitref:clear
:system:relative:splitref:factory:restore
:system:relative:splitref:factory:save <password>
:system:shutter <open|close>
:system:shutter?
:system:temperature <on|off>
:system:temperature?
:system:test:ccram <chassis> <channel>
:system:wlcorr <on|off>
:system:wlcorr?
:system:wref:config <enable|disable>
:system:wref:config?
:time <hh:mm:ss>
:time?

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

COMMON COMMANDS

*cls
*ese <value>
*ese?
*esr?
*gtl
*idn? <chanlist|trigger|<chassis#>>
*llo
*opc
*opc?
*rcl <filespec|factory>
*rst <reboot>
*sav <filespec>
*sre <value>
*sre?
*stb?
*tst?

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Device Specific Commands

:ABORt	Abort current sweep or measure operation

:CALCulate	Enable or disable calculate mode for selected channels
<ChanList>	List of channels to set calculate mode
<mode>	mode: ON: enable calculations OFF: disable calculations

:CALCulate?	Gets calculate enabled state selected channels
<ChanList>	List of channels to get calculate mode

:CALIbrate:DARKcurrent	Set Dark Count Calibration mode or execute single calibration
<mode>	AUTO: enable periodic automatic Dark Count calibration This will be done once an hour, providing a measurement is not in progress! OFF: disable periodic automatic Dark Count calibration ONCE: perform single Dark Count calibration sequence now
[<USE | IGNORE>]	This optional parameter specifies whether Dark Count calibration data is to be applied in subsequent measurements. This is typically only turned off during factory testing. USE: Dark Count calibration data is used. IGNORE: Dark Count calibration data is NOT used during measurements.

:CALIbrate:DARKcurrent?	Get Dark Count Calibration mode?

:CONFig:CALCulate	Set Power Correction values
<ChanList>	List of channels to configure calculation parameters
<gain>	Default of 1.0 Pmw = Pmw * gain + offset
<offset>	Default of 0.0

:CONFig:CALCulate?	Get Power Correction values
<ChanList>	List of channels to query

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:CONFig:CHANnel	Sets channel parameters
<ChanList>	List of channels to configure
<range>	Operating ranges for -202,-201, -940, -301: Rng1 (range A-auto, Fast 10mW), Rng2 (range B-auto, Fast 100uW), Rng3 (range C-auto, Fast 1uW), Rng4 (range D-auto, Fast 10nW), Rng5 (range E-auto, Fast 100pW) FixA1 (10mW), FixB1 (100uW), FixC1 (1uW), FixD1 (10nW), FixE1 (100pW), FixA10 (1mW), FixB10 (10uW), FixC10 (100nW), FixD10 (1nW) FixA100 (100uW), FixB100 (1uW), FixC100 (10nW), FixD100 (100pW) ABStitch (Ranges A1 through B100), ACStitch (Ranges A1 through C100), BCStitch (Ranges B1 through C100) Operating Ranges for -280 and -288 Rng1 (1A), Rng2 (100mA), Rng3 (10mA), Rng4 (1mA), Rng5 (100uA), Rng6 (10uA), Rng7 (1uA), Rng8 (100nA), Rng9 (10nA)
<"chanTag">	Name associated with channel – must be unique This and the remaining parameters are optional
<model>	model number of the card 280 - single input photodiode card 288 - 8 input photodiode card
<input_select>	This parameter must be entered for both models, 280 and 288, but in model 280 this parameter is ignored.
<OPEN | CONNected>	This parameter specifies if the input is connected to the card's input amplifier or not.
<VOLTage | CURRent>	Specifies what type of measurement is to be done.
<POSItive | NEGAtive> or <CATHode | ANODe>	Specify the polarity of the single ended input. positive | negative for voltage mode common cathode | common anode for current mode
<bias_voltage>	The bias voltage is entered, -10.0 to +10.0 volts, current mode only

:CONFig:CHANnel?	Gets channel parameters
<ChanList>	List of channels to query

:CONFig:COMMunications:TCP	Set Ethernet/TCP port parameters
<IP_addrs | DHCP | BOOTP>	IP_addrs is a standard dot notation address eg. 190.0.33.44 DHCP - Dynamic Host Config Protocol BOOTP – Bootstrap Protocol
<CR | CRLF | LF | NONE>	message terminator

:CONFig:COMMunications:TCP?	Return Ethernet/TCP port parameters

:CONFig:COMMunications:ENET?	Return the unique 6 byte Ethernet address and the current IP address in dot notation

:CONFig:COMMunications:GPIB	Set GPIB port parameters
<addrs>	Address
<CR | CRLF | LF | NONE>	message terminator
<EOI>	Enable EOI at end of message

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:CONFig:COMMunications:GPIB?	Get GPIB port parameters

:CONFig:COMMunications:LOG	Turn communications logging to the EVENTLOG.CSV file on or off.
<OFF | ON>	

:CONFig:COMMunications:LOG?	Get the communications log setting

:CONFig:COMMunications:RS232	Set RS-232 port parameters
<baud>	Baudrate
<CR | CRLF | LF | NONE>	message terminator
< NONE | XONXoff >	Handshaking

:CONFig:COMMunications:RS232?	Get RS-232 port parameters

:CONFig:CONFlict?	Cross-check sweep, TLS and channel configurations for conflicts
<CONTinuous|STEP|MEASure>	Mode to check for conflicts

:CONFig:DATA:BORDer	Sets byte order of numbers sent to the host
<MSBFirst | LSBFirst>	

:CONFig:DATA:BORDer?	Gets byte order of numbers sent to the host

:CONFIG:DATA:ASCII	Configure contents of ASCII data sets
<HEADer | NOHEader>	Specify whether data set should contain a header

:CONFig:DATA:ASCIi?	Gets ASCII data set configuartion

:CONFig:DATA:FORMat	Sets measurement data representation
<ASCII | SREAl>	Human readable text or IEEE floating point standard
[<version number>]	If SREAl is specified, an optional version number may also be specified. If not specified, the most recent version number is used for the BDS data.

:CONFig:DATA:FORMat?	Gets measurement data representation

:CONFig:DATA:PDLStates	Enable/disable output of PDL Matrix state sweep data in CSV and BDS formats.
<OFF | ON>	

:CONFig:DATA:PDLStates?	Find out if PDL Matrxi state sweep data is enabled for output.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:CONFig:MEASure	Sets the Measure parameters
<ChanList>	List of channels included in the measurement
<Wavelen>	Take readings at this wavelength
<NumReadings>	Number of readings to take
<IMMEdiate | EXTTrig >	Start measurement trigger selection – interval is in microseconds
<CONTinuous | <readingInterval>>	Continuous, means reading interval is ignored and NumReadings and NumAverage are used to determine reading interval. <readingInterval> is in microseconds.
<MAXAverage | <num_avg>>	Number of samples to average per reading. MAXAverage means to calculate numAvg and is only available when readingInterval is specified. NOTE: The CSA will return an error on this command if the reading interval specified is too short for the num_avg.
[<filespec>]	If file name exists, save data to specified file instead of sending it out the scpi port. The default drive and path is the internal harddrive, c:\csadata\. The default extension is either .csv or .bds depending on the current :config:data:format.

:CONFig:MEASure?	Gets the current Measure parameters

:CONFig:ORL	Configure ORL Measurements
< ON | OFF >	Enable ORL Measurement. The next time a measurement is made, this controls whether or not the ORL Channel is processed to compute ORL.
[<DUT1 ORL Channel>]	If ORL is ON, this paramter must be specified. Valid Values, 0 to 6, default = 4. A value of 0 turns off ORL for DUT1. This is the channel number connected to the “ORL” CSA output. When ORL is ON, the power data measured with this channel card is processed to compute ORL.
[<DUT2 ORL Channel>]	If ORL is ON, AND if Multi DUT ORL option (850) is installed, this parameter may be specifed. Valid Values, 0 to 6, default = 4. A value of 0 turns off ORL for DUT2. This is the channel number connected to the “ORL” CSA output. When ORL is ON, the power data measured with this channel card is processed to compute ORL.

:CONFig:ORL?	Gets the current ORL measurement settings

:CONFig:ORL:REFSave	Store or clear the ORL reference sweep data. Sweeps may be Time, Stepped, or Continuous sweeps. ORL reference data is stored on the CSA hard disk anytime a change is made to the data, and loaded on startup.
< ZERO | GAIN | CLEAr >	ZERO Store the current ORL channel data as the reference zero. GAIN Use the current ORL channel data to compute the ORL measurement gain. ZERO must be measured and stored first. CLEAr Clears the ORL reference data.
[<Ref Reflectance (dB)>]	If GAIN, this paramter must be specified. Valid Values, 0.0 to -90, default = -14.7.
[<DUT number >]	An optional parameter that is used when Multi DUT ORL option 850 is installed. This specifies which DUT data this command will operate on.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:CONFig:ORL:REF?	Get the ORL reference sweep data .
[<DUT number >]	An optional parameter that is used when Multi DUT ORL option 850 is installed. This specifies which DUT data this command will operate on.

:CONFig:OSC:MODEl	Enable or disable the interface between the CSA and multilple OSC units, one at a time.
< unit >	For now, only 1 unit is supported.
< OFF | model number >	OFF, will disable the interface, otherwise, enter the model number of the OSC.

:CONFig:OSC:MODEl?	Get the model numbers of the OSCs enabled with the CSA.
< unit | ALL >	unit, is the unit number, for now only 1 is allowed. ALL, specifies all unit numbers.

:CONFig:OSC:PREF	Specify which output port of the OSC 5209 is connected to the PRef channel. This is typically used in conjunction with the Dual Sweep PRef mode of operation.
< dutport >	There are only 3 valid dutport numbers 0 - normal PRef connection 3 - PRef connected to "To DUT Slow" 4 - PRef connected to "To DUT Fast"

:CONFig:OSC:PREF?	Get the OSC signal routing for the specified units.

:CONFig:OSC:ROUTe	Configure an OSC signal routing
< unit >	The OSC unit number.
<testport><dutport> [<testport><dutport>...]	testport is specified as A-Z dutport is specified as 1 to 999 For example "A4 B6" specifies testport A is connected to dutport 4 and testport B is connected to dutport 6.

:CONFig:OSC:ROUTe?	Get the OSC signal routing for the specified units.
< unit | ALL >	unit, the unit number, for now only 1 is accepted. ALL, specifies all units.

:CONFig:OSC:ROUTe:ALLOwed?	Get the list of allowed OSC signal routings for the specified units.
< unit | ALL >	unit, the unit number, for now only 1 is accepted. ALL, specifies all units.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:CONFig:PDCW	Setup the parameters that affect measurement of PDCW and PDBW.
< PEAK | VALLey >	Specify if channels are Peaks or Valleys.
<exThresh>	Excursion Threshold, in dB. Peaks and Valleys must differ by at least this much to be found.
<srchThresh>	Search Threshold, in dB or dBm. All Peaks or Valleys below this level are ignored. This is typically used to ignore noise in the signal.
<dBdown>	Bandwidth is computed by the dB down/up from the peak/valley.

:CONFig:PDCW?	Get the PDCW settings.

:CONFig:PSC:HALF	Set the half waveplate angle of the polarization state controller (when installed)
< angle >	Default 0.00, Min -360, Max +360

:CONFig:PSC:HALF?	Get and return the half waveplate angle reported by the polarization state controller (when installed)

:CONFig:PSC:POL	Set the polarizer angle of the polarization state controller (when installed)
< angle >	Default 0.00, Min -360, Max +360

:CONFig:PSC:POL?	Get and return the polarizer angle reported by the polarization state controller (when installed)

:CONFig:PSC:QUARter	Set the quarter waveplate angle of the polarization state controller (when installed)
< angle >	Default 0.00, Min -360, Max +360

:CONFig:PSC:QUARter?	Get and return the quarter waveplate angle reported by the polarization state controller (when installed)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:CONFig:PSC:SOP	Configure the :measure:sop? measurement.
< channel >	This specifies the channel that the DUT is connected to. format [chas].chan
< quarterstart >	The start angle used for the quarter waveplate during the initial rough scan for max and min. Default 0.00, Min -360, Max +360
< quarterstop >	The start angle used for the quarter waveplate during the initial rough scan for max and min. Default 180.00, Min -360, Max +360
< halfstart >	The start angle used for the half waveplate during the initial rough scan for max and min. Default 0.00, Min -360, Max +360
< halfstop >	The stop angle used for the half waveplate during the initial rough scan for max and min. Default 90.00, Min -360, Max +360
< stepmax >	The angle step size used during the initial rough scan for max and min. Default 15.00, Min 0.10, Max 360
< stepmin >	The scan for max and min continues with decreasing step size until the step size reaches stepmin. Default 0.25, Min 0.10, Max +360

:CONFig:PSC:SOP?	Return the configuration settings of the :measure:sop? measurement.

:CONFig:SWEEp:CONTinuous	
<ChanList>	List of channels included in the continuous sweep
<StartWavelen>	Sweep starts at this wavelength
<StopWavelen>	Sweep stops at this wavelength
<SweepSpeed>	Sweep rate in nMeters/second
<ReadingSpacing>	Reading spacing in picometers
<USETrig | IMMEdiate>	Start sweep selection
<MAXAverage | <num_avg>	Number of samples to average per reading. MAXAverage means to calculate numAvg. numAvg = (SweepTime / SampleTime) / ((StopWavelen - StartWavelen) / ReadingSpacing)
[<filespec>]	If file name exists, save data to specified file instead of sending it out the scpi port. The default drive and path is the internal harddrive, c:\csadata\. The default extension is either .csv or .bds depending on the current :config:data:format.

:CONFig:SWEEp:CONTinuous?	Gets the current Sweep Continuous settings

:CONFig:SWEEp:DWELl	Set the step mode dwell time
<dwell_time>	

:CONFig:SWEEp:DWELl?	Get the step mode dwell time

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:CONFig:SWEEp:FILE	Set the sweep data file name for the next sweep This is applied to the current sweep mode
<filespec>	If file name is valid, save data to specified file instead of sending it out the scpi port. The default drive and path is the internal harddrive, c:\csadata\. The default extension is either .csv or .bds depending on the current :config:data:format.

:CONFig:SWEEp:FILE?	Get the sweep data file name for the next sweep This is from the current sweep mode

:CONFig:SWEEp:INTErval	Set the sweep reading spacing This is applied to the current sweep mode
<reading_spacing>	In Time mode this will also set the timing to interval

:CONFig:SWEEp:INTErval?	Get the sweep reading spacing This is from the current sweep mode

:CONFig:SWEEp:MAXAverage	Turn max average on or off This is applied to the current sweep mode
< ON | OFF >	

:CONFig:SWEEp:MAXAverage?	Get the max average setting This is from the current sweep mode

:CONFig:SWEEp:MODE	Set the Sweep Mode of the CSA Some SCPI commands require the sweep mode to be set. The following commands do NOT set the Sweep Mode, but only configure specific sweep mode parameters. :config:sweep:cont ... :config:sweep:step... :config:measure ...
<CONTinuous | STEP | TIME>	

:CONFig:SWEEp:MODE?	Get the current Sweep Mode of the CSA

:CONFig:SWEEp:RATE	Set the continuous sweep, sweep rate
<sweep_rate>	

:CONFig:SWEEp:RATE?	Get the sweep reading spacing This is from the current sweep mode

:CONFig:SWEEp:READings	Set the number of readings in the current sweep mode
<num_readings>	
:CONFig:SWEEp:READings?	Get the number of readings in the current sweep mode

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:CONFig:SWEEp:SAMPles	Set the number of samples to average per reading in the current sweep mode. Using this command will also turn MAXAverage OFF.
<num_samples>	

:CONFig:SWEEp:SAMPles?	Get the number of samples to average per reading in the current sweep mode

:CONFig:SWEEp:STARt	Set the start wavelength in the current sweep mode. This command may only be used in step or continuous sweep modes.
<start_wavelength>	

:CONFig:SWEEp:STARt?	Get the start wavelength in the current sweep mode

:CONFig:SWEEp:STEP	
<ChanList>	List of channels included in the step sweep
<StartWavelen>	Sweep starts at this wavelength
<StopWavelen>	Sweep stops at this wavelength
<StepSize>	Steps wavelength by this amount
<USETrig | USEDelay>>	Start step selection
<NUMAvg>	Number of ADC samples to average to get one reading
[<filespec>]	If file name exists, save data to specified file instead of sending it out the scpi port. The default drive and path is the internal harddrive, c:\csadata\. The default extension is either .csv or .bds depending on the current :config:data:format.

:CONFig:SWEEp:STEP?	Gets the current Sweep Step settings

:CONFig:SWEEp:STOP	Set the stop wavelength in the current sweep mode. This command may only be used in step or continuous sweep modes.
<stop_wavelength>	

:CONFig:SWEEp:STOP?	Get the stop wavelength in the current sweep mode

:CONFig:SWEEp:TIMIng	Set the timing mode to continuous or interval for time mode sweeps.
< CONTinuous | INTErval >	

:CONFig:SWEEp:TIMIng?	Get the timing mode to continuous or interval for time mode sweeps

:CONFig:SWEEp:TRIGger	Set the trigger mode for continuous or time mode sweeps.
< USETrig | IMMEdiate >	

:CONFig:SWEEp:TRIGger?	Get the trigger mode for continuous or time mode sweeps
:CONFig:SWEEp:WAVElen	Set the time mode wavelength.
<wavelength>	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:CONFig:SWEEp:WAVElen?	Get the time mode wavelength

:CONFig:SWITch:DUT	Set the To DUT switch, option 972
< TODUt | AUXA >	Select the To DUT output connector

:CONFig:SWITch:DUT?	Get the setting of the To DUT switch, option 972

:CONFig:TLS	Set fixed properties of TLS
<MinWavelen>	Min Wavelength TLS is capable of generating. Used to error check TLS sweep limits
<MaxWavelen>	Max Wavelength TLS is capable of generating. Used to error check TLS sweep limits
<STARt | IN1| NONE>	Trigger In specs (Connects a CSA digital input to a TLS digital output) STARt – Use the STARt input. IN1 – Use the IN1 input. NONE - TLS has no trigger output.
<RISIng | FALLing>	Trigger In Edge specs RISING - Rising edge occurs when TLS is stable at new wavelength. FALLING - Falling edge occurs when TLS is stable at new wavelength.
<TlsTrigOutTimeToAction>	Skew between TLS Trigger out and stable wavelength in uSeconds
<TRIG@Start | NOTRig@Start>	Specifies if TLS generates 1st trigger
<MEAScomp | OUT1| OUT2 | NONE>	Trigger Out specs (Connects a CSA digital output to a TLS digital input) MEAScomp – Use the MEAScomp output. OUT1 – Use the OUT1 output. OUT2 – Use the OUT2 output. NONE - TLS has no trigger input.
<RISIng | FALLing>	Trigger Out Edge specs RISING - Rising edge occurs when CSA completed measurement FALLING - Falling edge occurs when CSA completed measurement.
<TlsTrigInTimeToAction>	Skew between CSA Trigger out and stable wavelength in uSeconds
<LINFreq | LINWavlen>	TLS sweeps linearly in Freq or Wavelen

:CONFig:TLS?	Gets fixed properties of TLS

:CONFig:TLS:ACTIve	Set the Active TLS. This applies to all subsequent :config:tls... commands. NOTE: The active TLS may be modified by measurement operations or other operations by the CSA so always set the active tls prior to using :config:tls commands.
< TLSA | TLSB | TLSC >	

:CONFig:TLS:ACTIve?	Query which TLS is active.

:CONFig:TLS:CONTrol	Set the Automatic TLS Control Settings.
< NONE | NEWFocus | AGILent | INTErnal | SANTec >	Specify the type of TLS.
[< GPIB Address >]	Specify the GPIB Address of the TLS.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:CONFig:TLS:CONTrol?	Query which TLS Control settings.

:CONFig:TLS:OUTPut	Under automatic control, turn the TLS On or Off.
< OFF | ON >	

:CONFig:TLS:OUTPut?	Query if the TLS is On or Off.

:CONFig:TLS:PATH	Set the TLS optical output path for dual output Agilent model TLSs.
< HIGH | LOWS | BHR | BLR >	

:CONFig:TLS:PATH?	Get the TLS optical output path for dual output Agilent model TLSs.

:CONFig:TLS:POWEr	Set the TLS power setting.
< power >	in dBm.

:CONFig:TLS:POWEr?	Query the TLS power setting.

:CONFig:TLS:SOURce	Set which TLS source input is active. This command is only valid when the Source Option is installed.
< TLSIn | AUXA | AUXB >	TLSIn – CSA Optical Input is connected to TLS IN or TLS A. AUXA – CSA Optical Input is connected to Aux A or TLS B. AUXB -- CSA Optical Input is connected to Aux B or TLS C

:CONFig:TLS:SOURce?	Query which TLS source input is active.

:CONFig:TRACe?	List ALL of the Traces in the CSA that are enabled for a measurement.

:CONFig:TRACe:CHANnel	Enable or Disable channel cards for the next measurement. Other commands that affect which channel cards participate in a measurement are: :config:meas :config:sweep:step :config:sweep:cont
<ChanList>	List of channels included in the next measurement
[< ON | OFF >]	If ON | OFF is specified, only the channels in the ChanList are modified by this command, all other channels are left alone.

: CONFig:TRACe:CHANnel?	Return the list of channels currently active for the next measurement.

:CONFig:TRACe:DIFF	Add or delete 1st Difference traces for the specified channels for processing in the next measurement. A 1st difference is the sampled equivalent of a first derivative.
<ChanList>	List of channels for 1st Difference processing.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

< ON | OFF >	ON: turn 1st Difference processing trace on OFF: turn 1st Difference processing trace off
[< RefTrace >]	Required if ON is selected. Specify the reference trace for the operation. Use the format: [chas]chan.trace Trace numbering is: 0 = Base channel data 1 = Saved Trace 2 = PDL Trace 3 = Maxhold Trace 4 = Minhold Trace 5 = Math Trace 6 = GasCell Wavelength Error Trace

:CONFig:TRACe:DIFF?	Return the list of channels currently configured for 1st difference operations.

:CONFig:TRACe:GASCell	Specify which channels have gas cells connected so that the data can be processed and an additional trace created which shows wavelength error in pm.
<ChanList>	List of channels with gas cells attached.
[< ON | OFF >]	If ON | OFF is specified, only the channels in the ChanList are modified by this command, all other channels are left alone.
[< HCN | H2C2|GAS3|CO12|H2O >]	Gas Cell type
[< PARAB | LORENTZ >]	This parameter is now ignored, Lorentz fits are always used.
[<ERROR | REF>]	ERROR: The gas cell is used to measure wavelength error of the sweep. REF: The gas cell is used as a wavelength reference for the sweep. The resulting error trace is computed after the the wavelength correction is applied to the wavelength data and should show zero error. More than one gas cell may be used as a reference at the same time.

:CONFig:TRACe:GASCell?	Return the list of channels currently configured for gas cell measurement.
:CONFig:TRACe:ITU	Add or delete ITU Channel Average traces for the specified channels for processing in the next measurement.
<ChanList>	List of channels for processing.
[< ON | OFF >]	ON: channel averaging is turned on OFF: turn ITU_IL and ITU_PDL traces off
[< MaxITUFreq>]	Specifies the first channel center to be processed. It is the highest channel frequency. (THz)
[<spacing>]	Center to center spacing between ITU channels. (GHz)
[<width>]	Specifies the width over which data is averaged into one reading for that channel. (GHz)
[<#channels>]	Number of channels to be processed. This will also equal the number of readings stored in the ITU Trace.
[<IL|PDL>]	specify which data is to be processed by the ITU function IL: The base trace data is processed. When PDL is on, this is IL data. PDL: The PDL trace data is processed.

:CONFig:TRACe:ITU?	Return the list of channels currently configured for ITU Channel Average operations.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:CONFig:TRACe:MATH	Add or delete math traces for the specified channels for processing in the next measurement. Take care not to create any circular dependancies, the CSA software does processes trace data in the same order in which it is displayed on the active channel list.
<ChanList>	List of channels with for math processing.
< A-B | OFF >	A-B: data = data – ref OFF: turn math processing off for the selected channels
[< B Trace >]	Required if A-B is selected. Specify the reference trace, B, for the math operation. See <TraceSpec> for details.
[< A Trace >]	Optional, if not specified, the base trace is used. See <TraceSpec> for details

:CONFig:TRACe:MATH?	Return the list of channels currently configured for math operations.

:CONFig:TRACe:MAXHold	Enable or disable a Max Hold Trace for each of the specified channels.
<ChanList>	List of channels for Max Hold measurement.
[< ON | OFF >]	ON: Enable Max Hold measurement for the channels listed, do not affect other channels. OFF: Disable Max Hold measurement for the listed channels, do not affect other channels. If not specified: Max Hold measurement is enabled for the listed channels and disabled for all other channels.
[< RefTrace >]	Specify the Trace that MaxHold references

:CONFig:TRACe:MAXHold?	Return the list of channels currently configured for max hold measurement.

:CONFig:TRACe:MINHold	Enable or disable a Min Hold Trace for each of the specified channels.
<ChanList>	List of channels for Min Hold measurement.
[< ON | OFF >]	ON: Enable Min Hold measurement for the channels listed, do not affect other channels. OFF: Disable Min Hold measurement for the listed channels, do not affect other channels. If not specified: Min Hold measurement is enabled for the listed channels and disabled for all other channels.
[< RefTrace >]	Specify the Trace that MinHold references

:CONFig:TRACe:MINHold?	Return the list of channels currently configured for min hold measurement.

:CONFig:TRACe:PDBW	Enable or disable a PDBW Trace.
<ChanList>	List of channels. Only one PDBW trace may be on at a time. If multiple channels are specified, the first one will be used.
[< ON | OFF >]	ON: (default) OFF:

:CONFig:TRACe:PDBW?	Return the PDBW configuration.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:CONFig:TRACe:PDCW	Enable or disable a PDCW Trace.
<ChanList>	List of channels. Only one PDCW trace may be on at a time. If multiple channels are specified, the first one will be used.
[< ON | OFF >]	ON: (default) OFF:

:CONFig:TRACe:PDCW?	Return the PDCW configuration.

:CONFig:TRACe:PDL	Enable or disable channels for Meuller Matrix PDL measurement in the next measurement sweep.
<ChanList>	List of channels for PDL measurement.
[< ON | OFF >]	ON: Enable PDL measurement for the channels listed, do not affect other channels. OFF: Disable PDL measurement for the listed channels, do not affect other channels. If not specified: PDL measurement is enabled for the listed channels and disabled for all other channels.
<8169A | MANUAL|INTErnal>	Polarization State Controller mode. If 8169A is selected, it must be connected to the CSA using the top GPIB connection on the rear of the CSA for automatic polarization state control. If internal is selected, the internal polarization controller will be used for PDL measurement.

:CONFig:TRACe:PDL?	Return the list of channels currently configured for PDL measurement.
:CONFig:TRACe:PDL:MAXImize	Adjust the Polarization State Controller to maximize the signal on the PRef channel input. This is normally done prior to taking a PDL measurement using the Mueller Matrix PDL method. This command returns ~> after receipt of the command then returns the final polarization angle when done.

:CONFig:TRACe:PDL:MAXImize:CHANnel	Used to specify the channel whose power is maximized during the :config:trace:pdl:maximize function.
< channel >	Specified as [chas]channel

:CONFig:TRACe:PDL:MAXImize:CHANnel?	returns the channel specified for use in :config:trace:pdl:maximize.

:CONFig:TRACe:PDL:REFSet	A reference set of sweeps may be stored and used for Matrix PDL measurements. The PDL RefSet, number of readings and wavelength start and stop values are stored in CSA RAM. A PDL RefSet must be valid for it to be used. In continuous sweep and stepped sweep modes, a PDL RefSet is valid if the number of readings, start and stop wavelengths in the RefSet match the current sweep settings. In time mode, a PDL RefSet is valid if the wavelength of the RefSet matches the current wavelength setting.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

< IGNOre | USE | SAVE >	IGNOre: The PDL RefSet is ignored when performing Matrix PDL measurements. This turns Save off. USE: The PDL RefSet (if valid) is used when performing the next Matrix PDL measurement. This turns Save off. SAVE: The 4 state sweeps from the next Matrix PDL measurement will be saved as a reference set of sweeps for subsequent PDL measurements. This command must then be followed by a ":meas?", ":sweep:cont?" or ":sweep:step?" command for a PDL RefSet to be saved.

:CONFig:TRACe:PDL:REFSet?	Returns the current status of the PDL RefSet if stored. Valid or Invalid is displayed based on a comparison of the PDL RefSet data with the current sweep mode of the CSA (as shown on the front panel). NOTE: if :system:display off, then SCPI commands dont update the front panel settings such as current sweep mode.

:CONFig:TRACe:PDL:STATes	Set the number of states for Matrix PDL measurements. Changing the number of states will invalidate a PDLRef set if one is stored.
<N>	The number of states. If the method is set to `Matrix` then the number of states can be either 4 or 6. If the method is `AllStates`, then the number of states can be between 4 to 10,000 and must have an integer square root.
[< MATRix | ALLStates >]	Optional. Specifies the PDL method to be used. The AllStates method will set the polarization controller to N different states and use the max and min sweep data to compute PDL and IL. NOTE: `Mueller` is still allowed for legacy support.

:CONFig:TRACe:PDL:STATes?	Returns the number of states specified for PDL measurements and the PDL method, `Matrix` or `AllStates`.

:CONFig:TRACe:SAVE	Copy the current data from the listed channels into a saved trace. This data is also stored to disk and loaded on system startup.
<ChanList>	List of channels for which to save data.
[< ON | OFF >]	ON: Save data for the channels listed, do not affect other channels with currently saved data. OFF: Delete saved data for the channels listed. If not specified: Save data for the channels listed and deleted saved data for all other channels.
< Trace Number >	The trace number specifies the Trace Type to be saved. See <TraceSpec> for the range of valid trace numbers.

:CONFig:TRACe:SAVE?	Return the list of channels with active saved data.

:CONFig:TRACe:SMOOth	Enable or disable a Data Smoothing for the specified Trace. Data smoothing is the last operation performed on the trace data. It can be used to smooth out the effects of noise. The smoothing filters are designed so that the dc gain is 1.0 and the nominal filter delay is zero.
<ALL | <TraceSpec>>	The trace being modified. Either all traces listed on the Active Channel Setup, or one trace may be specified per command.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

<OFF | <FilterWidth>>	The width of the filter is specified in number of readings, 1 to 111999. The filter width MUST be an odd number, if an even number is specified it is forced odd. 1 = OFF.
[< HAMM | RECT | TRIA | HANN >]	Data smoothing filter type. This parameter is required if the <filter width> is specified. HAMM: a Hamming filter (α = 0.54) RECT: a rectangular (aka Uniform) filter TRIA: a triangular filter HANN: a Hanning filter (α = 0.50)

:CONFig:TRACe:SMOOth?	Lists each individual Trace in which data smoothing is turned on.

:CONFig:TRACe:UPDAte	Turn the specified Trace(s) Update on or off.
<ALL | <TraceSpec>>	The trace being modified. Either all traces listed on the Active Channel Setup, or one trace may be specified per command.
[< ON | OFF >]	

:CONFig:TRACe:UPDAte?	Get the Update settings for the specified Trace(s).
<ALL | <TraceSpec>>	Either all traces listed on the Active Channel Setup, or one trace may be specified per command.

:CONFig:TRACe: VIEW	Turn the specified Trace(s) View on or off.
<ALL | <TraceSpec>>	The trace being modified. Either all traces listed on the Active Channel Setup, or one trace may be specified per command.
[< ON | OFF >]	
:CONFig:TRACe:VIEW?	Get the View settings for the specified Trace(s).
<ALL | <TraceSpec>>	Either all traces listed on the Active Channel Setup, or one trace may be specified per command.

:CONFig:UNITs:POWEr	Set units for power
<DBM | W | MW | UW | NW | PW | DB | RAW>	NOTE: raw is for inhouse use only

:CONFig:UNITs:POWEr?	Get units for power

:CONFig:UNITs:TEMPerature	Set units for temperature
<C | F>	

:CONFig:UNITs:TEMPerature?	Get units for temperature

:CONFig:UNITs:WAVElen	Set units for wavelength
<NM | THZ>	

:CONFig:UNITs:WAVElen?	Get units for wavelength

:DATE <mm/dd/yy>	Set system date

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:DATE?	Get system date

:DISPlay:GRAPh:X:SCALe:LEFT	Set value of the left side of the x axis in the currently selected graph
<value>	

: DISPlay:GRAPh:X:SCALe:LEFT?	Get value of the left side of the x axis in the currently selected graph

:DISPlay:GRAPh:X:SCALe:RIGHt	Set value of the right side of the x axis in the currently selected graph
<value>	

: DISPlay:GRAPh:X:SCALe:RIGHt?	Get value of the right side of the x axis in the currently selected graph

: DISPlay:GRAPh:Y:SCALe:AUTO	Auto Scale the Y axis of the currently selected graph.
<ONCE>	

:DISPlay:GRAPh:Y:SCALe:PDIVision	Set the Y axis Scale/Division of the currently selected graph
<value>	

: DISPlay:GRAPh:Y:SCALe:PDIVision?	Get the Y axis Scale/Division of the currently selected graph

:DISPlay:GRAPh:Y:SCALe:RLEVel	Set the Y axis Reference Level of the currently selected graph
<value>	

: DISPlay:GRAPh:Y:SCALe:RLEVel?	Get the Y axis Reference Level of the currently selected graph

:DISPlay:SELEct:GRAPh	Set the selected graph for the current view.
<n>	View, Range of allowed values 1GRAph, 1 2GRAphs, 1-2 3GRAphs, 1-3 ASELected, 1-2 AADJacent, 1-2

: DISPlay:SELEct:GRAPh?	Get the selected graph for the current view.

:DISPlay:SELEct:VIEW	Set the current graph view.
< 1GRAph | 2GRAphs | 3GRAphs | ASELected | AADJacent >	

: DISPlay:SELEct:VIEW?	Get the current graph view.

:FETCh?	Fetch data

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

<filespec>	If filespec is null then return data from channel memory. Else return specified file previously saved.

:FETCh:HEADer?	Fetch the ascii header, no data.

:FETCh:TRACe?	Fetch data from the most recent measurement for a single trace.
<trace spec>	
[< MAX | MIN | MEAN | SDEV | X | Y | READings >]	An optional parameter. If specified, the Max or Min data point from the trace data set will be returned MAX, MIN return a reading from the trace: x.xxxxxxxxx, y.yyyyyyyyy MEAN returns the average of the readings from the trace; note that if the trace units are logarithmic (e.g. dB or dBm), the trace data is converted to linear units, then the mean is computed, then the mean is converter back to log units and returned. y.yyyyyyyyy SDEV returns the standard deviation (1 sigma) of the readings in the trace. y.yyyyyyyyy X returns the x axis data for the trace as a single array of data with no header Y returns the y axis data for the trace as a single array of data with no header READings returns the number of readings in the trace

:INITiate[:IMMEdiate]	Start one measurement sweep using the current sweep configuration. Use *opc? to poll for sweep status to tell when the sweep is done. Use :fetch? then to get the sweep data. If repeat sweep mode is enabled, this command will start the repeat sweeps. Data is NOT saved to file when in repeat sweep mode. To stop repeat sweep mode, the mode must be turned off with the :init:cont off command.

:INITiate:CONTinuous	Enable or disable repeat sweep mode. If enabled, repeat sweeps can only be started by calling the :init command. Once repeat sweeps are started, the only way to stop them is by calling :init:cont off.
<ON | OFF>	

:INITiate:CONTinuous?	Return the repeat sweep mode setting.

:INITiate:ORLAutoref	This is the same as pressing the "ORL Auto Ref" softkey button on the front panel. The ORL Auto Ref procedure is initiated and this command returns immediately. Use *OPC? query to determine when

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

	the ORL Auto Ref process has completed.

:MEASure:PDOFfset	Start a measurement of the PD card's input and store the results as a linear offset for each PD card and enable card offset computation. This is used to measure and store dark current of a photodiode with the photodiode card(s). If the system includes a shutter, the shutter is opened during the measurement. A time based measurement is performed with 100,000 samples in 1 reading, which takes about 1 second. This command returns after the measurement has been triggered. Query *OPC? to determine when the measurement has completed.

: MEASure:SOP?	Measure insertion loss through a DUT and controls State of Polarization (SOP) to maximize and minimize DUT IL. For example, with an external 8169A controller on the CSA external gpib control bus, the following data is returned: ~> deg, deg, dBm 45.00, 41.00, -33.0033365 26.00, 76.00, -59.659202 => the first angle is the quarter waveplate angle the second angle is the half waveplate angle and the third number is the insertion loss (or power) measured at this SOP. Parameters that control SOP operation are specified with the :config:psc:sop command

:MEASure:TEMPerature?	Meausre the two thermocouple inputs, T1 & T2, on the rear of the CSA. The Temperature Measurement option must be installed. Both thermocouples must be installed for the measurement to work. The readings are returned T1 then T2. The units can be queried with :config:units:temp?. example :meas:temp? 44.22 23.34 =>

:MEASure?	Execute a time-domain measurement

:OUTPut	Set the 64 digital output bits Bits are numbered 1-64
< ByteValue in Hex >	Bits 1 thru 8 values
< ByteValue in Hex >	Bits 9 thru 16 values
< ByteValue in Hex >	Bits 17 thru 24 values
< ByteValue in Hex >	Bits 25 thru 32 values
< ByteValue in Hex >	Bits 33 thru 40 values
< ByteValue in Hex >	Bits 41 thru 48 values
< ByteValue in Hex >	Bits 49 thru 56 values

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

< ByteValue in Hex >	Bits 57 thru 64 values

:OUTPut?	Read the 64 digital output bits Example: :Output 01 23 45 67 89 AB CD EF => In the example above the following bits are set 1, 9, 10, 14, 25,27 …. 57, 58, 59, 60, 62, 63, 64

:OUTPut:SETBit	Set one digital output bit
<Bit number in Dec>	1 to 64

:OUTPut:CLEArbit	Clear one digital output bit
<Bit number in Dec>	1 to 64

:OUTPut:TEST	Test the digital outputs. Bits 1 to 64 are turned on in sequence, then bits 1 to 64 are cleared in sequence. The test takes about 4 seconds to run. The CSA does not have the capability to verify the actual voltage on the output pins, this test just runs the sequence and verifies internal command functions.

:SWEEp:CONT?	Execute a continuous sweep

:SWEEp:STEP?	Execute a stepped sweep

:SYSTem:CHANnels?	Return channel cards found in the system

:SYSTem:DISPlay	Setup front panel display under SCPI operations
<ON|OFF>	Enable / Disable the front panel display for SCPI initiated sweeps (time, sweep, step).

:SYSTem:COMMunications:ENET:CLEAr	Clear Ethernet card statistics
<HOST|CHASSIS>	Select with Ethernet card (defaults to host if not specified)

:SYSTem: COMMunications:ENET:STATus?	Request Ethernet card statistics
<HOST|CHASSIS>	Select with Ethernet card (defaults to host if not specified)

:SYSTem:DISPlay?	Return front panel display setting for SCPI operations

:SYSTem:FILTer	Setup analog filter
<ON|OFF>	Enable / Disable Analog Filter used during Sweeps & Measures

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:SYSTem:FILTer?	Return current Analog filter setting

:SYSTem:POSEtup	Select a system configuration file to use at startup
<filespec | FACTory>	Configuration to use at power on. Only the filename need be specified in filespec, the default extension and path c:\csadata*.sst is added if not specified.

:SYSTem:POSEtup?	Display the system configuration file used at startup

:SYSTem:RELAtive:CONFig	Configure power relative measurements.
<ON|OFF>	Enable/Disable power relative measurements

:SYSTem:RELAtive:CONFig?	Display power relative configuration

:SYSTem:RELAtive:DUALsweep	Dual Sweep mode is used to split each sweep into two seperate sweeps. The first sweep being the power reference sweep for the PRef channel and the second sweep for the rest of the measurements. This sweep mode is only useful for specific configurations, such as when using and OSC 5209.
<ON|OFF>	Enable/Disable dual sweep mode

:SYSTem:RELAtive:DUALsweep?	Get the Dual Sweep mode setting

:SYSTem:RELAtive:REFSave	Save a power reference sweep from the specified channel
<ChannelNumber>	1 to 6 (Chassis 0 only), card must be present in the slot

:SYSTem:RELAtive:SPLItref?	Get the current SplitRef data for the specified [chassis]channel.
< chassis >	The power reference channel is compared to [chassis]channel to compute the Splitter Compensation between the PREF output and the TO DUT output. TO DUT should be connected to [chassis]channel.
< channel >	

:SYSTem:RELAtive:SPLItref:ADDSweep	Setup the CSA to measure SplitRef data on the next sweep. This command must be followed by one of the following commands if ON is specified: :sweep:cont? or :sweep:step?
< ON | OFF >	ON The next sweep will be stored as SplitRef data OFF
< chassis >	The power reference channel is compared to [chassis]channel to compute the Splitter Compensation between the PREF output and the TO DUT output. TO DUT should be connected to [chassis]channel.
< channel >	
< ON | OFF >	ON This sweep/channel will be used as the global splitcal data for any channels that do not have thier own splitcal data OFF This sweep/channel data will only be used for this channel.

:SYSTem:RELAtive:SPLItref:ADDSweep?	Get the current CSA AddSweep settings. AddSweep will remain ON until after a successful sweep has been stored to split ref OR until the

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

	user turns it off.

:SYSTem:RELAtive:SPLItref:CLEAr	Clear the current SplitRef data table. This function clears ALL of the splitcal data in the CSA. Note that this differs from the front panel functionality, in that the front panel only clears data for one channel at a time.

:SYSTem:RELAtive:SPLItref:FACTory:RESTore	Load the SplitRef data table with the factory default data

:SYSTem:RELAtive:SPLItref:FACTory:SAVE	Save the current SplitRef data table into the factory default file. This command is only used by service personnel
< password >	Requires a special factory password for execution

:SYSTem:SHUTter	Open or close the system shutter. Only accepted when shutter is installed
<OPEN|CLOSe>	Open or Close the shutter

:SYSTem:SHUTter?	Return current status of shutter

:SYSTem:TEMPerature	Turn temperature monitoring on or off. This requires the temperature monitoring option to be installed.
<ON|OFF>	

:SYSTem:TEMPerature?	Return current status of temperature monitoring

:SYSTem:TEST:CCRAm	Diagnostic test of the channel card RAM and the interconnecting bus from the CSA main processor.
<chassis>	Chassis number, 0 = CSA, 1=first expansion chassis, etc…
<channel>	Channel number, 1 to 60

:SYSTem:WLCOrr	Wavelength correction data is 'learned' through front panel operation of the Gas Cell Test Application. This function enables or diables use of the previously learned correction factors.
<ON|OFF>	Enable / Disable wavelength correction.

:SYSTem: WLCOrr?	Return current status of wavelength correction setting.

:SYSTem:WREF:CONFig	Only accepted when a wavelength reference channel is installed
<ENABle|DISAble>	Enable/Disable use of a wavelength reference channel

:SYSTem:WREF:CONFig?	Display wavelength reference enable/disable setting.

:TIME <hh:mm:ss>	Set system time

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

:TIME?	Get system time

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Common Commands

***CLS**	Clear event status register

***ESE**	Writes <value> to the IEEE 488.2 Event Status Enable register
<value>	0 to 255

***ESE?**	Returns the IEEE 488.2 Event Status Enable register contents

***ESR?**	Returns the IEEE 488.2 Standard Event Status register contents

***GTL**	Go to local. Enable local

***IDN?**	Get id information (model, revision, etc)
<ChanList | TRIGger | <Chassis #>>	Channel(s)/Trigger or chassis to query No parameter returns id of main processor.

***LLO**	Local lock out

***OPC**	Sets the Operation Complete bit in the IEEE 488.2 Standard Event Status register

***OPC?**	Returns the Operation Complete bit from the IEEE 488.2 Standard Event Status register

***RCL**	Recalls data from disk
<filespec | FACTory>	Only the filename need be specified in filespec, the default extension and path c:\csadata*.sst is added if not specified. Filename Extensions Supported: .SST System State File (default if extension not specified) .SPC SplitCal File .CSV Measurement data

***RST**	Reset the instrument
<REBOot>	Option reboot

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

***SAV**	Save data to disk
<filespec>	Only the filename need be specified in filespec, the extension and path c:\csadata*.ext is added if not specified. A filespec = Factory is not valid. Filename Extensions Supported: .SST System State File (default if extension not specified) .SPC SplitCal File .CSV ASCII Data File from most recent measurement .BDS Binary Data File from most recent mesasurement

***SRE**	Writes <value> to the IEEE 488.2 Standard Request Enable register
<value>	0 to 255

***SRE?**	Returns the IEEE 488.2 Standard Request Enable register contents

***STB?**	Read status register. See SCPI document for extended status.

***TST?**	Perform a self test and return results.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Appendix A

This section includes a **MEASUREMENT WORKSHEET** to facilitate the collection of relevant information before beginning a sweep.

Section Six includes:

Appendix A: Measurement Worksheet

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Appendix A: Measurement Worksheet

The following list provides a summary of the basic information that is required before beginning **STEP SWEEP** or **CONTINUOUS SWEEP** measurement.

It is helpful to read the Operational Modes section of this manual for considerations to keep in mind when assigning values. It is also helpful to print a copy of this **MEASUREMENT WORKSHEET** to use when collecting the necessary data before beginning to setup.

STEP SWEEP		CONTINUOUS SWEEP	
Sweep parameters:		**Sweep parameters:**	
Start λ		Start λ	
Stop λ		Stop λ	
Step Size		Sweep Speed	
Dwell Time			
Triggering:		**Triggering:**	
Rising/Falling		Rising/Falling	
Delay		Delay	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP