

Optical Wavelength Laboratories

OPERATIONS GUIDE

OCM-C C-band DWDM Optical Channel Monitor

Model #:

OCM-C-01 (196.05 THz to 191.30 THz)

OCM-C-02 (196.10 THz to 191.35 THz)



Revision 2B

OWL-INC.COM

Optical Wavelength Laboratories (OWL)
N9623 West US Hwy 12
Whitewater, WI 53190
Phone: 262-473-0643
Internet: OWL-INC.COM



WARNING!!!

HANDLE WITH EXTREME CARE!

This device contains an expensive, extremely fragile MEMS module (2000.00).

This module is **highly susceptible** to **damage** from **impact** – avoid dropping this

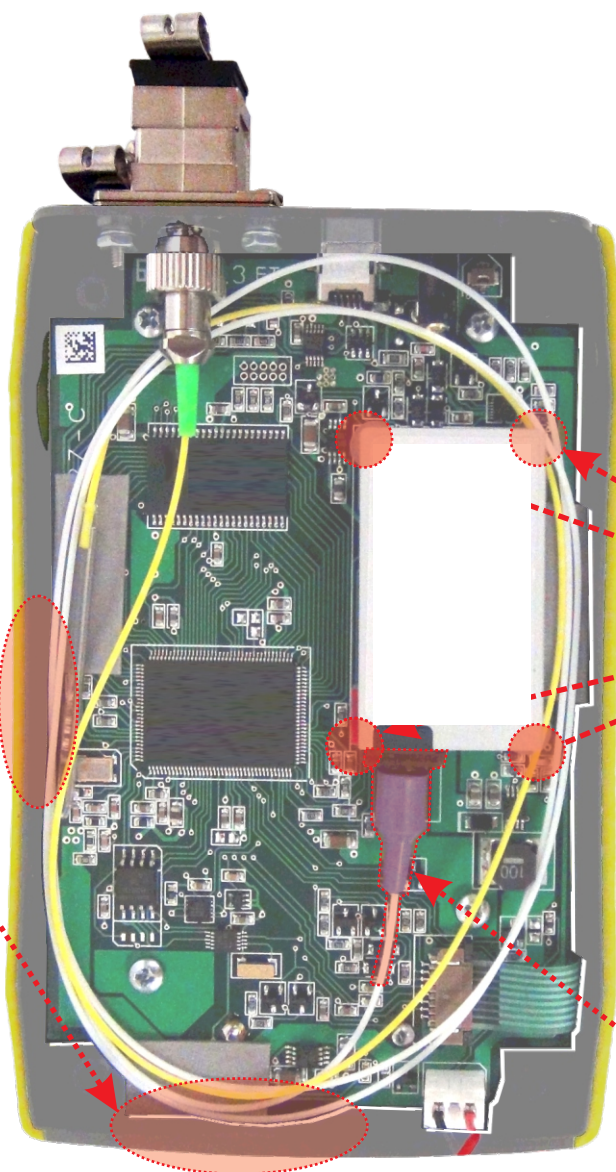
DO NOT OPEN THIS UNIT!

CRITICAL DAMAGE POINT
Fiber crush point near
enclosure's edge.

NOTE: This is an issue for
ALL SIDES of the enclosure
when re-sealing the unit

Pressure sensitive screws
on back side of PCB. Slight
screw pressure imbalances
will cause the unit to fail.

CRITICAL DAMAGE POINT
Fiber coupling to OCM module



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SECTION I: INTRODUCTION

BEFORE YOU BEGIN

All personnel testing optical fibers should be adequately trained in the field of fiber optics before using any fiber optic test equipment. If the user is not completely familiar with testing fiber optics, they should seek competent training. Such training can be acquired from a variety of sources, such as local hands-on training classes or online courses.

Optical Channel Monitors (OCM) are used to take incoming signals from Dense Wave Division Multiplexers (DWDM), and split these signals into separate channels based on the grid of frequencies/wavelengths defined in the ITU-T Rec. G.671 standard. The output power of each channel is measured and plotted on a graph.

DWDM systems typically use singlemode fibers as the physical medium, and singlemode lasers for transmission. As such, technicians working with DWDM systems should follow industry standard laser safety procedures to protect their eyes from accidental exposure to the high-intensity laser outputs of DWDM transmitters.

The OCM-C from OWL is capable of measuring 96 DWDM channels from 191.30 to 196.05 Terahertz (revision -01) or 191.35 to 196.10 Terahertz (revision -02), using 50 Gigahertz spacing. Each of these channels are measured for optical power levels, which are compared to user-definable minimum and maximum power levels (useful for determining PASS/FAIL). Captured data is then plotted on a bar graph on the color LCD display – each channel shows different colors to denote whether the signal is too high, too low, or within acceptable power levels.

Users can also choose specific ranges of channels to scan, toggle views between hertz and wavelength, and choose whether to use frequency or wavelength for channel numbering (lowest value is channel 1). Two cursors are available so users can zoom in on a specific range of channels for closer inspection.

Scan data can be stored in permanent memory, which can be recalled on the LCD display and downloaded into our OCM software.

The color LCD display implements state-of-the-art display technology that “flips” the display between portrait or landscape mode automatically simply by rotating the device 90°.

Powering the OCM-C is a re-chargeable Lithium-polymer battery that allows for up to 20 hours of normal usage.

ABOUT THIS MANUAL

Throughout this manual you will find various symbols that assist with understanding the procedures outlined in this manual. Below is a list of these symbols and a short description of their purpose:



Helpful tip



Cautionary information



Potentially dangerous condition or operation

SECTION I: INTRODUCTION

PRECAUTIONS

Eye Safety



NEVER look into the connector port of any fiber optic test or transmission equipment, patch cable, fiber link, or other installed fiber. Always assume that active laser equipment is attached to optical fibers, and is powered on.

Electrical Safety



Only use appropriate AC adapters for charging this device. Use of inappropriate power adapters could cause damage to the device, and could cause harm to the user from fire and electrical shock.

Operational



Keep connector ferrules and optical connector ports clean to prevent irreparable damage to the test port. For best results, replace dust caps after each use.



Do not run OCM tests longer than is absolutely necessary to acquire scan data.

Connector



For best results, do NOT insert APC (Angled Physical Contact) connectors into the test port, unless the port is clearly marked as APC.

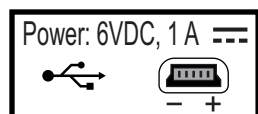
Service



There are no user-serviceable parts in this device. Unauthorized attempts to service this product will void the product warranty.

LABEL INFORMATION

On the back of each OCM-C is a label similar to the one shown here containing model number, serial number, power requirements, and special cautionary information.

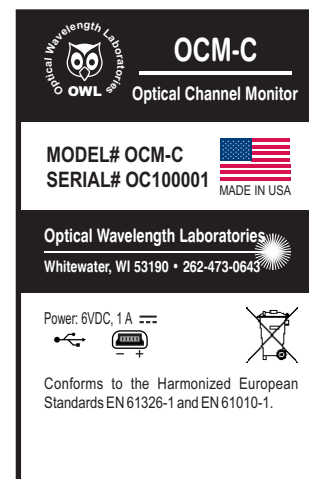


USB port 6VDC, 1A



Directive 2002/96/EC of 27 January 2003 on waste electrical and electronic equipment (WEEE)

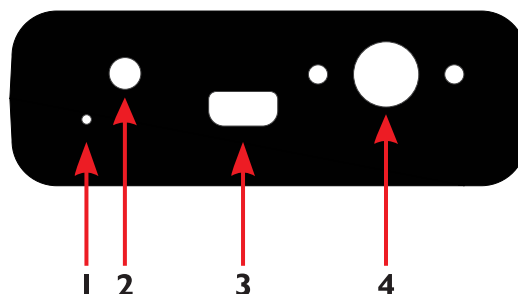
EU Directives EN 61326-1:2006 (EMC) and EN 61010-1:2001 (Safety)



SECTION I: INTRODUCTION

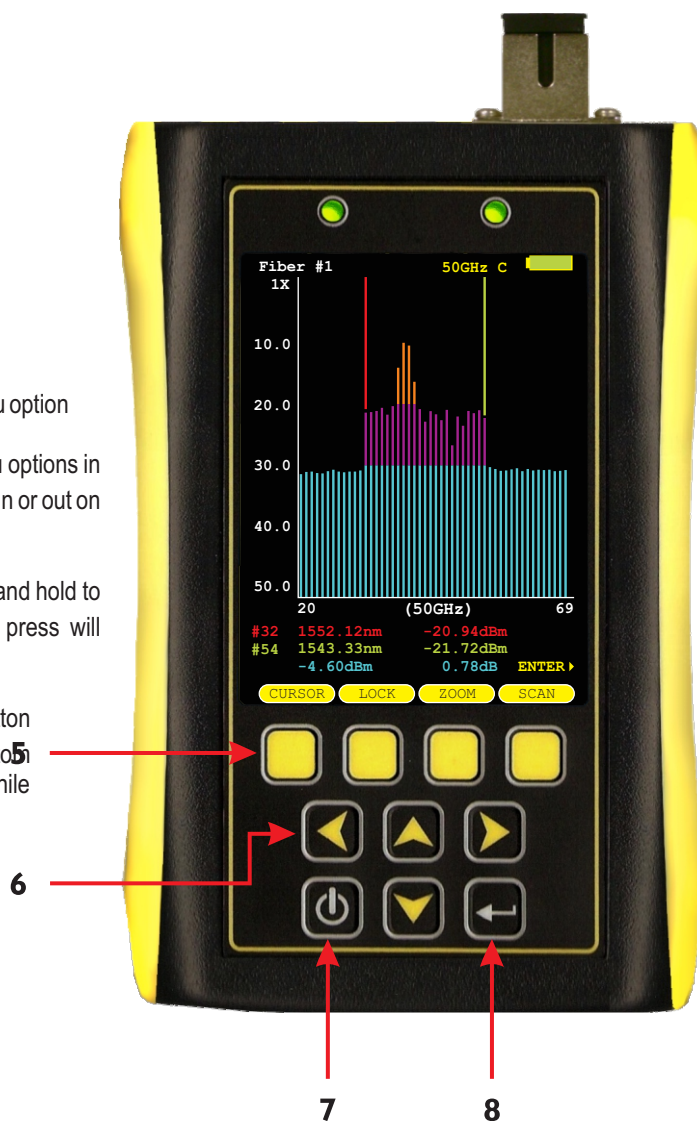
PORTS

- 1 **Reset Button** – resets the device in case of malfunction
- 2 **Battery Charger Port** – used for battery charging
- 3 **USB Download Port** – downloads data from the OCM to the PC; battery can also charge through this port
- 4 **Test Port** – connects the OCM to the fiber under test



BUTTONS

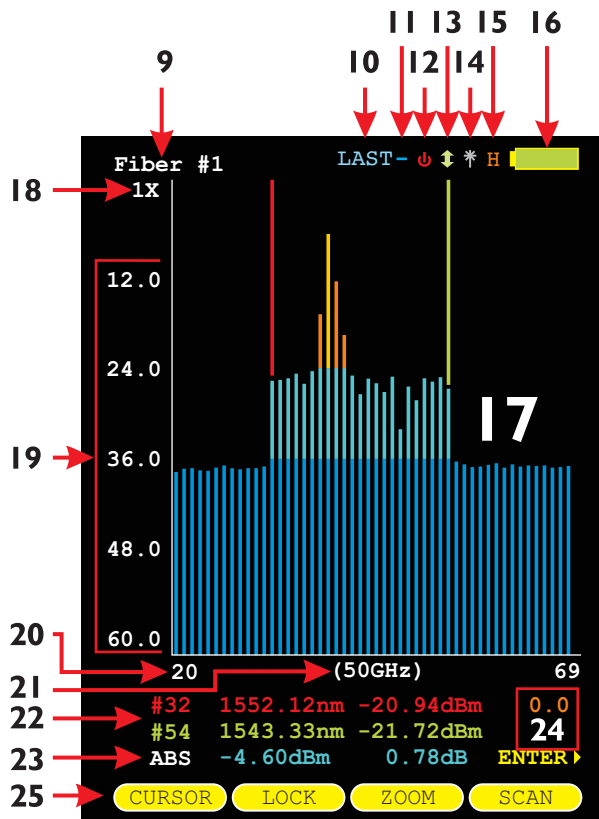
- 5 **Menu Buttons** – activates the associated menu option
- 6 **Navigation Buttons** – moves cursors or menu options in the direction of the button, or are used to zoom in or out on cursor placement
- 7 **Power Button** – powers the device on; press and hold to power off; also, while the OCM is on, brief press will activate other functions
- 8 **Enter Button** – from the test screen, this button changes the function options menu at the bottom of the screen. Also activates menu options while in the menu system



SECTION I: INTRODUCTION

DISPLAY

- 9 Fiber ID – name of the currently loaded test
- 10 Graph Data Mode – results of current scan
 - LAST most recent test taken
 - AVG average power level
 - MIN lowest power level
 - MAX highest power level
- 11 Gain Level – High (+) or Low (-) gain
- 12 OSA Status – green is scanning; red is off
- 13 USB Connection Status – shows whether or not the USB cable is connected
- 14 Peak Detection – channel peaks detected when green, saturated peaks when red
- 15 Zoom Indicator – shows whether Vertical (V) or Horizontal (H) zoom is selected
- 16 Battery Life Indicator – displays the remaining battery life
- 17 Channel Bar Graph – displays optical power levels for selected DWDM channels:
 - LOW below the minimum power threshold
 - ACCEPTABLE within acceptable tolerances
 - HIGH above the maximum power threshold
 - OVER too high to be measured accurately
- 18 Vertical Zoom Level – 1x, 2x, 4x, 8x, 16x; UP arrow to zoom in, DOWN arrow to zoom out
- 19 Optical Power Level Scale (y-axis) – shows optical power level range (numbers are shown without negative sign)
- 20 Channel Numbers (x-axis) – shows the beginning and ending channel number for the range of selected DWDM channels
- 21 Channel Spacing – shows whether 50 GHz or 100 GHz spacing is selected
- 22 Channel Information – shows the information for the channels where the red and green cursors are located
- 23 Channel Numbering – displays whether the channel numbers are shown based on absolute ITU grid numbers (ABS) or on relative scan channel numbers (REL).
- 24 Insertion Loss – corrective insertion loss factor for passive devices such as the tap port of a splitter
- 25 Function Options Menu – displays the on-screen menu options.



There are three sets of Function Options Menus. The Enter key (↵) is used to toggle between these three menus:



SECTION I: INTRODUCTION

INDICATOR LEDs

- 26** **CHARGING STATUS** – will be lit when charging through a transformer or USB port

GREEN battery fully charged

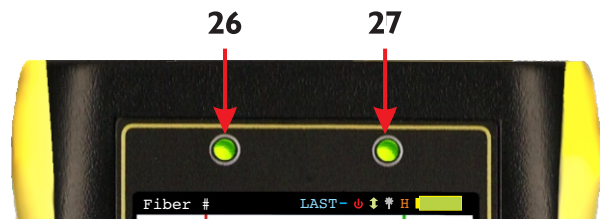
ORANGE battery charging

RED problem with battery and/or charger; contact OWL for service

- 27** **STANDBY STATUS**

Normal operation **GREEN** blinking

STANDBY **RED** solid; press any key to “wake up” the device



SECTION 2: OCM TESTING

POWER ON/OFF

POWER ON

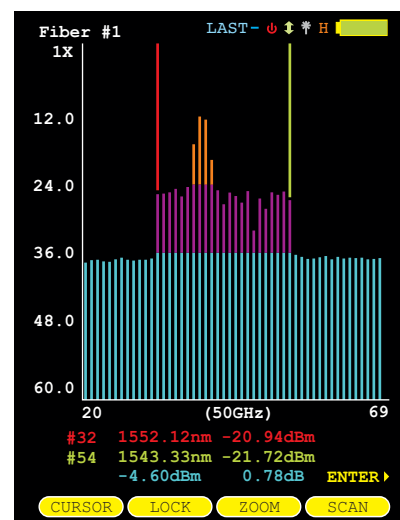
Press  to power on the device.

When the device has completed startup, the bar graph area will either be blank, or will show the previously viewed bar graph (as shown at right).

Continue below for more information about running a new OCM test.

POWER OFF

The device may be powered off from any screen by holding .



KEY OCM TEST PARAMETERS

Below is a descriptive list of key OCM test parameters, as found in the Scan Parameters setup screen.

GRAPH DATA MODE – range of values: **LAST, AVG, MIN, MAX**. Determines the scan data to be graphed. The following are available options:

- LAST** graph shows the results of the last test during the current scan period
- AVG** graph shows the average of all scans during the current scan period
- MIN** graph shows the minimum power level received during the current scan period
- MAX** graph shows the maximum power level received during the current scan period

DEFAULT UNITS – range of values: **nm, THz**. Selects the default displayed channel unit. Options are wavelength (in nm), or frequency (in THz).

SCALE MIN – range of values: **-30.0 to -60.0 dBm (in increments of 0.1 dB)**. Sets the minimum power displayed on the channel power bar graph in dBm. Channel power values below this value will not produce a bar on the graph.

POWER MIN – range of values: **-20.0 to -60.0 dBm (in increments of 0.1 dB)**. Sets the minimum power threshold needed to consider a channel active.

CHANNELS – range of values: **8 to 96**. Sets the total number of channels to include in the current scan.

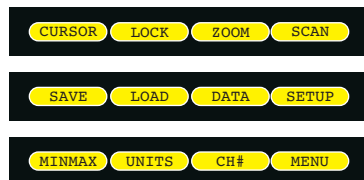
START – range of values: **1 to 89**. This sets the starting ITU channel number for the current scan.


SECTION 2: OCM TESTING

FUNCTION OPTIONS MENUS

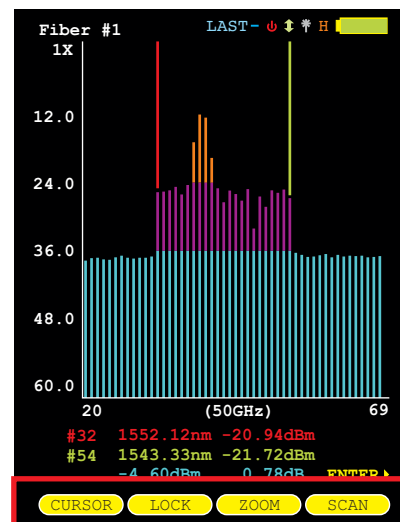
Function options menus are located above the yellow function buttons.

There are three sets of function options menus:




Press  to toggle between these function options menus.

The following pages will cover each of the menu options in detail.





SETTING TEST PARAMETERS

Press  from the bar graph screen until the following menu options appear:



 opens the SCAN PARAMETERS menu

  selects the next or previous test option

  changes the value in the selected test option

GRAPH DATA MODE – range of values: LAST, AVG, MIN, MAX. Determines the scan data to be graphed during the current scan period.

- LAST graph shows the results of the last test
- AVG graph shows the average of all scans
- MIN graph shows the minimum power level received
- MAX graph shows the maximum power level received




DEFAULT UNITS – range of values: nm, THz. Selects the default displayed channel unit. Options are wavelength (in nm), or frequency (in THz).

SCALE MIN – range of values: -30.0 to -60.0 dBm (in increments of 0.1 dB). Sets the minimum power displayed on the channel power bar graph in dBm. Channel power values below this value will not produce a bar on the graph.

POWER MIN – range of values: -20.0 to -60.0 dBm (in increments of 0.1 dB). Sets the minimum power threshold needed to consider a channel active.


CHANNELS – range of values: 8 to 96. Sets the total number of channels to include in the current scan.

START – range of values: 1 to 89. This sets the starting ITU channel number for the current scan.

Press  to save the scan parameters, press  to exit without saving the scan parameters, or press  for a description of each of the scan parameters.

SECTION 2: OCM TESTING


STARTING A SCAN

Press  from the bar graph screen until the following menu options appear:




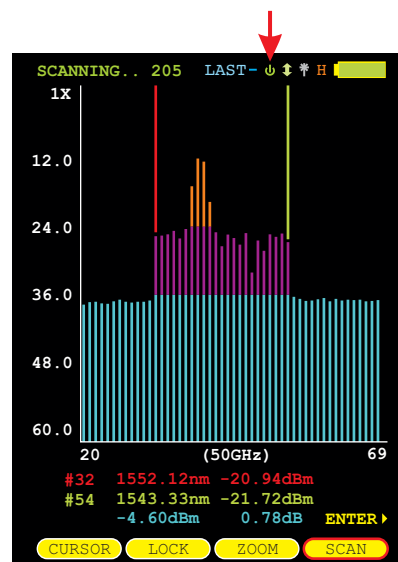
SCAN

starts a scan based on the selected scan parameters; press again to end the scan

The OSA Status icon () will turn green while the device is scanning. The scan area and channel information will update periodically as new scan data become available.

The status bar also displays a counter for the number of samples taken during the current scan period; for example, **SCANNING.. 205**

The OSA Status icon () will turn red when the device is no longer scanning. The scan area will then show the results of the scan, based on the scan mode: LAST, AVG, MIN, MAX.



CURSORS

Red and green cursors are provided as markers for specific channels to be analyzed. These cursors can be moved while a scan is in progress.

CURSOR

selects/de-selects the active cursor – no cursor, red, green, or both red and green.

A colored arrow will appear next to the scan data for cursors that are active.

LOCK

locks active cursors in their current location; unlocks a locked cursor

A colored padlock symbol will appear next to the scan data for locked cursors. Locked cursors will not move from their locked location.

ZOOM

sets the ZOOM mode to Horizontal (H) or Vertical (V)



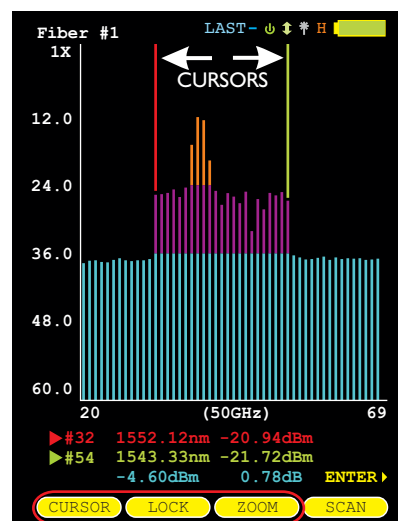
WHEN ONE OR MORE CURSORS ARE SELECTED (AND NOT LOCKED): moves the selected cursor(s) left or right

WHEN NO CURSORS ARE SELECTED: screen pans left and right



WHEN ONE OR MORE CURSORS ARE SELECTED: zooms in or out on the active cursor(s)

WHEN NO CURSOR IS SELECTED: zooms in and out on the center of the screen



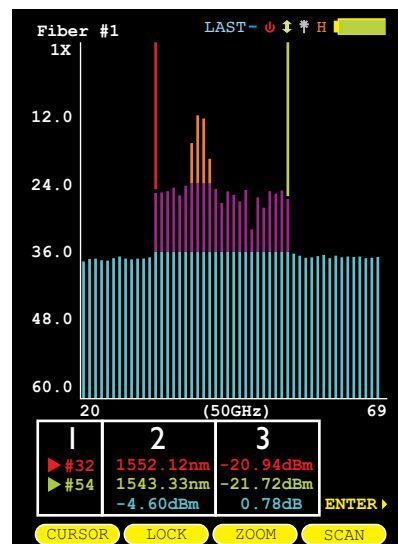
SECTION 2: OCM TESTING

CHANNEL INFORMATION

Channel information is located below the bar graph area, and will change when the cursors are moved to new channels.

The three columns of information are as follows:

COLUMN 1	Red	channel number at red cursor position
	Green	channel number at green cursor position
COLUMN 2	Red	wavelength/frequency of channel at red cursor position
	Green	wavelength/frequency of channel at green cursor position
	Blue	total optical power being received from all channels
COLUMN 3	Red	optical power of channel at red cursor position
	Green	optical power of channel at green cursor position
	Blue	difference in channel optical power between red and green cursor positions



NOTE: Channels with yellow peaks are saturated (i.e. too high to be measured accurately – over -10 dBm). The power values will change color when saturated channels are selected. When a channel includes saturated data points, the data is no longer accurate.

When saturated data points are detected, it is suggested to use an attenuator of an appropriate value to adjust the optical power below -10 dBm.

To compensate for the additional attenuation, add the attenuator value as Insertion Loss (see the OCM CONFIGURATION menu for more information).

SAVING TEST RESULTS

Scan results may be stored in permanent memory for later viewing or download to hard disk for data file retrieval.

From the bar graph screen, press **SAVE** to enter the fiber name and save the currently displayed test result to memory.

To enter a fiber name, use the arrow keys to highlight the appropriate character on the grid.

- <--** BACKSPACE
- SHIFT** TOGGLE BETWEEN UPPER AND LOWER CASE ALPHABET
- SPACE** FORWARD SPACE
- SELECT** SELECT THE HIGHLIGHTED CHARACTER
- DONE** FINISHED ENTERING NAME

Enter fiber name:

Fiber #

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
0	1	2	3	4	5	6	7	8	9	:	;	<

Use arrows to highlight letter then press the enter key. Tap the power button to abort.

<-- **SHIFT** **SPACE** **DONE**

SECTION 2: OCM TESTING

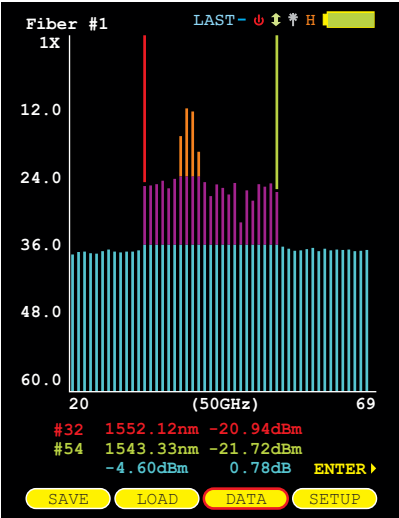
VIEW SCAN DATA ON-SCREEN

Press  from the bar graph screen until the following menu options appear:




DATA shows a listing of optical power data for all channels in columnar format

Optical power data is shown for the last scan, and average power, minimum power, and maximum power for all measurements taken during the current scan period



SETTING MIN/MAX POWER THRESHOLDS

Press  from the bar graph screen until the following menu options appear:

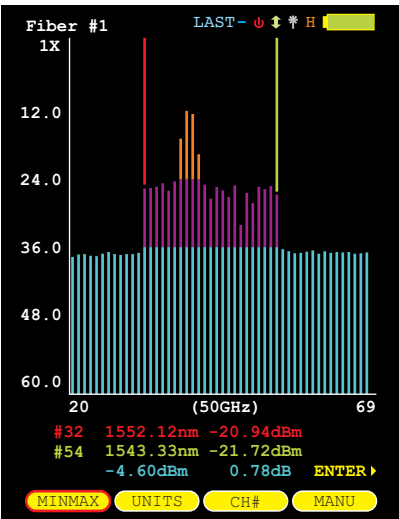


MINMAX allows the user to set default power thresholds for both minimum and maximum power levels, or can set power thresholds for the current scan only

Thresholds can be set in increments of 0.1 dB


MINIMUM Range: -11.0 to -40.0 dBm

MAXIMUM Range: -10.0 to -29.9 dBm



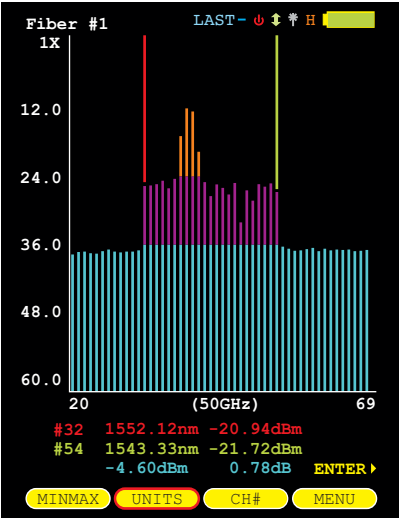
SECTION 2: OCM TESTING

TOGGLE CHANNEL UNITS


Press  from the bar graph screen until the following menu options appear:



UNITS toggles the displayed channel units on the bar graph screen between frequency (THz) and wavelength (nm)



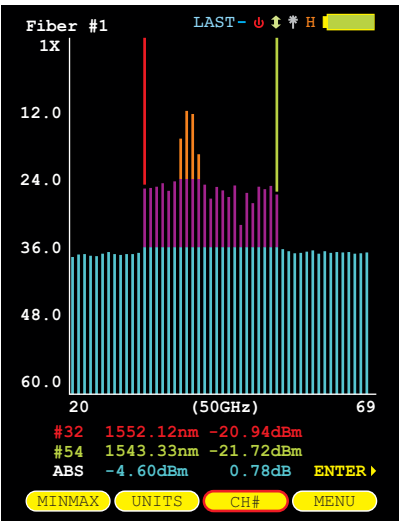
SETTING CURSOR CHANNEL NUMBERING

Press  from the bar graph screen until the following menu options appear:



CH# cursor channel number is either absolute ITU channel or relative scan channel number.

The current setting is shown below the cursor channel numbers. The graph channel numbers are always absolute ITU values.



SECTION 3: STORED SCANS

LOADING PREVIOUSLY STORED SCANS

Previously stored results can be loaded from memory for later on-screen analysis.

The STORED SCANS menu may be accessed two ways:

- 1) from the Function Options menu on the bar graph screen, press **LOAD** ; or
- 2) select the STORED SCANS option from the SETUP MENU.



moves the cursor up and down in the list of stored scans



exits the STORED SCANS menu and returns to the bar graph



accesses context-sensitive help



loads the currently selected scan into the bar graph area



NOT USED IN THIS DEVICE



gives the user the option: 1) to delete the currently selected scan; 2) to not delete the selected scan; 3) to delete all scans; or 4) delete only scans that have been previously downloaded (see SCAN DOWNLOAD STATUS below)



displays the next page of test results if there are more scans than will fit on the screen

STORED SCANS		
Scan Name	Date	Time
▶ SM-BB-F1-F2:1	10/05/09	04:16PM ✓
SM-BB-F1-F2:2	10/05/09	04:17PM
SM-BB-F1-F2:3	10/05/09	04:19PM
SM-BB-F1-F2:4	10/05/09	04:21PM
SM-BB-F1-F2:5	10/05/09	04:24PM
SM-BB-F1-F2:6	10/05/09	04:27PM

Download status column

Scan Parameters

L=361 S=1 C=96

◀ ABORT ⏻ HELP

LOAD OVERLAY DELETE PAGE

SCAN PARAMETER INFORMATION. Information at the bottom of the STORED SCANS screen shows scan parameter settings used when the scan was taken:

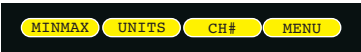
- L** number of total scans
- S** starting channel number
- C** number of channels included in the scan



SCAN DOWNLOAD STATUS. If the trace has already been downloaded to the PC, this trace will be marked by a green checkmark which appears at the right of each trace.

SECTION 4: OCM MENUS

SETUP MENU



Press from the bar graph screen until the following menu options appear:

Press to access the SETUP MENU.

NAVIGATING THE MENU SYSTEM

The arrow keys are used to navigate throughout the various menus and help screens in this device. Green selection arrows highlight different menu options.

moves the selection arrows to the next or previous menu option

jumps to the highlighted menu option

returns to the previous menu

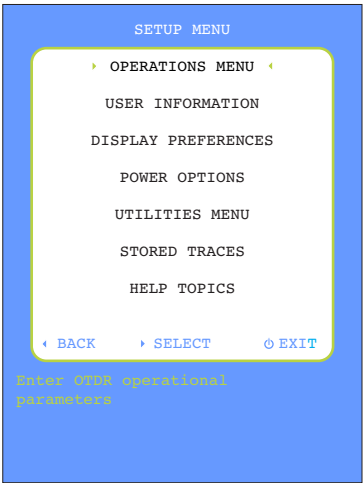
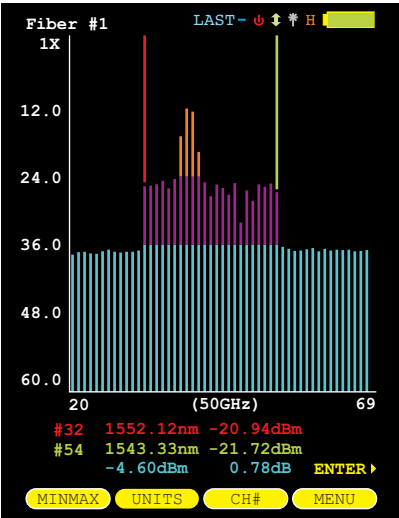
exits the menu system

SETUP MENU

The SETUP MENU is the main entry point into the device's menu system. Shown below is a tree of menu options.

Each option will be explained in detail on the following pages.

HELP TOPICS



SECTION 4: OCM MENUS

OPERATIONS MENU

OPERATIONS MENU

SCAN PARAMETERS

OSA CONFIGURATION

SYSTEM INFORMATION

CTM INFORMATION

◀ BACK ▶ SELECT ⏻ EXIT

Configure scan display Parameters

SCAN PARAMETERS

GRAPH DATA **LAST**

DEFAULT UNITS **THz**

SCALE MIN **-30.0**

POWER MIN **-60.0**

CHANNELS **96**

START **1**

SAVE QUIT HELP

SCAN PARAMETERS

See page 6 for more information on scan parameters.

OSA CONFIGURATION

INPUT GAIN **AUTO**

INSERTION LOSS **0.0**

PEAK THRESHOLD **-25.0**

CHANNEL SPACING **50G**

CHANNEL OFFSET **13**

OSA CONFIGURATION

INPUT GAIN – sets the gain of the OSA receiver.

LOW normal gain

HIGH increases gain by 10 dB

AUTO device auto-adjusts the gain based on total incoming optical power

INSERTION LOSS – sets the insertion loss in dB of the OSA connection to the fiber under test. The default value is 0.0 dB because a direct coupled fiber should have a low insertion loss.

However, if the connection is a tap port of a fiber splitter, or if you are using an in-line attenuator to “pad” the signal, the insertion loss of the tap port or attenuation value of the attenuator should be used. This insertion loss value is added to the measured channel power to give the actual channel power on the fiber under test.

PEAK THRESHOLD – in LOW gain mode, this is the minimum power in dBm that a channel must have to be considered active. The valid range is -20.0 to -50.0 dBm.

CHANNEL SPACING – sets channel spacing to 50GHz or 100GHz according to ITU G.694.1 DWDM channel grid

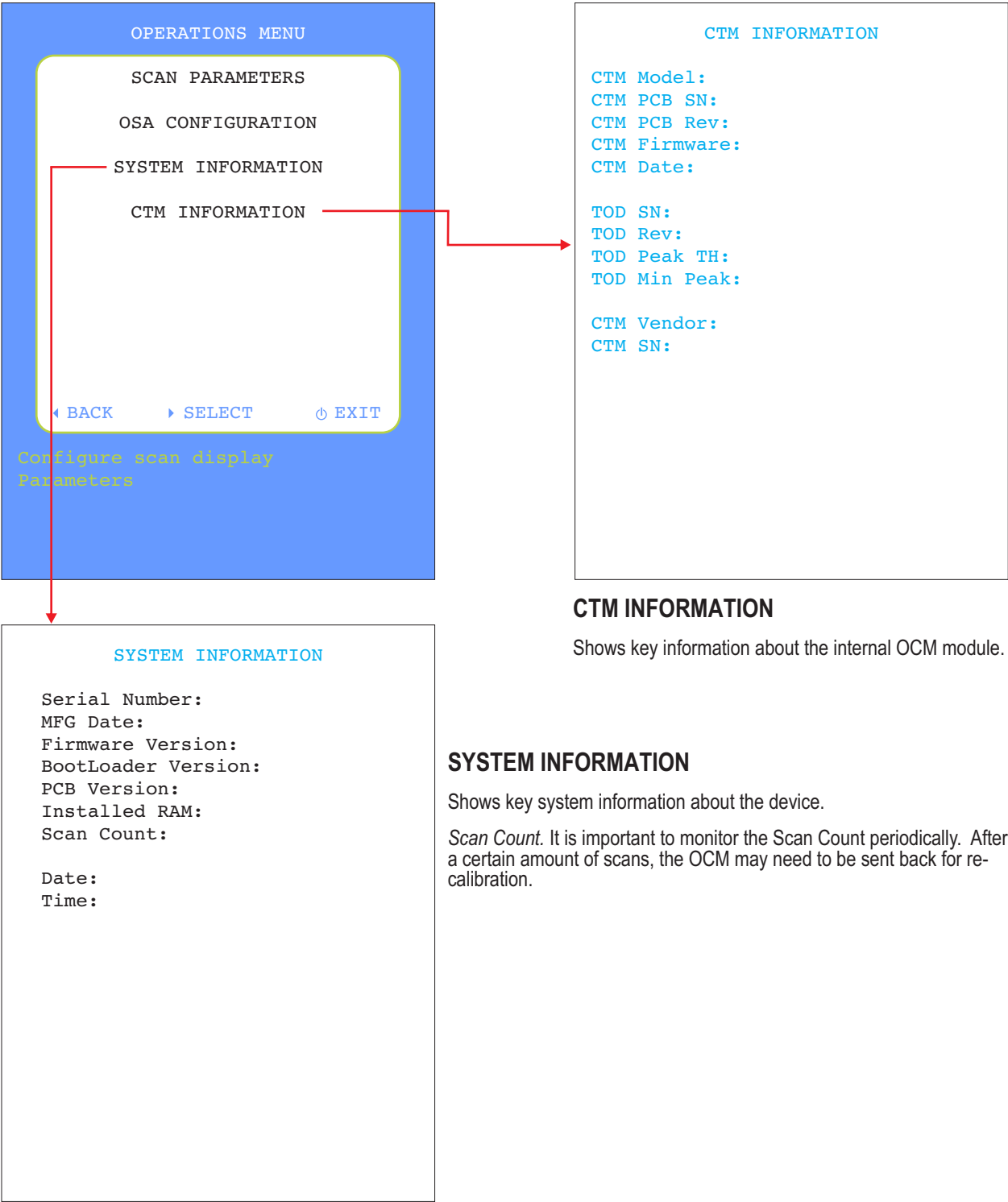
CHANNEL OFFSET – selects the OCM module channel number to be used as the first channel number based on the user’s particular channel number system.

For example: if the frequency of the user’s channel 13 is the same frequency as the OCM module channel 1, set the channel offset number to 13.

See the appendix for the OCM-C channel grid.

SECTION 4: OCM MENUS

OPERATIONS MENU



SECTION 4: OCM MENUS

USER INFORMATION MENU

USER MENU

USER NAME

USER PHONE

◀ BACK ▶ SELECT ⏻ EXIT

USER NAME

Enter user name:

USER NAME

ABCDEFGHIJKLM
NOPQRSTUVWXYZ
0123456789:;<

Use arrows to highlight letter then press the enter key. Tap the power button to abort.

<-- SHIFT SPACE DONE

Enter user name:

Enter the name of the person or company who owns the device. This information will appear on test reports.

Up to 16 characters are allowed in the user name entry field.

See the on-screen instructions for help with text entry.

Enter phone number:

XXX-XXX-XXXX

ABCDEFGHIJKLM
NOPQRSTUVWXYZ
0123456789:;<

Use arrows to highlight letter then press the enter key. Tap the power button to abort.

<-- SHIFT SPACE DONE

Enter phone number:

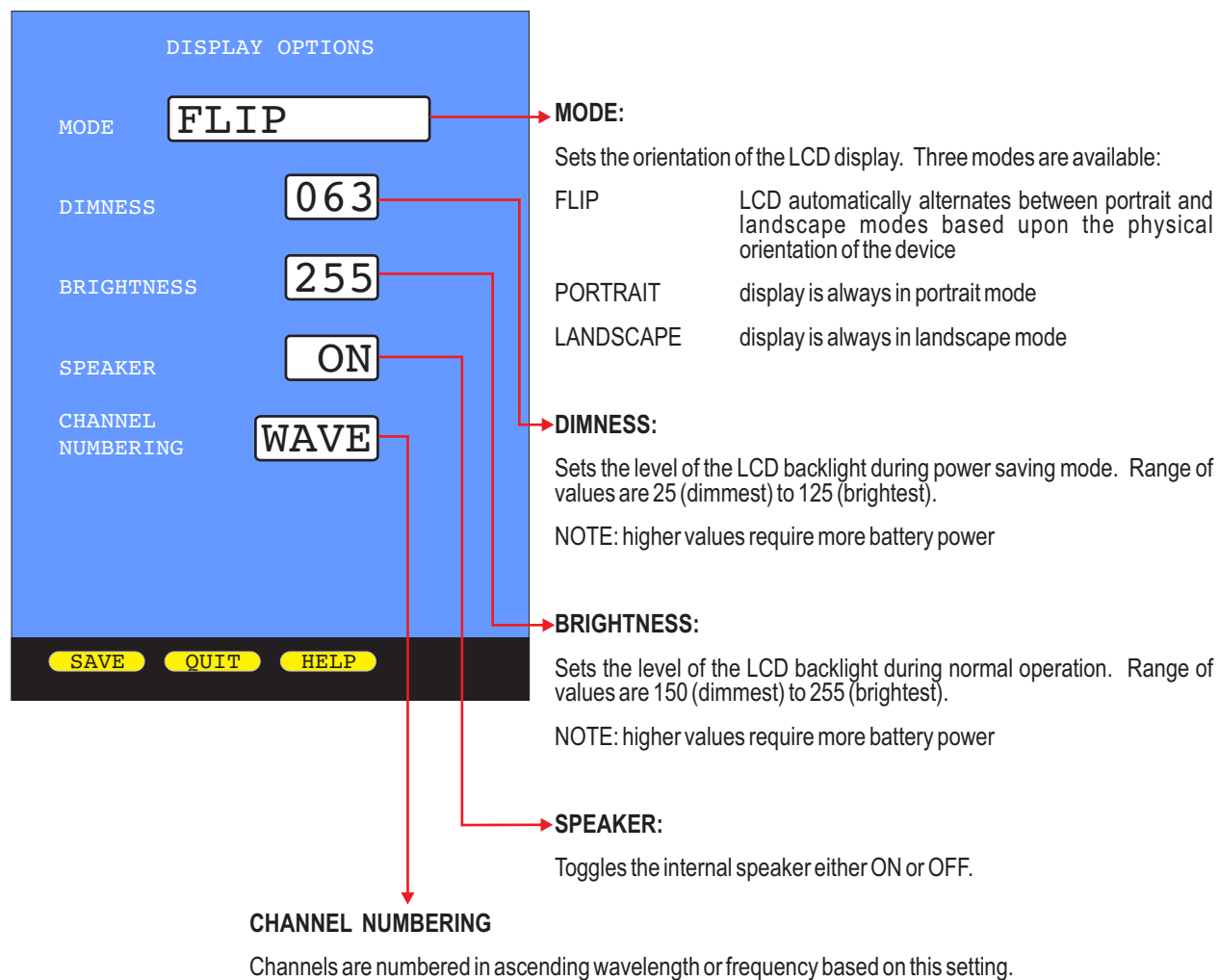
Enter the phone number of the person or company who owns the device. This information will appear on test reports.

Up to 13 characters are allowed in the phone number entry field.

See the on-screen instructions for help with text entry.

SECTION 4: OCM MENUS

DISPLAY PREFERENCES



SECTION 4: OCM MENUS

POWER OPTIONS

The screenshot shows a blue menu titled "POWER OPTIONS". It contains three settings: "DIM TIME" with a value of "003", "STANDBY TIME" with a value of "015", and "OFF TIME" with a value of "045". Below these is the text "Time in minutes (0 = disable)". At the bottom are three yellow buttons: "SAVE", "QUIT", and "HELP". Red arrows point from the values to their respective descriptions on the right.

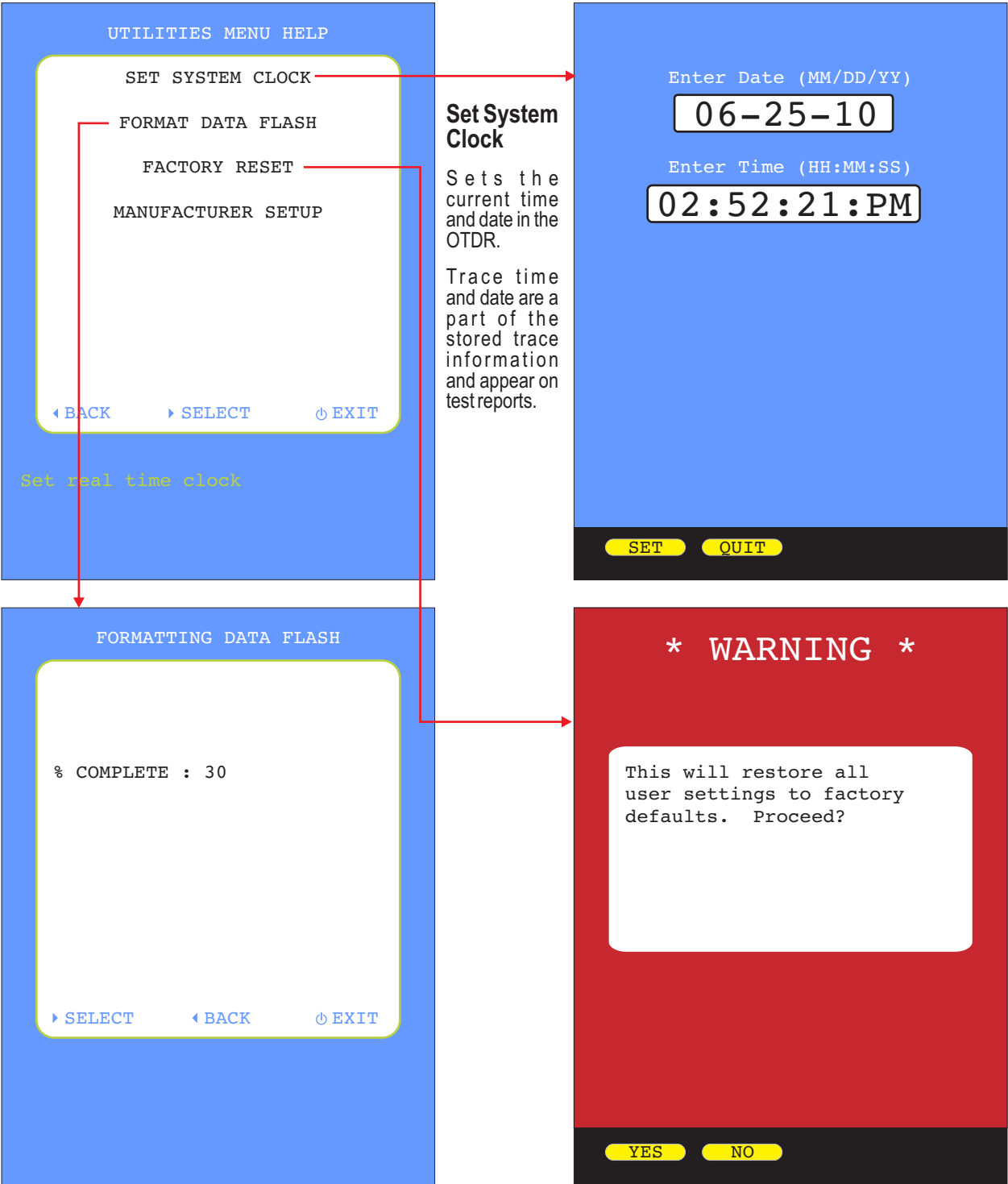
DIM TIME:
Sets the time (in minutes) before the display will enter DIM mode. Range of values is 1 to 250.

STANDBY TIME:
Sets the time (in minutes) before the device will enter STANDBY mode. Range of values is 2 to 250.

OFF TIME:
Sets the time (in minutes) before the device will power off. Range of values is 3 to 250.

SECTION 4: OCM MENUS

UTILITIES MENU



Format Data Flash

Initializes the internal trace storage memory. This option will erase all stored traces, and should only be used in cases where the file system has become corrupted.

Factory Reset

Restores user settings to factory defaults.

SECTION 5: OPERATION/MAINTENANCE

CLEANING THE OTDR PORT

This cleaning procedure applies to the OTDR port on the OWLTrek OTDR.

Required Accessories:

- › Isopropyl alcohol (91% or better)
- › In-adapter fiber optic cleaning accessories, such as 2.5mm cleaning swabs or 2.5mm HUXCleaner™
- › In-adapter fiber optic inspection scope (LCD-based, 200x magnification or greater recommended)
- › Compressed Air (optional)

Below are procedures for “wet” cleaning and “dry” cleaning. For best results, a combination of these cleaning methods is recommended.



IMPORTANT SAFETY NOTE: WHEN INSPECTING AN OPTICAL PORT, NEVER LOOK DIRECTLY OR INDIRECTLY INTO THE PORT WITHOUT SUFFICIENT EYE PROTECTION. THE OPTICAL PORT MAY BE ENERGIZED WITH POWERFUL INVISIBLE RADIATION THAT IS HARMFUL TO THE HUMAN EYE.

INVISIBLE LIGHT IS ESPECIALLY DANGEROUS SINCE THE EYE IS NOT AWARE OF EXPOSURE TO HARMFUL INVISIBLE ENERGY, AND BECOMES INCREASINGLY DANGEROUS WITH PROLONGED EXPOSURE.

TO AVOID ACCIDENTAL EXPOSURE TO OPTICAL ENERGY, IT IS HIGHLY RECOMMENDED TO POWER OFF EQUIPMENT BEFORE INSPECTING OPTICAL PORTS.

IT IS ALSO HIGHLY RECOMMENDED TO USE AN LCD-BASED FIBER INSPECTION SCOPE, WHICH CAN INSPECT OPTICAL PORTS AND FIBER ENDFACES WITHOUT EXPOSING THE EYE TO HARMFUL OPTICAL RADIATION.

“WET” CLEAN PROCEDURE

- 1 Wet the tip of a 2.5mm cleaning swab with isopropyl alcohol.
- 2 Carefully insert the wet tip of the swab into the optical port.
- 3 Clean out the optical port according to the directions provided with the swabs.
- 4 Blow dry the optical port with the compressed air. If compressed air is not available, allow 2 minutes for the alcohol to evaporate.
- 5 Inspect the optical port with the in-adapter fiber optic inspection scope to ensure the port is clear of obstructions.

“DRY” CLEAN PROCEDURE

- 1 Carefully insert a dry 2.5mm cleaning swab or a 2.5mm HUXCleaner™ into the optical port.
 - 2 Clean out the optical port according to the directions that came with the cleaning accessories.
 - 3 Inspect the optical port with the in-adapter fiber optic inspection scope to ensure the port is clear of obstructions.
- If the port is still dirty, another round of cleaning will be necessary. You may also want to use a combination of “wet” and “dry” cleaning to achieve best results.

If the port is still dirty, another round of cleaning will be necessary. You may also want to use a combination of “wet” and “dry” cleaning to achieve best results.

SECTION 6: APPENDICES

SPECIFICATIONS

Optical Specifications	
Operating Frequencies	191.30 to 196.05 THz (C-band)
Total Channels ²	96 @ 50GHz // 48 @ 100GHz
Nominal Channel Spacing	50 GHz or 100 GHz (selectable)
Input Signal Power Range ³	-10 to -40 dBm
Total Input Power	7 dBm
Absolute Power Accuracy	± 1.0 dB
Relative Power Accuracy ¹	1.0 dB
Total Power Accuracy	± 1.0 dB
Display Type	Backlit graphical LCD
Auto-shutdown	Yes
Operating Temperature	-5 to 70° C
Operating Humidity	5 to 85%
Storage Temperature	-40 to 85° C
Storage Humidity	5 to 95%

1. Increments of 50 + N x 12.5 GHz. Assumes valley between channels > 2 dB in 0.2 nm Integration Bandwidth.

2. 50 GHz channels spacing.

3. Power measured in 50 GHz bandwidth.

General Specifications	
Display Type:	High-resolution Color LCD
Display Size:	2.8" diagonal
Battery Type:	Lithium Polymer
Battery Life:	up to 20 hours normal usage
Dimensions:	2.87" x 4.42" x 1.25"
Weight:	10 ounces (284 g)

MAINTENANCE INFORMATION

Repair: Repair of this unit by unauthorized personnel is prohibited, and will void any warranty associated with the unit.

Battery Replacement. The OCM-C contains an internal Lithium Polymer battery. If the battery requires service, the device must be sent in to OWL. Unauthorized attempts to service the battery will void the product warranty.

Cleaning. For accurate readings, the optical connector port on the OCM-C and the connector on the patch cable should be cleaned prior to attaching them to each other. Minimize dust and dirt buildup by replacing the dust caps after each use.

Warranty. The OCM-C comes standard with a two-year factory warranty, which covers manufacturer defect and workmanship only.

CONTACT INFORMATION

Address:

Optical Wavelength Laboratories, Inc.
N9623 US Hwy 12
Whitewater, WI 53190
Phone:

262-473-0643

Internet:

OWL-INC.COM

SECTION 6: APPENDICES

OCM MODULE CHANNEL GRID (Model #: OCM-C-01)

Freq. (THz)	Wave ⁴ (nm)	Channel # (Freq. ↑)		Channel # (Wave ↑)	
		50 GHz ³	100 GHz ²	50 GHz ³	100 GHz ²
196.05	1529.16	96		1	
196.00	1529.55	95	48	2	1
195.95	1529.94	94		3	
195.90	1530.33	93	47	4	2
195.85	1530.72	92		5	
195.80	1531.12	91	46	6	3
195.75	1531.51	90		7	
195.70	1531.90	89	45	8	4
195.65	1532.29	88		9	
195.60	1532.68	87	44	10	5
195.55	1533.07	86		11	
195.50	1533.47	85	43	12	6
195.45	1533.86	84		13	
195.40	1534.25	83	42	14	7
195.35	1534.64	82		15	
195.30	1535.04	81	41	16	8
195.25	1535.43	80		17	
195.20	1535.82	79	40	18	9
195.15	1536.22	78		19	
195.10	1536.61	77	39	20	10
195.05	1537.00	76		21	
195.00	1537.40	75	38	22	11
194.95	1537.79	74		23	
194.90	1538.19	73	37	24	12
194.85	1538.58	72		25	
194.80	1538.98	71	36	26	13
194.75	1539.37	70		27	
194.70	1539.77	69	35	28	14
194.65	1540.16	68		29	
194.60	1540.56	67	34	30	15
194.55	1540.95	66		31	
194.50	1541.35	65	33	32	16
194.45	1541.75	64		33	
194.40	1542.14	63	32	34	17
194.35	1542.54	62		35	
194.30	1542.94	61	31	36	18
194.25	1543.33	60		37	
194.20	1543.73	59	30	38	19
194.15	1544.13	58		39	
194.10	1544.53	57	29	40	20
194.05	1544.92	56		41	
194.00	1545.32	55	28	42	21
193.95	1545.72	54		43	
193.90	1546.12	53	27	44	22
193.85	1546.52	52		45	
193.80	1546.92	51	26	46	23
193.75	1547.32	50		47	
193.70	1547.72	49	25	48	24

Freq. (THz)	Wave ⁴ (nm)	Channel # (Freq. ↑)		Channel # (Wave ↑)	
		50 GHz ³	100 GHz ²	50 GHz ³	100 GHz ²
193.65	1548.11	48		49	
193.60	1548.51	47	24	50	25
193.55	1548.91	46		51	
193.50	1549.32	45	23	52	26
193.45	1549.72	44		53	
193.40	1550.12	43	22	54	27
193.35	1550.52	42		55	
193.30	1550.92	41	21	56	28
193.25	1551.32	40		57	
193.20	1551.72	39	20	58	29
193.15	1552.12	38		59	
193.10¹	1552.52	37	19	60	30
193.05	1552.93	36		61	
193.00	1553.33	35	18	62	31
192.95	1553.73	34		63	
192.90	1554.13	33	17	64	32
192.85	1554.54	32		65	
192.80	1554.94	31	16	66	33
192.75	1555.34	30		67	
192.70	1555.75	29	15	68	34
192.65	1556.15	28		69	
192.60	1556.55	27	14	70	35
192.55	1556.96	26		71	
192.50	1557.36	25	13	72	36
192.45	1557.77	24		73	
192.40	1558.17	23	12	74	37
192.35	1558.58	22		75	
192.30	1558.98	21	11	76	38
192.25	1559.39	20		77	
192.20	1559.79	19	10	78	39
192.15	1560.20	18		79	
192.10	1560.61	17	9	80	40
192.05	1561.01	16		81	
192.00	1561.42	15	8	82	41
191.95	1561.83	14		83	
191.90	1562.23	13	7	84	42
191.85	1562.64	12		85	
191.80	1563.05	11	6	86	43
191.75	1563.45	10		87	
191.70	1563.86	9	5	88	44
191.65	1564.27	8		89	
191.60	1564.68	7	4	90	45
191.55	1565.09	6		91	
191.50	1565.50	5	3	92	46
191.45	1565.90	4		93	
191.40	1566.31	3	2	94	47
191.35	1566.72	2		95	
191.30	1567.13	1	1	96	48

NOTES

- 1) The reference frequency is 193.1THz.
- 2) 100 GHz spacing formula

$$f = 193.1 + n \cdot 0.1 \text{ THz; where } n \text{ is a positive or negative integer including 0}$$
- 3) 50 GHz spacing formula

$$f = 193.1 + n \cdot 0.05 \text{ THz; where } n \text{ is a positive or negative integer including 0}$$
- 4) Wavelengths are calculated using 299792458 meters per second (speed of light in a vacuum, or C).
- 5) The G.694.1 does not specify a channel numbering system.
- 6) Channel numbering systems are proprietary to DWDM equipment manufacturers.
- 7) The channel grid for the OCM-C is based on the upper (196.05 THz) and lower (191.30) frequency limits of the internal OCM module.

SECTION 6: APPENDICES

OCM MODULE CHANNEL GRID (Model #: OCM-C-02)

Freq. (THz)	Wave ⁴ (nm)	Channel # (Freq. ↑)		Channel # (Wave ↑)	
		50 GHz ³	100 GHz ²	50 GHz ³	100 GHz ²
196.10	1528.77	96		1	
196.05	1529.16	95	48	2	1
196.00	1529.55	94		3	
195.95	1529.94	93	47	4	2
195.90	1530.33	92		5	
195.85	1530.72	91	46	6	3
195.80	1531.12	90		7	
195.75	1531.51	89	45	8	4
195.70	1531.90	88		9	
195.65	1532.29	87	44	10	5
195.60	1532.68	86		11	
195.55	1533.07	85	43	12	6
195.50	1533.47	84		13	
195.45	1533.86	83	42	14	7
195.40	1534.25	82		15	
195.35	1534.64	81	41	16	8
195.30	1535.04	80		17	
195.25	1535.43	79	40	18	9
195.20	1535.82	78		19	
195.15	1536.22	77	39	20	10
195.10	1536.61	76		21	
195.05	1537.00	75	38	22	11
195.00	1537.40	74		23	
194.95	1537.79	73	37	24	12
194.90	1538.19	72		25	
194.85	1538.58	71	36	26	13
194.80	1538.98	70		27	
194.75	1539.37	69	35	28	14
194.70	1539.77	68		29	
194.65	1540.16	67	34	30	15
194.60	1540.56	66		31	
194.55	1540.95	65	33	32	16
194.50	1541.35	64		33	
194.45	1541.75	63	32	34	17
194.40	1542.14	62		35	
194.35	1542.54	61	31	36	18
194.30	1542.94	60		37	
194.25	1543.33	59	30	38	19
194.20	1543.73	58		39	
194.15	1544.13	57	29	40	20
194.10	1544.53	56		41	
194.05	1544.92	55	28	42	21
194.00	1545.32	54		43	
193.95	1545.72	53	27	44	22
193.90	1546.12	52		45	
193.85	1546.52	51	26	46	23
193.80	1546.92	50		47	
193.75	1547.32	49	25	48	24

Freq. (THz)	Wave ⁴ (nm)	Channel # (Freq. ↑)		Channel # (Wave ↑)	
		50 GHz ³	100 GHz ²	50 GHz ³	100 GHz ²
193.70	1547.72	48		49	
193.65	1548.11	47	24	50	25
193.60	1548.51	46		51	
193.55	1548.91	45	23	52	26
193.50	1549.32	44		53	
193.45	1549.72	43	22	54	27
193.40	1550.12	42		55	
193.35	1550.52	41	21	56	28
193.30	1550.92	40		57	
193.25	1551.32	39	20	58	29
193.20	1551.72	38		59	
193.15	1552.12	37	19	60	30
193.10¹	1552.52	36		61	
193.05	1552.93	35	18	62	31
193.00	1553.33	34		63	
192.95	1553.73	33	17	64	32
192.90	1554.13	32		65	
192.85	1554.54	31	16	66	33
192.80	1554.94	30		67	
192.75	1555.34	29	15	68	34
192.70	1555.75	28		69	
192.65	1556.15	27	14	70	35
192.60	1556.55	26		71	
192.55	1556.96	25	13	72	36
192.50	1557.36	24		73	
192.45	1557.77	23	12	74	37
192.40	1558.17	22		75	
192.35	1558.58	21	11	76	38
192.30	1558.98	20		77	
192.25	1559.39	19	10	78	39
192.20	1559.79	18		79	
192.15	1560.20	17	9	80	40
192.10	1560.61	16		81	
192.05	1561.01	15	8	82	41
192.00	1561.42	14		83	
191.95	1561.83	13	7	84	42
191.90	1562.23	12		85	
191.85	1562.64	11	6	86	43
191.80	1563.05	10		87	
191.75	1563.45	9	5	88	44
191.70	1563.86	8		89	
191.65	1564.27	7	4	90	45
191.60	1564.68	6		91	
191.55	1565.09	5	3	92	46
191.50	1565.50	4		93	
191.45	1565.90	3	2	94	47
191.40	1566.31	2		95	
191.35	1566.72	1	1	96	48

NOTES

- 1) The reference frequency is 193.1 THz.
- 2) 100 GHz spacing formula

$$f = 193.1 + n \cdot 0.1 \text{ THz; where } n \text{ is a positive or negative integer including 0}$$
- 3) 50 GHz spacing formula

$$f = 193.1 + n \cdot 0.05 \text{ THz; where } n \text{ is a positive or negative integer including 0}$$
- 4) Wavelengths are calculated using 299792458 meters per second (speed of light in a vacuum, or C).
- 5) The G.694.1 does not specify a channel numbering system.
- 6) Channel numbering systems are proprietary to DWDM equipment manufacturers.
- 7) The channel grid for the OCM-C is based on the upper (196.10 THz) and lower (191.35) frequency limits of the internal OCM module.