

SFP CHECK +LIGHT

Rev. D

SFP TRANSCEIVER READER AND TESTING DEVICE

U.S. PATENT 8,566,643

CONTENTS	PAGE
1. INTRODUCTION	1
A. Reason for Reissue	2
B. Description	2
C. Features	2
2. APPLICATIONS	3
A. Light Source for Fiber Optic Testing	3
B. SFP Transceiver Identification	3
C. SFP Transceiver Testing Device	4
D. Low-Precision Optical Power Meter	4
3. FUNCTIONAL DESCRIPTION	4
A. Hardware	4
B. Software	4
4. OPERATING INSTRUCTIONS	5
5. TABS AND SCREENS	11
6. SPECIFICATIONS	16
7. MAINTENANCE	16
8. CUSTOMER SERVICE	17



Figure 1. SFP CHECK +LIGHT

1. INTRODUCTION

This practice describes the Engenuity SFP CHECK™ +LIGHT, a Small Form-factor Pluggable (SFP) Transceiver Reader and Testing Device. See [Figure 1](#). Installation instructions and engineering references are included.

Trademarks used in this manual:

CLEI is a trademark of Telcordia Technologies, Inc. dba iconectiv.

SFP CHECK +LIGHT is a trademark of Engenuity Communications Corp.

Windows is a registered trademark of Microsoft, Incorporated.

©2017 Engenuity Communications Corp. All rights reserved.

A. Reason for Reissue

This practice has been reissued to document features of the SFP CHECK +LIGHT including improved compatibility with Windows 10 operating systems, improved screen layouts, display of additional SFP parameters, and ability to use two SFP CHECK +LIGHT units from one PC.

B. Description

The SFP CHECK +LIGHT is capable of powering SFP and SFP+ optical transceivers, reading the information programmed into an SFP and providing the user with pertinent information such as type, wavelength, reach, and vendor. In addition, this device can display diagnostic information such as transmit and receive levels of SFP transceivers that support diagnostics. +LIGHT, denotes the ability of the SFP CHECK +LIGHT to be powered using an AC adapter simplifying the use of the SFP CHECK +LIGHT as a light source for testing fiber optic cable.

When connected to a PC or laptop, the SFP CHECK +LIGHT uses the default web browser to display ID information and diagnostic information of an SFP. The SFP CHECK +LIGHT supports the display of **ID information** for SFP transceivers manufactured to:

SFP MSA September 14, 2001
SFP Multisource Agreement
INF-8074i Rev. 1.0
Specification for SFP Transceiver

The SFP CHECK +LIGHT supports the display of **ID and diagnostic information** for SFP transceivers manufactured to:

SFF-8472 Revisions 1.0 - 12.2
Diagnostic Interface for Optical Transceivers

XFPs, QSFPs, and compact SFPs (cSFPs) are not supported.

C. Features

The SFP CHECK +LIGHT provides the following features:

- Powers SFP transceivers
- Displays SFP transceiver operating characteristics in an easy-to-read format
- Enables go/no go evaluation of SFP transceiver operation
- Can be used as a low-precision incoming optical power level meter
- Can be used to determine minimum receive sensitivity
- Can be used to light fiber optic cable for testing purposes
- Compact, rugged aluminum device with a mini-USB connector on one end and an SFP transceiver cage on the other end
- Includes USB 2.0 compatible cable and hard-sided carrying case
- Connects to a PC or laptop running Windows® XP, Windows 7 or Windows 10 operating system and USB 2.0 or 3.0 port

- Operates from the PC's default web browser (no Internet connection required). At the time of writing, SFP CHECK +LIGHT has been verified as compatible with the following browsers:
 - Microsoft Edge
 - Microsoft Internet Explorer
 - Mozilla Firefox
 - Google Chrome
- Powered directly from the USB port of a laptop or by using an AC to USB adapter
- Operates over a -40°C to $+65^{\circ}\text{C}$ ambient temperature range

2. APPLICATIONS

Typical applications for the SFP CHECK +LIGHT include:

- Engineering Labs – To identify SFP transceivers and to qualify them for use.
- Central Office, Field, and Data Centers – To verify SFP transceiver type and to confirm proper signal level.
- Field – To support testing of fiber optic cable by providing a light source.
- Incoming Inspection – To ensure that the SFP transceiver received was the one ordered.
- Manufacturing – To check proper encoding and operation.

A. Light Source for Fiber Optic Testing

The SFP CHECK +LIGHT is powered using the AC adapter and, together with an SFP optical transceiver, provides a light source in support of testing fiber optic cable.

B. SFP Transceiver Identification

When equipped with an SFP transceiver, the SFP CHECK +LIGHT can quickly and easily display information such as:

- Synchronous Optical Network (SONET), Ethernet, InfiniBand, Fibre Channel, or Enterprise Systems Connection (ESCON) compatibility
- Single-mode fiber, multi-mode fiber, or copper interface
- Wavelength
- Reach
- CLEI™ code
- Operating temperature
- Transmit level
- Presence of digital diagnostics
- Date code

C. SFP Transceiver Testing Device

When equipped with an optical duplex SFP transceiver with digital diagnostics, the SFP CHECK +LIGHT can display transceiver temperature, internally measured supply voltage, transmit bias current, transmit output power, and received optical power as determined by the SFP transceiver. Levels that fall outside of acceptable thresholds are highlighted in the Diagnostics screen. Power measurements are approximate (typically ± 3 dB).

By using an appropriate single-mode or multimode fiber jumper and connecting the SFP transceiver's Tx to Rx, the transmit and receive power levels can be verified. Adding attenuators allows the receive sensitivity to be verified. Note that a physical loopback is not available when using bidirectional single-fiber or copper SFP transceivers.

When testing single-fiber bidi SFPs, it is recommended that two SFP CHECK +LIGHT units be used; each housing a bidi SFP of different wavelengths. The user may open two SFP CHECK +LIGHT screens on a single laptop and compare matching transmit and receive levels. Another option is to power one SFP CHECK +LIGHT from an AC source.

D. Low-Precision Optical Power Meter

To display optical power levels as determined by the transceiver, install an appropriate SFP transceiver with digital diagnostics into the SFP CHECK +LIGHT. The fiber can be plugged into the receive of the SFP transceiver, and the digital diagnostics page will show an approximate receive level (typically within ± 3 dB).

3. FUNCTIONAL DESCRIPTION

A. Hardware

[Figure 2](#) shows a functional block diagram. The SFP CHECK +LIGHT consists of a central processing unit (CPU) with an integral USB interface, an 8MByte serial flash memory, an SFP cage and connector, a programmable clock generator (up to 166 MHz) used to drive the transmit data input of the SFP transceiver, an electronic switch to turn transceiver power on and off, and a current limit on the SFP CHECK +LIGHT.

The CPU allows the PC to access the serial flash chip. One file in the serial flash is the hex code for the processor. The processor has its own internal memory for code, but the CPU will update its code from the file in the serial flash as needed.

At startup, the SFP CHECK +LIGHT establishes communication with the PC as a mass storage device. When the PC requests the web page to read the contents of the transceiver, the SFP memory is read, converted to HTML format, and then presented to the PC.

The user can install a fiber jumper to determine basic function of the transmit and receive features. The user may connect the receiver to another source and use the SFP CHECK +LIGHT as a coarse power meter.

B. Software

The key to the functionality of the SFP CHECK +LIGHT is the software in the processor. The CPU is responsible for making the device look like a standard SD card, generating a data file for each SFP transceiver, and monitoring the health of the unit.

The software includes the driver for the USB interface and implementation of the mass storage device so that the SFP CHECK +LIGHT will appear to the PC as an SD card similar to those found in cameras. The file access to the SFP memory will be intercepted by the CPU so that values from the SFP transceiver can be interpreted and placed in the web page as if it were coming from the flash memory.

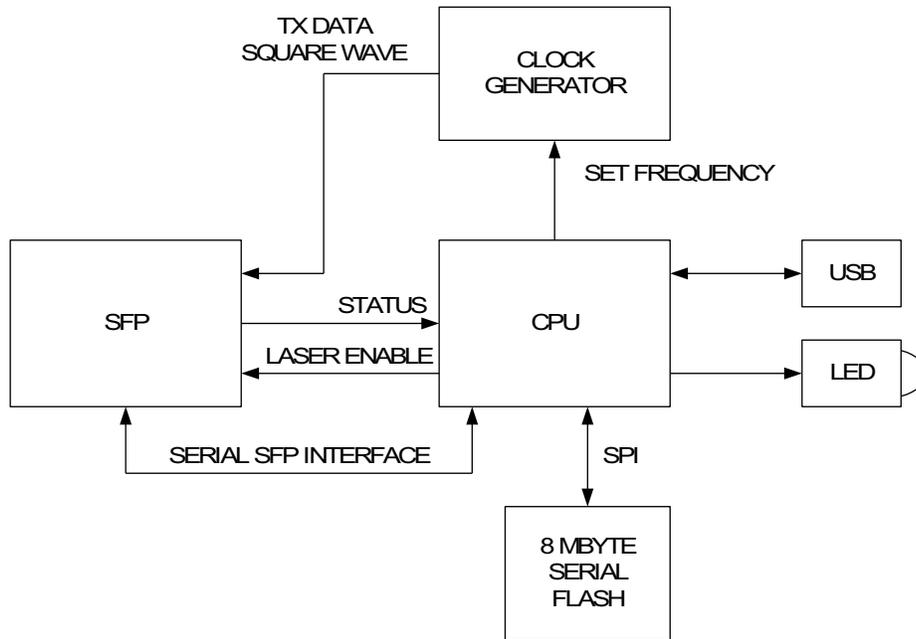


Figure 2. Functional Block Diagram

4. OPERATING INSTRUCTIONS

DANGER

The SFP CHECK +LIGHT tests Class 1 laser products. To avoid injury, do not look directly into the optical transceiver or into the fiber cable. Note that the light is invisible; the optical signal cannot be detected by the eye.

When using the SFP CHECK +LIGHT in support of fiber optic testing, simply connect to an AC power source using the supplied AC adapter and USB cable. Insert an SFP. The SFP will turn on immediately thereby providing a light source that may be used for testing. It is recommended that the SFP be verified using Procedure 1 prior to use in fiber optic testing.

When using the SFP CHECK +LIGHT for all other applications, follow the steps in [Procedure 1](#) to start the SFP CHECK +LIGHT.

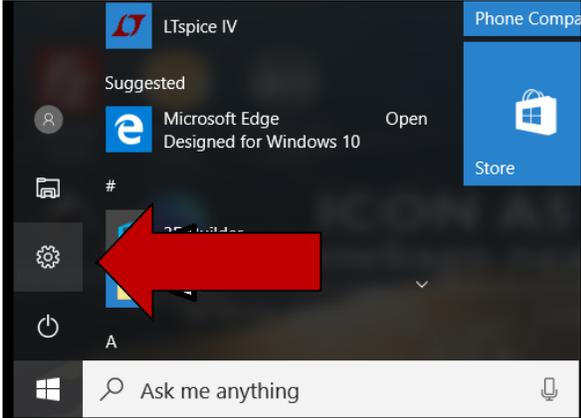
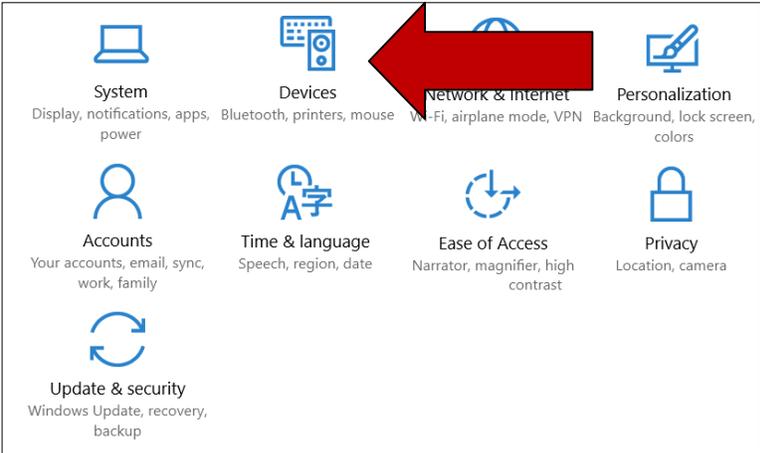
Procedure 1. Starting the SFP CHECK +LIGHT

STEP	ACTION
1	If using Windows10 or Windows 7 operating systems, turn off the PC's Autoplay function. See Procedure 2 (Windows 10) or Procedure 3 (Windows 7) for detailed instructions.
2	Connect the SFP CHECK +LIGHT to your computer (Windows XP, Windows 7 or Windows 10 with a web browser and USB 2.0 port) using the provided USB cable. The blue LED will light to show that the SFP CHECK +LIGHT is powered. NOTE: There will be a slight delay the first time your PC connects to the SFP CHECK +LIGHT. Messages such as "New hardware found" and "Installing driver for new hardware" might appear at the lower right corner of your screen. You do not need to intervene in this process; simply close any pop-up messages.
3	Click on the <i>start</i> button at the lower left corner of the screen; then click Computer (Windows 7) or File Manager (Windows 10) . You should see a new hard drive called SFP_CHECK2. If SFP_CHECK2 does <u>not</u> appear, you need to map the device to a drive letter manually as described in Procedure 4 .
4	Double-click on the SFP_CHECK2 drive. Then locate and double-click on the SFP Check Light.html file. Your web browser will start.
5	Depending upon the security settings of your browser, you might get a warning about active content, as shown in Figure 3 . The SFP CHECK +LIGHT uses Java Script files which get flagged when the security level is set high enough. If you receive this warning, right-click the Information Bar and select Allow Blocked Content .
6	Insert an SFP transceiver into the SFP CHECK +LIGHT cage. (You could have installed the transceiver into the device prior to starting the software.) Press the refresh button to update and view the Information screen.

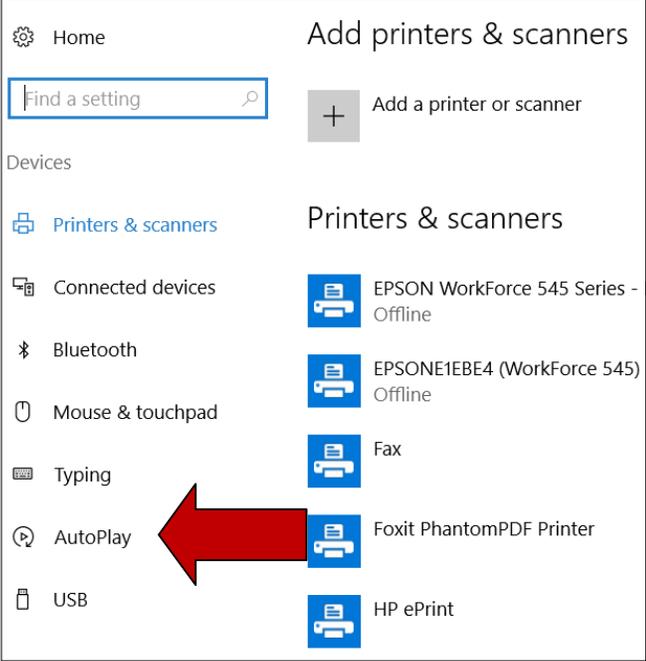


**Figure 3. Possible Security Warning
 (Select 'Allow Blocked Content')**

Procedure 2. Turning Off AutoPlay in Windows 10

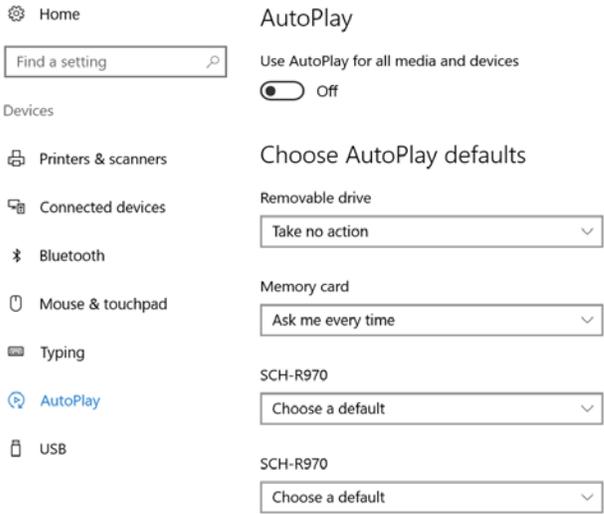
STEP	ACTION
1	<p>Go to SETTINGS from the Start Button.</p>  <p>The screenshot shows the Windows 10 Start menu. At the top, there is a search bar with the text "Ask me anything". Below the search bar, there are several app tiles. A red arrow points to the Settings app icon, which is a gear symbol.</p>
2	<p>Select Devices.</p>  <p>The screenshot shows the Windows Settings app. The 'Devices' category is selected and highlighted with a red arrow. The 'Devices' category is located in the top row, second from the left. Below the 'Devices' category, there are several other categories: System, Network & Internet, Personalization, Accounts, Time & language, Ease of Access, Privacy, and Update & security.</p>

3 Select AutoPlay.



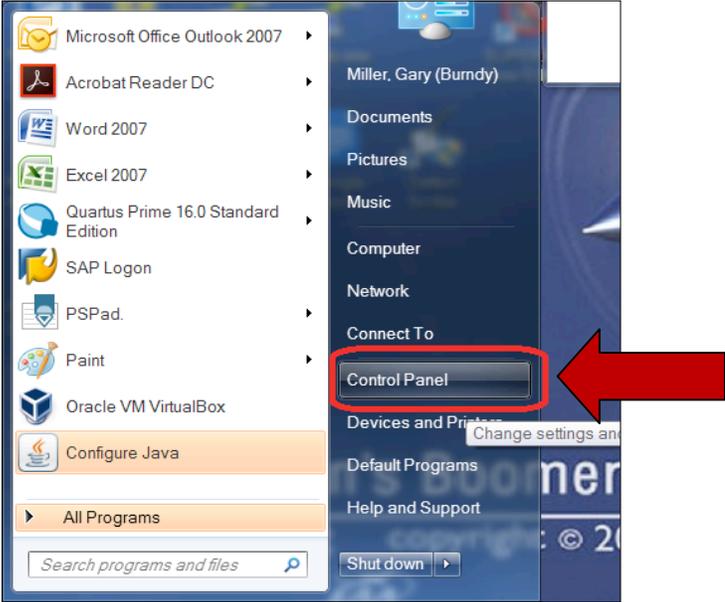
The screenshot shows the Windows Settings application. The left sidebar contains a list of settings categories: Home, Find a setting, Devices, Printers & scanners, Connected devices, Bluetooth, Mouse & touchpad, Typing, AutoPlay, and USB. A red arrow points from the 'AutoPlay' option in the sidebar to the right-hand pane. The right-hand pane is titled 'Add printers & scanners' and 'Printers & scanners'. It includes a search bar, a '+ Add a printer or scanner' button, and a list of installed devices: EPSON WorkForce 545 Series - Offline, EPSON1EBE4 (WorkForce 545) Offline, Fax, Foxit PhantomPDF Printer, and HP ePrint.

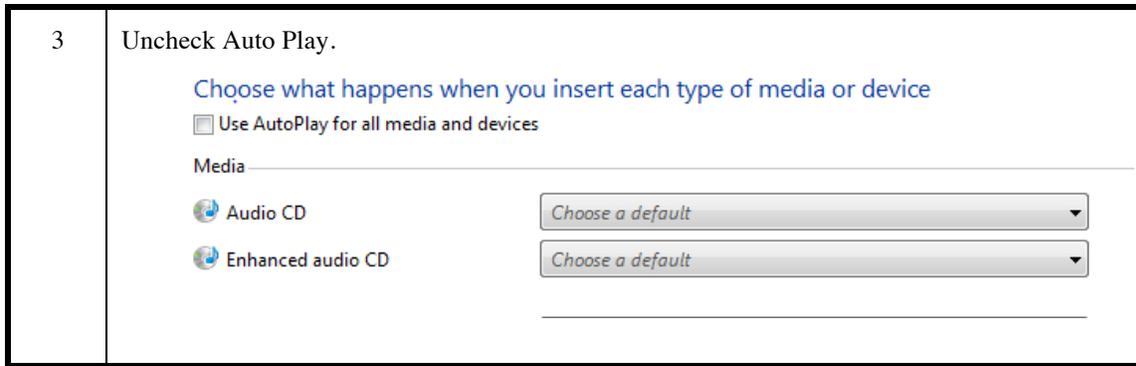
4 Turn AutoPlay Off.



The screenshot shows the Windows Settings application for the 'AutoPlay' category. The left sidebar lists settings categories: Home, Find a setting, Devices, Printers & scanners, Connected devices, Bluetooth, Mouse & touchpad, Typing, AutoPlay, and USB. The right-hand pane is titled 'AutoPlay' and contains the following settings: 'Use AutoPlay for all media and devices' with a toggle switch set to 'Off', 'Choose AutoPlay defaults' section with three dropdown menus: 'Removable drive' set to 'Take no action', 'Memory card' set to 'Ask me every time', and 'SCH-R970' set to 'Choose a default'.

Procedure 3. Turning Off AutoPlay in Windows 7

STEP	ACTION
1	<p>Go to the Control Panel from the Start Button.</p>  <p>The screenshot shows the Windows 7 Start menu open. The 'Control Panel' option is highlighted with a red box, and a red arrow points to it from the right. The Start menu lists various applications like Microsoft Office Outlook 2007, Acrobat Reader DC, Word 2007, Excel 2007, and others. The user's name 'Miller, Gary (Burndy)' and several folders like Documents, Pictures, Music, Computer, Network, and Connect To are also visible.</p>
2	<p>Select AutoPlay.</p>  <p>The screenshot shows the Windows 7 Control Panel window titled 'Adjust your computer's settings'. The 'AutoPlay' icon is highlighted with a red arrow pointing to it from the left. Other settings like Action Center, Administrative Tools, Backup and Restore, Date and Time, Dell Command Power Manager, Desktop Gadgets, Display, Folder Options, Getting Started, Intel® HD Graphics, and Internet Options are also visible.</p>



Procedure 4. Drive Mapping Instructions for Windows 7 or Windows 10

STEP	ACTION
1	Click on the <i>Start</i> button, and select Computer (Windows 7) or File Manager>This PC (Windows 10). Pick a drive letter ('capital letter:') that is not being used. This drive letter will be assigned to the SFP CHECK +LIGHT in a later step.
2	Click on the <i>Start</i> button again, and use the right mouse button to click Computer or File Manager>This PC . Select Map Network Drive .
3	In the left pane of the Computer Management window, click Storage , if necessary, until you see the Disk Management option. Click Disk Management .
4	In the right pane, you should see your local drives including SFP_CHECK2 (without its drive letter yet). Right-click on SFP_CHECK2 . From the drop-down menu, select Change Drive Letter and Paths .
5	In the new window, click the Add button. The Add Drive Letter or Path window will appear. With "Assign the following drive letter:" checked, choose the drive letter (noted in Step 1) from the drop-down list on the right. Then click the OK button and close the Computer Management window. If desired, return to the Computer or This PC window to verify that the SFP_CHECK2 with its drive letter is now available in the list.
6	Return to Step 3 of Procedure 1 .

5. TABS AND SCREENS

Click on the appropriate tab, shown in [Figure 4](#), to access the Identification, ID Raw Data, Diagnostics, Diag Raw Data, or References screen.



Figure 4. SFP CHECK +LIGHT Tabs and Buttons

Refresh and Reload All Buttons

The SFP CHECK +LIGHT default is manual refresh, but it may be set for automatic refresh at 20 second intervals. "Refresh" causes the SFP CHECK +LIGHT to request new information from the SFP.

The "Reload All" button restarts the SFP CHECK +LIGHT at the Identification page. The response time to a "Refresh" request varies by operating system and can be impacted by other tasks being performed. "Refresh" requests (either manual or automatic) performed at a higher rate than the operating system can accommodate may result in an error such as "file not found." If an error occurs, use the "Reload All" button. A manual (or automatic) refresh will always be safe if performed when the LED on the SFP Check +Light is not flashing.

Identification

Identification is used to identify attributes of an SFP transceiver. This screen displays capability, wavelength, manufacturer, serial number, reach, organization unique ID, part number, revision, CLEI code, lot code, and date code.

This screen also provides a top-level evaluation of SFP transceiver operation. Current consumption and transmit/receive functionality are summarized. [Chart 1](#) represents a sample Identification screen.

Chart 1. Typical Identification Screen

Basic SFP Identification

Capability	OC48 ETH: 1000BASE-LX Fibre Chan: 200M 100M	CLEI	SOOTAMXMAA
Wavelength	1611 nm	Manufacturer	OE SOLUTIONS
Reach	SONET IR-1 40km on SMF	Part Number	RCP31SEX-I61
Transmitter Status	Laser OK	Revision	01.0
Receive Signal	Rx LOS	Serial Number	B9211P13500001
Current Consumption	211 ma	Date Code	8/26/2011
		Lot Code	
		Organization Unique ID	00.19.3A

ID Raw Data

This screen displays the contents of the first 128 bytes of SFP memory in raw form and provides an interpretation of the contents. [Chart 2](#) represents a partial ID Raw Data screen.

Chart 2. Typical ID Raw Data Screen

Contents of SFP Page A0 (ID)

Addr	Hex	Dec	ASCII	Description
0	0x03	3	!etx!	Identifier: Either SFP or SFP+ type.
1	0x04	4	!eot!	Extended ID: Correct for SFP.
2	0x07	7	!bel!	Connector type: LC optical.
3	0x00	0	!nul!	No 10G or Infiniband capability.
4	0x12	18	!dc2!	No ESCON capability. OC48 SONET –IR1.
5	0x00	0	!nul!	No OC3 or OC12 capability.
6	0x02	2	!nul!	ETH: 1000BASE-LX.
7	0x22	34	"	intermediate Longwave laser.
8	0x00	0	!nul!	.
9	0x01	1	!nul!	Fiber Channel Media: Single mode
10	0x05	5	!nul!	Fibre Channel data rate: 200Mbytes/s 100Mbytes/s
11	0x03	3	!enq!	Encoding is NRZ (non return to zero)
12	0x1f	31	!em!	Nominal bit rate=3100 Mbps.
13	0x00	0	!nul!	Unspecified rate select functionality.
14	0x28	40	!nak!	Reach on single mode fiber=40km.

Diagnostics

Diagnostics is used to measure SFP transceiver operational characteristics, including incoming optical signal levels. This screen displays temperature in degrees C, voltage, receive (Rcv) level in mW and dBm, transmit (Xmt) level in mW and dBm, and laser bias in mA. When using DWDM transceivers, this screen may also display laser temperature in degrees C and Thermo-Electric Cooler (TEC) Bias in mA. These are optional measurements that apply to DWDM transceivers only and are not supported by all devices.

This screen also shows Alarm Low and High status as well as Warning Low and High values. Measured levels that fall outside of the acceptable range are highlighted. [Chart 3](#) represents a sample Diagnostics screen.

Chart 3. Typical Diagnostics Screen

Measured Values, Alarms, and Warnings (diagnostics)

	Module Temp	Voltage	Rcv Level	Rcv Level	Xmt Level	Xmt Level	Laser Bias	Laser Temp	TEC Bias
units->	°C	volts	milliwatt	dBm	milliwatt	dBm	ma	°C	ma
Measured:	+42.9	3.29	0.7620	-1.2	1.2480	+1.0	27.6		
Alarm Low:	-55.0	2.97	0.0087	-24.5	0.5012	-3.0	4.0		
Warning Low:	-45.0	3.14	0.0173	-21.5	0.5623	-2.5	5.0		
Warning High:	+90.0	3.47	2.0953	-0.7	4.4668	+6.5	80.0		
Alarm High:	+100.0	3.63	2.5575	+0.2	5.0119	+7.0	90.0		
									DWDM modules only

NOTE

Some SFP transceivers do not have diagnostics implemented. The SFP CHECK +LIGHT indicates this fact with an amber "Diagnostics not implemented" message.

Diag Raw Data

This screen displays the contents of the second 128 bytes of SFP memory in raw form and provides an interpretation of the contents. [Chart 4](#) represents a partial Diag Raw Data screen.

Chart 4. Typical Diag Raw Data Screen

Contents of SFP Page A2 (diagnostics)

Addr	Hex	Dec	ASCII	Description
0	0x6400	25600	'!nul!	Temperature high alarm. Temperature=+100.0°C
2	0xc900	51456	-x-!nul!	Temperature low alarm. Temperature=-55.0°C
4	0x5a00	23040	^!nul!	Temperature high warning. Temperature=+90.0°C
6	0xd300	54016	-x-!nul!	Temperature low warning. Temperature=-45.0°C
8	0x8dcc	36300	-x-!fs!	Voltage high alarm. Voltage=3.63V
10	0x7404	29700	y!can!	Voltage low alarm. Voltage=2.97V
12	0x878c	34700	-x--x-	Voltage high warning. Voltage=3.47V
14	0x7aa8	31400	y-x-	Voltage low warning. Voltage=3.14V
16	0xafc8	45000	-x-d	Laser bias high alarm. Current=90.0 ma
18	0x07d0	2000	!bsp!-x-	Laser bias low alarm. Current=4.0 ma
20	0x9c40	40000	-x--x-	Laser bias high warning. Current=80.0 ma
22	0x09c4	2500	!fl!-x-	Laser bias low warning. Current=5.0 ma
24	0xc3c7	50119	+x-	Transmit power high alarm. Power=5.0119 mW
26	0x1394	5012	!vt!!stx!	Transmit power low alarm. Power=0.5012 mW
28	0xae73	44668	!/'idle!	Transmit power high warning. Power=4.4668mW

References

This screen shows references to industry standards, contact information for Enginuity, software version, and application suggestions. [Chart 5](#) represents a partial References screen.

Chart 5. Typical References Screen

Contact Information: Enginuity Communications 3545 Stern Avenue St. Charles, IL 60174 Proudly manufactured in the USA.	
Software version = R02.00.07 2/13/2017	Web pages version = 1.03.02
Model = SFP CHECK +LIGHT	Item = 106928-1
Hardware revision = A	Serial number = 99988663
Date code = 4716	
<p>SFP = Small Formfactor Pluggable The Small Formfactor Committee controlling body had been replaced by the Storage Networking Industry Association (SNIA) Inside each SFP module is a small memory which describes the manufacturer, part number, features, and other information of the module. Some modules include digital diagnostics which can measure temperature, receive optical power, transmit optical power, and laser bias current. The coding for the memory is defined in documents: SFF-8472 and SFF-8024 which are controlled by the SNIA.</p>	

6. SPECIFICATIONS

[Table 1](#) lists the electrical and physical characteristics of the device.

Table 1. SFP CHECK +LIGHT Specifications

Description	Specification
Interfaces	USB cable SFP connector
Current	<500 mA (see NOTE)
Voltage	+4.5 to +5.5 VDC (powered from USB port)
Applicable Standards	SFF-8472 Rev. 12.2 and INF-8074i Rev. 1.0
Operating Temperature Range	-40° to +65°C
Relative Humidity, No Condensation	10% minimum to 95% maximum
Cable	USB 2.0 compliant, A male to mini-B 5-pin male, 2 meters long
AC to USB adapter	Type A plug to USB Input: 120VAC 60Hz Output: 5VDC 500mA maximum
Size (height × width × depth) a) SFP CHECK +LIGHT (excluding cable) b) Carrying Case	1.03 × 2.25 × 3.40 in (26.16 × 57.15 × 86.36 mm) 8.19 × 9.50 × 2.00 in (208.02 × 241.30 × 50.80 mm)
Weight a) SFP CHECK +LIGHT (excluding cable) b) Carrying Case with SFP CHECK +LIGHT, USB Cable and AC adapter	3.20 oz. (90.72 gm) 15.10 oz. (428.08 gm)
NOTE: The SFP CHECK +LIGHT includes a current-limit circuit that prevents drawing over 500 mA from the USB port. Some optics, such as 10G SFP+ devices, might require more power when the laser is enabled. The SFP CHECK +LIGHT can read the memory contents of these high-powered transceivers but will not be able to turn on the laser.	

7. MAINTENANCE

In case of equipment malfunction, check the USB cable for connection. Then hit the refresh button on the screen.

If enhancements have been implemented, the most current version of the SFP CHECK +LIGHT software will be available from Engenuity Technical Support.

Replacement parts are listed in [Table 2](#).

Table 2. Replacement Parts

Part Number	Description
003636-0042	USB Cable
SFP CHECK CASE	Carrying Case

8. CUSTOMER SERVICE

Direct questions concerning the operation of the device to Enginuity Technical Support. Obtain repair services by returning the SFP CHECK +LIGHT to the Enginuity Repair Department, 3545 Stern Avenue, St. Charles, IL 60174; email sales@enginuitycom.com.

Enginuity Communications

3545 Stern Avenue
St. Charles, Illinois 60174

14500 Avion Parkway, Suite 110
Chantilly, Virginia 20151
PRINTED IN USA

Customer Service

1-800-980-3266
sales@enginuitycom.com

Technical Support

1-800-841-1005
support@enginuitycom.com