LTS-3900

Loss Test Set

Instruction Manual

February 2000
P/N: MAN-104-I .4ACE

Fourth Edition

CE

If the equipment described herein bears the CE *symbol, the said equipment complies with the European Community Directive and Standards found in the Declaration of Conformity.*

If the equipment described herein bears an **FCC** *statement, the said equipment complies with the relevant Federal Communications Commission standards.*

CONTENTS

FIGURES

CERTIFICATION INFORMATION

F.C.C. INFORMATION TO USER

This unit has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 (Subpart B) of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This unit generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this unit does cause harmful interference to radio or television reception, which can be determined by turning the unit off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the unit and receiver.
- Connect the unit into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING

Changes or modifications not expressly approved by EXFO Electro-Optical Engineering could void the user's authority to operate the unit.

INDEPENDENT LABORATORY TESTING

This unit has undergone extensive CE certification testing both internally, at EXFO, and externally, at an independent, qualified laboratory. All pre-qualification tests were performed at EXFO while all final tests were performed at UltraTech Engineering Labs, Inc., a renowned test laboratory from Mississauga, Canada. This guarantees the unerring objectivity and authoritative compliance of all test results.

CE INFORMATION TO USER

This unit has been tested and found to comply with the limits for a Class B digital device. Please see the Declaration of Conformity.

This page intentionally left blank.

1 INTRODUCTION

EXFO Electro-Optical Engineering, Inc. (EXFO) is pleased to introduce the LTS-3900 Loss Test Set. EXFO's commitment to superior design in all its fiber-optic instrumentation is respected throughout the industry and is based on the following four goals:

- reliable and accurate performance
- simple operation
- extensive features
- dedicated interest in customer needs

The LTS-3900 will provide many years of reliable operation. To benefit fully from the many features offered by the LTS-3900, it is important to read the following instructions thoroughly.

1.1 Unpacking and Inspection

The LTS-3900 is delivered at least with the following standard items:

- instruction manual
- Certificate of Calibration
- Declaration of Conformity
- warranty validation card
- cleaning kit
- one test jumper
- one connector adapter (FOA-XX)
- mandrel tool (with ORL option only)
- LTS-3900 Label Printing Utility installation floppy disks (with ORL option only)
- "null modem" cable (with ORL option only)

The LTS-3900 has been thoroughly inspected before shipment. If any damage has occurred during transportation or if any item is missing, please notify EXFO immediately. Retain the original packing material in case you need to return the LTS-3900.

1.2 Transportation and Storage

Maintain a temperature range within specifications when transporting or storing the unit. Transportation damage can occur from improper handling. The following steps are recommended to minimize the possibility of damage:

- Pack the unit in the original packing material when shipping.
- Store unit at room temperature in a clean and dry area. Avoid high humidity or large temperature fluctuations.
- Keep the unit out of direct sunlight.
- Avoid unnecessary shock and vibration.

1.3 Safety Conventions

The following conventions should be understood before operating the unit:

WARNING	Refers to a potential *personal* hazard. It requires a procedure which, if not correctly followed, may result in bodily harm or injury. Do not proceed beyond a **WARNING** unless the required conditions are understood and met.
CAUTION	Refers to a potential *product* hazard. It requires a procedure which, if not correctly followed, may result in component damage. Do not proceed beyond a **CAUTION** unless the required conditions are understood and met.
IMPORTANT	Refers to any information regarding the operation of the product which should not be overlooked.

1.4 General Safety Information

CAUTION

Use of controls, adjustments and procedures for operation and maintenance other than those specified herein may result in hazardous radiation exposure.

CAUTION

Use of optical instruments with this product will increase eye hazard.

1.4.1 Safety Precautions

Laser radiation may be encountered at the output port. The LTS-3900 may be equipped with an optional visual fault locator, in which case visible laser radiation is emitted from the VFL port. Avoid long-term exposure to laser radiation.

When the visual fault locator is installed, the following labels may be found on the LTS-3900 case, as shown below.

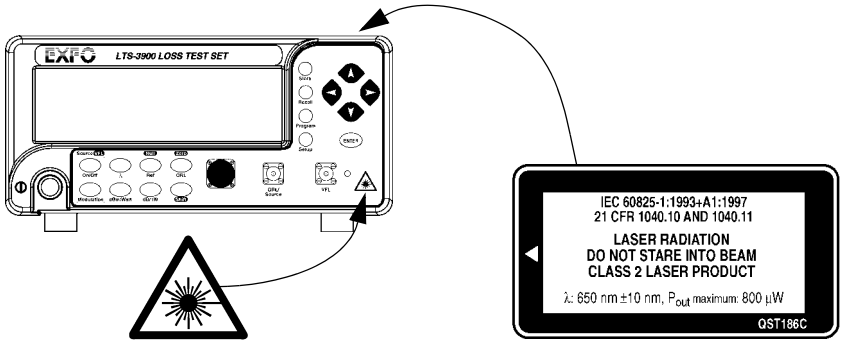


Figure 1-1. Laser Warning Label

WARNING

Do not install or terminate fibers while a laser source is active. Never look directly into a live fiber and ensure that your eyes are protected at all times.

The following safety precautions must be observed while operating and servicing the units. Failure to comply with these precautions or with specific indications elsewhere in this manual violates safety standards of intended use of the unit. EXFO assumes no liability for the user's failure to comply with these requirements.

- Use this unit indoors only.
- Do not remove unit covers during operation.
- Before powering on the unit, all grounding terminals, extension cords, and devices connected to it should be connected to a protective ground via a ground socket. Any interruption of the protective grounding is a potential shock hazard and may cause personal injury.
- Whenever the protective grounding is impaired, do not use the unit and secure it against any accidental or unintended operation.
- Only use fuses with the required rated current and specified type (IEC, 250 V, 2 A, fast blow, 0.197 in. x 0.787 in. / 5 mm x 20 mm) for replacement. Do not use repaired fuses or short-circuited fuse holders.
- Avoid any adjustments, maintenance, and repair of opened units under voltage. These should only be carried out by skilled personnel aware of the hazards involved. Do not attempt internal service or adjustment unless another person qualified in first aid is present. Do not replace any components while power cable is connected.
- Operation of any electrical instrument around flammable gases or fumes constitutes a major safety hazard.
- Installation of replacement parts or modification of the unit should be carried out by authorized personnel only.
- Capacitors inside the unit may be charged even if the unit has been disconnected from its electrical supply.

1.4.2 AC Requirements

The LTS-3900 can operate from any single-phase AC power source between 100 V and 240 V (50/60 Hz). The maximum input current is 2 A.

1.4.3 Power Cable

This unit uses an international safety standard three-wire power cable. This cable serves as a ground when connected to an appropriate AC power receptacle. The type of power cable supplied with each unit is determined according to the country of destination.

Only qualified electricians should connect a new plug if needed. The color coding used in the electric cable depends on the cable. New plugs should meet the local safety requirements and include the following features:

- adequate load-carrying capacity
- ground connection
- cable clamp

WARNING

To avoid electrical shock, do not operate the unit if there are signs of damage to any part of the outer surface (covers, panels, etc.).

To avoid serious injury, the following precautions must be observed before powering on the unit:

- ***If the unit is to be powered via an auto-transformer for voltage reduction, the common terminal must be connected to the grounded power source pole.***
- ***Insert the plug into a power outlet with a protective ground contact. Do not use an extension cord without a protective conductor.***
- ***Before powering on the unit, the protective ground terminal of the unit must be connected to a protective conductor using the unit power cord.***
- ***Do not tamper with the protective ground terminal.***

1.5 Getting Help

If you encounter any difficulty while operating this product, please call EXFO at one of the offices listed below. Our Customer Service Group is available in North America from 7:30 a.m. to 8:00 p.m. (Eastern Standard Time), Monday to Friday.

EXFO Electro-Optical Engineering (Corporate Headquarters)
465 Godin Avenue
Vanier QC G1M 3G7
Canada

1 800 663-3936 (USA and Canada)
Tel.: (418) 683-0211
Fax: (418) 683-2170
support@exfo.com
www.exfo.com

EXFO Europe
Centre d'Affaires Les Metz
100, rue Albert Calmette
78353 Jouy-en-Josas, France

Tel.: 33-1 34 63 00 20
Fax: 33-1 34 65 90 93

2 GENERAL DESCRIPTION

The LTS-3900 is a combination of high resolution optical test tools: a power meter, source, and optional optical return loss (ORL) meter and visual fault locator. The main features include power and loss measurements in dBm and watts, ORL testing, as well as manual data storage and programmed data acquisition. The LTS-3900 is particularly well suited to the most demanding laboratory and manufacturing qualification applications. The LTS-3900 can be remotely controlled through a GPIB or RS-232 interface.

2.1 The Front Panel

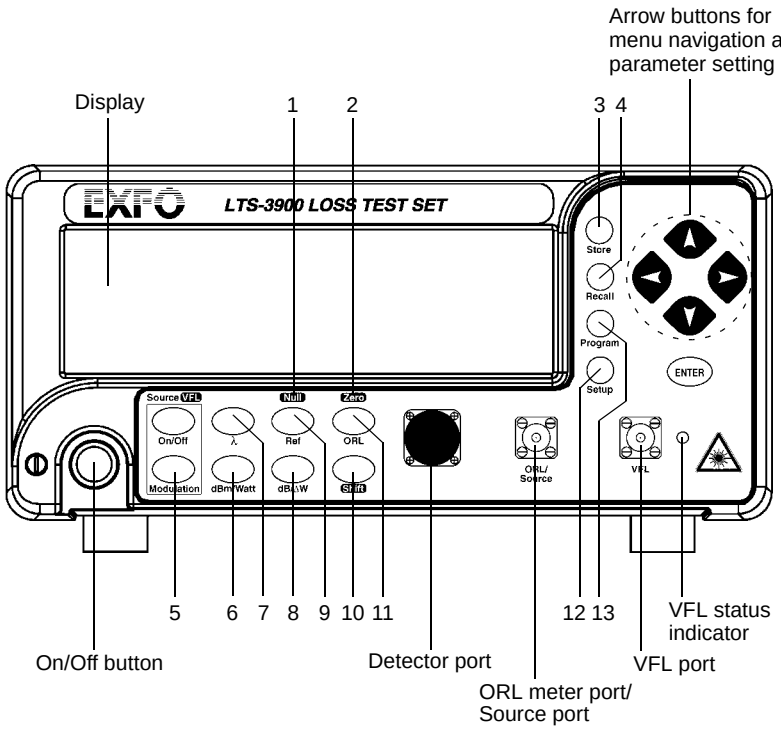


Figure 2-1. Front Panel

Note: *Your LTS-3900 may differ slightly from the illustration.*

For information on the...		go to...
1	nulling control *(secondary function)*	page 3-1
2	ORL zero measurement control *(secondary function)*	page 3-11
3	*Store* menu access	page 4-2
4	*Recall* menu access	pages 4-2, 4-8, and 4-17
5	source and VFL controls	pages 3-6 and 3-12
6	measurement units control	page 3-2
7	wavelength control	page 3-2
8	relative mode access	page 3-3
9	reference setting button	page 3-5
10	second function access	—
11	ORL mode access	page 3-7
12	*Setup* menu access	pages 4-20 to 4-28
13	*Program* menu access	pages 4-4 to 4-17

Table 2-1. Front Panel Items Identification

2.2 The Back Panel

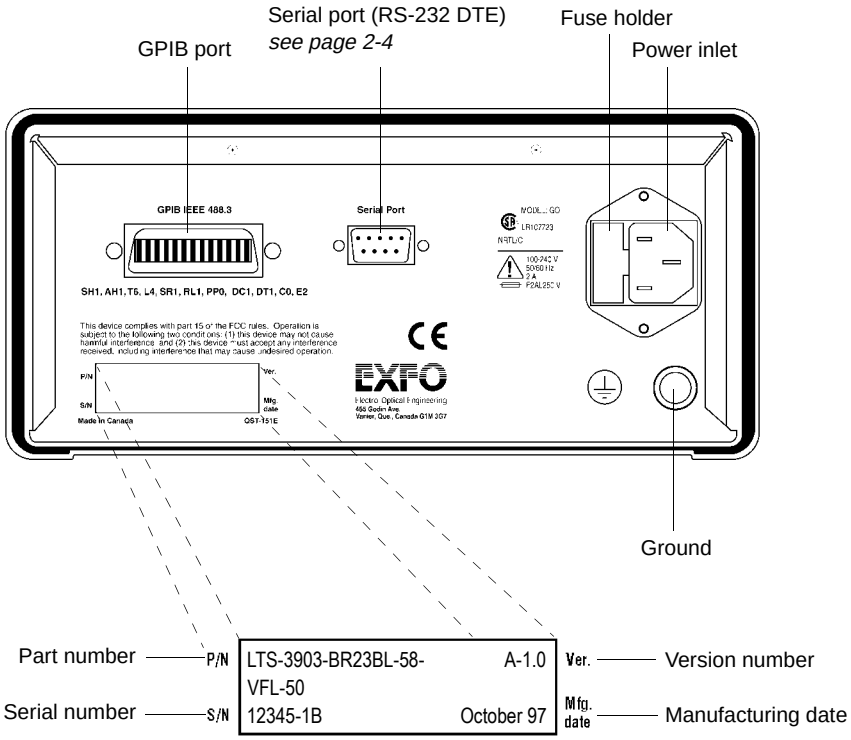


Figure 2-2. Back Panel

Note: *Your LTS-3900 may differ slightly from the illustration.*

2.3 RS-232 Connector Pinout

The RS-232 connector (serial port) at the back of the LTS-3900 uses a DTE pinout configuration.

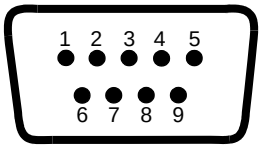


Figure 2-3. RS-232 Connector Pinout

Pin	Description	Direction
2	Receive (Rx)	Input
3	Transmit (Tx)	Output
5	Signal ground (Gnd)	—

Table 2-2. RS-232 Pinout Configuration

3 BASIC OPERATION

3.1 Turning the LTS-3900 On and Off

Before turning the LTS-3900 on, please read the general safety information (see *General Safety Information* on page 1-3). To turn the unit on and off, use the red button in the lower left corner of the front panel.

When turned on, the unit beeps twice and performs a self-test. Before taking any measurements, it is recommended that you null the detector offsets (see *Nulling the Offsets* on page 3-1). When the unit is turned off, the following items remain in non-volatile memory:

- manually stored data
- acquisition data
- reference values
- remote control settings
- shortlisted wavelengths
- customized settings
- saved configurations (up to 10)

Note: *The power cord is the most effective disconnect device. To ensure the power is completely turned off, disconnect the power cord.*

3.2 Nulling the Offsets

It is recommended to null the detector offsets before every test session and after any environmental change (temperature and humidity variations affect the performance of optical detectors).

IMPORTANT

Light must not reach the detector when performing the offset nulling.

1. Place protective cap over the detector port.

2. Press **Null** (on certain models, you must press **Shift** to access the null function). The offset nulling process takes approximately 60 seconds. Once done, the unit returns to the previously active operation state.

If you are trying to perform an offset nulling with the protective cap improperly tightened over the detector port, the message *PUT CAP* will flash on the display. Once *PUT CAP* is displayed, tighten the protective cap and press **Null** to resume the offset nulling process, or **ENTER** to cancel the offset nulling.

Note: *Offset nulling constants are retained until a new offset nulling is performed.*

3.3 Measuring Absolute Power

To display the absolute power of the signal received at the detector port, press **dBm/Watt**. **dBm/Watt** is also used to toggle between dBm and watts as measurements units. When using watts as measurement units, the LTS-3900 will automatically use pW, nW, μW, or mW, according to the power of the signal. Press λ to toggle between the wavelengths in the shortlist (to edit the shortlist of wavelengths, see *Customizing the Shortlist of Wavelengths* on page 4-21).

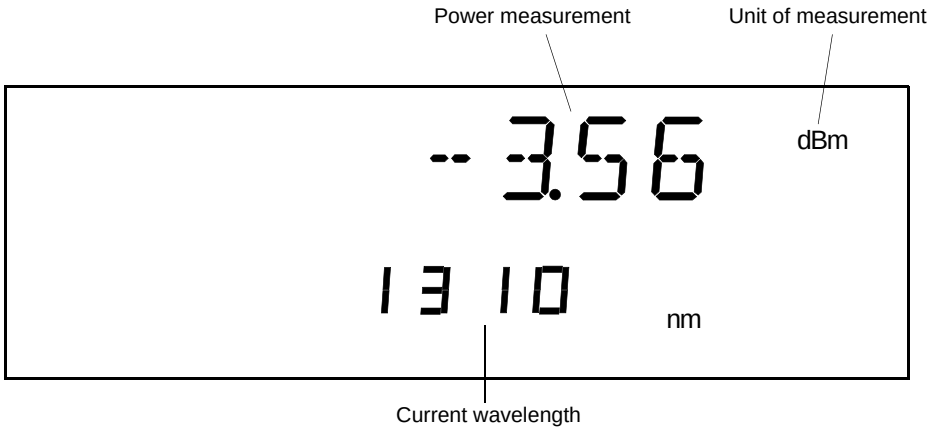


Figure 3-1. Display in Absolute Mode

Note: *«– – – – – – – –» indicates a reading below range and «+++++++++» indicates a reading above range.*

When an LTS-3900 source is activated, the power meter of the same LTS-3900 automatically adjusts to the same wavelength.

3.4 Measuring Relative Power

In relative mode, the LTS-3900 compares the power of the signal received at the detector port to a preset reference value in dBm or watts. The relative power is equal to the absolute power minus the reference value, so

- a negative measurement indicates that the received power is below the reference value, and
- a positive measurement indicates that the received power is above the reference value.

To activate relative mode, press **dB/ΔW**. Once in relative mode, pressing **dB/ΔW** switches between dB and watts as measurement unit for the relative power and reference value. If necessary, press λ to toggle between the wavelengths in the shortlist (to edit the shortlist of wavelengths, see *Customizing the Shortlist of Wavelengths* on page 4-21).

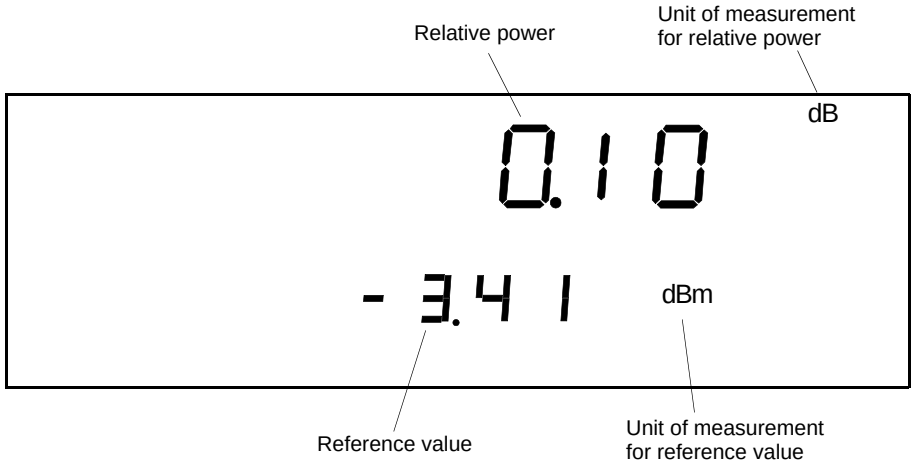


Figure 3-2. Display in Relative Mode (units of dB)

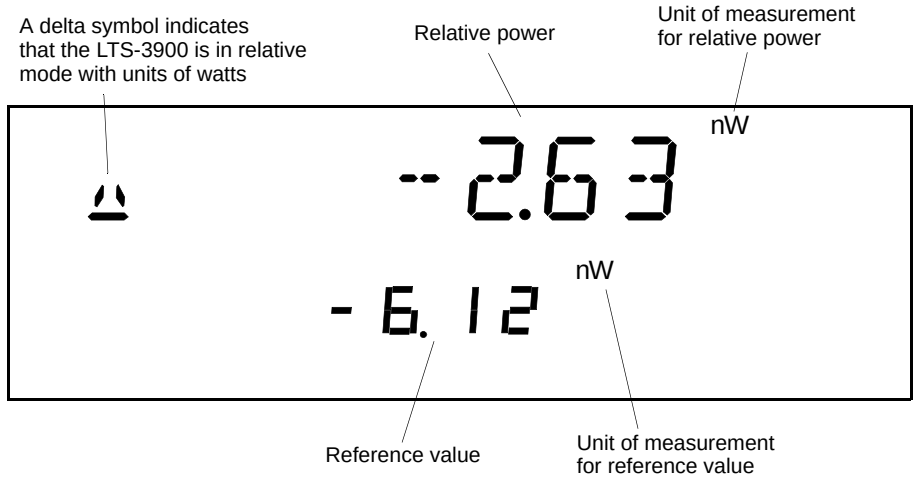


Figure 3-3. Display in Relative Mode (units of watts)

When you access relative mode, the LTS-3900 displays the last reference value entered at the current wavelength. One reference value can be stored for each wavelength in the shortlist and will remain in memory until a new reference value is stored at the same wavelength. However, if you use **dB/ΔW**, the

reference value will be converted from dBm to watts (and vice versa) at the same time the measurement unit of the relative power toggles between dB and watts.

Note: *If you set a reference while an offset is active, the reference measurement will take the offset into account (only when using the dB as measurement units).*

3.4.1 Entering the Current Power as the Reference Value

The power of the signal currently received at the detector port can be stored as the reference value.

1. Use λ to select the wavelength.
2. Use **dBm/Watt** to select the measurement units.
3. Press **Ref**.

3.4.2 Entering a Specific Reference Value

1. Use λ to select the wavelength.
2. Press **dBm/Watt** until the absolute power is displayed in the measurement unit for which you want to set a reference value.
3. Press **Setup**.
4. Scroll (left/right arrows) to *REF.VALUE*.

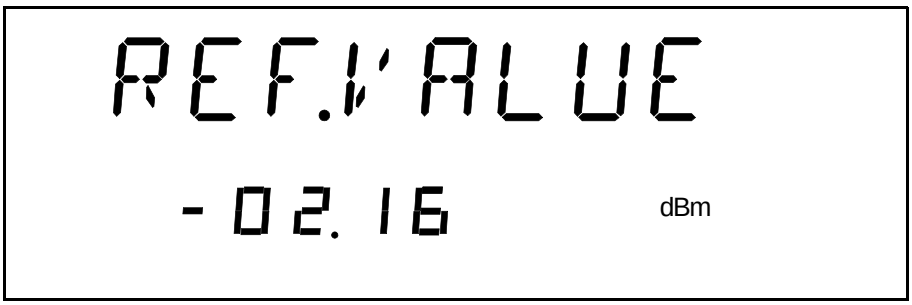


Figure 3-4. Current Reference Value (Selected Wavelength and Unit)

5. Press **ENTER**. The first element of the current reference value will start flashing.

6. Enter a new reference value. Use the up/down arrows to change the flashing element and left/right arrows to make another element flash.

7. Press **ENTER**.

Note: *Any value outside the LTS-3900 measurement range will be rejected. The unit will beep and you will be prompted to enter a new value.*

8. To exit the *Setup* menu, press **Setup**.

3.5 Using the Light Source

The LTS-3900 features a light source, which, depending on the configuration, may be a single- or dual-wavelength LED or laser (see *Source Specifications* on page 7-1). The source signal can be continuous (CW) or modulated (2 kHz) and uses the same port as the ORL meter (see *The Front Panel* on page 2-1).

To activate the source, press **On/Off**. Once the source is activated, the source status and wavelength are displayed in the lower right part of the screen.

Note: *When an LTS-3900 source is activated, the power meter of the same LTS-3900 is automatically adjusted to the same wavelength.*

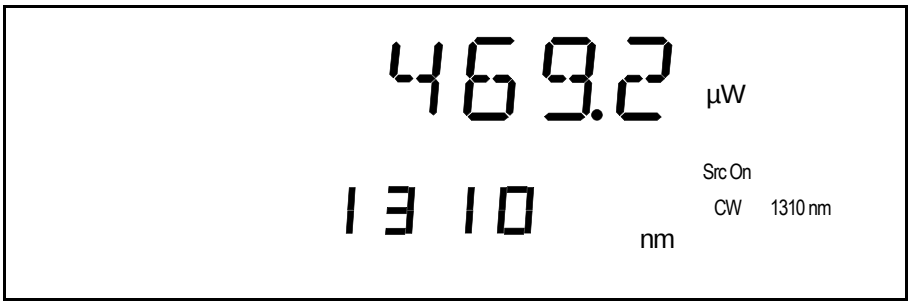


Figure 3-5. Display with a 1310-nm Source Activated in CW

Note: *Even when the source is activated, the power of the signal received at the detector port is still displayed in large digits.*

Press **On/Off** again to switch to the second available source wavelength (if any) and one more time to deactivate the source. The source signal is continuous (CW) by default. To toggle the source signal state between CW and 2 kHz, press **Modulation**.

3.6 Measuring Optical Return Loss (optional)

The ORL meter uses the same port as the source (see *The Front Panel* on page 2-1). To access or exit ORL mode, press **ORL**. The first time you access ORL mode, the message *LOOPBACK* is displayed, asking you to take a loopback reference measurement. To obtain the most accurate measurements possible, it is strongly recommended that you take this reference (see *Taking a Loopback Reference* on page 3-8).

Note: *With* LOOPBACK *displayed, if you want to access the ORL mode without taking a loopback reference, press any of the arrow buttons.*

When exiting ORL mode, the source remains activated. In ORL mode, the display looks as follows:

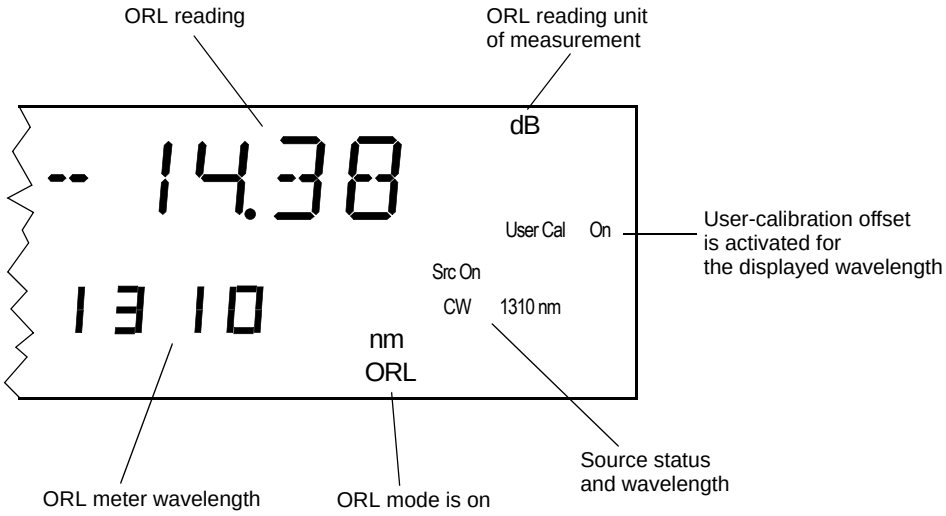


Figure 3-6. Display in ORL Mode

If the LTS-3900 is configured with two source wavelengths, you can test ORL at both wavelengths. To switch wavelength once in ORL mode, use λ.

3.6.1 Taking a Loopback Reference

The first time you press **ORL** to access the ORL mode, the message *LOOPBACK* is displayed, asking you to take a loopback reference.

1. With *LOOPBACK* displayed, connect a test jumper from the detector port to the ORL meter port.

2. Press **ENTER**. The loopback process is initiated. During the loopback process (approximately 30 seconds), the message *TAKE REF* flashes on the screen.

During the loopback process, the LTS-3900 stores correction factors that are specific to the current test jumper and environmental conditions.

IMPORTANT

If you replace the test jumper or the environmental conditions change, you should take a new loopback reference.

To initiate a loopback reference when already in ORL mode,

1. Press **Ref**. The message *LOOPBACK* is displayed.

2. Connect a test jumper from the detector port to the ORL meter port.

3. Press **ENTER**. The loopback process is initiated. During the loopback process (approximately 30 seconds), the message *TAKE REF* flashes on the screen.

Note: *After a loopback reference, disconnect the test jumper from the detector port to connect it to the fiber under test. If you disconnect the test jumper from the ORL meter port, you will need to take a new loopback reference.*

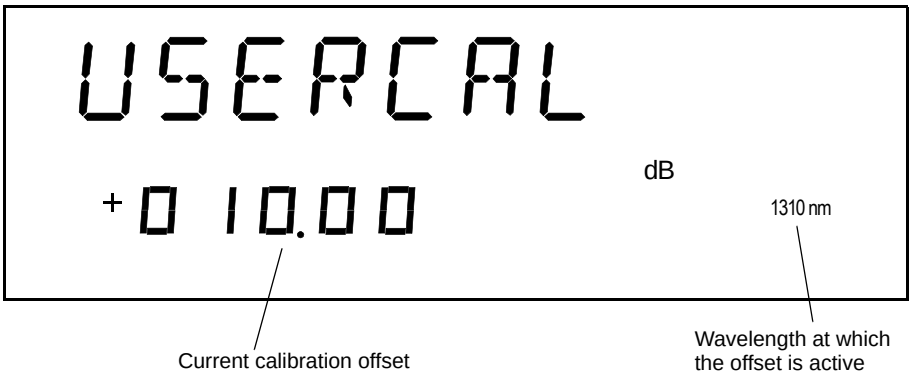
3.6.2 User Calibration Offset

You can set a calibration offset for ORL readings. A different calibration offset can be entered for each wavelength available in ORL mode. When an offset is applied at the selected wavelength, *UserCal On* is displayed to the right of the screen.

To enter a calibration offset,

1. Press **Setup**.

2. Scroll (left/right arrows) to *USERCAL*.



3. Using the up/down arrows, select the wavelength for which you want to enter an offset.

4. Press **ENTER**. The first element of the current calibration offset will start flashing.

5. Enter a calibration offset. Use the up/down arrows to change the flashing element and the left/right arrows to make another element flash.

Note: *If you do NOT want to use a calibration offset for the selected wavelength, set the calibration offset to 000.00.*

6. Press **ENTER**.

7. To exit the *Setup* menu, press **Setup**.

3.6.3 Fiber Termination

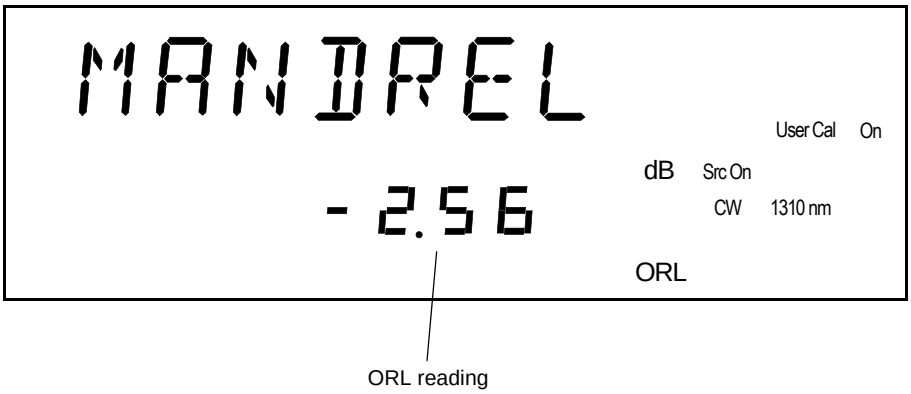
Fiber termination refers to the attenuation of light to such a degree where back reflection past the termination point yields a negligible contribution to the reading. The best way to terminate a fiber is to wind it several times around the supplied mandrel. The fiber is sufficiently wound around the mandrel when the return loss reading no longer experiences significant change (at least eight complete turns around the mandrel).

3.6.4 Background Reflection Cancellation

When performing ORL measurements, it is often necessary to cancel the reflection measured before a user-defined termination point, which is often referred to as “zeroing the reflection”.

To cancel the reflection before a specific point on a fiber,

1. Connect a fiber to the ORL meter port.
2. Turn on the LTS-3900, access ORL mode and perform a loopback reference.
3. Select a wavelength using λ.
4. Press **Shift**, then **Zero**.



5. Terminate the fiber at the desired point by winding it around the supplied mandrel until the ORL reading goes below range (dashed line) or stabilizes.
6. Press **ENTER**. *MANDREL* will flash while the unit processes the operation.

Note: *The above procedure must be performed at every available wavelength.*

3.7 Using the Visual Fault Locator (optional)

The visual fault locator (VFL) emits a signal of -1 dBm at 650 nm. This bright red signal can be continuous (CW) or modulated (1 Hz). The VFL uses a dedicated port (see *The Front Panel* on page 2-1). To activate the VFL, press **Shift** then **On/Off**. Once the VFL is activated, the VFL status is displayed in the lower right portion of the screen: *VFL CW* or *VFL 1Hz*.

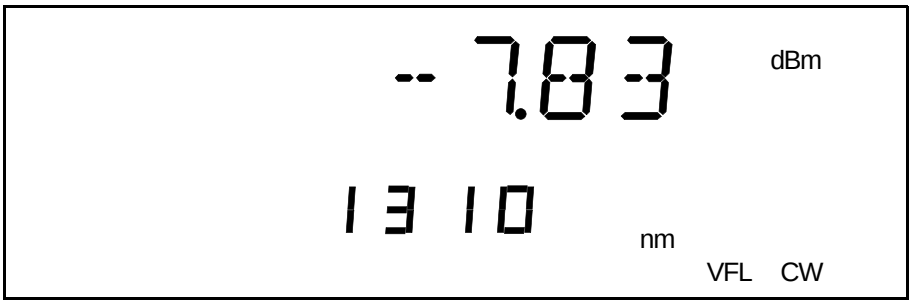


Figure 3-7. Display with the VFL Activated in CW

Note: *Even when the VFL is activated, the power of the signal received at the detector port is still displayed in large digits.*

The VFL signal is continuous (CW) by default. To toggle the VFL signal state between CW and 1 Hz, press **Shift** then **Modulation**.

WARNING

When the VFL is activated, visible laser radiation is emitted from the VFL port. Do not stare into beam.

4 ADVANCED FUNCTIONS

The blue buttons to the right of the display give access to menus: *Store*, *Recall*, *Program* and *Setup*. The following diagram shows the menus and their items.

Note: *Steps shown in bold are valid with ORL option only.*

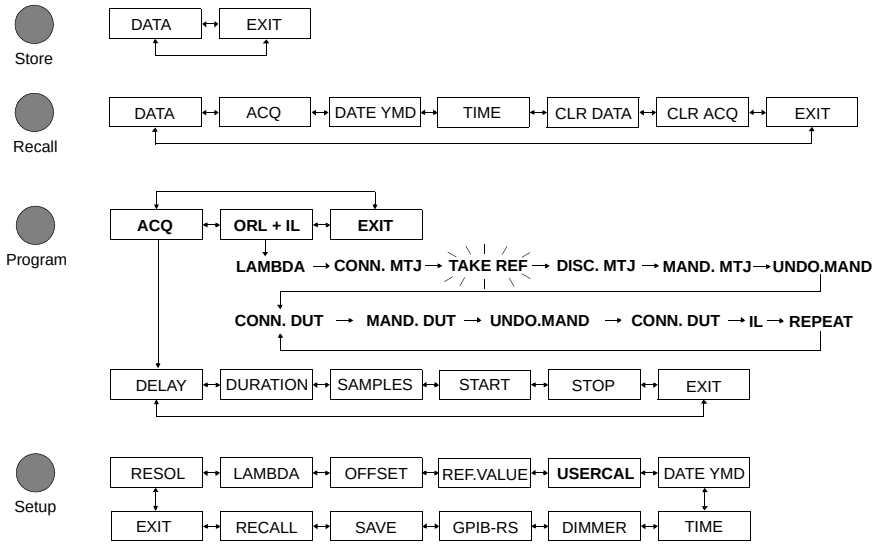


Figure 4-1. Menu Diagram

To move (in loop) between the menu items, use the left/right arrows.

To exit a menu,

- press the button that gave access to the menu; or
- scroll (left/right arrows) until *EXIT* is displayed, then press **ENTER**.

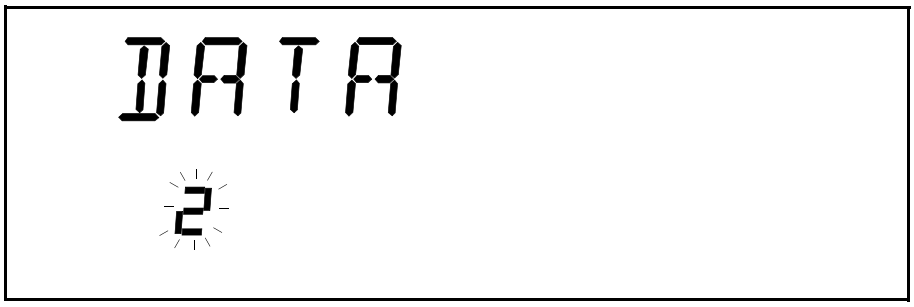
4.1 Manual Data Storage

4.1.1 Storing Data Manually

The LTS-3900 offers 512 memory registers to manually store power, loss, or ORL measurements.

To store a measurement,

1. Once you have the desired measurement displayed, press **Store**. A register number will be suggested (flashing).



Note: *The suggested register number increments each time you store a measurement.*

You can select another register number using the up/down arrows.

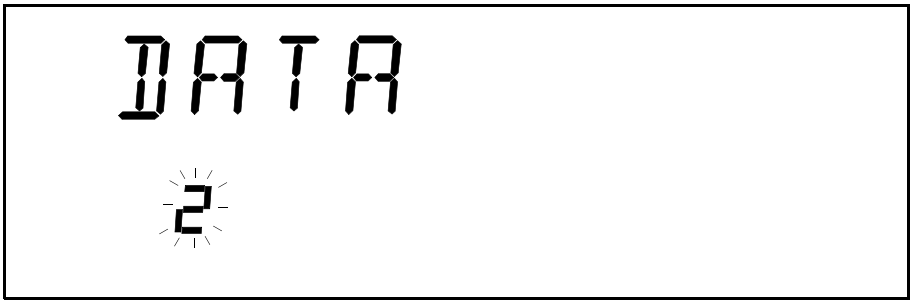
2. Press **ENTER** to store the measurement in the flashing register. The unit automatically returns to measurement mode. To exit the *Store* menu without storing the data, press **Store**.

Note: *If a measurement was present in the selected register, it will be erased and replaced by the new one without any warning.*

4.1.2 Recalling Manually Stored Data

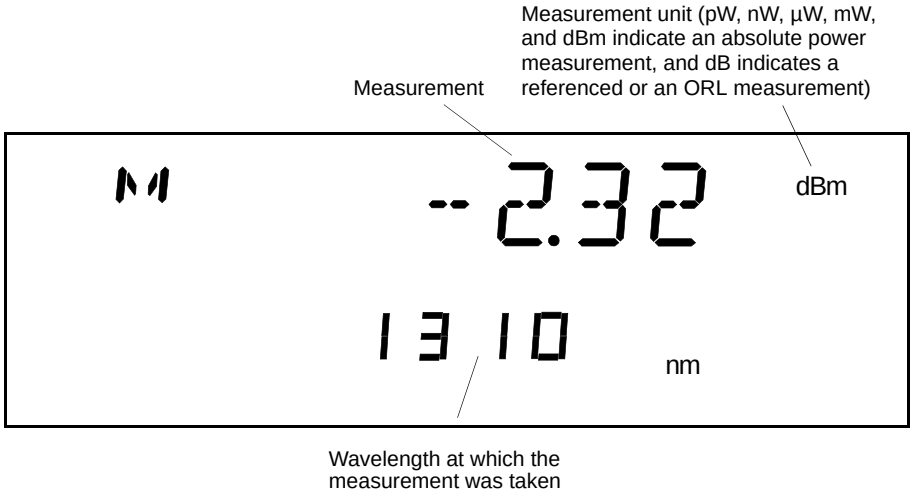
The data you stored manually (Section 4.1.1) can be recalled one register at a time.

1. Press **Recall**. You will see the following display with a register number flashing.



2. Using the up/down arrows, scroll to the register number you want to view.

3. Press **ENTER**. The selected register will be displayed.



Note: *A dashed line with no unit of measurement indicates an empty register. A dashed line along with a wavelength and the unit of measurement indicates a reading below range. «++++++++» indicates a reading above range. ORL measurements are identified by* ORL *at the bottom of the display.*

- To view another register, press **ENTER**. The next register will be suggested to you (flashing). If necessary, scroll (up/down arrows) to the desired register number. Press **ENTER** again to display the register.

➤ ***Tip:*** *You can keep* **ENTER** *pressed to quickly scan the measurements in adjacent registers.*

- To exit the *Recall* menu, press **Recall**.

4.1.3 Erasing Manually Stored Data

IMPORTANT

Performing this operation will delete ALL the manually stored data without any other warning. The data (up to 512) can only be erased all at once.

1. Press **Recall**.
2. Scroll (left/right arrows) to *CLR DATA*.
3. Press **ENTER**.
4. To exit the *Recall* menu, press **Recall**.

4.2 Automatic Data Acquisition

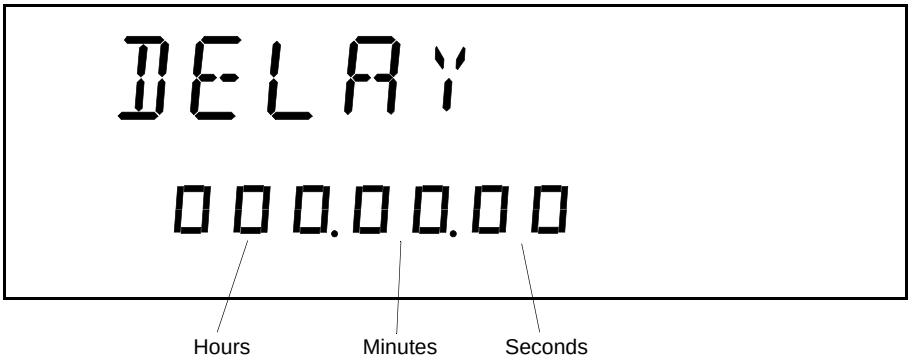
4.2.1 Programming an Acquisition

You can program the LTS-3900 to automatically acquire power, loss, or ORL measurements. The program parameters to be set are:

- delay: the beginning of the program may be delayed up to 999 hours, 59 minutes, and 59 seconds;
- duration: the program can last up to 999 hours, 59 minutes, and 59 seconds;
- number of samples: up to 1024 samples can be taken (depending on the selected duration).

1. Press **Program**.

2. *(This step applies only to the LTS-3900s configured with the ORL option.)* Scroll (left/right arrows) to *ACQ*, then press **ENTER**.

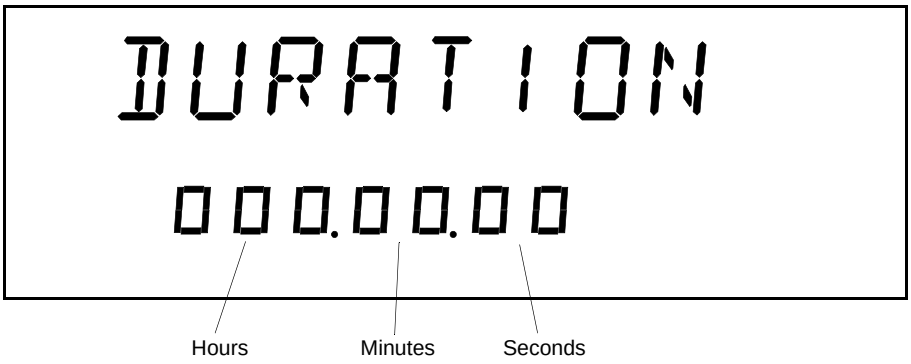


3. Set a delay (if you do not want the acquisition to be delayed, leave the delay value at 000.00.00).

   3 a. Press **ENTER**. The first digit will start flashing. Use the up/down arrows to change the flashing digit and the left/right arrows to make another digit flash.

   3 b. Once you are satisfied with the delay, press **ENTER**.

4. Press the right arrow.

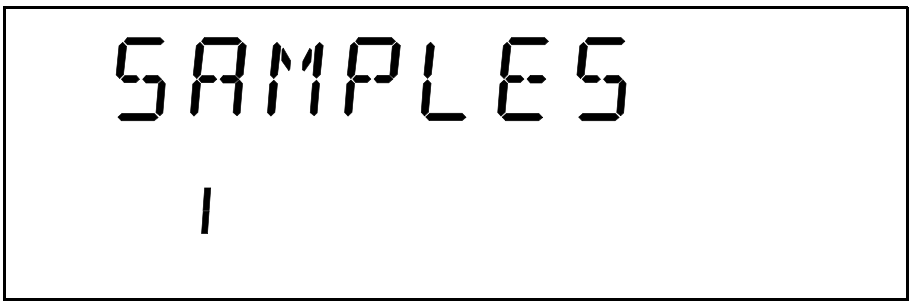


5. Set the duration of the acquisition.

   5 a. Press **ENTER**. The first digit will start flashing. Use the up/down arrows to change the flashing digit and the left/right arrows to make another digit flash.

   5 b. Once you are satisfied with the duration, press **ENTER**.

6. Press the right arrow.



7. Set the number of samples to be taken during the acquisition.

   7 a. Press **ENTER**. The digit will start flashing. Use the up/down arrows to toggle between the possible number of acquisitions (the number of acquisitions the LTS-3900 can store depends on the duration you set at step 5).

   7 b. Once you are satisfied with the number of samples, press **ENTER**.

IMPORTANT

Before you start the acquisition, it is recommended that you read the section* Starting the Acquisition *on page 4-7.

- To quickly start the acquisition, scroll (left/right arrows) to *START*, then press **ENTER**.
- To exit the *Program* menu and return to measurement mode, press **Program**. If your LTS-3900 is configured with the ORL option, you will have to press **Program** twice.

4.2.2 Starting the Acquisition

When you start an acquisition, data is acquired in the current measurement mode; that is power, loss, or ORL measurements at the current wavelength with the current measurement unit, and with or without an offset and reference. So, before starting an acquisition, you should set these parameters as required. You can choose one of the following two procedures.

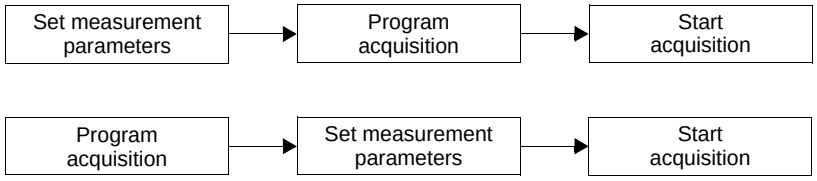


Figure 4-2. Starting an Acquisition

IMPORTANT

The acquisition data is stored in the same memory registers as the results of the automated ORL and insertion loss tests [see* Step-by-Step ORL and Insertion Loss Test (optional) *on page 4-11]. Starting an acquisition erases all data in these memory registers.

Whenever you are ready to start the acquisition,

1. Press **Program**.

2. *(This step applies only to the LTS-3900s configured with the ORL option.)* Scroll (left/right arrows) to *ACQ*, then press **ENTER**.

3. Scroll (left/right arrows) to *START*, then press **ENTER**.

- If no delay was set, the acquisition will start right away.
- If a delay was set, choosing **START** will initiate the countdown. The acquisition will automatically start once the countdown has elapsed.

PROGRAM is displayed on the left side of the display while the countdown and acquisition are in progress. All functions are deactivated during the countdown and acquisition.

➤ ***Tip:*** *Once you have started the acquisition, the display goes back to measurement mode. If you want to know how much time is left in the delay (before the acquisition starts), press* **Program**, *and then scroll (left/right arrows) to* DELAY. *If you want to know how much time is left in the acquisition, press* **Program**, *and then scroll (left/right arrows) to* DURATION.

4.2.3 Stopping the Acquisition

Once the acquisition starts, it continues until the set duration is over. When the acquisition is over, the unit beeps, *PRG STOP* is displayed, and the data is stored automatically. But you can also terminate the acquisition before the set duration has elapsed.

IMPORTANT

If you stop the acquisition before it ends, only the samples that were taken before you stopped the acquisition will be saved.

1. While the acquisition is in process, press **Program**. *STOP* is displayed.

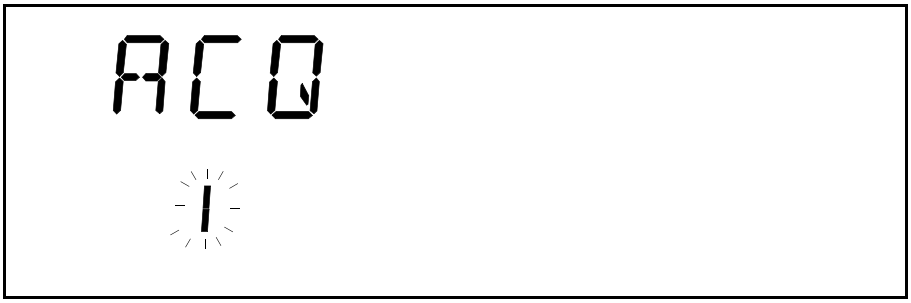
2. Press **ENTER**.

4.2.4 Recalling Acquisition Data

The data you stored through a programmed acquisition (see *Programming an Acquisition* on page 4-4) can be recalled one sample at a time. Each sample is stored in a memory register.

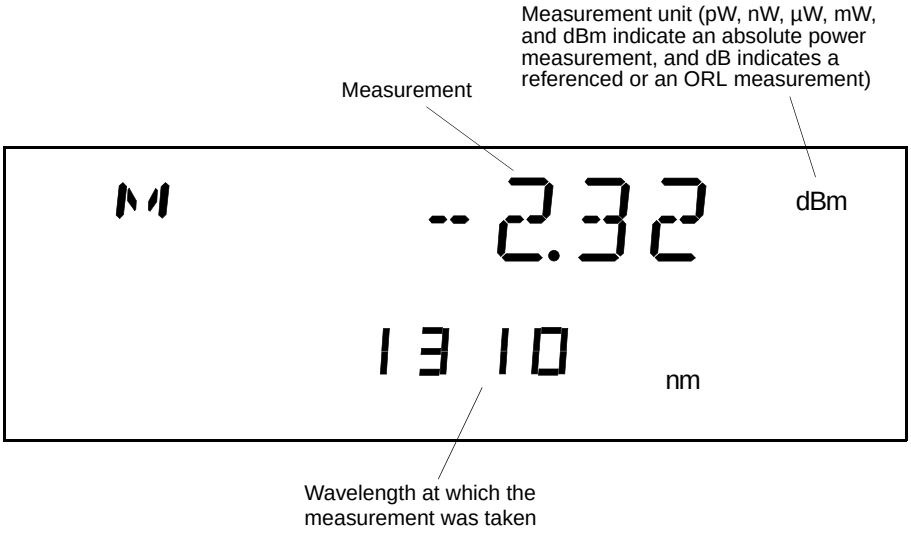
1. Press **Recall**.

2. Scroll (left/right arrows) to *ACQ*. You will see a register number flashing.



3. Using the up/down arrows, scroll to the register number you want to view.

4. Press **ENTER**. The selected register will be displayed.



Note: *A dashed line along with a wavelength indicates a reading below range. «++++++++» indicates a reading above range. ORL measurements are identified by* ORL *at the bottom of the display.*

- To view another register, press **ENTER**. The next register will be suggested (flashing). If necessary, scroll (up/down arrows) to the desired register number. Press **ENTER** again to display the register.

➤ ***Tip:*** *You can keep* **ENTER** *pressed to quickly scan the measurements in adjacent registers.*

- To exit the *Recall* menu, press **Recall**.

4.2.5 Recalling the Acquisition Date and Time

The LTS-3900 automatically stores the date and time when the last acquisition or step-by-step ORL and insertion loss test was started. To recall these parameters,

1. Press **Recall**.
2. Scroll (left/right arrows) until *DATE YMD* is displayed. The date in the lower portion of the screen is the date on which the acquisition started.
3. Scroll (left/right arrows) until *TIME* is displayed. The time in the lower portion of the screen is the time at which the acquisition started.

Note: *If no date and time are displayed, no acquisition data is in memory.*

4. To exit the *Recall* menu, press **Recall**.

4.2.6 Erasing Acquisition Data

The data you stored through a programmed acquisition (up to 1024) can only be erased all at once.

1. Press **Recall**.
2. Scroll (left/right arrows) to *CLR ACQ*.
3. Press **ENTER**. All the acquisition data will be deleted without any other warning.
4. To exit the *Recall* menu, press **Recall**.

4.3 Step-by-Step ORL and Insertion Loss Test (optional)

When the LTS-3900 is configured with the ORL meter option, a step-by-step procedure is available for automated ORL and insertion loss tests. Once the procedure is initiated, the LTS-3900 guides you through the test steps and lets you store the results at the end.

4.3.1 Initiating the Step-by-Step ORL and Insertion Loss Test

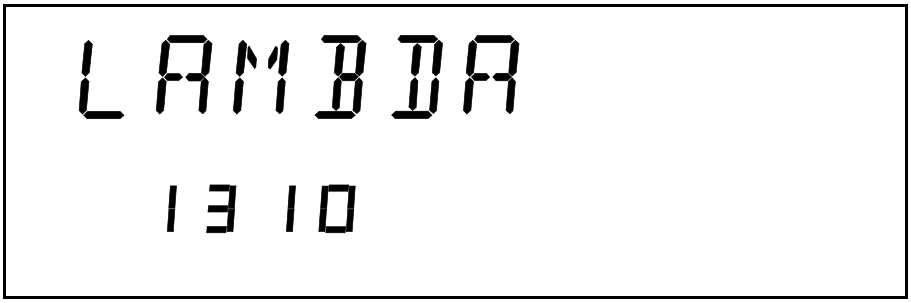
IMPORTANT

The results of the automated ORL and insertion loss tests are stored in the same memory registers as the acquisition data (see* Automatic Data Acquisition *on page 4-4). Starting a step-by-step ORL and insertion loss test erases all data in these memory registers.

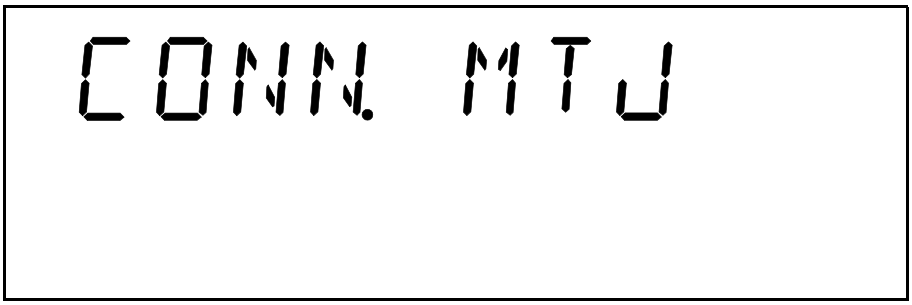
Note: *Once the ORL and insertion loss test is started, you can stop it by pressing* **Program** *twice. The measurements taken so far will be stored.*

1. Press **Program**.

2. Scroll (left/right arrows) to *ORL+IL*, then press **ENTER**.

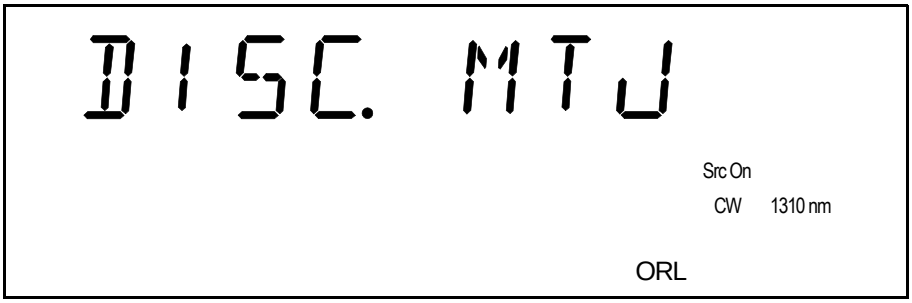


3. Using the up/down arrows, choose the wavelength(s) at which you want to perform the tests (to perform dual-wavelength tests, choose *DUAL*). Then press **ENTER**.



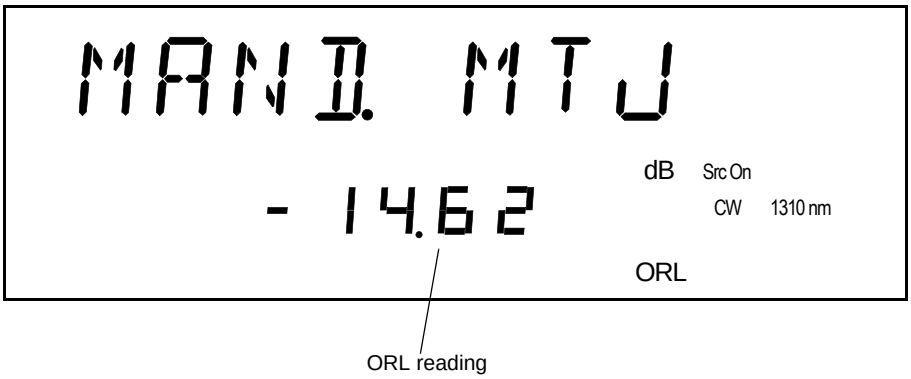
4. Connect the master test jumper from the source port to the power meter port. The master test jumper is the one that will later be connected to the device(s) under test (DUTs).

5. Press **ENTER**. *TAKE REF* will flash while a loopback reference is taken (approximately 30 seconds). The following screen will then be displayed.

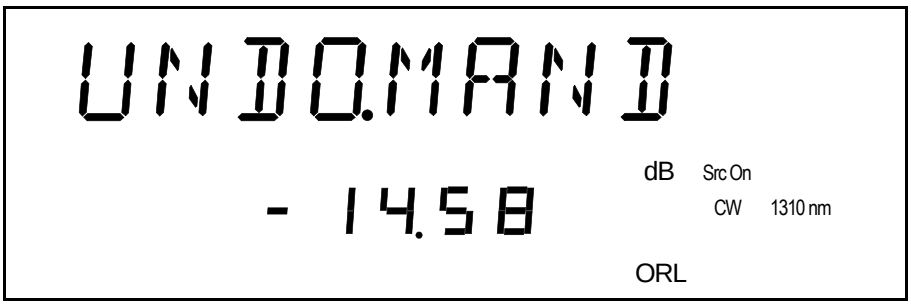


Note: *If the loss inserted by the master test jumper is greater than 0.75 dB, the message "*LOSS >0.75 dB*" will flash. EXFO recommends that you check the connections, clean the fiber ends, or replace the test jumper, and then begin the tests again. To make the message disappear, press* **ENTER**.

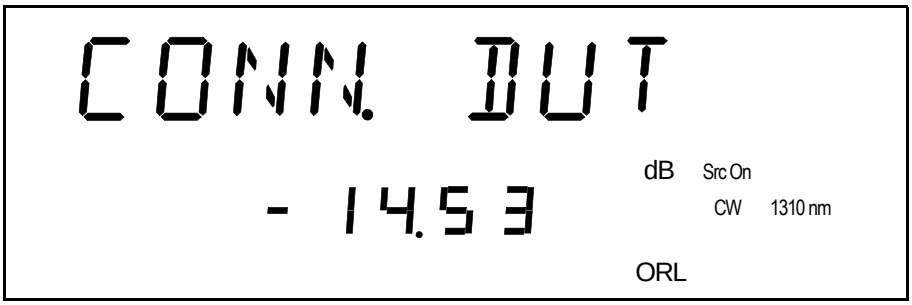
6. Disconnect the end of the master test jumper that is connected to the power meter port, then press **ENTER**.



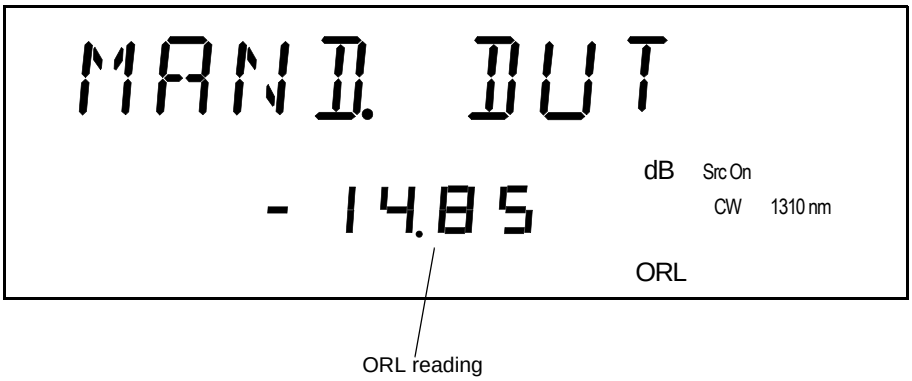
7. Terminate the master test jumper by winding it around the supplied mandrel until the ORL reading goes below range (dashed line) or stabilizes. Then press **ENTER**.



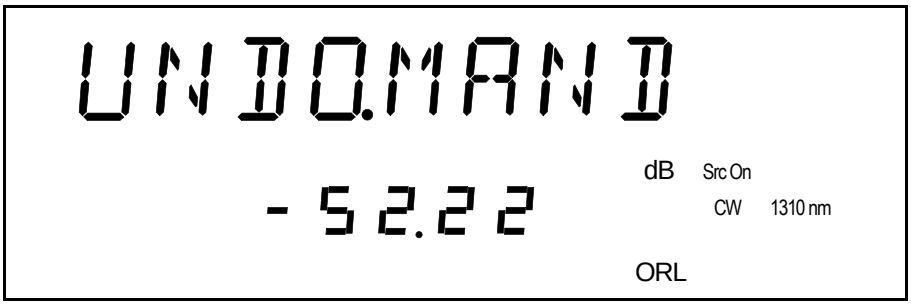
8. Unwrap the master test jumper from the mandrel, then press **ENTER**.



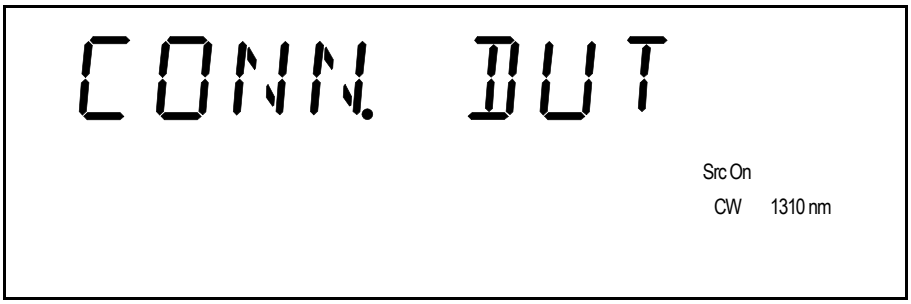
9. Connect the fiber under test to the master test jumper, then press **ENTER**.



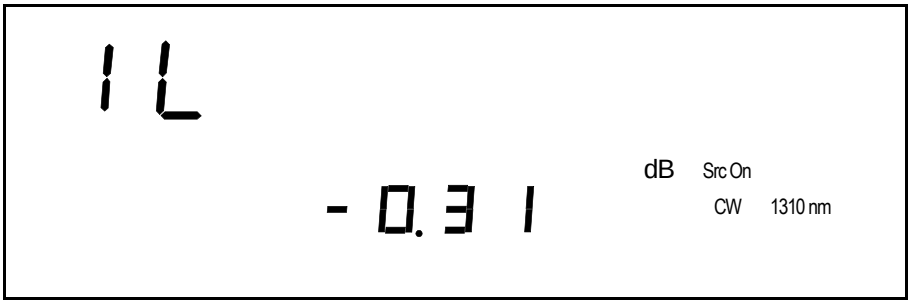
10. Terminate the fiber under test by winding it around the mandrel until the ORL reading stabilizes, then press **ENTER**. The ORL measurement is stored.



11. Unwrap the fiber under test from the mandrel, then press **ENTER**.

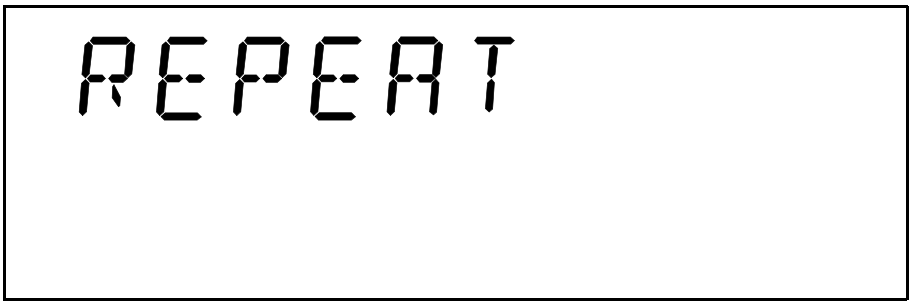


12. Connect the fiber under test to the detector port, then press **ENTER**. The LTS-3900 displays the insertion loss measured for the fiber under test.



Note: *If an offset is set (see* Setting an Offset *on page 4-22), the insertion loss measurement will take this offset into account.*

13. Press **ENTER**. The insertion loss measurement is stored.



14. At this point, you have the choice of

    - testing another DUT by pressing **ENTER**. The LTS-3900 will ask you to connect another DUT (go to step 9 of this procedure).
    - stopping the tests by pressing **Program** twice.

4.3.2 Recalling the Measurements Stored During the Step-by-Step ORL and Insertion Loss Test

The step-by-step procedure performs two tests on each DUT: an ORL and an IL test. Each result is stored in its own memory register. The following table shows how the results will be stored if you test many DUTs in a row *at one wavelength:*

Memory register	Test
1	ORL measurement of DUT 1
2	Insertion loss of DUT 1
3	ORL measurement of DUT 2
4	Insertion loss of DUT 2
5	ORL measurement of DUT 3
6	Insertion loss of DUT 3
etc.	etc.

Table 4-1. Memory Registers Usage

The following table shows how the results will be stored if you test many DUTs in a row *at two wavelengths:*

Memory register	Test
1	ORL measurement of DUT 1 at λ1
2	Insertion loss of DUT 1 at λ1
3	ORL measurement of DUT 1 at λ2
4	Insertion loss of DUT 1 at λ2
5	ORL measurement of DUT 2 at λ1

Table 4-2. Memory Registers Usage (Part 1 of 2)

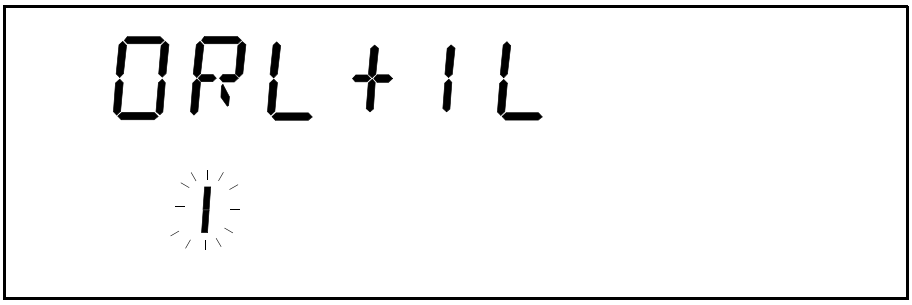
Memory register	Test
6	Insertion loss of DUT 2 at λ1
7	ORL measurement of DUT 2 at λ2
8	Insertion loss of DUT 2 at λ2
9	ORL measurement of DUT 3 at λ1
10	Insertion loss of DUT 3 at λ1
11	ORL measurement of DUT 3 at λ2
12	Insertion loss of DUT 3 at λ2
etc.	etc.

Table 4-2. Memory Registers Usage (Part 2 of 2)

Data you stored through a step-by-step test (see *Initiating the Step-by-Step ORL and Insertion Loss Test* on page 4-11) can be recalled one at a time.

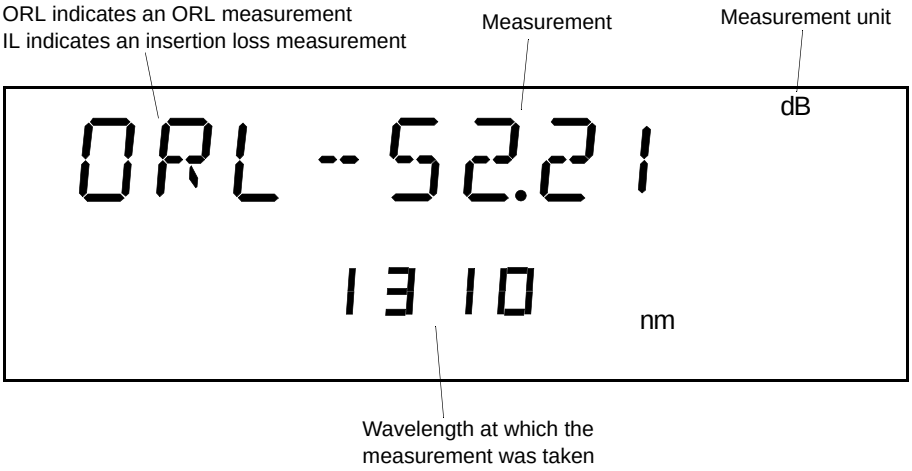
1. Press **Recall**.

2. Scroll (let/right arrows) to *ORL+IL*. You will see a register number flashing.



3. Using the up/down arrows, scroll to the register number you want to view.

4. Press **ENTER**. The selected register will be displayed.



- To view another register, press **ENTER**. The next register will be suggested to you (flashing). If necessary, scroll (up/down arrows) to the desired register number. Press **ENTER** again to display the register.

➤ ***Tip:*** *You can keep* **ENTER** *pressed to quickly scan the measurements in adjacent registers.*

- To exit the *Recall* menu, press **Recall**.

4.3.3 Recalling the Date and Time of the Step-by-Step ORL and Insertion Loss Test

The LTS-3900 automatically stores the date and time when the last acquisition or step-by-step ORL and insertion loss test was started. To recall these parameters,

1. Press **Recall**.

2. Scroll (left/right arrows) until *DATE YMD* is displayed. The date in the lower portion of the screen is the date on which the test started.

3. Scroll (left/right arrows) until *TIME* is displayed. The time in the lower portion of the screen is the time at which the test started.

Note: *If no date and time are displayed, no test data is currently in memory.*

4. To exit the *Recall* menu, press **Recall**.

4.3.4 Erasing Measurements Stored During the Step-by-Step ORL and Insertion Loss Test

IMPORTANT

The data you stored through a step-by-step ORL and insertion loss test (up to 1024) will ALL be deleted at once without any other warning.

1. Press **Recall**.

2. Scroll (left/right arrows) to *CLR ORL*.

3. Press **ENTER**.

4. To exit the *Recall* menu, press **Recall**.

4.4 Customizing Your LTS-3900

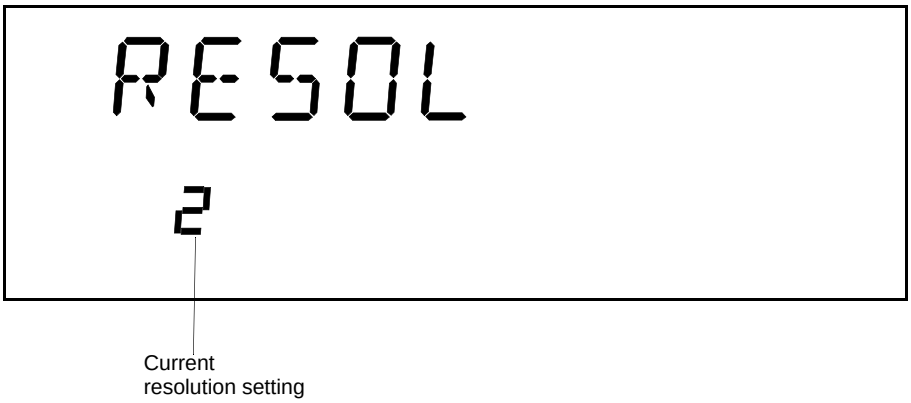
Customized settings are kept in non-volatile memory when the LTS-3900 is turned off; thus, they are still active when the unit is turned on again. Settings for a specific use or user may also be saved (up to 10 configurations can be saved). See *Saving a Configuration* on page 4-27.

4.4.1 Changing the Resolution

When measuring power in dBm or loss in dB, you can set the LTS-3900 to display 0, 1, or 2 digits after the decimal point. An automatic resolution is also available, where the number of digits after the decimal point is determined by the actual power level being measured.

Note: *Higher power levels can be more accurately measured and, therefore, displayed with a greater resolution.*

1. Press **Setup**.



2. Press **ENTER**. The current resolution setting starts flashing.

3. Scroll (up/down arrows) to select a new resolution setting (*0*, *1*, *2*, or *Auto*).

4. Press **ENTER**.

5. To exit the *Setup* menu, press **Setup**.

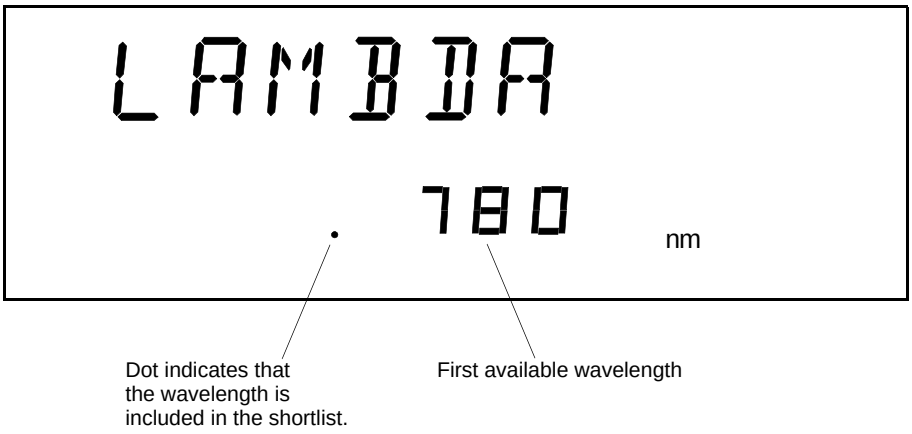
4.4.2 Customizing the Shortlist of Wavelengths

The LTS-3900 detector port can measure optical power at many wavelengths. The accepted wavelengths (spectral range, see *Power Meter Specifications* on page 7-2) depend on the type of detector with which the LTS-3900 is equipped. Store the wavelengths you use the most often in a shortlist so you can quickly access them by pressing λ during a test session. The shortlist may include up to 20 wavelengths.

To edit the shortlist of wavelengths,

1. Press **Setup**.

2. Scroll (left/right arrows) to *LAMBDA*. The first available wavelength is displayed.



You can scroll (up/down arrows) through the available wavelengths. Wavelengths included in the shortlist are marked with a dot.

3. To include or remove a wavelength from the shortlist, press **Enter**.

Note: *When the shortlist is nearly full, the LTS-3900 takes a few seconds to include or remove a wavelength from the shortlist.*

It is impossible to remove from the shortlist

- wavelength(s) corresponding to the source(s) available on the unit; and
- the wavelength that is currently in use by the power meter.

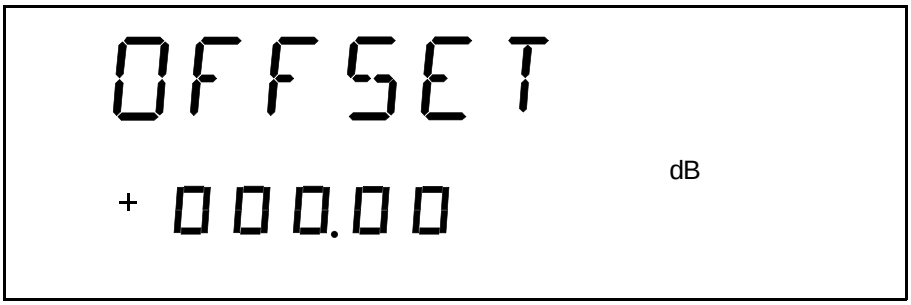
4. When you are done, to exit the *Setup* menu, press **Setup**.

4.4.3 Setting an Offset

An offset can be added to any measurement that is displayed in either dB or dBm. The offset value is between -225.00 dB and 275.00 dB. *Offset On* appears to the left of the display when an offset is being used. Offsetting measured power is useful when compensating for known power losses or applying a calibration offset.

Note: *The offset is only applied when units of dB or dBm are selected.*

1. Press **Setup**.
2. Scroll (left/right arrows) to *OFFSET*.



3. Press **ENTER**. The sign of the offset (- or +) will start flashing.
4. Set a new offset. (Use the up/down arrows to change the flashing element and the left/right arrows to make another element flash.)
5. Press **ENTER**.

Note: *Any value below -225.00 or above 275.00 will be rejected. The unit will beep and you will be prompted to enter a new value.*

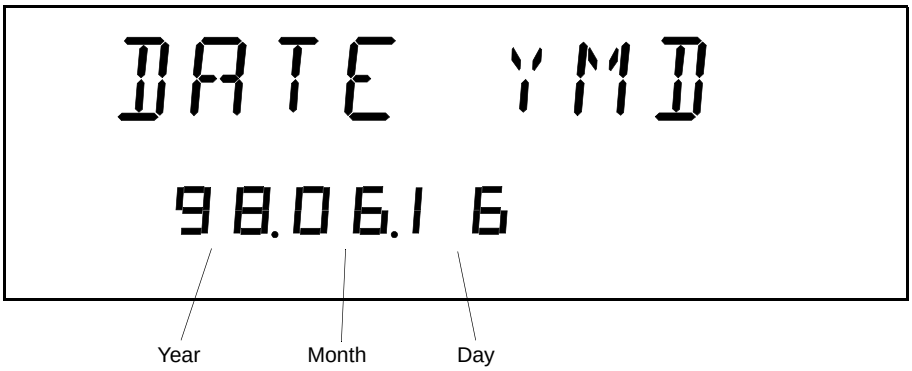
6. To exit the *Setup* menu, press **Setup**.

Note: *To deactivate the offset, you must set it to 000.00. Then,* Offset On *is no longer displayed.*

4.4.4 Setting the Date

The date must be entered according to the year-month-day format.

1. Press **Setup**.
2. Scroll (left/right arrows) to *DATE YMD*.



3. Press **ENTER**. The first digit will start flashing.

4. Set a new date. (Use the up/down arrows to change the flashing digit and the left/right arrows to make another digit flash.)

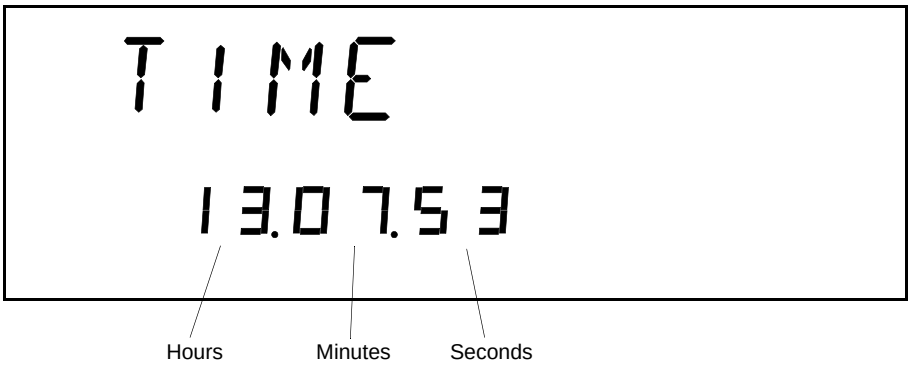
5. Press **ENTER**.

6. To exit the *Setup* menu, press **Setup**.

4.4.5 Setting the Clock

The time must be entered according to the 24-hour format.

1. Press **Setup**.
2. Scroll (left/right arrows) to *TIME*.

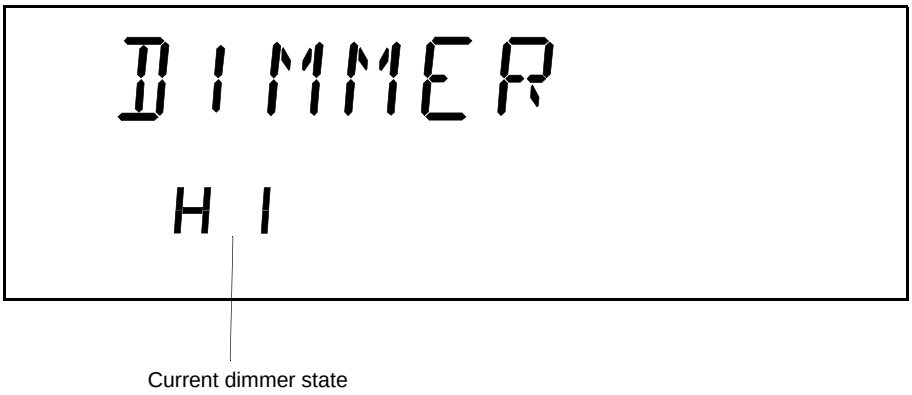


3. Press **ENTER**. The first digit will start flashing.
4. Set a new time. (Use the up/down arrows to change the flashing digit and the left/right arrows to make another digit flash.)
5. Press **ENTER**.
6. To exit the *Setup* menu, press **Setup**.

4.4.6 Setting the Display Intensity

Display intensity may be set to high or low. You can also turn off the display without turning off the unit.

1. Press **Setup**.
2. Scroll (left/right arrows) to *DIMMER*.



3. Press **ENTER**. The current dimmer state will start flashing.
4. Use the up/down arrows to modify the dimmer: *LO*, *HI*, or *OFF*.
5. Press **ENTER**.

Note: *Setting the dimmer to* OFF *turns the display black. Afterwards, press any key to turn on the display.*

6. To exit the *Setup* menu, press **Setup**.

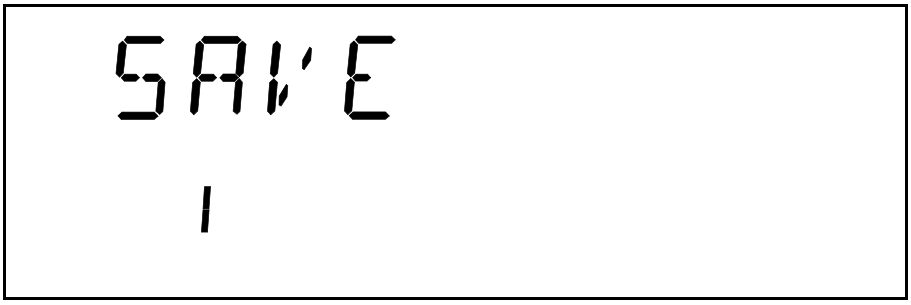
4.4.7 Saving a Configuration

Once the LTS-3900 is customized for a specific application or user, it is possible to save the configuration. Saved parameters are:

- resolution
- current wavelength and corresponding reference
- offset

Up to ten configurations can be saved and recalled as needed.

1. Customize the LTS-3900 as required.
2. Press **Setup**.
3. Scroll (left/right arrows) to *SAVE*.

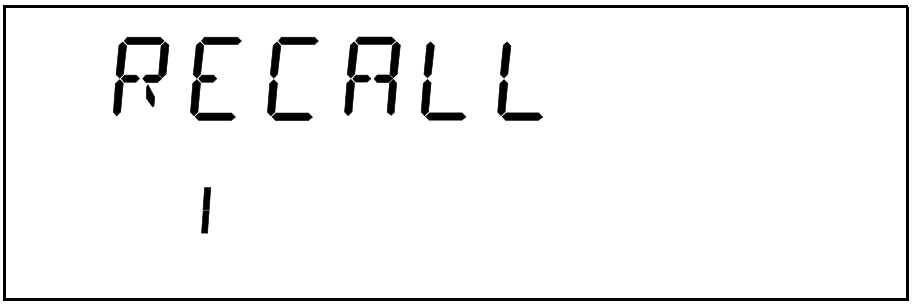


4. Press **ENTER**. The current configuration number will start flashing.
5. Use the up/down arrows to modify the configuration number.
6. Press **ENTER**.
7. To exit the *Setup* menu, press **Setup**.

4.4.8 Recalling a Configuration

Once you have saved a configuration (*Saving a Configuration* on page 4-27), you can recall it at any time.

1. Press **Setup**.
2. Scroll (left/right arrows) to *RECALL*.



3. Press **ENTER**. The configuration number (bottom of the screen) will start flashing.
4. Use the up/down arrows to select the number of the configuration you want to recall.
5. Press **ENTER**.
6. To exit the *Setup* menu, press **Setup**.

5 PRINTING LABELS

If you have a label printer connected to a PC, you can use the *LTS-3900 Label Printing Utility* to print labels based on your LTS-3900 test results.

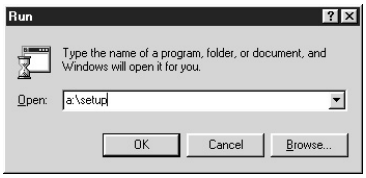
Note: *The* LTS-3900 Label Printing Utility *is only provided when you have ordered the ORL option.*

5.1 Installing and Uninstalling the Software

5.1.1 Installing the Label Printing Utility on your PC

1. Insert Disk 1 of the *LTS-3900 Label Printing Utility* in the floppy drive.

2. Select **Run**... from the **Start** menu. The *Run* window appears.



3. Type *a:\setup* in the **Open** text field. Then click **OK**.

4. Select the language you want to use for the installation procedure in the *Setup Type* window (shown below), then click **Next**.

Note: *This choice does not affect the language of the* LTS-3900 Label Printing Utility *itself. The application language depends on the operating system.*

5. Make sure all other applications are closed, as indicated. Then click **Next**.

6. Follow the on-screen instructions to complete the installation procedure.

5.1.2 Uninstalling the *LTS-3900 Label Printing Utility*

1. Access the Windows 95 *Control Panel* and double-click on the *Add/Remove Programs* icon.

2. On the *Install/Uninstall* page, select *LTS-3900 Label Printing Utility,* then click **Add/Remove** and follow the on-screen instructions.

5.2 Using the *LTS-3900 Label Printing Utility*

5.2.1 Connecting the LTS-3900 to your PC

For the LTS-3900 Label Printing Utility to function properly, you must connect your LTS-3900 to the PC using a serial cable of the “null modem” type.

To connect the PC and the LTS-3900 together

1. Turn off the PC and the LTS-3900.

2. Connect one end of the “null modem” cable to the serial (RS-232) port of the LTS-3900, and the other end to an unused PC serial port (for example, COM2).

Note: *By default, the application is configured to communicate with the LTS-3900 using the COM1 serial port. If this port is already used or if you prefer to use another serial port, you will have to provide its COM number to the application. See* Printing Labels *on page 5-4.*

3. Turn on the PC and the LTS-3900.

5.2.2 Launching the Label Printing Utility

To launch the *LTS-3900 Label Printing Utility*

1. Select **Programs** from the **Start** menu.

2. From the *EXFO* submenu, select **LTS-3900 Label Printing Utility**. The application launches and its main window appears, as shown below.

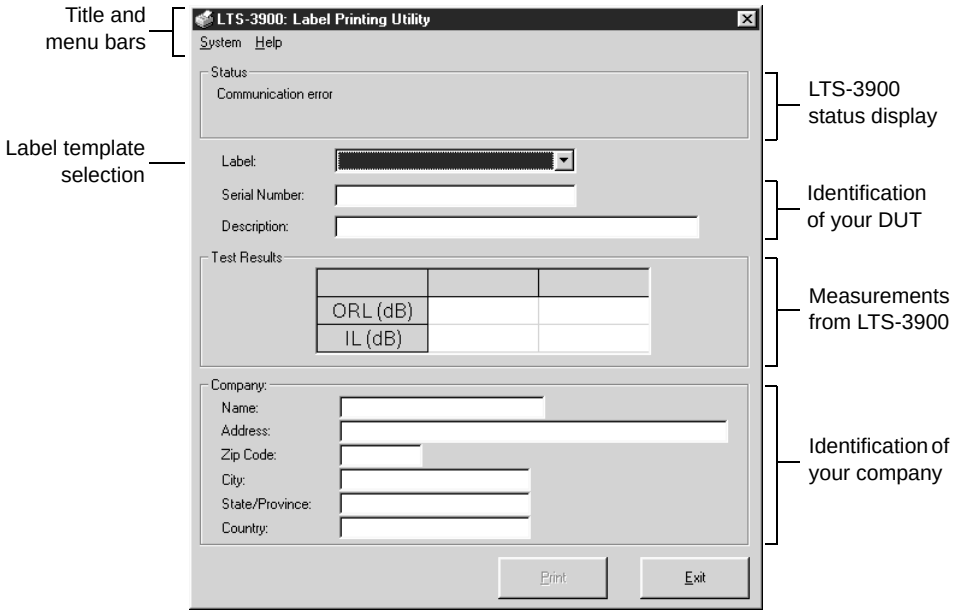


Figure 5-1. LTS-3900 Label Printing Utility Window

Note: *The* **Print** *button is grayed out until your LTS-3900 is in Repeat status.*

5.2.3 Printing Labels

1. Select **Serial Port** from the *System* menu to specify the serial port to which the "null modem" cable is connected. If both settings do not match, you will get a Communication error in the **Status** field.

2. Set the LTS-3900 unit to RS-232 control mode (see *Setting the LTS-3900 for Remote Control* on page 6-1). This will allow real-time measurements to be displayed in the **Test Results** section automatically.

3. Select the label template you want to use in the **Label** list box. Two templates are provided by EXFO (SmallLabel and LargeLabel), but you can create and use new ones as needed (see *Designing Custom Templates* on page 5-5).

4. Enter the identification information to be printed on the label in the text boxes. By default, this information will be recalled the next time you run the *LTS-3900 Label Printing Utility*.

   - Information about the DUT: the **Serial Number** and **Description** fields.
   - Information about the company: the **Company** section.

5. Click **Print**.

When you are done printing labels, click **Exit** to close the *LTS-3900 Label Printing Utility*.

5.3 Designing Custom Templates

You can design customized templates for your labels using the Seagate Crystal Reports software. EXFO has developed default templates that you can use as a basis to design new ones. Please refer to the Crystal Reports instruction manual if you want to learn more about the software.

IMPORTANT

EXFO strongly suggests that you use the templates provided with the* LTS-3900 Label Printing Utility*. The instructions given below are based on these templates. EXFO will not provide support on the use of the Crystal Reports software to design new templates from scratch.

To design a new label template

1. Copy and rename one of the provided label templates, using Windows Explorer. The templates are stored in the application folder, typically "C:\Program Files\Exfo\LTS-3900". Template files bear the .rpt extension.

IMPORTANT

***If you copy your file to another location, it will not be available to the* LTS-3900 Label Printing Utility.**

2. Remove the Read-Only attribute from the new template file.

3. Open the new template file (YourName.rpt) by double-clicking the file in Windows Explorer, or directly in Crystal Reports.

4. Select **Formula Field** from the *Insert* menu. The following window appears.

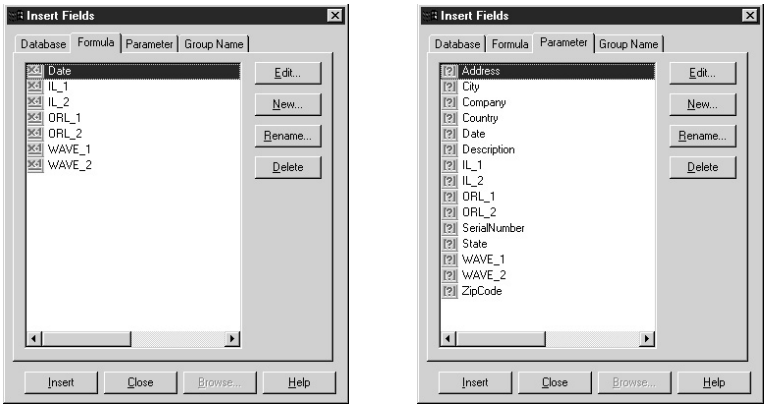


Figure 5-2. Crystal Reports–Insert Fields Window

5. Select the fields to add on the template from the **Formula** and **Parameters** pages, and click **Insert**.

IMPORTANT

It is strongly recommended that you never delete fields from the list, to ensure correct data transmission.

6. Move the fields on the design screen to get the desired layout. You can also change the properties of each field (font, size, attributes, etc.).

Note: *To include bar codes on your label template, select the font corresponding to your bar code format in the font list.*

7. Save the new label template.

6 REMOTE CONTROL

The LTS-3900 can be controlled remotely either by

- a GPIB interface (through a GPIB cable connected to the GPIB port); or
- an RS-232 interface (through a serial cable connected to the serial port).

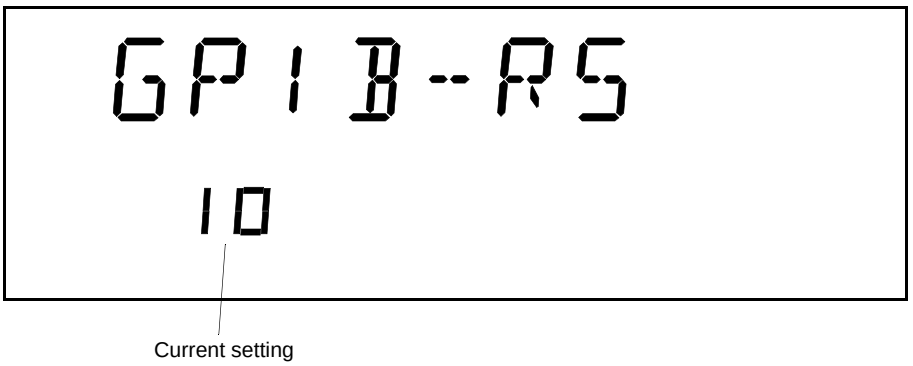
The commands used in both protocols are the same and are described in the following pages. When the LTS-3900 is being controlled remotely, *Remote* appears in the lower left corner of the display.

Note: *If you have already designed a GPIB program to control a power meter or a source from EXFO's IQ Series, you can reuse sections for the LTS-3900.*

6.1 Setting the LTS-3900 for Remote Control

To control the LTS-3900 remotely, you need to set a GPIB address or activate the RS-232 port.

1. Press **Setup**.
2. Scroll (left/right arrows) to *GPIB-RS*.



3. Press **ENTER**. The current setting will start flashing.

4. Using the up/down arrows, enter a new setting.
   - a numbered setting represents a GPIB address (between 1 and 30)
   - for RS-232 control, scroll (up/down arrows) to *RS-232* (before setting 1 or after setting 30)
5. Press **ENTER**.
6. To exit the *Setup* menu, press **Setup**.

6.2 Communication Parameters

For GPIB Communication	
Terminate Read on EOS	Yes
Set EOI with EOS on Writes	Yes
Type of compare on EOS	8-bits
EOS byte	0Ah
Sens EOI at end of Writes	Yes
GPIB Primary address	see Section 6.1
GPIB Secondary address	None

Table 6-1. GPIB Communication Parameters

For RS-232 Communication	
EOS bytes	0Ah
Baud rate	9600 bps
Parity	None
Data bits	8 bits
Stop bits	1 bits
Flow Control	None
Activation	see Section 6.1

Table 6-2. RS-232 Communication Parameters

***Note**: EOS means "End of String". EOI means "End or Identify".*

6.3 Standard Status Data Structure

Figure 6-1 on the following page illustrates the four common status and enable registers as defined by IEEE 488.2. This diagram is a useful aid in understanding the general commands and how a service request (SRQ) is generated. The four registers are:

- Standard Event Status Register (ESR)
- Standard Event Status Enable Register (ESE)
- Status Byte Register (STB)
- Service Request Enable Register (SRE)

Bit	ESR	ESE	STB	SRE
0	Operation Complete	Operation Complete	N/A	N/A
1	Request Control	Request Control	N/A	N/A
2	Query Error	Query Error	Error Bit	Error Summary Bit
3	Device Dependent Error	Device Dependent Error	Questionable Status	Questionable Status
4	Execution Error	Execution Error	Message Available	Event Status Summary Bit
5	Command Error	Command Error	Event Status Summary Bit	Message Available
6	User Request	User Request	Master Summary Status	Request Service/Master Summary Status
7	Power On	Power On	Operation Status	Operation Status

Table 6-3. Standard Registers

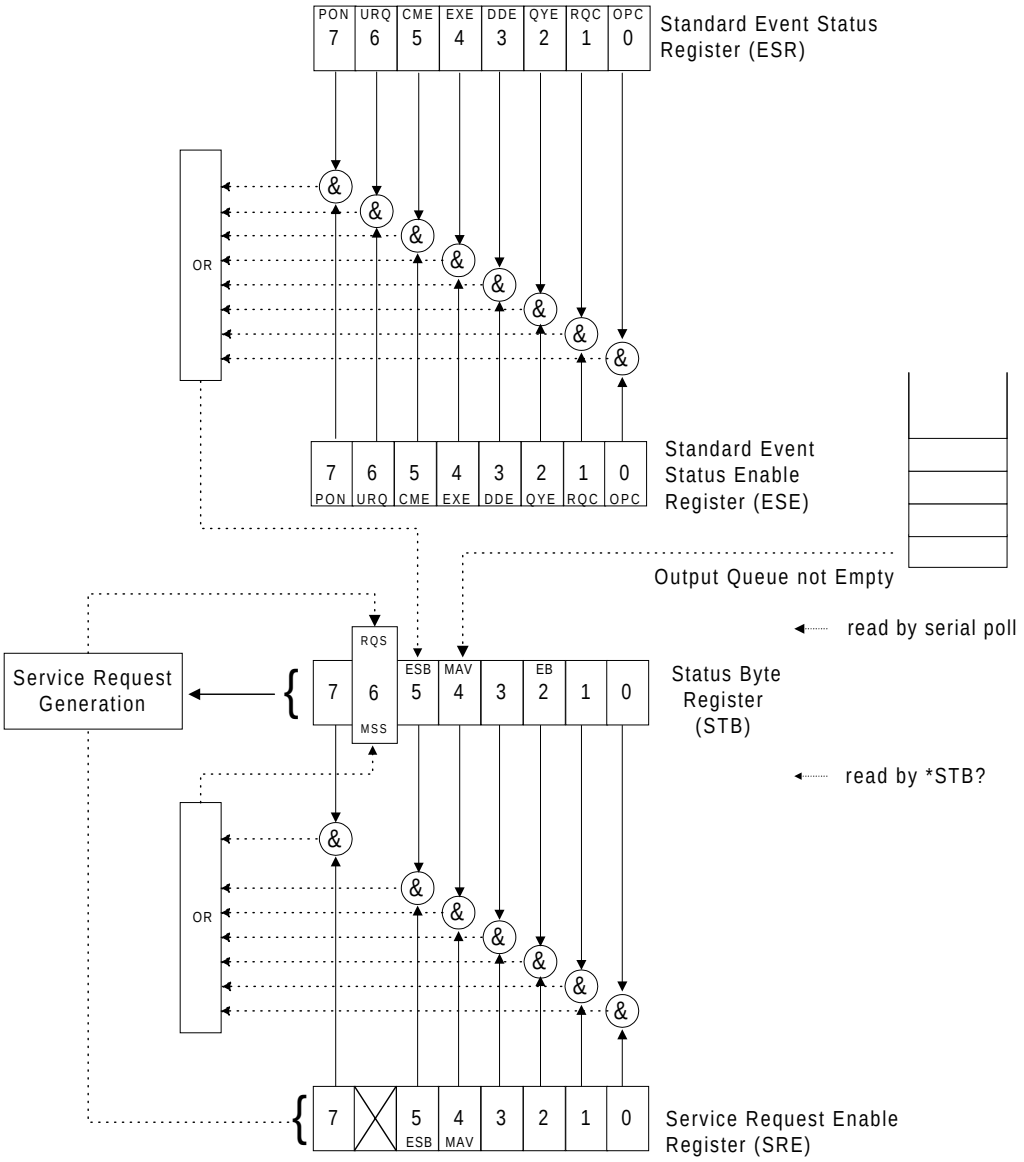


Figure 6-1. Standard Status Data Structures (IEEE 488.2)

An SRQ is forced when a bit is set in the STB and at the same time the corresponding SRE bit is set. When the SRQ is generated, the RQS bit is set to 1 and remains set until read by a serial poll. Once the RQS is read, it returns to 0.

6.4 Command Structure

The GPIB and RS-232 commands follow the guidelines determined by the Standard Commands for Programmable Instruments (SCPI) consortium. For example, the command syntax:

FORM:READ[:DATA]<space><digits>

is used to change the measurement display resolution (number of digits after the decimal point) of an LTS-3900.

In this particular example,

- FORM identifies that the command is a part of the SCPI FORMat subset of commands;
- READ and DATA are keywords that define the function of the command;
- [ ] indicates that a keyword or a parameter is optional;
- <space> is included to indicate that a space is required;
- <digits> is the command parameter; and
- Keywords must be separated by a colon.

For example, the typical command FORM:READ:DATA 1 would instruct the LTS-3900 to display a power measurement with 1 digit after the decimal point.

Note: *It is recommended to fetch the response immediately after each query.*

If the buffer is full (i.e. if too many commands have been sent at the same time), the unit will beep.

6.5 General Commands

The LTS-3900 recognizes the main commands identified in IEEE-488.2.

Command	Function
*CLS	Clear status command
*CSB	Clear status byte command
*ESE	Standard event status enable command
*ESE?	Standard event status enable query
*ESR?	Standard event status register query
*IDN?	Identification query
*OPC	Operation complete command
*OPC?	Operation complete query
*RST	Reset command
*SRE	Service request enable command
*SRE?	Service request enable query
*STB?	Read status byte query
*TST?	Self test query

Table 6-4. Common Commands Summary

The commands are fully explained on the following pages.

*CLS

Description This command sets the contents of the Standard Event Register (ESR), the Status Byte Register (STB), and the Error Queue (ERR) to zero. This command is commonly used to clear the status registers before enabling SRQ. Note that the output queue, Standard Event Status Enable Register (ESE), and Service Request Enable Register (SRE) are not affected.

Syntax *CLS

Note The command CLR is equivalent to the command *CLS. Both give the same result.

*CSB

Description This command clears the status byte to zero.

Syntax *CSB

*ESE

Description This command is used to set bits in the Standard Events Status Enable Register (ESE) to a new value (default value is 255). The contents of the ESE register are logically ANDed with the ESR register. A non zero result will set the Event Summary Bit (ESB) of the Status Byte Register (STB). This command is useful for selecting which events may generate an SRQ.

Syntax *ESE<space><value>

Parameter The <value> parameter must be between 0 and 255 (inclusive).

*ESE?

Description This query reads the contents of the Standard Event Status Enable Register (ESE).This query reads the contents of the Events Status Register.

Syntax *ESE?

Response A binary integer between 0 and 255.

*ESR?

Description This query reads the contents of the Standard Events Status Register (ESR).

Syntax *ESR?

Response A binary integer between 0 and 255.

*IDN?

Description This query reads the LTS-3900 identification string.

Syntax *IDN?

Response “EXFO E.O. Engineering LTS-3900 Vxx.xx”, where xx.xx is the current product version.

Note The queries SYST:VERS? and IDN? are equivalent to the query *IDN?. They give the same result.

*OPC

Description This command causes the LTS-3900 to generate the operation complete message in the Standard Event Status Register (ESR) when all pending selected LTS-3900 operations have been completed.

Syntax *OPC

Example *OPC;*IDN?

*OPC?

Description This query puts an ASCII 1 in the output queue when the content of the input queue has been processed. This query is useful to prevent another command from processing until the current command is complete.

Syntax *OPC?

Response "1"

Note The query OPC? is equivalent to the command *OPC?. Both give the same result.

*RST

Description This command empties the step response list. It is only seen when it is part of another multiple command. In the example below, by adding this command after *IDN?, you will not be able to access the answer. The *RST, in this instance, erases the identification string. In addition, this command performs the following operations:

1. Return to initial state before command was sent, and not necessarily to previous settings.
2. Force the device to enter into an Operation Complete Command Idle State (OCIS).
3. Force the device to enter into an Operation Complete Query Active State (OQAS).
4. Initialize previous responses unless there has been a program message terminator preceded by an *RST.

Syntax *RST

Example *IDN?;*RST<NL>

*SRE

Description This command sets bits in the Service Request Enable Register (default value is 255) and enables the corresponding bit in the Status Register. The command can be used to select which events can initiate a service request.

Syntax *SRE<space><value>

Parameter The <value> parameter must be between 0 and 255.

*SRE?

Description This query returns the contents of the Service Request Enable Register.

Syntax *SRE?

Response A binary integer between 0 and 255.

*STB?

Description This query returns the contents of the Status Byte Register.

Syntax *STB?

Response A binary integer between 0 and 255.

Note The query STB? is equivalent to the command *STB?. Both give the same result.

*TST?

Description This query initiates an internal self-test and returns a binary value indicating the results of the test.

Syntax *TST?

Response A binary value:
"0" -test is complete with no errors
"1" -test is complete with errors

6.6 Specific Commands

DISPlay:DIMMer

Description This command is used to adjust the intensity of the LTS-3900 display (high or low) or to turn off the display without turning off the unit.

Syntax DISP:DIMM<space><data>

Parameters The <data> parameter can be “HI”, “LO”, or “OFF”.

Example DISP:DIMM OFF

Note When the display is turned off by this command, any key pressed on the LTS-3900 keypad will return the display to high intensity. To prevent this, lock the LTS-3900 keypad with the command *LOK.

See also DISP:DIMM?, *LOK, and *LOK?

DISPlay:DIMMer?

Description This query returns the intensity of the LTS-3900 display (high, low, or off).

Syntax DISP:DIMM?

Response
“HI” -intensity is high
“LO” -intensity is low
“OFF” -display is off

Example DISP:DIMM?

FETCh[:SCALar]:POWer:DC?

Description This query returns the last measurement stored in the buffer (measurements can be stored into the buffer with the commands INIT:IMM and INIT:CONT).

Syntax FETC[:SCAL]:POW:DC?

Response A measurement with the appropriate measurement unit in the format "±999.99 dBm". The absolute power measurement units can be dBm, mW, μW, nW, or pW. The referenced power measurement units can be dB, D mW, D μW, D nW, or D pW. The ORL measurement unit is dB ORL. When the measurement is in dB or dBm, the number of digits after the decimal point depends on the selected resolution.

Example FETC:SCAL:POW:DC?

See also INIT:CONT, INIT:CONT?, and INIT:IMM

FORMat:READings[:DATA]

Description This command changes the resolution of the displayed power value, when units of dB or dBm are selected.

Syntax FORM:READ[:DATA]<space><digits>

Parameters The <digits> parameter can be:
"0" -set zero digit after the decimal point
"1" -set one digit after the decimal point
"2" -set two digits after the decimal point
"AUTO" -set automatic resolution (determined by the measured power level)

Example FORM:READ:DATA 2

FORMat:READings[:DATA]?

Description This query returns the current resolution of the displayed power value when units of dB or dBm are selected.

Syntax FORM:READ[:DATA?]

Response
"0" -zero digit after the decimal point
"1" -one digit after the decimal point
"2" -two digits after the decimal point
"AUTO" -automatic resolution is set (determined by the measured power level)

Example FORM:READ:DATA?

INITiate:CONTinuous

Description This command starts or stops Continuous mode. When Continuous mode is activated, values are continuously stored into a buffer so they can be fetched at any time with the command FETC:SCAL:POW:DC?. Values can be power, loss, or ORL measurements, depending on the current measurement mode of the LTS-3900.

Syntax INIT:CONT<space><boolean>

Parameters The <boolean> value can be:
"0" -stop Continuous mode
"1" -start Continuous mode

Example INIT:CONT 1

See also FETC:SCAL:POW:DC?, INIT:CONT?, INIT:IMM, and READ:SCAL:POW:DC?

INITiate**:CONT**inuous**?**

Description This query returns a value indicating whether Continuous mode is activated.

Syntax INIT:CONT?

Response A boolean value:
"1" -Continuous mode is activated
"0" -Continuous mode is deactivated

Example INIT:CONT?

See also FETC:SCAL:POW:DC?, INIT:CONT, INIT:IMM, and READ:SCAL:POW:DC?

INITiate[**:IMM**ediate]

Description This command stores a value into the buffer so it can be fetched with the command FETC:SCAL:POW:DC?. Values can be power, loss, or ORL measurements, depending on the current measurement mode of the LTS-3900.

Syntax INIT[:IMM]

Example INIT:IMM

See also FETC:SCAL:POW:DC?, INIT:CONT, and READ:SCAL:POW:DC?

INITiate**:STOR**age

Description The LTS-3900 offers 512 memory registers to manually store data and 1024 memory registers for data acquisition. Before recalling stored data, first use the command INIT:STOR to specify from which register you want to recall data. Then, to actually recall the data, use either MMEM:STOR:DATA:RECA? or MMEM:ACQ:DATA:RECA? whether you want to recall manually stored data or acquisition data.

Syntax INIT:STOR<space><data>

Parameters The <data> parameter is a memory register between 0 and 1025. If a parameter greater than 1024 is entered, the memory register 1024 will be selected.

Example INIT:STOR 99

See also MMEM:STOR:DATA:RECA? and MMEM:ACQ:DATA:RECA?

INSTrument**:CAT**alog**?**

Description This query returns the instrument options or equipment.

Syntax INST:CAT?

Response The configuration of the LTS-3900. For example:
"InGaAs Power Meter 1310/1550 nm Laser with ORL, VFL"

Example INST:CAT?

*LOK

Description This command is used to lock and unlock the LTS-3900 keypad. Once the LTS-3900 keypad is locked, no external input can interfere with the GPIB communication. The only way to unlock the keypad is to use the *LOK command again or turn off the unit.

Syntax *LOK <space><data>

Parameters The <data> parameter can be:
"1" -lock the keypad
"0" -unlock the keypad

Example *LOK 1

Note When the keypad is locked, the unit will beep twice if any key is pressed on the keypad. The indicator *Remote* appears in the lower left corner of the display while the unit is being controlled remotely.

*LOK?

Description This query returns the LTS-3900 keypad lock state.

Syntax *LOK?

Response "1" -LTS-3900 keypad is locked
"0" -LTS-3900 keypad is unlocked

Example *LOK?

MMEMory:ACQuisition:DATA:RECAll?

Description This query is used to recall acquisition data. Before using the query MMEM:ACQ:DATA:RECA?, the register from which to recall the data must be specified with the command INIT:STOR.

Syntax MMEM:ACQ:DATA:RECA?

Response A measurement with the appropriate measurement unit in the format "±999.99 dBm". The absolute power measurement units can be dBm, mW, μW, nW, or pW. The referenced power measurement units can be dB, D mW, D μW, D nW, or D pW. The ORL measurement unit is dB ORL. When the measurement is in dB or dBm, the number of digits after the decimal point depends on the selected resolution.

Example
```
INIT:STOR 99
MMEM:ACQ:DATA:RECA?
```

See also INIT:STOR and MMEM:STOR:DATA:RECA?

MMEMory:STORed:DATA:RECAll?

Description This query is used to recall manually stored data. Before using the query MMEM:STOR:DATA:RECA?, the register from which to recall the data must be specified with the command INIT:STOR.

Syntax MMEM:STOR:DATA:RECA?

Response A measurement with the appropriate measurement unit in the format "±999.99 dBm". The absolute power measurement units can be dBm, mW, μW, nW, or pW. The referenced power measurement units can be dB, D mW, D μW, D nW, or D pW. The ORL measurement unit is dB ORL. When the measurement is in dB or dBm, the number of digits after the decimal point depends on the selected resolution.

Example
```
INIT:STOR 99
MMEM:STOR:DATA:RECA?
```

See also INIT:STOR and MMEM:ACQ:DATA:RECA?

READ[:SCALar]:POWer:DC?

Description This query returns the measurement currently read by the LTS-3900 (whether the unit is in absolute power, relative, or ORL mode).

Syntax READ[:SCAL]:POW:DC?

Response A measurement with the appropriate measurement unit in the format "±999.99 dBm". The absolute power measurement units can be dBm, mW, μW, nW, or pW. The referenced power measurement units can be dB, D mW, D μW, D nW, or D pW. The ORL measurement unit is dB ORL. When the measurement is in dB or dBm, the number of digits after the decimal point depends on the selected resolution.

Example
```
READ:SCAL:POW:DC?
```

See also INIT:CONT, INIT:CONT?, INIT:IMM and FETC:SCAL:POW:DC?

SENSe:CORRection:COLLect:ZERO

Description When the LTS-3900 is in Power meter mode, this command initiates an offset nulling measurement. If light is detected, the error message “Light Detected” appears.
When the LTS-3900 is in ORL mode, this command initiates a zero measurement.

Syntax SENS:CORR:COLL:ZERO

Example SENS:CORR:COLL:ZERO

Note The command SENS:CORR:COLL:ZERO takes some time to be executed (up to about 1 minute in Power meter mode). While this command is being executed, no other GPIB command can be processed. To be notified when the command SENS:CORR:COLL:ZERO is completed,

1. Set your GPIB time-out to a value greater than 1 minute (e.g. 100 seconds)
2. Send the commands “SENS:CORR:COLL:ZERO;*OPC?”
3. When you receive the answer “1”, the command is completed.

or
Use the serial poll feature with the *OPC command to receive a service request when the command is completed.
ex. *OPC;SENS:CORR:COLL:ZERO

Before using this command in Power meter mode, tighten the protective cap on the detector port. Before using this command in ORL mode, terminate the fiber by wrapping it at least ten turns around the supplied mandrel.

SENSe:CORRection:OFFSet[:MAGNitude]

Description This command sets an offset value that is applied in Power meter mode, when units of dB or dBm are selected.

Syntax SENS:CORR:OFFS[:MAGN]<space><numeric_value>[<space>DB]

Parameters The <numeric_value> is an offset between -225.00 dB and 275.00 dB. If an invalid parameter is entered, the error message "Data Type Error" appears.

Example SENS:CORR:OFFS:MAGN 22.105

SENSe:CORRection:OFFSet:MAGNitude?

Description This query returns the offset value currently set in Power meter mode (remember the offset is applied only when units of dB or dBm are selected).

Syntax SENS:CORR:OFFS:MAGN?

Response The current offset with units of dB.

Example SENS:CORR:OFFS:MAGN?

SENSe:MODE?

Description This query returns the LTS-3900 current measurement mode.

Syntax SENS:MODE?

Response "ORL MODE" -LTS-3900 is in ORL mode
"POWER MODE" -LTS-3900 is in Power meter mode

Example SENS:MODE?

SENSe:MODE:ORL

Description This command sets the LTS-3900 to ORL mode.

Syntax SENS:MODE:ORL

Example SENS:MODE:ORL

SENSe:MODE:PowerMeter

Description This command sets the LTS-3900 to Power meter mode.

Syntax SENS:MODE:PM

Example SENS:MODE:PM

Note If the previous mode was ORL, the power meter operating wavelength will be the last wavelength used in ORL mode.

SENSe:ORL:REFerence

Description When the LTS-3900 is in ORL mode, this command initiates a loopback reference. Before using this command, connect a test jumper from the detector port to the source port.

Syntax SENS:ORL:REF

Example SENS:ORL:REF

Note The command SENS:ORL:REF takes some time to be executed (up to about 10 seconds). While this command is being executed, no other GPIB command can be processed. To be notified when the command SENS:ORL:REF is completed,

1. Set your GPIB time-out to a value greater than 1 minute (e.g. 100 seconds)
2. Send the commands “SENS:ORL:REF;*OPC?”
3. When you receive the answer “1”, the command is completed.

or

Use the serial poll feature with the *OPC command to receive a service request when the command is completed.
ex. “*OPC;SENS:ORL:REF”

SENSe:POWer:RANGe:LOWer?

Description This query returns the minimum measurable ORL value (in dBm).

Syntax SENS:POW:RANG:LOW?

Response The minimum measurable ORL value in the format “-99”.

Example SENS:POW:RANG:LOW?

SENSe:POWer:REFerence

Description This command is used to store a user-selected reference value (in dBm) for the current wavelength.

Syntax SENS:POW:REF<space><value>[<space>dBm]

Parameters The <value> parameter represents the new reference value to be stored for the current wavelength. The reference value in dBm must be within the power range of the LTS-3900 in the format "±99.99". The dBm parameter is optional.

Example SENS:POW:REF

SENSe:POWer:REFerence?

Description This query returns the reference value for the current wavelength.

Syntax SENS:POW:REF?

Response The current reference value in dBm, which can be any value within the power range of the LTS-3900, in the format "±99.99 dBm".

Example SENS:POW:REF?

SENSe:POWer:REFerenc:DISPlay

Description This command stores the power currently read at the detector port as the new reference value (in dBm). The LTS-3900 then accesses relative mode with units of dB.

Syntax SENS:POW:REF:DISP

Example SENS:POW:REF:DISP

SENSe:POWer:REFerence:STATe

Description This command enables absolute (units of dBm) or relative (units of dB) mode.

Syntax SENS:POW:REF:STAT<space><boolean>

Parameters The <boolean> value represents either dB or dBm:
"0" -enable absolute mode (units of dBm)
"1" -enable relative mode (units of dB)

Example SENS:POW:REF:STAT

SENSe:POWer:REFerence:STATe?

Description This query returns a value indicating if the power meter is displaying absolute (dBm) or relative power values.

Syntax SENS:POW:REF:STAT?

Response "0" -absolute mode is enabled (units of dBm)
"1" -relative mode is enabled (units of dB)

Example SENS:POW:REF:STAT?

SENSe:POWer:UNIT

Description This command changes the measurement units.

Syntax SENS:POW:UNIT<space><units>

Parameters The <units> parameter can be:

WATT	measured value displayed in watts (pw, nw, μw, or mw);
DB	measured value displayed in dB relative to the current reference;
DBM	measured value displayed in dBm; or
DWATT	measured value displayed in watts relative to the current reference.

Example SENS:POW:UNIT DBM

SENSe:POWer:UNIT?

Description This query returns the current measurement units.

Syntax SENS:POW:UNIT?

Response DBM, DB, WATT, or DWATT

Example SENS:POW:UNIT?

SENSe:POWer:WAVElength

Description This command selects a new operating wavelength (in Power meter mode only).

Syntax SENS:POW:WAVE<space><value>[<space>NM]

Parameters The <value> parameter is a valid wavelength expressed in nanometers (nm). Valid wavelengths are those returned by the query SENS:POW:WAVE:CATA?. An invalid parameter will raise the error message “Invalid Wavelength”.

Example SENS:POW:WAVE 1310

Note To select the operating wavelength in ORL mode, use the command SOUR:POW:WAVE.

SENSe:POWer:WAVElength?

Description This query returns the current wavelength in Power meter mode.

Syntax SENS:POW:WAVE?

Response The current wavelength in nanometers (nm) in the format “9999 nm”

Example SENS:POW:WAVE?

SENSe:POWer:WAVElength:CATAlog?

Description This query returns the list of calibrated power meter wavelengths (at least 20). Values are in “nm”, separated by a “;”.

Syntax SENS:POW:WAVE:CATA?

Response The list of calibrated power meter wavelengths. For example: “0840;0850;0860;0910;0980;1060;1250;1280;1290;1300;1310; 1320;1500;1520;1530;1540;1550;1560;1600;1650”

Example SENS:POW:WAVE:CATA?

SOURce:AM[:INTernal]:FREQuency

Description This command selects the internal modulation frequency for the source. The internal modulation is 50% duty cycle at the selected frequency.

Syntax SOUR:AM[:INT]:FREQ<space><value>[<space><units>]

Parameters The available modulation frequencies are 2 kHz (or 2000 Hz) and CW (for no modulation).
The <units> parameter is optional and must be “HZ” or “KHZ”.
Entering an invalid parameter sets the source to CW.

Example SOUR:AM:INT:FREQ 2000 HZ (set modulation to 2000 Hz)
SOUR:AM:INT:FREQ CW (set modulation to none)

SOURce:AM[:INTernal]:FREQuency?

Description This query returns a value indicating the current internal modulation frequency for the source.

Syntax SOUR:AM[:INT]:FREQ?

Response The current internal modulation frequency in the format "2 kHz", "CW" (for no modulation), or "OFF" (if the source is off).

Example SOUR:AM:FREQ?

SOURce:POWer:STATe

Description This command activates or deactivates the optical source. When the source is activated, "Src On" appears on the LTS-3900 display.

Syntax SOUR:POW:STAT<space><boolean>

Parameters The <boolean> value can be:
"0" or "OFF" -deactivate the source
"1" or "ON" -activate the source

Example SOUR:POW:STAT ON

SOURce:POWer:STATe?

Description This query returns a value indicating the status of the optical source: ON or OFF.

Syntax SOUR:POW:STAT?

Response "0" -the source is OFF
"1" -the source is ON

Example SOUR:POW:STAT?

SOURce:POWer:WAVElength

Description This command selects the source wavelength when using a dual-wavelength source. When the source wavelength is changed, the power meter of the same LTS-3900 automatically adjusts to the same wavelength.

Syntax SOUR:POW:WAVE<space><value>

Parameters The <value> parameter can be:
"UPP" -switch to the highest available source wavelength
"LOW" -switch to the lowest available source wavelength

Example SOUR:POW:WAVE UPP

Note When in ORL mode, this command can be used to change the ORL meter wavelength.

SOURce:POWer:WAVElength?

Description This query returns a value indicating which wavelength is currently selected.

Syntax SOUR:POW:WAVE?

Response A four-digit number identifying the current wavelength (units are nm) in the format "9999".

Example SOUR:POW:WAVE?

VFL:AM[:INTernal]:FREQuency

Description This command selects the internal modulation frequency for the VFL. The internal modulation is 50% duty cycle at the selected frequency.

Syntax VFL:AM[:INT]:FREQ<space><value>[<space><units>]

Parameters The available modulation frequencies are 1 Hz and CW (for no modulation).
The <units> parameter is optional and must be "HZ".
Entering an invalid parameter sets the VFL to CW.

Example VFL:AM:INT:FREQ 1 HZ (set modulation to 270 Hz) or
VFL:AM:INT:FREQ CW (set modulation to none)

VFL:AM[:INTernal]:FREQuency?

Description This query returns a value indicating the current internal modulation frequency for the VFL.

Syntax VFL:AM[:INT]:FREQ?

Response The current internal modulation frequency in the format "1 Hz", "CW" (for no modulation), or "OFF" (if the VFL is off).

Example VFL:AM:FREQ?

VFL:STATe

Description This command activates or deactivates the VFL. When the VFL is activated, “VFL” appears on the LTS-3900 display.

Syntax VFL:STAT<space><boolean>

Parameters The <boolean> value can be:
“0” or “OFF” -deactivate the VFL
“1” or “ON” -activate the VFL

Example VFL:STAT ON

VFL:STATe?

Description This query returns a value indicating the VFL status: ON or OFF.

Syntax VFL:STAT?

Response “0” -the VFL is OFF
“1” -the VFL is ON

Example VFL:STAT?

6.7 Quick Reference Command Tree

Command				Parameter/ Response	Description
DISP	DIMM			<LO|HI|OFF>	Set display intensity
	DIMM?			(LO|HI|OFF)	Get display intensity
FETC	[SCAL]	POW	DC?	(±999.99)	Get last stored value
FORM	READ	[DATA] *		<0|1|2|AUTO>	Set display resolution
		[DATA]? *		(0|1|2|AUTO)	Get display resolution
INIT	CONT			<0|1>	Start or stop continuous mode
	CONT?			(0|1)	Continuous measurements started?
	[IMM]				Store one measurement
	STOR			0<register<1025	Set memory register to be recalled
INST	CAT?			(options)	Get instrument options
*LOK				<0|1>	Lock device keypad
*LOK?				(0|1)	Lock device keypad query
MMEM	ACQ	DATA	RECA?	(±999.99)	Get data acquisition
	STOR	DATA	RECA?	(±999.99)	Get manually stored measurement
READ	[SCAL]	POW	DC?	(±999.99)	Get current value
SENS	CORR	COLL	ZERO *		Initiate null or zero measurement
		OFFS	[MAGN]	<±99.999> [DB]	Set offset value
			MAGN?	(±99.999)	Get current offset value
	MODE?			(POWER MODE| ORL MODE)	Get current measurement mode
	MODE	ORL			Set ORL mode
		PM			Set power meter mode
	ORL	REF			Initiate loopback reference
	POW	RANG	LOW?	(-99)	Get minimum ORL value

Table 6-5. LTS-3900 Command Tree (Part 1 of 2)

Command				Parameter/ Response	Description
		REF		<±99.99> [DBM]	Set reference value
		REF?		(+99.99) [DBM]	Get reference value
SENS	POW	REF	DISP *		Set new reference
			STAT *	<0|1>	Set absolute or relative
			STAT?	(0|1)	Get absolute or relative
		UNIT *		<WATT|DB| DBM|DWATT>	Set display unit
		UNIT?		(WATT|DB| DBM|DWATT)	Get current display unit
		WAVE *		<9999> [NM]	Set wavelength
		WAVE?		(9999) [NM]	Get wavelength
		WAVE	CATA?	list of wavelengths	Get list of calibrated wavelengths
SOUR	AM	[:INT]	FREQ	<value> [HZ| KHZ] | CW	Set source modulation
			FREQ?	(2 KHZ | CW | OFF)	Get source modulation
	POW	STAT		<0|1|ON|OFF>	Turn source on or off
		STAT?		(0|1)	Get source state
		WAVE		<UPP|LOW>	Set source wavelength
		WAVE?		(9999)	Get source wavelength
VFL	AM	[:INT]	FREQ	<1 HZ] | CW>	Set VFL modulation
			FREQ?	(1 HZ | CW | OFF)	Get VFL modulation
	STAT			<0|1|ON|OFF>	Turn VFL on or off
	STAT?			(0|1)	Get VFL state

Table 6-5. LTS-3900 Command Tree (Part 2 of 2)

* These commands are not executed if a data acquisition is in progress. The message “Acquisition already running” will then be returned.

6.8 Error Messages

System and device specific errors are managed by the LTS-3900. The generic format for error messages is illustrated in Figure 6-2.

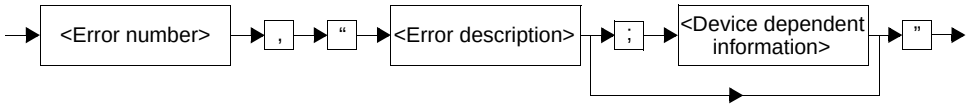


Figure 6-2. Error Message Format

As shown in the above figure, the message contains three parts: the error number, error description, and device dependent information. All error messages are stacked in a FIFO buffer. When there is at least one message in the buffer, bit 2 of the Status Byte Register is set to 1. Use the queries SYST:ERR?, ERR?, or LERR? to read the most recent message. The error message buffer is initialized when powering up the LTS-3900, when executing the command *CLS, or by reading the last message stored in the buffer.

Error Number	Description	Probable Cause
-100	“Command Error.”	An error occurred while validating a command.
-101	“Undefined Header.”	Unknown command.
-102	“Missing Parameter.”	A command parameter is missing.
-103	“Parameter not allowed.”	An extra parameter is present.
-104	“Data Type Error.”	Invalid parameter format.
-200	“Execution Error.”	An error occurred while executing a command.
-300	“No VFL Detected.”	The VFL option was not detected.

Table 6-6. Error Messages (Part 1 of 3)

Error Number	Description	Probable Cause
-300	“Nulling In Progress.”	A command has been sent while nulling is in progress.
-300	“No ORL Detected.”	The ORL option was not detected.
-300	“Invalid Offset.”	The requested offset is out of range.
-300	“Invalid Wavelength.”	The requested wavelength is not available.
-300	“Invalid Reference.”	The requested reference value is invalid.
-300	“No Active Source.”	The command SOUR:AM[:INT]:FREQ cannot be executed because the source is not active.
-300	“No Source Detected.”	The command SOUR:POW:STAT? cannot be executed because no source is detected.
-300	“Power Mode Not Active.”	The command SOUR:POW:STAT, SENS:POW:REF:DISP, or SENS:POW:UNIT cannot be executed because the power meter mode is not active.
-300	“ORL Mode Not Active.”	The command SENS:ORL:REF cannot be executed because the ORL mode is not active.
-300	“Too Many Commands To Process.”	The requested operation was aborted because there was not enough memory to store the command.

Table 6-6. Error Messages (Part 2 of 3)

Error Number	Description	Probable Cause
-300	“Connection Lost <-0.75 dB Warning.”	The command SENS:ORL:REF was completed successfully but the loss inserted by the test jumper is unexpectedly high. You should clean the connector ends or replace the test jumper and perform the loopback reference again.
-300	“ORL Calibration Warning.”	The command SENS:ORL:REF was completed successfully but the loss inserted by the test jumper is unexpectedly low. You should check your setup, perform the loopback reference again. If the problem persists, contact EXFO. There might be a calibration problem.
-300	“Invalid Source.”	The command SOUR:POW:WAVE received a wrong parameter.
-300	“Program Running.”	The command MMEM:ACQ:DATA:RECA cannot be executed because a program is running.
-400	“Output Buffer Full.”	Too many queries were performed without fetching their responses so the output buffer is full.
-400	“Query Error.”	An error occurred while accessing the output queue.
-500	“System Error.”	System is out of memory.

Table 6-6. Error Messages (Part 3 of 3)

This page intentionally left blank.

7 TECHNICAL SPECIFICATIONS

Specifications are subject to change without notice. All specifications are for a temperature of +73°F/+23°C with FC/PC connector unless otherwise specified.

7.1 Source Specifications

Option	-23BL	-BR23BL
Center wavelength (nm)	1310±30/ 1550±15	1310±30/ 1550±15
Spectral width (nm)	5 (FWHM)	5 (FWHM)
Output power (dBm)	-3.4/-5.2	-5.0/-6.8
Stability (10 hours) (dB)[a]	±0.10	±0.10

Table 7-1. Laser Source Specifications

a. After a warm-up time of 20 minutes.

Option	-12C	-12D	-23B	-12CFF	-12DFF
Center wavelength (nm)	850±25/ 1300±45	850±25/ 1300±60	1310±30/ 1550±15	850±30/ 1300±30	850±30/ 1300±30
Spectral width (nm)[a]	≤50/145 (FWHM)	≤50/145 (FWHM)	80 (FWHM)	≤50/145 (FWHM)	≤50/145 (FWHM)
Output power (dBm)	≥-18/-22	≥-15/-18	≥-25/-30	≥-22/-26	≥-19/-23
Stability (dB) (15 min)	±0.01	±0.01	–	±0.01	±0.01
Stability (dB) (10 hours)[b]	±0.05	±0.05	±0.10	±0.05	±0.05

Table 7-2. LED Source Specifications

a. FWHM = full width at half maximum
b. After a warm-up time of 20 minutes.

7.2 Power Meter Specifications

Model		LTS-3902	LTS-3902X	LTS-3903
Detector type		Ge	Ge High Power	InGaAs
Detector size (mm)		1	2	1
Measurement range (dBm)		+10 to -73	+25 to -62	+4 to -75
Spectral range (nm)		780 to 1625	780 to 1625	840 to 1650
Linearity (dB)[a]		±0.05	±0.05	±0.05
Accuracy (dB)		±0.2	±0.2	±0.2
Resolution (dB) vs. measuring range	0.01 dB	+10 to -53	+25 to -42	+4 to -55
	0.1 dB	-53 to -63	-42 to -52	-55 to -65
	1.0 dB	-63 to -73	-52 to -62	-65 to -75

Table 7-3. Optical Specifications

a. Linearity of the power meter varies as a function of the resolution.

7.3 Optical Return Loss Specifications

Option		-BR23BLC
Sensor type		Ge, GeX, InGaAs
Measurement range (dB)		65
Accuracy (dB)		0.4
Resolution (dB) vs. measuring range	0.01 dB	0 to -45
	0.1 dB	-45 to -55
	1.0 dB	-55 to -65

Table 7-4. ORL Specifications

7.4 General Specifications

Note: *The LTS-3900 is intended for indoor use only.*

Model	LTS-3900
Dimensions	Width: 8.75 in. / 21.8 cm Height: 4.575 in. / 11.1 cm Length: 11.25 in. / 28.5 cm
Operating temperature	32° to 104°F / 0° to 40°C
Storage temperature	-4° to 140°F / -20° to 60°C
Relative humidity	0 to 80%, non-condensing
Maximum operation altitude	6150 ft./2000 m
Pollution degree	2
Installation category	II
Power supply rating	100 to 240 V (50/60 Hz) maximum 2 A

Table 7-5. General Specifications

7.5 Visual Fault Locator Specifications

Model	LTS-3900
Wavelength	650±10 nm
Emitter type	Laser (Class II)
Max. power output (CW)	800 μW
Modulation	1 Hz
Stability (10 hours)[a]	±0.5 dB

Table 7-6. VFL Specifications

a. After a warm-up time of 20 minutes.

8 MAINTENANCE

There are no user-serviceable components in the LTS-3900, notwithstanding the routine maintenance described in this section. The LTS-3900 has been designed to require minimum maintenance and provide reliable operation for many years.

8.1 General Maintenance

To help ensure long, trouble-free operation

- Keep the LTS-3900 free of dust;
- Avoid liquid spills on or into the unit. If the unit gets wet, turn off the power immediately and let the unit dry completely;
- Clean the LTS-3900 casing with a cloth slightly damped with water.

8.2 Cleaning the Detector Port

Regular cleaning of the detector port helps maintain optimum performance. To clean the detector port, wipe it gently with a lint-free cloth moistened with isopropyl alcohol. Blow dry using compressed air.

IMPORTANT

To help keep the detector port clean, it is recommended that the protective cap be installed when the unit is not being used and that the fiber ends are always cleaned before connecting them to the detector port.

8.3 Cleaning the Output Port

Regular cleaning of the source and VFL output ports will help maintain optimum performance. The cleaning swabs supplied with EXFO test equipment are specially designed to clean inside the ports without having to disassemble the unit. No cleaning solution is required as the tips are used dry.

1. Take a swab from the package without touching the soft end.

2. Slowly insert the swab into the port until it reaches the ferrule inside (a slight clock-wise rotating movement may help).

3. Applying moderate pressure, turn the swab one full turn.

4. Continue to turn as you withdraw the swab.

5. Dispose of the used swab after 5 uses or as soon as it is visibly dirty.

IMPORTANT

To help keep the source port clean, it is recommended that the protective cap be installed when the unit is not being used and that the fiber ends are always cleaned before connecting them to the source port.

The cleaning swabs can also be used to clean adapters before inserting connectors.

Note: *Individual connectors still need to be cleaned according to standard cleaning methods.*

8.4 Recalibration

To ensure that the LTS-3900 remains within the published specifications and to maintain NIST traceability, EXFO recommends that an annual calibration be performed. Please contact EXFO for further information.

8.5 Fuse Replacement

The LTS-3900 contains two fuses of type IEC, 250 V, 2 A, fast blow 0.197 in. x 0.787 in./5 mm x 20 mm. The fuse holder is located at the back of the LTS-3900, just beside the power inlet.

This symbol, found at the back of the LTS-3900, indicates that the user should refer to the instruction manual for fuse replacement and information on the power rating.

To replace the fuses,

1. Unplug the power cord from the LTS-3900.
2. Pull the fuse holder out of the LTS-3900.

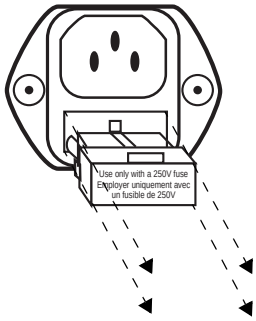


Figure 8-1. Pulling out the Fuse Holder

3. Check and replace the fuses if necessary.

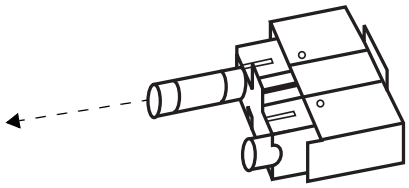


Figure 8-2. Replacing the Fuses

4. Make sure the fuses are firmly in the holder prior to reinsertion.
5. Firmly push the holder into place.

8.6 Software Upgrade

To upgrade the LTS-3900 embedded software using diskettes, you must connect your LTS-3900 to a computer through a null modem cable.

Note: *The software upgrade may be performed in DOS, Windows 3.1, or Windows 95. If problems occur, refer to the* ***readme file*** *on the diskette.*

IMPORTANT

When using a notebook computer to upgrade the LTS-3900 software, you should perform the upgrade in a DOS environment.

Proceed with the software upgrade only if the version indicated on the diskette is higher than the software version currently installed on your unit. To check the software version currently installed on your unit, simultaneously press and hold the up and right arrow keys.

To perform a software upgrade,

1. Turn off the LTS-3900.
2. Connect one end of a null modem cable to the LTS-3900 RS-232 serial port and the other end to an unused communication port on your computer (ex. COM2).
3. Insert the first upgrade diskette into the computer diskette drive.
4. Create a new directory on the computer hard drive, then copy the content of the diskette into the new directory.
5. Execute the file “lo0006.exe” to start the software upgrade.
6. Highlight the command *SELECT COM PORT*, and then press **ENTER**.
7. Select the COM port to which the null modem cable is connected on your computer and then press **ENTER**.
8. Highlight the command *PROGRAM DEVICE FLASH* and then press **ENTER**.

9. Once you see the message "*Waiting for device handshake*", turn on the LTS-3900. The LTS-3900 screen will remain off; the unit will beep once and programming will start automatically. A progress bar on the computer screen will indicate the status of the software upgrade.

   Once the software upgrade is complete, the message "*Reboot device for selftest*" will appear.

10. Turn the LTS-3900 off and then on again to use the upgraded software.

This page intentionally left blank.

9 WARRANTY

9.1 General Information

EXFO Electro-Optical Engineering, Inc. (EXFO) warrants this equipment against defects in material and workmanship for a period of two years from the date of original shipment. EXFO also warrants that this equipment will meet applicable specifications under normal use.

During the warranty period, EXFO will, at its discretion, repair, replace, or issue credit for any defective product. This warranty also covers recalibration during two years if the equipment is repaired or if the original calibration is erroneous.

IMPORTANT

The warranty can become null and void if

- ***the equipment has been tampered with, repaired, or worked upon by unauthorized individuals or non-EXFO personnel,***
- ***the warranty sticker has been removed,***
- ***case screws, other than those specified in this manual, have been removed,***
- ***the case has been opened, other than as explained in this manual,***
- ***the equipment serial number has been altered, erased, or removed,***
- ***the equipment has been misused, neglected, or damaged by accident.***

This warranty is in lieu of all other warranties expressed, implied or statutory, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. In no event shall EXFO be liable for special, incidental, or consequential damages.

9.2 Liability

EXFO shall not be liable for damages resulting from the use of the purchased product, nor shall be responsible for any failure in the performance of other items to which the purchased product is connected or the operation of any system of which the purchased product may be a part.

EXFO shall not be liable for damages resulting from improper usage or unauthorized modification of the product, its accompanying accessories and software.

9.3 Exclusions

EXFO reserves the right to make changes in the design or construction of any of its products at any time without incurring any obligation to make changes whatsoever on units purchased. Accessories, including but not limited to fuses, pilot lamps and batteries used with EXFO's products are not covered by this warranty.

9.4 Certification

EXFO certifies that this equipment met its published specifications at the time of shipment from the factory.

9.5 Service and Repairs

EXFO commits to providing product service and repair for five years after the date of purchase.

To obtain service or repair for any equipment, follow the procedure below:

1. Call EXFO Customer Service Group. Support personnel will determine if the equipment requires service, repair, or calibration.

2. If the equipment must be returned to EXFO or an authorized service center, support personnel will issue a Return Merchandise Authorization (RMA) and an address for return.

IMPORTANT

Never send any unit or accessory back to EXFO without a Return Merchandise Authorization (RMA).

3. If the unit has an internal storage device, do a backup of your data before sending the unit for repairs.

4. Pack the equipment in its original shipping material. Be sure to include a statement or report fully detailing the defect and the conditions under which it was observed.

5. Return the equipment, prepaid, to the address given by the support personnel. Be sure to write the RMA on the shipping slip. EXFO will refuse and return any package which does not bear an RMA.

Note: *A test setup fee will apply to any returned unit which, after test, is found to meet the applicable specifications.*

After repair, the equipment will be returned with a repair report. If the equipment is not under warranty, the customer will be invoiced for the cost appearing on this report. Return-to-customer shipping costs will be paid by EXFO for equipment under warranty. Shipping insurance is at the customer's expense.

This page intentionally left blank.

GLOSSARY

adapter	A device for coupling two connectors.
amplitude	The distance between high and low points of a waveform or signal.
ASCII	American Standard Code for Information Interchange. A system used to represent letters, numbers, symbols, and punctuation as bytes of binary signals.
attenuation	The diminution of average optical power. Attenuation results from absorption, scattering, and other radiation losses. Attenuation is generally expressed in dB without a negative sign.
attenuation coefficient	A factor expressing attenuation per unit length, expressed in dB/km.
attenuator	An optical device, either fixed or adjustable, that reduces the intensity of light propagating through it.
backscattering	That portion of scattered light that returns in a direction generally opposite to the direction of propagation.
baud rate	Measurement of data transmission speed, expressed in bits per second or bps.
Bellcore	Bell communications research, an organization that contains much of the former Bell labs. It specializes in telephone network technology, standards and interfaces.
BER	Bit error rate. On a transmission link, the number of digital “highs” that are interpreted as “lows”, and vice versa, divided by the total number of bits received. In modern networks, BERs much better than 10^{-9} are expected.
c	Velocity of light in a vacuum = 299 792 458 m/s
°C	Degree Celsius. To convert to Fahrenheit: $F = \frac{9}{5}C + 32$.
CFR	Code of Federal Regulations

connector	A junction that allows an optical fiber or cable to be repeatedly connected or disconnected to a device such as a source or detector.
coupler	A device whose purpose is to distribute optical power among two or more ports or to combine optical power from two or more fibers into a single port.
CW	Abbreviation for continuous wave. Refers to non-modulated, constant-intensity light.
dB	Decibel
dBm	Decibel referenced to a milliwatt.
DDE	Dynamic Data Exchange
decibel (dB)	The standard unit used to express gain or loss of optical power. A standard logarithmic unit for the ratio of two powers.
directivity	In a 3-port optical circulator, the ratio of power launched into port 1 that exits via port 2 vs. the fraction that exits via port 3.
DLL	Dynamic Link Library
DMA	Direct Memory Addressing
DUT	Device under test
dynamic range	For an optical instrument, generally defined as the ratio (in dB) of the smallest signal that can be observed (at a specified wavelength separation) in the presence of a strong, nearly saturating signal.
EDFFA	Erbium doped fluoride fiber amplifier
EDFSA	Erbium doped silica fiber amplifier
EIA	Electronics Industries Association
electromagnetic interference	Any electrical or electromagnetic interference that causes degradation, failure in electronic equipment, or undesirable response. Optical fibers neither emit nor are affected by EMI.

EMI	Electromagnetic interference
EOI	End of Image Marker
EOS	Effective Opening Size
ESB	Event Summary Bit
ESE	Standard Event Status Enable Register
ESR	Standard Event Status Register
f	Abbreviation for femto, which indicates 10^{-15} units.
f	Frequency, often also designated by ν.
FCC	Federal Communications Commission. A U.S. government body overseeing and regulating national electrical and radio communications. The FCC, formed in 1934, also deals with licences, tariffs, and limitations. The members of the commission are appointed by the U.S. president.
FIFO	First In First Out
frequency	The number of cycles per second, denoted by hertz (Hz).
G	Abbreviation for giga, which indicates 10^{9} units.
Ge	Germanium
GeX	High power germanium
GPIB	General Purpose Interface Bus
hr	Hour
Hz	Hertz. Denotes number of cycles per second.
IEC	International Electrotechnical Commission. A standardization body at the same level as ISO.
IEE	Institute of Electronic Engineering. It is a professional body covering all aspects of electronics and electrical engineering, including software, network, and computer engineering.

IEEE	Institute of Electrical and Electronics Engineering. It is a professional body very active, among other things, in many fiber-optic and opto-electronic related fields.
index matching material	A material, often a liquid or a cement, whose refractive index is nearly equal to the core index, used to reduce Fresnel reflections from a fiber's endface.
index of refraction	The ratio of the group velocity of light in a vacuum to the group velocity of light in a given medium.
InGaAs	Indium gallium arsenide.
ISA	Industry Standard Architecture
ISO	International Organization for Standardization. Commonly believed to stand for International Standards Organization. In fact, ISO is not an abbreviation—it is intended to signify uniformity (derived from the Greek *iso* meaning "equal"). ISO is responsible for many standards including those for data communications and computing.
ITU	International Telecommunications Union. The ruling body for telecommunications and the source of many network standards.
jumper	Fiber-optic cable that has connectors terminated on both ends. Used to connect two pieces of equipment, modules, or components.
LD	Laser diode
LED	Light emitting diode
loopback	Type of diagnostic test in which the transmitted signal is returned to the sending device after passing through a communications link or network.
M	Abbreviation for mega, 10^6 units.
m	Abbreviation for milli, 10^{-3} units.
min	Minute
n	Abbreviation for nano, 10^{-9} units.

n	Refractive index. For the silica glass used in optical fibers, $n \approx 1.465$.
NIST	National Institute of Standards and Technology. U.S. governmental body that provides the assistance in developing standards. It was formerly the National Bureau of Standards.
noise figure	A measure of the quality of an amplifier, defined as the ratio of output to input SNRs.
p	Abbreviation for pico, 10^{-12} units
P	Power
PCS	Plastic-clad silica (fiber)
RMA	Return merchandise authorization
s	Second
SCPI	Standard Commands for Programmable Instruments
sensitivity	For an optical instrument, the smallest signal that can be detected in the absence of any other signal.
Si	Silicon
SNR	Signal-to-noise ratio. The ratio of the received optical power, divided by the noise floor for the optical system.
SRE	Service Request Enable Register
SRQ	Service Request
STB	Status Byte Register
t	Time
T	Abbreviation for tera, 10^{12} units.
V	volt
VA	volt-ampere
W	watt

wavelength	For monochromatic light, the distance between two successive peaks (or troughs) of the sinusoidally-varying electric-field amplitude. Note that, unlike frequency, the wavelength of light is inversely proportional to the refractive index of the medium through which it propagates. It is for this reason that accurate wavelength measurements are generally specified as being determined in “air” or in “vacuum”.
λ	lambda. Greek letter used to denote wavelength.
μ	Abbreviation for micro, 10^{-6} units.
ν	nu. Greek letter used to denote frequency. Traditionally, the physics community uses “ν” to denote frequency whereas the engineering community uses “*f*”.

INDEX

A

C

D

E

F

G

I

L

M

N

O

P

R

S

T

U

V

W