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User's Guide

Pulsed Current Source
LDP-3840B



ILX Lightwave · 31950 Frontage Road · Bozeman, MT, U.S.A. 59715 · U.S. & Canada: 1-800-459-9459 · International Inquiries: 406-556-2481 · Fax 406-586-9405

www.newport.com/ilxlightwave

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TABLE OF CONTENTS

General Safety Considerations ix
Safety Marking Symbols x
Comments, Suggestions, and Problems xii

Chapter 1 Introduction and Specifications

Safety Considerations 1
Product Overview 2
Available Options and Accessories 2
Specifications[1] 3

Chapter 2 Configuration and Troubleshooting

Installation 5
AC Power Considerations 5
Rack Mounting 5
Power-Up Sequence 6
Introduction to the LDP-3840B Series Front Panel 7
General Functions 8
Instrument Modes 8
Current Source OUTPUT 8
Conditions Which Will Automatically Shut Off the LASER OUTPUT 9
GPIB Section 9
ADJUST Knob 9
MODE Section 9
Constant Duty Cycle (CONST %) Mode 10
Constant Pulse Repetition Interval (CONST PRI) Mode 10

External Trigger (TRIG) Mode 10
Output Polarity 10

DISPLAY Switch Section 11
PARAM Switch 11
I LIMIT 11
SAVE and RECALL Parameter Functions 11

Error Indicators 13

Back Panel Controls and Connections 13
OUTPUT Laser Connector 14
TRIGGER Connector 16
ANALOG OUTPUT Connector 16
GPIB Connector 16
KEYLOCK Switch 16
AC Power Entry Module and Fuse 16
Chassis Ground 17
Interlock (INTLK) connector 17

General Operating Procedures 18

Warm-Up and Environmental Considerations 18

Pulse Mode Operation 18

Chapter 3 Remote Operation

Changing Operation from Local to Remote 21

Preparation for Bus Control 22

ANSI/IEEE-488.2 Definitions 23

Syntax Diagrams 23

White Space 23

Power-on Conditions 24

<nrf value> 24

<PROGRAM MESSAGE TERMINATOR> 24

<PROGRAM MESSAGE UNIT SEPARATOR> 25

<PROGRAM HEADER SEPARATOR> 26

<COMPOUND COMMAND PROGRAM HEADER> 26
<PROGRAM DATA> (Parameters) 27
<ARBITRARY BLOCK PROGRAM DATA> 28

<PROGRAM DATA SEPARATORS> 28
Default Parameters 29

Getting Started with GPIB 30
Overview of the LDP-3840B Series Pulsed Current Source Syntax 30
Using Commands with Parameters 31
Common Commands and Queries 32
*CAL? 32
*CLS 32
*DLF 33
*ESE 33
*ESE? 35
*ESR? 35
*IDN? 36
*OPC 36
*OPC? 37
*PSC 37
*PSC? 38
*RCL 38
*RST 39
*SAV 40
*SRE 41
*SRE? 42
*STB? 42
*TST? 43
*WAI 43
Advanced Programming 44
Path Specification 44
Error Messages 45
Status Reporting 46
Event and Condition Registers 46
Operation Complete Definition 48
Command Timing and Completion 48
Output Off Registers 49
Input Buffer and Output Data 51

Remote Interface Messages 52
Interface Function Subsets 52
LDP-3840B Series Remote Messages 53
Non-Supported Remote Interface Messages 53

Chapter 4 Command Reference

Overview of the LDP-3840B Pulsed Current Source Command Set 56
Substitute Parameter Names 56
Compound Command Structure 57
Common Commands 57
GPIB Commands 58
Device Dependent Commands 60
Command Paths 61
LDP-3840B Device-Command Reference 62
Error Messages 97

Chapter 5 Maintenance

Calibration Overview 100
Recommended Equipment 100
Local Calibration 101
Remote Calibration 102
Fuse Replacement 103
Line Voltage Selection 104

Appendix A Troubleshooting

Appendix B Error Messages

Appendix C Quick Start Guide

Introduction 113
Setup 113
Initialize Test Mode Parameters 113

Connect the Laser 114

Adjust the Output Amplitude 114

Turn the Output On 114
More Information 115

LIST OF FIGURES

Figure 2.1 LDP-3840B Series Front Panel 7
Figure 2.2 LDP-3840B Rear Panel 14
Figure 2.3 CC-380 Interconnect Cable Pinout 15
Figure 2.4 LPB-380 Laser Mounting Board 15
Figure 3.1 White Space Syntactic Diagram 24
Figure 3.2 <PROGRAM MESSAGE TERMINATOR> Syntax Diagram 25
Figure 3.3 <PROGRAM MESSAGE UNIT SEPARATOR> Syntax Diagram 25
Figure 3.4 <PROGRAM HEADER SEPARATOR> Syntax Diagram 26
Figure 3.5 <compound command program header> Syntax Diagram 26
Figure 3.6 <compound query program header> Syntax Diagram . . 27
Figure 3.7 <ARBITRARY BLOCK PROGRAM DATA> Syntax Diagram 28
Figure 3.8 <PROGRAM DATA SEPARATOR> Syntax Diagram . . . 29
Figure 3.9 Standard Event Status Register/Standard Event Status Enable Register 34

Figure 3.10 Service Request Enable Register 41
Figure 3.11 LDP-3840B Status Reporting Schematic Diagram 47
Figure 3.12 LDP-3840B LASER Output Off Register 50
Figure 4.1 Command Description Format 60
Figure 4.2 Command Path Structure 61

SAFETY AND WARRANTY INFORMATION

The Safety and Warranty Information section provides details about cautionary symbols used in the manual, safety markings used on the instrument, and information about the Warranty including Customer Service contact information.

Throughout this manual, you will see the words *Caution* and *Warning* indicating potentially dangerous or hazardous situations which, if not avoided, could result in death, serious or minor injury, or damage to the product. Specifically:



Caution indicates a potentially hazardous situation which can result in minor or moderate injury or damage to the product or equipment.



Warning indicates a potentially dangerous situation which can result in serious injury or death.



Visible and/or invisible laser radiation. Avoid direct exposure to the beam.

General Safety Considerations

If any of the following conditions exist, or are even suspected, do not use the instrument until safe operation can be verified by trained service personnel:

- Visible damage
- Severe transport stress
- Prolonged storage under adverse conditions
- Failure to perform intended measurements or functions

If necessary, return the instrument to ILX Lightwave, or authorized local ILX Lightwave distributor, for service or repair to ensure that safety features are maintained (see the contact information on page xii).

All instruments returned to ILX Lightwave are required to have a Return Authorization Number assigned by an official representative of ILX Lightwave Corporation. See Returning an Instrument on page xi for more information.

SAFETY SYMBOLS

This section describes the safety symbols and classifications. Technical specifications including electrical ratings and weight are included within the manual. See the Table of Contents to locate the specifications and other product information. The following classifications are standard across all ILX Lightwave products:

- Indoor use only
- Ordinary Protection: This product is NOT protected against the harmful ingress of moisture.
- Class I Equipment (grounded type)
- Mains supply voltage fluctuations are not to exceed ±10% of the nominal supply voltage.
- Pollution Degree 2
- Installation (overvoltage) Category II for transient overvoltages
- Maximum Relative Humidity: <80% RH, non-condensing
- Operating temperature range of 0 °C to 40 °C; Storage and transportation temperature of –40 °C to 70 °C
- Maximum altitude: 3000 m (9843 ft.)
- This equipment is suitable for continuous operation.

Safety Marking Symbols

This section provides a description of the safety marking symbols that appear on the instrument. These symbols provide information about potentially dangerous situations which can result in death, injury, or damage to the instrument and other components.

 Caution, refer to manual	 Earth ground Terminal	 Alternating current	 Visible and/or invisible laser radiation
 Caution, risk of electric shock	 Protective Conductor Terminal	 Caution, hot surface	 Frame or chassis Terminal
 or (I) On: In position of a bistable push control. The slash (I) only denotes that mains are on.		 or (O) Off: Out position of a bistable push control. The circle (O) only denotes that mains are off.	

WARRANTY

ILX LIGHTWAVE CORPORATION warrants this instrument to be free from defects in material and workmanship for a period of one year from date of shipment. During the warranty period, ILX will repair or replace the unit, at our option, without charge.

Limitations

This warranty does not apply to fuses, lamps, defects caused by abuse, modifications, or to use of the product for which it was not intended**.**

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for any particular purpose. ILX Lightwave Corporation shall not be liable for any incidental, special, or consequential damages**.**

If a problem occurs, please contact ILX Lightwave Corporation with the instrument's serial number, and thoroughly describe the nature of the problem.

Returning an Instrument

If an instrument is to be shipped to ILX Lightwave for repair or service, be sure to:

1. Obtain a Return Authorization number (RA) from ILX Customer Service.
2. Attach a tag to the instrument identifying the owner and indicating the required service or repair. Include the instrument serial number from the rear panel of the instrument.
3. Attach the anti-static protective caps that were shipped with the instrument and place the instrument in a protective anti-static bag.
4. Place the instrument in the original packing container with at least 3 inches (7.5 cm) of compressible packaging material. **Shipping damage is not covered by this warranty.**
5. Secure the packing box with fiber reinforced strapping tape or metal bands.
6. Send the instrument, transportation pre-paid, to ILX Lightwave. Clearly write the return authorization number on the outside of the box and on the shipping paperwork. ILX Lightwave recommends you insure the shipment.

If the original shipping container is not available, place your instrument in a container with at least 3 inches (7.5 cm) of compressible packaging material on all sides.

Repairs are made and the instrument returned transportation pre-paid. Repairs are warranted for the remainder of the original warranty or for 90 days, whichever is greater.

Claims for Shipping Damage

When you receive the instrument, inspect it immediately for any damage or shortages on the packing list. If the instrument is damaged, file a claim with the carrier. The factory will supply you with a quotation for estimated costs of repair. You must negotiate and settle with the carrier for the amount of damage.

Comments, Suggestions, and Problems

To ensure that you get the most out of your ILX Lightwave product, we ask that you direct any product operation or service related questions or comments to ILX Lightwave Customer Support. You may contact us in whatever way is most convenient.

In the United States:

Phone . . . . . (800) 459-9459 or (406) 586-1244

Fax . . . . . (406) 586-9405

Online: . . . . . http://ilx.custhelp.com

Email: . . . . . support@ilxlightwave.com

Or mail to:

ILX Lightwave Corporation
P. O. Box 6310
Bozeman, Montana, U.S.A 59771
www.ilxlightwave.com

In Europe:

Optical Test and Calibration Ltd.
Listerhills Science Park
Bradford, BD7 1HR United Kingdom
Phone: (44) 1274 393857
Fax: (44) 1274 393336
Online: www.otc.co.uk
Email: sales@otc.co.uk

In Japan:

Kyosai Technos
424, Shimo-Ongata-Machi
Hachioji-Shi
Tokyo, 192-0154 Japan
Phone: (81) 426 521 388
Fax: (81) 426 513 270

In China:

ETSC Technologies Co.
9/F Building 1
SBI Street
Dongxin Road
East Lake High-Tech Development Zone
Wuhan, Hubei, 430074 PRC China
Phone: (86) 27 8717 0152; (86) 27 8741 2681; (86) 27 8780 7925
Fax: (86) 27 8780 7133
Online: www.etsc-tech.com
Email: sales@etsc-tech.com

In China:

Kyosai Technos
3F Bldg G, No.21 Changjiang Road, Wuxi
National Hi-Tech Development Zone
Jiangsu, P.R. China
Phone: (86) 510 522 1707
Fax: (86) 510 522 1679
Email: ilx-service-china@kyosaitec.co.jp

When you contact us, please have the following information:

Model Number: _____

Serial Number: _____

End-user Name: _____

Company: _____

Phone: _____

Fax: _____

Description of what is connected to the ILX Lightwave instrument: _____

Description of the problem: _____

If ILX Lightwave determines that a return to the factory is necessary, you are issued a Return Authorization (RA) number. Please mark this number on the outside of the shipping box.

You or your shipping service are responsible for any shipping damage when returning the instrument to ILX Lightwave; ILX recommends you insure the shipment. If the original shipping container is not available, place your instrument in a container with at least 3 inches (7.5 cm) of compressible packaging material on all sides.

We look forward to serving you even better in the future!

CHAPTER 1

INTRODUCTION AND SPECIFICATIONS

This manual contains operation and maintenance information for the LDP-3840B Laser Diode Precision Pulsed Current Source. If you want to get started right away, read Appendix C, Quick Start, first. Chapter 2 has a section for quick familiarization of the LDP-3840B front panel and also provides an in-depth operation reference.

Safety Considerations



WARNING

The high brightness and invisible light output of laser diodes and other laser sources poses a definite eye hazard. Direct viewing of the laser output can produce retinal or corneal damage. Absorption of the laser light by the eye causes localized heating and denaturing of tissue proteins.



WARNING

If any of the following symptoms exist, or are even suspected, remove the LDP-3840B from service. Do not use the LDP-3840B until safe operation can be verified by trained service personnel.

Visible damage

Severe transport stress

Prolonged storage under adverse conditions

Failure to perform intended measurements or functions

If necessary, return the instrument to ILX Lightwave for service and repair to ensure that safety features are maintained.

Product Overview

The LDP-3840B is a microprocessor controlled pulsed current source designed specifically for pulse testing laser diodes. It provides accurate, clean pulses up to 3A at laser diode load levels with fast rise times of <50 nS and low overshoot (<5%). Pulse parameters such as pulse width, duty cycle, and frequency are programmable from the front panel or through the GPIB/IEEE interface. The current source can be operated in two modes, constant duty cycle and constant frequency allowing adjustment of the pulse width while maintaining either respective control mode. Laser diode protection features include programmable current limit, output shorting circuits, AC line filters and double shielded transformers to help suppress AC line transients. Testing and characterization can be automated with the 3840B through the GPIB/IEEE-488 interface. For basic system integration without a command program, a trigger can be used to control pulses and initiate corresponding measurements. An analog output proportional to the current set point is available through a BNC connector on the rear panel.

Available Options and Accessories

Options and accessories available for the LDP-3840B Series Current Sources include the following:

Model Number	Description
LDP-3840B	3A Precision Pulsed LD Current Source
----------	GPIB/IEEE-488 Interface (Standard)
CC-380	3840 Output Cable, 3Ω Strip-Line Cable
LPB-380	Laser Diode Mounting Board
LPC-388	Current/Voltage Monitor Cable
RM-134	Single Rack Mounting Kit
RM-135	Dual Rack Mounting Kit

Table 1.1 LDP-3840B Series Options

Specifications[1]

Specification	Description
Pulse Amplitude	
Output Current Range:	0 to 3000 mA
Set Point Resolution:	1000 uA
Set Point Accuracy (% of FS)[2]:	± 2.5%
Compliance Voltage:	10 V maximum
Overshoot:	<5%
Noise and Ripple (uA rms):	500 uA
Pulse Parameters	
Pulse Width	
Range:	100 ns to 10 ms
Resolution:	100 ns
Accuracy:	-35 to 10 ns; ±0.01% of set point
Rise/Fall Time[3]:	≤ 50 ns
Polarity[4]:	Positive or Negative
Pulse Repetition Interval	
Range	
Internal:	1 us to 100 ms
External:	1 us to single shot
Resolution:	1 us
Accuracy:	20 ns ± 0.01%
Duty Cycle:	10% maximum
Trigger Output	
Type:	TTL
Connector:	BNC
Jitter:	± 5 ns
Delay:	100 ns ± 10ns
Trigger Input	
Type:	TTL
Connector:	BNC
Jitter:	± 100 ns
Delay:	290 nS ±20 nS

Specification	Description
Analog Output	
Transfer Function	3.3 V/A, 10V full scale
Connector	BNC
General	
Chassis Ground	4mm banana jack
Power Requirements	100-120/220-240 V~ 1/1A 50/60 Hz
Size	88mm x 185mm x 304mm (3.5” x 7.3” x 12”)
Weight	3.6 kg (8 lbs)
Operating Temperature	10°C to 40 °C
Storage Temperature	-40 °C to 70 °C
Humidity	<85% relative
Laser Safety	Interlock, keyswitch, output delay CDRH vs. 21 CFR 1040.10

1. All specifications measures @ 25°C after a one-hour period with an ILX LPB mounting board, unless otherwise specified. Pulse parameter measured at current levels >300 mA.
2. Accuracy measurements from 10% to full scale output.
3. Measured from 10% to 90% points at half scale output with the typical being 25 ns.
4. Polarity selected via front panel switch.

CHAPTER 2

CONFIGURATION AND TROUBLESHOOTING

This chapter describes how to install, adjust and operate the LDP-3840B. It is divided into five sections covering installation, familiarization and adjustment of the LDP-3840B, warm-up and environmental considerations, and normal operating procedures.

Installation

AC Power Considerations

The LDP-3840B can be configured to operate at nominal line voltages of 100 - 120 VAC or 220 - 240 VAC at 50/60/Hz. Normally, this is done at the factory and need not be changed before operating the instrument. However, check to be sure that the voltage printed on the back panel of the instrument matches the power line voltage in your area.



WARNING

To avoid electrical shock hazard, connect the instrument to properly earth-grounded, 3-prong receptacles only. Failure to observe this precaution can result in severe injury or death.

Rack Mounting

The LDP-3840B Precision Pulsed Current Source may be rack mounted in a single or dual configuration by installing the appropriate rack mount flange on either side of the enclosure. All rack mount accessory kits contain detailed mounting instructions. Refer to Chapter 1 for applicable rack mount accessory part numbers.

Power-Up Sequence

With the LDP-3840B connected to an AC power source, pressing the POWER switch will supply power to the instrument and start the power-up sequence.

During the power-up sequence, the following takes place. For about 3 seconds a lamp test is conducted. During the lamp test all indicators light up, and all of the 7-segment displays indicate "8".

Then, a self-test is performed to ensure that the LDP-3840B's hardware and firmware are communicating. If the LDP-3840B cannot successfully complete this test, an error message of E720 - E975 will be displayed. Contact Customer Service if any of these errors are displayed.

After this test, the LDP-3840B will display its firmware version number for three more seconds. This completes the power up sequence. The LDP-3840B is configured to the state it was in when the power was last shut off.

The user may choose to "clear" the instrument configuration by recalling "BIN 0" either manually (see Chapter 2) or through the GPIB (see Chapter 3). When "BIN 0" is called, the instrument will be in the following state:

Instrument in LOCAL mode
I LIMIT = 750 mA
OUTPUT off
MODE = CONST % (Constant Duty Cycle)
Pulse Width (PW) = 0.1 uSec
Pulse Repetition Interval (PRI) = 0.001 mSec
Duty Cycle = 0.01%
Display showing Current Set Point, I
Set Point = 0 mA
Polarity = P (Positive)

Table 2.1 LDP-3840B Series Default Settings

Introduction to the LDP-3840B Series Front Panel

The LDP-3840B front panel contains displays and controls for the current source output. Each of the labeled areas on the front panel (i.e. TRIGGER, GPIB, MODE, or OUTPUT), and the display and adjustment sections of the front panel, is described in a separate subsection in this chapter.

Note: The following section gives a quick introduction to the front panel functions by briefly describing the switches and indicators.

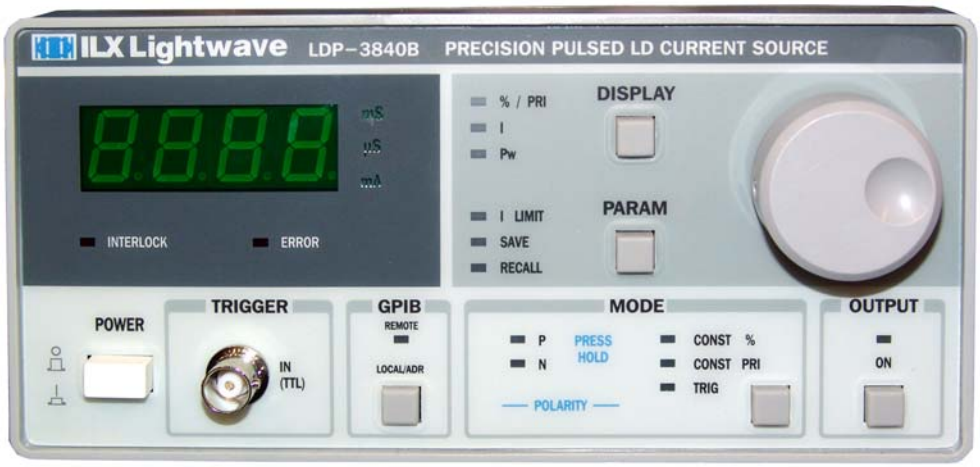


Figure 2.1 LDP-3840B Series Front Panel

General Functions

The **POWER switch** is used to power the LDP-3840B.

The **GPIB section** is used for changing instrument control to remote operation from local and back to local from remote. It is also used to display the GPIB address of the instrument.

The **ADJUST knob** is used for entering pulse parameter values such as set point, pulse width and frequency. It is also used to enter calibration values.

The **DISPLAY** switch selects pulse parameters displayed on the LED display.

The **PARAM** switch selects and allows adjustment of current limit and save or recall BIN numbers.

The **MODE section** is used to select the instrument's control mode, **CONST %**, **CONST PRI**, and **TRIG** and the output current **POLARITY**.

The **OUTPUT** switch enables/disables the current source output to the laser.

Instrument Modes

When the **MODE SELECT** switch is pressed the instrument will toggle between **CONST %** (duty cycle) mode, **CONST PRI** (pulse repetition interval) mode, and **TRIG** (input trigger) mode. When the **MODE SELECT** switch is held in for 3 seconds, the instrument will change output pulse polarity from positive to negative, or negative to positive.

Current Source OUTPUT

When the **(OUTPUT) ON** switch is pressed, and the indicator is lit, the laser drive current will be enabled. After a delay of 2 seconds, the output on sequence starts with a 2 second slow start ramp during which the OUTPUT current will be driven to the set point value. During the 2 second delay, and whenever the OUTPUT is on (indicator lit), the I (drive current) display shows the set point value only. If the POLARITY MODE of the LDP-3840B is changed with the output on, the output will be disabled.

When the OUTPUT is off, the I (drive current) display shows 0 mA until the ADJUST knob is turned. When the ADJUST knob is turned the I display shows the set point current. The set point will remain on the display for three seconds after the ADJUST knob is released.

Conditions Which Will Automatically Shut Off the LASER OUTPUT

- Interlock Open (rear panel input jack should be shorted)
- KEYLOCK switch in "disabled" position (turned to the left when facing the rear of the instrument)
- Line Voltage drop-out (E533)
- Change of MODE (includes polarity)
- RECALL of a pre-configured state
- Laser Drive Current Source Failure (E529)
- Loosening and/or removal of the output cable

GPIB Section

The GPIB section is located next to the POWER switch at the left side of the LDP-3840B front panel (see Figure 2.1), and designated by "**GPIB.**"

The GPIB section contains the LOCAL/ADR switch and the REMOTE indicator. The functions of the indicator and switch are related to GPIB operations, as described below.

The **LOCAL/ADR switch** is used for several functions. When the LDP-3840B is in REMOTE mode, pressing the LOCAL switch returns the instrument to LOCAL control mode unless a Local Lockout state has been activated by the low level GPIB command LLO from the host computer. Local Lockout disables all LDP-3840B front panel switches until this condition is changed by the host computer.) When the unit is in LOCAL mode, pressing the LOCAL/ADR switch causes the GPIB address to be displayed, e.g. "-01-", and the GPIB address may be changed by turning the ADJUST knob while viewing the GPIB address. The usable GPIB address range is 0 - 30.

The **REMOTE indicator** is lit when the LDP-3840B is in GPIB remote mode. When the instrument is put in Local Lockout Mode by the host computer, the REMOTE indicator will flash at a 1 Hz rate.

ADJUST Knob

The ADJUST knob is located on the upper right side of the LDP-3840B front panel. It is used to change the set points, enter parameter values, enter the GPIB address, enter Save or Recall bin number, or enter instrument calibration data.

MODE Section

The **MODE switch** is used to select one of three available instrument operating modes, Constant Duty Cycle (CONST %), Constant Pulse Repetition Interval (CONST PRI), or External Trigger (TRIG). When a mode is selected, the

corresponding LED is illuminated. If the output is on and the MODE switch is pressed, the OUTPUT will be disabled.

Constant Duty Cycle (CONST %) Mode

During operation in Constant Duty Cycle (CONST %) mode, the instrument maintains a constant duty cycle for a set pulse width. The pulse repetition interval will automatically be adjusted to create the desired Duty Cycle, independent of the PRI setting. In CONST % mode, with the %/PRI indicator illuminated (display section), the display is indicating duty cycle percentage.

The duty cycle, pulse width and pulse repetition interval have the following relationship:

DC = (PW / PRI) * 100

where:

DC is Duty Cycle in percent

PW is Pulse Width in uS

PRI is Pulse Repetition Interval in uS

Constant Pulse Repetition Interval (CONST PRI) Mode

During operation in constant pulse repetition interval (PRI) mode, the instrument maintains a constant pulse repetition interval (on/off time in mS) for a set pulse width. The duty cycle will automatically be adjusted to create the desired Pulse Repetition Interval. In CONST PRI mode, with the %/PRI indicator illuminated, the display is indicating pulse period in mS.

External Trigger (TRIG) Mode

During operation in External Trigger mode, with an externally supplied trigger, only the Pulse Width may be adjusted. The % / PRI display mode is disabled in TRIG mode. Instead, the repetition interval is determined by the rate of the TTL signal at the TRIGGER IN connector. To maintain optimum instrument performance, the duty cycle should not exceed 10%.

Output Polarity

The output current **POLARITY** is indicated by illumination of the **P** (positive) or **N** (negative) indicator. To switch polarity, press and hold in the **MODE switch** for three seconds. The POLARITY indicators will then change to indicate the new output polarity. After switching the polarity, the 3840B will not allow you to switch the output on for 4 seconds.

The output trigger pulse width is the same as the Pulse Width (PW) value.

DISPLAY Switch Section

The DISPLAY switch is used to select the display mode to indicate the laser drive current (I), pulse width (PW), pulse repetition interval (PRI), or duty cycle percent (%).

Pressing the **DISPLAY switch** repeatedly causes the display to toggle between the valid display modes for the present operating mode (CONST %, CONST PRI, TRIG). For example, in TRIG mode, the display will toggle between I and PW only (since duty cycle or PRI are set by the external trigger). In CONST % mode the display toggles between current (I), the duty cycle (%), and the pulse width (Pw). In CONST PRI mode the display toggles between current (I), pulse repetition interval (PRI), and the pulse width (Pw).

PARAM Switch

The **PARAM switch** is used to select the laser drive current limit (I LIMIT), SAVE and RECALL bin parameters. When these parameters are selected, their present value will be displayed on the LED display. The selected parameter may be adjusted by turning the ADJUST knob within three seconds of selecting a parameter. If a parameter is selected unintentionally, press the DISPLAY switch to abort adjusting that parameter or press the PARAM switch again until the desired parameter is selected.

I LIMIT

The I LIMIT parameter is used to set the maximum allowable output current. The current limit cannot be exceeded when adjusting the output current.

During operation, when the current limit is reached, the **I LIMIT indicator** will flash.

In remote mode through the GPIB interface, a current limit condition may be used to turn the laser drive current output off via the ENABle:OUTOFF command.

SAVE and RECALL Parameter Functions

The SAVE and RECALL parameter functions are used to store and retrieve instrument configurations.

Non-volatile memory is used for saving the instrument parameters. When a save operation is performed, all of the instrument parameters currently in effect are stored to a "bin" number (1 - 10). When that "bin" number is recalled, the instrument configuration is recalled to the stored values.

To enter the SAVE/RECALL mode, first press the **PARAM switch** until the SAVE or RECALL parameter is selected; the LDP-3840B displays the SAVE or RECALL "bin" number. To adjust the "bin" number, turn the ADJUST knob. Wait three seconds. After three seconds, the "save" or "recall" operation is performed. If the

PARAM switch is pressed again before the three seconds are up, the SAVE or RECALL operation will not be performed and the display will toggle to the next parameter.

The **SAVE indicator** becomes lit when the LDP-3840B is displaying a save bin number. The "bin" number is displayed as a number in the range 1 - 10. "Bin" 0 holds the default parameters.

The **RECALL indicator** becomes lit when the LDP-3840B is displaying a recall "bin" number. The "bin" number is displayed as a number in the range 0 - 10. "Bin" 0 is reserved for the default parameters.

Error Indicators

There are two error indicators on the front panel, one labeled INTERLOCK, the other labeled ERROR. The INTERLOCK indicator is illuminated whenever the interlock is open or the ENABLE keyswitch is in the disable position. The ERROR indicator will be illuminated under all other error conditions.

Error Condition	Action
Interlock Open/ Keyswitch in Disable Position	Output off, INTERLOCK light comes on, E501 is displayed for three seconds
Current Limit	I LIMIT light flashes at 1 Hz
Line Voltage drop-out, low line voltage, transient induced drop-out	ERROR light comes on, E533 is displayed for three seconds
Internal Hardware Error including Pulse Module Error	ERROR light comes on, E529 is displayed for three seconds

Table 2.2 LASER Error Indicators

Back Panel Controls and Connections

Refer to Figure 2.2 for the following discussions of back panel controls and connectors.

The rear panel of the LDP-3840B consists of connectors for power input, analog and trigger outputs, Laser Enable Keyswitch, GPIB cables, pulse output, system interlock, and chassis ground. Also, indication as to the power configuration and fuse requirements are printed in the text box adjacent to the fuse.

When connecting laser diodes and other sensitive devices to the LDP-3840B, we recommend that the instrument be powered-up and the OUTPUT be off. In this condition, a low impedance shunt is active across the output terminals. When disconnecting devices, it is only necessary to turn the OUTPUT off.

Note: The interlock plug (supplied with shipping kit) must be configured or shorted and the keyswitch must be in the enable position (to the right when facing the rear panel) in order to turn the OUTPUT on.



Figure 2.2 LDP-3840B Rear Panel

OUTPUT Laser Connector

The DB-15 pin connector at the center of the rear panel serves as the laser current output connector (labeled OUTPUT). For optimum pulse performance, we recommend the use of the 3Ω strip line cable and the laser mounting board supplied with the instrument. The laser mounting board can be configured for either cathode or anode grounded laser diodes and is factory configured for positive pulse operation (cathode grounded device). In order to configure the board for negative (anode grounded) laser diodes, zero ohm jumpers are loaded on both the top and bottom side of the board as follows:

Case Negative (anode grounded): R20, R23, R26, and R27

Case Positive (cathode grounded): R18, R19, R22, and R24

The pads are best suited for an 0805 surface mount package, although a jumper wire can be substituted.

OUTPUT Cable Pintout

The pinout of the ILX supplied CC-380 cable is as shown in Figure 2.3. Both sides of the cable are terminated with a DB-15 connector with pins 1-8 wired to the anode output and pins 9-15 wired to the cathode output.

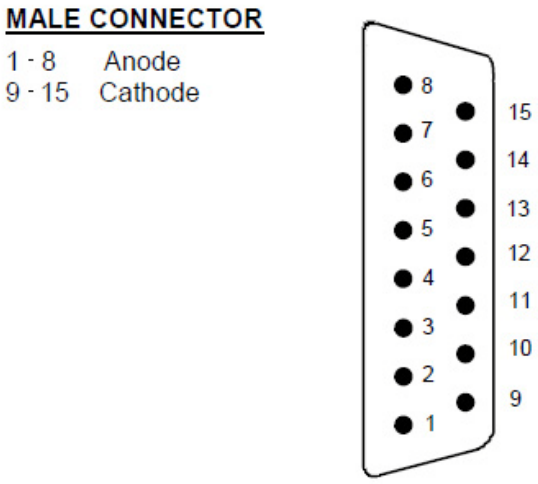


Figure 2.3 CC-380 Interconnect Cable Pinout

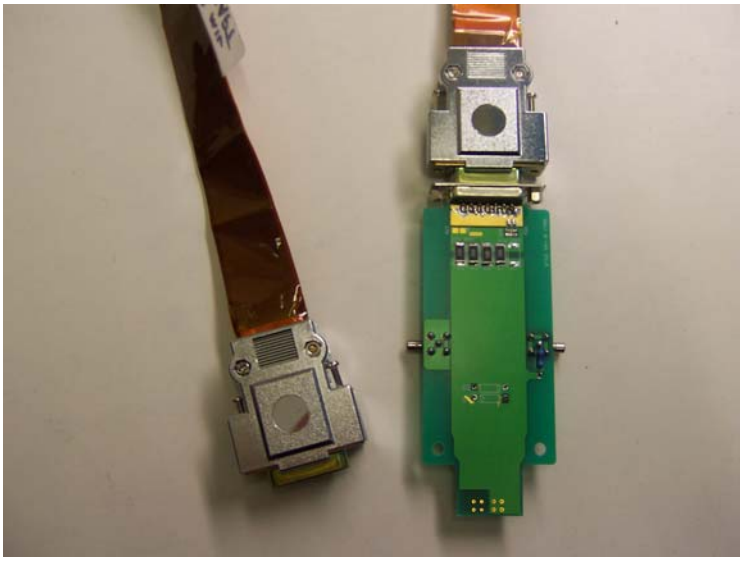


Figure 2.4 LPB-380 Laser Mounting Board

LPB-380 Laser Mounting Board

The ILX supplied laser mounting board is highly recommended as they are designed to allow load impedance matching for the best pulse performance at the laser diode. The boards have additional space for soldering load matching resistors. Refer to Technical Note TN3840B-2 for tuning the load for optimum pulse response. If the supplied laser mounting board is not used, the pulse performance of the 3840B is not guaranteed.

The laser mounting boards also provide SMB connectors for connecting an oscilloscope or DMM to monitor laser diode forward voltage or actual current. The boards are supplied with 50Ω terminators which should be left in place when an oscilloscope or DMM is not connected. If an oscilloscope or meter are connected to the board, they should be connected in place of the 50Ω terminators.

Note: The input impedance of the oscilloscope or meter should also be matched to 50Ω for the most accurate measurements.

TRIGGER Connector

The **TRIGGER OUT** connector is a standard BNC type and it is located on the bottom left side of the rear panel (when facing the rear of the instrument). The trigger OUT has the same pulse width and repetition interval as the OUTPUT pulse, but at TTL level. This signal is available whenever the output of the LDP-3840B is on and when any of the three Pulse modes of operation (CONST %, CONST PRI, TRIG) are selected.

ANALOG OUTPUT Connector

An analog output signal is available at the ANALOG OUTPUT connector which is a standard BNC. This signal voltage is between 0 - 10 volts and is proportional to the output current set point with a nominal transfer function of 3.3 V/A.

GPIB Connector

An IEEE 488 GPIB connector is standard on the LDP-3840B. It is located to the right of center on the back panel.

KEYLOCK Switch

A **KEYLOCK switch** is located at the upper left of the rear panel, and labeled **ENABLE**. To enable the current source drive circuits, the keyswitch must be in the ON position. If the keyswitch is in the OFF position, the current source output will not operate if the front panel output push button is pressed.

AC Power Entry Module and Fuse

The AC Power Entry Module with fuse are located at the right side of the LDP-3840B's rear panel. The LDP-3840B must be connected to a properly rated AC source in order to operate. A three prong power cord is supplied with each instrument. The fuse should only be replaced with the same value fuse, as indicated on the LDP-3840B's rear panel.

Chassis Ground

For convenience, a chassis ground post connector is located on the rear panel, just below the OUTPUT connector.

Interlock (INTLK) connector

CDRH standards require an system interlock on laser power supplies. The output of the LDP-3840B is disabled until it senses the interlock input shorted. This can be accomplished by a system short where a switch provides the short or by directly shorting the plug. An Interlock shorting plug is supplied in the shipping kit.

General Operating Procedures

The following sections present some guidelines for operation, as well as some common operating procedures. Remote operations are discussed in Chapter 4.

Before turning on the laser drive current OUTPUT, be sure that the current limit (LIM), is slightly greater than your laser's maximum operating current. Also, adjust the output current set point to a safe and reasonable level.

The cable connections to the laser must be secure enough that they won't open-circuit, should they be jostled or bumped. Should an open circuit occur during laser operation, the OUTPUT will be turned off automatically.

Experience indicates that should an open circuit occur during laser operation (while the OUTPUT is ON), the laser may be damaged by a momentary circuit break-and-remake before the final circuit break. Therefore, secure cabling is very important.

Warm-Up and Environmental Considerations

Operate the LDP-3840B at an ambient temperature in the range of 10 to +40 °C. Storage temperatures should be in the range of -40 to +70 °C. To achieve rated accuracy, let the LDP-3840B warm up for at least 1 hour before use.

Pulse Mode Operation

You can operate the LDP-3840B in several modes, Constant Duty Cycle (CONST%), Constant Pulse Repetition Interval (CONST PRI), or External Trigger (TRIG) mode.

For instrument pulse mode operation in any control mode, follow the steps below.

- Plug the LDP-3840B into an AC power source supplying the correct voltage for the instrument (refer to the back panel for the correct ratings).
- Turn the back panel KEYLOCK switch to the ENABLE position (to the right). Turn on the LDP-3840B power by pressing the front panel POWER switch.
  - The OUTPUT stage will be off at power-up and the instrument will be configured to the state it was in when the power was last shut off.
- Press the PARAM switch until I LIM is illuminated. Adjust the limit by turning the adjust knob.
  - If a pre-configured setup is to be recalled, use the RECALL feature and then recheck the configuration parameters.
- Connect the laser (or other output device) to the instrument.
  - Press the DISPLAY switch until the "I" indicator is illuminated. Turn the ADJUST knob until the desired setpoint is displayed.
- Select the mode by pressing the MODE switch until the desired mode indicator is illuminated.

- Check the output current polarity by observing the POLARITY indicators. If the polarity needs to be changed, press and hold in the MODE switch until the desired POLARITY indicator is illuminated.

- For CONST % or CONST PRI modes, press the DISPLAY switch until %/PRI is illuminated. Then turn the ADJUST knob to set the respective value.

  - Next, set the Pulse Width by pressing the DISPLAY switch until the Pw indicator is illuminated. Then turn the ADJUST knob to set pulse width.

- Turn the OUTPUT on by pressing the ON switch. After a 2 second delay the output on sequence starts with a 2 second slow start ramp during which the LDP-3840B will automatically drive the laser to the set point current.

  - While the OUTPUT is on, the laser drive current set point and limit may be changed. Also, the pulse width and/or duty cycle percentage may be adjusted. If the pulse width is changed, the duty cycle percentage range may be automatically limited, if required (due to the limitations of the resolution of the PW and PRI values.

  - If the MODE of operation (CONST %, CONST PRI, TRIG) is changed, the OUTPUT will be automatically turned off.

CHAPTER 3

REMOTE OPERATION

The LDP-3840B Pulsed Current Source can be used as a remotely controlled laser diode testing instrument. In remote operating mode, the LDP-3840B Pulsed Current Source offers control over all of the features accessible from the front panel in addition to advanced features that are only accessible via the GPIB interface bus.

This chapter is a guide to the syntax and usage of the various IEEE/488 common commands available for the LDP-3840B. It also includes advanced programming tips for remote use with the device-dependent commands, hardware diagrams, and other information relating to remote operation.

This chapter is divided into three parts. The first part contains information regarding use of GPIB with the LDP-3840B as well as sections focused on each common GPIB (ANSI/IEEE-488) command which is supported by the LDP-3840B. The second part contains information on advanced programming techniques and status reporting. The third part contains information on remote interface messages; these low-level messages are generally transparent to the user.

Changing Operation from Local to Remote

Sending a command over the GPIB bus automatically puts the instrument in REMOTE mode. The REMOTE indicator identifies when the instrument is in remote operation mode. When the instrument is in REMOTE mode, pressing the LOCAL switch returns the instrument to LOCAL control mode unless a Local Lockout state has been activated by the low level GPIB command LLO from the host computer. Local Lockout disables all LDP-3840B front panel switches until this condition is changed by the host computer. In this condition, the REMOTE indicator will flash at a 1 Hz rate.

For more information on low level interface commands such as LLO, refer to the IEEE488.1 specification.

Table 3.1 Device Setup

Select an unused device, i.e. DEV1. Then edit the setup (press F6) as follows.

Primary Address	Any valid value (instrument default is 1)
Secondary Address	None
Timeout Setting	T1s
EOS Byte	00H
Terminate Read on EOS	No
Set EOI with EOS on Write	Yes
Type of Compare on EOS	7-bit
Set EOI with Last Byte of Write	Yes
Repeat Addressing	Yes

Note: Some of the device setting labels may be slightly different, depending on the GPIB card.

Preparation for Bus Control

To use the LDP-3840B Pulsed Current Source remotely, you will need to install an IEEE-488 interface adapter in your host computer. These adapters and support software are available from several manufacturers and can be installed in most computers. Table 3.1 provides configuration information for your GPIB card. This manual assumes that you have a basic knowledge of the GPIB/IEEE-488 interface bus and how to use it for instrument control. This chapter also assumes that you are familiar with the controls on the LDP-3840B. Review Chapter 2 if you need more details on how to operate the LDP-3840B.

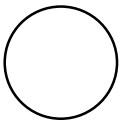
The talk and listen addresses on the LDP-3840B Pulsed Current Source are identical. This GPIB address is read locally by pressing the GPIB LOCAL switch and reading the display. To set the GPIB address, press the LOCAL/ADR front panel switch. The display will indicate the address in the following format, - xx -, where xx is the address number from 00 to 30. Turn the ADJUST knob until the desired address value is displayed. The new GPIB address will then be stored in non-volatile memory, independent of the SAVE and RECALL "bin" number. Extended GPIB addressing is not implemented on the LDP-3840B at this time.

ANSI/IEEE-488.2 Definitions

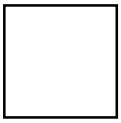
The following sections contain the relevant definitions for syntax diagrams and syntax elements for the LDP-3840B Series Pulsed Current Source commands, as defined by the IEEE-488.2 standard.

Syntax Diagrams

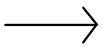
The syntax diagrams in Chapter 4 show the most complete form of command construction, but they don't show every possible construction. Some of the other possibilities which are not shown in the syntax diagrams of Chapter 4 are discussed in the Advanced Programming section of Chapter 3. These syntax diagrams conform to the ANSI/IEEE-488.2-1987 standard, and the terminology presented here reflects that standard.



The oval (or round) shape contains a terminal syntactic element. These represent a basic function, such as a single ASCII character, which cannot be divided.



Rectangles contain non-terminal syntactic elements. These represent elements which are expandable to a diagram of terminal syntactic elements. However, they are presented as a unit for clarity or emphasis.



Lines and arrows indicate correct paths through the syntax diagram. A reverse line around an element indicates that the element may be repeated indefinitely. A forward arrow around an element indicates that the element may be omitted.

White Space

White space is defined by the syntactic diagram shown in Chapter 3, where <white space character> is defined as a single ASCII-encoded byte in the range 00-09, 0B-20 (0-9, 11-32 decimal). This range includes the ASCII control characters, carriage return, and the space, but excludes the new line character.

In most practical programming situations, the space character (space bar) would be used as white space. White space is generally used for separating other

syntactic elements. White space is processed by the LDP-3840B Series Pulsed Current Source without interpretation.

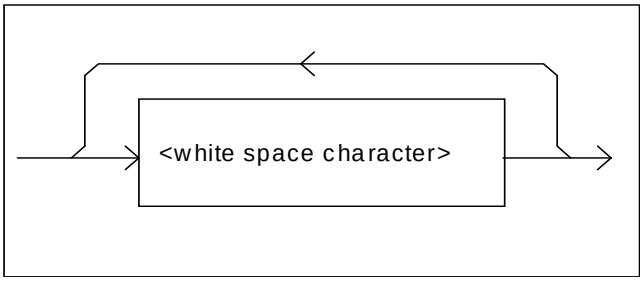


Figure 3.1 White Space Syntactic Diagram

Power-on Conditions

During power-on, the LDP-3840B will initialize the setup parameters to be the same as when the power was last shut down. The default conditions may be recalled by using the *RST command. The default conditions are outlined later in this chapter.

<nrf value>

The symbol “<nrf value>,” refers to the flexible numeric representation, as defined by the IEEE-488.2 standard. This means that numbers may be represented in one of three forms: integer, floating point, or engineering/scientific notation. For example, the number “twenty” can be represented by an ASCII string of:

- 20 or +20,
- 20.0 or +20.0,
- 2.0E+1 or +2.0E+1 or 2.0e+1 or +2.0E+1

These three forms are denoted, NR1, NR2, and NR3, respectively, by the IEEE-488.2 standard. For more information on the precise syntax of these definitions, refer to the IEEE-488.2 standard.

<PROGRAM MESSAGE TERMINATOR>

When you send a command using the standard format, the host computer (or GPIB driver) usually puts a <CR><NL><^END> (carriage return-line feed-EOI) on the data bus following the command string. The IEEE.488.2 standard requires either <NL><^END>, <NL>, or <^END> as an acceptable <PROGRAM MESSAGE TERMINATOR>, while the <CR> is treated as <white space> (ignored). The LDP-3840B will accept any <PROGRAM MESSAGE TERMINATOR> shown in Figure 3.2. The LDP-3840B terminates its responses

with a <NL><^END> (unless the user changes the terminator via the TERM command).

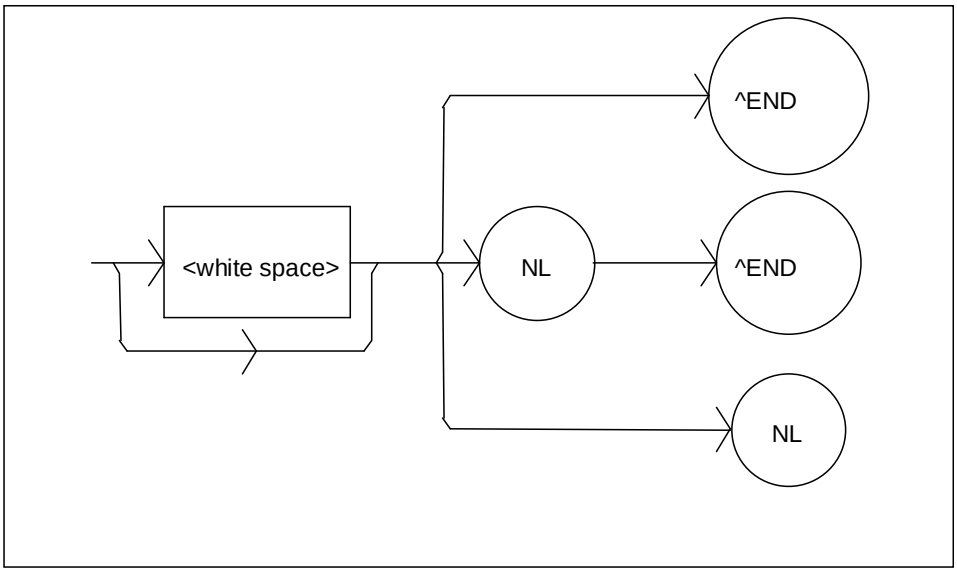


Figure 3.2 <PROGRAM MESSAGE TERMINATOR> Syntax Diagram

If you encounter problems with GPIB communications with the LDP-3840B Series Pulsed Current Source, refer to your GPIB driver manual for the exact syntax of the output terminator. See also, Appendix C.

<PROGRAM MESSAGE UNIT SEPARATOR>

A <PROGRAM MESSAGE UNIT SEPARATOR> is used to separate sequential <PROGRAM MESSAGE UNIT> elements (commands) from one another within a <PROGRAM MESSAGE>. The syntax for a <PROGRAM MESSAGE UNIT SEPARATOR> is shown in Figure 3.3.

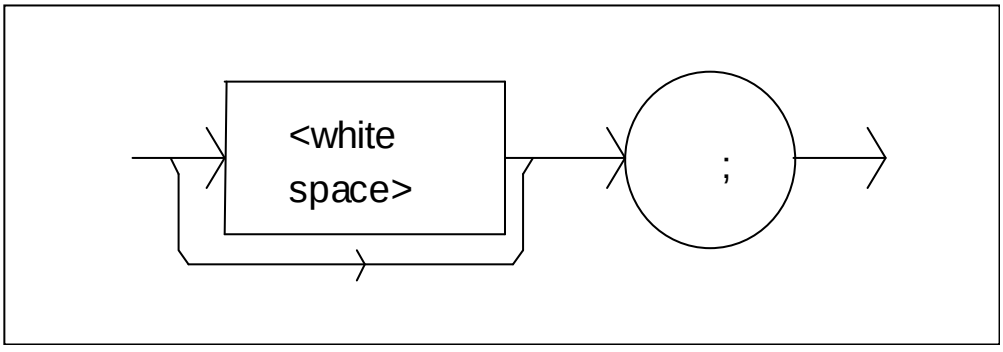


Figure 3.3 <PROGRAM MESSAGE UNIT SEPARATOR> Syntax Diagram

<PROGRAM HEADER SEPARATOR>

The <PROGRAM HEADER SEPARATOR> separates the <COMMAND PROGRAM HEADER> (LDP-3840B Pulsed Current Source command) from the <PROGRAM DATA> (first parameter after the command). In the case of the LDP-3840B, a single white space must be used to separate the command from the first parameter.



Figure 3.4 <PROGRAM HEADER SEPARATOR> Syntax Diagram

<COMPOUND COMMAND PROGRAM HEADER>

A <compound command program header> is a compound command heading which may be followed by <program data> (parameters). The LDP-3840B command structure is a tree, as shown in Figure 4.2. A compound command or <compound command program header> determines the proper command by following a path from the root node. This is similar to determining a path for a file by starting with the root directory and listing the intermediate subdirectories. The syntax for a <compound command program header> is shown in Figure 3.5. The syntax diagram for a <compound query program header> is shown in Figure 3.6.

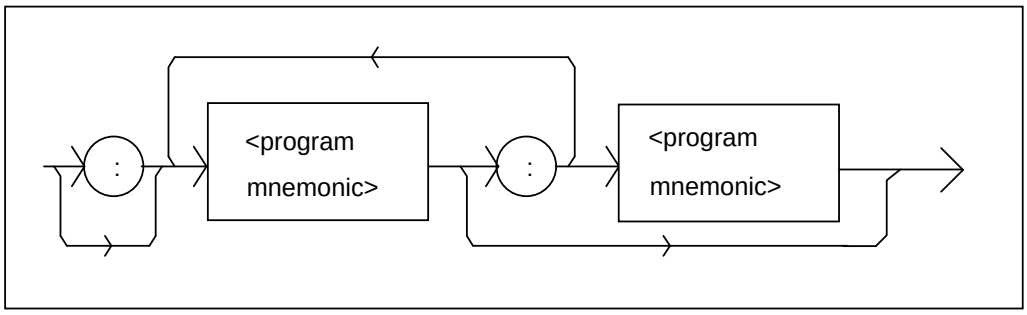


Figure 3.5 <compound command program header> Syntax Diagram

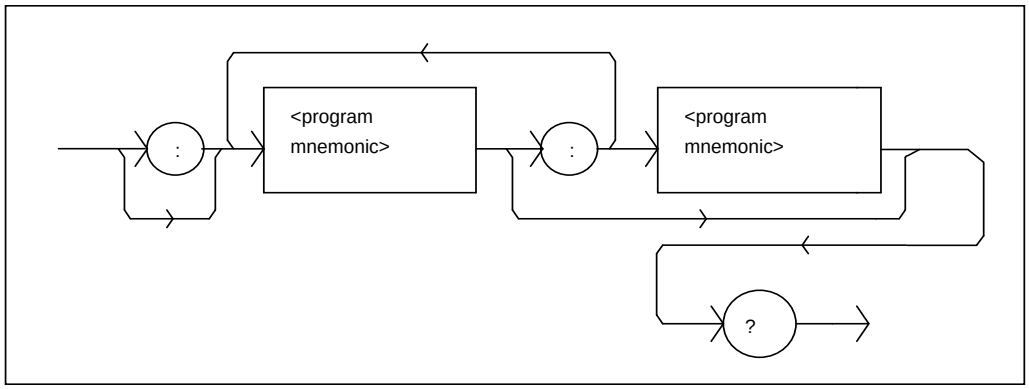


Figure 3.6 <compound query program header> Syntax Diagram

A <program mnemonic> is a command or command path identifier. For example, the <PROGRAM MESSAGE> "LAS:Inc" consists of the command "Inc" and the path identifier "LAS". All of the legal <compound command program headers> may be traced by starting from the root node of the command structure and moving down by levels to paths, and finally to the command (see Figure 4.2).

A <PROGRAM MESSAGE TERMINATOR> causes the next command search to begin at the root node. A leading colon (:) on a <PROGRAM MESSAGE UNIT> will cause the LDP-3840B to begin searching for the command at the root node. Otherwise (after a semicolon), the LDP-3840B will first search the most recently used node for the command. It will continue to search the command tree until it finds a legal command path, by searching each previously used node up to the root. If no legal path is found, the LDP-3840B will generate an error message. For more information on creating and using LDP-3840B commands, see Chapter 3, Advanced Programming.

<PROGRAM DATA> (Parameters)

Parameters (and other <PROGRAM DATA>) may be entered after a command in a <PROGRAM MESSAGE UNIT>. The <COMMAND PROGRAM HEADER> (command) and first <PROGRAM DATA UNIT> (parameter) must be separated by a <PROGRAM HEADER SEPARATOR> (white space).

<ARBITRARY BLOCK PROGRAM DATA>

This element allows any 8-bit bytes (including extended ASCII) to be transmitted in a message. The syntax for an <ARBITRARY BLOCK PROGRAM DATA> element is:

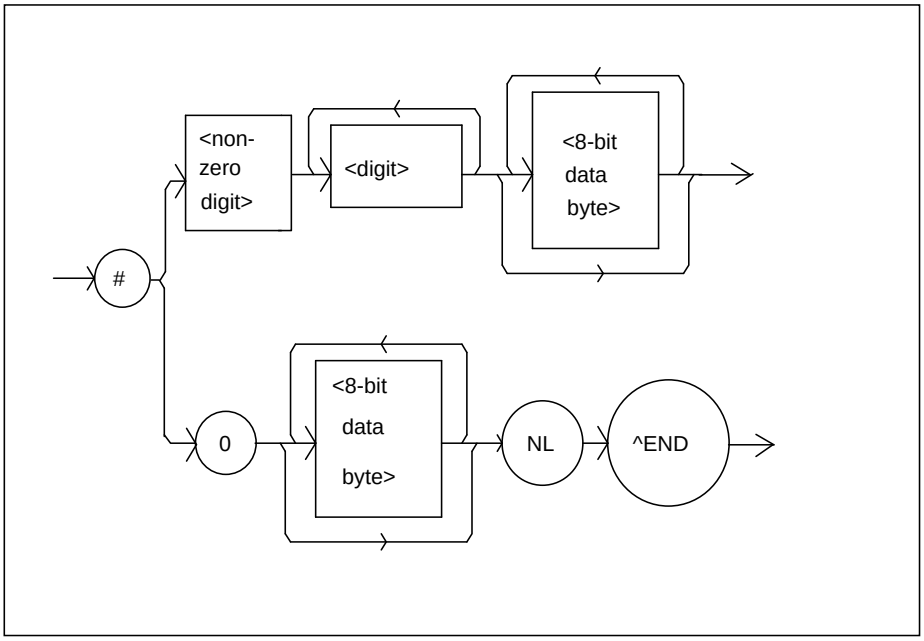


Figure 3.7 <ARBITRARY BLOCK PROGRAM DATA> Syntax Diagram

- where a non-zero digit is defined as a single ASCII encoded byte in the range 31 -39 (49 - 57 decimal). 8-bit data byte is defined as an 8-bit byte in the range 00 -FF (0 -255 decimal). NL is a new line (LF) and ^END is an end or identify (EOI).

<PROGRAM DATA SEPARATORS>

When there is a list of <PROGRAM DATA UNITS> (parameters) following a <PROGRAM HEADER SEPARATOR> (white space), the <PROGRAM DATA UNITS> must be separated with a <PROGRAM UNIT SEPARATOR>. The syntax diagram for a <PROGRAM UNIT SEPARATOR> is shown in Figure 3.8.

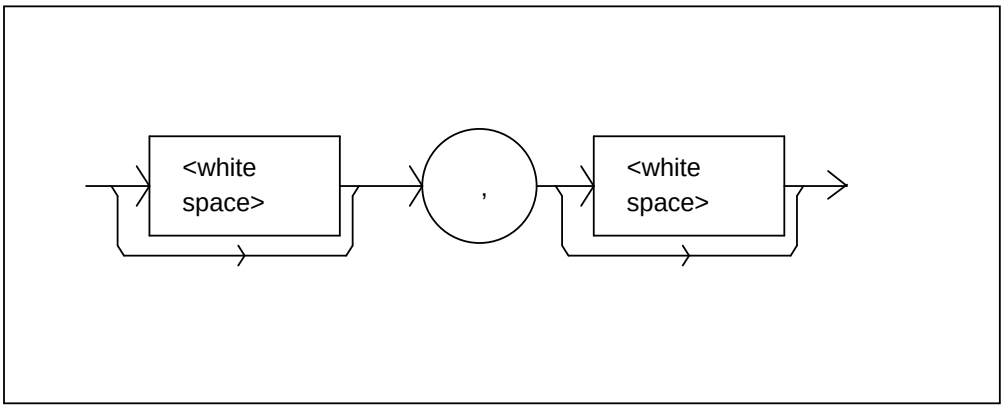


Figure 3.8 <PROGRAM DATA SEPARATOR> Syntax Diagram

Default Parameters

There are no default values for omitted parameters. If a command is expecting a parameter and none is entered, an error will be generated.

However, if a reset is performed via a *RST command (or a RCL 0 command), the following parameters will be set to the default state shown in Table 3.1.

GPIB mode in LOCAL via front panel, or in REMOTE via GPIB
I LIMIT = 750mA
OUTPUT off
MODE = CONST Duty Cycle (CDC)
Pulse Width (PW) = 0.1 uSec
Duty Cycle % = 0.01%
Display Showing Duty Cycle
Set Point = 0 mA
Polarity = P (Positive)
RECALL BIN number = 0
STEP value = 1mA

Table 3.2 State of the LDP-3840B Series Pulsed Current Source After *RST

Getting Started with GPIB

This section is intended as a quick guide to the GPIB syntax and commands used by the LDP-3840B. The LDP-3840B's unique (device-dependent) commands are described in Chapter 4.

Overview of the LDP-3840B Series Pulsed Current Source Syntax

Generally, a command or query is entered (spelled) as shown in Table 4.1. The command/query MUST CONTAIN all of the letters which are shown in upper case in Figure 4.2 and Table 4.1. However, the LDP-3840B's command parser is NOT CASE SENSITIVE so upper or lower case may be used in any combination. The lower case letters shown with the commands in Chapter 4 (GPIB Commands) are optional letters, and may be used for clarity. For example, the following commands are equal, and only the first three letters "DIS" are required, while the other letters, "play" are optional.

- "DIS 1", "DISPLAY 1", and "DisP 1".

The syntax of the LDP-3840B commands follows the rules laid out in the IEEE-488.2 standard. Colons (:) indicate the start of a new command path, while semicolons (;) indicate a separation of commands within a command string. A leading semicolon on a command may be used to return the LDP-3840B command parser to the command path root (see Figure 4.2).

Spaces, or white space, may be placed anywhere in a command string (after the command header or query question mark), and must be used to separate the command (header) from the first parameter (or program data). The following examples show valid syntax for commands with the LDP-3840B Pulsed Current Source:

- “MODE:CDC;:Pw 1.0;CDC 2.5;Ldi 50;OUT 1"
- ":DIS 1;:set:ldi?;
- "limit:i 40"
- "display:ldi"

The following are examples of invalid syntax for the LDP-3840B. These command strings would produce an erroneous result, as explained:

- "MODE CDC"Missing colon, MODE? expected
- "MODE:CDC;CDC 15" Second "CDC" command is still under the "MODE:" path, so the LDP-3840B generates an "unexpected parameter error". This could be fixed by using the form, "MODE:CDC; :CDC 15".
- "MODE:PRI DEC"Missing semicolon, DEC command generates an error
- "DIS ?"-Space not allowed before question mark, DIS command expected.
- "LDI33;dis?"-Space missing between LDI command and the parameter value, 33.
- "Disply-Optional letters must follow the correct order. Therefore, "Dis", "Disp", "Displ", "Displa", or "Display" are equivalent.

Using Commands with Parameters

Some commands expect a parameter. For example, if the duty cycle set point is to be entered, the command could be "CDC 10". This would set the LDP-3840B's duty cycle 10.00% for use in constant duty cycle mode. If a single parameter is expected, it should follow the command with at least one space between the command and the parameter.

The nominal value for on/off parameters is 1 = on, 0 = off. For example, the command:

- "Display 1" -turns the LDP-3840B's display on, and
- "Display 0" - turns the LDP-3840B's display off.

The words "on" and "off" may be substituted in the above example:

- "Display On"-turns the LDP-3840B's display on, and
- "Display OFF"-turns the LDP-3840B's display off.

For more information on parameter name substitutions, see Chapter 4.

A query has no space between the mnemonic and the question mark, as in:

- "LDI?"

The LDP-3840B uses a terminator of <CR><NL><^END> (carriage return, new line, EOI). In almost all cases, these terminators are automatically inserted by the host (user's) computer or GPIB driver. For more information, see Chapter 4 or the IEEE-488.2 standard definition.

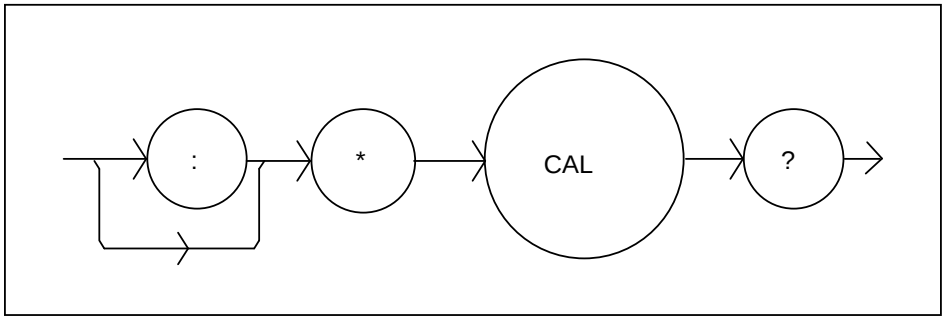
Common Commands and Queries

This section contains a list of the common commands and queries which are supported by the LDP-3840B. The common commands and queries are distinguished by the * which begins each mnemonic. The common commands and queries are listed in alphabetical order, and a brief description of their functions is given. For more information on these commands, refer to an ANSI/IEEE 488.2-1987 standards reference.

*CAL?

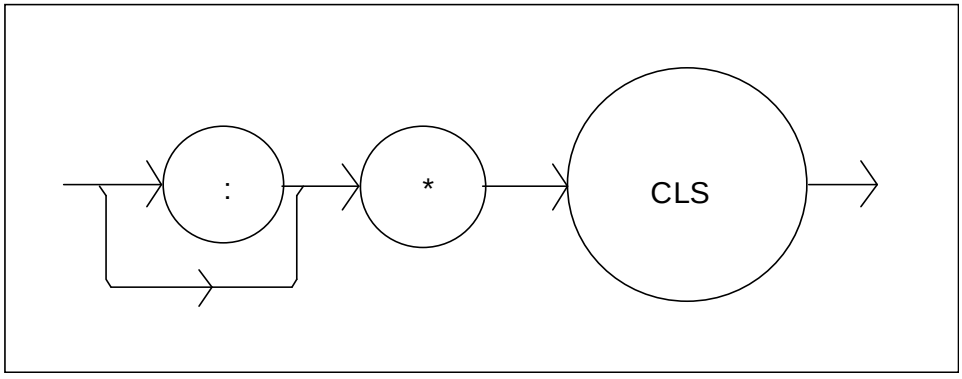
This is the calibration query. A response of 1 is returned since there is no internal autocalibration of the LDP-3840B Series Pulsed Current Source.

The syntax for the *CAL? query is:



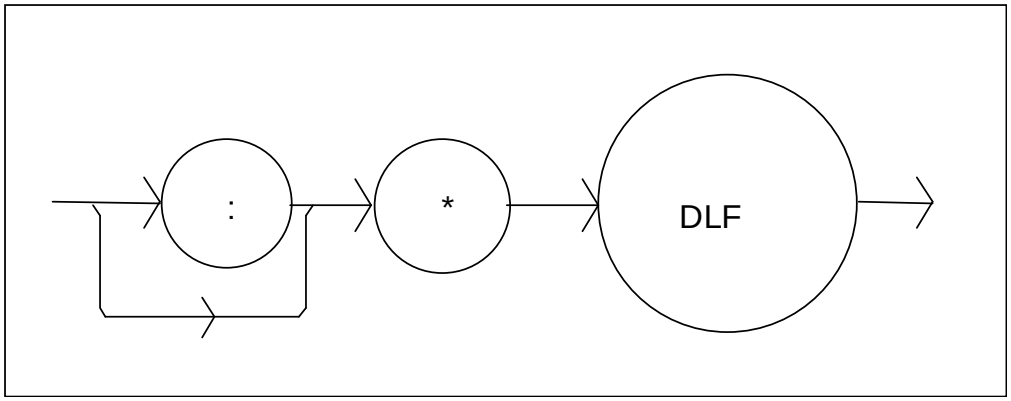
*CLS

This is the Clear Status command. It is used to clear the status event registers. It may be used, for example, to clear the Event Status Register, the Standard Event Status Register, and the Error Queue before enabling SRQ generation from instrument events. The syntax for the *CLS command is:



*DLF

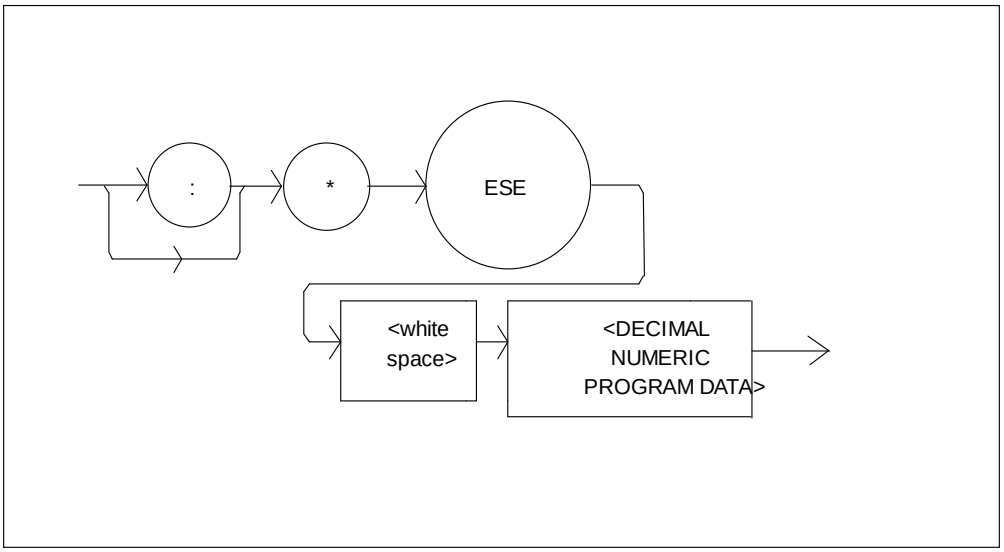
This is the Disable Listener Function command. It is used to cause the LDP-3840B to cease being a listener. The syntax for the *DLF command is:

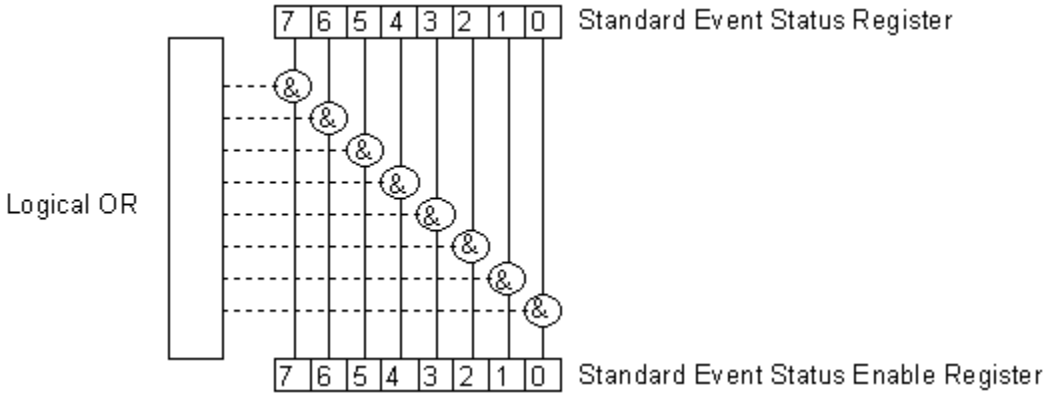


*ESE

This is the Standard Event Status Enable command. This command enables the Standard Event Status Register to update bit 5 of the status byte. The Structure of the Standard Event Status Enable Register and Standard Event Status Register are shown in Figure 3.9. The contents of these two registers are logically ANDed then the bits are ORed to get the Event Summary Bit message.

The syntax for the *ESE command is:





0 - Operation Complete	4- Execution Error
1 - N/A	5 - Command Error
2 - Query Error	6 - N/A
3 - Device Dependent Error	7 - Power On

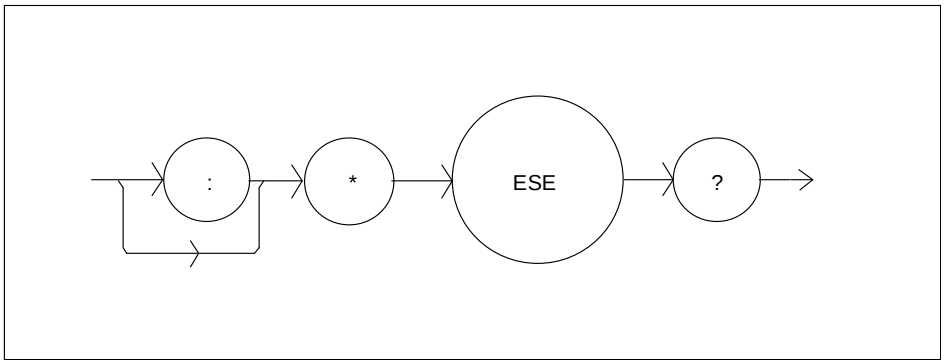
Figure 3.9 Standard Event Status Register/Standard Event Status Enable Register

Setting bit 0 allows the user to poll or generate SRQ from any overlapped commands after any previous operations are completed. This may be useful for ensuring that an operation, such as OUTPUT on, is complete before a measurement is made. Although this could be performed without using service requests, an interrupt-driven program makes more efficient use of the GPIB than polling or waiting (*WAI) routines.

*ESE?

This query will cause the LDP-3840B Series Pulsed Current Source to return the value of the Standard Event Enable Register. This allows the user to determine which status bits can set the summary bit (bit 5) in the status byte register. The response will be the sum of all of the enabled bits, as represented in Figure 3.9.

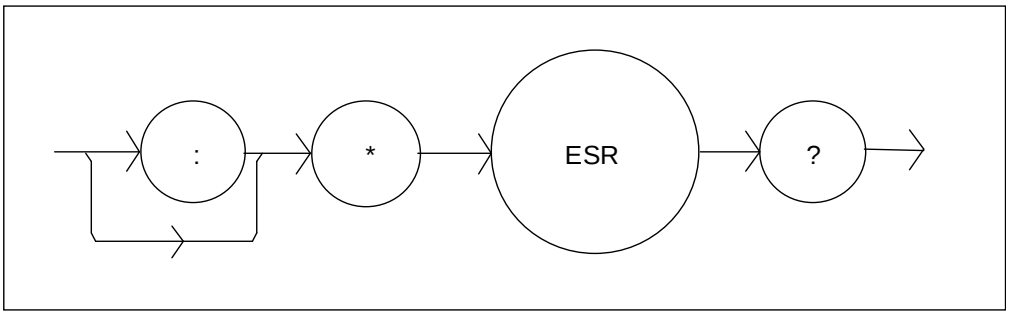
The syntax for the *ESE? query is:



*ESR?

This query will cause the LDP-3840B to return the value of the Standard Event register. This allows the user to determine which type of error has occurred, for example. The value of the response will be the sum of the bits as represented in Figure 3.9.

The syntax for the *ESR? query is:

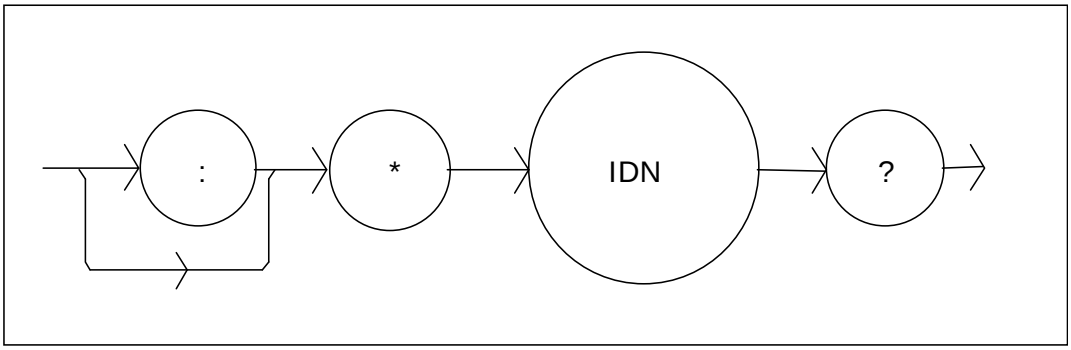


*IDN?

This query will cause the LDP-3840B Series Pulsed Current Source to return the following identification string:

ILX Lightwave, LDP-3840B,(7-digit serial number),(2-digit software version number). This identifies the specific device for the user. The manufacturer, model, serial number, and version number are listed in order.

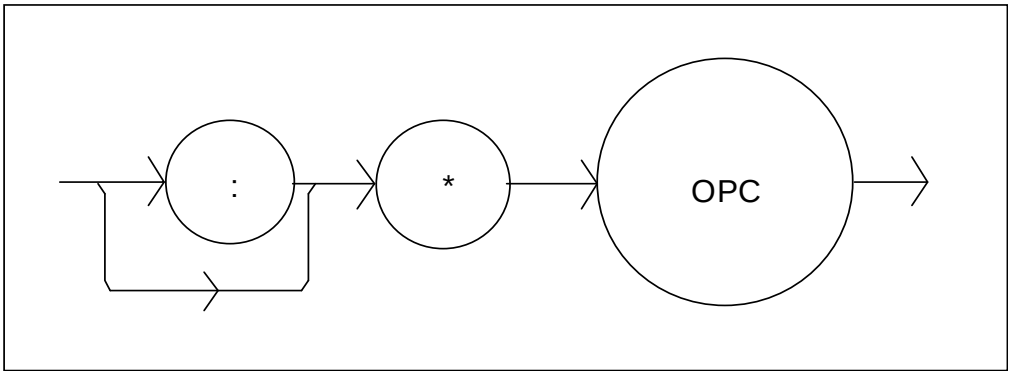
The syntax for the *IDN? query is:



*OPC

The *OPC command causes the LDP-3840B to generate the operation complete message in the Standard Event Status Register when all pending overlapped commands have been completed.

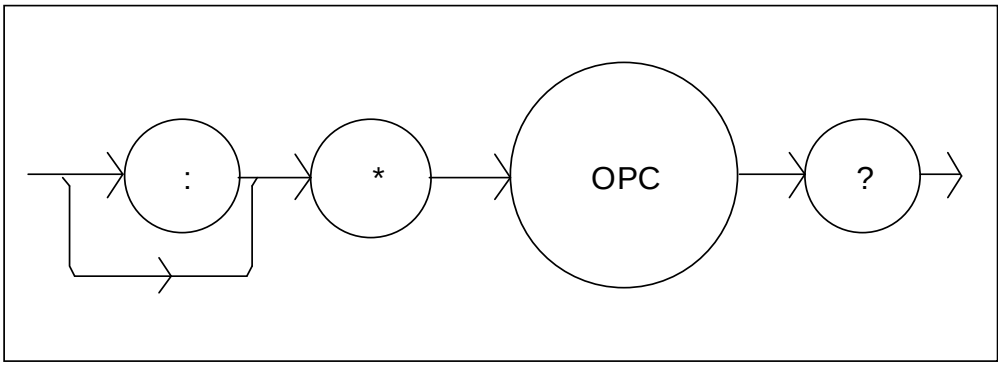
The syntax for the *OPC command is:



*OPC?

This query places an ASCII character 1 into the LDP-3840B's Output Queue when all pending operations have been finished.

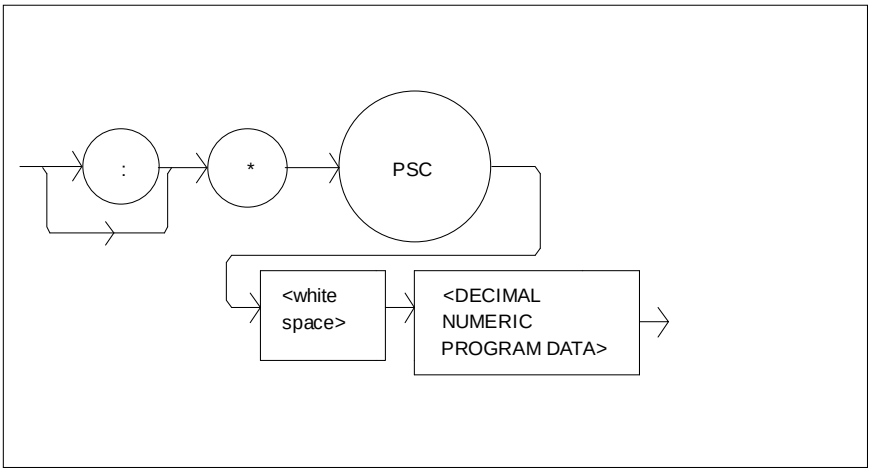
The syntax for the *OPC? query is:



*PSC

The Power-on Status Clear command controls the automatic power-on clearing of the Service Request Enable Register, the Standard Event Status Enable Register, the Event Status Enable Register, the Condition Status Enable Register, and the Parallel Poll Enable Register.

The syntax for this command is:



where the data is a Boolean value:

0 - Power-on-status-clear flag is set FALSE, therefore allowing SRQ interrupts after power on.

1 - Power-on-status-clear flag is set TRUE, therefore clearing all enable registers and disallowing SRQ interrupts to be asserted after power-on.

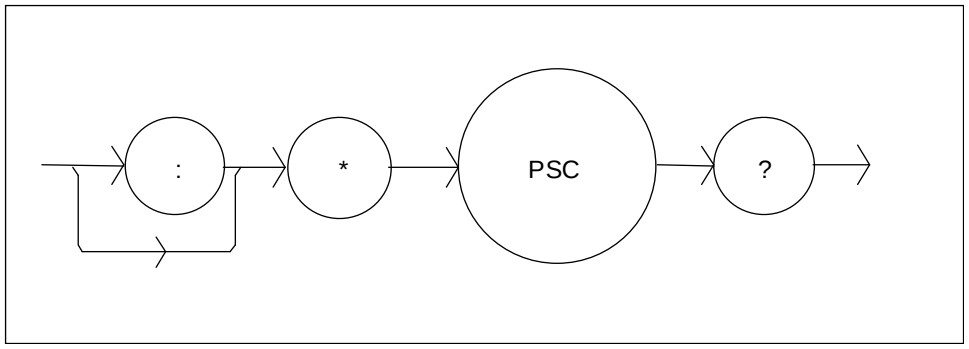
When the "*PSC 1" command is sent, the LDP-3840B will clear the above-mentioned enable registers (set them all to 0) at power-up. This may be done to avoid any undesirable service requests after a power on/off cycle of the LDP-3840B Series Pulsed Current Source.

The factory default value for this bit is 0, Power-on Status Clear is disabled. Therefore, the values of the enable registers are restored from their condition at the last power-down when a power-up occurs.

*PSC?

The Power-on Status Clear Query allows the programmer to query the LDP-3840B's power-on-status-clear flag. A response of 0 means that the Standard Event Status Enable Register, Service Request Enable Register, the Event Status Enable Register, the Condition Status Enable Register, and the Parallel Poll Enable Register will retain their values when power is restored to the LDP-3840B. A returned value of 1 indicates that the registers listed above will be cleared when power is restored to the LDP-3840B.

The syntax for this query is:

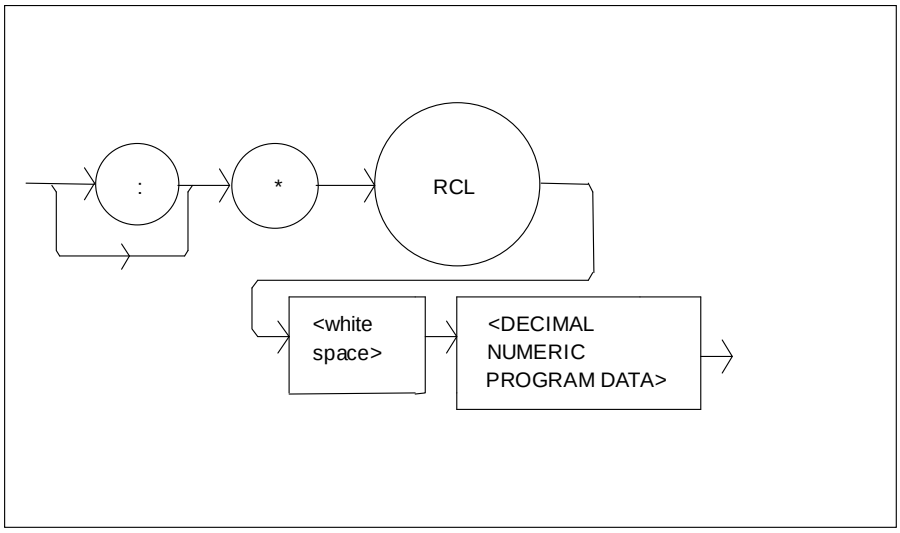


*RCL

The *RCL (Recall) command restores the LDP-3840B to the setup state which is in its local memory (Bin 0 - 10). The following criteria are restored when the *RCL command is given:

- The LDP-3840B Pulsed Current Source is in the parameter state which was last stored in that bin.
- The pulsed current output is off.

The syntax for the *RCL command is:



- where the data value must round off to an integer between 0 and 10. A value of 0 means the recalled state shall be the same as that of a *RST command (see Table 3.1). Up to 11 different stored recall states can be used. Ten of these recall states (1 - 10) are saved by using the *SAV command.

*RST

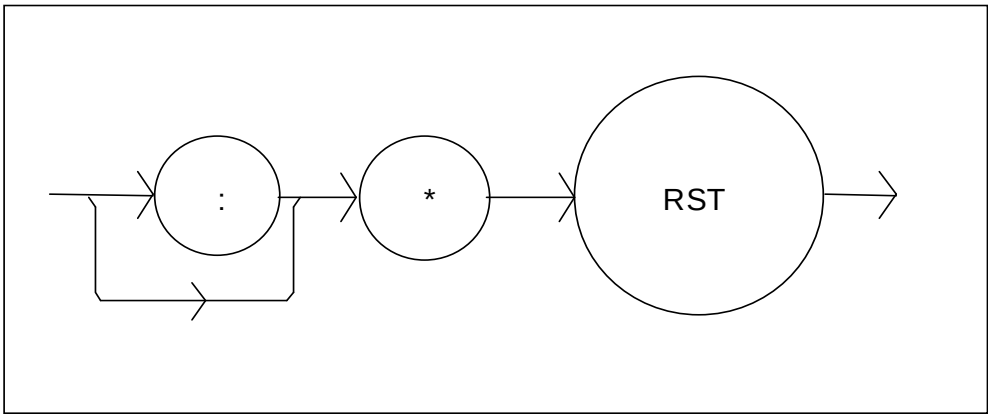
The *RST (Reset) command performs a device reset. This has the same effect as *RCL 0 (see Table 3.1), but additionally the LDP-3840B's OCIS and OQIS idle states are set with the *RST command.

The Operation Complete Command Idle State (OCIS) is the state which the LDP-3840B Series Pulsed Current Source is in when it is no longer waiting for any operation to complete, after an *OPC command has been executed.

The Operation Complete Query Idle State (OQIS) is the state which the LDP-3840B Series Pulsed Current Source is in when it is no longer waiting for any operation to complete, after an *OPC? query has been executed.

These idle states allow the LDP-3840B to complete its reset process (and have no operations pending) before continuing with any other commands after the *RST is executed.

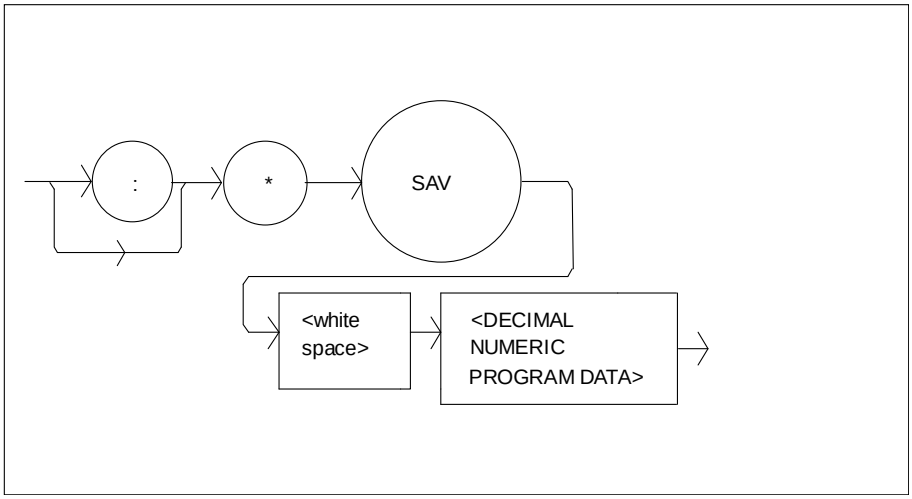
The syntax for the *RST command is:



*SAV

The Save command stores the current state of the LDP-3840B Series Pulsed Current Source in non-volatile local memory. A particular state is then recalled by using the *RCL recall command. There are 10 unique states which can be stored.

The syntax of the *SAV command is:

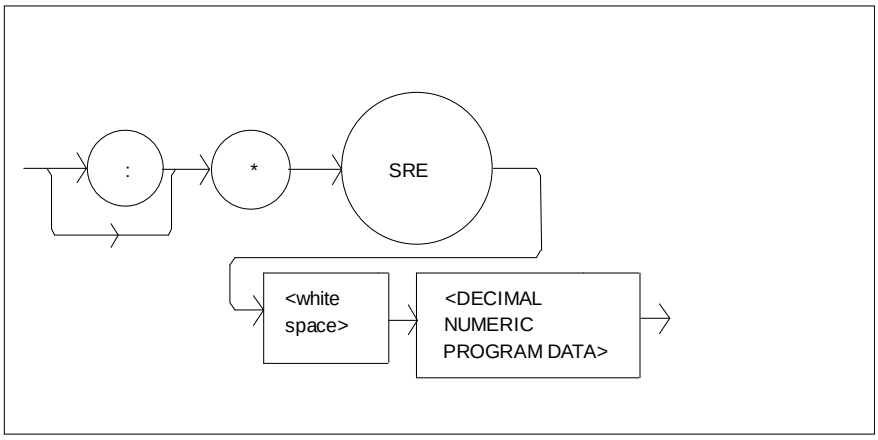


-where the data value must round off to an integer between 1 and 10. The rounded integer value corresponds to a unique saved state which can be recalled by using the same value with the *RCL command.

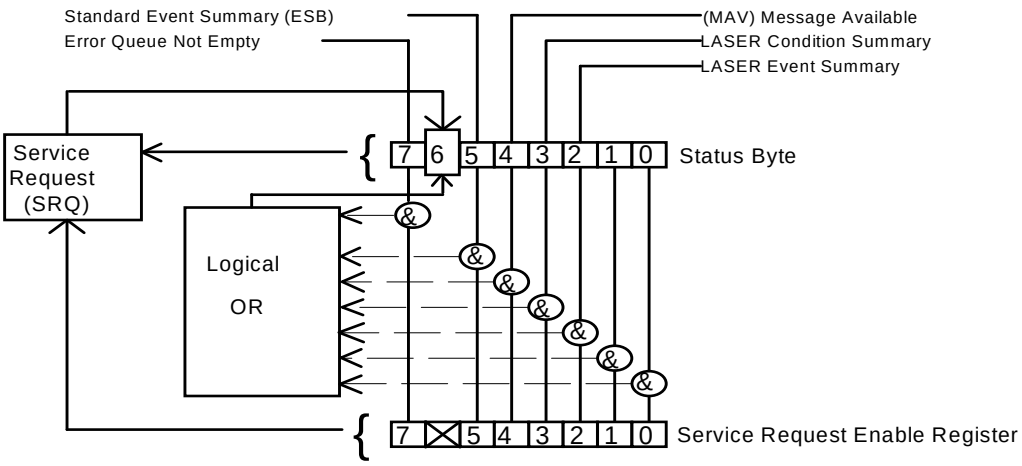
*SRE

The Service Request Enable command sets the Service Request Enable Register bits to allow the LDP-3840B to generate the user-selectable service requests.

The syntax of the *SRE command is:



-where the value of the numeric data rounds off to an integer between 0 and 255. The value of the numeric data corresponds to the bits enabled (see Figure 3.10)



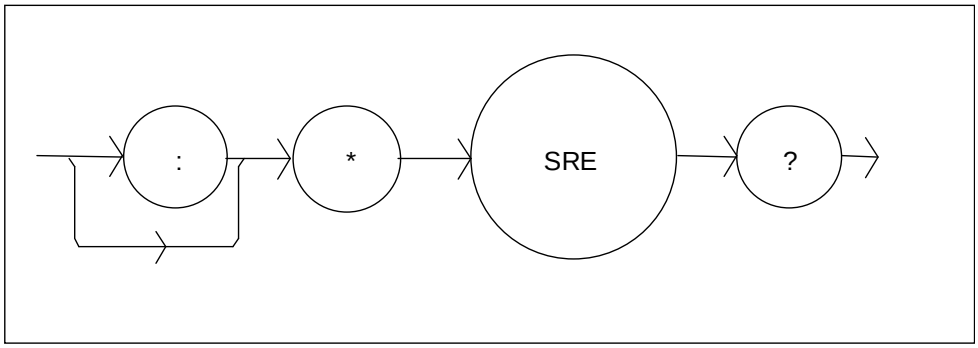
0 - N/A	4- Message Available
1 - N/A	5 - Event Status Summary
2 - LASER Event Summary	6 - Request Service/Master Status Summary
3 - LASER Condition Summary	7 - Error Message Availabe

Figure 3.10 Service Request Enable Register

*SRE?

The Service Request Enable query allows the user to determine the current contents of the Service Request Enable Register. When this query is made, the response is the binary integer value of the contents of the register (see Figure 3.10).

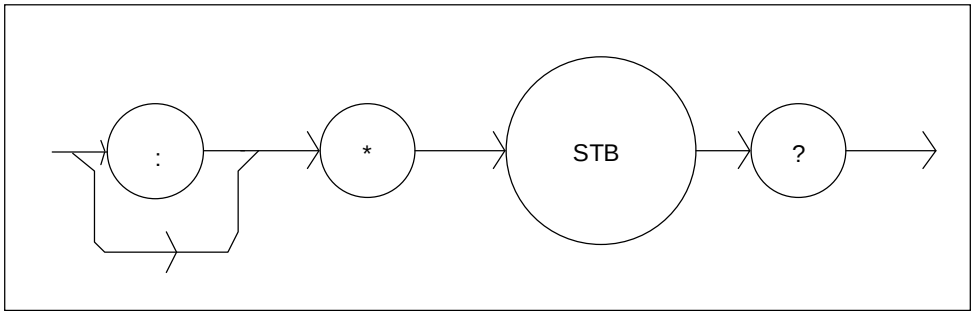
The syntax of the *SRE? query is:



*STB?

The Read Status Back query allows the programmer to read the status byte and Master Summary Status bit. The response to this query is an integer value of the contents of the Status Byte Register, where bit 6 represents the MSS (Master Summary Status) bit and not the RQS message (see Figure 3.10).

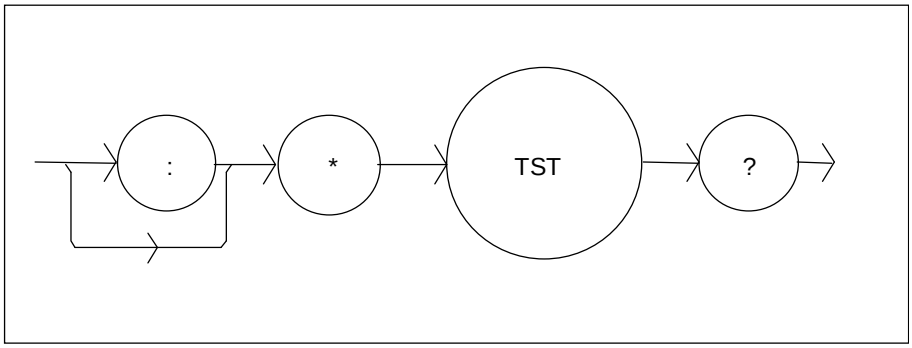
The syntax of the *STB? query is:



*TST?

The Self-Test query causes an internal self-test and returns a response when the self-test is complete.

The syntax of the TST? query is:

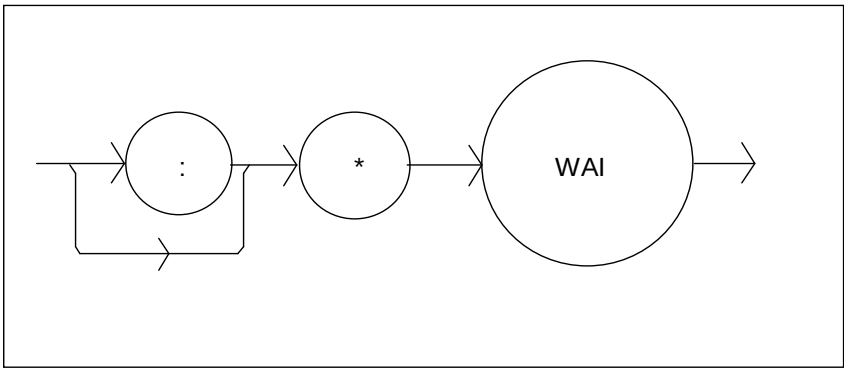


The response is <DECIMAL NUMERIC RESPONSE DATA>, where the value of the response is 0 if the self-test completes with no errors. If the response is a value other than 0, the self-test was not completed or it was completed with errors detected.

*WAI

The Wait-to-Continue command prevents the LDP-3840B from executing any further commands until the No-Operation-Pending flag is true. This allows the programmer to make the LDP-3840B wait for the completion of an operation before continuing.

The syntax for the *WAI command is:



Advanced Programming

Once you have become familiar with the command syntax and structure, you may take advantage of some programming shortcuts which are available. Due to the "tree-walking" capabilities of the LDP-3840B firmware, the user may elect to write command strings without constantly repeating the entire command path for each command.

Path Specification

The first command in the string must have its entire path entered. But once a path level is reached, other commands which are at the same level (or higher level) may then be entered without repeating the path. To accomplish this, the semicolon (;) must be used to separate the commands in the string, as usual. However, the command following the semicolon need not specify its full path, if the same path which was previously written out could be used for the new command.

For example, the following legal command string could be used to (1) set the LDP-3840B display to the laser drive current and then (2) set the display for the constant duty cycle set point value:

"DIS:LDI; CDC"

The path "DIS:" is "remembered" by the LDP-3840B software in this case. If the "CDC" command were not found at this level, the software would walk back to the "root" level and search for a "CDC" command. If the command is not found, an error message will be generated. (In this case, if there were no "DIS:CDC" command the LDP-3840B software would try to execute the "CDC" command and would generate an error because there was no parameter value given.)

Care must be taken to avoid errors which are caused by trying to implement commands from the wrong path or level. For example, the following command string was intended to (1) set the mode to constant duty cycle and (2) read back the pulse repetition interval:

"MODE:CDC; PRI?"

Instead, the LDP-3840B would set the mode to duty cycle but generate an error on the PRI? query. When the "PRI?" is encountered, the firmware will first search for that command at its present level. Since it finds it there as a command, it will generate an error. If the (MODE:)PRI command did not exist at this level, the software would search down to the "root" level and find and execute the intended command, "PRI?". Instead, if the user tries to read back the PRI value, the GPIB will hang up because the LDP-3840B will not reply.

In order to ensure the proper command is executed for the example above, the following command string should have been issued:

"MODE:CDC?;:PRI?"

The use of the colon forces the search for the "PRI?" query to begin at the root level, and thus the desired effect is achieved.

If you are not sure of the path level of a command, refer to the LDP-3840B Command Path Structure diagram, Figure 4.2. For this discussion, the root level is the highest level, and moving down the diagram (Figure 4.2) decreases the level.

Once the software has "walked" to a lower path level, it remains at that level when it receives the next command.

The only exception to the rule described above is when common commands are used. In that case, the software remembers which level the user was at before the common command was found, and it returns to that same level after finding and executing the common command. Therefore the following command string is legal:

"DIS:CDC; *SAV 1; LDI"

Here, (1) the display is set to show the set point duty cycle percentage, (2) the present setup is stored in "bin" 1, and (3) the display is set to show the laser drive current.

Error Messages

Error messages may appear on the display when error conditions occur which force the output off or reflect hardware errors in the respective functions of the LDP-3840B. For example, a module open error of the LDP-3840B will be displayed on the front panel display.

In most cases, the error message will appear for three seconds and then the display will revert to its former state. In the case of multiple error messages, the LDP-3840B will show each new message as soon as it is detected.

In remote operation, the current error list can be read by issuing the "ERR?" query. When this is done, a string will be returned containing (up to 10 of) the error messages which are currently in the error message queue.

Appendix B contains an explanation of the error messages which may be reported remotely by the LDP-3840B.

Status Reporting

Figure 3.11 shows the status reporting scheme of the LDP-3840B. Each of the registers which may be accessed by a command or query has the appropriate command or query written above or below the register representation. For example, the LASER Condition Register may be queried via the "LASer:COND?" query, as shown by its register heading in Figure 3.11.

The condition or event registers are logically ANDed with their respective enable registers. These bits are then logically ORed to form a summary message in the status byte for that particular register.

Event and Condition Registers

The Event Registers are used to report events which occur during the operation of the LDP-3840B. Events differ from conditions in that events signal an occurrence once, and are not reset until the Event Register is queried or the LDP-3840B is powered off. Conditions reflect the current state of the device, and therefore may change many times during operation. Querying a Condition Register does not change its contents.

The LDP-3840B contains Event and Condition Registers for LASER controller operations. It also contains the Standard Event Status Register which reports events for general operation of the LDP-3840B. The Standard Event Status Register conforms to the IEEE-488.2 standard.

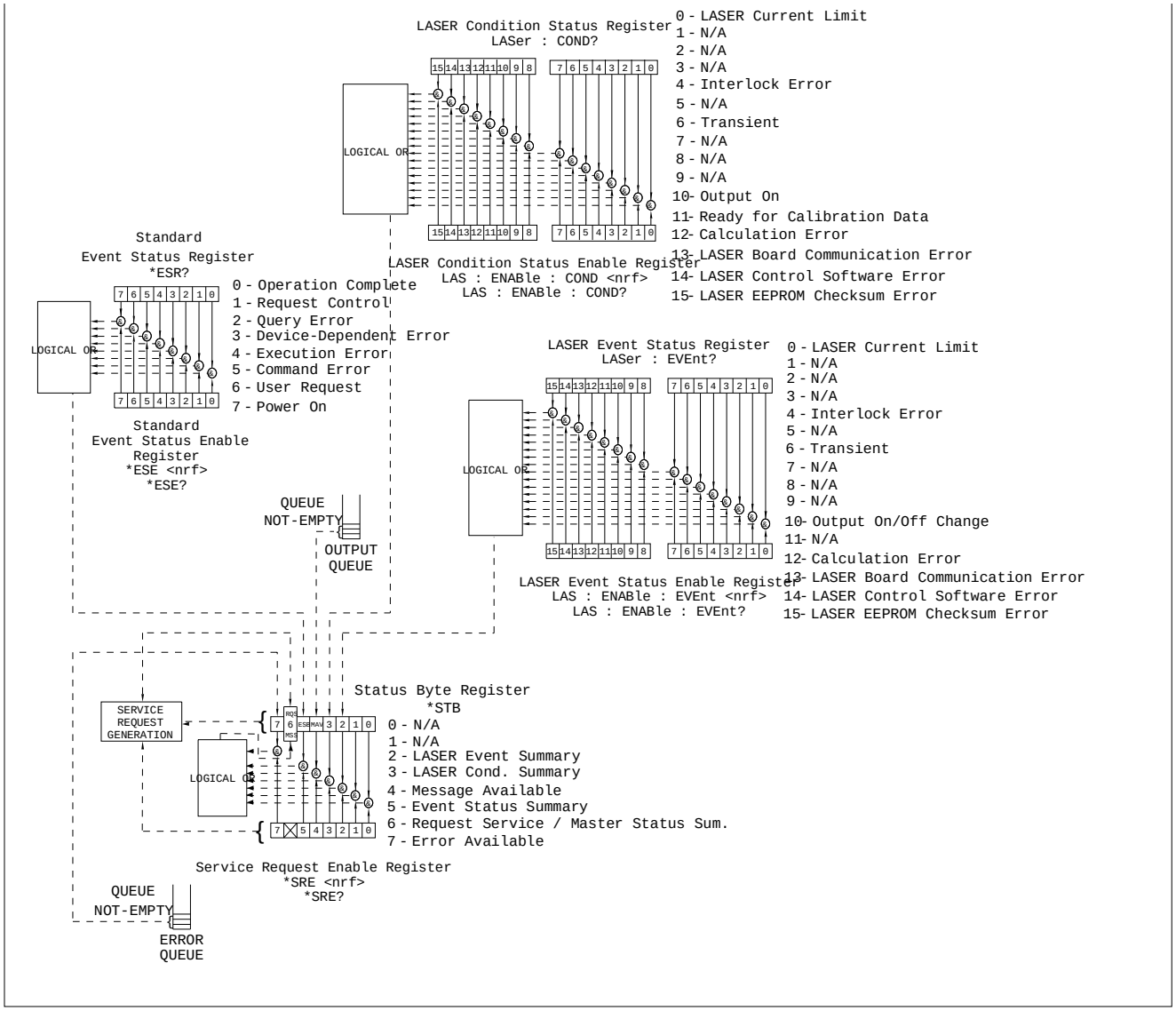


Figure 3.11 LDP-3840B Status Reporting Schematic Diagram

Operation Complete Definition

Note that bit 0 of the Standard Event Status Register contains the status of the Operation Complete flag (see *OPC). Enabling this bit via the *ESE command allows the user to update bits of the status byte. Then, if the SRE mask has bit 5 set, and the user issues an *OPC command, an SRQ will be issued upon completion of the currently processed commands. This may be used to initiate service request routines which depend on the completion of all previous commands.

Operation Complete on the LDP-3840B is defined as:

1. The controller, which is updating the current source hardware, is idle.
2. No NVRAM (non-volatile) memory write cycles are in progress.
3. No calibration routines are running.
4. The OUTPUT is off, or the OUTPUT is on and the output-on delay has finished
5. (OUTPUT current is enabled).

Note: Care must be taken when using the *OPC, *OPC?, and *WAI commands when command times are long (i.e. a large number of steps is made with the INC command and a device query is pending such as *OPC?). In some cases the operation completion may far exceed the standard GPIB time-out setting. If the GPIB times out while waiting for a response which indicates completion, either set the GPIB time-out longer or use SRQ generated interrupts in the program. See your GPIB manual for time-out configuration or SRQ programming setup.

The *OPC, *OPC?, and *WAI commands should not be used inside a calibration routine, except to detect the completion (exiting) of calibration. Notice that Operation Complete criteria 7 will hold the OPC flag false throughout calibration. If the program waits until the OPC flag is true before entering a calibration value, it will wait forever.

Command Timing and Completion

This section describes, for each device-dependent command, whether that command is performed in an overlapped or sequential manner. In other words, it states whether the next command may begin while this command is being executed, or if the next command must wait until this command is completed before its execution begins. The conditions for setting the operation complete flag are given in the previous section.

All LDP-3840B device-dependent commands are executed in an overlapped manner, and the operation complete flag is set after the conditions outlined in the previous section have been satisfied.

The *WAI (common command) is an example of a sequential command which forces the next command to wait until the no-operation-pending flag is true. This is essentially the same as waiting for the OPC flag to become true, because the

no-operations-pending flag is used to set the OPC flag (bit 0 of the Standard Event Status Register).

In normal operation, the overlapped commands execute faster than would appear by querying the OPC flag. This is due to the nature of the non-volatile memory storage process. Commands which change the status of the instrument limits, or change its mode or current range, step value, or status enable registers, will not have their OPC flag set until all current writing to non-volatile memory has been completed. This is done to ensure that the OPC flag is never set prematurely. However, in most cases, the individual operation will be completed immediately.

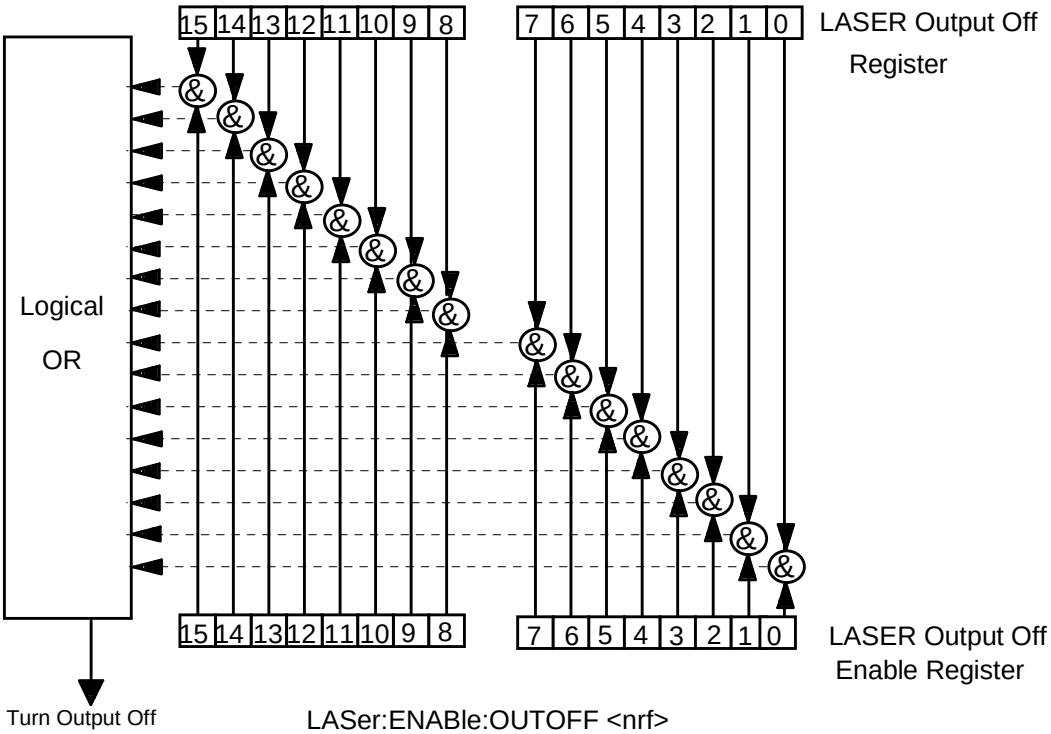
The speed of writing to non-volatile memory (NVRAM) is slow compared to processor speed, and the new information (to be written) is placed on a queue to reduce the processor overhead for non-volatile storage operations. However, the new information (e.g. new parameter value) is buffered and is essentially stored as soon as the command which created it is parsed. Therefore, even though the OPC flag may not be set immediately after a new parameter value is created, the new value is stored for all intents and purposes, and command throughput is not directly related to the OPC rate.

Whenever there is any output (response) data in the Output Queue, bit 4 is set in the Status Byte Register. Whenever there is any error message in the Error Queue, bit 7 is set in the Status Byte Register.

Output Off Registers

The Output Off Enable Register allows the user to determine which conditions and events in the controller cause the laser will drive current OUTPUT to be turned off. This register is configured in a manner which is similar to the status reporting register. However, its output is not reported in the Status Byte Register. Rather, it goes to the hardware which controls the output switching. The events and conditions which may be set to cause the laser drive current OUTPUT to be turned off are shown in Figure 3.12.

The default (factory) setting for this register is 0, Current Limit does not shut the OUTPUT off. This setting is not affected by the *PSC (Power-On Status Clear) command.



LASer:ENABle:OUTOFF <nrf>
LASer:ENABle:OUTOFF?

0 - Disabled	8 - N/A
1 - N/A	9 - N/A
2 - N/A	10 - N/A
3 - N/A	11 - N/A
4 - N/A	12 - N/A
5 - N/A	13 - N/A
6 - N/A	14 - N/A
7 - N/A	15 - N/A

Figure 3.12 LDP-3840B LASER Output Off Register

0 - Disabled	8 - N/A
1 - N/A	9 - N/A
2 - N/A	10 - N/A
3 - N/A	11 - N/A
4 - N/A	12 - N/A
5 - N/A	13 - N/A
6 - N/A	14 - N/A
7 - N/A	15 - N/A

Table 3.3 LDP-3840B Series Default Settings for Output Off Register

Input Buffer and Output Data

The output (response) data of the LDP-3840B is sent in blocks of up to 80 bytes in length. It is sent using high speed DMA within the LDP-3840B, but may be of indefinite length. Although some commands have a definite length response, such as the MESsage? query, the response length is indefinite because the LDP-3840B will respond to multiple queries in a single response output. The user may enter as many queries as desired in a single input message, and the LDP-3840B will respond to all of them in the same output message, if possible. For example, the user may enter the following command:

"Mes?; Rad?; LDI?; Err?"

The response may appear in this manner:

"TEST1 ,DEC,25.0,0"

All query responses are evaluated at the time the query is parsed, and not at the time the response message is sent. In most cases this does not create a problem since the time between parsing a query and sending its response is small, unless the GPIB controller takes a long time to request the response.

Remote Interface Messages

The following sections are intended as a reference for using the LDP-3840B Pulsed Current Source when an understanding of the lower level interface messages is required. These sections deal with the remote interface messages which are available with the LDP-3840B, and they contain a list of the Interface Function subsets. This information is generally not required by the user unless there is a question of compatibility of the instrument with a specific GPIB controller. A list of interface messages which are not supported by the LDP-3840B is shown below. These messages will be ignored by the instrument.

Interface Function Subsets

Table 3.3 contains the remote Interface Function Subsets which are supported by the LDP-3840B Series Pulsed Current Source. For more information, see the ANSI/IEEE-488.1-1987 standard.

SH1	Source Handshake - complete compatibility
AH1	Acceptor Handshake - complete capability
T6	Talker Functions
L4	Listener Functions
SR1	Service Request - complete capability
RL1	Remote Local Function - complete capability
PP0	Remote Configuration Parallel Poll - no capability
DC1	Device Clear - complete capability
DT0	Device Trigger - no capability
C0	Controller Function - no capability
E2	Three-state bus drivers (where allowed)

Table 3.4 LDP-3840B Series Interface Function Subsets

LDP-3840B Series Remote Messages

The following list contains GPIB remote messages which are compatible with the LDP-3840B Series Pulsed Current Source GPIB driver.

ACG	LAG	PPR2	RQS
ATN	LLO	PPR3	SCG
DAB	MLA	PPR4	SDC
DAC	MTA	PPR5	SPD
DAV	OTA	PPR6	SPE
DCL	PCG	PPR7	SRQ
END	PPC	PPR8	STB
GTL	PPE	PPU	TAG
IDY	PPD	REN	UCG
IFC	PPR1	RFD	UNL
			UNT

Table 3.5 LDP-3840B Series Allowable GPIB Interface Messages

Non-Supported Remote Interface Messages

Table 3.5 contains GPIB interface messages which are known to be incompatible with the LDP-3840B Series Pulsed Current Source. Other interface messages which do not appear in Chapter 3 may also be incompatible with the LDP-3840B Series Pulsed Current Source.

EOS	GET	MSA	NUL	OSA	TCT

Table 3.6 Non-Supported Interface Messages for LDP-3840B

CHAPTER 4

COMMAND REFERENCE

This chapter is a guide to the syntax and usage of the various device-dependent commands for the LDP-3840B. It contains a reference section for all of the device-dependent commands, including those which may only be accessed via remote operation. Therefore, it is of primary interest to users who wish to utilize the GPIB option.

This chapter is divided into two parts. The first part contains an overview of the remote commands and syntax used by the LDP-3840B. If you are not interested in remote operation, skip this chapter.

The second part contains all of the LDP-3840B commands in alphabetical order. Figure 4.1 shows the format for the device command descriptions in this chapter. The commands which emulate local (front panel) operation are denoted by the solid box next to the Local label in the upper left corner of the command description. The error messages which may be displayed on the LDP-3840B front panel are listed in Appendix B.

The common GPIB (ANSI/IEEE 488.2) commands which are supported by the LDP-3840B are described in Chapter 3.

The following syntax terms are frequently used in this reference:

<white space> refers to ASCII characters (such as Space Bar) which are used as specific separators in the command syntax

<nrf value> refers to the IEEE-488.2 standard for numeric format notation. It is a generic label which means either an integer, floating point, or scientific notation number representation may be used.

For more information on terminology, see Chapter 3.

Overview of the LDP-3840B Pulsed Current Source Command Set

There are two types of device "commands", commands --which do not return anything, and queries --which return a stored value or state of the instrument. Queries must be terminated with a question mark (?), while commands may require a parameter(s) to follow.

"DIS 1"

For example, the "1" in the command "DIS 1", enables the LDP-3840B display, while a "0" would disable (blank) the display. Table 3.1 contains the allowed substitute mnemonics for 1 and 0.

This command emulates the front panel operation of (1) selecting the display section, and (2) turning it on.

Most of the commands which emulate the front panel operation are just as intuitive (see Table 4.2). In Table 4.2 the required letters for each command are shown. A detailed account of each command and tells which are also supported by front panel operations is later in this chapter. Near the end of this chapter, each command is spelled out with the required letters in upper case and the optional letters in lower case. The optional letters may be used to improve program readability.

Substitute Parameter Names

For clarity in programming, the (Boolean) values of one and zero may also be represented by the appropriate substitute parameter names, as shown in Table 4.1.

Substitute Name	Value
ON	1
OFF	0
OLD	1
NEW	0
TRUE	1
FALSE	0

Table 4.1 Substitute Parameter Names

The ON parameter name could be used in place of the 1 in the example in Chapter 3 as follows: “DIS ON”

Compound Command Structure

Many of the LDP-3840B remote commands require a compound structure. This is done to distinguish between different commands of the same type.

The compound command structure is similar to a directory path structure, as found in DOS. For example, commands which deal with the LDP-3840B's current limit have the path "LIM:", as in the command to set the current limit to 150.0mA,

"LIM:I 150"

This structure is illustrated in Figure 4.2. Table 4.2 lists all of the LDP-3840B's device-dependent commands, with the full path shown for each command and a brief explanation of its usage. For more information, see Chapter 3.

A more detailed look at the LDP-3840B device-dependent commands, including syntax diagrams, and example usage is later in this chapter.

Common Commands

Another type of command is the "common command." These commands are common to instruments which support the ANSI-IEEE-488.2 standards and are not necessarily reflected by front panel operations. Some of the common commands are useful for advanced programming techniques, such as generating service requests. However, common commands are not necessarily for remote operation, and the beginning programmer may chose to ignore them entirely. The common commands for the LDP-3840B are documented later in this chapter.

GPIB Commands

Table 4.2 Device-Dependent Commands

NAME	PARAMETERS	FUNCTION
CAL:LDI	NONE	Used to initialize the laser drive current calibration cycle.
CAL:LDI?	NONE	Returns to the ready state for entering the laser drive current calibration value.
CDC	1	Used to set the constant duty cycle percentage value
CDC?	NONE	Returns the actual duty cycle percentage
COND?	NONE	Returns the value of the condition register.
CONST	2	Used to enter calibration constants for gain and offset, linear portion of response curve
CONST?	NONE	Used to read out the calibration gain and offset constants
DEC	0, 1, or 2	Used with STEP command to decrement the laser drive current set point value, options are number of steps and time between steps (see also INC command)
DELAY	1	Used to create a delay in the execution of further commands
DIS	1	Turns the display on or off
DIS?	NONE	Returns the display message or value
DIS:CONST	NONE	Sets the display to show Duty Cycle % or PRI
DIS:LDI	NONE	Sets the display to show laser drive current
DIS:PW	NONE	Sets the display to show pulse width values
ENAB:COND	1	Sets the enable register for conditions
ENAB:COND?	NONE	Returns the value of the conditions enable register.
ENAB:EVE	1	Sets the enable register for events
ENAB:EVE?	NONE	Returns the value of the event enable register
ENAB:OUTOFF	1	Sets the enable register for conditions/events which turn the OUTPUT off
ENAB:OUTOFF?	NONE	Returns the value of the outoff enable register.
ERR?	NONE	Returns errors generated since the last query.
EVE?	NONE	Returns the value of the event register.
INC	0,1, or 2	Used with STEP command to increment the laser drive current set point value, options are number of steps and time between steps (see also DEC command).
LDI	1	Used to set the laser drive current set point value.
LDI?	NONE	Used to return the laser drive current value.
LIM:I	1	Used to set the laser drive current limit value.
LIM:I?	NONE	Used to return the laser drive current limit value.
LOOKUP	2	Used to enter calibration constants for non-linear part of response curve; password accessible only.
LOOKUP?	NONE	Used to read out the calibration values for non-linear portion of response curve.
MES	1	Used to enter a string of 16 ASCII bytes.
MES?	NONE	Returns a previously stored ASCII message.

Table 4.2 Device-Dependent Commands

NAME	PARAMETERS	FUNCTION
MODE?	NONE	Returns the mode: PRI (pulse repetition interval) DUTY (duty cycle%) EXT (external trigger)
MODE:CDC	NONE	Sets the LDP-3840B to CDC (constant duty cycle) mode.
MODE:EXT	NONE	Sets the LDP-3840B to EXT (external trigger) mode.
MODE:PRI	NONE	Sets the LDP-3840B to PRI (pulse repetition interval) mode.
OUT	1	Same action as setting the OUTPUT switch on/off.
OUT?	NONE	Returns the OUTPUT switch status.
POL?	NONE	Returns the output current polarity.
POL:N	NONE	Sets the output current to negative polarity
POL:P	NONE	Sets the output current to positive polarity
PRI	1	Sets the constant pulse repetition interval (PRI) value, in mSec.
PRI?	NONE	Returns the present pulse repetition interval value, in mSec.
PW	1	Sets the pulse width, in uSec.
PW?	NONE	Returns the pulse width value, in uSec.
RAD	1	Used to set the radix type for numerical data; decimal, binary and hexadecimal are allowed.
RAD?	NONE	Used to return the radix type for numerical data; decimal, binary and hexadecimal are allowed.
SET:CDC?	NONE	Returns the duty cycle percentage (CDC) set point.
SET:LDI?	NONE	Returns the laser drive current set point, in mA.
SET:PRI?	NONE	Returns the pulse repetition interval (PRI) set point, in uSec
STEP	1	Used to set the Step value for use with DEC or INC commands; defaults to a set of 1 (mA); range is 1 to 1000 mA.
STEP?	NONE	Returns the Step value
TERM	1	Sets the program message terminator.
TERM?	NONE	Returns the program message terminator.
TIME?	NONE	Returns the elapsed time since the unit was last powered up.
TIMER?	NONE	Returns the elapsed time since the timer was last reset.

Device Dependent Commands

This section contains all of the device-dependent commands for the LDP-3840B Pulsed Current Source, listed in alphabetical order. Sub-sections for each path are presented, listing the commands which are legal for that path. See Figure 4.2 for command path tree structure. All of the LDP-3840B Pulsed Current Source's common commands and queries are listed in Chapter 3. The lower level remote interface messages are also listed in Chapter 3.

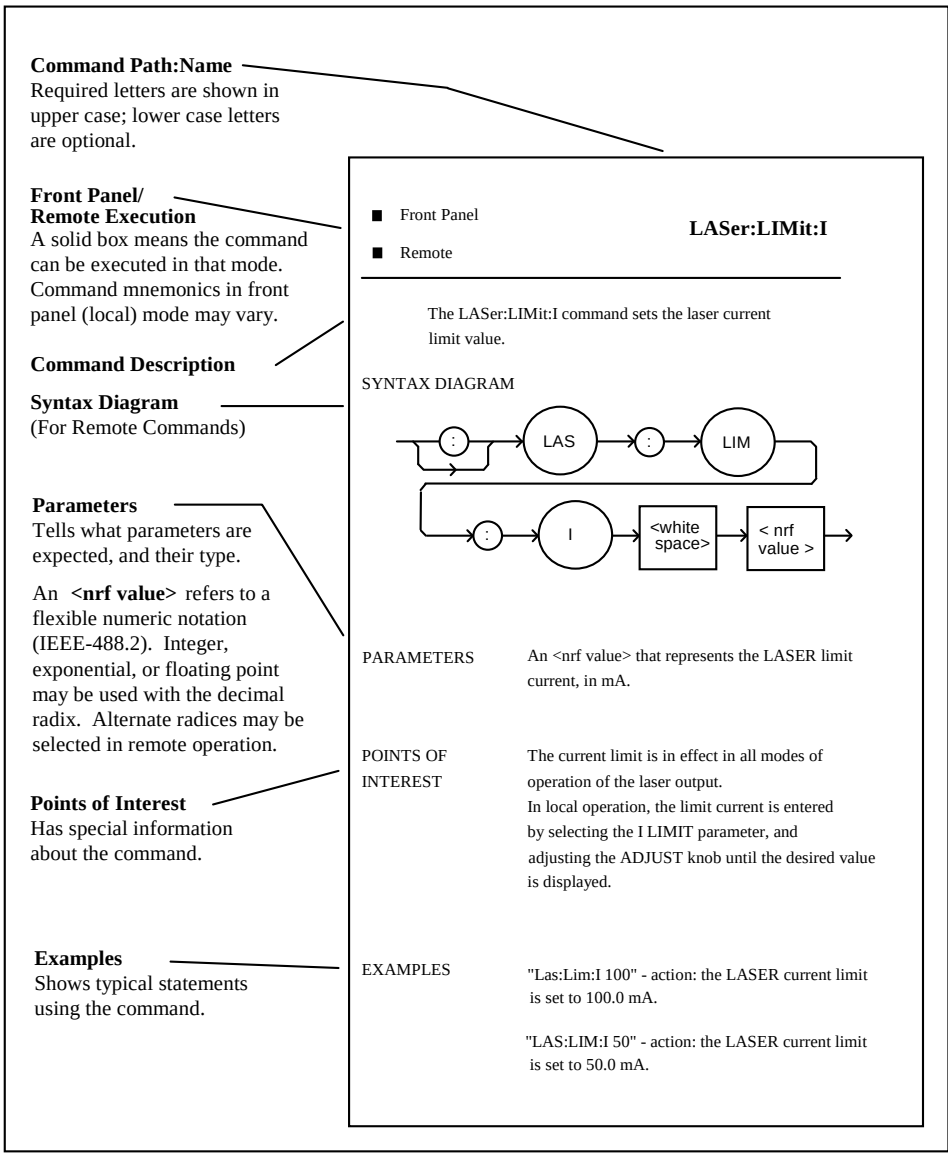


Figure 4.1 Command Description Format

Command Paths

The LDP-3840B device-dependent commands are structured into a tree format (Figure 4.2). Each of the legal paths is listed below, followed by it's list of path options, each of which is followed by the commands themselves.

It is recommended that the first-time user begin learning the commands by using the full path notation. Once you are familiar with the commands, you may wish to take advantage of the shortcuts allowed for command paths.

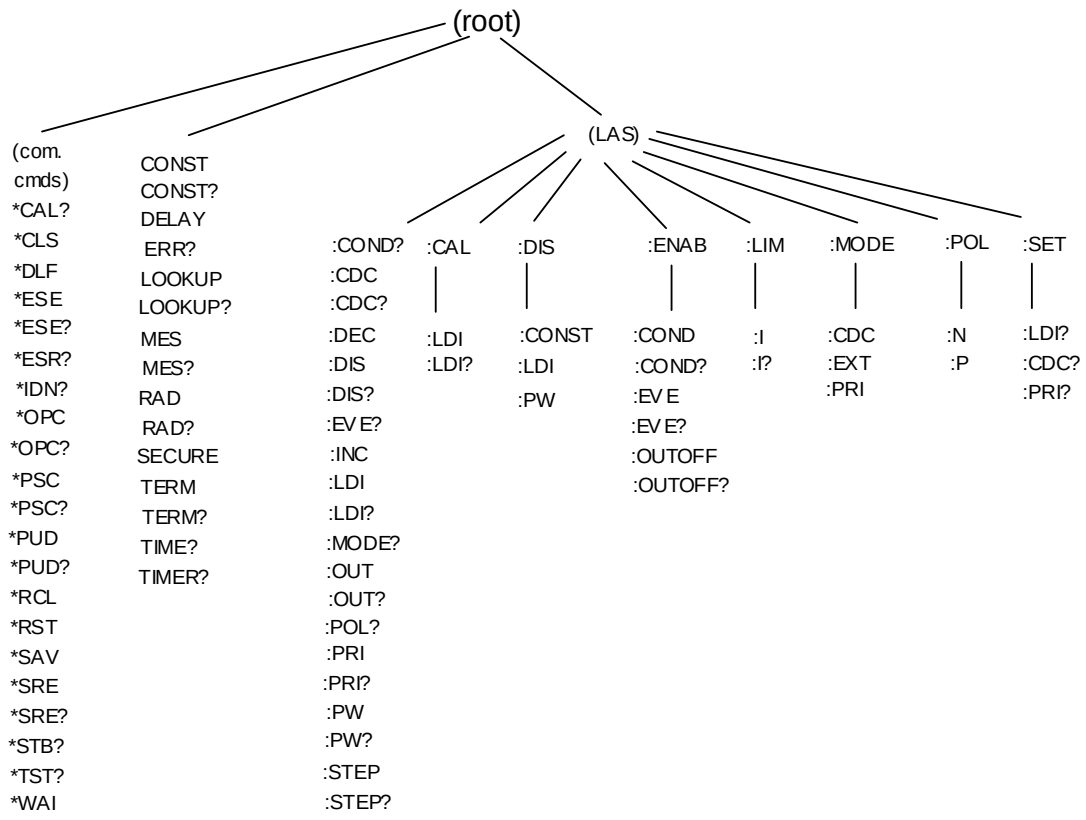


Figure 4.2 Command Path Structure

LDP-3840B Device-Command Reference

The following pages contain a reference for the device-dependent commands of the LDP-3840B. This reference contains useful information for both local and remote operation of the LDP-3840B.

References to the front panel labels are capitalized in the following reference pages (as is done throughout this manual). Therefore, a reference to the MODE section refers to the same-labeled switch are of the LDP-3840B.

The commands may include any combination of upper and lower case valid letters, as shown in the command examples in the following pages. For example, “LIm:i 100”, “lim:I 100”, and “LIM:i 100” are all equivalent.

The required letters of a command are capitalized and the optional valid letters are in lower case in the headings of the command descriptions in the following pages. For example, the command heading “LIMit:I” has the required letters “LIM:I”, but allows the use of LIMIT:I” for clarity.

The following syntax terms are frequently used in this reference:

<white space> refers to ASCII characters (such as Space Bar) which are used as specific separators in the command syntax.

<nrf value> refers to the IEEE-488.2 standard for numeric format notation. It is a generic label which means either integer, floating point or scientific notation number representation may be used.

CAL :

FRONT PANEL
REMOTE

The CAL: command is used to get to the LDP-3840B's Laser Drive Current calibration commands.

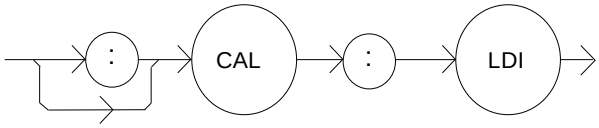
Note The proper test equipment and test fixtures should be set up in order for these commands and queries to work.

Example
CAL:LDI
CAL:LDI?

CAL:LDI

FRONT PANEL
REMOTE

The CAL:LDI command is used to enter the Laser Drive Current (set point) calibration mode.



Parameters None

Note After this command is issued, the LDP-3840B will allow calibration of the current set point and limit. In local operation, calibration mode is entered by simultaneously pressing the LOCAL/ADR and MODE switches.

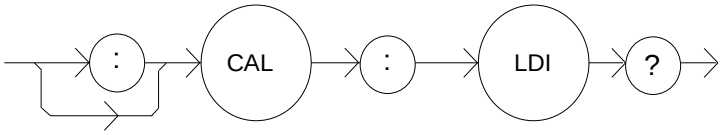
The CAL:LDI? query may be used to determine if the LDP-3840B is ready for the user to enter the correct value (in mA) via the LDI command.

Example "CAL:LDI" -action: the LDP-3840B enters calibration mode for Laser Drive Current.
"Cal:Ldi" -action: the LDP-3840B enters calibration mode for Laser Drive Current.

CAL:LDI?

FRONT PANEL
REMOTE

The CAL:LDI? query is used to determine that the LDP-3840B is ready for a value to be entered during the CAL:LDI calibration cycle for the Laser Drive Current values.



Parameters None; the response will be in the form:
-where 1 = ready, 0 = not ready

Notes After this query is issued and a response of 1 is received, the LDP-3840B will be ready for the user to enter a value via the LDI command

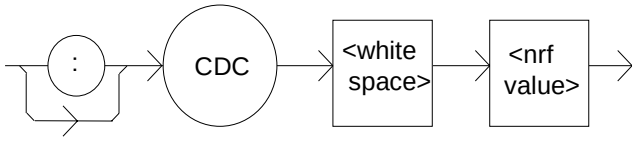
Examples “CAL:LDI?” -response: 1, means the unit is ready for the user to enter a value (in mA) via the LDI command

'Cal:LDI?” -response: 0, means the unit is not yet ready for the user to enter a Laser Drive Current value (because it is busy with internal operations which don’t require user input, or an error has occurred”.

CDC

FRONT PANEL
REMOTE

The CDC command is used to set the value of the Constant Duty Cycle, as a percentage, for use in constant duty cycle (CONST %) mode.



Parameters An <nrf value> which represents the constant duty cycle set point, as a percentage.

Notes This value may be set remotely only when in constant duty cycle mode (CONST %). In all other modes, the value is ignored, but no error is generated.

In local operation, this parameter can only be set while operating in constant duty cucle (CONST %) mode.

CDC is related to PW and PRI as follows: CDC - (PW/PRI) * 100
The set CDC value is restricted to valid values based on the present PW (and the resolution of the PW and PRI parameters).

In local operation, valid CDC values are calculated and displayed automatically when CDC is edited. However, in remote mode, if an invalide CDC value is entered, the LDP-3840B will set the CDC to the closest valid CDC value and generate error #201. Therefore, in remote operation, it is recommended that CDC set point values be

compared to the desired value (via the SET:CDC? query), and that the error queue be checked periodically (via the ERR? query). The range of values of CDC is 0.01 - 10.00%.

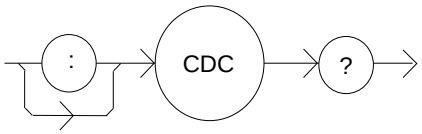
Examples "CDC:10.0" -action: The constant duty cycle set point is set to 10.00%.

"Cdc 2; Set:cdc?" -returns: 2.5, means that although the constant duty cycle set point is initially set to 2.00%, 2.50% is the closest valid duty cycle (based on the present PW value).

CDC?

FRONT PANEL
REMOTE

The CDC? query returns the value of the actual duty cycle, as a percentage.



Parameters None; the response will be in the form:
-where the response is an <nrf value>.

Notes The response is in percent; the actual CDC value is not valid when in external trigger mode.

The actual CDC value is usually different than the SET: CDC value, unless the LDP-3840B is in constant CDC (CONST %) mode.

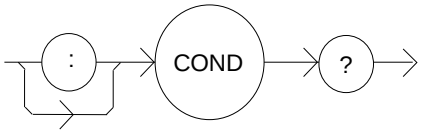
In local operation, the CDC displayed is always the actual value; when CONST % mode is entered, if the set point CDC value is invalid for the present PW value, the set point CDC value is automatically changed to the closest valid value (based on the present PW and the resolution of the PW and PRI parameters). The actual CDC value is then set to the set point CDC value.

Examples "cdc?" -response: 9.6 means the actual duty cycle is 9.60%.

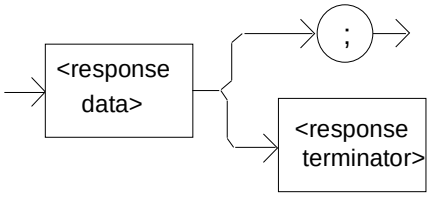
COND?

FRONT PANEL
REMOTE

The COND? query returns the value of the status condition register.



Parameters None; the response will be in the form:



-where the response is the sum of the following

1 - Laser Drive Current Limit	256 - N/A
2 - N/A	512 - N/A
4 - N/A	1024 - Output On/Off State
8 - N/A	2048 - Ready for Calibration Data State
16 - Interlock/Keylock Open	4096 - Calculation Error
32 - N/A	8192 - Hardware Error
64 - Line Transient	16384 - Software Error
128 - N/A	32768 - N/A

Notes The conditions which are reported to the status byte are set via the ENABle:COND command.

The condition status may be constantly changing, while the event status is only cleared when the event status is read or the *CLS command is issued.

Examples “COND?” -response: 1025, means that the laser drive current limit and output on conditions currently exist.

CONST

FRONT PANEL
REMOTE

The CONST command sets the gain and offset calibration constants for the linear portion of the current output response curve.

Parameters — Two parameters required; the first parameter is the gain; the second parameter is the offset. Any floating point or integer value will work. **Caution should be exercised when entering values.** A zero entry will cause the instrument to be inoperable. Values which differ greatly from the original values can cause unexpected performance. A 1% or 2% change in this number is desirable, any more than this indicates other calibration problems.

Notes — The linear portion of the output current response curve falls between 10% and 100% of the maximum output. It may be desirable to adjust, slightly, the response for a particular operating point.

CONST?

FRONT PANEL
REMOTE

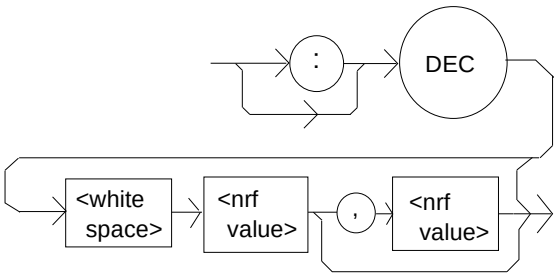
The CONST? query reads the gain and offset constants back to the user for the linear portion of the output current response curve.

Notes — The response values will be floating point values; these values are only the gain and offset numbers to calibrate the instrument in the linear portion of the output current response curve. See LOOKUP? command for calibration values in the non-linear portion of the response curve.

DEC

FRONT PANEL
REMOTE

The DEC command decrements the output current set point by one or more steps. The step size is determined by the STEP command.



Parameters None, 1 or 2. The first optional parameter is the number of steps, and the second optional parameter is the number of mSec between steps (with a practical range of 20 - 50,000 mSec).

Notes The decremented amount is one or more steps. The step size can be edited via the STEP command, its default value is 1 mA.

If the first optional parameter is used, but not the second, the user may decrement the LASER set point by a multiple of the STEP size, without changing the STEP size. If both optional parameters are used, the user may create an automated stepping ramp function for the LASER output.

The minimum time to complete one decrement is about 10 to 20 mS. When the second parameter is omitted, the delay is minimized. The delay does not begin until after the first step.

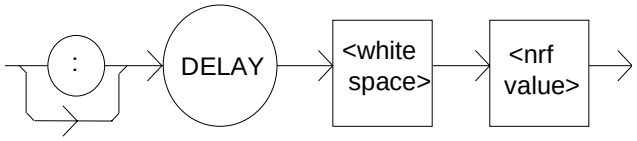
Examples “STEP 30;DEC” -action: The Laser Drive Current set point is decremented by 30 mA.

“STEP 1;DEC 10,100” -action: The Laser Drive Current set point is decremented by 1 mA ten times, with a delay of about 100 mS between each step.

DELAY

FRONT PANEL
REMOTE

The DELAY command is a sequential command which causes the execution of further commands to be delayed by a user-defined time.



Parameters An <nrf value> which represents the delay time, in milliseconds.

Notes The Operation-Complete flag is held false until the delay period elapses in between a series of commands.

This command is useful for creating delays based on the instrument clock, instead of having the host computer create a delay loop (which may be an inefficient use of the host's CPU).

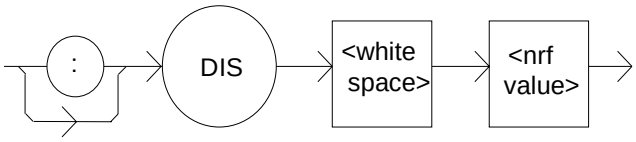
Examples "DELAY 500" -action: Further commands and queries are not executed until 0.5 seconds have elapsed from the time this command is executed.

"Ldi 22;Delay 2000;PW?" - actions: The laser drive current is set to 22 mA, then the LDP-3840B waits for 2.0 seconds before returning the pulse width.

DISplay

FRONT PANEL
REMOTE

The DISplay command enables or disables (turns off) the display and indicator LEDs.



Parameters 1 = on, 0 = off.

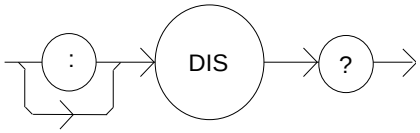
Notes When the display is enabled, the value displayed will depend on the present mode of operation. When the display is disabled, it contains a blank message.

Examples "DIS ON" -action:display is enabled.
"DISp 0" -action:display is disabled, blank.

DISplay?

FRONT PANEL
REMOTE

The DISplay? query returns the value shown on the display.



Parameters None; the response will be in the form:
-where the response data is a string.

Notes Returns the actual string from the output buffer to the display; if the display is disabled, it returns " ". In local operation, the display is queried by visually reading the display value.

Examples "DIS?" -response: "999" means the value on the display is 999.
"DISp?" -response: "0.6" means the value on the display is 0.6.
"Disp?" -response: "E501" means there is an E501 error message on the display (which means: interlock open --output off).

DISplay:

FRONT PANEL
REMOTE

The DISplay: command is used to get to the LDP-3840B's display commands.

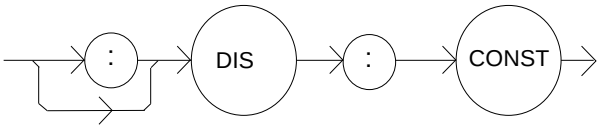
Notes The following commands may be reached directly from the DISplay: command path:

DISplay:CONST
DISplay:LDI
DISplay:PW

DISplay:CONST

FRONT PANEL
REMOTE

The DISplay:CONST command activates the %/PRI display.



Parameters None.

Notes Effects the display only, not the laser drive current mode of operation; this command has no effect when the LDP-3840B is in TRIG mode (external triggering).

In local operation, pressing the DISPLAY switch until the %/PRI indicator is lit has the same effect as issuing this command remotely.

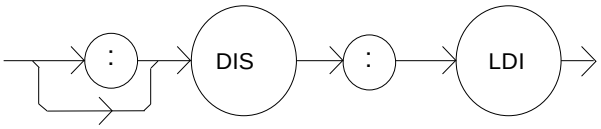
Examples “Mode:PRI; Display:Const” -action: sets the LDP-3840B to constant PRI mode and activates the display to show the PRI set point value.

“Mode:CDC; Dis:CONST” -action: sets the LDP-3840B to constant duty cycle mode and activates the display to show the duty cycle percentage set point value.

DISplay:LDI

FRONT PANEL
REMOTE

The DISplay:LDI command activates the display to show current (LDI).



Parameters None.

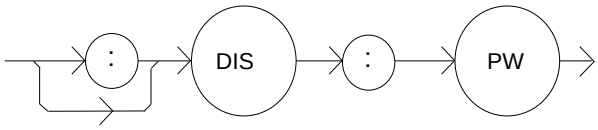
Notes In local operation, the I display will show the laser drive current set point when the DISPLAY switch is pressed until the I indicator is lit, or the ADJUST knob is turned. Otherwise, the actual laser drive current is displayed.

Examples “DIS:LDI” -action: activates the display to show laser drive current.
“Disp:Ldi” -action: activates the display to show the laser drive current.

DISplay:PW

FRONT PANEL
REMOTE

The DISplay:PW command activates the pulse width display.



Parameters None.

Notes Effects the display only, not the laser drive current mode of operation.

In local operation, pressing the DISPLAY switch until the PW indicator is list has the same effect as issuing this command remotely.

Examples “Mode:PRI; Display:Pw” -action: sets the LDP-3840B to constant PRI mode and activates the display to show the pulse width (PW) value.

ENABle:

FRONT PANEL
REMOTE

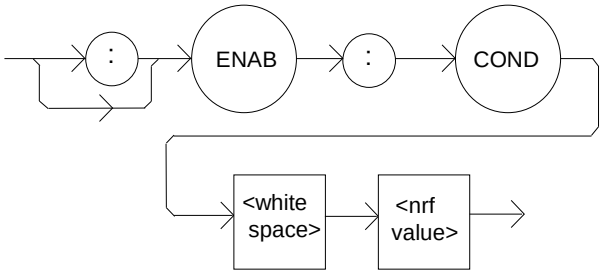
The ENABle: command is used to get to the LDP-3840B’s status enable commands.

Notes The following commands may be reached directly from the ENABle: command path:
ENABle:COND
ENABle:COND?
ENABle:EVEnt
ENABle:EVEnt?
ENABle:OUTOFF
ENABle:OUTOFF?

ENABle:COND

FRONT PANEL
REMOTE

The ENABle:COND command sets the condition status enable register of the operations for summary (in bit 3 of the status byte) and generation of service requests.



Parameters An <nrf value> whose sum represents the enabled bits:

1 - Laser Drive Current Limit	256 - N/A
2 - N/A	512 - N/A
4 - N/A	1024 - Output On/Off State
8 - N/A	2048 - Ready for Calibration Data State
16 - Interlock/Keylock Open	4096 - Calculation Error
32 - N/A	8192 - Hardware Error
64 - Line Transient	16384 - Software Error
128 - N/A	32768 - N/A

Notes The enabled or disabled conditions can be read by using the ENABle:COND? query.

The condition status can be monitored by the COND? query; if any of the enabled conditions are true, bit 3 of the status byte register will be set.

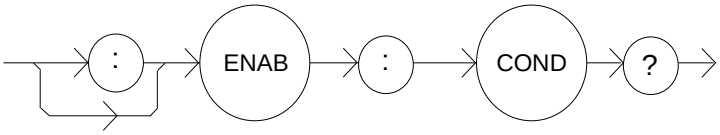
The enable registers normally retain their values at power-up (as they were at the last power-down) unless the power-on status clear flag is set true.

Examples “ENAB:COND 1” -action: enables the status condition register so that laser drive current limit condition will be summarized in the status byte (bit 3).

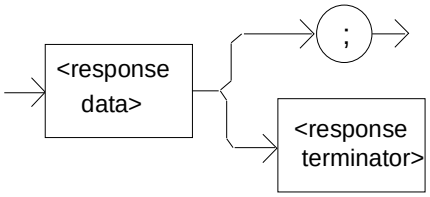
ENABle:COND?

FRONT PANEL
REMOTE

The ENABle:COND? query returns the value of the status condition enable register.



Parameters None. The response will be in the form:



-where the response is the sum of the following:

1 - Laser Drive Current Limit	256 - N/A
2 - N/A	512 - N/A
4 - N/A	1024 - Output On/Off State
8 - N/A	2048 - Ready for Calibration Data State
16 - Interlock/Keylock Open	4096 - Calculation Error
32 - N/A	8192 - Hardware Error
64 - Line Transient	16384 - Software Error
128 - N/A	32768 - N/A

Notes The enabled conditions can be set by using the ENABle:COND command.

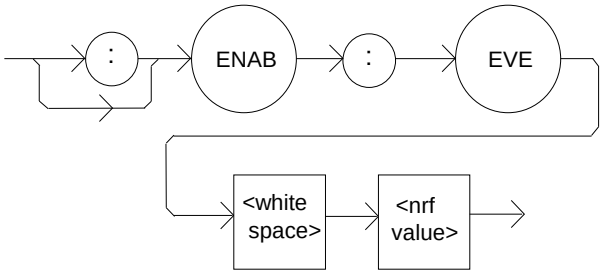
The condition status can be monitored by the COND? query.

Examples “ENAB:COND?” -response: 17, means that the Current Limit and Interlock Open conditions will be reported (in summarized form) to the status byte (bit 3).

ENABle:EVEnt

FRONT PANEL
REMOTE

Sets the status event enable register of the LAS operations. These events are summarized in bit 2 of the status byte register.



Parameters An <nrf value> whose sum represents the bits which are enabled:

1 - Laser Drive Current Limit	256 - N/A
2 - N/A	512 - N/A
4 - N/A	1024 - Output On/Off State Changed
8 - N/A	2048 - N/A
16 - Interlock/Keylock State Changed	4096 - Calculation Error
32 - N/A	8192 - Hardware Error
64 - Line Transient	16384 - Software Error
128 - N/A	32768 - N/A

Notes The enabled events can be read by using the ENABle:EVEnt? query. The Event status can be monitored by the EVEnt? query.

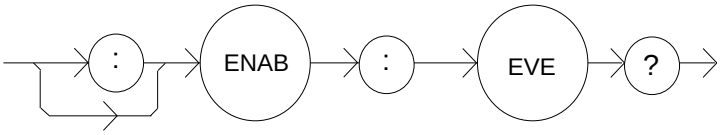
The enable registers normally retain their values at power-up (as they were at the last power-down) unless the power-on status clear flag is set true (see *PSC).

Examples “ENAB:EVENT 17” -action: enables the status event register so that the laser drive current limit and the interlock/keylock state changed events will be reported (in summarized form) to the status byte (bit 2).

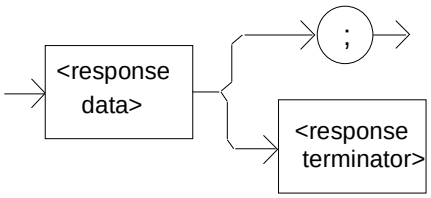
ENABle:EVEnt?

FRONT PANEL
REMOTE

The ENABle:EVEnt? query returns the value of the status Event enable register.



Parameters None. The response will be in the form:



-where the response is the sum of the following:

1 - Laser Drive Current Limit	256 - N/A
2 - N/A	512 - N/A
4 - N/A	1024 - Output On/Off State Changed
8 - N/A	2048 - N/A
16 - Interlock/Keylock State Changed	4096 - Calculation Error
32 - N/A	8192 - Hardware Error
64 - Line Transient	16384 - Software Error
128 - N/A	32768 - N/A

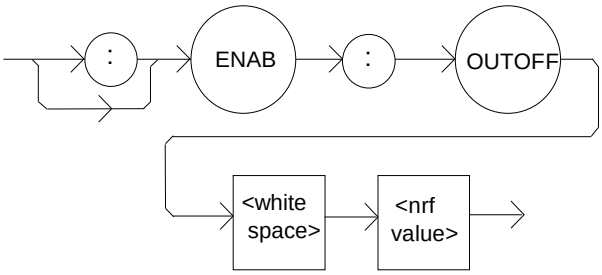
Notes The enabled events can be set by using the ENABle:EVEnt command. The event status can be monitored by the EVEnt? query.

Examples “ENAB:EVE?” -response: 1040, means that the Output on/off state change and Interlock/keylock State Changed events will be reported (in summarized form) to the status byte register (bit 2).

ENABle:OUTOFF

FRONT PANEL
REMOTE

Sets the status outoff enable register for the operations (things which will turn the Laser Drive Current output off).



Parameters An <nrf value> whose sum represents the enabled bits:
1 - Laser Drive Current Limit (all other bits are N/A)

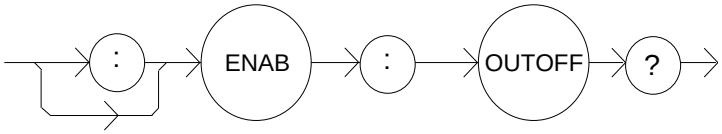
Notes The enabled Outoff bits can be read by using the ENABle:OUTOFF? query; the factory default value for this register is 0.

Examples “ENAB:OUTOFF 1” -action: enables the status Outoff register so that the Laser Drive Current Limit condition will cause the Laser Drive Current output to be turned off.

ENABle:OUTOFF?

FRONT PANEL
REMOTE

Returns the value of the status outoff enable register.



Parameters None. The response will be in the form:
-where the response is the sum of the following:
1 - Laser Drive Current Limit (all other bits are N/A)

Notes The enabled events or conditions which are used to turn the laser drive current output off can be set by using the ENABLE: OUTOFF command. The laser drive current output status can be monitored by the OUT? or COND? query.

Examples “ENAB:OUTOFF” -response: 0, means that the Laser Drive Current Limit condition will not cause the Laser Drive Current output to be turned off.

“ENAB:OUTOFF?” -response: 1, means that the Laser Drive Current Limit condition will cause the Laser Drive Current output to be turned off.

ERRors?

FRONT PANEL
REMOTE

The ERRors? query returns a list of command, execution, and device errors which have occurred since the last ERRors query. These errors are indicated by a number which corresponds to the type of error which occurred. See Appendix B for error code information.

Parameters None. The response will be in the form:
-where each <response data unit> consists of an error code value.

Notes The response data will be a list of the current errors. The errors are represented by numbers and are separated by commas. A response of 0 indicates that no errors were reported. The response data is sent as character data.

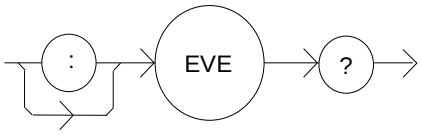
Examples "ERR?" -response: 0, means no errors reported.

"Errors?" -response: 201, means that the <PROGRAM DATA> (command parameter) value out of range error was reported since the last ERRors? query.

EVEnt?

FRONT PANEL
REMOTE

The EVEnt? query returns the value of the status event register.



Parameters None. The response will be in the form:
-where the response is the sum of the following:

1 - Laser Drive Current Limit	256 - N/A
2 - N/A	512 - N/A
4 - N/A	1024 - Output On/Off State Changed
8 - N/A	2048 - N/A
16 - Interlock/Keylock State Changed	4096 - Calculation Error
32 - N/A	8192 - Hardware Error
64 - Line Transient	16384 - Software Error
128 - N/A	32768 - N/A

Notes The events which are summarized in bit 2 of the status byte can be set by using the ENABle:EVEnt command.

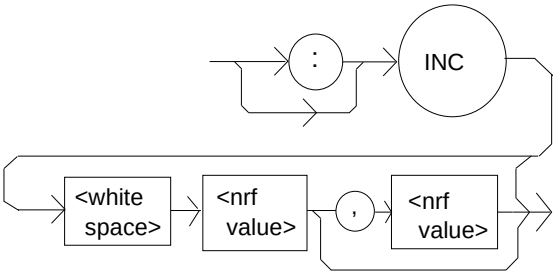
Any bits set in the event status are cleared when the event status is read or when the *CLS command is issued, whereas the condition status bits reflect the continually updated state and are not effected by any query.

Examples "EVE?" -response: 1025, means that the Output On/Off State Changed and Laser Drive Current Limit events occurred since the last EVE? query.

INC

FRONT PANEL
REMOTE

The INC command increments the output current set point by one or more steps. The step size is determined by the STEP command.



Parameters None, 1 or 2. The first optional parameter is the number of steps, and the second operation parameter is the number of mSec between steps (with a practical range of 20 - 50,000 mSec).

Notes The incremental amount is one or more steps. The step size can be edited via the STEP command, its default value is 1 mA.

If the first optional parameter is used, but not the second, the user may decrement the LASER current set point by a multiple of the STEP size, without changing the STEP size.

If both of the optional parameters are used, the user may create an automated stepping ramp function for the LASER output.

The minimum time to complete on increment is about 10 to 20 mSec between steps. When the second parameter is omitted, the delay is minimized.

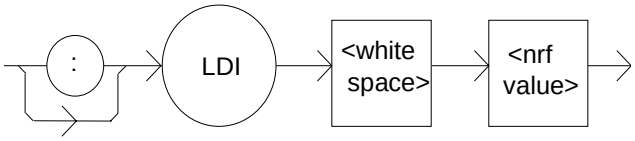
Examples “STEP 30;INC” -action: The Laser Drive Current set point is incremented by 30 mA.

“STEP 1;Inc 100,100” -action: The Laser Drive Current set point is incremented by 1 mA one hundred times, with a delay of about 100 mSec between each step.

LDI

FRONT PANEL
REMOTE

The LDI command sets the Laser Drive Current set point.



Parameters An <nrf value> which represents the Laser Drive Current in mA.

Notes If the LDP-3840B is in CAL:LDI calibration mode, this command is used to enter the measured Laser Diode Current (in mA) to calibrate the Laser Diode Current measurement.

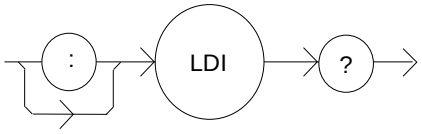
Examples “LDI 40.0” -action: sets the Laser Drive Current to 40 mA.

“ldi 100” -action: sets the Laser Drive Current to 100 mA.

LDI?

FRONT PANEL
REMOTE

The LDI? query returns the value of the actual Laser Drive Current.



Parameters None. The response will be in the form:
-where the response is and <nrf value>.

Notes Response is the actual Laser Drive Current output current, based on the set point value and the output ON/OFF status.

Examples “ldi?” -response: 30, means the Laser Drive Current is 30 mA and the output is on.

LIMit:

FRONT PANEL
REMOTE

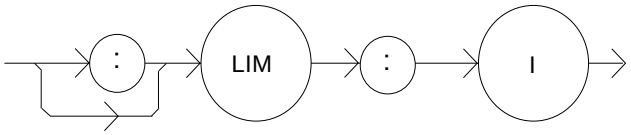
The LIMit: command path is used to get to the LDP-3840B's limit commands and queries.

Notes The following commands and queries may be reached directly from the LIMit:command path:
LIMit:I
LIMit:I?

LIMit:I

FRONT PANEL
REMOTE

The LIMit:I command sets the Laser Drive Current limit value.



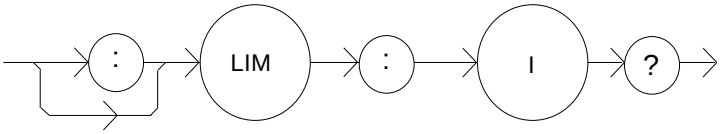
Parameters An <nrf value> which represents the limit current, in mA.
Notes The Laser Drive Current limit is in effect in all modes of operation of the laser output.
Examples "LIM:I 50" -action: the Laser Drive Current limit is set to 50 mA.

"Limit:I 60" -action: the Laser Drive Current limit is set to 60 mA.

Limit:I?

FRONT PANEL
REMOTE

The LIMit:I? query returns the value of the Laser Drive Current limit.



Parameters None. The response will be in the form:
-where the response is an <nrf value>.
Notes The current limit is valid for all modes of laser operation.
Examples "LIM:I?" -response: 40, means the current limit is 40 mA.

"lim:I?" -response: 50, means the current limit is 50 mA.

LOOKUP?

FRONT PANEL
REMOTE

The LOOKUP? query command reads both the A and B constants back to the user for the non-linear portion of the output current response curve.

Parameters None. The response will be in the form:

Notes The response values will be floating point values; these values are the A and B constants in a calibration equation to calibrate the instrument in the non-linear portion of the output current response curve. See CONST? command for calibration values in the linear portion of the response curve.

MESsage

FRONT PANEL
REMOTE

The MESsage command allows the user to enter an ASCII string of up to 16 non-zero characters. This command may be useful for storing messages which relate to a test or configuration.

Parameters An ASCII string which is 1 - 16 bytes in length.

Notes The message may contain any ASCII character, but will be terminated when a NULL terminator character is received. If the message has less than 16 bytes, the software will fill the remaining message space with the space character. After 16 bytes have been entered, the software will null-terminate the string.

Examples MESSAGE “This is a test.” -action: The string, “This is a test.” will be stored in non-volatile memory.

MESsage?

FRONT PANEL
REMOTE

The MESsage? query returns the previously stored message. This message will always be 16 bytes long and enclosed in quotes. The message is entered via the MESsage command.

Parameters None. The response will be in the form:
-where the <response data> is a 16-byte long string.

Notes The response data will be a 16-byte long string. If there is no previously stored message, the response will be " ", all spaces.

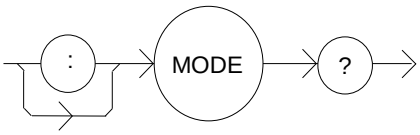
Examples "MES?" -response: "Test 3 ", means the previously stored message was "Test 3".

'Message?" -response: "This is a test ", means the previously stored message was "This is a test."

MODE?

FRONT PANEL
REMOTE

The MODE? query returns the selected laser control mode.



Parameters None. The response will be in the form:
-where the response is character data.

Notes In local operation, the mode is determined by visually checking the MODE indicators.

Examples "Mode?" -response: CDC, means that (CONST %) Constant Duty Cycle (pulsed) mode is in effect for the Laser Drive Current output.

MODE:

FRONT PANEL
REMOTE

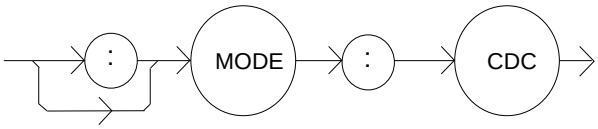
The MODE: command path is used to get to the LDP-3840B's laser mode selection commands.

Notes The following commands may be reached directly from the MODE: command path:
MODE:CDC
MODE:EXT
MODE:PRI

MODE:CDC

FRONT PANEL
REMOTE

The MODE:CDC command selects laser (CONST %) constant duty cycle (pulsed) mode.



Parameters None.

Notes This command has the same effect as selecting CONST % mode on the LDP-3840B front panel.

In this mode, when the pulse width (PW) is edited, the pulse repetition interval is automatically adjusted to match the desired duty cycle percentage. However, if the pulse width is such that the desired duty cycle cannot be achieved (due to the resolution of the pulse on/off times), the duty cycle set point will be changed automatically.

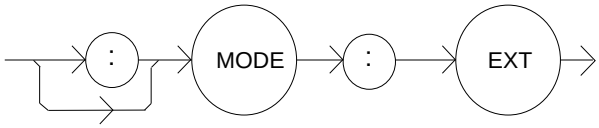
Examples “mode:cdc” -action: enables the laser constant duty cycle (pulsed) mode.

“Mode:CDC” -action: enables the laser constant duty cycle (pulsed) mode.

MODE:EXT

FRONT PANEL
REMOTE

The MODE:EXT command selects External Trigger (TRIG) mode.



Parameters None.

Notes This command has the same effect as selecting EXT TRIG mode on the LDP-3840B front panel.

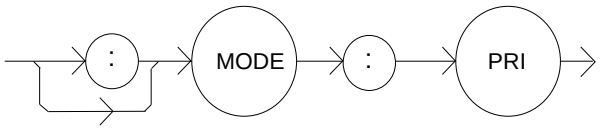
In this mode, the laser drive current output pulse is fired whenever a TTL level input signal is received via the TRIGGER IN (BNC), “TRIG”, connector on the unit’s front panel.

Examples “mode.ext” -action: enables the External Trigger (TRIG) mode.
“Mode:EXT” -action: enables the External Trigger (pulsed) mode.

MODE:PRI

FRONT PANEL
REMOTE

The MODE:PRI command selects Constant Pulse Repetition Interval mode.



Parameters None.

Notes This command has the same effect as selecting CONST PRI mode on the LDP-3840B front panel.

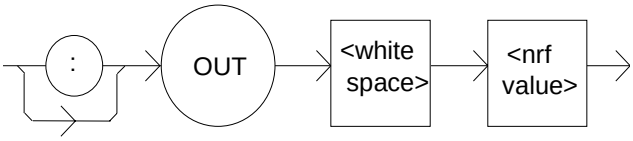
In this mode, the laser drive current Pulse Repetition Interval is constant. However, the PRI value cannot be set less than the PW value.

Examples “MODE:PRI” -action: sets the Laser Drive Current output for Constant Pulse Repetition Interval mode.

OUTput

FRONT PANEL
REMOTE

The OUTput command turns the laser drive current OUTPUT on or off.



Parameters An <nrf value>; 1 = on, 0 = off.

Notes After the OUTPUT is turned on, it is useful to wait until the output is stable before performing further operations (see DELAY command). The two second delay and slow-start circuit in the LDP-3840B requires about 2.5 seconds before the OUTPUT settles (within specification) to a non-zero set point value.

It is safe to connect or disconnect output devices ONLY when the output is OFF.

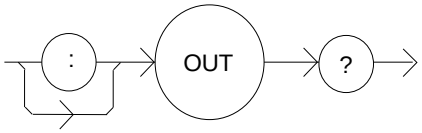
Examples “LDI 20; OUT ON” -action: sets the Laser Drive Current to 20 mA and then turns the OUTPUT on.

“OUT 0” -action: turns the Laser Drive Current OUTPUT off.

OUTput?

FRONT PANEL
REMOTE

The OUTput? query returns the status of the Laser Drive Current OUTPUT.



Parameters None. The response will be in the form:
-where the response is an <nrf value>.

Notes The OUTput? query has the same effect s visually checking the front panel OUTPUT ON indicator. The OUTPUT current may not be activated, even though the response is 1, due to the 2 second OUTPUT on delay.

Examples “OUT?” -response: 0, means that the Current OUTPUT if “off”.
“OUT?” -response: 1, means that the Current OUTPUT if “on”.

POLarity:

FRONT PANEL
REMOTE

The POL: command path is used to get to the LDP-3840B’s laser polarity commands.

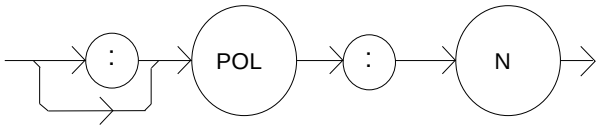
Notes The following commands may be reached directly from the POL: command path.

POL:N
POL:P

POLarity:N

FRONT PANEL
REMOTE

The POL:N command is used to set the polarity of the output current for negative going pulses.



Parameters None.

Notes Changing the polarity forces the output to be turned off and it cannot be turned back on for approximately 4 seconds.

The default polarity is negative.

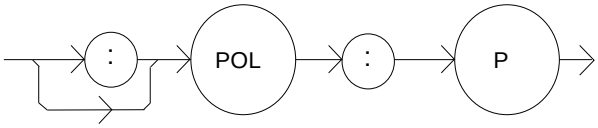
For local operation, the polarity is changed by pressing and holding the MODE switch for 3 seconds.

Examples “POL:N” -action: The output current polarity is set to negative pulses.
“Polarity:N” -action: The output current polarity is set to negative pulses.

POLarity:P

FRONT PANEL
REMOTE

The POL:P command is used to set the polarity of the output current for positive going pulses.



Parameters None.

Notes Changing the polarity forces the output to be turned off and it cannot be turned back on for approximately 4 seconds.

The default polarity is positive.

For local operation, the polarity is changed by pressing and holding the MODE switch for 3 seconds.

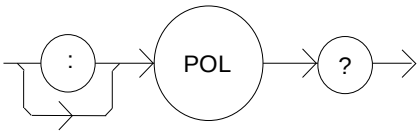
Examples “Pol:p” -action: The output current polarity is set to positive pulses.

“Polarity:P” -action: The output current polarity is set to positive pulses.

POLarity?

FRONT PANEL
REMOTE

The POL? query returns the output current polarity.



Parameters None. The response will be in the form:
-where the response is a character, where ‘P’ = positive, ‘N’ = negative.

Notes In local operation, the polarity is read by viewing the P and N indicators on the front panel.

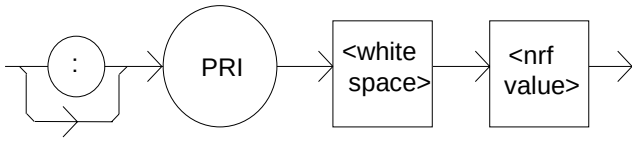
Examples “pol?” -response: ‘N’ means the pulse output has negative polarity.

“POLar?” -response: ‘P’ means the pulse output has positive polarity.

PRI

FRONT PANEL
REMOTE

The PRI command is used to set the value of the Pulse Repetition Interval, in mSec, for use in constant PRI mode.



Parameters An <nrf value> which represents the pulse repetition interval, in mSec.

Notes This value may be set remotely only while in constant PRI mode. In all other modes, the value is ignored, but no error is generated.

In local operation, this parameter can only be set while operating in constant PRI mode.

The set PRI value is limited to be greater or equal to 10 times the present PW value. If a value for PRI is entered which is less than 10 times the present PW value, it will be automatically adjusted to equal PW times 10. Thus, duty cycle cannot exceed 10%.

The range of values of PRI is 0.001 - 6.500 mSec.

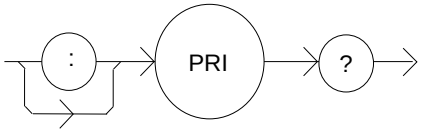
Examples “PRI 4.00” -action: The PRI is set to 4.000 mSec.

“PW 200; PRI .5” -action: The pulse width is set to 200.0 uSec, then the PRI is set to 2.00 mSec (since it cannot be less than PW times 10).

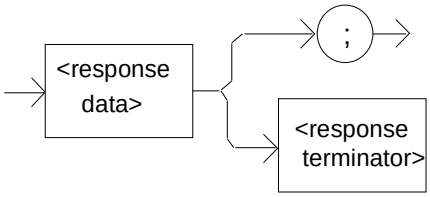
PRI?

FRONT PANEL
REMOTE

The PRI? query returns the value of the actual pulse repetition interval, in mSec.



Parameters None. The response will be in the form:



-where the response is an <nrf value>.

Notes The response is in mSec.

The actual PRI value is not valid when in external trigger mode.

The actual PRI value is usually different than the SET:PRI value, unless the LDP-3840B is in constant PRI mode.

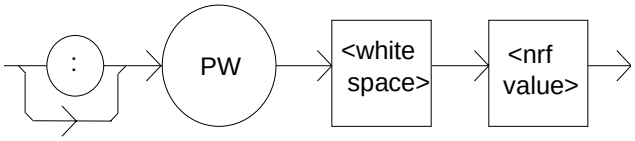
Examples “pri?” -response: 0.906 means the actual pulse repetition interval is 0.906 mSec.

“PRI?” -response: 1.202 means the actual pulse repetition interval is 1.202 mSec.

PW

FRONT PANEL
REMOTE

The PW command is used to set the value of the Pulse Width in uSec, for use in all pulsed modes.



Parameters An <nrf value> which represents the pulse width, in uSec.

Notes The PW value is limited to be less than or equal to the present PRI value divided by 10. If a value of PW is entered which is greater than the present PRI value divided by 10, it will be automatically adjusted to equal PRI divided by 10. Thus the duty cycle cannot exceed 10%.

Editing the PW value may change the constant duty cycle percentage (due to the resolution of the pulse width and pulse repetition interval parameters).

The range of values of PW is 0.1 - 10.0 uSec.

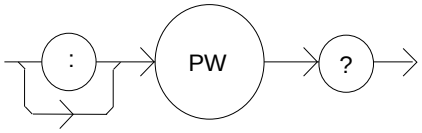
Examples "PW 4" -action: The PW is set to 4.0 uSec.

"MODE:PRI; PRI .002; PW .5" -action: PRI mode is selected. The pulse repetition interval is set to 0.002 mSec, then the PW is set to 0.2 uSec (since it cannot be greater than the actual PRI/10).

PW?

FRONT PANEL
REMOTE

The PW? query returns the value of the pulse width, in uSec.



Parameters None. The response will be in the form:
-where the response is an <nrf value>.

Notes The response is in uSec.

The pulse width is limited to be less than or equal to the present (actual) PRI value divided by 10.

Examples "pw?" -response: 9.6 means the pulse width is 9.6 uSec.

"PW?" -response: 1.2 means the pulse width is 1.2 uSec.

RADix

FRONT PANEL
REMOTE

The RADix command allows the programmer to select the radix type for status, condition, and event query response data. Decimal, binary, hexadecimal and octal are allowed.

Parameters Character program data is expected, as shown above.

Notes DECimal is the default type. Only the first three letters of the words decimal, hexadecimal, binary or octal are required.

When the RADIX is selected, all status, condition, and event queries will return values in the new radix.

In the cases where the radix is not DECimal, the flexible numeric type <nrf value> (as shown in the Command Reference diagrams) will be replaced by HEX, BIN or OCT representation.

All of the above radixes may be used to enter program data at any time, without the need for issuing the RADix command. The proper prefix must also be used with Hex (#H), binary (#B) or octal (#O).

This command may be useful for setting up status reporting blocks. The bit-wise status representation may be more easily read in BIN or HEX.

Examples

"RAD dec" -action: the decimal radix is selected.

"rad hex; *ESR?" -action: the hexadecimal radix is selected; -response: #H80, means power-on was detected.

"RADIX BIN" -action: the binary radix is selected.

"rad octal" -action: the octal radix is selected.

RADix?

FRONT PANEL
REMOTE

The RADix? query allows the programmer to determine which radix type for status, condition and event query response data is currently selected. Decimal, binary, octal and hexadecimal are allowed.

Parameters

None. The response will be in the form:
-where the character response data of DEC means decimal, BIN means binary, HEX means hexadecimal and OCT means octal.

Notes

DEC is the default type. The LDP-3840B defaults to this radix at power-up.

The RADix command is used to select the desired radix. Once it is changed, the new radix will remain in effect until the power is shut off or a new RADix command is issued.

Examples

"RAD?" -response: Dec, means the selected radix is decimal.

"rad?" -response: Hex, means the selected radix is hexadecimal.

"RADIX?" -response: Oct, means the selected radix is octal.

SET:

FRONT PANEL
REMOTE

The SET: command path is used to get to the LDP-3840B's laser set point queries.

Notes

The following commands may be reached directly from the SET: command path:

SET:CDC?

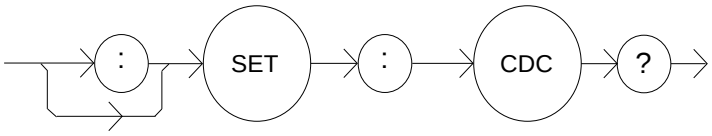
SET:LDI?

SET:PRI?

SET:CDC?

FRONT PANEL
REMOTE

The SET:CDC? query returns the constant duty cycle value which is used in Constant Duty Cycle Percent (CONST %) mode.



Parameters None. The response will be in the form:
-where the response is an <nrf value> which represents the constant duty cycle set point value, as a percentage.

Notes The set point value does not change when the Laser Drive Current output mode is changed.

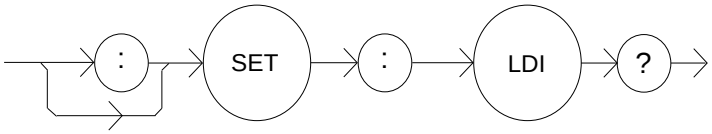
The actual duty cycle percentage may vary from the set point. If a (set point) value of CDC is entered which is not valid (due to the present PW and the limitation of CDC based on the resolution of PW and PRI), the CDC value will automatically be adjusted to the closest valid value. For more information, see the CDC command.

Examples “SET:CDC?” -response: 5.0, means the constant duty cycle set point is 5.00%
“set:cdc?” -response: 2.01 means the constant duty cycle set point is 2.01%.

SET:LDI?

FRONT PANEL
REMOTE

The SET:LDI? query returns the laser drive current set point value which is used for both output ranges.



Parameters None. The response will be in the form:
-where the response is an <nrf value> which represents the Laser Drive Current set point value, in mA.

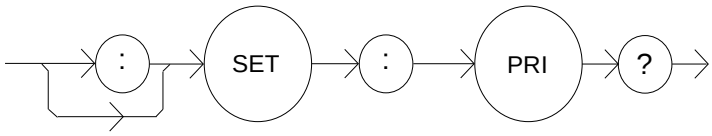
Notes The set point value does not change when the Laser Drive Current range is changed, unless it is over the limit for the new range. In that case, it would be changed to the limit value of the selected range.

Examples “SET:LDI?” -response: 50, means the Laser Drive Current set point value is 50 mA.
“set:Ldi” -response: 120.0 means the Laser Drive Current set point value is 120 mA.

SET:PRI?

FRONT PANEL
REMOTE

The SET:PRI? query returns the Constant Pulse Repetition Interval set point value which is used in CONST PRI mode.



Parameters None. The response will be in the form:
-where the response is an <nrf value> which represents the constant pulse repetition interval set point value, in mSec.

Notes The set point value does not change when the Laser Drive Current output mode is changed.

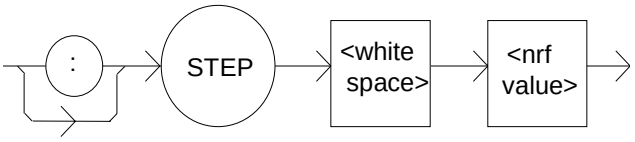
Examples “SET:PRI?” -response: 5.0, means the PRI set point (for constant PRI mode) is 5.00 mSec.

“set:pri?” -response: 1.203, means the PRI set point (for constant PRI mode) is 1.203 mSec.

STEP

FRONT PANEL
REMOTE

The STEP command is used to increment or decrement the selected Laser Drive Current set point by the given amount, when used with the INC or DEC command.



Parameters A value of the step amount, in the range 1 to 100 (steps).

Notes The step of 1 corresponds to 1 mA.

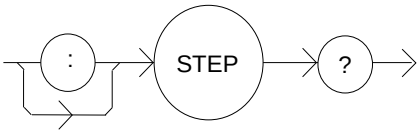
Examples “Idi 20; Step 1; Inc; set:Idi?” -action: sets the step to 1 mA, so the set:Idi? query will return a value of 21.0 mA.

“STEP 10” -action: sets the step size to 10 mA.

STEP?

FRONT PANEL
REMOTE

The STEP? query is used to read back the STEP value. This value is used to increment or decrement the Laser Drive Current set point by the given amount, when used with the INC or DEC command.



Parameters None. The response will be in the form:
-where the response is an <nrf value> of the step amount.

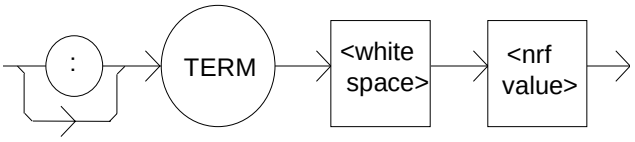
Notes The step of 1 corresponds to a step of 1 mA.

Examples “Step?” -response: 1.0 means the step size is 1 mA.

TERM

FRONT PANEL
REMOTE

The TERM command allows the programmer to select the message terminator type for GPIB messages. <CR> (carriage return), <CR><NL> (new line), <CR><^END> (EOI), <CR><NL><^END>, <NL><^END>, <NL> and <^END> are allowed.



Parameters An <nrf value>, where 0 = <CR><NL><^END>, 1 = <CR><NL>, 2 = <CR><^END>, 3 = <CR>, 4 = <NL><^END>, 5 = <NL> and 6 = <^END>.

Notes <CR><NL>N^END> (0) is the default type. This is not truly the IEEE-488.2 specification. However, the <CR> character is ignored as <white space> by the IEEE-488.2 specification, so this terminator may be used with other IEEE-488.2 compliant instruments. (The <CR> has been left in our default terminator due to its historical usage).

Setting the terminator to anything other than number 4, <NL><^END> puts the LDP-3840B out of compliance with the IEEE-488.2 specification. However, the other options are given here to allow compatibility with GPIB drivers which do not meet IEEE-488.2 specification.

Use of terminator number 3 is especially risky with other devices which comply with IEEE-488.2 specification. This is because the <CR> character is ignored, treated as

<white space>. Therefore, if number 3 terminator is used, other IEEE-488.2 devices may wait indefinitely for message termination and "hang up" the GPIB.

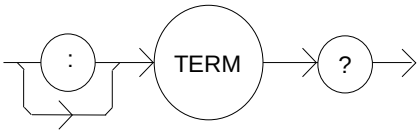
Examples "TERM 5" -action: the <NL> (new line) terminator is selected. The LDP-3840B will terminate a message with the <NL> character.

"Term 4" -action: the <NL> (new line) <^END> (EOI) terminator is selected. The LDP-3840B will terminate a message with the <NL><^END> characters, in succession, and in that order.

TERM?

FRONT PANEL
REMOTE

The TERM? query allows the programmer to determine which program message terminator is currently selected. <CR> (carriage return), <CR><NL> (new line), <CR><^END> (EOI), <CR><NL><^END>, <NL><^END>, <NL> and <^END> are allowed.



Parameters None. The response will be in form:
-where 0 = <CR><NL><^END>, 1 = <CR><NL>, 2 = <CR><^END>, 3 = <CR>, 4 = <NL><^END>, 5 = <NL> and 6 = <^END>.

Notes <CR><NL><^END> (number 0) is the default type.

Use of any terminator, other than number 4, removes the LDP-3840B from strict compliance with IEEE-488.2 standards.

Although the <CR> is recognized as <white space> by the IEEE-488.2 standard, it is used as a possible terminator in order to be compatible with GPIB products which do not meet IEEE-488.2 specification.

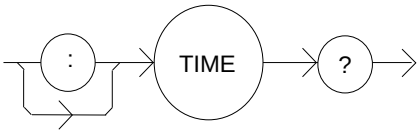
Examples "Term?" -response: 0, means the selected program message terminator is the <CR><NL><^END> characters, in succession, in that order.

"TERM?" -response: 2, means the selected program message terminator is the <CR><^END> characters, in succession, and in that order.

TIME?

FRONT PANEL
REMOTE

The TIME? query allows the programmer to determine how much time has passed since the LDP-3840B was last powered up.



Parameters None. The response will be in the form:
-where the response is character data in the form: hours:minutes:seconds.

Notes The TIME clock is independent of the TIMER clock.

The clock “turns over” after about 1193 hours.

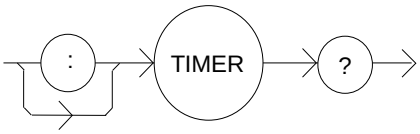
Examples “Time?” -response: 0:01:02.36, means that 1 minute and 2.36 seconds have passed since the LDP-3840B was powered up.

“TIME?” -response: 0:32:00.76, means that 32 minutes and 0.76 seconds have passed since the LDP-3840B was powered up.

TIMER?

FRONT PANEL
REMOTE

The TIMER? query allows the programmer to determine how much time has passed since the last TIMER? query was issued.



Parameters None. The response will be in the form:
-where the response is character data which represents hours:minutes:seconds.

Notes Each time the TIMER? query is issued, the timer is reset to 0 and the elapsed time since the last TIMER? query is returned.

The timer counter is initially set at power-up, the same as the TIME? counter. So the first time the TIMER? is issued, its response will be the same as if a TIME? query response.

The clock “turns over” after about 1193 hours.

Examples “Timer?” -response: 0:02:00.31, means the LDP-3840B has been on for 2 minutes and 0.31 seconds since the last TIMER? query was issued.

“TIMER?” -response: 0:00:12.03, means the LDP-3840B has been on for 12.03 seconds since the last TIMER? query was issued.

Error Messages

Error messages may appear on the display when error conditions occur in the LDP-3840B.

In remote operation, the current error list can be read by issuing the “ERR?” query. When this is done, a string will be returned containing the previously unread error messages (up to ten) which are currently in the error message queue.

Appendix B contains an explanation of the error messages which may be reported by the LDP-3840B on the display or via remote operation.

CHAPTER 5

MAINTENANCE

This chapter describes how to maintain the LDP-3840B. Included are sections covering calibration, fuse replacement line voltage selection and disassembly.

WARNING

The service procedures described in this chapter are for use by qualified personnel. Potentially lethal voltages exist within the LDP-3840B Series Pulsed Current Source.

To avoid electric shock, do not perform any of the procedures described in this chapter unless you are qualified to do so.

Qualified personnel are required to wear protective eyeglasses and anti-static wrist bands while working on the LDP-3840B Series Pulsed Current Source circuit boards.

CAUTION

High voltages are present on and around the printed circuit boards of the LDP-3840B Pulsed Current Source.

Calibration Overview

The LDP-3840B should be calibrated every 12 months or whenever performance indicates that calibration is necessary.

All calibrations can be done with the case closed. Calibrate the instrument under laboratory conditions, i.e., 23 ^{o}C $\pm$ 1 ^{o}C. The LDP-3840B may be calibrated at its intended use temperature if this is within the specified operating temperature range of 10^{o} to 40 ^{o}C.

Before calibration, the LDP-3840B should be allowed to warm up for at least one hour. Calibration can be performed locally (calibration data entered through the front panel), or remotely (instrument control and calibration data entered with a command program through the GPIB/IEEE interface). The following sections describe local and remote calibration of the LDP-3840B.

Recommended Equipment

For optimal calibration results the recommended test equipment for calibrating the LDC-3840B Series Pulsed Current Source is listed in Table 5.1. Caution should be exercised if the test equipment performance is less than that specified especially in the choice or availability of an oscilloscope. This will greatly impact the accuracy of the calibration. Equipment other than that shown in the table may be used if the specifications meet or exceed those listed.

Description	Manufacturing/Model	Specification
DMM	HP-3457A	Resistance (@10 Ω); 0.02%
Oscilloscope[1]	TDS-320	Tektronix (or equivalent)
Cal. Fixture	LPB-380	ILX laser diode mounting board
50 Ω Terminator[2]		ILX SMB terminator
Monitor Cable	LPC-388	ILX C/V monitor cable

Table 5.1 Recommended Test Equipment

1. For best results, measurement averaging should be enabled through the “Acquire” menu. We recommend averaging no less than 16 measurements and using the “Measurement - Amplitude” function.
2. Comes with LPB380 adapter boards.

Local Calibration

The following procedure is for local calibration of the LDP-3840B.

a Connect the LDP-3840B to an appropriate AC source. Turn the power on and allow the LDP-3840B to warm up for at least one hour. Turn the KEYLOCK switch to the ENABLED position.

b Set the laser drive current to 1 A. For best results, set the current limit (I LIMIT) to full scale. Set the pulse width to 1.1 uS and the duty cycle to 1%.

Note: The I LIMIT must be set greater than or equal to 1800 mA for the calibration to work. If this condition is not met, error #516 will be generated.

c Before connecting the calibration fixture to the instrument, measure and record the resistance across the current monitor output of the calibration fixture (laser mounting board) using the HP multimeter or equivalent. For best results, use the four point probe technique or equivalent compensation to measure 1/2 Ω with 4 1/2 digits of accuracy. The 50 Ω SMB terminator should be used on the current monitor output and the impedance of the oscilloscope probe should be 50 Ω.

d Connect the calibration fixture to the OUTPUT terminals of the LDP-3840B using the ILX CC-380 cable or equivalent 3Ω coax cable. Connect the oscilloscope to the current monitor (SMB connector) on the calibration fixture.

e Enter the instrument calibration mode by pushing the (GPIB) LOCAL and MODE switches at the same time. The display will be blank for a few seconds, and then it will indicate the output current in mA. The output current will be set to 90% of the limit value.

f Measure the pulse amplitude (voltage) with the oscilloscope. Determine the actual current using OHM's law:

V= IR
where,

V = Voltage Pulse
I = Current Pulse
R = Measured resistance of load resistor

g Press and hold in the "DISPLAY" switch and turn the ADJUST knob until the display indicates the same current as calculated in Step f. Release the "DISPLAY" switch to store the new value into non-volatile memory.

h After the "DISPLAY" switch is released, the LDP-3840B will set the OUTPUT to a value of 450 mA. Repeat steps f and g for the second calibration point. After the "DISPLAY" switch is released the LDP-3840B will return to its former state, before calibration. The non-linear calibration will be automatically adjusted, based on the new calibration for the linear response.

If an error occurs during calibration, i.e. the interlock connections are opened, the LDP-3840B will exit calibration mode without changing the calibration values. If this happens, fix the error and repeat the calibration procedure.

Remote Calibration

The following procedure is for calibrating the current source range via remote (GPIB) operation.

a Connect the LDP-3840B to the appropriate AC source. Turn the power on and allow the LDP-3840B to warm up for at least one hour. Turn the KEYLOCK switch to the ENABLED position.

b Before connecting the calibration fixture to the instrument, measure and record the resistance across the current monitor output of the calibration fixture using the HP multimeter or equivalent.

c Connect the calibration fixture to the OUTPUT terminals of the LDP-3840B using the ILX CC-380 cable or equivalent 3Ω coax cable. Connect the oscilloscope to to the current monitor (SMB connector) on the calibration fixture. Connect the 50 Ω terminator to the voltage monitor SMB connector on the calibration fixture.

d Set the current limit (I LIMIT) to full scale with the "LIM:I 3000" command. Set the Pulse Width to 1.1 uS and the duty cycle to 1% with the command: “MODE:CDC; PW 1; CDC 1”.

Note: The I LIMIT must be set greater than or equal to 1800 mA for the calibration to work. If this condition is not met, error #516 will be generated.

e Enter the calibration mode by issuing the "CAL:LDI" command.

f After a 5 second delay, issue the "CAL:LDI?" query. If the LDP-3840B returns "1", it is ready to continue the calibration procedure. If the LDP-3840B returns "0", it is not ready. In that case repeat step f until a "1" is returned.

The "DELAY 5000" command may be used to create the delay. The delay is needed to allow for the CDRH required OUTPUT on delay. The OUTPUT ON sequence does not start until 2 seconds after the OUTPUT is turned on, for safety reasons. An additional 2 seconds is required for the slow-start circuit of the LDP-3840B to stabilize the OUTPUT current to the set point.

If the LDP-3840B returns "0" after the "CAL:LDI?" query, it is recommended to check for errors by issuing the "ERR?" query. If any errors have occurred during the calibration process, the LDP-3840B will abort the calibration process. Therefore, any response other than "0" to the "ERR?" query should be handled before continuing restarting the calibration procedure.

g Measure the pulse amplitude on the oscilloscope (voltage), and calculate the pulse current using Ohm’s Law. Input the calculated pulse current (as an <nrf value>, in mA) via the "LDI <nrf value>" command.

V=I/R
where,

V = Voltage Pulse
I = Current Pulse
R = Measured resistance of load resistor

The measured value of the current should not be entered until the LDP-3840B is

ready to receive it.

h The LDP-3840B will be ready to receive the current value when, after a "CAL:LDI?" query is sent, the response from the LDP-3840B is "1".

After the "LDI" value is entered, the "*OPC?" query may be used to determine when the calibration sequence is done. However, the "*OPC", or "*WAI" command, or "*OPC?" query should not be issued until after the expected "LDI" value is entered, or the system will "hang". This happens because the LDP-3840B will wait indefinitely for an input, yet not allow any input until the calibration is finished.

i Once the actual current value is entered via the "LDI" command, the new calibration value will be stored into non-volatile memory. The "OPC?" query may be used (after the "LDI" value is sent) to determine when the calibration is completed.

The operation complete flag (bit 0 of the Standard Event Status Register) may be used to trigger an interrupt. This type of interrupt is enabled by setting bit 0 of the Service Request Enable register and using the *OPC command.

j After the 1st point calibration is complete, the LDP-3840B will set the output to 450 mA. Repeat steps g and h for the second calibration value. After the lower calibration point value is entered via the "LDI" command, the LDP-3840B will return to the state it was in prior to calibration. The non-linear calibration will be automatically adjusted, based on the new calibration for the linear response.

If an error occurs during calibration, i.e. the interlock connections are opened, the LDP-3840B will exit calibration mode without changing the calibration values. Error events may be retrieved via the "ERR?" query, as explained in Step f. If an error happens during calibration, fix the error and repeat the calibration procedure.

Fuse Replacement

The fuse is accessible from the back panel of the LDP-3840B in the power entry module. Before replacing the fuse, turn power off and disconnect the line cord. Use only the fuses indicated below in Table 5.2.

Line Voltage	Fuse Replacement
100 - 120 V~	1A T 250V~ 5 x 20mm
220 - 240 V~	1A T 250V~ 5 x 20mm

Table 5.2 Fuse Replacement

Line Voltage Selection

Line voltage selection requires opening the case and exposure to potentially lethal voltages. These procedures are to be performed by qualified personnel only. Consult the factory for service information.

APPENDIX A

TROUBLESHOOTING

This appendix is intended to be used as a guide when the LDP-3840B does not perform as expected. It is not a service manual, but rather a guide to alleviating basic problems which may arise during LDP-3840B operation.

If you have difficulty while operating the LDP-3840B, refer to the symptoms listed here. Some of the common causes and corrective actions for these symptoms are listed in this section.

Symptoms	Causes and Corrective Actions
LDP-3840B will not power up	Check the power cord to make sure that is it properly connected. Check the fuse for integrity and proper rating.
OUTPUT does not stay on	Check the display for error messages when the (OUTPUT) ON switch is pressed "on". • "E501" indicates an open interlock. The Interlock Plug must be inserted into the INTLK connector on the back panel and configured for your system interlock or shorted. The ENABLE keyswitch must be in the ON position (turned to the right when facing the rear of the instrument). • "E529" indicates the voltage on the output FET has exceeded specification. This error can be caused by an open circuit, over compliance voltage, or damage to the output stage. Verify the output cable connections and connections to the device are secure. Verify the device compliance voltage will not exceed 10V. Verify the polarity of output current. If this error persists, contact the factory for servicing instructions. • "E533" caused by power line fluctuations. The hardware has detected a drop in line voltage. Check power to instrument. • If GPIB (remote) operation is used, the user should be aware that the conditions which force the OUTPUT off may be changed by the user via the "ENAB:OUTOFF" command. If this command is issued, the current limit (LIM) condition may cause the OUTPUT to be turned off.
Front panel displays "E529"	This error can be caused by an open circuit, over compliance voltage or damage to the output stage. Verify the output cable connections and connections to the device are secure. Verify that device compliance voltage will not exceed 10V. Verify the polarity of output current. In addition, a short can be placed across the anode and cathode pads to verify the operation of the LDP-3840B.
Duty Cycle set point is not constant	The LDP-3840B may force the Duty Cycle (CDC) set point to change to a valid value when and if the Pulse Width (PW) is changed. This is necessary because the resolution of the "on" and "off" times of the Pulse cycle dictate the resulting duty cycle. A resolution of 0.1 uSec for PW and 0.001 mSec for PRI, and a maximum duty cycle of 10% are the limiting factors. Adjust the Pulse Width (PW) first, then edit the Duty Cycle (DC). When editing PW (in CDC mode) it may be necessary to check the duty cycle set point to see if it has changed. Then, if it has changed, adjust the PW and reset duty cycle, as necessary.
Duty Cycle display does not show all possible values	See description for Duty Cycle set point not constant.
Pulse ringing	Poor impedance match to the laser. Refer to technical note TN3840B-2.
No apparent output pulse	Check limit and LAS set point values. Check the connections to the laser and oscilloscope. Refer to technical note TN3840B-2. If necessary, connect the laser mounting board with no laser. If no mounting board is available, connect the oscilloscope to the end of the output cable, i.e. between the shell and center pin of the BNC connector. The input impedance of the oscilloscope probes should be 50 Ω.

Set point current appears to be out of calibration	This could be an impedance mismatch at the laser. Test the output using 100 Ω in parallel with the laser. Refer to technical note TN3840B-2. If tuning the output impedance does not improve the measurement, recalibrate the instrument.
Setting Duty Cycle remotely gets wrong results	This may happen because the resolution of the “on” and “off” times of the pulse cycle dictate the resulting duty cycle. A resolution of 0.1 uSec for PW and PRI is the limiting factor. Therefore, if a value for Duty Cycle (DC) is entered which is not valid (given the present pulse width), the LDP-3840B will automatically adjust the duty cycle set point to the nearest valid value. It is recommended that the user query the duty cycle set point via the “SET:CDC?” query after issuing the “CDC” command. This allows the user to determine if some adjustment is required.
Calibration does not begin	If the error message “E516” is displayed (or returned remotely via the “ERR?” query), it indicates that the laser drive current limit (LIM) is set too low for the present range. It is recommended that the laser drive current limits be set to full scale for the respective output range for calibration.
Error light flashing, but no apparent error	Error messages are only displayed for three seconds. After that, the error light will remain flashing until the error is corrected. In the case of a voltage limit/open circuit error, the error light will remain flashing until the error is corrected and the OUTPUT is turned on again. This is done because the act of turning the OUTPUT off would otherwise remove that error condition. If the error light flashes and the message is missed, and turning the OUTPUT on does not restore the error message, it means that there was an intermittent voltage limit/open circuit condition.
OUTPUT is turned off, but no apparent error	An error condition occurred which turned the OUTPUT off, but the error was corrected before the user read the message. This is most likely caused by an intermittent open in the interlock connection.

APPENDIX B

ERROR MESSAGES

Error messages may appear on the display when error conditions occur in the LDP-3840B Pulsed Current Source. In most cases, the error message will appear for three seconds and then the display will revert to its former state. In the case of multiple error messages, the LDP-3840B may show each message for three seconds in succession.

In remote operation, the current error list can be read by issuing the “ERR?” query. When this is done, a string will be returned containing all of the error messages which are currently in the error message queue.

Table B.2 contains all of the error messages which may be generated by the LDP-3840B Pulsed Current Source. Not all of these messages may appear on the front panel displays. Some refer to GPIB activities only, for example. The error codes are numerically divided into areas of operation. Errors which pertain to the following areas are listed in the ranges shown in Table B.1.

Error Code Range	Area of Operation
E001 to E099	Internal Program Errors
E100 to E199	Parser Errors
E200 to E299	Execution Control Errors
E300 to E399	GPIB Errors
E500 to E599	LASER Control Errors
E700 to E999	Device Errors

Table B.1 Error Code Classifications

Table B.2 LDP-3840B Series Pulsed Current Source Error Message Codes

Error Code	Explanation
E001	Memory allocation failure
E101	<program mnemonic> is too long
E102	<PROGRAM MESSAGE UNIT> is too long
E103	<DEFINITE LENGTH ARBITRARY BLOCK PROGRAM DATA> length too long
E104	<NON-DECIMAL NUMERIC PROGRAM DATA> type not defined
E105	<DECIMAL PROGRAM DATA> exponent not valid
E106	<DECIMAL PROGRAM DATA> digit expected
E107	<DECIMAL PROGRAM DATA> digit not expected
E108	<DECIMAL PROGRAM DATA> more than one decimal point
E109	<DECIMAL PROGRAM DATA> more than one exponential indicator (E)
E110	<SUFFIX PROGRAM DATA> must have digit following sign
E111	<SUFFIX PROGRAM DATA> must have alpha character following operator
E113	<ARBITRARY BLOCK PROGRAM DATA> length less than digit count
E114	<DEFINITE LENGTH BLOCK PROGRAM DATA> premature end of data
E115	<PLACEHOLDER PROGRAM DATA> identifier not valid
E116	Parser syntax error, character was not expected
E120	<program mnemonic> Lookup, word as part of a header path, has no commands
E121	<program mnemonic> Lookup, word as part of a header path, is not found
E122	<program mnemonic> Lookup, cannot find a null entry
E123	<program mnemonic> Lookup, word within context of current path, is not found
E124	<program mnemonic> Lookup, failed because query/command type match failed
E125	<program mnemonic> Lookup, word within context of common command path, is not found
E126	Too few or too many program data elements
E201	<PROGRAM DATA> value out of range
E202	<PROGRAM DATA> will not convert to valid type
E203	Security violation, command is not available without clearance
E204	<PROGRAM DATA> suffix type is not valid
E205	<PROGRAM DATA> is not a boolean value or word
E206	<PROGRAM DATA> will not convert to a signed 16-bit value

Error Code	Explanation
E207	<PROGRAM DATA> will not convert to an unsigned 16-bit value
E208	<PROGRAM DATA> will not convert to a signed 32-bit value
E209	<PROGRAM DATA> will not convert to an unsigned 32-bit value
E210	<PROGRAM DATA> will not convert to a floating point value
E211	<PROGRAM DATA> will not convert to a character value
E212	<PROGRAM DATA> will not convert to a byte array pointer
E213	<PROGRAM DATA> is incorrect block data length
E214	<PROGRAM DATA> length exceeds maximum
E301	A <RESPONSE MESSAGE> was ready, but controller failed to read it. (Query error).
E302	Device was addressed to talk, but controller failed to read all of the <RESPONSE MESSAGE>. (Query error)
E501	LASER interlock disabled output
E504	LASER current limit disabled output
E516	Incorrect configuration for calibration sequence to start (check limit set point)
E529	Overdriving voltage on output FET; see Troubleshooting section
E533	Line Transient forced the laser current output to be OFF
E720 - E975	Invalid internal status reporting error

APPENDIX C

QUICK START GUIDE

Introduction

Check to be sure that the voltage printed on the back panel of the instrument matches the power-line voltage in your area. Connect the LDP-3840B to the proper AC power receptacle and turn the back panel ‘ENABLE” keyswitch to the ON position (to the right when facing the rear of the instrument). Be sure to configure the interlock (INTLK) input on the rear panel for your system or short the plug and insert into the connector. Turn the instrument power on by pushing the front panel POWER switch in. The 3840B will run its standard power-up routine. For a complete description of the power up routine, see Chapter 2.

Setup

Press the PARAM switch to view the I LIMIT value. Then, if needed, turn the adjust knob to select a limit value which is compatible with the laser (or other device) you are using.

Check the polarity of the output for your device (anode or cathode grounded). The LDP-3840B can be configured for either case by switching the output polarity of the current source. LED indicators in the mode section indicate the polarity of the output (positive or negative).

Initialize Test Mode Parameters

CONST % (Constant Duty Cycle) is the default mode. CONST % mode allows the user to adjust the pulse width (PW) while maintaining a constant duty cycle percentage. CONST PRI (Constant Pulse Repetition Interval) mode allows the user to adjust the pulse width while maintaining a constant pulse period.

Pressing the mode switch repeatedly will toggle through the instrument modes and instrument polarity.

The Pulse Width is set by pressing the DISPLAY switch until the PW indicator is lit and then turning the adjust knob to the desired pulse width.

In CONST % mode, set the duty cycle by pressing the DISPLAY switch until the %/PRI indicator is lit and then turn the front panel adjust knob. Valid duty cycles, in percent, are automatically determined by the PW stored in memory (and are based on the resolution of the LDP-3840B pulse circuit on/off times).

In CONST PRI mode, set the PRI by pressing the DISPLAY switch until the %/PRI indicator is lit and then turn the front panel adjust knob. Valid pulse periods, in mS, are automatically determined by the PW stored in memory (and are based on the resolution of the LDP-3840B pulse circuit on/off times).

Connect the Laser

A 3Ω coax cable and laser mounting board has been supplied with the instrument for convenient connection of the laser. Connect the laser to the board, and then connect the laser board to the cable.

For optimum pulse performance we suggest the use of the ILX CC-380 cable supplied with the instrument with the LPB-380 laser mounting board. The output impedance can be matched to tune the pulse with the use of the optional laser mounting boards.

The ILX supplied laser mounting board is highly recommended as they are designed to allow load impedance matching for the best pulse performance at the laser diode. The boards have additional space for soldering load matching resistors. Refer to Technical Note TN3840B-2 for tuning the load for optimum pulse response. If the supplied laser mounting board is not used, the pulse performance of the 3840B is not guaranteed..

The mounting boards come with 50 Ω terminators for the SMB connectors. These terminated loads are needed on the SMB board whenever a oscilloscope or meter is not present. If an oscilloscope or meter are connected to the mounting board, they should be connected in place of the 50 Ω terminator. However, the input impedance of the oscilloscope or meter should also be matched to 50 Ω for accurate measurements.

Adjust the Output Amplitude

Push the DISPLAY switch on the front panel until the I indicator is lit. Adjust the set point to the desired value by turning the adjust knob (the display switch does not have to be held to adjust any of the set points).

Turn the Output On

Turn the OUTPUT on by pressing the ON switch. After a 2 second delay, the LDP-3840B will automatically drive the laser to the set point current.

While the OUTPUT is on, the laser drive current OUTPUT set point and limit may be changed. Also, the pulse width and frequency may be adjusted. If the pulse width is changed, the duty cycle percentage may be automatically altered, if required (due to the limitations of the resolution of the PW and PRI values).

If the mode of operation is changed, the OUTPUT will be disabled.

More Information

The user should read Chapter 2, Operation, to become familiar with all of the features of the LDP-3840B. Remote operation is discussed in Chapters 3 and 4 of this manual.

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