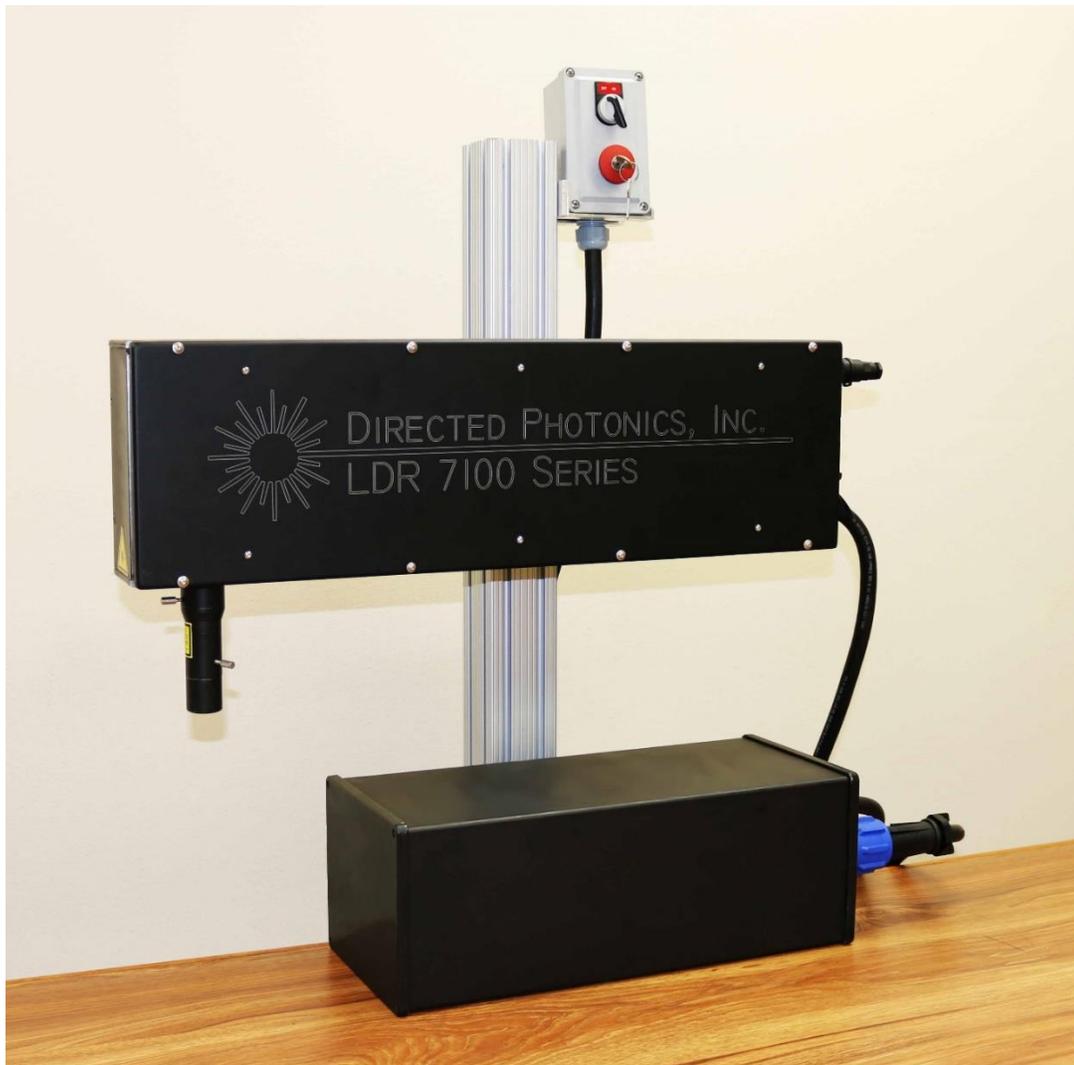


LDR Software Instruction Manual
Revision 1.2
11 April 2016



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LDR Software Manual

Revision 1.2 / 11 APR 2016

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Software Overview and Features

Overview

The LDR Series of digital CO2 Laser Printers are designed to mark moving substrates, flat or curved, at high speed in harsh industrial environments. With an IP65 environmental rating and providing up to 300 peak watts peak of highly focused laser power, the LDR meets the most demanding marking requirements needed for dynamic high-speed production lines in the world today. Dot matrix and high resolution print fonts can be obtained with the standard 7 or 9 laser channels. The LDR marks the culmination of nearly 30 years of development and is the only digital laser coder of its type in the world.

The control software for the LDR system addresses the communication technology developments in the industrial market. The LDR can be operated via hand-held Tablet or Smartphone devices wherein the Tablet or Smartphone (the Smart Interface or herein "SI") running the DPI>>Connect software or App and operating as USB-connected terminal emulators, are able to build, control and command printing of the LDR. Moreover the controlling SI can be removed (or reattached) after marking is enabled and the LDR will continue to operate under automatic control. The automatic print control will be terminated via a series of safety and print control states or commands that can automatically or manually be activated by the user.

Features

The LDR Software Interface has numerous control and interface features which are essential for continuous long-term quality production laser marking and coding:

1. The SI can be operated from any MS-based or Android-based tablet, Tablet or Smartphone using the DPI>>Connect executable or App.
2. The LDR provides a TTY-UART USB interface cable with a USB Type-A connector.
3. Some SI devices run with Micro-USB which can be obtained via a Micro-USB / Type-A OTG interface jumper cable.
4. The mark to be printed is easily assembled from a set of code blocks and can be assembled in any order the user desires using code block formats provided on ancillary support screens.
5. In the mark enabled state, the SI can be removed or reattached at any time.
6. Password protection for the various operating and message assembly parameters may be set by the user.
7. The message screens described later in this document are highly intuitive so that the user can readily and easily navigate the message screens and obtain the desired mark message, format and control.
8. The software updates can be easily installed by the user from website downloads of the updated executables and Apps.
9. Firmware updates can be accomplished in-situ in minutes at the user site via a service call by a trained technician in the event that firmware updates occur.
10. The LDR has a Control Pendant which contains an E-Stop (with key-switch) and an Arming Switch which are key safety devices for the LDR system. When activated these two devices will (i) completely shut down or (ii) disarm (stop marking) of the LDR respectively regardless of the LDR software status.
11. The SI software continuously monitors the status of the LDR including external inputs (such as interlock activation, product detect, encoder inputs, etc.) and internal safety checks (such as laser control status, system temperature, voltage status, etc.) and displays and issues detected in a Fault Log for user action.
12. The LDR printer head will display fault codes even with the SI disconnected via a blue flashing LED that can be viewed through the corner of the top cover. The table for the flashing blue LED Fault Status Lamp gives the flash pattern and associated fault.

Software Fault Code Name	Internal Code	Long Flashes	Short Flashes	Fault Description Text
ERR_CODE_FPGA	0x0101	1	1	FPGA mismatch error
ERR_CODE_INTERLOCK	0x0201	2	1	Interlock Fault
ERR_CODE_KEYSWITCH	0x0202	2	2	Arm Switch Fault
ERR_CODE_DC_POWER	0x0203	2	3	DC Power Fault
ERR_CODE_LASER_84V	0x0204	2	4	Laser 84V Loss
ERR_CODE_LASER_MOD	0x0205	2	5	Laser Modulation
ERR_CODE_DUTY_CYC	0x0206	2	6	Duty Cycle
ERR_CODE_LASER_RF	0x0301	3	1	Laser RF Fault
ERR_CODE_OVER_TEMP	0x0302	3	2	Over Temperature
ERR_CODE_VACUUM	0x0303	3	3	Vacuum Error
ERR_CODE_COOLANT	0x0304	3	4	Coolant Error
ERR_CODE_OVERLAP	0x0305	3	5	Mark Overlap

Table 1. Fault Code Table for Flashing Blue LED Fault Status Lamp

The LDR Series of is the state-of-the-art in industrial digital laser printing. The user will want to check for updates and technical bulletins at the DPI website or from direct DPI technical support noted on the cover of this document.

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1. USB LOGIN Screen

This screen appears first after communication is made between the Tablet/Android device and the LDR. This screen is at the top of the screen hierarchy at Level 1 (see Appendix A for the Software Screens Navigation Map).

Screen Options: The user may chose the default password which is blank (no entry) or set another one at the PASSWORDS Screen on Level 4. The arrow down buttons take the user to Level 2 after the correct Level 2 Password is entered.

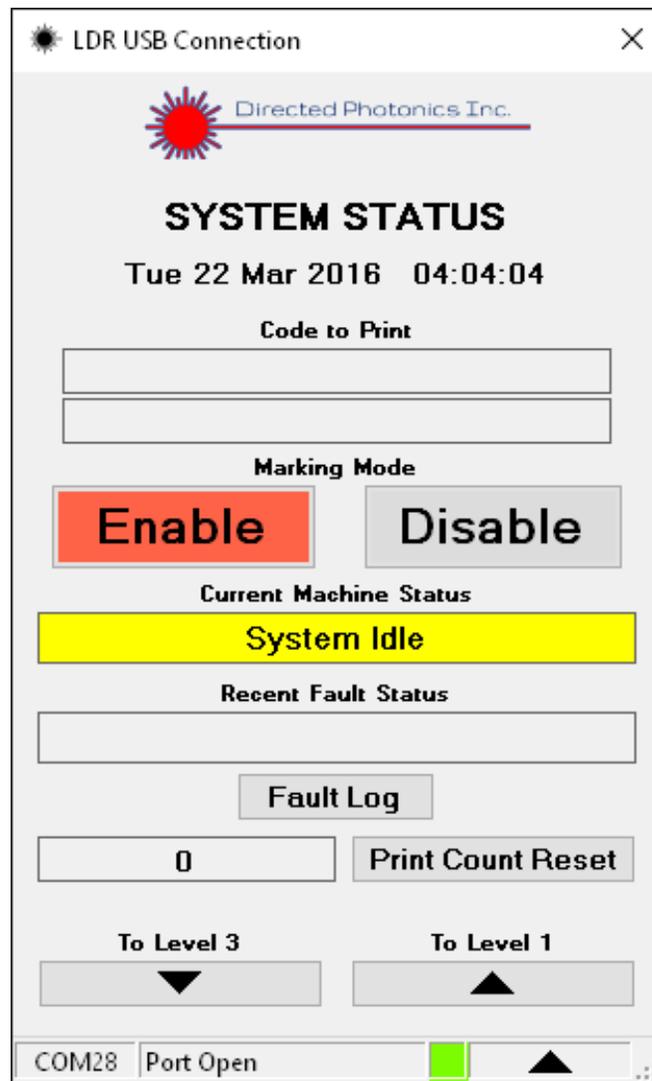


2. SYSTEM STATUS Screen

This screen appears first after the USB LOGIN screen after the correct password is entered and the down arrow is activated in the USB LOGIN screen. This screen is at the top of the screen hierarchy at Level 2 and shows the status of the LDR printer.

Screen Options:

- A. System Idle can be set to system Ready by toggling the Arming Switch on the Control Pendant to the "On" state (either "Off" >> "On" or "On" >> "Off" >> "On"). System Idle must be reset after any hard fault or interlock is activated.
- B. The code to be printed can only be Enabled or Disabled from this screen.
- C. The Fault Log can be accessed where the chronology of any system faults can be viewed and/or reset.
- D. The Print Count can be reset to "0".
- E. Access to Level 1 or the SETUP LOGIN screen for Level 3 may be obtained.

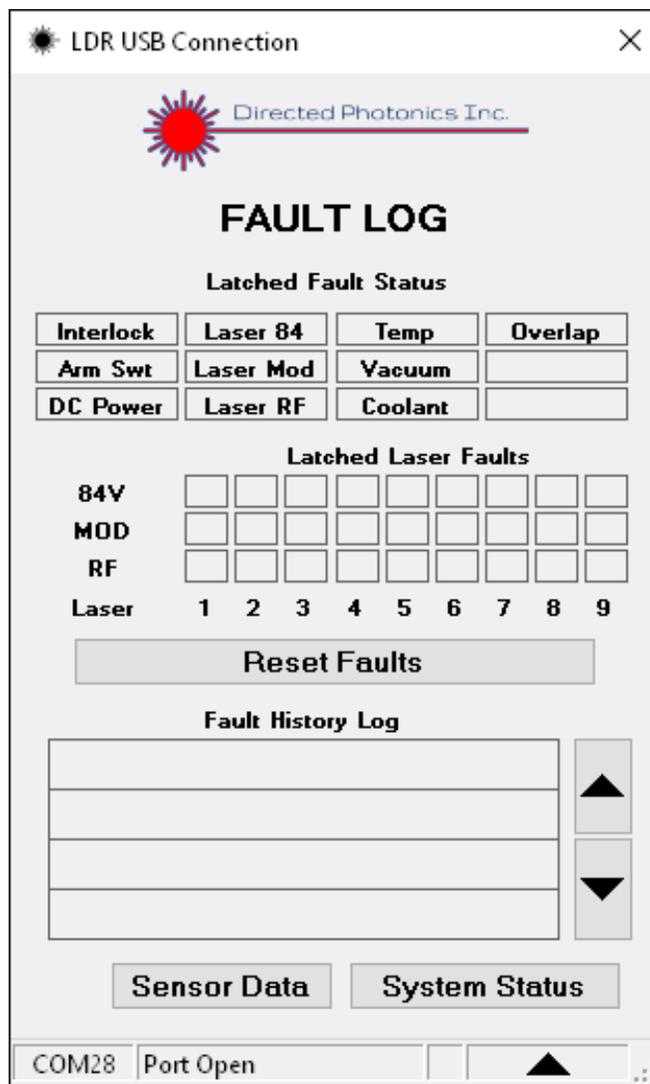


3. FAULT LOG Screen

This screen is only accessed from the SYSTEM STATUS screen and indicates the various possible faults that may be or have been detected. It is present at Level 2 of the screen hierarchy. Observed faults may be warnings (like Temp which indicates high system temperature) or hard faults shutting off printing (like Interlock which means the system interlock is activated and a safety condition is present).

Screen Options:

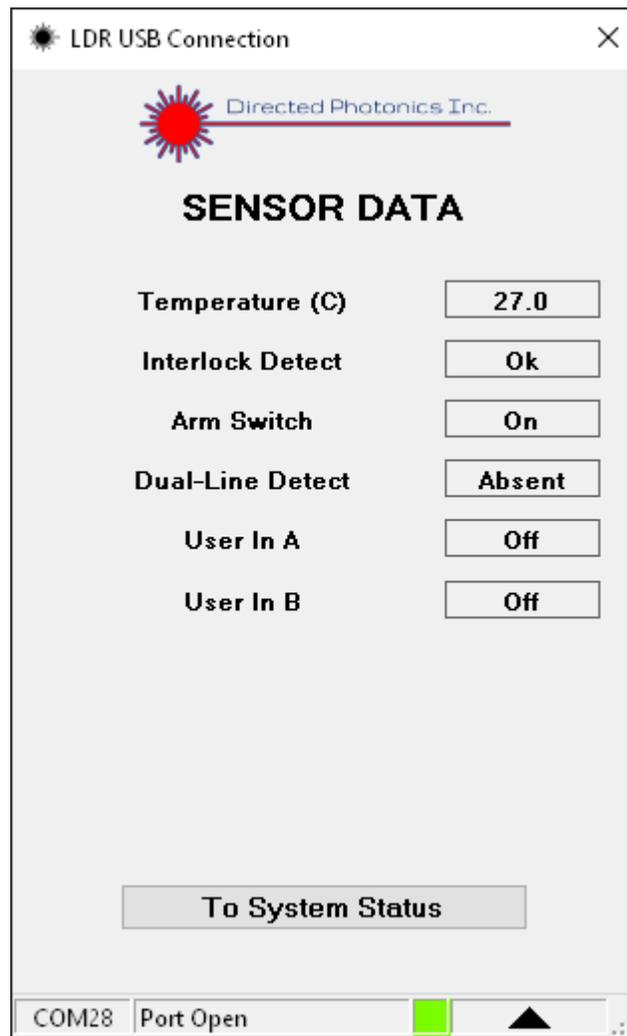
- A. The Reset Faults may be activated to clear the current displayed faults but the Fault History Log will continue to hold any prior fault type and time of occurrence.
- B. The Fault History Log can be scrolled with the Up and Down arrows.
- C. The system Sensor Data can also be accessed from this screen.
- D. The System Status screen can also be accessed from this screen.



4. SENSOR DATA Screen

This screen shows the status of the various system sensors. It is present at Level 2 of the screen hierarchy.

Screen Options: There are no user accessible options from this screen other than a return to the SYSTEM STATUS screen. This screen is strictly for informational purposes only.



5. SETUP LOGIN Screen

This screen allows access to the Level 3 screens via entry of the correct password. The default password is blank but a fixed password may be set in the PASSWORD screen on Level 4. The arrow down must be activated after the Level 3 Password is entered. If the user entered Level 3 Password is blank then this screen will be skipped entirely.

Screen Options: There are no user accessible options from this screen other than a return to the SYSTEM STATUS screen on Level 2.

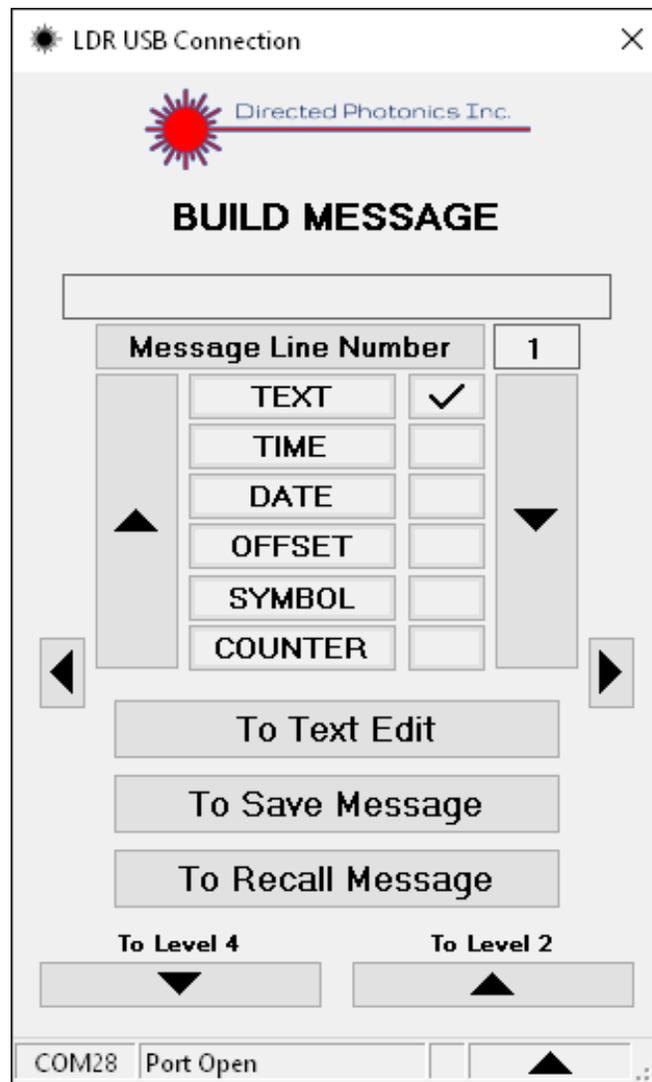


6. BUILD MESSAGE Screen

This screen creates the messages to be printed. It is the primary “hub” screen for the entire LDR control software and it is present at Level 3 of the screen hierarchy.

Screen Options:

- A. The Message Line Number can be chosen (1 or 2). Each message may contain one or two message lines. The 2nd message line only works with dual line printer attachment.
- B. The TEXT, TIME, DATE, OFFSET, SYMBOL and COUNTER can be selected and placed in order of print using the up and down arrows. Coding for each of the six print options are chosen on other menus.
- C. The TEXT EDIT, SAVE MESSAGE and RECALL MESSAGE screens are accessible from this menu.
- D. Access to Levels 2 and 4 are also accessible from this menu without additional passwords for periods of time set by the user on Level 4.
- E. The user may also scroll left or right on Level 3 using the arrow buttons.

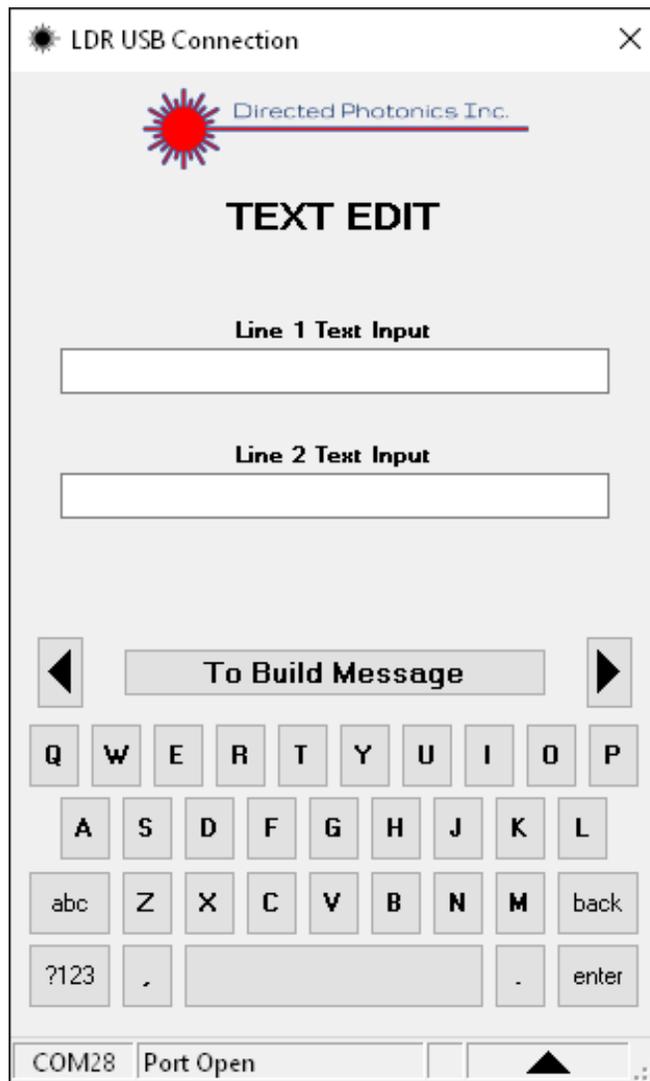


7. TEXT EDIT Screen

This screen is where the text inserts to be printed are created. It is a supporting screen for the LDR message build software and it is present at Level 3 of the screen hierarchy.

Screen Options:

- A. Line 1 and or Line 2 ASCII text codes may be entered in the corresponding entry blocks with a maximum character length of 200 on each line.
- B. The user may access the BUILD MESSAGE Screen.
- C. The user may also scroll left or right on Level 3 using the arrow buttons.



8. SAVE MESSAGE Screen

This screen where the messages can be saved. It is a supporting screen for the LDR message build software and it is present at Level 3 of the screen hierarchy.

Screen Options:

- A. A Message Name may be entered for the corresponding line 1 and Line 2 message entries with 1 being the default entry and 16 being the maximum entry.
- B. A Message Number may be selected via up and down arrow scrolling.
- C. The message is then saved by activating the Save Message button.
- D. Access to the BUILD MESSAGE screen is also available to the user.
- E. The user may also scroll left or right on Level 3 using the arrow buttons.

The screenshot shows a software window titled "LDR USB Connection" with a close button (X) in the top right corner. Below the title bar is the Directed Photonics Inc. logo, which consists of a red sunburst icon and the company name. The main heading is "SAVE MESSAGE". Underneath, it says "Save Message Name and Texts" followed by three empty text input fields. Below these is the "Save Message Number" section, which includes a down arrow, a box containing the number "1", and an up arrow. A large "Save Message" button is positioned below the number. Underneath that is a "To Build Message" button, flanked by left and right arrow buttons. A virtual keyboard is displayed at the bottom of the screen, with keys for Q, W, E, R, T, Y, U, I, O, P; A, S, D, F, G, H, J, K, L; abc, Z, X, C, V, B, N, M, back; and ?123, ., a space bar, ., and enter. At the very bottom, a status bar shows "COM28 Port Open" next to a green indicator light and a right arrow button.

9. RECALL MESSAGE Screen

This screen is where the messages can be recalled. It is a supporting screen for the LDR message build software and it is present at Level 3 of the screen hierarchy.

Screen Options:

- A. A Message Name may be entered for the corresponding line 1 and Line 2 message entries with 1 being the default entry and 16 being the maximum entry.
- B. A Message Number may be selected via up and down arrow scrolling.
- C. The message is then recalled by activating the Recall Message button.
- D. Access to the BUILD MESSAGE screen is also available to the user.
- E. The user may also scroll left or right on Level 3 using the arrow buttons.

The screenshot shows a software window titled "LDR USB Connection" with a close button in the top right corner. Below the title bar is the logo for "Directed Photonics Inc." featuring a red sunburst icon. The main heading is "RECALL MESSAGE". Underneath, the text "Recall Message Name and Texts" is followed by three empty text input fields. Below these is the "Recall Message Number" section, which includes a dropdown arrow on the left, a box containing the number "1", and an upward arrow on the right. A large button labeled "Recall Message" is positioned below the number. Underneath that is a button labeled "To Build Message" flanked by left and right arrow buttons. A virtual keyboard is displayed below the "To Build Message" button, with keys for Q, W, E, R, T, Y, U, I, O, P; A, S, D, F, G, H, J, K, L; abc, Z, X, C, V, B, N, M, back; ?123, ., a wide empty space, ., and enter. At the bottom of the window, a status bar shows "COM28 Port Open" and a small upward arrow icon.

10. MESSAGE FORMAT Screen

This screen allows for messages to be formatted. It is a supporting screen for the LDR message build software and it is present at Level 3 of the screen hierarchy.

Screen Options:

- A. Font Dot Size of 5X5, 5X7, 6X7, 9X7 and Hi Res can be selected by toggling the entry key.
- B. The user entries Message Reverse, Character Flip, Dual Line, All Caps and Double Spacing can each be toggled to the On or Off state.
- C. Bolding can be toggled among the values 1, 2, 3 and 4 with 1 being the default value.
- D. Screen below shows all the default values for this screen.
- E. Access to the BUILD MESSAGE screen is also available to the user.
- F. The user may also scroll left or right on Level 3 using the arrow buttons.

The screenshot shows a window titled "LDR USB Connection" with a close button (X) in the top right corner. Below the title bar is the logo for "Directed Photonics Inc." and the text "MESSAGE FORMAT".

Font Dot Size	5 x 7
Message Reverse	Off
Character Flip	Off
Bolding	1
Dual Line	Off
All Caps	Off
Double Spacing	Off

Below the table is a button labeled "To Build Message" with left and right arrow buttons on either side. Underneath is a keyboard interface with the following keys:

- Row 1: Q, W, E, R, T, Y, U, I, O, P
- Row 2: A, S, D, F, G, H, J, K, L
- Row 3: abc, Z, X, C, V, B, N, M, back
- Row 4: ?123, ., [empty], ., enter

At the bottom of the screen, there is a status bar showing "COM28" and "Port Open" with a small upward-pointing arrow and a multi-dot icon on the right.

11. PRODUCT DETECT Screen

This is the screen where the print activation signal (the “Print Go”) is generated. It is a supporting screen for the LDR message build software and it is present at Level 3 of the screen hierarchy.

Screen Options:

- A. The Product Detect Source can be toggled to the On or Off state.
- B. The Internal PD Timing Divider can be set between 5 and 10000.
- C. The Internal PD Trigger Source can be toggled among the settings Mark Tmr (mark timer), Enc Quad (quadrature encoder), Enc-A (encoder channel A) and Internal.
- D. External PD Source user selections are PDET-A (product detect channel A) or PDET-B (product detect channel B).
- E. Product Detect A Edge and Product Detect B Edge can be both toggled to Rise or Fall.
- F. Mark Enable Mode may be toggled among the entries Pulse or Level.
- G. Screen below shows all the default values for this screen.
- H. Access to the BUILD MESSAGE screen is also available to the user.
- I. The user may also scroll left or right on Level 3 using the arrow buttons.

The screenshot shows a software window titled "LDR USB Connection" with a close button (X) in the top right corner. Below the title bar is the logo for "Directed Photonics Inc." featuring a red sunburst icon. The main heading is "PRODUCT DETECT".

Product Detect Source	External
Internal PD Timing Divider	1000
Internal PD Trigger Source	Mark Tmr
External PD Source	PDET_A
Product Detect A Edge	Rise
Product Detect B Edge	Rise
Mark Enable Mode	Pulse

Below the settings table is a button labeled "To Build Message" with left and right arrow navigation buttons. Underneath is a standard QWERTY keyboard layout. At the bottom of the window, there is a status bar showing "COM28" and "Port Open" next to a small upward-pointing arrow icon.

12. MARK TIMING Screen

This screen where the print timing signal (the “Print Pulse”) is generated. It is a supporting screen for the LDR message build software and it is present at Level 3 of the screen hierarchy.

Screen Options:

- A. The Timing Pulse Source can be toggled to the Internal or External state.
- B. The Internal Timing Pulse can be set between 5 and 5000.
- C. The External Timing Select can be toggled between Pulse and Quad (quadrature).
- D. The External Timing Divider can be set between 1 and 65535.
- E. The Encoder Connection Type can be toggled between CH A+B or CH-A.
- F. Mark Delay (pulse count) can set between 3 and 10000.
- G. Screen below shows all the default values for this screen.
- H. Access to the BUILD MESSAGE screen is also available to the user.
- I. The user may also scroll left or right on Level 3 using the arrow buttons.

The screenshot shows the 'MARK TIMING' screen within the 'LDR USB Connection' application. At the top, there is a logo for 'Directed Photonics Inc.' and the title 'MARK TIMING'. Below the title is a table of settings:

Timing Pulse Source	Internal
Internal Timing Pulse (usec)	200
External Timing Select	Pulse
External Timing Divider	1
Encoder Connection Type	Ch-A+B
Mark Delay (pulse count)	3

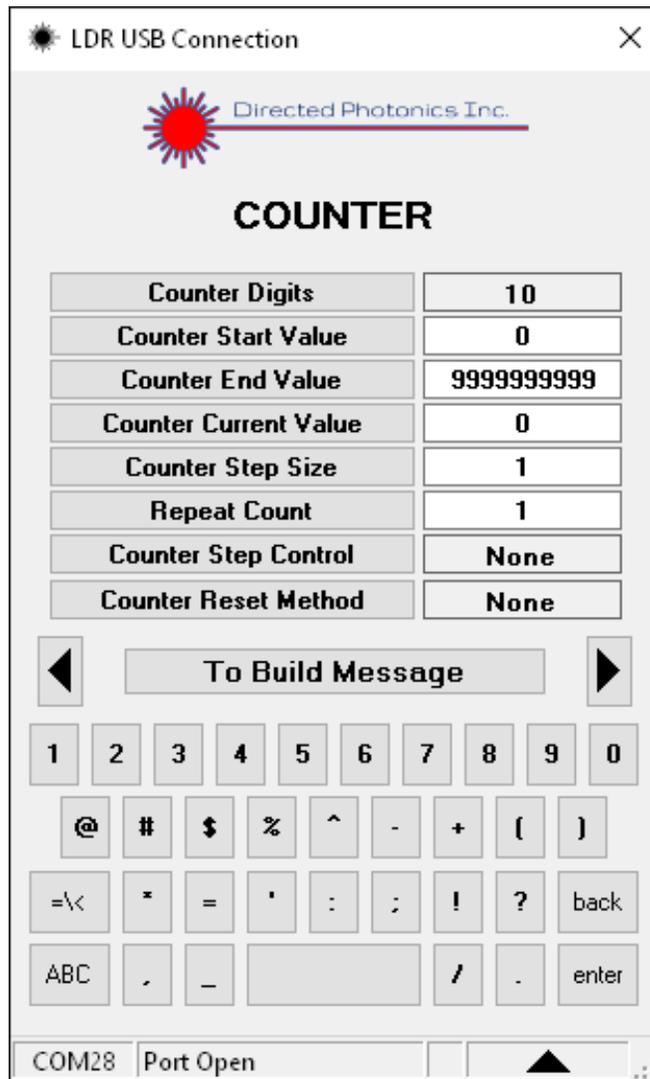
Below the table is a navigation bar with a left arrow, a button labeled 'To Build Message', and a right arrow. Underneath is a virtual keyboard with buttons for digits 1-0, symbols (@, #, \$, %, ^, -, +, [,]), function keys (= \<, *, =, ', :, ;, !, ?, back), and a row with ABC, ., -, /, ., and enter. At the bottom, there is a status bar showing 'COM28' and 'Port Open'.

13. COUNTER Screen

This screen allows the user to sequentially mark products. It is a supporting screen for the LDR message build software and it is present at Level 3 of the screen hierarchy.

Screen Options:

- A. The Counter Digits can be set between 1 and 10 (where the choice of the number 4 yields a maximum count of 9999 before resetting).
- B. The Counter Start Value can be set to any value between 0 and 9999999999.
- C. The Counter End Value can be set to any value between 0 and 9999999999.
- D. The Counter Current Value can be reset to any value between 0 and 9999999999.
- E. The Counter Step Size can be set to any value between 0 and 9999.
- F. The Repeat Count can be set to any value between 0 and 1000.
- G. Counter Step Control can be toggled among None, Prod Det, User In A+/A-, and User In B+/B-.
- H. Counter Reset Method can be toggled between None, User In A+/A-, and User In B+/B-.
- I. Screen below shows all the default values for this screen.
- J. Access to the BUILD MESSAGE screen is also available to the user.
- K. The user may also scroll left or right on Level 3 using the arrow buttons.



14. TIME STAMPS Screen

This screen is where the time to be marked is set. It is a supporting screen for the LDR message build software and it is present at Level 3 of the screen hierarchy.

Screen Options:

- A. The Date Code Format can be toggled among the settings mm/dd/yy, dd-mmm-yy, ddmmyy and jjj (for Julian date).
- B. The Time Code Format can be toggled among the settings hh:mm, HH:mm or Qtr Code (15 minute daily increments between 0 and 96).
- C. The Offset (days) is user adjustable between 0 and 10000 (the number of days to offset from the current date).
- D. Screen below shows all the default values for this screen.
- E. Access to the BUILD MESSAGE screen is also available to the user.
- F. The user may also scroll left or right on Level 3 using the arrow buttons.

The screenshot shows a window titled "LDR USB Connection" with a close button (X) in the top right corner. Below the title bar is the logo for Directed Photonics Inc., which consists of a red sunburst icon and the text "Directed Photonics Inc." with a horizontal line underneath. The main heading is "TIME STAMPS".

Date Code Format	mm/dd/yy
Time Code Format	hh:mm ap
Offset (days)	1

Below the table is a button labeled "To Build Message" with left and right arrow buttons on either side. Underneath is a keyboard with the following layout:

- Row 1: Q, W, E, R, T, Y, U, I, O, P
- Row 2: A, S, D, F, G, H, J, K, L
- Row 3: abc, Z, X, C, V, B, N, M, back
- Row 4: ?123, ., [space], ., enter

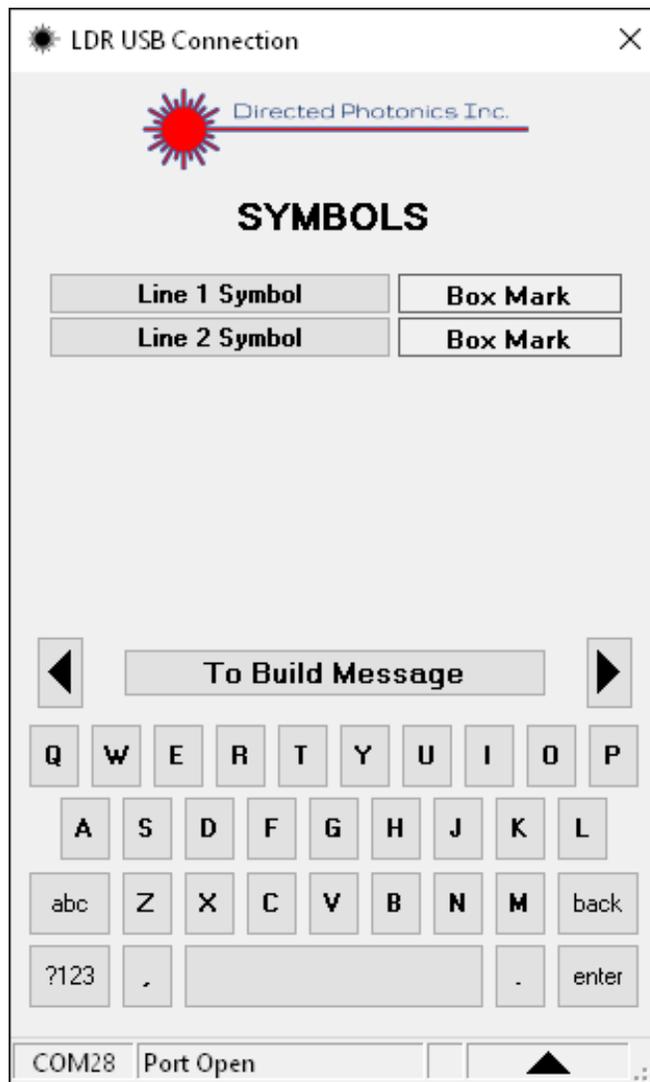
At the bottom of the screen, there is a status bar showing "COM28" and "Port Open" with a green indicator light and a black arrow pointing up.

15. SYMBOLS Screen

This screen is where the user defined Symbol to be marked is selected. It is a supporting screen for the LDR message build software and it is present at Level 3 of the screen hierarchy.

Screen Options:

- A. The Line 1 and Line 2 Symbols are selectable by toggling the corresponding keys.
- B. Current symbol selections programmed into the LDR are Box Mark, Left Wall, Right Wall and Checker Board.
- C. Screen below shows all the default values for this screen.
- D. Access to the BUILD MESSAGE screen is also available to the user.
- E. Assistance with programming the symbols is available from DPI Technical Support.
- F. The user may also scroll left or right on Level 3 using the arrow buttons.



16. LASER PARAMETERS Screen

This screen is where the parameters for laser operation are set. It is a supporting screen for the LDR message build software and it is present at Level 4 of the screen hierarchy.

Screen Options:

- A. The Laser Count may be toggled among the values 5, 7 and 9.
- B. The Pulse Time (usec) may be set between 10 and 500.
- C. The Fault Strobe Position (usec) is adjustable between 25 and 50 but the user is advised to use the default value of 25.
- D. Laser Weighting may be toggled between the On and Off settings.
- E. Laser Channel may be toggled from 1 to 9 and selects the laser channel to be weighted.
- F. Laser Channel Weight (%) may be set between 50 and 150 and allows more or less power per laser channel selected.
- G. Screen below shows all the default values for this screen.
- H. Access to the BUILD MESSAGE screen is also available to the user.
- I. The user may also scroll left or right on Level 4 using the arrow buttons.

The screenshot shows the 'LASER PARAMETERS' screen within the 'LDR USB Connection' application. The interface includes a title bar, a logo for Directed Photonics Inc., and a table of parameters. Below the table is a navigation bar with left and right arrow buttons and a 'To Build Message' button. A numeric keypad is positioned below the navigation bar, and a status bar at the bottom shows 'COM28' and 'Port Open'.

Parameter	Value
Laser Count	7
Pulse Time (usec)	150
Fault Strobe Pos (usec)	25
Laser Weighting Enable	On
Laser Channel	1
Laser Channel Weight (%)	100

Navigation: ◀ To Build Message ▶

Keypad: 1 2 3 4 5 6 7 8 9 0, @ # \$ % ^ - + (), =\< * = ' : ; ! ? back, ABC . _ / . enter

Status: COM28 Port Open

17. REAL TIME CLOCK Screen

This screen is where the parameters for the clock time are set. It is a supporting screen for the LDR message build software and it is present at Level 4 of the screen hierarchy.

Screen Options:

- A. The Time (hhmmss) can be set by the user to any value between 000000 and 235959.
- B. The Date (mmddyy) can be set by the user to any value between 010100 and 123199.
- C. The Set Time/Date to Clock fixes the adjusted settings above to the LDR clock.
- D. Screen below shows all the default values for this screen.
- E. Access to the BUILD MESSAGE screen is also available to the user.
- F. The user may also scroll left or right on Level 4 using the arrow buttons.

LDR USB Connection

Directed Photonics Inc.

REAL TIME CLOCK

Time (hhmmss) 04:05:36

Date (mmddyy) 03/22/16

Set Time/Date To Clock

Current Clock Setting

Tue 22 Mar 2016 04:05:39

To Build Message

1 2 3 4 5 6 7 8 9 0

@ # \$ % ^ - + ()

=\< * = ' : ; ! ? back

ABC . _ / . enter

COM28 Port Open

18. DUAL LINE Screen

This screen is where the parameters for the dual line codes are generated. It is a supporting screen for the LDR message build software and it is present at Level 4 of the screen hierarchy. It is only active when the dual line attachment is detected by the LDR system.

Screen Options:

- A. The Justification Delay is counted in timing pulses and is user adjustable between 10 and 1000.
- B. The Minimum Delay is counted in timing pulses and is user adjustable between 10 and 100.
- C. Print Which Line First may be toggled between 1 (for Line #1) and 2 (for Line #2).
- D. The Mirror Start Position may be toggled by the user between Up or Down.
- E. Screen below shows all the default values for this screen.
- J. Access to the BUILD MESSAGE screen is also available to the user.
- K. The user may also scroll left or right on Level 4 using the arrow buttons.

LDR USB Connection

Directed Photonics Inc.

DUAL-LINE PARAMETERS

Justification Delay	100
Minimum Delay	20
Print Which Line First	1
Mirror Start Position	Up

◀ To Build Message ▶

1 2 3 4 5 6 7 8 9 0

@ # \$ % ^ - + ()

=\< * = ' : ; ! ? back

ABC . - / . enter

COM28 Port Open

19. LASER TEST Screen

This screen is where the parameters for laser testing are set. It is primarily a troubleshooting tool. It is a supporting screen for the LDR message build software and it is present at Level 4 of the screen hierarchy.

Screen Options:

- A. The Pulse Period (usec) is user adjustable between 500 and 1000 (the time between laser pulses).
- B. The Pulse Time (usec) is user adjustable between 50 and 150 (the laser on pulse time).
- C. Trigger Select may be toggled by the user among the settings Menu Key, User In A or User In B.
- D. One or more lasers can be selected for testing by the buttons labeled 1 to 9.
- E. The All Lasers Off button turns off all the lasers being tested.
- F. The Start/Stop Test button is the Menu Key that turns the laser test on and off.
- G. Screen below shows all the default values for this screen.
- H. Access to the BUILD MESSAGE screen is also available to the user.
- I. The user may also scroll left or right on Level 4 using the arrow buttons.

The screenshot shows a software window titled "LDR USB Connection" with a close button (X) in the top right corner. Below the title bar is the logo for "Directed Photonics Inc." featuring a red sunburst icon. The main heading is "LASER TEST".

Pulse Period (usec)	1000
Pulse Time (usec)	100
Trigger Select	Menu Key

Below the table are buttons labeled 1 through 9. Further down are two buttons: "All Lasers Off" and "Start/Stop Test".

Below these are two arrow buttons pointing left and right, with a button in between labeled "To Build Message".

Below that is a row of buttons labeled 1 through 0. At the bottom of the main area is a large box labeled "System Idle State".

At the very bottom of the window is a status bar with "COM28" and "Port Open" on the left, and a small upward-pointing arrow and a three-dot menu icon on the right.

20. COLD START Screen

This screen is where the parameters for cold start are set. It is primarily a system initialization sequence that fires the lasers for a brief period to optimize performance 5 seconds after initiating ENABLE on the SYSTEM STATUS screen. It is a supporting screen for the LDR message build software and it is present at Level 4 of the screen hierarchy.

Screen Options:

- A. The Pulse Period (usec) is user adjustable between 10 and 1000 (the time between laser pulses).
- B. The Pulse Time (usec) is user adjustable between 20 and 50 (the laser on pulse time).
- C. Pulse Count is user adjustable between 100 and 1000.
- D. Enable may be toggled between On and Off.
- E. Screen below shows all the default values for this screen.
- F. Access to the BUILD MESSAGE screen is also available to the user.
- G. The user may also scroll left or right on Level 4 using the arrow buttons.

The screenshot shows a software window titled "LDR USB Connection" with a close button in the top right corner. Below the title bar is the logo for "Directed Photonics Inc." and the text "COLD START".

Pulse Period (usec)	1000
Pulse Time (usec)	50
Pulse Count	500
Enable	Off

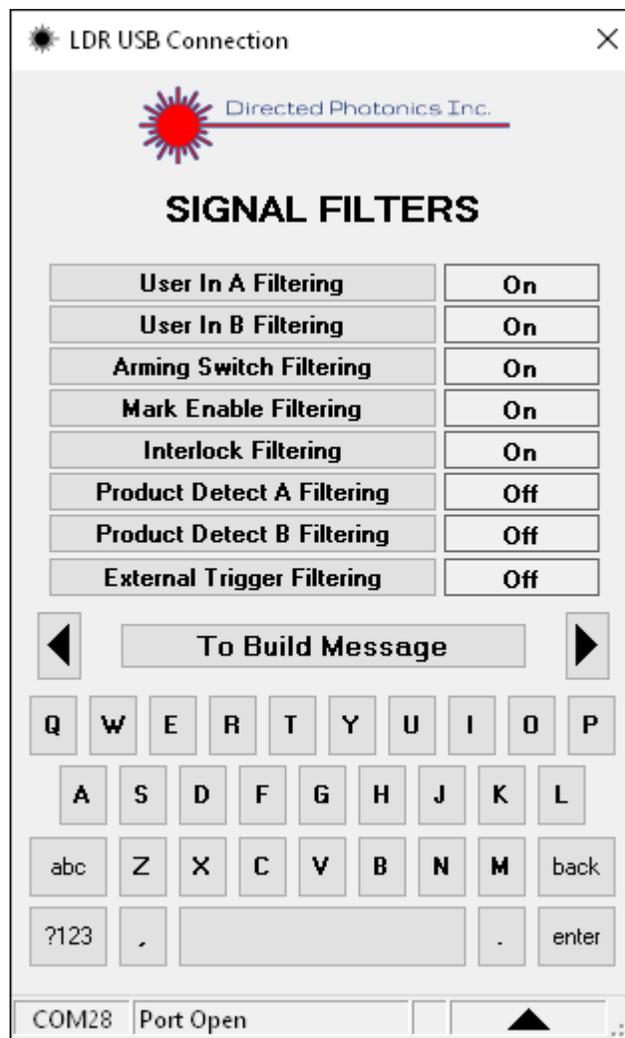
Below the table is a button labeled "To Build Message" with left and right arrow buttons on either side. Underneath is a numeric keypad with digits 1-0, a row of symbols (@, #, \$, %, ^, -, +, (,), =\<, *, =, ', :, ;, !, ?, back), and a row with ABC, ., -, /, ., enter. At the bottom, there is a status bar with "COM28" and "Port Open" and a small upward-pointing arrow button.

21. SIGNAL FILTERS Screen

This screen is where the filtering parameters for the system external inputs are set. It is a supporting screen for the LDR message build software and it is present at Level 4 of the screen hierarchy.

Screen Options:

- A. The user selectable inputs for all option are On or Off.
- B. The filters that are adjustable are self-explanatory by their descriptions.
- C. It is recommended that the user not change the default settings.
- D. Screen below shows all the default values for this screen.
- E. Access to the BUILD MESSAGE screen is also available to the user.
- F. The user may also scroll left or right on Level 4 using the arrow buttons.



22. FAULT CONFIGURATION Screen

This screen is where the fault severity selections are set. It is a supporting screen for the LDR message build software and it is present at Level 4 of the screen hierarchy.

Screen Options:

- A. The Vacuum Sensor and Coolant Sensor inputs may both be toggled by the user among the settings Off, User In A or User In B.
- B. The Vacuum Fault Type and Coolant Fault Type may both be toggled by the user between the settings Warning and Critical.
- C. The Coolant Sensor Delay (sec) may be set by the user between 1 and 30.
- D. The Laser RF Fault Type and Overlap Fault Type may be toggled by the user between the settings Warning and Critical.
- E. It is recommended that the user not change the default settings.
- F. Screen below shows all the default values for this screen.
- G. Access to the BUILD MESSAGE screen is also available to the user.
- H. The user may also scroll left or right on Level 4 using the arrow buttons.

The screenshot shows a software interface titled "LDR USB Connection" with a close button (X) in the top right corner. Below the title bar is the logo for "Directed Photonics Inc." and the main heading "FAULT CONFIGURATION".

Vacuum Sensor	Off
Vacuum Fault Type	Warning
Coolant Sensor	Off
Coolant Fault Type	Warning
Sensor Delay (sec)	1
Laser RF Fault Type	Warning
Overlap Fault Type	Warning

Below the table is a button labeled "To Build Message" with left and right arrow buttons on either side. Underneath is a numeric keypad with digits 1-0 and a row of symbols: @, #, \$, %, ^, -, +, {, }. The next row contains: =\<, *, =, ', :, ;, !, ?, back. The final row contains: ABC, ., -, /, ., enter.

At the bottom, there is a status bar showing "COM28" and "Port Open" with a small upward-pointing arrow and a three-dot menu icon on the right.

23. LED INTENSITY Screen

This screen is where the intensity of the LDR print head LEDs are set. It is a supporting screen for the LDR message build software and it is present at Level 4 of the screen hierarchy. The adjustments are used to compensate for ambient lighting conditions.

Screen Options:

- A. The four (4) LED % selections can all be set by the user between 1 and 100.
- B. The Intensity Control Enable may be toggled between On and Off.
- C. It is recommended that the user not change the default settings.
- D. Screen below shows all the default values for this screen.
- E. Access to the BUILD MESSAGE screen is also available to the user.
- F. The user may also scroll left or right on Level 4 using the arrow buttons.

The screenshot shows a software window titled "LDR USB Connection" with a close button (X) in the top right corner. Below the title bar is the logo for "Directed Photonics Inc." featuring a red sunburst icon. The main heading is "LED INTENSITY".

Red LED (%)	100
Green LED (%)	100
Yellow LED (%)	100
Blue LED (%)	100
Intensity Control Enable	Off

Below the table is a "To Build Message" button flanked by left and right arrow buttons. Underneath is a numeric keypad with buttons for digits 1-0, symbols @, #, \$, %, ^, -, +, (,), =\<, *, =, ', :, ;, !, ?, back, ABC, ., -, /, ., and enter.

At the bottom, there is a status bar showing "COM28" and "Port Open" with a green indicator light and an upward-pointing arrow.

24. PASSWORDS Screen

This screen is where the passwords for the various screen levels selections are set. It is a supporting screen for the LDR message build software and it is present at Level 4 of the screen hierarchy.

Screen Options:

- A. The Login Password (for Level 2 entry) and the Setup Password (for Level 3 and 4 entry) may be set by the user.
- B. The password Bypass Time (min) can be set by the user between 1 and 60 and is the number of minutes the user can stay at Levels 3 and 4 before having to re-enter the Setup Password.
- C. Screen below shows the default values for this screen.
- D. Access to the BUILD MESSAGE screen is also available to the user.
- E. The user may also scroll left or right on Level 4 using the arrow buttons.

The screenshot shows a window titled "LDR USB Connection" with a close button (X) in the top right corner. Below the title bar is the logo for Directed Photonics Inc., which consists of a red sunburst icon and the text "Directed Photonics Inc." with a horizontal line underneath. The main heading is "PASSWORDS" in bold black text. Below this heading are three rows of input fields:

Login Password	<input type="text"/>
Setup Password	<input type="text"/>
Bypass Time (min)	10

Below the input fields is a button labeled "To Build Message" with left and right arrow buttons on either side. Underneath the button is a virtual keyboard with the following layout:

Q	W	E	R	T	Y	U	I	O	P
A	S	D	F	G	H	J	K	L	
abc	Z	X	C	V	B	N	M	back	
?123	.						.	enter	

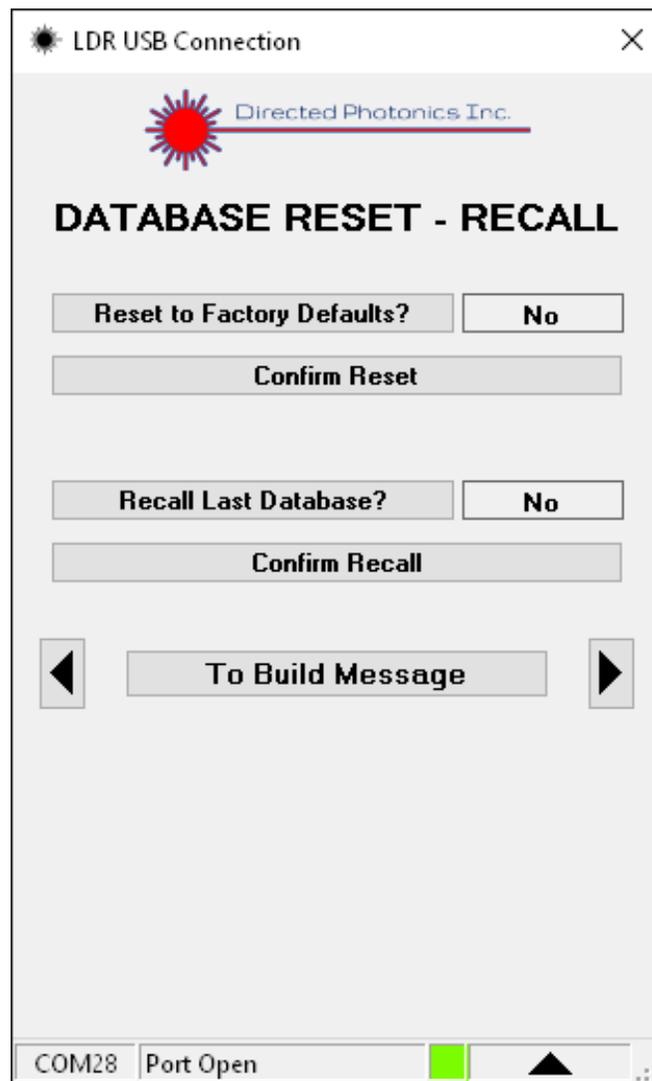
At the bottom of the screen, there is a status bar showing "COM28" and "Port Open" in a box, followed by a small upward-pointing arrow and a small icon of three dots.

25. DATABASE RESET-RECALL Screen

This screen is where the entire LDR database can be reset to the original factory defaults or can be set to a prior saved database. It is a supporting screen for the LDR message build software and it is present at Level 4 of the screen hierarchy.

Screen Options:

- A. The user can choose to Reset to Factory Defaults via a toggle of the Yes/No button and then confirm with activation on the Confirm Reset key.
- B. The user can choose to Recall Last Database via a toggle of the Yes/No button and then confirm with activation on the Confirm Recall key.
- C. It is recommended that the user not change the LDR database before thoroughly reviewing all other options.
- D. Screen below shows all the default values for this screen.
- E. Access to the BUILD MESSAGE screen is also available to the user.
- F. The user may also scroll left or right on Level 4 using the arrow buttons.

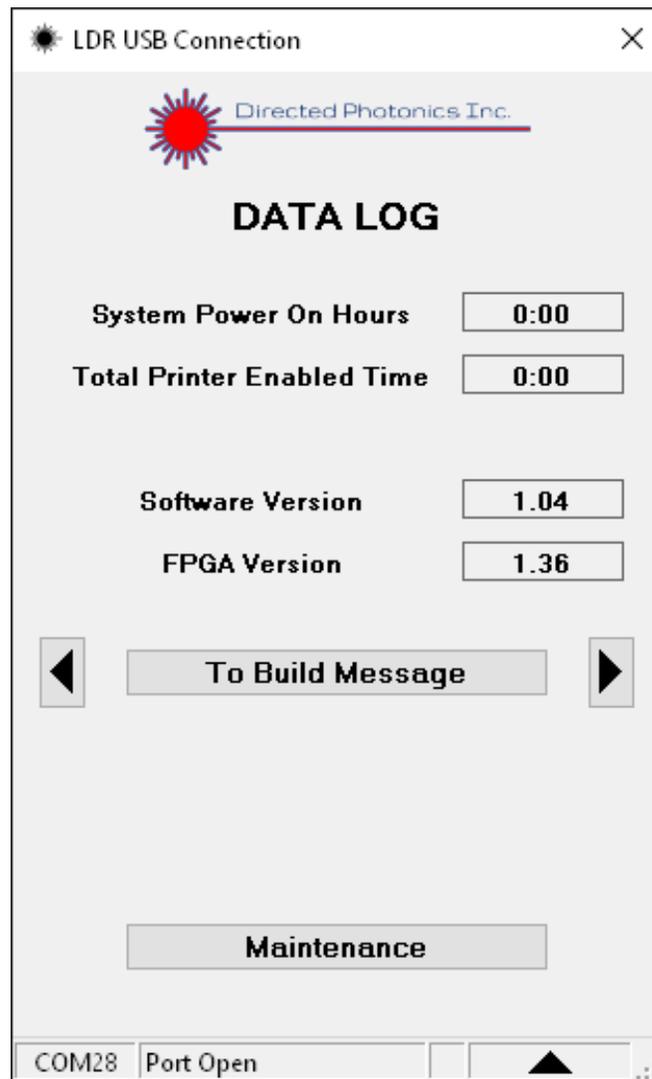


26. DATA LOG Screen

This screen is where the operational time of the LDR is recorded and the software and FPGA versions are noted. It is a supporting screen for the LDR message build software and it is present at Level 4 of the screen hierarchy.

Screen Options:

- A. There are no user adjustable inputs on this screen.
- B. Access to the BUILD MESSAGE and MAINTENANCE screens are also available to the user.
- C. The user may also scroll left or right on Level 4 using the arrow buttons.

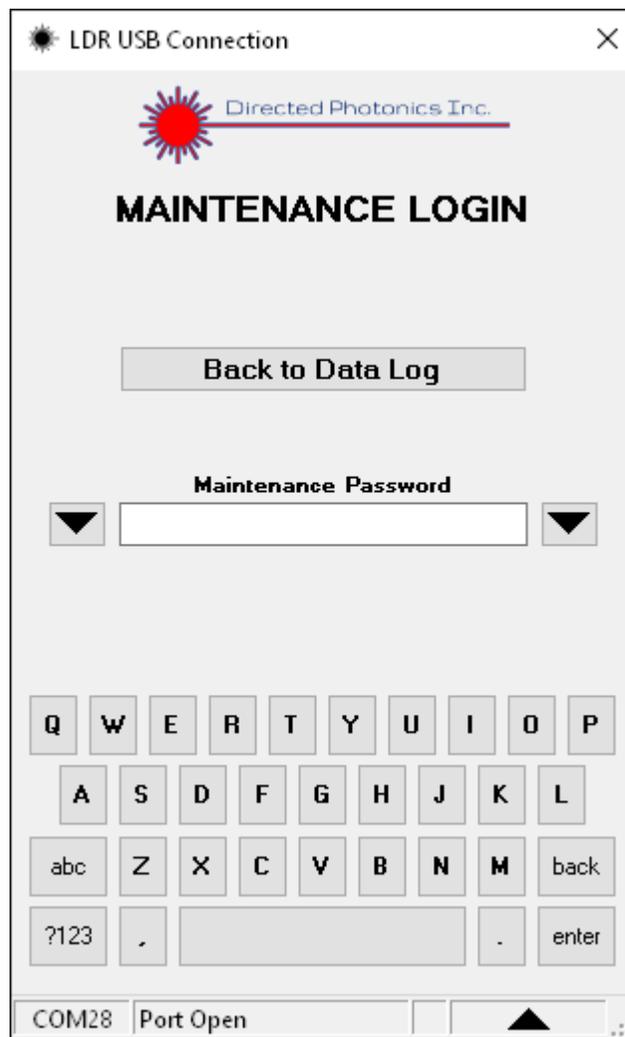


27. MAINTENANCE LOGIN Screen

This screen is where access to the core maintenance parameters is made possible. It is a supporting screen for the LDR message build software and it is present at Level 4 of the screen hierarchy. The password for this screen is not available to the user.

Screen Options:

- A. There are no user adjustable inputs on this screen. The Maintenance Password is a DPI-protected parameter.
- B. Access to the DATA LOG screen is also available to the user.



28. MAINTENANCE Screen

This screen is where access to the reset of the LDR running time is made possible. It is a supporting screen for the LDR message build software and it is present at Level 4 of the screen hierarchy. The password for this screen is not available to the user.

Screen Options:

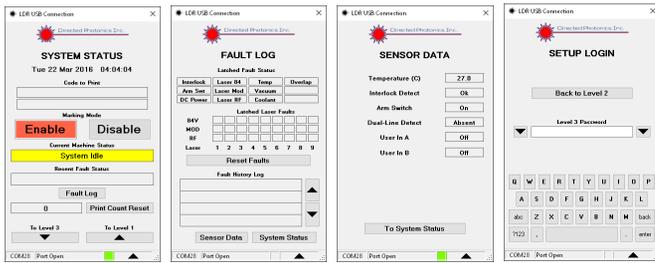
- A. There are no user adjustable inputs on this screen.
- B. Access to the BUILD MESSAGE screen is also available to the user.
- C. The user may also scroll left or right on Level 4 using the arrow buttons.



Appendix A: Software Screens Navigation Map



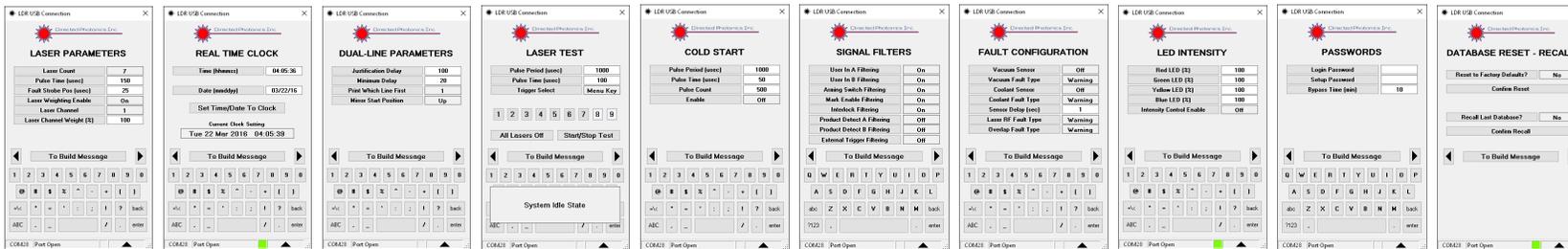
LEVEL 1



LEVEL 2

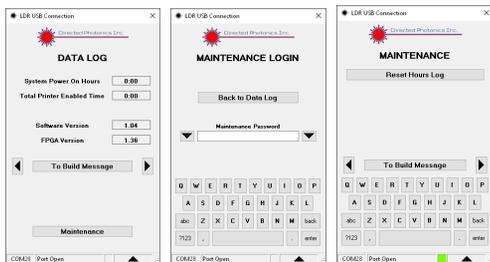


LEVEL 3



LEVEL 4>>>

LEVEL 4>>



<<END>>