

2 Level II Basics

This chapter is intended to familiarize Pioneer LD-V8000 users with basic concepts, terms, and procedures associated with developing and delivering Level II program applications. A Level II program consists of a series of commands that, when stored in the player's RAM and interpreted by the microprocessor, cause the player to operate in a pre-defined way.

This chapter explains how Level II programs can be written into the player's memory. It contains a CAUTION section detailing the differences between the LD-V8000 and the LD-V6000A. It describes the player's 7K Random Access Memory — both the Program Area and the Registers. It also describes the elements of a Level II Program: Arguments, Commands, variables, and data. Finally, the chapter covers the structure of Level II Program code in memory and instruction Execution Speed.

2.1 What is Level II?

As with the authoring languages used for other interactive video productions, the Level II programming language is responsive to new hardware capabilities. Thus, it continues to evolve. Sophistication of Level II applications depends upon the increasing knowledge of programmers and developers who work with the system.

Any successful interactive videodisc production requires meticulous planning and Level II applications are no exception to the rule. A well-planned, carefully programmed Level II application can provide a very complex and highly interactive application that is extremely easy to work with — requiring no prior computer knowledge on the part of the viewer. The Level II system allows both simple and complex interactive programming to be delivered with only a Level II videodisc player, a remote keypad, a monitor, and, of course, a videodisc. It does not require an external computer to send commands to the player.

In most cases, a Level II program is prepared and tested in advance of disc production. The program's object code is encoded into Audio Channel 2 when the videodisc is manufactured. When the start-up parameters on the LD-V8000 are set for automatic Level II execution, the disc's Level II program is loaded into the player's memory just after the disc spins up. However, Level II discs are not required. For some applications, the "Level II" program is simply entered into the player's memory with the RCU or downloaded into the videodisc player's memory from a computer.

For trade shows, museums, and other situations where the program and the videodisc do not change, the program might simply reside in the player. However, when there is a library of training videodiscs to choose from, it is quite convenient to select the one disc (lesson) you want, put it into the player, and have the whole lesson ready to run. No floppy disks or complex startup procedure. Likewise, when a network of point of purchase kiosks must be updated monthly, it is again most convenient to simply mail out a new videodisc for the store manager to put

into the player. The simplicity and overall low cost of updating the entire interactive network in this manner is noteworthy.

Level II applications have saved developers and system integrators thousands of dollars in hardware costs by allowing applications to be used in multiple settings without an expensive computer at every workstation. Level II applications provide, in effect, "stand-alone systems". When Level II programs are carefully planned and efficiently developed, companies find that cost savings using Level II program delivery are substantial, primarily because a computer is not required to control each videodisc player kiosk or station. Level II delivery systems are often comprised entirely of "off the shelf" components. This can lower the cost, allow for faster system delivery and simplify set-up for customers.

When a Level II encoded videodisc spins-up on the LD-8000, program code on Audio Channel 2 of the disc can be automatically loaded or "dumped" into the LD-V8000's 7K of RAM. The program information is written into one of seven "pages", where each page can contain 1022 bytes of information.

Earlier Pioneer Industrial Videodisc Players (the LD-V6000 series, the LD-V3000, and the PR-V7820-3) are also capable of loading and executing Level II programs. However, they all have slightly different hardware capabilities. Thus, the available Level II commands also vary from player to player to reflect these differences.

(See **Section 2.4, CAUTION: Differences Between the LD-V8000 and the LD-V6000A**. See also **Appendix A, Comparison of Level II Commands Available on Different Pioneer Industrial Laserdisc Players**.)

The succession of players has been generally upward compatible. Usually discs for the PR-V7820-3 run on the LD-V6000, LD-V6000A, and on the LD-V8000. In order to take advantage of the latest hardware features, we urge developers to write Level II programs for use with specific players. Note that other players in the current Pioneer Industrial Videodisc product line: the LD-V2000, LD-V2200, CLD-V2400, LD-V4400, and the LC-V330 (Autochanger), are *not* "Level II" players and do not contain an internal microprocessor that will execute Level II programs.

When new LD-V8000 players are purchased, Level II programs written for and tested on LD-V8000 players containing older EPROMs (Erasable Programmable Read Only Memory chips) should be thoroughly tested with the newer EPROMs that may contain improvements and additional features. (See **Technical Bulletin #131, LD-V8000 Version Upgrade**.)

All Level II programs should be thoroughly tested, preferably with a proof disc, before the master stamper is made and replicates are pressed. A proof disc is a pre-replication test disc containing all program video, audio, and Level II program information. It is used to verify and confirm both the video and audio material and the disc's interactive programming functions.

Caution: Pioneer Level II programs will not execute on "Level II players" produced by other manufacturers, because Level II languages vary between manufacturers.

Level II programming code is usually developed and tested using an external computer to edit, compile, download, and test the application. Then, a properly formatted object code version of the program is submitted to a specific videodisc manufacturer for encoding into Audio Channel 2 of the videodisc. Although hundreds of dumps can be placed on a single disc, ***typically, from one to fifteen program dumps (1022 bytes each) are encoded onto a Pioneer videodisc.***