EY-DX002-CG-003

RL01/RL02 Disk Drive Maintenance Course

Course Guide

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RL DISK DRIVE MAINTENANCE COURSE

COURSE GUIDE

No. EY-DX002-CG-003
A Part of Course No. EY-DX037-SP-002

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OUTLINE

COURSE GUIDE

ABSTRACT

This course is designed to train field service personnel to perform basic maintenance on an RLØ1 or RLØ2 disk drive. The course is divided into two main sections. The basic (CORE) material, and the optional (extended) material. The basic material is mandatory. It contains all the necessary information about the drive that you need to know in order to service it. The optional material contains the theory of operation of both the drive and all four controllers that are currently available.

The course materials that you should receive include the following.

- Drive Workbook - EY-DXØ26-WB-ØØ2
- RL11 Controller Workbook - EY-DXØ27-WB-ØØ2
- RLV11 Controller Workbook - EY-DXØ28-WB-ØØ2
- RLV12 Controller Workbook - EY-DXØ29-WB-ØØ2
- RL8A Controller Workbook - EY-DXØ3Ø-WB-ØØ2
- RLØ1/RLØ2 Pocket Service Guide - EK-RLØ12-PG-ØØ4
- DECDisk Subsystem Register Quick Reference Card - EH-18955

Field Service Job Analysis

The following outline describes the tasks a field service engineer must be capable of performing when servicing an RL subsystem.

I. Install a drive

   A. Cable a drive to the controller

   B. Set up jumpers/switches on drives and controller

   C. Mount the drive into a rack

   D. Cable the controller into the system

E. Run diagnostics on an RL subsystem

1. Use conversational mode
2. Interpret error printouts
3. Interpret normal printouts
4. Loop on sub-test of diagnostics

F. Correct an adjustment on an RL subsystem drive

1. Belt tension
2. Positioner azimuth
3. Heads
4. Read Signal Amplitude

II. Perform preventive maintenance procedures

A. Change filters

1. Open covers
2. Insert and remove cartridge
3. Remove front panel
4. Use operator's control panel

B. Clean an RL drive

III. Perform Corrective Maintenance

A. Make drive modules accessible

B. Toggle-in manual-entry programs to aid trouble-shooting

C. Make voltage checks

D. Disconnect servo system to enable positioner to be moved by hand

E. Remove and replace the failing Field Replaceable Unit (FRU)

TARGET POPULATION

Branch Field Service and Support Personnel

PREREQUISITES

1. Ability to program a CPU (Introduction to the PDP-11 A/V course, or a PDP-11 processor course or a PDP-8 processor course)

2. Knowledge of magnetic recording principles and concepts (Magnetic Recording A/V course or previous background from other companies or other courses at DEC)

3. Knowledge of basic disk drive concepts (Disk Principles A/V course, prior experience, or other courses at DEC)

4. Experience in using common hand tools

5. Experience in using a dual-trace, triggered-sweep oscilloscope (similar to a Tektronics 465) in internally- and externally-triggered modes; the student must also be able to interpret the display. with respect to time and voltage measurement

6. Experience in loading subsystem diagnostics from the from panel of a C.P.U.

Prerequistes 1, 2, and 3 are necessary only for the advanced source material as these concepts are not covered in this course. Prerequistes 4 and 5 are necessary to complete the basic core material.

GOALS

To train the student in the maintenance and repair of the RL Disk Subsystem to the Field Replaceable Unit (FRU).

FRU List

1. AC Servo Module
2. DC Servo Module
3. R/W Module
4. Drive Logic Module
5. Positioner
6. R/W Heads
7. Spindle
8. Cartridge
9. Power Supply
10. Brush Motor
11. Cables
12. Filters
13. Fan
14. Spindle Drive Motor
15. Drive Belt

NON-GOALS

This course does not teach any theory of operation of the 8-family OMNIBUS or the 11-family UNIBUS. It also does not attempt to teach the field maintenance print set (either reading or interpretation).

MAINTENANCE PHILOSOPHY

The primary maintenance philosophy to which this course subscribes is training technicians to replace, swap, adjust, or clean FRUs in the field. In addition, it supports the concept of providing the more advanced technician, already proficient in maintaining and repairing FRUs, with the theoretical knowledge to perform more sophisticated troubleshooting, such as signal-tracing through a device.

COURSE ORGANIZATION

The following paragraphs describe the basic elements of this self-paced course. The course map leads you through the selection of course topics. The course modules each contain an RL subsystem topic to be described. Testing is involved with most course modules to check your basic comprehension of the subject material.

Course Map

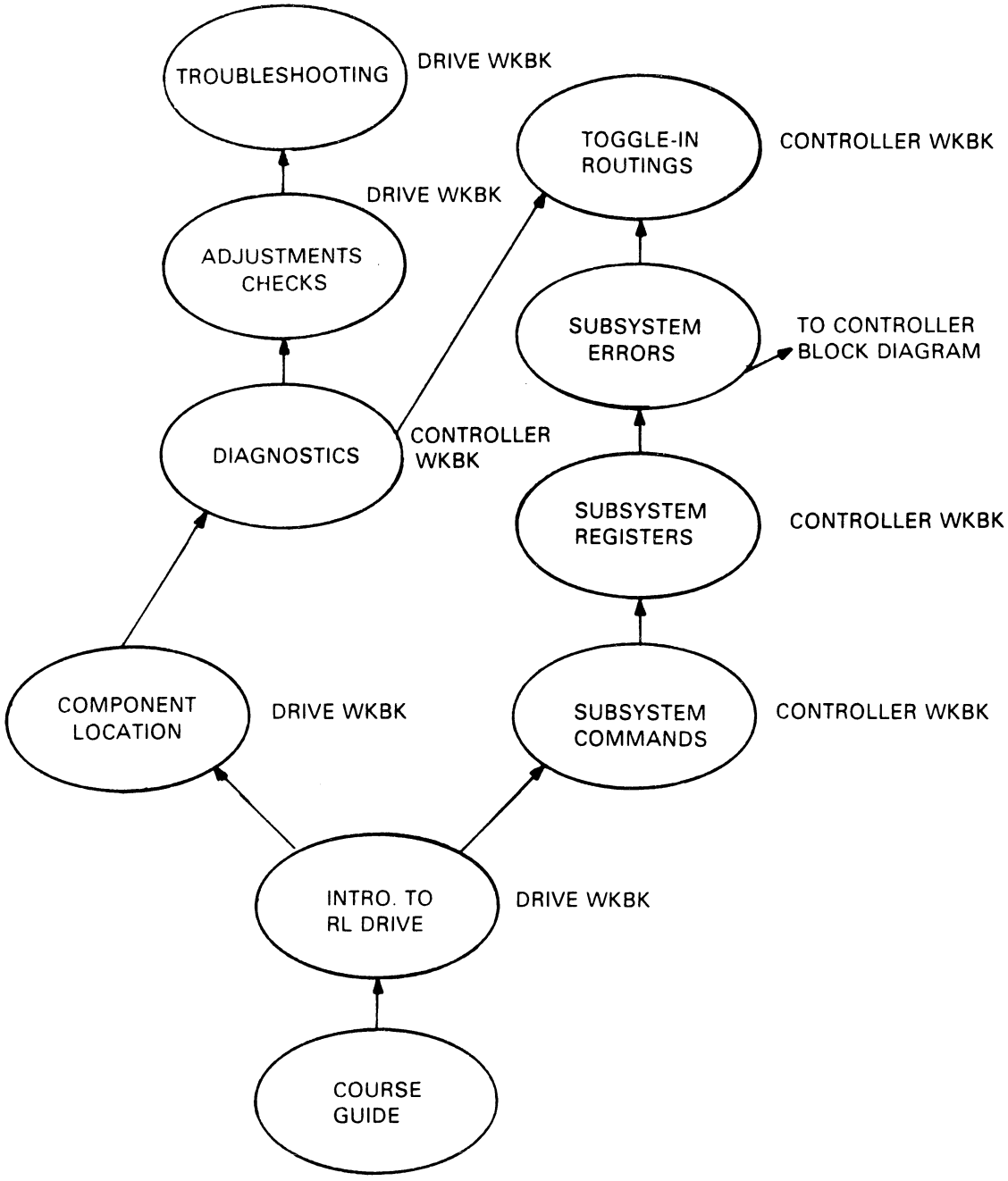
The five workbooks are functionally divided into the individual products comprising a part of the subsystem. The map of basic core material shows a path starting at the bottom with the Course Guide and flowing towards the troubleshooting module. In between, there are course modules;each represents a separate subsystem topic. The arrows represent the suggested path to take. In some cases, there is more than one path. The decision is yours. The diagnostic module has two paths leading to it. This means that both paths must be completed at that point before the diagnostic module can be taken.

Some of the modules are designated as being in a controller workbook. You are to pick the controller of your choice and go to that workbook to study the module. These modules are packaged this way so that, in the future, if you desire to study one of the other controllers, all the information is grouped together.

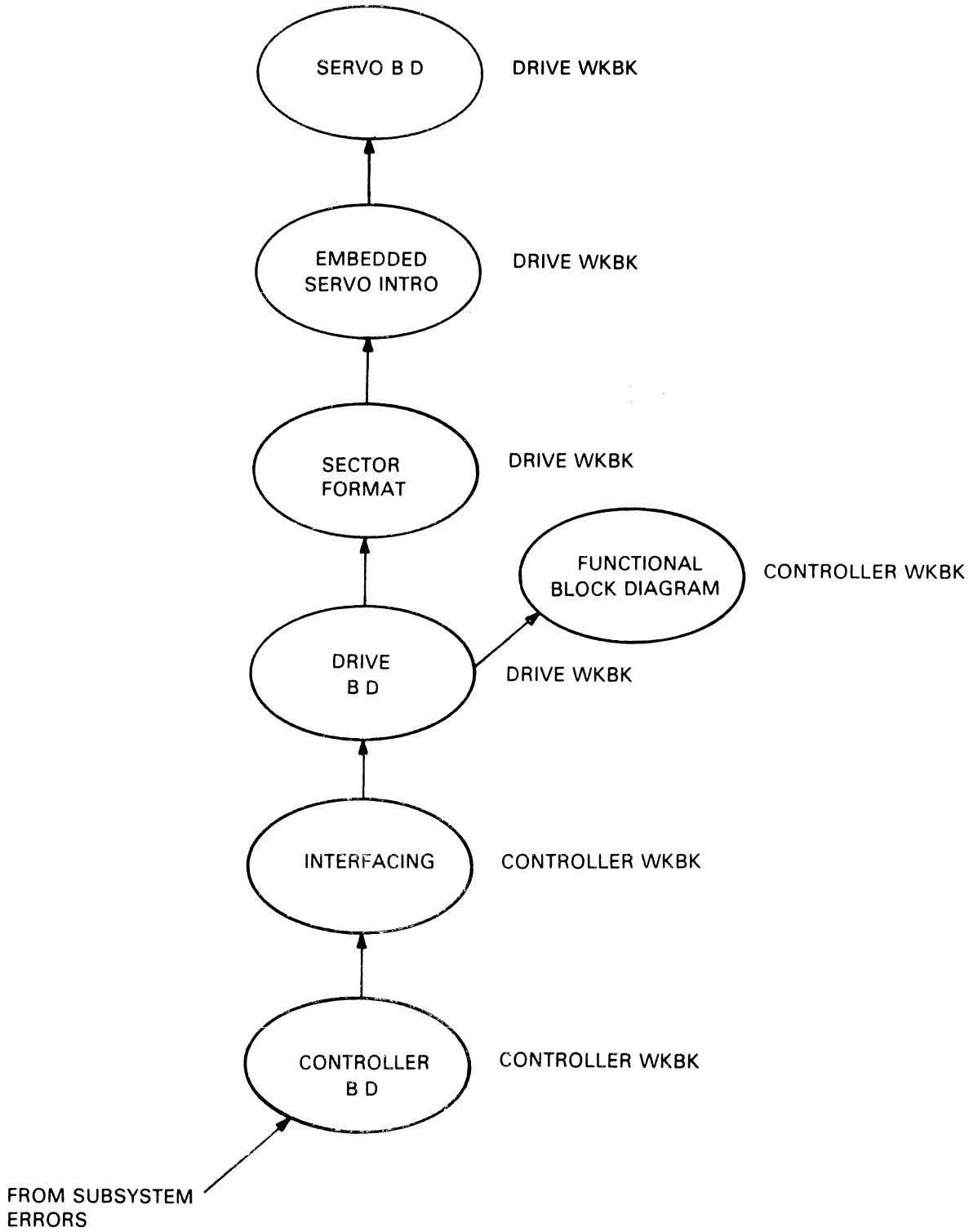
Module Contents

Each of the modules contains at least one objective which states what you must be able to do to complete the module. Following the objectives are sample test items which illustrate how you will be tested.

Each module also lists additional resources, should you desire extra work. You should at least skim over the related logic areas as defined. This is so that you will become familiar with the location of the various subject areas in the technical manuals (fiche or hard copy). If the additional resources listed are not available, this course can still be successfully completed.


TROUBLESHOOTING
DRIVE WKBK
TOGGLE-IN ROUTINGS
CONTROLLER WKBK
DRIVE WKBK
ADJUSTMENTS CHECKS
SUBSYSTEM ERRORS
TO CONTROLLER BLOCK DIAGRAM
DIAGNOSTICS
CONTROLLER WKBK
SUBSYSTEM REGISTERS
CONTROLLER WKBK
COMPONENT LOCATION
DRIVE WKBK
SUBSYSTEM COMMANDS
CONTROLLER WKBK
INTRO. TO RL DRIVE
DRIVE WKBK
COURSE GUIDE
CZ-0418

Optional Course Material



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If you use the additional reference material, sign the course administrator's sign-out sheet. This will help in keeping track of the limited number of hard-copy manuals. Return the manuals before the end of the course.

Testing

Most modules contain exercises which allow you and the course administrator to see if you are ready for the module test. Once ready, you will take the module test (packaged separately from the workbooks). It will cover the material stated in the objectives in a form similar to that of the sample test items. To complete each module satisfactorily, you must meet the stated criteria in each objective.

The course administrator should check your answers and review the material with you as you complete each module test. As you satisfactorily complete each module, the course administrator's Master Progress Plotter should be updated to keep a record of your progress. You may also keep a record by updating the Personal Progress Plotter found in the back of the Course Guide.

If a module is not satisfactorily completed, review the material. Assistance from the course administrator and/or a peer may be in order so you will understand the material and be ready to re-take the test. All answers to the module tests are packaged separately.

Work on only one module at a time. The only exception to this rule is if you must wait for equipment in the lab in order to continue.

Summary of Module Topics

MODULE TITLE	TOPIC
Introduction to the RL Drive	Describes a basic subsystem and its operating specs; teaches how to operate the drive, how to load and unload a cartridge, and how to remove the drive covers
Sector Format	Describes how cartridge data is aligned on the disk surface
Embedded Servo	Describes in basic terms a new concept: how track-following servo data is embedded in the customer's data
Subsystem Commands	Describes the tasks that the subsystem can perform for the software
Subsystem Registers	Illustrates the configurations of the subsystem registers (in four separate modules)
Subsystem Errors	Categorizes the possible errors that the RL subsystem can detect
Toggle-in Routines	Contains a lab exercise using existing programs in which you will toggle-in these routines to exercise a subsystem
Component Location	Prepares you for doing the removal and replacement lab by illustrating the drive in various states of disassembly and noting items of interest; following this is a lab exercise of field-stripping the drive
Diagnostics	Contains lab exercises that allow you to practice using the RL diagnostics
Controller Block Diagrams	Describes the controller operation by utilizing block diagrams for the RL11, RL8A and RLV11 or RLV12 subsystem controllers (in four separate modules)

Summary of Module Topics (Cont)

MODULE TITLE	TOPIC
Interfacing Signals	Describes communications between the drive and the controllers
RL Drive Block Diagram	Describes the drive logic via a block diagram
Adjustments/Checks	Describes the what as well as how in performing adjustments on the drive
Servo Block Diagram	Illustrates how track-following servo data is utilized to control the movements of the carriage
Controller Functional Block Diagrams	Describes the various subsystem commands via block diagrams to illustrate their theory of operation (in four separate modules)
Subsystem Cabling	Describes the basic installation of a subsystem; the four controllers are described as to the various jumper/switches arrangement and cabling to a drive
Troubleshooting	Contains lab exercises that allow you to practice using the skills you have learned

OPTIONAL COURSE RESOURCES

These resources listed below should be kept in the learning center as optional references. They are not necessary for completion of the course.

RL01/RL02 Disk Subsystem User's Guide	EK-RL012-UG
RL01/RL02 Disk Drive Technical Manual	EK-RL012-TM
RL01 Field Maintenance Print Set	MP-00527
RL02 Field Maintenance Print Set	MP-00347
RL11 Disk Controller Technical Description Manual	EK-RL11-TD
RL11 Field Maintenance Print Set	MP-00153
RLV11 Controller Technical Description Manual	EK-RLV11-TD
RLV11 Field Maintenance Print Set	MP-00635
RLV12 Disk Controller User's Guide	EK-RLV12-UG
RLV12 Controller Technical Description Manual	EK-RLV12-TD
RLV12 Field Maintenance Print Set	
RL8A Omnibus Controller Technical Manual	EK-RL8A-TM
RL8A Field Maintenance Print Set	MP-00538

Memories and Peripherals Handbook	EB-15114
Computer Interfacing Accessories and Logic Handbook	EB-09876
PDP-11 Bus Handbook	EB-17525
PDP-11/04/05/10/30/40/45 Processor Handbook	EB-05138

PERSONAL PROGRESS PLOTTER

BASIC COURSE MATERIAL	DATE ACHIEVED	INITIALS
Introduction to Drive		
Subsystem Commands		
Subsystem Registers		
Subsystem Errors		
Toggle-In Routines		
Component Location		
Adjustments/Checks		
Subsystem Cabling		
Troubleshooting		

OPTIONAL COURSE MATERIAL	DATE ACHIEVED	INITIALS
Controller Block Diagram		
Interfacing		
Drive Block Diagram		
Functional Block Diagram		
Sector Format		
Embedded Servo Intro		
Servo Block Diagram		

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