



COMPRO Computer Services, Inc.  
105 East Drive  
Melbourne, FL 32904  
Telephone: (321) 727-2211  
Fax: (321) 727-7009  
[www.compro.net](http://www.compro.net)

# COMPRO REAL-TIME TRAINING: STANDARD COURSE OFFERINGS



## Notices

©2010 COMPRO Computer Services, Inc. All rights reserved. No part of this document, including text, code examples, diagrams, or icons, may be reproduced or transmitted in any form, by any means (electronic, photocopying, recording, or otherwise) without the prior written permission of COMPRO Computer Services, Inc.

Information in this document is subject to change without notice. COMPRO Computer Services, Inc. may have patents or pending patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. The furnishing of this document does not give you license to these patents, trademarks, copyrights, or other intellectual property. Please send licensing inquiries to: COMPRO Computer Services, Inc., 105 East Drive, Melbourne, Florida 32904.

Neither COMPRO nor its dealers or distributors shall be liable to the purchasers or any other person or entity with respect to any liability, loss, or damage, caused or alleged to have been caused directly or indirectly by reliance upon the contents of this document.

## Trademarks

Linux is a registered trademark of Linus Torvalds.  
UNIX is a registered trademark of The Open Group.  
Xilinx is a registered trademark of Xilinx, Inc.

All other product, service, and company names are trademarks or registered trademarks of their respective owners.

COMPRO Computer Services, Inc.  
105 East Drive  
Melbourne, Florida 32904



### *Table of Contents*

**INTRODUCTION ..... 4**

**T116: INTRODUCTION TO FORTRAN 77+ ..... 5**

**T117: ADVANCED FORTRAN 77+ PROGRAMMING ..... 6**

**T121: INTRODUCTION TO ASSEMBLY ..... 7**

**T151: INTRODUCTION TO MPX-32 (RELEASE 3.X) ..... 8**

**T152: MPX-32 PROGRAMMING ENVIRONMENT (FORTRAN 77+ FORMAT) ..... 9**

**T153: PROGRAMMING IN ASSEMBLY LANGUAGE FORMAT (RELEASE 3.X) ..... 10**

**T155: MPX-32 SYSTEM ADMINISTRATION FUNCTIONS (RELEASE 3.X) ..... 11**

**T156: HARDWARE CONCEPTS FOR THE MPX-32 SOFTWARE USER ..... 12**

**T158: MPX-32 INTERNALS (RELEASE 3.X) ..... 13**

**T360: 32/87 & 32/97 MAINTENANCE ..... 14**

**T361: 32/87 & 32/97 MICRO-DIAGNOSTICS TROUBLESHOOTING TECHNIQUES ..... 15**

**T362: 32/87 & 32/97 ADVANCED CPU/IPU FAULT ISOLATION ..... 16**

**T2000: RSX MAINTENANCE DIFFERENCES ..... 17**

**T2060: RSX SYSTEM MAINTENANCE ..... 18**



## INTRODUCTION

COMPRO is the best source for the training you need to get the most from your COMPRO real-time system. COMPRO's experienced staff can provide training at your site or at COMPRO's training facility in Melbourne, Florida.

The standard real-time course offerings are described on the pages that follow. COMPRO also can deliver customized courses for the COMPRO product line (such as LCRS, GPIO-HSD, PCI-RMS, MUSE™/simulation, etc.). Contact us at **(321) 727-2211** or **(800) 936-2673** to discuss your specific training needs.

**T116: Introduction to FORTRAN 77+**

Item	Description
<b>Course:</b>	T116
<b>Title:</b>	Introduction to FORTRAN 77+
<b>Length:</b>	5 days
<b>Prerequisites:</b>	Knowledge of basic programming
<b>Course Description:</b>	<p>This course teaches fundamental FORTRAN programming techniques. The course prepares the student to write and execute basic FORTRAN 77+ programs on CONCEPT/32 computers.</p> <p>Upon completion of the this course, the student will be able to:</p> <ul style="list-style-type: none"><li>• Declare and initialize Integer, Real, and Character data types.</li><li>• Declare, dimension, and initialize array data types.</li><li>• Apply structured programming techniques in FORTRAN 77+ using sequential, control, and iterative control structures.</li><li>• Interpret data storage as it relates to numeric character, and array data types.</li><li>• Perform and correctly format standard I/O operations.</li><li>• Construct and apply arithmetic, relational and logical expressions and statements.</li><li>• Divide FORTRAN 77+ programs into modules using subroutine and function subprograms.</li></ul>

**T117: Advanced FORTRAN 77+ Programming**

Item	Description
<b>Course:</b>	T117
<b>Title:</b>	Advanced FORTRAN 77+ Programming
<b>Length:</b>	5 days
<b>Prerequisites:</b>	<ul style="list-style-type: none"><li>• One year programming experience in FORTRAN</li><li>• Completion of course T152</li></ul>
<b>Course Description:</b>	<p>This course provides the FORTRAN 77+ user with an introduction to advanced programming techniques.</p> <p>Upon completion of the this course, the student will be able to:</p> <ul style="list-style-type: none"><li>• Define and use character data types including substrings and arrays.</li><li>• Use I/O and format statements to perform standard input/output operations.</li><li>• Construct, access, and use subroutines and function subprograms.</li><li>• Use the symbolic debugger to trace program execution.</li><li>• Initialize local commons using a block data subprogram.</li><li>• Evaluate FORTRAN compiler and cataloger output.</li><li>• Use compiler options and directives to manage the compilation environment.</li><li>• Formulate code to link FORTRAN programs to Assembly subroutines.</li><li>• Incorporate inline coding with a FORTRAN main program.</li></ul>
<b>Notes:</b>	<p>The following FORTRAN 77+ features will be covered in courses T152:</p> <ul style="list-style-type: none"><li>• OPEN</li><li>• CLOSE</li><li>• INQUIRE</li><li>• BUFFERIN/OUT</li></ul>



## T121: Introduction to Assembly

Item	Description
<b>Course:</b>	T121
<b>Title:</b>	Introduction to Assembly
<b>Length:</b>	5 Days
<b>Prerequisites:</b>	Knowledge of number systems, basic computer concepts, and prior programming experience
<b>Course Description:</b>	<p>This course prepares the student to write and execute non-base Assembly language programs on CONCEPT/32 computers.</p> <p>Upon completion of the this course, the student will be able to:</p> <ul style="list-style-type: none"><li>• Identify key hardware components of CONCEPT/32 computer systems.</li><li>• Use macro assembler directives.</li><li>• Write programs and subprograms using the CPU instruction set.</li><li>• Translate Assembly instructions into machine code and machine code into Assembly instructions.</li><li>• Define and initialize fixed and character data types.</li><li>• Identify and use symbolic, relative, and self-relative addressing techniques.</li><li>• Incorporate indexed and indirect addressing.</li><li>• Perform repetitive operations using various methods of iteration.</li><li>• Perform basic subroutine linkage using various modes of parameter passing.</li><li>• Perform basic I/O operations.</li></ul>

**T151: Introduction to MPX-32 (Release 3.x)**

Item	Description
<b>Course:</b>	T151
<b>Title:</b>	Introduction to MPX-32 (Release 3.x)
<b>Length:</b>	5 days
<b>Prerequisites:</b>	Prior experience using an operating system
<b>Course Description:</b>	<p>This course provides the MPX-32 user with the skills necessary to interface with the MPX-32 environment. This course is a prerequisite for all other MPX-32 courses.</p> <p>Upon completion of the this course, the student will be able to:</p> <ul style="list-style-type: none"><li>• Use an editor to create and modify text files.</li><li>• Use Volume Manager (VOLMGR) to create, delete, and log directories and files, and to save and restore files.</li><li>• Use Job Control Language (JCL) to activate system processors and user tasks, utilizing the conditional processing capability.</li><li>• Build batch and interactive command files that support parameter passing.</li><li>• Manipulate and convert data using the Media (MEDIA) utility.</li><li>• Use operator communications (OPCOM) to inquire about the status of tasks, devices, memory, and to control the execution states of active tasks.</li><li>• Use the on-line help and command line edit and recall features.</li></ul>

**T152: MPX-32 Programming Environment (FORTRAN 77+ Format)**

Item	Description
<b>Course:</b>	T152
<b>Title:</b>	MPX-32 Programming Environment (FORTRAN 77+ Format)
<b>Length:</b>	7 days
<b>Prerequisites:</b>	Completion of course T151 and course T116 <b>Note:</b> FORTRAN programming experience may be substituted for course T116.
<b>Course Description:</b>	<p>This course provides the FORTRAN programmer with the skills necessary to develop and execute programs in an MPX-32 environment.</p> <p>Upon completion of the this course, the student will be able to:</p> <ul style="list-style-type: none"><li>• Compile, catalog and execute FORTRAN 77+ tasks.</li><li>• Compile and catalog tasks that reference subroutines contained in a user-created object library.</li><li>• Dynamically allocate files and devices for I/O operations.</li><li>• Perform I/O operations in the no-wait and random access modes.</li><li>• Debug FORTRAN 77+ programs using an interactive debugger.</li><li>• Write FORTRAN 77+ programs that dynamically access MPX-32 system services via subroutines in the Scientific Run-Time Library.</li><li>• Communicate between tasks using run, message, break and abort requests.</li><li>• Communicate between tasks using Global Common and Datapool.</li></ul>

**T153: Programming in Assembly Language Format (Release 3.x)**

Item	Description
<b>Course:</b>	T153
<b>Title:</b>	Programming in Assembly Language Format (Release 3.x)
<b>Length:</b>	7 days
<b>Prerequisites:</b>	Completion of courses T121 and T151
<b>Course Description:</b>	<p>This course provides the Assembly language programmer with the skills necessary to develop and execute programs in an MPX-32 environment.</p> <p>Upon completion of the this course, the student will be able to:</p> <ul style="list-style-type: none"><li>• Compile, catalog, and execute Assembly language tasks.</li><li>• Compile and catalog tasks that reference subroutines contained in a user-created object library.</li><li>• Dynamically allocate files and devices for I/O operations.</li><li>• Perform I/O operations in the no-wait and random-access modes.</li><li>• Debug Assembly language programs using an interactive debugger.</li><li>• Write Assembly language programs that dynamically access MPX-32 system services.</li><li>• Communicate between tasks using run, message, break, and abort requests.</li><li>• Communicate between tasks using Global Common and Datapool.</li></ul>
<b>Notes:</b>	The students must supply their own reference manuals which were provided by COMPRO in prerequisite courses (specifically, <i>MPX-32 Volume II</i> ).



**T155: MPX-32 System Administration Functions (Release 3.x)**

Item	Description
<b>Course:</b>	T155
<b>Title:</b>	MPX-32 System Administration Functions (Release 3.x)
<b>Length:</b>	5 days
<b>Prerequisites:</b>	Completion of course T151
<b>Course Description:</b>	<p>This course provides the MPX-32 system administrator with the skills necessary to interface with the MPX-32 environment.</p> <p>Upon completion of the this course, the student will be able to:</p> <ul style="list-style-type: none"> <li>• Implement proper power on/off, shutdown and restart procedures.</li> <li>• Perform media verification on a disk pack.</li> <li>• Format a disk volume.</li> <li>• Install the MPX-32 Operating System.</li> <li>• Customize the MPX-32 environment using COMPRESS and SYSGEN.</li> <li>• Configure user terminal profiles, including MPX.PRO and LONGONFLE.</li> <li>• Create and maintain System Administrator files, including M.Key, M.PRJCT, M.CNTRL, M.MOUNT and M.ACCNT.</li> <li>• Build an installation tape of a customized MPX-32 image.</li> <li>• Monitor and maintain volume resources.</li> <li>• Recover from or document system problems.</li> <li>• Install, initialize and configure inter-system communications.</li> </ul>



**T156: Hardware Concepts for the MPX-32 Software User**

Item	Description
<b>Course:</b>	T156
<b>Title:</b>	Hardware Concepts for the MPX-32 Software User
<b>Length:</b>	5 days
<b>Prerequisites:</b>	Completion of course T155
<b>Course Description:</b>	<p>This course provides the experienced software user basic hardware concepts that will aid in configuring handlers, in writing application programs to interface with hardware, and in communicating with hardware, and in communicating with hardware personnel.</p> <p>Upon completion of the this course, the student will be able to:</p> <ul style="list-style-type: none"> <li>• Use nucleus and peripheral diagnostic software.</li> <li>• Identify major components of the CONCEPT/32 and the subsystems to which they belong.</li> <li>• Execute panel model commands and machine language programs to access, test, and modify the contents of memory.</li> <li>• Interpret the contents of memory locations associated with the occurrence of system traps and interrupts.</li> <li>• Verify system memory, subsystem configurations, capabilities, and impact on application programs.</li> <li>• Determine SelBUS priority as jumpered on each system module and the SelBUS terminator card.</li> <li>• Analyze the result of Class F I/O instruction execution and Service Interrupt processing.</li> <li>• Configure SelBus system modules and Multipurpose Bus controllers.</li> </ul>
<b>Notes:</b>	The students must supply their own reference manuals which were provided by COMPRO in prerequisite courses (specifically, <i>MPX-32 Volume III</i> ).

**T158: MPX-32 Internals (Release 3.x)**

Item	Description
<b>Course:</b>	T158
<b>Title:</b>	MPX-32 Internals (Release 3.X)
<b>Length:</b>	5 days
<b>Prerequisites:</b>	<ul style="list-style-type: none"><li>• Completion of courses T121, T153, T155, and T157</li><li>• Thorough knowledge of CONCEPT/32 Assembly language</li></ul> <p><b>Note:</b> Completion of course T156 is recommended.</p>
<b>Course Description:</b>	<p>This course prepares the student to write and integrate new non-I/O modules into MPX-32, and to provide an understanding of the internal structure of MPX-32.</p> <p>Upon completion of the this course, the student will be able to:</p> <ul style="list-style-type: none"><li>• Translate a logical address into a physical address via the MPX-32 mapping scheme.</li><li>• Write and incorporate a service module into both extended and non-extended MPX-32.</li><li>• Write and incorporate an Interrupt Handler into MPX-32.</li><li>• Utilize the System Debugger to debug the above modules.</li><li>• Incorporate a patch into MPX-32.</li><li>• Analyze a system crash by using panel model directives.</li></ul>
<b>Notes:</b>	The students will supply their own reference manuals which were provided by COMPRO in prerequisite courses (specifically, <i>CPU Reference and MPX-32 Volume III</i> ).



**T360: 32/87 & 32/97 Maintenance**

Item	Description
<b>Course:</b>	T360
<b>Title:</b>	32/87 & 32/97 Maintenance
<b>Length:</b>	15 days
<b>Prerequisites:</b>	<ul style="list-style-type: none"> <li>• Knowledge of electronic fundamentals, numbering systems, digital logic, and data processing techniques</li> <li>• One year maintaining software-programmable equipment</li> </ul>
<b>Course Description:</b>	<p>This course provides the student with the skills needed to operate, test, adjust, and troubleshoot CONCEPT 32/87 and CONCEPT 32/97 systems to the board level.</p> <p>Upon completion of the this course, the student will be able to:</p> <ul style="list-style-type: none"> <li>• Identify all major components and the subsystems to which they belong.</li> <li>• Configure and install a system, including I/O processors.</li> <li>• Utilize the system control panel for troubleshooting purposes.</li> <li>• Create boot-loadable copies of macro-diagnostics using the AUTOGEN utility.</li> <li>• Load, initialize, and execute level 1 and 2 diagnostics and interpret results as an aid to fault isolation.</li> <li>• Follow logical procedures to isolate system malfunctions to the board level.</li> <li>• Identify the physical and functional differences between the CONCEPT 32/97, and CONCEPT 33/87 systems.</li> <li>• Perform preventive maintenance on a nucleus system.</li> <li>• Analyze system malfunctions using operating system status.</li> <li>• Troubleshoot Initial Program Load (IPL) failures.</li> </ul>

**T361: 32/87 & 32/97 Micro-diagnostics Troubleshooting Techniques**

Item	Description
<b>Course:</b>	T361
<b>Title:</b>	32/87 & 32/97 Micro-diagnostics Troubleshooting Techniques
<b>Length:</b>	5 days
<b>Prerequisites:</b>	Completion of course T360
<b>Course Description:</b>	<p>This course provides the student with the skills needed to operate, test and troubleshoot the CONCEPT 32/87 and CONCEPT 32/97 at a micro level. The course stresses micro-diagnostic troubleshooting procedures to be used to isolate, to the board level, failures within the 16 to 21 board CPU or IPU.</p> <p>Upon completion of the this course, the student will be able to:</p> <ul style="list-style-type: none"><li>• Isolate faults using the Autotest Sequence.</li><li>• Use the Z-80 Executive Program (ZXP), the Field Support Systems (FSS), and micro-diagnostics as an aid in troubleshooting CPU/IPU problems to the board level.</li><li>• Identify the major micro-code differences between the CONCEPT 32/87 and CONCEPT 32/97.</li><li>• Use the micro-code disassembler to isolate micro-word field functions as an aid to fault isolation.</li></ul>

**T362: 32/87 & 32/97 Advanced CPU/IPU Fault Isolation**

Item	Description
<b>Course:</b>	T362
<b>Title:</b>	32/87 & 32/97 Advanced CPU/IPU Fault Isolation
<b>Length:</b>	10 days
<b>Prerequisites:</b>	Completion of course T360 and T361 or two years experience in maintaining a CONCEPT 32/97 or CONCEPT 32/87 system
<b>Course Description:</b>	<p>This course provides the student with the advanced skills needed to fully utilize the facilities of the Z-80 Executive Program (ZXP) and the Field Support System (FSS) for troubleshooting problems in the CPU/IPU.</p> <p>Upon completion of the this course, the student will be able to:</p> <ul style="list-style-type: none"><li>• Identify all major CPU circuitry at the logic level.</li><li>• Use an oscilloscope to aid in locating failing CPU/IPU circuitry.</li><li>• Use the Z-80 Diagnostic Executive Program to troubleshoot Instrumentation Unit Failures.</li><li>• Use the Field Support System to isolate Execution Unit micro-diagnostic failures.</li><li>• Use the Field Support System to encode micro-program routines to aid in fault isolation.</li><li>• Use the Field Support System to set micro-code breakpoints on macro routines.</li><li>• Use all applicable technical documentation to aid in fault isolation.</li></ul>



## T2000: RSX Maintenance Differences

Item	Description
<b>Course:</b>	T2000
<b>Title:</b>	RSX Maintenance Differences
<b>Length:</b>	10 days
<b>Prerequisites:</b>	Completion of course T360
<b>Course Description:</b>	<p>This course covers the differences between the CONCEPT/32 nucleus computer systems, and the COMPRO RSX, RSX180, and CONCEPT 32/20xx line of products. This course addresses system fault isolation using both the diagnostic package and operating system status.</p> <p>At the completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> <li>• Locate system status and fault isolation information within the RSX documentation set.</li> <li>• Configure RSX CPU/DMC components and identify the features and functions of each component.</li> <li>• Configure, install, and test the RSX Clock/Terminator module including its unique Memory Mover I/O feature.</li> <li>• Configure Reflective Memory System (RMS) components either as a stand-alone shared memory option, an RSX180 CPU/IPU, or part of an existing Reflective Memory System.</li> <li>• Use the PC-based, Intelligent Console, system control panel to initiate, monitor, and manipulate system operations as an aid in system fault isolation.</li> <li>• Use the RSX documentation set to define and select the components necessary to configure a Remote Console (RMAC) and install a "Dumb Terminal" for system operation.</li> <li>• Select, load, and execute the appropriate micro-diagnostic routines, via the menu-driven interface program, to exercise CPU features and functions.</li> <li>• Use the Automated Control Executive (ACE) program to load, initialize, and execute CPU external, and system macro-diagnostics.</li> <li>• Analyze and interpret diagnostic test results to isolate failing system components.</li> <li>• Configure and install the Multi-Function Processor (MFP) I/O Subsystem, and test the functionality of selected installed devices.</li> <li>• Identify the physical and functional differences between the CONCEPT 32/2000 and the RSX system components.</li> </ul>
<b>Notes:</b>	<p>This course is appropriate for those students who are well-versed in the architecture, operation, and use of the CONCEPT/32 or PowerNode processor line. This course also is appropriate for students whose systems are being upgraded to include RSX180 CPU/IPU processor configurations. Prerequisites should be strictly adhered to.</p>



## T2060: RSX System Maintenance

Item	Description
<b>Course:</b>	T2060
<b>Title:</b>	RSX System Maintenance
<b>Length:</b>	15 days
<b>Prerequisites:</b>	<ul style="list-style-type: none"> <li>Knowledge of electronic fundamentals, numbering systems, digital logic, and data processing techniques</li> <li>(Recommended) One year maintaining software programmable equipment</li> </ul>
<b>Course Description:</b>	<p>This course provides the student with the skills necessary to operate, test, adjust, and troubleshoot the CONCEPT 32/2000 and RSX processor based systems to the board level.</p> <p>At the completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> <li>Identify all major components and the subsystems to which they belong.</li> <li>Configure and install the nucleus system including the MFP I/O subsystem and selected components.</li> <li>Use the PC-based, Intelligent Console, system control panel to initiate, monitor, and manipulate system operations and as an aid in system fault isolation.</li> <li>Select, load, initialize, and execute all levels of diagnostics and, interpret results including error messages as an aid to system fault isolation.</li> <li>Use the Intelligent Console editor to create diagnostic batch files, and CV.GEN to tailor and build boot-loadable diagnostic media.</li> <li>Configure Reflective Memory System (RMS) components as a stand- alone shared memory option, an RSX180 CPU/IPU, or as part of an existing Reflective Memory System.</li> <li>Use the CONCEPT 32/2000 and/or RSX documentation set to define and select the components necessary to configure a Remote Console (RMAC) and install a "Dumb Terminal" for system operation and/or as an aid to fault isolation.</li> <li>Use the System documentation set to locate system status and fault isolation information.</li> <li>Use the operating system and short machine language programs to obtain status and exercise the system during fault isolation.</li> <li>Follow logical procedures to isolate system bus malfunctions to the board level</li> <li>Identify the physical and functional differences between the CONCEPT 32/2000 and the RSX system components.</li> <li>Perform preventive maintenance on a nucleus system.</li> </ul>