



IBM System/3 Model 8, Model 10, Model 12, and Model 15 RPG II Compilers

**Program Numbers: 5702-RG1 Model 8 and Model 10
5704-RG1 Model 15
5704-RG2 Model 15
5705-RG1 Model 12**

The RPG II compilers for the IBM System/3 Model 8, Model 10, Model 12, and Model 15 are disk-resident computer programs. Program 5704-RG1 is used with Model 15 SCP 5704-SC1, and Program 5704-RG2 is used with Model 15 SCP 5704-SC2. Each of the compiler programs requires as input an RPG II source language program and produces as output a System/3 link-edited or nonlink-edited (Model 15 only) object program, either cataloged in an object library, punched into 80-column or 96-column cards, or written to diskette. A source program listing, a diagnostic, and a storage map may be requested. The RPG II compilers can run in dedicated or nondedicated mode.

The System/3 Model 8 is supported by System/3 Model 10 system control program and program products. It should be noted that not all devices and features which are available on the Model 10 are available on the Model 8.

Each Model 15 compiler overlaps reading and printing of the source program by accessing the source program directly from the system input device or directly from the source library.

Each compiler requires two work files. These compiler work files can be on the following disk units.

	Program 5702-RG1	Program 5704-RG1	Program 5704-RG2	Program 5705-RG1
5444 Disk Storage Drive	X	X	-	-
5448 Disk Storage Drive	-	-	-	-
5445 Disk Storage	-	X	-	-
3340 Direct Access Storage Facility				
- Main data area	-	X	X	-
- Simulation area	-	X	X	X
3344 Direct Access Storage				
- Main data area	-	-	X	-
- Simulation area	-	-	X	-

The compiler halts if errors are found. If only warning messages occur, the user has the option of continuing the compilation. However, if terminal errors are found, the program must be corrected and recompiled.

The compiler selects, from its own library, the I/O routines needed for the object program. These routines initiate the request for records from system data management, which initiates the I/O operations.

Disk system management indicates not-ready or incorrect device conditions on the system console. For other error conditions, the I/O routines display an identifier code on the system console.

Using the identifier code, the operator can find an explanation of the error and the recovery procedure in the applicable system halt guide.

System data management for Model 15 indicates I/O errors or device conditions by a message on the 3277 Display Station. The I/O routines place an identifier code in the message to be displayed on the 3277 Display Station. Using the identifier code, the operator can find an explanation of the error and the recover procedure in the applicable Model 15 messages manual.

The object program processes user files until a valid end-of-file or error condition occurs. In either case, a code is placed in the halt code display lights indicating the condition (Model 8, 10, or 12) or in the message display on the 3277 (Model 15).

Each of the System/3 RPG II compilers provides the following functions:

- **Compiler-related functions:**
 - Creates a program that can be executed in less storage by automatically generating overlays. (Using 5704-RG1, object program size can range from 8K to 48K bytes. Using 5704-RG2, object program size can range from 8K to 56K, depending on the CCP, spool, and configuration options selected during system generation.)

- Provides access to the system date that has been previously entered via OCL, OCC (Model 15 only), or IPL date prompt. This allows the entire date or any of the three parts of the date, to be referenced by the reserved names UDATE, UMONTH, UDAY, or UYEAR. These fields may be referenced on the calculation specifications or on the output specifications.
- Allows conditioning of files, calculations, or output by external indicators (U1-U8) previously set by OCL. Program 5704-RG2 allows external indicators to be set within an RPG II program.
- Loads tables, at either compile or object time, that might contain fewer than the total number of all allowable entries. If tables are loaded at object program execution time, temporary expansion of tables, without modification to the source program, is allowable.
- Supports RPG II Auto Report. Auto Report is standard for Programs 5704-RG1, 5704-RG2, and 5705-RG1, and a feature of Program 5702-RG1 (see *Features* for an explanation of Auto Report).
- Processing-related functions:
 - Supports the DEBUG operation code to assist the user in program debugging.
 - Supports the CHAIN operation code to retrieve records from an indexed file.
 - Finds the square root of a number.
 - Sets and tests bits of a one-byte binary field if the user specifies.
 - Controls multifile processing with nine matching fields.
 - Signals changes in control fields via a control level indicator.
 - Uses more than one line of conditioning indicators during a calculation by the user specifying AND/OR indicators.
 - Defines, indexes, and accesses fields within an array of like fields. The array can be read from data records or created in storage.
 - Defines subroutines that can be executed from any point in calculation. After the subroutine is executed, calculations resume where interrupted.
 - Looks at the contents of fields of the next record awaiting processing for calculations, testing, comparison, or output.
 - Updates and writes out tables.
- Edits output fields according to a user-specified single-character code (including slashes in data fields).
- Checks user switches to condition calculations, input files, output files, or specific output records.
Note: Program 5704-RG2 supports an external buffers option and does not support B-type inquiry programs.
- I/O-related functions:
 - Reads input records from a sequentially processed file if the user specifies the READ operation code.
 - Builds a table in main storage that contains entries for tracks in the index portion of a data file.
 - Performs exception output during both detail and total calculations. When the requested output is completed, calculations resume where interrupted.
 - Supports the DSPLY operation code to display output and accept input from the 3277 Display Station and its associated keyboard (Model 15) or from the operator console.
 - Processes spread cards. A spread card is a record that contains fixed data pertaining to the whole record and a variable number of trailer data fields that contain the same type of information.
 - Determines and controls the file or record that is to be processed during the next RPG II program cycle.
 - Translates, character-by-character, using a file translation table (external code to internal code and internal code to external code).
 - Interprets while punching, without user redefinition of the output line.
 - Prints on cards without punching.
 - Prints identical invoices or labels side-by-side (2-up, 3-up) without user redefinition of the individual fields on the output specifications.
 - Calls the overflow routine during the printing of a line when the user specifies fetch overflow.
 - Controls page length and overflow line via line counter specifications.
 - Performs repetitive printing of the first page (1P) output to assist in the proper alignment of printer forms.
 - Inserts the user's own program support for any input/output device attached to the system.

- Uses dual I/O areas, if specified, for performance improvement when processing sequential disk file.
- Supports the calculation operation set lower limit (SETLL) operation code to allow the user to set limits during calculations for processing of indexed files within limits.
- Supports directly attached 3741 Data Station/Programmable Work Station.
- Sends and receives binary synchronous data over voice-grade or high-speed communications lines by means of telecommunications (standard support in programs 5704-RG1, 5704-RG2, and 5705-RG1; a feature in Program 5702-RG1). See *Features* for more information about telecommunications.
- Allows the user to access data files on 5445 Disk Storage or 5448 Disk Storage Drive. (See *Features* for more information.)
- Supports processing data or record address files on magnetic tape. (See *Features* for more information.)
- Supports 3270 displays for the development of programs using the IBM 3270 Information Display System (see *Features* for more information).
- Program 5702-RG1 or 5705-RG1
 - Supports the console as a normal RPG II file. This differs from the DSPLY function that supports the console as a field-entering device.
 - Uses the same data management input buffer for all single-volume disk input files (shared I/O in Program 5702-RG1 only).
 - An inline inquiry subroutine (SUBR95) can be used to test for an inquiry request from the 5471 Printer-Keyboard.
- Program 5704-RG1 or 5704-RG2
 - Supports the 3277 Display Station and its associated keyboard as a normal RPG II file. This differs from the DSPLY function that supports the 3277 Display Station and its associated keyboard as a field entering device.
 - Supports the data management option of expanded index storage in main storage for index file processing when the user specifies the continuation entry INDEX on the file description specifications.
 - Supports the calculation operation code for time of day (TIME) to access the current time of day.
 - Program function keys 1 through 9 on the 3277 Display Station (system console) can be tested by using subroutine SUBR89.

To use the RPG II compiler, the user supplies information about the job to be processed. The job can be described on specification sheets prior to entering the source statements into the system. The specification sheets are:

- Auto Report Specifications allow the user to specify whether the source program generated by Auto Report will be punched into cards, whether data and page information will be suppressed from the first heading line, and whether asterisk (*) will be suppressed from generated total lines.
- Control Card and File Description Specifications define control information to the RPG II compiler and specific variables relating to the data files in the program.
- Extension and Line Counter Specifications describe tables, arrays, and record address file; specify the line number where overflow should occur and the number of available print lines on the form.
- Telecommunications Specifications define the control information and the variables necessary to establish and maintain the communications link.
- Input Specifications define the input records and the fields in the records and are used to set up control and matching record indicator breaks.
- Calculation Specifications describe all operations to be performed on data and the logic of all the user's programs.
- Output Specifications specify the type of data to be written or punched and the arrangement of data on printed reports, cards, diskette files, BSCA files, disk files, display files, or tape files.

System/3 RPG II object programs can process fixed-length EBCDIC disk records using the following disk file organizations:

- Sequential: Random processing by relative record number, including updating in place; or consecutive processing, including updating in place and file loading.

- Indexed: Random or sequential processing by key, including file loading. Unlike non-System/3 indexed file organizations, the keys and data for a file can be in different sequences; that is, the most active records can be placed in the front of the file and the index can be in sequence by item number. Files can be reorganized by the disk copy/dump program or by a user-written RPG II program. (Using 3340 or 3344 Direct Access Storage devices, indexed files are not supported in the simulation areas.) Indexed files can be accessed in simulation areas but can be processed only as sequential files.
- Direct: Consecutive processing or random processing by relative record number, including updating and file loading. The open routine during file load clears the file space on disk.

Standard System/3 disk labels are required on all disk files.

Object programs can process EBCDIC or ASCII tape files. The records may be fixed or variable length, blocked or unblocked format.

Programming Systems

The RPG II compilers operation under control of the System Control Program (SCP) indicated below. Also, the minimum main storage required for compilation (exclusive of SCP requirements) is given.

RPG II Compiler	SCP	Minimum Main Storage
5702-RG1 (Model 8)	5702-SC1	5.25K
5702-RG1 (Model 10)	5702-SC1	5.25K
5705-RG1 (Model 12)	5705-SC1	8K
5704-RG1 (Model 15)	5704-SC1	10K
5704-RG2 (Model 15)	5704-SC2	10K

System Requirements

The minimum system configuration is:

Model 8

- 5408 Processing Unit, one of the following:
 - Model A14 (16K bytes)
 - Model A16 (32K bytes)
 - Model A17 (48K bytes)
 - Model A18 (64K bytes)
- 5444 Disk Storage Drive, one of the following:
 - Model A1
 - Model A2
 - One Model A2 and one Model A3
 - Two Model A2s
- 5203 Printer, Model 1, 2, or 3
- Input/output device, one of the following:
 - 5471 Printer-Keyboard Model
 - Directly attached: 3741 Data Station Model 1 or 2, or 3741 Programmable Work Station Model 3 or 4

Model 10

- 5410 Processing Unit, one of the following:
 - Model A13 (12K bytes)
 - Model A14 (16K bytes)
 - Model A15 (24K bytes)
 - Model A16 (32K bytes)
 - Model A17 (48K bytes)
- 5444 Disk Storage Drive, one of the following:
 - Model 1
 - Model 2
 - One Model 2 and one Model 3
 - Two Model 2s
 - Model A1
 - Model A2
 - One Model A2 and one Model A3
 - Two Model A2s
- Printer, one of the following:
 - 5203 Printer, Model 1, 2, or 3
 - 1403 Printer, Model 2 or N1
- Input/output device, one of the following:
 - 5424 MFCU, Model A1 or A2
 - 1442 Card Read Punch, Model 6 or 7

Model 12

- 5412 Processing Unit, one of the following:
 - Model B16 (32K bytes)
 - Model B17 (48K bytes)
 - Model B18 (64K bytes)
 - Model C19 (80K bytes)
 - Model C20 (96K bytes)
- 3340 Direct Access Storage Facility, Model C2
- Printer, one of the following:
 - 5203 Printer, Model 1, 2, or 3
 - 1403 Printer, Model 2, 5, or N1

- Inout/output device, one of the following:
 - 5424 MFCU, Model A1 or A2
 - 1442 Card Read Punch, Model 6 or 7
 - Directly attached: 3741 Data Station Model 1 or 2, or 3741 Programmable Work Station Model 3 or 4

Model 15

- 5415 Processing Unit (see below)
- 3277 Display Station Model 1 with Operator Console Keyboard (Feature Code 4632)
- Disk storage device (see below)
- 1403 Printer, Model 2, 5, or N1
- Input/output device, one of the following:
 - 5424 MFCU, Model A1 or A2
 - 2560 MFCM, Model A1 or A2
 - 1442 Card Read Punch, Model 6 or 7
 - Directly attached: 3741 Data Station, Model 1 or 2
 - Directly attached: 3741 Programmable Work Station, Model 3 or 4

Model 15A (5704-RG1)

5415 Processing Unit, Models A17 through A20 (48K-128K) plus one 5444 Disk Storage Drive. An input/output device, listed above, is not required on Model 15A, but is recommended.

Model 15B (5704-RG1)

5415 Processing Unit, Models B17 through B20 (48K-128K) plus one 3340 Direct Access Storage Facility.

Model 15C (5704-RG1)

5415 Processing Unit, Models C21 through C24 (160K-256K) plus one 3340 Direct Access Storage Facility.

Model 15D (5704-RG2)

5415 Processing Unit, Models D19 through D26 (96K-512K) plus one 3340 Direct Access Storage Facility.

Note: For information concerning additional devices supported for System/3 RPG II, see one of the following publications:

- *IBM System/3 Models 4, 6, 8, 10, and 12 System Generation Reference Manual, GC21-5126*
- *IBM System/3 Model 15 System Generation Reference Manual, GC21-7616*

Compatibility

The IBM System/3 RPG II compilers are source language compatible (assuming equivalent hardware devices) except for the differences described in this specification. A System/3 RPG II source program can be recompiled using a different System/3 compiler, without having to change the source program (assuming equivalent devices and function). The resulting object program can then be executed under control of the appropriate SCP and the output will be identical to that on the previous system (assuming equivalent devices, functions, and data).

Features

Feature Name	Feature Numbers For		
	Program 5702-RG1	Program 5705-RG1	Programs 5704-RG1, 5704-RG2
Auto Report	6028/6029	(standard)	(standard)
5445 Disk Storage Drive	6012/6014	–	(standard)
Telecommunications	6000/6002	(standard)	(standard)
Magnetic Tape	6016/6018	(standard)	(standard)
3270 Display Control*	6070	6003/6004	6005/6006
*Does not apply to Program 5704-RG2			

Auto Report

The RPG II Auto Report Feature adds three functions that make RPG II coding easier:

- **Page headings:** A simplified method of specifying headings at the top of every page of a report.
- **Simplified output specifications:** An easier way of specifying column headings, totals, total lines, edit codes, and report formats.
- **Copy:** A method of copying RPG II source statements, located in a library, into an RPG II source program.

Auto Report accepts as input a combination of RPG II source statements and statements specifying the Auto Report functions. The RPG II source statements supplied by the user, along with those produced by Auto Report, are used as input to the IBM System/3 RPG II Compiler.

An additional specification sheet, the RPG Auto Report specifications, allows the user to specify whether the source program generated by Auto Report will be punched into cards and/or cataloged into a library, whether the date and page information will be suppressed from the first heading line, and whether asterisks (*) will be suppressed from generated total lines.

Auto Report generates a listing that includes a printout of the specifications used by Auto Report (for the job being run), a list of errors encountered in the Auto Report specifications, and a message describing each error. Programs 5704-RG1, 5704-RG2, and 5705-RG1 allow the user to suppress this listing.

The minimum system requirements for Auto Report are the same as for RPG II (see *System Requirements*).

5445 Disk Storage Drive

The 5445 Disk Storage Drive Feature allows the user to access data files on the 5445 or 5448 Disk Storage Drive. The 5445 uses removable disk packs organized by cylinders, tracks, and sectors; the 5448 uses fixed disks organized like the 5445 disks. No libraries can reside on the 5445 or 5448 disk; they are used only for data storage.

Programming support for the 5445 or 5448 is patterned after the 5444 programming support. The 5445 requires minimum system requirements of the IBM System/3 Model 10 (see *System Requirements*). The 5448 requires minimum system requirements of the IBM System/3 Model 8 or 10 (see *System Requirements*). This feature operates under control of system control program 5702-SC1 and is available as a separately-orderable component of the RPG II program (5702-RG1). Prerequisite SCP features are:

- IBM 5448 Disk Storage Drive Feature 5702-SC1, Feature 6074
- IBM 5445 Disk Storage Drive Feature 5702-SC1, Feature 6022/6023

Telecommunications

The RPG II Telecommunications Feature provides the user with the ability to use the binary synchronous communications adapter (BSCA) as an input/output device for sending and receiving binary synchronous data over voice-grade or high-speed communication lines. The user adds to the RPG II source program the telecommunications specification statements necessary to describe the configuration.

The generated object program will allow the system to:

- Receive only
- Receive only conversational reply (not supported on 2770 and 2780)
- Transmit only
- Transmit with conversational reply (not supported on 2770 and 2780)
- Transmit and receive with no conversational reply (not supported on 2770 and 2780)
- Receive a file, then transmit a file

For example, a System/3 with a BSCA and the telecommunications feature can communicate with the following:

- Another System/3 with BSCA and the telecommunications feature
- System/360 Model 20 with BSCA and BSCA IOCS program support
- System/360 or System/370 with DOS BTAM, OS BTAM, or OS TCAM (except conversational TCAM) program support (see note 1)
- 2770 data communication system
- 2780 data transmission terminal
- 3741 Data Station, Model 2 or Model 4

The telecommunications feature supports three types of communications networks: point-to-point switched, point-to-point nonswitched, and multipoint (as a tributary station). It also supports manual call, manual answer, auto call, auto answer, medium speed, high speed, station selection, EBCDIC data transparency, intermediate block checking, and EBCDIC or ASCII code.

System/3 with BSCA can be intermixed with other BSC terminals (System/360 Model 20, 1130, 1800, 2770, 2780, and 2715 Model 2) on a multipoint line when operating as a tributary station with a central System/360 or System/370 computer (see note 1) using DOS BTAM, OS BTAM, or OS TCAM (except conversational TCAM). The system can also share the same phone number at the central System/360 or System/370 computer (see note 1) with other BSC terminals—System/360 or System/370 computers (see note 2) System/360 Model 20, 1130, 1800, 2770, 2780, and 2715 Model 2.

RPG II source programs containing telecommunications feature specifications can be compiled on the minimum system configuration (see *System Requirements*).

For object program execution, the BSCA feature (Feature Number 2074) is required on the processing unit in addition to the minimum system requirements. In addition, support of the 2770 or 2780 requires a minimum of 12K bytes.

Notes:

1. System/360 Models 22, 25, and 30 with DOS/360; Models 40, 50, 65, 67 (in 65 mode), and 75 with DOS/360 and OS/360; and Models 85, 91, and 195 with OS/360. System/370 Models 135, 145, and 155 with DOS and OS; and Model 165 with OS when operating in basic compatibility mode.
2. System/360 Model 22 with DOS; Models 25 and 30 with BOS/BPS or DOS/360; Models 40, 50, 65, 67 (in 65 mode), and 75 with BOS/BPS, DOS or OS/360; and Models 85, 91, and 195 with OS/360. System/370 Models 135, 145, and 155 with DOS and OS; and Model 165 with OS when operating basic compatibility mode.

Magnetic Tape

The RPG II Magnetic Tape Feature provides RPG II support for processing data or record address files on magnetic tape. Records must be fixed length, blocked or unblocked format. The feature supports consecutive input and output files recorded in either EBCDIC or ASCII code.

The Magnetic Tape feature can be used with a minimum system configuration (see *System Requirements*) and an IBM 3411 Magnetic Tape Unit and Control. The Magnetic Tape feature operates under control of System Control Program 5702-SC1 and is available as a separately orderable component of the RPG II program (5702-RG1). The SCP feature, magnetic tape support feature (5702-SC1, Feature 6024 or 6025), is a prerequisite.

3270 Display Control

The RPG II 3270 Display Control Feature provides an alternate solution to batch teleprocessing for the development of programs using the IBM 3270 Information Display System. The 3270 Display Control Feature allows a user to write application programs that have full access to the 3270 system facilities.

The 3270 Display Control Feature offers the following:

- Low initial installation costs
- Full support of IBM 3270 displays and printers directly controlled by RPG II application programs
- Automatic control of terminal configurations
- Full support of the 3270 field concept
- Simple and flexible mapping support
- Easy system operation since application programs are batch programs
- Symbolic naming of up to 18 terminals

The 3270 Display Control Feature is written in System/3 Assembler language and is linked into the application program through the SPECIAL file facility of RPG II. Because of the simplicity and ease of use of the Display Control Feature, the user requires only a knowledge of RPG II and the IBM 3270 Information Display System, and a minimal knowledge of teleprocessing and line control.

The IBM RPG II 3270 Display Control Feature operates in one of the following environments:

- In a dedicated System/3 Model 8, 10, 12, or 15 under control of the system control program
- In a program level of the Dual Program Feature under control of the System/3 Model 8, 10, or 12 system control program
- In a partition under control of the Model 15 system control program (Program 5704-SC1 only)

The 3270 Display Control Feature requires the following exceptions to the minimum system configuration for RPG II shown under *System Requirements*:

- For Model 8 and Model 10, processing unit Model A16 or above (32K minimum)
- For Model 8 and Model 10, at least one Model A2 5444 Disk Storage Drive (or 5444-2 for Model 10)

In addition, the 3270 Display Control Feature requires one of the following processing unit features:

- Binary Synchronous Communications Adapter (Feature 2074)
- Integrated Communications Adapter (Feature 4645)—Model 8 or Model 12
- Local Communications Adapter (Feature 4765)—Model 10 or Model 15
- Display Adapter (Feature 4601)—Model 15
- Local Display Adapter (Feature 4702)—Model 8 or Model 12

With BSCA, ICA, or LCA, one of the following:

- 3275 Display Station and Control
- 3271 Control Unit and one of the following:
 - 3277 Display Station Model 1 or Model 2
 - 3284 Printer Model 1 or Model 2
 - 3286 Printer Model 1 or Model 2
 - 3288 Line Printer Model 2

With Display Adapter or Local Display Adapter, one of the following:

- 3277 Display Station Model 1 or Model 2
- 3284 Printer Model 1 or Model 2
- 3286 Printer Model 1 or Model 2
- 3288 Line Printer Model 2

For Model 8 or Model 10, the RPG II 3270 Display Control Feature requires the BSCA Multiline/Multipoint Feature (Feature Number 6030 or 6031) of the system control program (5702-SC1).

Reference Material

Refer to the following manuals for additional information about RPG II:

- *Introduction to RPG II*, GC21-7514
- *IBM System/3 Disk Systems RPG II Auto Report Feature General Information Manual*, GC21-7563
- *IBM System/3 RPG II Reference Manual*, SC21-7504
- *IBM System/3 RPG II Auto Report Feature Reference Manual*, SC21-5057
- *IBM System/3 RPG II Telecommunications Programming Reference Manual*, SC21-7507
- *IBM System/3 RPG II 3270 Display Control Feature Reference and Logic Manual*, SC21-5161

Programming Service Classification: A

The programming service classification assigned to any licensed program may be changed by IBM in accordance with the terms of the license agreement for IBM program products. Some reclassifications may constitute a discontinuance of service.

Note: The SPECIAL exit is included under the Class A Maintenance plan of the RPG II Program Product, but Class A Maintenance will not be provided for a user's routine under the program product agreement for RPG II.

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