software survey

3600

INTRODUCTION

This survey explains in simple language the RC 3600 Multiprogramming Utility System, goes on to describe the User Software currently available for the RC 3600, and concludes with a Software Configuration Guide, which may be used in conjunction with the *RC 3600 Hardware Catalog* (a separate publication to be had on request) to assist you in the conceptualization of your own RC 3600 system.

The first section of this survey explains, among other things, the software modules of the RC 3600 Multiprogramming Utility System, and how they are combined to perform jobs.

The next section first concentrates on the Main Program module, which is written or adapted according to the processing requirements of the individual user, and then proceeds to describe the RC 3600 software now available for data communications, data conversion, data collection, and data entry applications.

The final section – which includes a model configuration, guidelines for determining memory requirements, and examples of typical RC 3600 systems – shows how you can combine the modules presented earlier in the survey to form a complete RC 3600 software configuration capable of performing the job or jobs that you envisage.

We hope that you will find this survey helpful and easy to use, and welcome any suggestions that you might wish to offer for its next edition. Inquiries about the software or systems described in this survey should be addressed to the main RC sales office nearest you. A list of these offices, with their addresses and telephone numbers, is found on the back of this sheet.

MAIN RC SALES OFFICES ▶

MAIN RC SALES OFFICES

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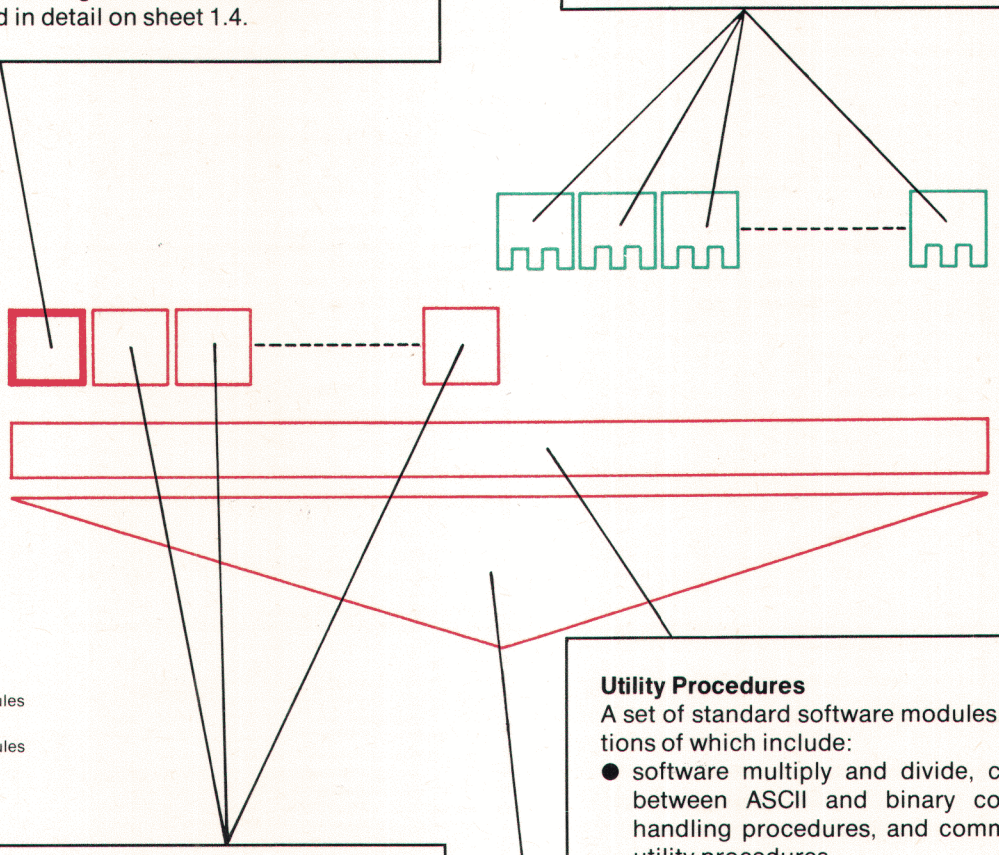
CONTENTS

SYSTEM MODULES

Operating System
Permits the user to load and run one or more programs at will by means of a few simple commands.
This standard software module, the functions of which include system command interpretation and loading of relocatable modules, is described in detail on sheet 1.4.

Main Programs
Each of which performs a particular processing job, according to the requirements of the individual user.
These adaptable software modules are described in detail on sheet 2.1.



- Adaptable software modules
- Standard software modules

Driver Programs
Drivers to handle RC 3600 equipment modules may be included in users' Basic and Job Configurations as required.
A complete list of these standard software modules is given on the back of this sheet.

Utility Procedures
A set of standard software modules, the functions of which include:

- software multiply and divide, conversion between ASCII and binary codes, byte handling procedures, and common driver utility procedures
- input/output initialization, positioning, close-down, and basic multibuffering including check and repetition
- character oriented and record oriented input/output procedures
- execution of Main Programs

Monitor
A standard software module, the functions of which include interrupt handling, multiprogramming implementation, software timing, and interprogram communication.

STANDARD DRIVER PROGRAMS ▶

STANDARD DRIVER PROGRAMS

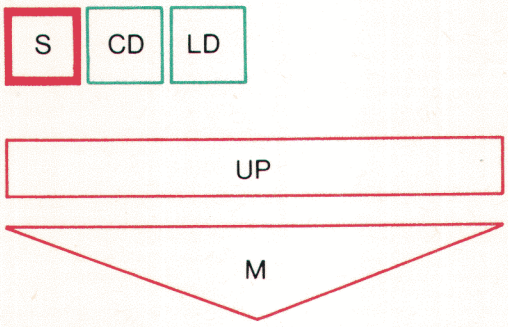
RC 3600 Equipment Modules	Driver Module
F 11 Operator Control Panel	OCP (Operator Control Panel)
F 12 KSR Teletype F 13 Alphanumeric Keyboard-Display	TTY (Teletype)
"S" Series Magnetic Tape Units	MTA (Magnetic Tape Unit)
RC 3600 Series Line Printers RC 3600 Series Serial Printers	LPT (Line Printer)
RC 3675 2000 cps Paper Tape Reader RC 3676 500 cps ISO Paper Tape Reader RC 3677 420 cps Olivetti Paper Tape Reader	PTR (Paper Tape Reader)
RC 3665 75 cps Paper Tape Punch	PTP (Paper Tape Punch)
RC 3671C 300 cpm Card Reader RC 3672C 600 cpm Card Reader	CDR (Card Reader)
RC 3660 200/45 cpm Card Reader Punch RC 3661 200/45 cpm Printing Card Reader Punch RC 3662 200/45 cpm Printing Card Reader Punch with Keyboard	CRP (Card Reader Punch)
RC 3650 Flexible Disc Drive	FDD (Flexible Disc Drive)
RC 3652 Disc Cartridge Drive	DCD (Disc Cartridge Drive)
RC 3680C BSC Channel	BSC (BSC Channel)
RC 3681 4 Line BSC Multiplexer RC 3682 8 Line Asynchronous Multiplexer RC 3683 64 Line Asynchronous Multiplexer	MPX (Multiplexer)

A detailed description of the RC 3600 hardware line of equipment modules is found in the publication "RC 3600 Hardware Catalog," which is available on request.

BASIC CONFIGURATIONS

The modules of the RC 3600 Multiprogramming Utility System can be combined in different ways to run different jobs.
Certain modules must always be present – to run any job whatsoever – while other modules are included only if they are required to run a particular job.

The Monitor, Utility Procedures, and Operating System must always be present in any system.
Two Driver Modules are always included, too, in order to operate the system. The one is for a console device, the other is for a load device.
Together, these modules make up a Basic Configuration:



- Always present, user-specified
- Always present

M Monitor
UP Utility Procedures
S Operating System
CD Driver Module for Console Device
LD Driver Module for Load Device

As there are eight possible combinations of Driver Modules for console devices and load devices, there are eight Basic Configurations, one and only one of which must be specified with any system.

A survey of the Basic Configurations is found on the back of this sheet.

BASIC CONFIGURATIONS SURVEY ▶

BASIC CONFIGURATIONS SURVEY

Monitor, Utility Procedures, Operating System, and one of the following combinations of Driver Modules:

	(console device)		(load device)
1.	OCP	and	MTA
2.	OCP	and	PTR
3.	OCP	and	CDR
4.	OCP	and	FDD
5.	TTY	and	MTA
6.	TTY	and	PTR
7.	TTY	and	CDR
8.	TTY	and	FDD

Driver Modules for Console Devices

OCP (Operator Control Panel)	for F 11 Operator Control Panel
TTY (Teletype)	for F 12 KSR Teletype or F 13 Alphanumeric Keyboard-Display

Driver Modules for Load Devices

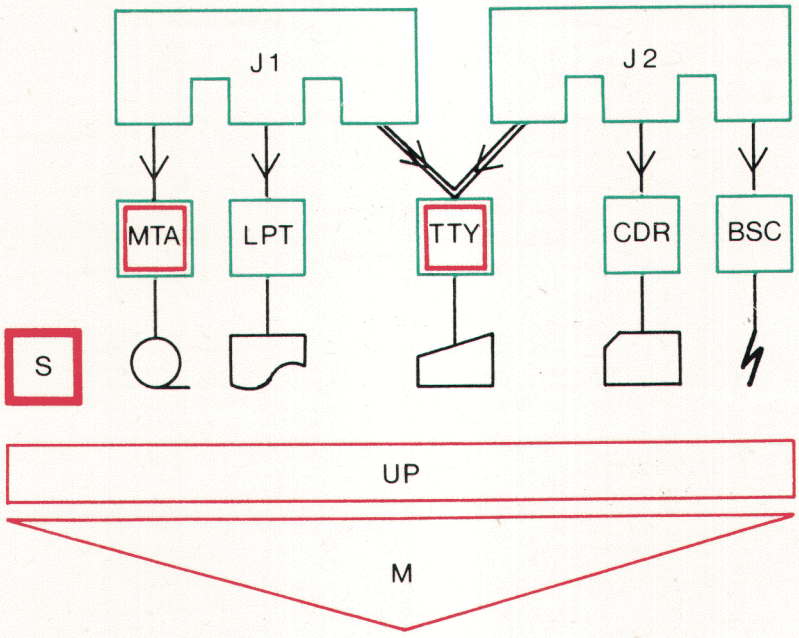
		Program Load Feature
MTA (Magnetic Tape Unit)	for RC 3610S or RC 3615S or RC 3620S Magnetic Tape Unit	F 01 9-track magnetic tape
PTR (Paper Tape Reader)	for RC 3675 or RC 3676 Paper Tape Reader	F 02 8-channel paper tape
CDR (Card Reader)	for RC 3671C or RC 3672C Card Reader	F 03 punched cards
FDD (Flexible Disc Drive)	for RC 3650 Flexible Disc Drive	F 04 flexible disc

JOB CONFIGURATIONS

Within the framework provided by the various system modules, the RC 3600 Multiprogramming Utility System can execute a number of concurrent jobs, limited only by the number of available peripheral devices and the memory capacity of the hardware configuration in question.
The first limitation arises from the fact that in general a device can only be used by one job at a time for reasons of data integrity.
One exception to this is the F 12 KSR Teletype (or the logically identical F 13 Alphanumeric Keyboard-Display), which may be used, in certain configurations, as an operator device by more than one job. Recommendations as to which console device or devices to use in order to run specific kinds of jobs are given on the back of this sheet.

Example of Job Configuration
The following diagram shows a Job Configuration with Main and Driver Programs for concurrent execution of two jobs, namely, off-line printing and transmission of card data:

- Job Configuration
- Basic Configuration



J1 Main Program for execution of printing job (Job 1)
J2 Main Program for execution of transmission job (Job 2)
MTA Driver for the load device, here a magnetic tape unit, which is used for automatic program loading and otherwise serves as the input device for Job 1
LPT Driver for line printer (output device for Job 1)
TTY Driver for the console device, here a KSR Teletype, which is used for system control functions and otherwise shared – in this particular configuration – by both jobs for operator communication purposes
CDR Driver for card reader (input device for Job 2)
BSC Driver for BSC channel (output device for Job 2)
S Operating System
UP Utility Procedures
M Monitor

RECOMMENDED CONSOLE DEVICES ▶

RECOMMENDED CONSOLE DEVICES

The console device is used for basic system control as well as for operator communication when running jobs.

The RC 3600 hardware line of equipment modules includes three such console devices: the F 11 Operator Control Panel, the F 12 KSR Teletype, and the F 13 Alphanumeric Keyboard-Display. Which of these devices should be included in a specific hardware configuration will depend on what kind or kinds of jobs are to be run.

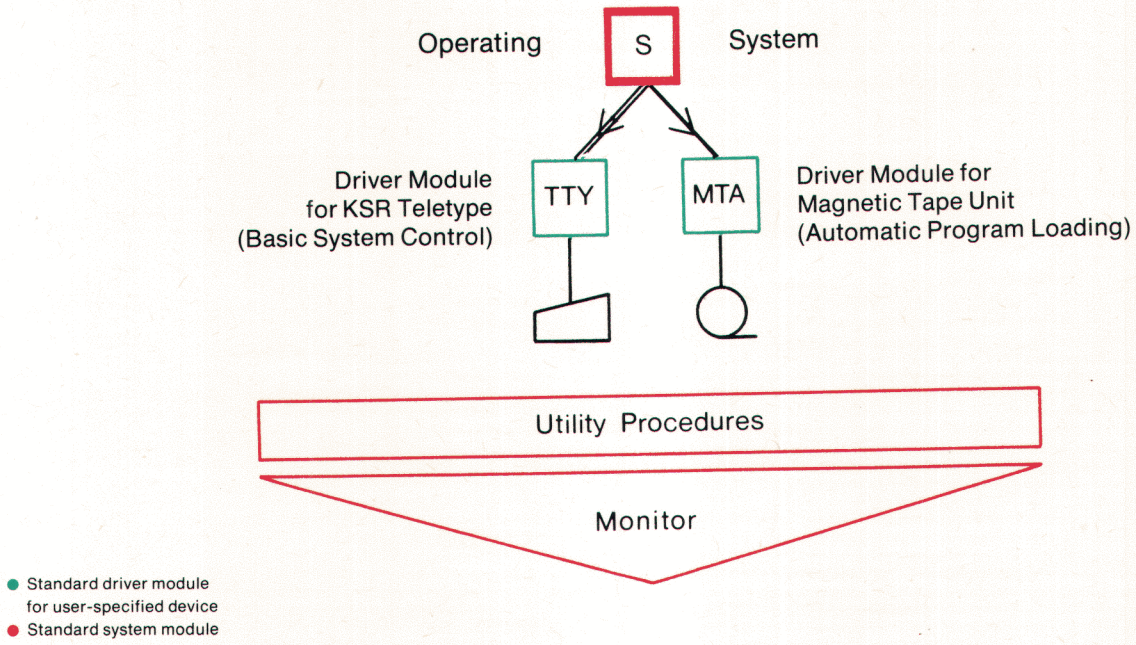
Generally speaking, the following console devices are recommended for these systems:

Off-line systems, single program	F 13 or F 12 or F 11	
RC 3600 point-to-point communications systems	F 13 or F 12 or F 11	
Multi-programming systems	F 13 or F 12	§
Terminal systems (except CDC 200 UT)	F 13 or F 12	
Terminal systems (including CDC 200 UT)	F 13	

§ Use of the F 11 in combination with either of these devices will facilitate operation.

OPERATING SYSTEM

Under the RC 3600 Multiprogramming Utility System, the memory of the central unit contains the Monitor, the Utility Procedures, and a number of programs running independently under control of the Monitor. Among these are Driver Programs, Main Programs, and the Operating System.
The Operating System is so designed as to permit the operator – by means of a few simple commands from the console device – to load Driver and Main Programs from the load device (except when the latter is being used by a job) and to delete existing programs in memory as required.
Only a limited number of Basic Configurations are therefore required for system operation, each including, in addition to the Monitor and Utility Procedures, the Operating System, a Driver Module for a console device, and a Driver Module for a load device.
Here is one example of a Basic Configuration:



A survey of the eight Basic Configurations is found on the back of sheet 1.2.

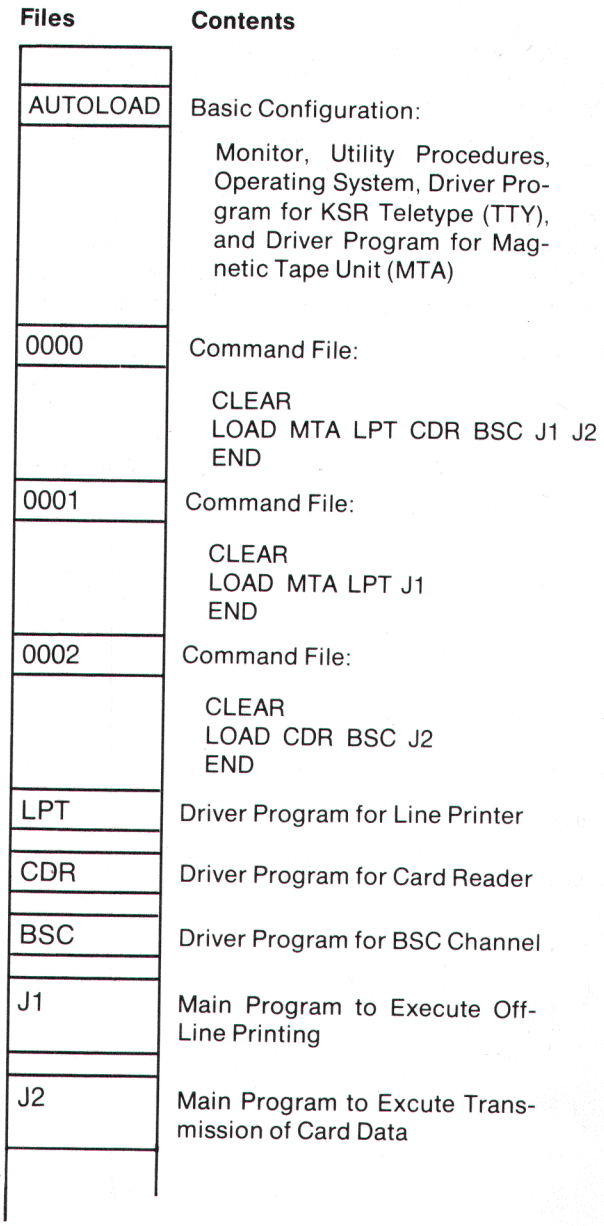
CREATION AND REMOVAL OF JOBS ▶

CREATION AND REMOVAL OF JOBS

Once a Basic Configuration has been loaded (by executing the autoload procedure), the operator may at any time instruct the Operating System to load the programs required to create a new Job Configuration, or delete the programs necessary to remove an existing job.

In order to make system control functions as simple as possible, the Operating System first reads and executes a series of pre-coded commands from the load device, and then reverts to the console device. When the programs required for a particular Job Configuration are loaded, the job starts automatically. As the Operating System uses Driver Programs only when executing commands involving input to or output from them, they can be used by jobs as well.

The ease with which jobs can be created and removed under the RC 3600 Multiprogramming Utility System may be illustrated by the example of a user program tape containing the Basic Configuration, Driver Programs, Main Programs, and pre-coded command files shown in the diagram on the right.



When the Basic Configuration is loaded, the operator command INT 0000 will remove any existing jobs from memory, load the Driver and Main Programs for the two jobs indicated, and start both jobs simultaneously.

The command INT 0001 will remove any existing jobs, load the programs for the printing job alone, and start it.

The command INT 0002 will remove any existing jobs, load the programs for the transmission job alone, and start it.

Note that the Driver Program for the magnetic tape unit has already been loaded as part of the Basic Configuration, so that the Operating System will ignore "MTA" in command files 0000 and 0001.

A detailed description of the RC 3600 Multiprogramming Utility System is found in the publication "MUS System Introduction/MUS Programmer's Guide," which is available on request.

MAIN PROGRAMS

Under the RC 3600 Multiprogramming Utility System, a Job Configuration is completed by one or more Main Programs, each of which performs a particular job such as off-line printing or transmission of card data.

While the Monitor, Utility Procedures, Operating System, and Driver Programs may be regarded as standard, non-adaptable system modules, the Main Programs are written or adapted according to the requirements of individual users.

In order to facilitate the implementation of Job Configurations for a wide variety of user applications, RC has developed a high-level programming language, called MUSIL, in which all Main Programs can be easily defined.

MUSIL (Multiprogramming Utility System Interpretive Language) bears an external resemblance to the programming lanugage PASCAL, which in turn is reminiscent of both ALGOL and PL/1. MUSIL utilizes the input/output utility procedures of the RC 3600 Multiprogramming Utility System and, like PASCAL, provides a strong framework for handling both structured and unstructured string type data, which is essential for administrative data processing applications.

A description of the MUSIL language and compiler is found in the publication "Introduction to MUSIL," which is available on request.

Customized, Ready-to-Run Programs

RC 3600 User Software includes completely finished programs for data communications, data conversion, and data collection applications, which are delivered in a form ready to load and run without involving the user in coding. No training is necessary in order to use this software, assuming that the operator has familiarized himself with the operating procedures and facilities of the program supplied.

Program production is carried out by RC on the basis of specifications and test material submitted by the user. To obtain a program for a particular application, the user will in most cases be able to avail himself of a Standard Main Program, which provides for a specific combination of input and output devices and a specific set of processing facilities in a given applicational area. Frequently, all of the information needed to produce a program to carry out processing functions within the scope of a Standard Main Program can be specified parametrically using pre-printed Job Definition Sheets.

All Main Programs have a set of so-called Run-Time Parameters, which are used by the operator to control the execution of the job. Many of these parameters can be specified – if the user so desires – to be modifiable at run time through the console device. When this is the case, a single Main Program can be set up at run time to perform jobs having different parameter values, and the user need not specify in advance every possible variation in processing requirements that may arise.

The Run-Time Parameters are further described on the back of this sheet.

RUN-TIME PARAMETERS ▶

RUN-TIME PARAMETERS

Each Main Program has a set of Run-Time Parameters, which have current values, stored within the system, and are used to control the execution of processing functions from the console device. The kinds of parameters included and their number will vary from one Main Program to another, depending on what sort of job control information the system requires.

Initial values for the Run-Time Parameters are entered in the Main Program, either as specified or by default, at the time of program generation. At run time the operator controls the program by keying in appropriate values to these parameters, which may be interrogated and, if necessary, updated, for example, if the next job is to run with parameter values different from the current values.

To take one of many conceivable sets of Run-Time Parameters as an illustration, let us consider a Main Program which accepts line image records from magnetic tape and outputs to a line printer. This particular program, designed for Siemens labeled standard/non-standard data sets, employs four such parameters, namely:

```
BLOCK NO ?  nnnnn
FILE NO ?   nnnnn
REWIND ?      s
SELECT ?    nnnnn
```

where nnnnn denote digits (0 to 9) and s denotes a sign (+ or –).

The initial values of these parameters are:

```
BLOCK NO ?  00001
FILE NO ?   00001
REWIND ?      +
SELECT ?    00255
```

The numerical parameter BLOCK NO indicates to the system on which block of the current input file the job should commence or continue. It is reset to 1 when the program is loaded or on End of Job.

FILE NO indicates from which file the next block should be read. It is reset to 1 when the program is loaded. When a tapemark is read, it is increased by 1. If the tape is rewound on End of Job, it is reset to 1.

The value of the logical parameter REWIND may be + or –, indicating whether or not the tape should be rewound automatically on End of Job. If the operator specifies rewinding, the magnetic tape unit will be set off-line when the tape has been rewound. This parameter is reset to + when the program is loaded.

SELECT is a compound numerical parameter, the format of which is XYZZZ.

The X digit is used to control printing. The value of X may be 0 or 1. 0 indicates that the line printer control character of the input record should be used. 1 indicates that the default value »space one line after printing« should be used.

The Y digit has no significance in this program and should always have the value 0.

The digits ZZZ, which form the actual select value of the parameter, are used to select records for printing in the following way:

If a value greater than 255 is specified, no selection will take place and all records will be printed in the sequence in which they are read.

If a value less than 255 is specified, only the records that contain the specified value will be selected for printing.

If the value 255 is specified, the program itself will find select values in the data set, and run through the data set as many times as there are different select byte values.

In the first run, the program takes the select byte value of the first record and uses this as the current select value. During this first run, all other values found by the program are stored in a table. After the run, the current value is deleted, a new value is taken from the table, a new run is made through the data set, and so on until the table is empty.

Sample Main Programs showing other sets of Run-Time Parameters are found on the back of sheet 2.4.

DATA COMMUNICATIONS - TERMINAL AND WORK STATION SIMULATORS

The RC 3600 provides comprehensive facilities for remote batch processing, remote work station functions, point-to-point communications, and other applications requiring synchronous communications techniques.

Main Programs – called Simulators – enable standard RC 3600 equipment modules to be used in any data communications system in place of IBM 2780/3780, Univac DCT 2000, CDC 200 UT, or ICL 7020/4 or 7020/5 terminals, or IBM HASP work stations. Additional Simulators will soon be released for Univac 9300, Honeywell G 115, and Siemens Transdata 840 terminals. As a replacement for the mainframe manufacturers' terminals, the RC 3600 offers several advantages.

The RC 3600 runs under its own operating system, communicating with the operator, in the case of terminal systems, via the F 12 KSR Teletype or the F 13 Alphanumeric Keyboard-Display. Many of the operating procedures associated with the switches, push-buttons, and indicators of other terminals are replaced by a set of simple keyboard commands.

A single command can thus connect the RC 3600 to a central computer or transmit a card deck, for example, while the RC 3600 itself keeps the operator informed of all events occurring within the system, including the peripheral devices and the communications link, that may require action on his part.

Through the use of double-buffering and other programming techniques, the RC 3600 can maintain the highest possible throughput permitted by external factors such as the speed and quality of the communications line.

By software simulation of the standard peripherals supported by the mainframe manufacturers' terminals for use in remote batch mode, RC 3600 terminal systems can make use of magnetic disc and magnetic tape units, paper tape readers, incremental plotters, and other equipment modules included in the RC 3600 hardware line.

Thus the operator at run time can indicate to the system, for example, that data nominally destined for the printer or punch should be output to magnetic tape instead (assuming that the user specified the inclusion of this facility in his Main Program).

The RC 3600 is not confined to remote working in connection with the systems of a single mainframe manufacturer. Since terminal simulation takes place entirely by software, using standard RC 3600 equipment modules, the RC 3600 can be switched between two or more simulation modes simply by loading the appropriate Simulator.

Other useful features of RC 3600 terminal systems may be summed up as follows:

- Statistics for line quality checks by operator command.
- Switching of input device during transmission by control characters or operator command.
- Selection of output device by special control characters in received data or operator command.
- Selection of data code translation table by operator command.
- Diagnostic programs for preventive or unscheduled maintenance.

The standard facilities and special features of currently released Simulators are listed on the back of this sheet.

SIMULATOR FACILITIES AND FEATURES ▶

SIMULATOR FACILITIES AND FEATURES

IBM 2780/3780 Terminal Simulator
Point-to-point or multipoint operation
EBCDIC, USASCII, or SBT codes
EBCDIC or SBT transparency
Multiple record feature
Vertical format control
Horizontal format control
Space compression/expansion
Cyclic redundancy check
Full or half duplex communications line
Automatic error recovery
Transmission speeds up to 9600 bps
Keyboard simulation of control cards
Special input/output devices

Univac DCT 2000 Terminal Simulator
Character and block parity check
Select character capability
Error detection and retransmission
ASCII-8 code
Short block capability
Card code translation
Line printer form control
Full or half duplex communications line
Transmission speeds up to 9600 bps
Keyboard simulation of control cards
Special input/output devices

CDC 200 UT Terminal Simulator
Shared line operation
Interleaved communications
Character and block parity check
External BCD or ASCII codes
Card code translation
Error detection and retransmission
Character compression (receive only)
Line truncation
Hardcopy output
Full or half duplex communications line
Transmission speeds up to 9600 bps
Special input/output devices

ICL 7020 Terminal Simulator
Poll/selection communications
ICL 1900 ASCII-7 code
Automatic retransmission
Parity and block sum check
Station selection
Code conversion
Horizontal and vertical tabulation
Full or half duplex communications line
Transmission speeds up to 9600 bps
Special input/output devices

Options such as blank column suppression, data end code, and short block working available on request

IBM HASP multileaving Work Station Simulator
Two-directional pseudo-simultaneous communications
Interleaving of multiple data streams
EBCDIC code
EBCDIC transparency
String compression and decompression
Automatic retransmission
HASP work station console commands
Up to 7 logical readers
Up to 7 logical punches/printers
Code conversion
Full or half duplex communications line
Transmission speeds up to 9600 bps
Special input/output devices

DATA COMMUNICATIONS POINT-TO-POINT COMMUNICATIONS SYSTEMS

As a component of a point-to-point communications system, the RC 3600 can function as the sender or as the receiver of data, or as both. An RC 3600 can function as a terminal simulator – this is described in detail on sheet 2.2 – but it can also function without simulation as a remote output or input batch facility, or two RC 3600's in communication with each other can be used for various applications.

One of the most frequent uses of the RC 3600 in remote batch processing is as a remote "print" station. The "printing" need not, however, mean actual printing to paper; remote output can just as well be on magnetic tape or disc, paper tape, or other media. For this function two configurations are possible.

In the first, the computer mainframe dumps the output destined for the remote site onto a fast medium, such as magnetic tape or disc, and goes on to other work. This tape or disc can then be input to an RC 3600 for possible editing and/or conversion and subsequently transmitted to another RC 3600 at a remote site, or directly to the output device using a simple RC 3600 communications system. If the receiving equipment is in fact another RC 3600 with data conversion capability, then the remote site can simultaneously output the data (possibly after editing) and convert it to yet another medium.

In the second configuration, the mainframe is online with its RC 3600 data transmission system. This might be the case, for example, if the mainframe's output of data destined for transmission was occurring at a rate compatible with transmission speeds.

In both configurations the major advantages lie in having a transmission system that can do various kinds of conversion, but even where conversion is not required (except, of course, with respect to conversion to data transmission and back again) the RC 3600 might be chosen for many other reasons. Among these are the speed and quality of the RC 3600 Series printers, their long mean times between failure and low heat dissipation properties, the sturdiness of the paper tape punches, and the overall ease of operation of RC 3600 systems.

An example of an actual RC 3600 point-to-point data communications system is found on the back of this sheet.

CONTINUED ▶

POINT-TO-POINT COMMUNICATIONS SYSTEMS (CONTINUED)

System Example

The following RC 3600 system is in operation at a bank with many branches. It has three major functions and a number of minor ones. There is a data conversion and a data collection function, which need not be described here except as they interact with the point-to-point communications function. The minor functions are mostly involved in providing flexibility and back-up capacity, such as allowing the RC 3600 to be used for mainframe functions when the latter is down or overloaded.

The actual point-to-point function involves communication with an IBM 370/155 through OS and HASP, so that the RC 3600 here is operating as a HASP Work Station. It does this by simulating, at various times, an IBM 2780, 3780, or 360/20, receiving output in this way from the mainframe and outputting it to line printer and/or magnetic tape at a remote location via a second RC 3600 at that site.

The RC 3600 installation also serves to input data to the mainframe, both via cassette tapes from other terminals and via a dial-up line. The advantages of the RC 3600 in the latter case are that it can operate either automatically or under operator control and that it can handle many lines, acting as a concentrator as well. Finally, the RC 3600 can perform many of these functions simultaneously, edit both input and output, and direct different data to different destinations.

Résumé

To sum up, the RC 3600 – when used in point-to-point data communications systems of varying kinds – provides the advantages of on-line or off-line simultaneous data conversion, data concentration, and routing of incoming or outgoing data along several paths.

These functions operate via a combination of program packages, which can be modified to customize them to each installation's special needs. All Main Programs for the application or applications in question are written in the MUSIL language, and the entire communications system operates under the RC 3600 Multiprogramming Utility System, thereby adding the capability of easy up-dating or expansion of the system at any point.

DATA CONVERSION

Data conversion means the transfer of data from one input or output medium to another, with or without intervening editing or routing. Data is not produced in a data conversion system; it is moved.

Data conversion occurs, for example, when data on one kind of magnetic tape, with its peculiar formatting characteristics, is moved, in part or as a whole, to another magnetic tape, perhaps of another kind and with other formatting characteristics, or to paper tape, or to cards, or to line printer, or to several of these simultaneously or serially. Thus data conversion systems have as their purpose the transfer of data from one or more sources to one or more destinations.

RC 3600 data conversion systems currently can move data about among the following input/output media:

- 7 or 9 track magnetic tape
- printer
- paper tape
- cards
- flexible or moving-head cartridge disc
- plotter

and in doing so can also interact with various kinds of data communications and data collection systems (as described on sheets 2.3 and 2.5).

In most cases, data conversion systems are satellite systems associated with computer installations. If, for example, an installation receives input in the form of cards or paper tape, and if that installation finds it advantageous to input data to its main computer via an input medium that is faster than cards or paper tape, then often a satellite system is used that will put the information from the cards or paper tape onto one or more magnetic tapes. This procedure might be employed, for example:

- if the computer was too busy to wait for slow forms of input,
- if it was desired to edit and route the data before it was input, for instance, if the data was destined for different kinds of computers, or
- if input was to be performed at an inconvenient time or by inexperienced personnel.

Data conversion is sometimes found in the absence of a computer, for example, when an organization uses a service bureau to do its computing. Here, it is often advantageous to transfer input data to, say, magnetic disc and to receive output in a form such as magnetic tape, so as to reduce service bureau charges.

The major reason for the existence of data conversion systems is the fact that input/output functions are not only the slowest, but also the most error-prone of all computer installation activities. Mechanical devices, such as line printers, are thousands of times more likely to be down than is the mainframe. Very frequently, therefore, input/output functions are removed from the mainframe, both to speed up processing time and to lessen the impact of I/O down-time on the main system.

The RC 3600 functions described on this sheet operate via a combination of program packages, which can be modified to customize them to each installation's special needs. All Main Programs for the application or applications in question are written in the MUSIL language, and the entire data conversion system operates under the RC 3600 Multiprogramming Utility System, thereby adding the capability of easy updating or expansion of the system at any point.

A small sample of the Standard Main Programs currently available for data conversion applications is given on the back of this sheet.

SAMPLE MAIN PROGRAMS ▶

SAMPLE MAIN PROGRAMS

Standard Print Image Program
This program handles no label magnetic tapes with a maximum block size of 1,340 bytes, each block consisting of fixed length records with CCW control characters and EBCDIC code data. Output is to an RC 3600 Series printer with a 64 character ASCII drum.

The program requires 5,546 bytes of memory, and has the following Run-Time Parameters:

BLOCK NO	: 00001	Next block to be read from current file
FILE NO	: 00001	File from which block is read
REWIND	: +	Rewind or not on EOF
MARGIN	: 00000	Spaces to left of print line
SELECT	: 00999	Default CCW switch, select mode/value
RECSIZE	: 00133	Length of input record

Fixed length records with ANSI, rather than CCW, control characters are handled by a second standard print image program, which has a memory requirement of 5,588 bytes.

Variable length records in blocks of up to 1,384 bytes – either with CCW or with ANSI control characters – are handled by two further print image programs, which require 5,640 and 5,674 bytes of memory, respectively.

IBM Label Print Image Program
This program handles IBM label magnetic tapes with a maximum block size of 1,384 bytes, each block consisting of fixed or variable length records with CCW or ANSI control characters, depending on the information given in the label, and EBCDIC code data. Output is to an RC 3600 Series printer with a 64 character ASCII drum.

If the HDR2 label is missing, the default values are fixed length records of 133 bytes with ANSI control characters.

The program requires 7,974 bytes of memory, and has the following Run-Time Parameters:

BLOCK NO	: 00001	Next block to be read from current file
DATASET	: 00001	Data set from which block is read
REWIND	: +	Rewind or not on end of data set
MARGIN	: 00000	Spaces to left of print line
SELECT	: 00999	Default CCW switch, select mode/value
L-PRINT	: +	Label print or not

Tapes with a maximum block size of 13,804 bytes are handled by a second IBM label print image program, which requires 20,394 bytes of memory.

Cards to No Label Magnetic Tape Program
This program accepts 80 column cards in EBCDIC code as input. Output is fixed or variable length format records in EBCDIC code, in blocks of up to 1,264 bytes, on no label magnetic tape.

The program requires 4,836 bytes of memory, and has the following Run-Time Parameters:

BLOCK NO	: 00001	Next block to be written to current file
FILE NO	: 00001	File in which block is written
REWIND	: +	Rewind or not on tapemark
FIXRECS	: +	Output record format
MAXCOL	: 00080	Maximum columns transferred when variable length format output. When fixed length format output, then number of columns transferred
MINCOL	: 00080	Minimum columns transferred when variable length format output
BLOCKED	: 00010	Number of records in each output block

Paper Tape to No Label Magnetic Tape Program
This program accepts undefined length paper tape input records of up to 4,096 bytes. Output is variable length blocks of from 18 to 4,096 bytes on no label magnetic tape. No code translation is performed.

The program requires 14,932 bytes of memory, and has the following Run-Time Parameters:

BLOCK NO	: 00001	Next block to be written to current file
FILE NO	: 00001	File in which block is written
BLOCKSIZE	: 01000	Length of output block
REWIND	: +	Rewind or not on EOJ
FILLCHAR	: 00000	Fill character in last block of each paper tape

DATA COLLECTION

When information from many places must be collected together into one place, a data collection system is needed. The RC 3600 can perform data collection functions in a variety of ways.

The simplest kind of RC 3600 data collection system involves receiving and storing (and possibly editing) data that has been put to some data storage medium by a number of machines of the same or of different kinds.

To illustrate such a system, let us consider a company with a great amount of record processing, where the accounting department has several machines that accumulate and output data on punched paper tape, either with the same or with different codes and data formats. Here, the RC 3600 could receive and edit the tapes, and rearrange and store the information on them on a number of other storage media, or even on another paper tape. Most frequently, however, the final storage medium chosen is magnetic tape or disc.

A logically equivalent, but more complicated data collection system may be illustrated by an accounting department with machines that do not output to any storage medium themselves, but instead output over a wire to an RC 3600 that includes the facility of multiplexing input from a number of machines – possibly of different kinds – and storing that input, most probably on magnetic tape via disc. Here, the RC 3600 might also function as a data collection terminal itself in communication with a remote central computer site.

The third and last kind of data collection system is even more complex. Suppose that data was being accumulated by an accounting machine of some kind, or by a teller's terminal in a bank, or by some other device that was required to accumulate information throughout the day and store it on some medium or transmit it continuously to some other storage device.

Several of these data accumulation devices might be connected to an RC 3600, by communications link, by hard-wire, or by the manual operation of taking the output from the device and setting it onto an input device on the RC 3600.

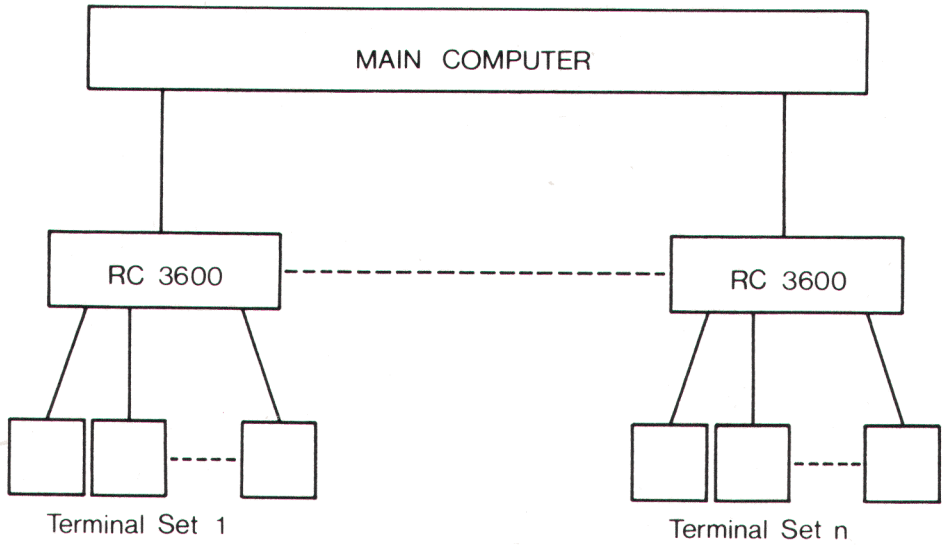
Let us further suppose that many RC 3600's were occupied in this way, each with its own set of devices. Now, the flow of data might stop at this point, or the RC 3600's might themselves be in communication with a central computer. In either case, wherever the RC 3600 entered the system, data conversion, editing, and routing could occur.

The diagram on the back of this sheet should help to clarify this concept.

CONTINUED ▶

DATA COLLECTION (CONTINUED)

Complex Data Collection System



Various parts of this third kind of system might be utilized in a specific RC 3600 data collection system, and the connecting lines on the diagram above might represent data communications links or, simply, the manual transfer of, say, a paper tape from an accounting machine to a paper tape reader on an RC 3600. Editing and routing might be done at any or at all levels, and data conversion, editing, and routing could be done by the RC 3600's.

Résumé

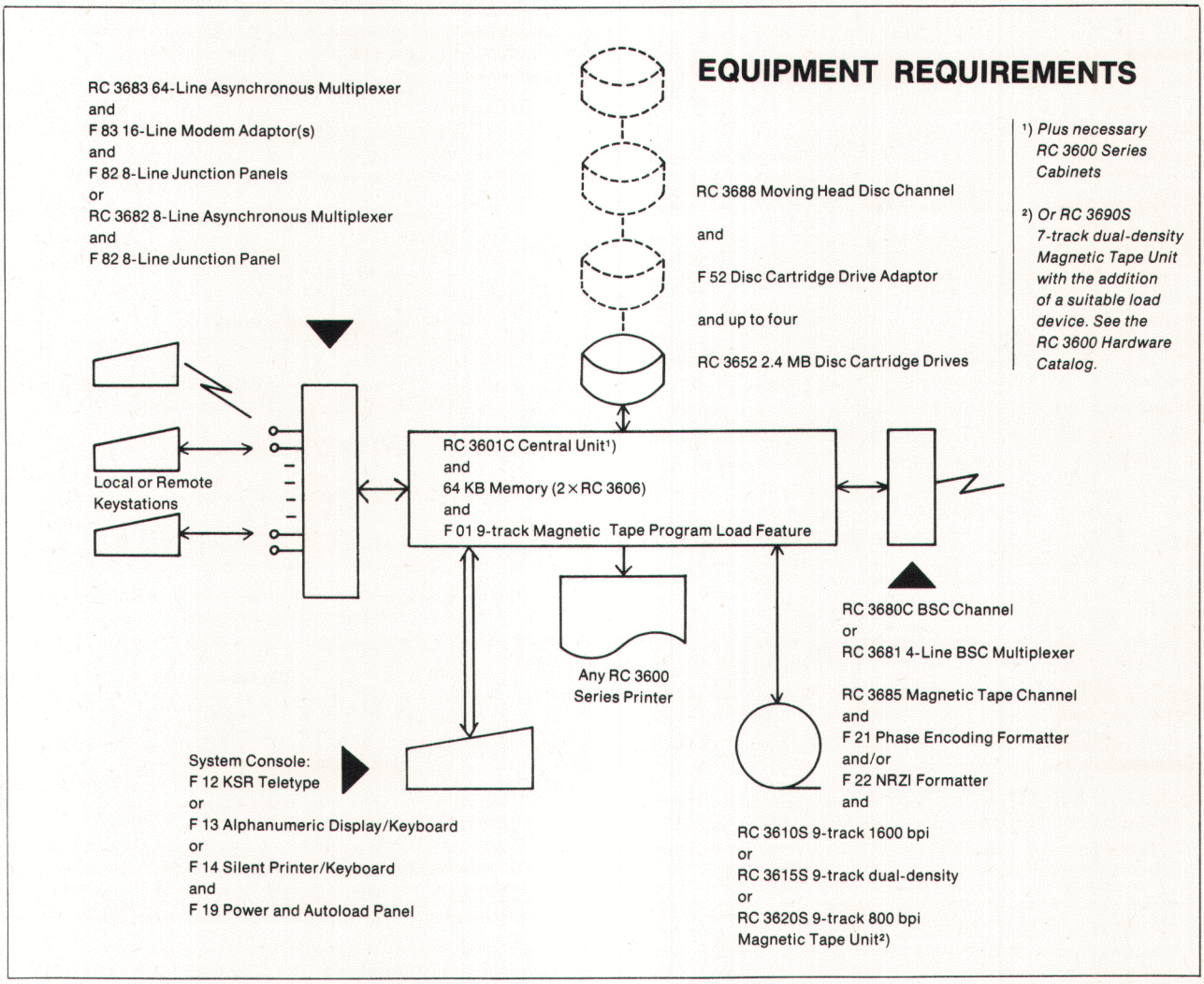
The advantages of introducing the data conversion capability of the RC 3600 into a data collection system are manifold. Such a capability allows greater flexibility in choosing and/or updating the sets of terminals used at the initial data entry points. It is also helpful when parts of the main system are down, for example, when the printer on the mainframe is not functioning. In the latter case, data conversion can be used to by-pass the disfunction, or the output devices of the RC 3600 can substitute for the non-functioning device on the mainframe system.

The use of an RC 3600 in a data collection system also adds the possibility of using data communications for the transfer of data within the total system. The advantages of this are reduction in human error, time and cost savings, and the ability to solve special problems arising outside the system itself. Thus data collection using data communications is often found, for example, as a substitute for the use of the mails to transmit tapes and the like.

Essentially, then, the use of the RC 3600 in a data collection system adds the advantages of conversion and communications possibilities to the system.

These functions operate via a combination of program packages, which can be modified to customize them to each installation's special needs. All Main Programs for the application or applications in question are written in the MUSIL language, and the entire data collection system operates under the RC 3600 Multiprogramming Utility System, thereby adding the capability of easy updating or expansion of the system at any point.

DATA ENTRY



The RC 3600 data entry system enables the user to collect up to 9.3 million bytes of data on disc files from local and remote keystations under record format control. Completed data batches may be dumped to computer-compatible magnetic tape or transferred in RJE fashion to a central computer for processing. New record formats are easy to create, and any format included in the system can be accessed by all keystations simultaneously.

Validation, editing, skipping, duplication, arithmetic operations, and batch accumulation are some of the many possibilities provided by the system for manipulating data from the keystation during entry. The translation of format programs, extraction of statistics, transfer of completed batches, and other management functions are all assigned to a designated supervisory keystation.

The standard system, which permits simultaneous data communications and keystation operations, supports up to four 2.4 MB disc cartridge drives, a 9-track magnetic tape unit, printer, system console device, and, typically, 16 local or (with modems) remote keystations.

The keystation consists of a display and a keyboard, which are physically and functionally separate, all communication between them being handled by software. The CRT is capable of displaying at least 640 characters, arranged in 8 lines of 80 characters each. The keyboard is designed for easy customization to special user requirements.

The data entry functions operate via a combination of program packages, which can be modified to customize them to the particular needs of each installation. All application programs are written in the MUSIL language, and the entire data entry system operates under the RC 3600 Multiprogramming Utility System, thereby adding the capability of easy updating and expansion of the system at any point.

Concurrent operation as an RJE terminal is supported by the standard simulation packages available with the RC 3600 and described elsewhere in this booklet.

CONTINUED ▶

Operator Functions

The data entry system receives input from the keystation and, depending on the mode of operation (data entry, re-keying, or edit) selected by the keystation operator, permits him to do the following:

- Select record formats.
- Create new data batches or continue the keying of temporarily closed batches.
- Key data fields with validation.
- Edit the current record (backspace characters or fields).
- Flag an invalid field or record.
- Output records to disc.
- Re-key to verify a disc-resident batch, simultaneously with the first keying of fields in the same batch from another keystation.
- Edit any batch.
- Create new formats, subprograms, and tables.

A field error is indicated by an audible signal. The operator may either correct it immediately or flag it for correction when the batch is re-keyed or edited.

In edit mode the operator can enter into any batch and alter its contents. Searches by flagged field or record, field or record number, or any text string as well as global searches for strings can be made. Corrections take place under control of the record format. Records may be inserted or deleted.

New formats, subprograms, or tables can be keyed as a normal data entry task, under record format control, and stored in a batch. The supervisor can then translate the source text and, if it is syntactically correct, transfer it to the appropriate, disc-resident library.

Supervisor Functions

These are performed by relocatable application programs, stored on disc and loaded to memory as required. New supervisor functions can be easily added to the system. From his keystation the supervisor can:

- Translate format programs, subprograms, and tables.
- Request surveys of the job, format, subprogram, and table libraries, disc surveys, and job, batch, and operator statistics.
- Transfer disc-resident batches to magnetic tape or to a communications line.
- Load, delete, list, and copy batches. The supervisor can also close a batch, if, for example, a keystation goes down during input.
- Transform his keystation into an ordinary keystation; any other keystation can then designate itself supervisor.

Record Formats

Every keystation task is associated with a batch file on disc. Initial keying of fields, validation, output of records to the disc file, re-keying to verify the disc-resident batch, and editing of the batch are all controlled by a specified record format, as is the creation of new formats, subprograms, and tables.

A record format consists of a number of subformats (up to 32). These may be entered in random sequence, but a new subformat cannot be entered until the current one is finished. New subformats can be selected by the program or by the operator.

Each subformat contains a number of sequentially entered field descriptions, each of which consists of a so-called checkbox part and an optional program part. The checkbox, which is used for a basic check of the input data and for definition of the output format, permits specification of the following:

- Maximum length of the field: 0–80 characters.
- Minimum length of the input field: 0–80 characters.
- Type of field: numeric, signed numeric, alphabetic, or alphanumeric.
- Right or left justification of the characters in the output field.
- Fill characters to be used in the output field: zero, asterisk, or space.
- Verification, if the field must be keyed during re-keying verification.
- Display of the keyed field on the keystation CRT.
- Kind of field: keyed, not keyed, duplication, semi-duplication, constant, or semi-constant.
- Register containing a duplication or constant value.
- Position of the field in the output record: field number from 1 up (for possible re-formatting in a form more compatible with computer processing).

The optional program part of the field description enables the user to modify or add to the standard parameters in the checkbox. These programs, which are written in a format language similar to COBOL, can operate on all of the keyed fields in the subformat as well as on a number of registers associated with the individual keystations and used for the transfer of data from one record to another. The number and length (minimum 5 bytes) of the registers are limited only by available memory capacity. Some of the commonly used standard features of the format language are:

- Arithmetic computations such as batch balancing and crossfooting. Arithmetic functions include addition, subtraction, multiplication, and division.
- Range sets.
- Check-digit verification.
- Tables of legal or illegal values.
- Double-entried tables.
- Automatic or semi-automatic insertion of constant fields, duplication of fields, or skipping of fields.
- Compare and branch operations.
- Display of alarm and other operator messages on the keystation CRT.

Data Organization

The system organizes data into fields of from 0 to 80 characters in length, keyed records of variable length, and output records of variable length. Any number of formats can be accommodated, limited only by available disc capacity. Up to 32 subformats within each format can be manually or automatically linked.

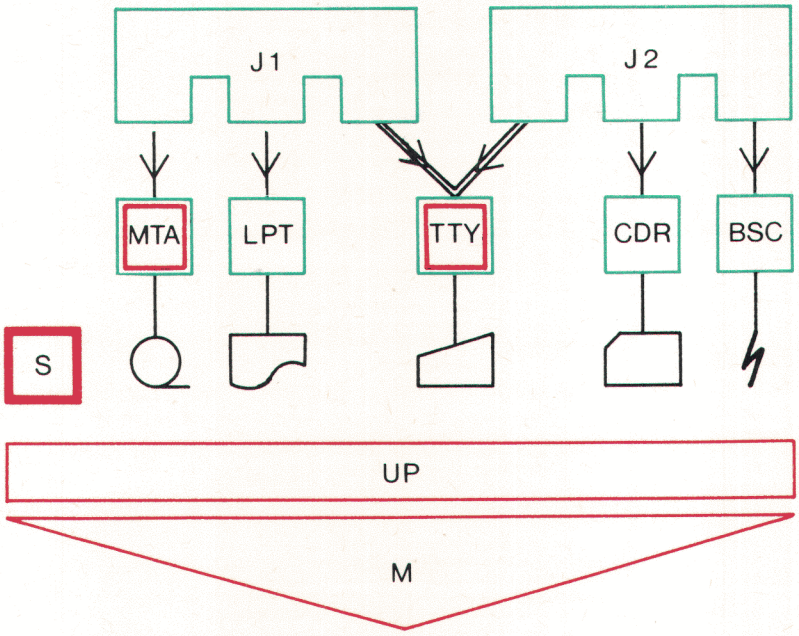
Example of a Data Entry Configuration

The permissible number of keystations in a given data entry system will depend on the record sizes and the number and complexity of the formats, supervisor programs, and terminal simulators required. With a 64 KB memory, the system will optimally accommodate 16 keystations, but in some cases it is possible to support as many as 24 keystations.

By way of illustration, the memory requirement of a configuration with 16 keystations might be as follows:

Standard RC 3600 software modules	19 KB
Data entry master program	18 KB
16 keystations (0.5 KB each)	8 KB
6 formats (1 KB each)	6 KB
Supervisor area for application programs, terminal simulators, etc.	13 KB
Total memory requirement	64 KB

SOFTWARE CONFIGURATION MODEL



● Job Configuration
● Basic Configuration

STANDARD SOFTWARE MODULES	Size in Bytes
Required in any configuration:	
M Monitor	1,394
UP Utility Procedures	2,546
S Operating System	1,488
Required in any configuration, user-specified:	
TTY Driver Program for a Console Device, which is required in any configuration for basic system control. Here, the F 12 KSR Teletype has been specified as the Console Device. Apart from its system control functions, the Teletype is also used – in this multiprogramming configuration – to control the execution of the two jobs.	562
MTA Driver Program for a Load Device, which is required in any configuration for automatic program loading. Here, a Magnetic Tape Unit has been specified as the Load Device. In this particular configuration, the Magnetic Tape Unit also serves as the input device for Job 1.	768
Required in this configuration for job execution:	
LPT Driver Program for a Line Printer (output device for Job 1)	358
CDR Driver Program for a Card Reader (input device for Job 2)	658
BSC Driver Program for a BSC Channel (output device for Job 2)	1,668
ADAPTABLE SOFTWARE MODULES	
Required in this configuration for job execution:	
J1 Main Program, written or adapted according to the user's requirements, for execution of the printing job (Job 1)	5,660
J2 Main Program, written or adapted according to the user's requirements, for execution of the transmission job (Job 2)	12,000
Total Memory Requirement of Configuration in Bytes:	**27,102**

This example shows an RC 3600 software configuration for concurrent execution of two jobs, namely, off-line printing and transmission of card data. It may also, however, be used as a model in conceptualizing other RC 3600 software configurations, showing, as it does, the five kinds of system modules which any such configuration must contain in order to run jobs, namely, the Monitor, Utility Procedures, Operating System, Driver Programs, and Main Programs.

Apart from knowing which software modules to include when planning a specific configuration – and possibly listing them as shown on the left – it is also an advantage to be able to work out the total memory requirement of the contemplated configuration. This, too, might be done by simply listing the size in bytes of each software module required and adding up the total, again, as suggested here.

As an aid in such planning, the memory requirements of the various system modules are given on the back of this sheet, while further examples of RC 3600 software configurations are given on sheet 3.2.

MEMORY REQUIREMENTS OF SYSTEM MODULES ▶

MEMORY REQUIREMENTS OF SYSTEM MODULES IN BYTES

Standard Software Modules

Monitor (M)	1394
Utility Procedures (UP)	2546
Operating System (S)	1488
Driver Programs	
OCP Operator Control Panel	686
TTY Teletype	562
MTA Magnetic Tape Unit[1]	768
MTU Magnetic Tape Unit[1]	118
LPT Line Printer	358
PTR Paper Tape Reader	328
PTP Paper Tape Punch	178
CDR Card Reader	658
CRP Card Reader Punch	972
FDD Flexible Disc Drive	900[2]
DCD Disc Cartridge Drive	900[2]
BSC BSC Channel	1668
MPX Multiplexer	2362

[1] As the Driver Programs employ re-entrant input/output procedures, the same Driver Program can be used for additional devices of the same category, each of which will require approximately 120 bytes of additional code. Thus »MTU« refers to the code that is required to connect an additional magnetic tape unit to the system using the Driver Program »MTA«.

[2] Provisional figure.

Adaptable Software Modules

The Main Program, which is written or adapted according to the specifications of the individual user, will vary in size depending on the variety and the complexity of the processing facilities required, and in direct proportion to the size of the buffers included. It is therefore impossible to state in advance the byte requirement of a Main Program for a specific application. Nevertheless, it should be possible to make a rough estimate of the size of the Main Program, if the following factors are kept in mind:

A Main Program is made up of three elements: Main Program statements, input/output buffers, and code translation tables.

- The size of the Main Program statement section ranges typically between 2,000 and 5,000 bytes.
- The size of a buffer can vary from a low of, say, 133 bytes for a single line printer buffer, or 160 bytes for a card reader operating in column binary mode, to a high of 13,804 bytes for a magnetic tape buffer, for example.
- The typical size of translation tables is 256 bytes or 512 bytes, depending on the codes involved.

Thus the two Main Programs included in the example on the front of this sheet might contain the elements shown below.

J1 Main Program for Printing Job	
Main Program Statements	3,000
Magnetic Tape Buffer	1,340
Line Printer Buffers (8 of 133 bytes each)	1,064
Line Printer Table	256
Total Byte Size:	5,660
J2 Main Program for Transmission Job	
Main Program Statements	9,600
Teletype Table	128
Card Reader Buffers (7 of 80 bytes each)	560
Card Reader Tables (2 of 256 bytes each)	512
BSC Channel Buffers (2 of 600 bytes each)	1,200
Total Byte Size:	12,000

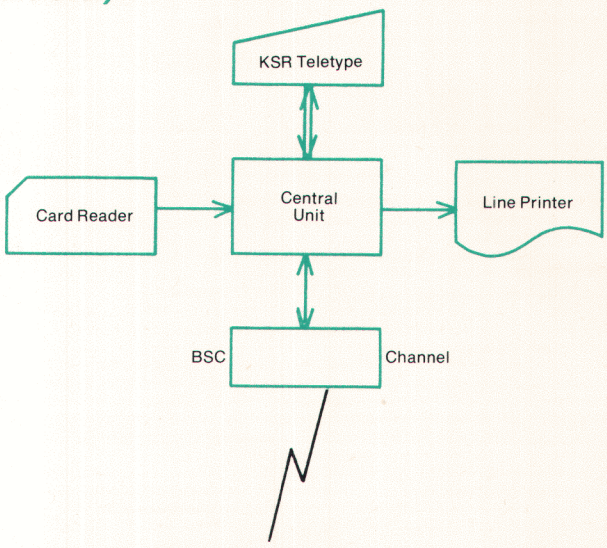
EXAMPLES OF SOFTWARE CONFIGURATIONS

Data Communications Configuration (Terminal Simulator)

Software Modules	
M Monitor	1,394
UP Utility Procedures	2,546
S Operating System	1,488
TTY Driver for Teletype	562
CDR Driver for Card Reader (also for loading)	658
BSC Driver for BSC Channel	1,668
LPT Driver for Line Printer	358
Main Program for IBM 2780 Simulation §	6,668
Total Memory Requirement in Bytes	**15,342**

§ Main Program Elements

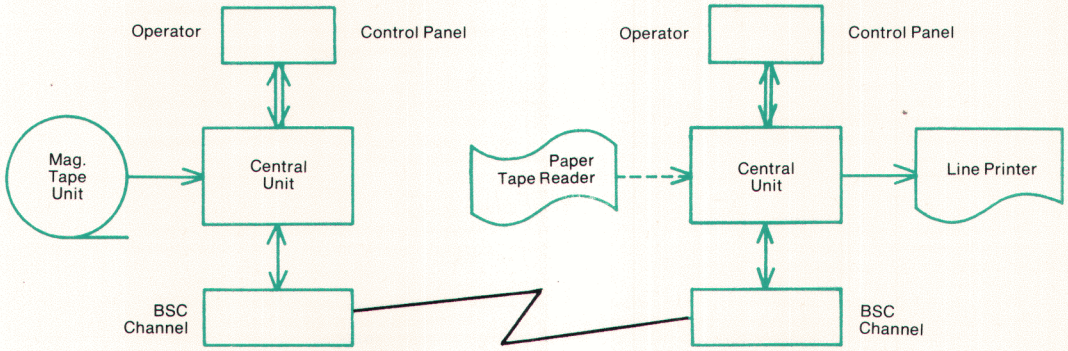
Main Program Statements	4,270
Teletype Buffer	128
Teletype Table	256
Card Reader Buffers (2 of 80 bytes each)	160
Card Reader Table	256
BSC Channel Buffers (2 of 520 bytes each)	1,040
Line Printer Buffers (2 of 151 bytes each)	302
Line Printer Table	256
Total Byte Size, Main Programs	6,668



Data Communications Configuration (Point-to-Point Communications System)

Software Modules	
M Monitor	1,394
UP Utility Procedures	2,546
S Operating System	1,488
OCP Driver for Operator Control Panel	686
MTA Driver for Magnetic Tape Unit (also for loading)	768
BSC Driver for BSC Channel	1,668
Main Program for Print Image Transmission §	6,394
Total Memory Requirement in Bytes, Transmission Station	**14,944**

M Monitor	1,394
UP Utility Procedures	2,546
S Operating System	1,488
OCP Driver for Operator Control Panel	686
PTR Driver for Paper Tape Reader (only for loading)	328
BSC Driver for BSC Channel	1,668
LPT Driver for Line Printer	358
Main Program for Remote Printing §	5,928
Total Memory Requirement in Bytes, Printing Station	**14,396**



§ Main Program Elements

Main Program Statements	4,330
Magnetic Tape Buffers (2 of 512 bytes each)	1,024
BSC Channel Buffers (2 of 520 bytes each)	1,040
Total Byte Size, Transmission Program	6,394

Main Program Statements	4,330
BSC Channel Buffers (2 of 520 bytes each)	1,040
Line Printer Buffers (2 of 151 bytes each)	302
Line Printer Table	256
Total Byte Size, Printing Program	5,928

CONTINUED ▶

EXAMPLES OF SOFTWARE CONFIGURATIONS (CONTINUED)

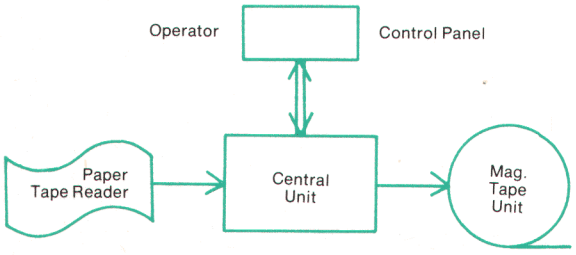
Data Conversion Configuration

Software Modules

M	Monitor	1,394
UP	Utility Procedures	2,546
S	Operating System	1,488
OCP	Driver for Operator Control Panel	686
PTR	Driver for Paper Tape Reader (also for loading)	328
MTA	Driver for Magnetic Tape Unit	768
	Main Program for Conversion of Paper Tape to No Label Magnetic Tape (No Code Translation) §	4,000
Total Memory Requirement in Bytes		**11,210**

§ Main Program Elements

Main Program Statements	2,800
Paper Tape Reader Buffers (2 of 100 bytes each)	200
Magnetic Tape Buffer	1,000
Total Byte Size, Main Program	4,000



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