RC890/RC891 Control Unit
User's Guide

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A. INTRODUCTION

The RC890 and RC891 Control Units allow clusters of RC terminals and personal computers with terminal emulation programs to access host computer systems which support communication with IBM 3270 Information Display Stations. With respect to the communication with the host system, both Control Units are compatible with the IBM 3274 Control Unit, and support SNA/SDLC as well as BSC protocol.

RC45 and RC855 terminals may be connected to RC890 as well as to RC891 using a multidropped terminal network, called RcCircuit. The RC891 may also be attached to a 1 Mbps CSMA/CD type local area network (LAN), called RcMicronet. This makes it possible to connect RC750 (Partner) personal computers (PCs) as well as other RC products, notably the RC8000 mainframe computer, to the RC891.

Except for functions utilizing the RcMicronet and which therefore cannot be performed by the RC890, the two products are very similar. Throughout this guide we use the abbreviation CU whenever a common property of the two products is discussed.

The link between the CU and the host computer may be established using a telephone line and modems (V.24 interface) or using a circuit-switched public data network (X.21 interface).

The CU is housed in a compact cabinet (shown in Figure E.1 and E.2). The most important components inside the cabinet are two or three single-board microcomputers which cooperate to perform the tasks of a terminal control unit. The programs to be executed by the microcomputers are loaded from a diskette which resides in the drive accessible from the front of the cabinet.

CU models

Both the RC890 CU and the RC891 CU come in three models: RC890/RC891-05, RC890/RC891-10 and RC890/RC891-20. The models have different limitations as to the number of

terminals, PCs and hosts that can be connected. Also, the maximum number of emulated 3270 devices differs from model to model. To gain an understanding of the meaning of these limititations, it will be necessary to read main section B.

Software for the CU and terminals

The diskette containing the programs for the CU is delivered along with the CU itself, while new releases of the programs providing added or improved features are distributed on separate diskettes. Similarly, programs to be executed by soft-programmed terminals are delivered as separate SW packages. These programs are installed on the CU diskette and may be subsequently be downloaded to the terminals.

The relevant SW packages, all of which are distributed on 5 1/4" diskettes, are:

SW8900 Programs to be executed by the RC890 CU.

SW8910 Programs to be executed by the RC891 CU.

SW8914 IBM 3270 emulator programs for terminals.

SW8906 TTY/ANSI X3.64 terminal programs. Note, that the TTY/ANSI X3.64 terminal function is independent of the CU once the terminal is loaded.

SW8915 Combined IBM 3270 and TTY/ANSI X3.64 emulator program for RC45 terminals.

The system administrator

In this guide one user at each terminal cluster site is designated the system administrator. A number of tasks concerning the CU are described as system administrator responsibilities. It is not the intention to imply that these tasks must necessarily all be carried out by the same person, although such an arrangement would be very practical. In general it can be said that most of the information in this guide is addressed to the system administrator.

Overview of this guide

This guide covers those aspects of using the CU and a cluster of connected terminals or PCs for 3270 emulation which pertain to the cluster as a whole, with emphasis on the customization of the CU. Information about 3270 emulation relevant for the terminal operator may be found in the user's guide for the terminal or PC emulator in question (refs. 1,2,3). It is also possible to access the 3270 communication function from a program running on a PC. Information about this feature may be found in ref. 4.

The following is an overview of the contents of the remaining sections of this guide.

Main section B contains a general description of the functions of the CU emphasizing how the CU will interact with terminals, PCs, a public data network, and remote host computers. A number different models exist of the RC890 as well as the RC891 with support for different numbers of terminals and 3270 devices. These are also discussed in section B.

Program files from distribution diskettes can be installed on the CU diskette by means of a program that can be executed on the CU controlled from a terminal. The procedure is described in main section C.

By editing a number of text files containing a specification of the functional configuration and a number of operational parameters, the system administrator may tailor the CU to the needs of the particular installation. The configuration possibilities and customization parameters are explained in main section D.

The responsibilities of the system administrator and the tools available for accomplishing these tasks are the subjects of main section E.

In normal use the CU does not have an independent function which is visible to users at terminals or PCs. It just allows access to the remote host system and therefore plays a rather anonymous role. However, it is the source of a number of messages, i.e. brief texts, which appear in the

status line of a terminal or PC display when the downloader or an emulation system is used. The meaning of these messages is discussed in main section F.

B. SYSTEM OVERVIEW

The purpose of this main section is to provide a general understanding of the working of the CU and to establish a frame of reference for the specific information given in main section D on the customization of a CU. The CU performs some basic functions: LAN communication, communication with terminals via RcCircuit, and download of terminals, which may be used for multiple purposes, as well as the specific function of IBM 3270 emulation. The first three of the following sections deal with the basic functions; the remaining part of main section B is about 3270 emulation.

LAN Communication

The RC891 supports a general form of data message exchange on the LAN. This general communication function allows the RC891 to simultaneously communicate with RC8000 mainframe computers as well as a number of PCs attached to the same LAN.

The PC connection is used primarily for emulating 3270 devices on PCs, but may also be used to run RC891 system administration utilites on a PC, cf. ref. 1, or to let an application program running on a PC interact with a soft device on the RC891, cf. the section Emulated 3270 devices, below.

The RC8000 connection is used for communication between terminals attached to the RC891 CU or PCs performing 3270 emulation under control of the CU on one hand, and the RC8000 mainframe on the other hand.

RcCircuit Communication

All communication between the CU and terminals attached via the RcCircuit takes place as block-at-a-time data exchange on the Circuit. This function can also serve multiple purposes; it allows some terminals to be downloaded while others are actively performing 3270 emulation.

Terminal Download

RC45 and RC855 terminals are based on a soft-programmed microcomputer. In order to perform a useful function they must therefore be loaded with a program. A terminal may be configured to expect its program to be downloaded from a CU. The program is then transferred from a file on the RC39 disk to the program execution memory of the terminal by transmission on the RcCircuit.

Alternatively, terminals may be configured to load from built-in permanent memory (PROM) or from a local floppy disk (RC855 only).

Download is a little slower than load from a built-in PROM, but more flexible, since several different terminal programs may be downloaded to the same terminal, e.g. an IBM 3270 emulator to be used in cooperation with a CU and an ANSI X3.64 terminal program to be used as a stand-alone terminal function.

The selection of the program to be downloaded to a terminal is made by means of a menu. The default menus are very simple. However, menus may be extended by the system administrator.

It is possible for one emulator program to appear more than once in the same menu in different disguises. This is meaningful if different parameters are supplied for the program in each instance, causing it to behave differently. See section B.2, Host line selection, for a description of how parameters are used with the 3270 emulator programs.

Terminal menus may be customized for each installation, see section D.2, Download menus. It is possible to specify a different menu for each individual terminal. It is also possible to install additional terminal programs and include them in the menu for any desired terminal.

IBM 3270 Emulation

Together with a number of terminals and/or personal computers the CU may emulate an IBM 3274 Control Unit with a cluster of attached devices. Each terminal or PC which is to emulate one or more 3270 devices is required to run the appropriate emulator program.

The emulation system provides a number of functions beyond those of a traditional 3270-type device cluster. However, the central purpose remains: to allow communication to take place between a host computer-based application and a number of devices. The devices may be printers or displays with keyboards; they may also include "soft devices", i.e. software modules with no direct physical representation.

Linking the CU to a host computer

A link is needed between the CU and the host computer in order to exchange data between the application program running on the host and devices attached to the CU. Such a link may be established in several different ways, and a CU may support communication on several links simultaneously.

The concept of a host link is important in order to understand the host link menus and link names that occur in the emulation system, particularly when the CU is configured and customized to support multiple links.

A host link may be remote, utilizing telephone lines or a public data network, or local, utilizing a LAN.

Multiple links

When the CU supports multiple links simultaneously it must establish correspondences between active devices and links. We say that a device is attached to a link. In general, any device may be attached to any link, but not to more than one link at a time. A display device is always attached to a link; an idle printer need not be.

When a device is attached to a given host link, the CU will report to other hosts attempting to access the device that it is unavailable, as if it were switched off.

In some cases the host may later be notified when the device becomes available, e.g. when a printer has completed its operation.

Host link selection

Consider the situation when an emulated display device belonging to a cluster with multiple host links is activated in a terminal or PC. The CU must then attach the device to a host link. This is done by presenting a menu on the terminal display allowing the operator to select any one of the host links.

Host links must therefore have names which can be shown in the host link menu. The name of the host link to which the device is attached is shown in the status line of the display during normal emulator operation.

If there is only one host link, an activated display device is automatically attached to this link. No menu is shown, but the link name will appear in the status line.

For remote links, the link names may be defined as part of CU customization. For local links, the names are received from the host, and cannot be changed at the CU.

Skipping the host link menu. It is possible to supply a host link name as a parameter when the 3270 emulator program for RC45 or RC855 terminal is loaded. If such a name is present the emulator will skip the menu presentation and automatically attach the device to the link. This feature is only relevant if multiple links exist. See the description of download menu customization (section D.2, Download menus) for information on how to pass parameters to the terminal emulators.

Remote host links

A remote host link can be established via a permanent (leased) or dial-up telephone line to the host computer. The CU must be connected to the telephone line by means of a modem according to CCITT interface standard V.24.

Alternatively, a remote host link can be established via a circuit-switched public data network. In this case the CU must be connected to the network by means of a DCE according to CCITT interface standard X.21.

The communication protocol used on the host link can be either BSC or SNA/SDLC.

IBM-compatible links. Three combinations of line kind and protocol, viz. V.24-BSC, V.24-SNA/SDLC and X.21-SNA/SDLC, enable the CU to communicate with standard IBM products and compatible products from other vendors. In these cases there is a one-to-one relationship between the modem (V.24 signal cable) or DCE (X.21 signal cable) and a host link. Notice that such a host link may provide access to several applications running on the same host computer, or in fact to several host computers in the case of an SNA network. However, from the point of view of the CU and the terminal emulator there is only one host link.

The CU communicates with each remote host as if it were an IBM 3274 control unit. When multiple host links exist the hosts need not be aware of each other.

X.21-BSC. The fourth combination of line kind and protocol, X.21-BSC, is not supported by IBM or IBM-compatible vendors. This combination therefore requires a special front-end (FE) computer, the RC3803, at the host site. By utilizing the fast switching capability of the public network - assuming it is indeed fast - to hold a line only when there is actual data traffic, the CU is able to maintain communication with up to 4 FEs simultaneously per DCE, i.e. per X.21 subscriber attachment (in IBM terminology this technique is referred to as "short-hold mode with multiple port sharing").

As in the case of IBM-compatible links we shall refer (in main sections D and E) to the connection between the CU and the X.21 DCE as a link. However, with respect to host link selection this link has up to four sublinks, one per RC3803 FE, each with its own link name.

Dual host configuration. The CU may be configured with connections to one or two modems or X.21 DCEs. A configuration with two such connections is referred to as "dual host". The various combinations of line kind and protocol may be freely mixed on the two connections of a dual host configured CU. It should be clear from the discussion above that if the X.21-BSC combination is used on (at least) one of the two connections the number of host links may be greater than two. The phrase "dual host" is therefore slightly misleading.

Figure B-1 shows an example configuration with three remote host links.

Local host links

Local host links are established on a LAN and therefore only supported by the RC891 CU. The host computer must be an RC8000 attached to the LAN by means of a so-called Attached Device Processor (ADP). The number of host links is customized in the ADP. It is possible to customize so that each one of possibly several applications on the RC8000 host has its own link. Local links are logical in nature since they all share the same physical LAN.

Emulated 3270 devices

3270-type devices can be emulated on several different kinds of equipment which of course must be connected to the CU. The different emulators may be freely combined in a cluster.

An RC45 or RC855 terminal, which is connected to the CU via RcCircuit and runs the 3270 emulator program, supports up to two display devices and one printer device. Only one

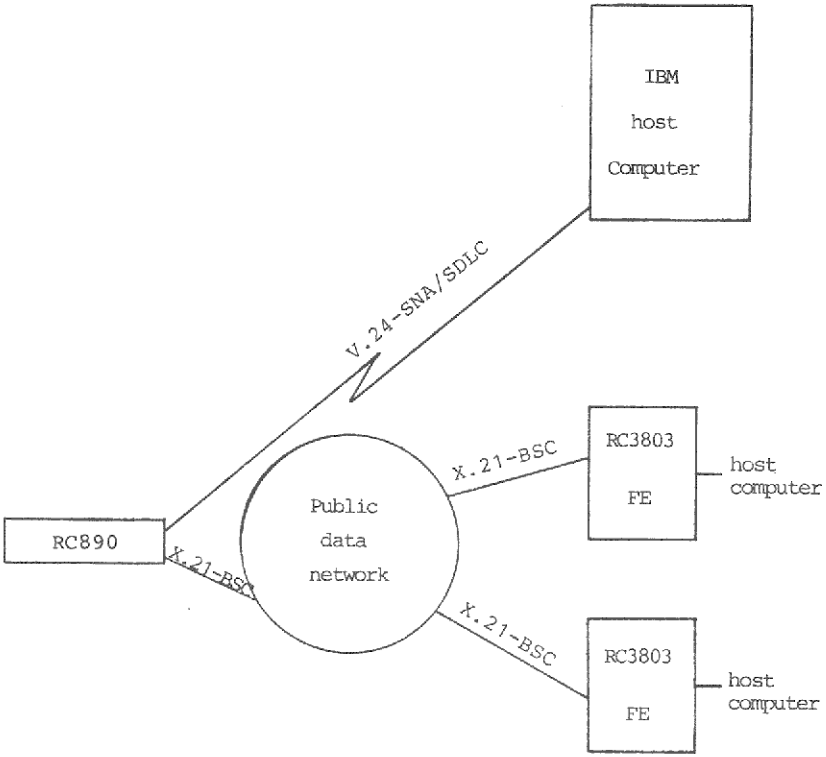

Figure B-1. Example: configuration of 3270 host links.

of the display devices is visible, but the operator can switch display device at any time.

A PC, which is connected to the CU via a LAN and runs its version of the 3270 emulator program, supports up to four display devices and four printer devices. Normally, the operator sees only one display device at a time, but can switch among them. By means of windows, parts of two or more display devices may be visible simultaneously. It is not possible to connect four printers directly to the same PC, so some of them may be reached via re-routing through the

LAN. This re-routing is handled by the emulator program running on the PC and is unknown to the CU.

In addition to emulated devices which are mapped to physical devices by emulator programs in terminals or PCs, the CU itself may be configured to maintain a number of "soft devices". The soft devices have no physical manifestation, but they behave exactly like other devices toward the host. Operations on soft devices can be performed by application programs running on a PC connected to the CU by a LAN. The soft devices allow such programs to access host computers as if they were terminal operators. Soft devices are only provided on the RC891.

An example system with several different kinds of emulated devices is shown in Figure B-2. The letter D indicates a display device and the letter P a printer device.

The device numbers used to address the individual devices in a an emulated 3270 cluster are in general not customized as parameters of the CU, but as parameters of the units, i.e. terminals or PCs, where the devices reside. Soft devices, however, are customized as CU parameters, since these devices do reside within the CU.

This customization method is intended to be flexible and easy to use: it is not necessary to change the customization of the CU because a new terminal is added to the cluster. As a consequence, the CU, when it begins operation upon load, has no knowledge of the device configuration of the cluster. If configuration errors exist, i.e. if the same device number has been used for emulated devices in two or more units or twice in the same unit, this will not be uncovered until both devices become active simultaneously. When such a situation arises, the CU will reject the second device which attempts to use the contested device number.

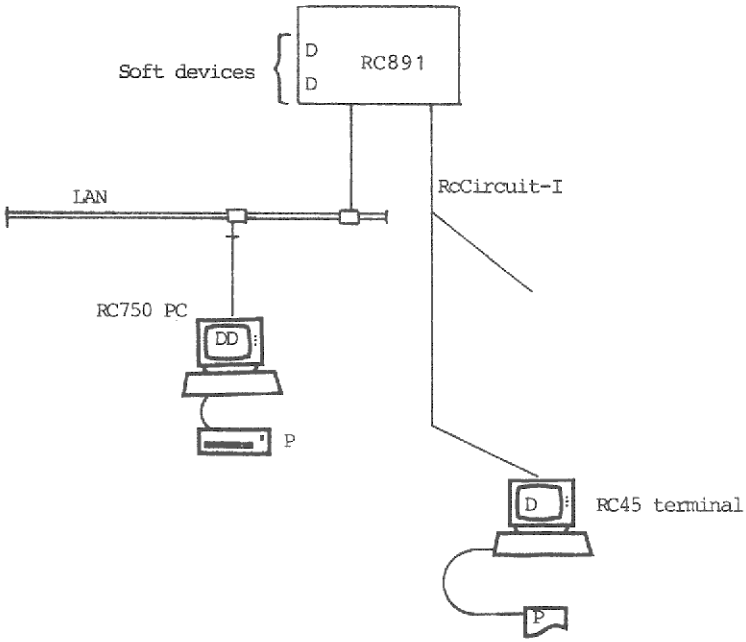

Figure B-2. Example: cluster of 3270 devices.

C. Software Installation

Programs to be downloaded to terminals attached to the CU via RcCircuit are in general not distributed with the CU, i.e. not on the CU diskette, but on separate diskettes from which they must be copied to the CU diskette before they can be loaded. The task of copying a program file, or indeed any file, from a diskette where it resides to the CU diskette is performed by a program called the RC890 Software Install program. This program must itself be downloaded to a terminal, but unlike other terminal programs it is distributed on the CU diskette. Note that the maximum size of a file to be copied is 42.5 Kbytes.

Normally, the Install program can only be loaded to the terminal with secondary address 0 (cf. section D.2, Download menus).

The Install program helps the person installing a SW package by prompting, instructing, and displaying informative messages as it goes along. Initially, it displays the following :

```
RC890 Install Program

Change diskette and type filename:
```

Now remove the CU diskette from the drive, insert the diskette containing the file to be installed, and type the name of the file terminated by . The relevant file names are listed in the SW package descriptions.The file is then read and the following displayed:

```
Reading file: <filename>
```

When the file has been successfully read the following is displayed:

```
Mount RC890 diskette, and type filename:
```

Now remove the diskette with the file to be installed and reinsert the CU diskette. Subsequently type the name by which the file should be known on the CU diskette terminated by <return>. If the same name is to be used as on the source diskette, just press <return>. If a file exists already with the specified name, it is overwritten; otherwise a new file is created.

When writing begins, the following is displayed:

```
Writing file: <filename>
```

When the file has been successfully written, the following is displayed:

```
Install complete - continue y/n?
```

If y (yes) is typed, the installation procedure is repeated, making it possible to install another file. If n (no) is typed, the terminal will return to the download menu.

If an error is detected during installation, an error message is displayed. After displaying the error, the program will wait for something to be typed. CTRL+CLEAR causes installation to be abandoned, and the terminal will return to the download menu. Any other key will cause the failing step of the installation procedure to be repeated.

D. System Customization

The RC890/RC891 Control Unit can be configured and customized in a simple and flexible manner. All information concerning the configuration and customization of a CU is collected in a number of text files which are read by the CU when its software is loaded.

The term configuration is used to refer to the selection of CU functions. The configuration of a CU determines which software modules are loaded and activated. By customization, on the other hand, we refer to the control at a detailed level of operational parameters for the modules which have been selected for a configuration.

There is one file, the configuration file, which contains a description of the CU configuration, and a number of files, the parameter files, which contain specifications of customization parameters. This main section is concerned with the form and meaning of the contents of these files. Practical aspects, such as finding the files and editing them, are discussed in main section E.

Whenever the CU is reset (cf. section E, Resetting the CU), an initial program is executed which reads the configuration file, determines which software modules to load, and then reads the parameter files to obtain parameters for the activation of these modules. Default values for all the parameters are built into the initial program, and these values remain in effect in all cases where no modification is read from the appropriate parameter file. Consequently, the parameter files need only contain specifications of deviations from the default parameter values for those functions which are active.

As a general rule all the files have a name of the form *.CST, where * stands for some sequence of letters, and CST is intended as a mnemonic for "CuSTomization". Similarly the * part of the name is chosen so as to give a clue to the subject of the contents of the file.

Another rule is that semicolons (;) may be used in the files to introduce comments; i.e. the part of a text line which follows a semicolon is ignored, when the files are read during load of the CU, and may contain explanatory information for the system administrator who will be responsible for editing the files.

D.1 Configuration

The significant part of the configuration file - excluding comments - is a list of so-called configuration switches, each of which causes a particular function or set of functions to be activated or deactivated. Syntactically, a configuration switch is just a sequence of characters. In the list, the configuration switches may be separated by commas (,) and/or newline characters.

The name of the configuration file is CONFIG.CST. The distributed version of this file contains configuration switches for the default configuration which is single host BSC. In addition, a long comment makes the file largely selfexplanatory. The remaining part of this section goes into more detail than the explanation found in the distributed file.

Basic functions

The basic functions independent of 3270 emulation are: LAN communication, communication on the RcCircuit, and download of terminals.

LAN communication is activated by the configuration switch LAN which works only on the RC891. Unless this switch is set the CU will not attempt to perform any communication on the LAN.

The other basic functions are activated by default, since they are normally always required to be active. It is possible to deactivate these functions by means of the configuration switches -lCIRC, for RcCircuit communication,

and -MDLL, for terminal download. Beware, however, that deactivation of RcCircuit communication will disable any form of communication between terminals and the CU.

IBM 3270 emulation

There are two aspects of 3270 emulation which are configured independently: 1) the ability to communicate with one or more host computers via one or more links, and 2) soft devices (RC891 only) which reside within the CU and may be accessed from programs running on an RC750 PC or other processors attached to the LAN.

Remote host links

A "dual host" configuration is one which supports two remote links (with possible sublinks in the X.21-BSC case). For each link there is a connection to a V.24 modem or an X.21 DCE. A "high performance" configuration supports only one remote link, but allows a data transfer rate up to 19200 bps. The maximum data transfer rate in dual host as well as ordinary single host configurations is 9600 bps.

Because the protocols BSC and SNA/SDLC are handled by different software modules, protocol selection is also a configuration issue, whereas line kind selection (V.24 or X.21) is handled by means of a customization parameter.

There are seven configuration switches which activate 3270 emulation with remote link support. At most one of these may be present in the configuration file. The switches are:

conf.switch	description
3270B	Single host BSC, ordinary
3270BH	Single host BSC, high performance
3270BD	Dual host, both BSC
3270S	Single host SNA/SDLC, ordinary
3270SH	Single host SNA/SDLC, high performance
3270SD	Dual host, both SNA/SDLC
3270BS	Dual host, one BSC, one SNA/SDLC

In order to distinguish the links in dual host configurations the specifications of customization parameters (see section D.2) use the concept of a link number which can be 1 or 2. Link number 2 will apply only to dual host configurations where the same protocol is used for both links (3270BD or 3270SD). In single host configurations and mixed protocol dual host configurations the link/both links is/are defined to be link number 1, and the link number may be omitted from parameter specifications as it is not needed to identify the link (the BSCID and BSCXNO parameters are exceptions from this general rule).

Local host links

The configuration switch CULANI (3270 CU emulation with LAN Interface) will activate 3270 emulation with support for local host links. This switch may be present together with any one of the switches mentioned under remote host links, or with none of them.

Soft devices

The configuration switch SOFTDEV will activate one or more soft 3270 devices. The device numbers of soft devices must be specified by a customization parameter. Unless either remote or local host links are also activated, the soft devices will not be able to communicate with a host.

D.2 Customization, Parameter Files

In order to simplify the task of customization by text file editing, the customization parameters have been divided into groups according to subject. A parameter file is defined for each group of parameters. A value for a given parameter must be specified in the file to which the parameter has been assigned. If a parameter specification is placed in a wrong file it will have no effect.

There are five parameter files. These, and the associated subjects are:

MENUDL.CST	Download menus.
CONV1.CST	Conversion between EBCDIC character code used
(CONV.CST)	for transmission on remote host links and the
CONV2.CST	internal character code used by the CU and emulated 3270 devices.
TEXTS.CST	Texts for status lines and host link menus.
COMM.CST	Communication, both local and remote, and device cluster control.

Parameter file syntax

Each line in one of the parameter files contains the specification of a parameter value, or just a comment if the line begins with a semicolon. A parameter specification line always begins with the name of the parameter, which is a sequence of letters (at most 8), possibly followed by some further information to identify the desired parameter, typically an index when several similar parameters are organized in a table. Then follows an equals sign and the value to be used for the parameter in question.

In the subsections dealing with the individual parameter files each parameter specification line is shown in a generic form which indicates the proper syntax. In these lines parentheses are used to delimit optional parts, slashes (/) to delimit alternatives, and words or phrases

written in small case letters to indicate parts whose syntax is explained in subsequent paragraphs.

On the other hand, the parameter name which occurs at the beginning of each parameter line written in capital letters, comma (,), equals sign (=) and binary digits (0/1) shall be used literally in actual parameter lines.

Whenever a parameter specification includes a text (character string), each character following the preceeding delimiter (comma or equals sign) is significant, i.e. a character string may include leading blanks. On the other hand, a numeric parameter may be preceeded by blanks, which in this case have no significance.

In the following subsections, the generic form of each parameter specification line is shown as the part to the right of the colon in the headline introducing the description of the parameter.

Download menus (MENUDL.CST)

The menu-based terminal downloader identifies terminals by their addresses as secondary stations on the RcCircuit (SA parameter in the configuration of the terminal). The default menus are identical for all terminals except the one with secondary address 0 which is designated as the system administrator terminal. Figure D-1 shows the default menu for common terminals. Three texts frame the menu:

1. TERMINAL FUNCTION MENU
2. Key Description
3. Press function key to select application

These "frame texts" appear in fixed positions on the display, but may be modified using the FTEXT parameter specification. They will appear identically on all terminals connected to the CU. The key names (PF1, PF2) cannot be modified; they correspond to engravings on the keys. Each line centered underneath the two frame lines at the top represents a terminal program which can be selected for

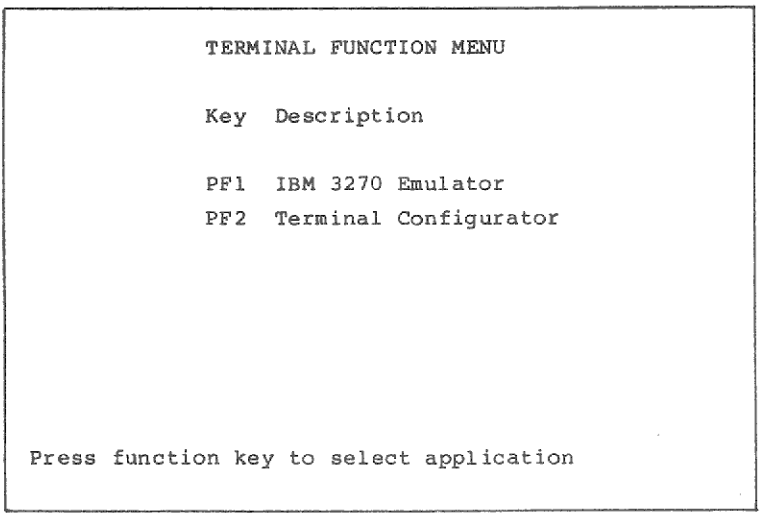

Figure D-1. Default terminal download menu.

download. The CU must know three things, each represented by a character string, about a terminal program:

1. A file name whereby the file containing the program to be downloaded will be retrieved. These names are automatically extended with ".855" or ".S45" for an RC855 or RC45 terminal, respectively, to obtain the actual file name. For example, if the file name is specified as CONFI the actual name of the program file which is downloaded to an RC45 terminal is CONFI.S45. Because of the automatic extension, the same terminal program specifications may be used for both RC855 and RC45 terminals.
2. A description to appear in the menu line representing the terminal program, e.g. "IBM 3270 Emulator".
3. (optional) A parameter to be supplied to the terminal program subsequent to download. See section B.2, Skipping the host line menu, for a description of how the 3270 terminal emulators use such a parameter.

Frame text: FTEXT,ftno=text
FTEXT specifies one of the frame texts of the download menu. Ftno is a number: 1, 2 or 3, which identifies the particular text. The numbering is as indicated above for the default texts. The text may be at most 45 characters long.

Error text: ETEXT,etno=text
ETEXT specifies a text which may occur as an error message in the status (bottom) line of the terminal in case of an error during download. Etno must be a number in the range 1..4, and the text may be at most 25 characters long. The four default texts are shown in the example below. The error situations they refer to are described in section F, Error messages during download.

Terminal program: TPRG,tpno=fname,desc(,param)
TPRG specifies a terminal program which may be referred to in terminal menu specifications (TMENU, see below) by its number, given as tpno, which must be in the range 0..25. Thus there can be at most 26 terminal programs. Fname is the file name, at most 8 characters; desc is the description, at most 25 characters; the optional part param is the character string which, if present, will be passed to the downloaded program, at most 89 characters.

If fname is specified as A: no program will be downloaded; instead the terminal, which must be an RC855 workstation, will load the CP/M operating system from the local floppy disk. A program to be loaded from the floppy disk may be specified in the param part using capital letters. This feature may be used to combine local programs with downloaded programs providing a unified method of selecting terminal function. Example:

```
TPRG,7=A:,RcTekst,RCTEKST
```

The same file name may be used in several terminal program specifications. This can be meaningful if the desc and param parts are different.

Terminal menu: TMENU,secaddr=tpnolist
TMENU specifies the menu for a terminal whose secondary address is given as secaddr, a number in the range 0..31. Tpnolist is a list of terminal program numbers. It must consist of numbers which have appeared in TPRG parameter specification lines prior to the TMENU line. The numbers must be separated by commas.

A number may be immediately preceeded by D to indicate a default terminal program. If a terminal is configured for default download and its menu contains a default terminal program, then no menu is shown when the terminal is powered on or reset. Instead, the default program is loaded without requiring selection by the operator.

Example
As an example, the following lines could be used to specify the default menu for an RC890 CU (also found in the distributed file DEFAULT.MDL). Note that the system administrator terminal has access to the Editor and Installator programs which are not available at other terminals.

```
FTEXT,1=TERMINAL FUNCTION MENU;     default download menu
FTEXT,2=Key  Description
FTEXT,3=Press function key to select application
ETEXT,1=CU: diskette error
ETEXT,2=CU disconnected
ETEXT,3=Checksum error
ETEXT,4=CU: Program not found
TPRG,0=CONFI,Terminal Configurator
TPRG,1=3270,IBM 3270 Emulator
TPRG,2=EDIT,RC890 Editor
TPRG,3=INSTALL,RC890 SW Installator
TMENU,0=D1,0,2,3
TMENU,1=D1,0
TMENU,2=D1,0
TMENU,3=D1,0
...
TMENU,31=D1,0
```

Conversion tables (CONV1.CST, CONV2.CST)

Two different kinds of character encoding are used by the 3270 emulation system. Externally, when characters are transmitted on remote host links in BSC or SNA/SDLC protocol, the character code is EBCDIC according to IBM convention. Displayable characters have EBCDIC codes in the range 64..255 ($40_{Hex}..FF_{Hex}$). Internally, when characters are stored and manipulated in device buffers within the CU as well as by terminal emulator programs, characters have codes in accordance with ISO standard 646 (7-bit coded character set for information processing interchange), i.e. ASCII-like. In this encoding displayable characters have codes in the range 32..126 ($20_{Hex}..7E_{Hex}$).

As a consequence of the two kinds of encoding the CU must perform a conversion. Characters received from a remote host are converted from EBCDIC representation to internal code using a table called the intcode-table (because its output is internal code). Conversely, before transmission to a remote host, characters are converted from the internal representation to EBCDIC using another table, the ebcdic-table.

The internal character set, i.e. character repertoire and encoding, is implemented in terminals by means of character image generators and tables in PROMs. A number of national versions of the internal character set are supported with RC terminal products, see appendix H.2. The character set must be the same for all terminals in a cluster. Once chosen, it must be regarded as fixed for the installation.

Given the internal character set, the same character repertoire, or a subset thereof, must necessarily be employed in communication with remote hosts. However, by modifying the conversion tables it is possible to customize the EBCDIC encoding of the available characters.

In the case of multiple remote host links (dual host configuration) it may not be appropriate to use the same EBCDIC code in communication with all/both hosts. The CU

therefore supports two different EBCDIC codes, called EBCDIC code 1 and EBCDIC code 2, implemented by means of two pairs of conversion tables, each pair consisting of an intcode table and an ebcdic table. The EBCDIC code to be used on a given remote host link is selected by means of the BSCCONV or SNACONV parameter specification; see the section Communication parameters (COMM.CST) below.

The default conversion, identical for both pairs of tables, is between US English (ASCII) internal code (see appendix H.2) and US English EBCDIC code (see appendix H.3). Each displayable character entry in each of the conversion tables may be modified by means of an appropriate parameter specification line. The modifications specifying EBCDIC code 1 are defined in the file CONV1.CST (or in the absence of such a file, by the file CONV.CST), and those specifying EBCDIC code 2 in the file CONV2.CST. The same syntax applies to both of these files; see below.

Those modifications to the default conversion tables which are necessary in order to support a given internal character set and a corresponding EBCDIC encoding may be derived from a comparison of charts for the codes in question with the default code charts as shown in the appendices mentioned above. The number of changes that are necessary will depend on how different the code charts are from the default ones.

When the internal character sets supported with RC terminal products and the corresponding standard EBCDIC encodings are used (see appendix H.3) it is not necessary for the user to devise conversion table modifications, as all standard sets of modifications are provided in the form of files distributed on the CU diskette (cf. section E, Selecting character conversion).

Conversion to internal code: INTCODE,ecode=icode
Each INTCODE parameter line specifies one entry in the intcode-table. Ecode is the EBCDIC code, i.e. the input to the table lookup; it must be written as a hexadecimal number

in the range 40..FF. Icode is the internal code, i.e. the output of the table lookup; it must be written as a hexadecimal number in the range 20..7E.

When a particular EBCDIC code is not used it is appropriate to specify the internal code as null (0).

Conversion to EBCDIC code: EBCDIC,icode=ecode
Each EBCDIC parameter line specifies one entry in the ebcdic-table. Icode is the internal code, i.e. the input to the table lookup; it must be written as a hexadecimal number in the range 20..7E. Ecode is the EBCDIC code, i.e. the output of the table lookup; it must be written as a hexadecimal number in the range 40..FF.

Displayable texts (TEXTS.CST)

Messages shown to the operator of a terminal or PC which emulates a 3270 display device in the host link menu or in the status line may be customized in the file TEXTS.CST. All the parameters described in this section are specified as character strings.

Host link menu heading: HOSTMENU=htext
HOSTMENU specifies the text to be written as a heading in the host link menu. The maximum length of htext is 32 characters.

The default text is: Host link menu

BSC link name: BSCID(,linkno(,sublinkno))=lname
BSCID specifies the name of a remote BSC host link or sublink.

Sublinkno must be present if the link kind is X.21 and must be left out if it is V.24. If present, it identifies the sublink and must be a number in the range 1..4.

Linkno may be omitted unless the configuration is dual host with two BSC links. However, in the case of an X.21 link, i.e. if sublinkno is present, linkno must not be

omitted even if there is only one BSC link. It specifies the number of the link and must be 1 or 2.

Lname is the link name which will be shown in the host link menu and in the status line of display devices which are attached to the link. The maximum length of lname is 12 characters.

The same name may not be given to two different links.

SNA/SDLC link name: SNAID(,linkno)=lname

SNAID specifies the name of a remote SNA/SDLC host link.

Linkno may be omitted unless the configuration is dual host with two SNA/SDLC links. It specifies the number of the link and must be 1 or 2.

Lname is the link name which will be shown in the host link menu and in the status line of display devices which are attached to the link. The maximum length of lname is 12 characters.

The same name may not be given to two different links.

Device status message: DSTEXT,dstno=dsmsg

DSTEXT specifies one of the messages which may be shown in the status line of an emulated 3270 display device to inform the operator of the status of the display device or of another device (printer or card reader) on which an operation was attempted.

Dstno is the number of the status message and must be in the range 1..12. The maximum length of dsmsg is 21 characters. The default status messages and their numbers are shown below. Note that they all begin with a blank.

1= Printer not ready
2= Print cancelled
3= Printer offline
4= Printer unavailable
5= Printer busy
6= Protected field
7= Card read error
8= Card format error

9= Field size error
10= Configuration error
11= CU disconnected
12= Illegal position

An explanation of the meaning of the messages is given in section F, Device status messages.

Communication status message: CSTEXT,cstno=csmsg
CSTEXT specifies one of the messages which may be shown in the status line of an emulated 3270 display device to inform the operator of the status of the remote host link to which the device is attached.

Cstno is the number of status message and must be in the range 1..8.

The default status messages and their numbers are shown below. Shown in parentheses is the maximum number of characters to be included in a message specified as a replacement for each default message. Note that all the texts begin with a blank.

1= Modem off	(19)
2= Line not ready	(15)
3= System not available	(24)
4= Cabling error	(19)
5= Device not supported	(24)
6= Call status CP	(15)
7= Call error	(15)
8= Waiting for menu	(24)

An explanation of the meaning of the messages is given in section F, Communication status messages.

Communication parameters (COMM.CST)

Parameters for detailed control of communication functions and the organization of device clusters may be customized in the file COMM.CST.

Note that for many of the parameters discussed in this section it is essential that they be specified in agreement with those specified when the (IBM or IBM compatible) host and FE systems are generated.

Parameters for BSC links

The major parameter for a BSC link is BSCKIND which specifies the kind of the link as either V.24 or X.21. Of the remaining parameters BSCCU, BSCDTR, BSCDUP and BSCPTIME will only affect a V.24 link, and BSCXNO will only affect an X.21 link. Specifying one of these parameters for a link of the wrong kind is not treated as an error, but has no effect.

The four possible sublinks of an X.21-BSC link do not exist by default. Unless the subscriber number of the Front-End computer associated with each sublink is specified using the BSCXNO parameter the link is treated as non-existing. There is no parameter to inform the CU of its own subscriber number; it does not need this information.

BSC link kind: BSCKIND(,linkno)=0/1

BSCKIND specifies the kind of a BSC link as V.24 (0, default) or X.21 (1).

Linkno may be omitted unless the configuration is dual host with two BSC links. It specifies the number of the link and must be 1 or 2.

Note that the kind of a link should only be specified as X.21 if automatic call handling and subscriber number signalling is required. In case of an X.21 bis interface (DATEX-L) the link should be specified as V.24 and the BSCDTR parameter set to 2 (see below).

EBCDIC code for BSC link: BSCCONV(,linkno(,sublinkno))=1/2

BSCCONV specifies whether EBCDIC code 1 or 2 (cf. the section Conversion tables above) is to be used on a remote BSC host link or sublink.

Sublinkno must be present if the link kind is X.21 and must be left out if it is V.24. If present, it identifies the sublink and must be a number in the range 1..4.

Linkno may be omitted unless the configuration is dual host with two BSC links. However, in the case of an X.21 link, i.e. if sublinkno is present, linkno must not be omitted even if there is only one BSC link. It specifies the number of the link and must be 1 or 2.

CU number: BSCCU(,linkno)=cuno

BSCCU specifies the CU number of a V.24-BSC link. It is given as cuno, which must be a decimal number in the range 0..31. The CU number determines the addressing sequences (poll and select) to which the CU will respond. The default value is 0, corresponding to polling address 40_{Hex} and selection address 60_{Hex}.

Linkno may be omitted unless the configuration is dual host with two BSC links. It specifies the number of the link and must be 1 or 2.

DTR handling: BSCDTR(,linkno)=dtrspec

BSCDTR specifies how the DTR signal of the V.24 interface is to be handled for a V.24-BSC link. Dtrspec must be 0 (default), 1 or 2, and is interpreted as follows:

0. Nonswitched line, DTR is always set.
1. Manual call. DTR is set initially, and the CU waits for DSR. If DSR subsequently disappears, DTR is reset for 5 seconds and thereafter set again.
2. Automatic call (X.21 bis). DTR is set and the CU waits up to 5 seconds for DSR. If DSR fails to appear or subsequently disappears, DTR is reset for 5 seconds, whereupon the procedure is repeated. After 8 unsuccessful attempts there is a 30 seconds pause, in which DTR is reset.

Linkno may be omitted unless the configuration is dual host with two BSC links. It specifies the number of the link and must be 1 or 2.

Half/full duplex: BSCDUP(,linkno)=0/1
BSCDUP specifies half duplex (0) or full duplex (1, default) treatment of a V.24-BSC link. The parameter affects the use of the RTS signal of the V.24 interface.

Linkno may be omitted unless the configuration is dual host with two BSC links. It specifies the number of the link and must be 1 or 2.

BSC printer timeout: BSCPTIME(,linkno)=timeout
BSCPTIME specifies for a V.24-BSC link how long a printer shall be reserved for the host after completion of a printout operation initiated by the host. While the printer is reserved it cannot be used for local hard-copy. Moreover, the CU monitors that the printer is not switched offline. This mechanism is provided to avoid mixing up printed data originating from different sources.

Timeout specifies the reservation period in seconds and must be in the range 1..60. The default value is 15.

Linkno may be omitted unless the configuration is dual host with two BSC links. It specifies the number of the link and must be 1 or 2.

X.21 subscriber number: BSCXNO,linkno,sublinkno=xno
BSCXNO specifies the subscriber number in the public data network of the FE associated with an X.21-BSC sublink.

Linkno specifies the number of the link and must be 1 or 2. It must be present even if there is only one BSC link. Sublinkno identifies the sublink and must be a number in the range 1..4.

Xno is the subscriber number. It must consist of up to 16 decimal digits, and will be extended with zeroes. Other characters appearing among the digits are ignored.

Parameters for SNA/SDLC links
The major parameter for an SNA/SDLC link is SDLCKIND which specifies the kind of the link as either V.24 or X.21. Of the remaining parameters SDLCDTR, SDLCDUP and MPOINT will

only affect a V.24 link, and SDLCHXNO and SDLCCXNO will only affect an X.21 link. Specifying one of these parameters for a link of the wrong kind is not treated as an error, but has no effect.

In case of an X.21-SNA/SDLC link the CU must know the subscriber number of the host computer as well as its own subscriber number. These numbers are specified using the SDLCHXNO and SDLCCXNO parameters, respectively.

SNA/SDLC link kind: SDLCKIND(,linkno)=0/1
SDLCKIND specifies the kind of a SNA/SDLC link as V.24 (0, default) or X.21 (1).

Linkno may be omitted unless the configuration is dual host with two SNA/SDLC links. It specifies the number of the link and must be 1 or 2.

Note that the kind of a link should only be specified as X.21 if automatic call handling and subscriber number signalling is required. In case of an X.21 bis interface (DATEX-L) the link should be specified as V.24 and the SDLCDTR parameter set to 2 (see below).

EBCDIC code for SNA/SDLC link: SNACONV(,linkno)=1/2
SNACONV specifies whether EBCDIC code 1 or 2 (cf. the section Conversion tables above) is to be used on a remote SNA/SDLC host link.

Linkno may be omitted unless the configuration is dual host with two SNA/SDLC links. It specifies the number of the link and must be 1 or 2.

SDLC address: SDLCADDR(,linkno)=saddr
SDLCADDR specifies the SDLC address for an SNA/SDLC link (V.24 or X.21). It is given as saddr, which must be a hexadecimal number in the range 0..FF. The SDLC address identifies the frames to which the CU will respond. The default value is C1.

Linkno may be omitted unless the configuration is dual host with two SNA/SDLC links. It specifies the number of the link and must be 1 or 2.

Terminal ID: TERMID(,linkno)=tid
TERMID specifies the terminal ID for an SNA/SDLC link (V.24 or X.21). It is given as tid, which must be a sequence of 5 hexadecimal digits. The terminal ID is transmitted to the host computer in response to XID. The default value is 00000.

Linkno may be omitted unless the configuration is dual host with two SNA/SDLC links. It specifies the number of the link and must be 1 or 2.

NRZI encoding: SDLCNRZI(,linkno)=0/1
SDLCNRZI specifies whether NRZI encoding is to be used (1) or not used (0, default) on an SNA/SDLC link (V.24 or X.21).

Linkno may be omitted unless the configuration is dual host with two SNA/SDLC links. It specifies the number of the link and must be 1 or 2.

Printer sharing: PSHARING(,linkno)=0/1
PSHARING applies to printer devices which can be activated by a host computer (not in local mode, cf. the PMODE parameter discussed in the following subsection, Printer authorization) as seen by the host computer with which the CU communicates on an SNA/SDLC link (V.24 or X.21).

The parameter specifies whether the printer is to be shared between this host and other sources of printout operations only between sessions (0, default) or between brackets (1).

Linkno may be omitted unless the configuration is dual host with two SNA/SDLC links. It specifies the number of the link and must be 1 or 2.

DTR handling: SDLCDTR(,linkno)=dtrspec
SDLCDTR specifies how the DTR signal of the V.24 interface is to be handled for a V.24-SNA/SDLC link. Dtrspec must be 0 (default), 1 or 2. It has the same interpretation as described for the BSCDTR parameter (cf. the preceeding subsection, Parameters for BSC links).

Half/full duplex: SDLCDUP(,linkno)=0/1
SDLCDUP specifies half duplex (0) or full duplex (1, default) treatment of a V.24-SNA/SDLC link. The parameter affects the use of the RTS signal of the V.24 interface.

Linkno may be omitted unless the configuration is dual host with two SNA/SDLC links. It specifies the number of the link and must be 1 or 2.

Point-to-point/multipoint: MPOINT(,linkno)=0/1
MPOINT specifies whether a V.24-SNA/SDLC link is established on a point-to-point line (0, default), or an a multipoint line (1).

Linkno may be omitted unless the configuration is dual host with two SNA/SDLC links. It specifies the number of the link and must be 1 or 2.

Host subscriber number: SDLCHXNO(,linkno)=xno
SDLCHXNO specifies the subscriber number in the public data network of the host computer with which the CU communicates on an X.21-SNA/SDLC link.

Linkno may be omitted unless the configuration is dual host with two SNA/SDLC links. It specifies the number of the link and must be 1 or 2.

Xno is the subscriber number. It must consist of up to 16 decimal digits, and will be extended with zeroes. Other characters appearing among the digits are ignored.

Own subscriber number: SDLCCXNO(,linkno)=xno
SDLCCXNO specifies the local subscriber number in the public data network, i.e. the number of the CU itself, for an X.21-SNA/SDLC link.

Linkno may be omitted unless the configuration is dual host with two SNA/SDLC links. It specifies the number of the link and must be 1 or 2.

Xno is the subscriber number. It must consist of up to 16 decimal digits, and will be extended with zeroes. Other characters appearing among the digits are ignored.

Printer authorization
The use of printer devices in an emulated 3270 cluster is controlled by printer authorization parameters. There are three aspects of printer authorization.

1. For each printer a mode is specified which determines whether the printer is to be used exclusively for local hard-copy (local mode), or exclusively for printout operations initiated by a host (system mode), or for both of these types of printing (shared mode).
2. Up to 16 classes of printers may be defined. A class is a group of printers. The concept allows the hard-copy printer for a terminal (configured in each terminal) to be specified as a class rather than an individual printer. A hard-copy printout requested for the display may be performed on any printer in the class. The printer classes are numbered from 0 to 15. When configuring a terminal, printer class n is specified by using device number 140+n, i.e. a number in the range 140..155.
3. For each printer a source device list is defined. This is a list of display devices for which the printer may execute local hard-copy operations. If a display device does not belong to the source device list of a given printer, hard-copy cannot take place on that printer even if it is selected as the hard-copy printer for the device, either individually or as a member of a class.

Notice that the parameter specifications described below include device numbers which in each case must identify either a printer or a display device. Since the CU does not know the devices in a cluster or their numbers when the parameter file is read, some of the information in these parameter specifications may turn out to be meaningless, in which case it will have no effect.

Printer mode: PMODE,devno=pmo
PMODE specifies the mode of the printer whose device number is given as devno, which must be a number in the range 0..127. Pmo must be 0, 1 or 2, meaning:

0 local mode
1 system mode (default)
2 shared mode

Printer class: PCLASS,clno=devno-list
PCLASS specifies that the listed (printer) devices belong to the printer class whose number is given as clno, which must be a number in the range 0..15. Devno-list must be a list of device numbers in the range 0..127, separated by commas or hyphens. If two device numbers in the list, the first one smaller than the second one, are separated by a hyphen, then all device numbers in the interval between them are also included. By default, all printer classes are empty.

As an example: PCLASS,7=2,4,8-12
specifies that the printers with device numbers 2, 4, 8, 9, 10, 11 and 12 belong to printer class number 7.

Printer source device list: PSRCLIST,devno=devno-list
PSRCLIST specifies that the source device list for the printer whose device number is given as devno, which must be a number in the range 0..127, comprises precisely the listed (display) devices. Devno-list is written in the same way as for the PCLASS parameter (see above). By default, all display devices belong to the source lists of all printers.

Cluster size

There are two parameters related to the size of a cluster: the maximum 3270 device number and the number of terminals with which the CU will communicate on RcCircuit. 3270 devices include devices emulated in PCs connected to the CU via RcMicronet and soft devices resident in the CU itself as well as devices in terminals connected to the CU via RcCircuit.

Maximum device number: MAXDEVNO=mno

MAXDEVNO specifies the maximum number which the CU will accept as a valid device number. Mno gives this number, which must be in the range 1..127. The default value is 63. If a device is activated with a device number greater than the one specified by MAXDEVNO it will be rejected by the CU.

Note that regardless of the value specified by MAXDEVNO devices with device numbers greater than 63 cannot communicate with a host computer via a remote BSC link because of limitations in the BSC protocol.

Number of terminals: NOTERMS=tno

NOTERMS specifies the number of terminals with which the CU will communicate via RcCircuit. The number is given as Tno, which must in the range 1..32. A terminal whose secondary address is configured to be equal to or greater than the value specified by NOTERMS will not be able to communicate with the CU. The default value is 16.

A value greater than 16 may only be specified if the configuration is "dual host" or "high performance"; otherwise it will be ignored, i.e. the default value will remain in effect.

Local host links

When configured to support local host links the CU acts as a 3270 CU with LAN Interface (CUL/CULI). As such, it may interact with the 3270 device handler function of an RC8000

ADP (cf. ref. 8). The customization parameters for local host links must be set in agreement with those chosen for the ADP.

Number of local host links: CULCONS=n
CULCONS specifies the maximum number of local host links which can be active simultaneously. Each 3270 device handler pair on an RC8000 ADP (representing an RC8000 application) requires its own link. N gives the number, which must be in the range 0..10. The default value is 2.

Output message size for local host links: CULOSIZE=n
CULOSIZE specifies the maximum size of individual messages transmitted from the RC8000 ADP to the CU (number of bytes). The actual size is negotiated with the device handler on the ADP when the link is established; to avoid waste, the same size should be specified for the CU and the ADP. N gives the number, which must be in the range 100..3860. The default value is 1024.

Input message size for local host links: CULISIZE=n
CULISIZE specifies the maximum size of individual messages transmitted from the CU to the RC8000 ADP (number of bytes). The actual size is negotiated with the device handler on the ADP when the link is established; to avoid waste, the same size should be specified for the CU and the ADP. N gives the number, which must be in the range 256..3860. The default value is 256.

CU port name for local host link: CULIPORT=pname
Every CU attached to the LAN has a port name by which it is known to the RC8000 ADP. CULIPORT specifies this name. Pname must be a string of at most 12 characters. The ADP requires port names to have the form CUxx, where xx is a decimal number starting from 00; i.e. the names of the CUs attached to a given LAN must be specified as CU00, CU01, CU02 etc. The default port name is CU00.

Soft devices

If the soft device function of the CU is activated, it is necessary to specify the numbers of the desired soft devices (cf. section E, Device number management).

Device numbers: SOFTDEVS=devno-list

SOFTDEVS specifies the numbers of soft devices to be activated on the CU. Devno-list must be a list of device numbers in the range 0..127, separated by commas. By default there are no soft devices.

Soft device timeout: SOFTMOUT=t

SOFTMOUT specifies the timeout period used by soft devices (when the local application program is waiting for a locked keyboard, cf. ref. 5). T, which must a number in the range 1..255, gives the timeout period in seconds.

E. System Management

The responsibilities of the system administrator in conjunction with the CU are:

- configuring and customizing the CU by editing the configuration and customization parameter files,
- managing the assignment of device numbers to devices in an emulated 3270 cluster,
- reporting errors.

Some of the information provided in this main section is intended to help the system administrator with respect to finding and editing the configuration and customization parameter files. The remaining part of the section aims to enable the system administrator to determine whether a malfunction of the CU is due to improper customization or installation, or whether the product is defective, so that an error report should be made.

Resetting the CU

The CU is reset, causing it to read the configuration and parameter files and activate or reactivate its functions accordingly by switching power on or, if the CU is already powered and active, by pressing the reset button.

It is important to note that when the configuration or parameter files have been changed, the CU must be reset before the changes will take effect. The configuration and parameter files are only read by the CU when it is reset.

CU files

The information on the CU diskette is organized as a number of named files. The files are of different types: software modules to be loaded and executed on one of the microcomputers in the CU, program files for download to terminals,

customization files to be read by the CU during load, and auxiliary files (see below).

All CU files have names of the form "name.ext", where name consists of at most 8 characters and ext, the file name extension, is at most 3 characters. The convention for file naming comes from the CP/M operating system, and the file format used on the CU diskette is the same that is used with the RC874 diskette drive for RC855 workstations running CP/M. Files with the same file name extension are referred to collectively as "*.ext" files. The form "name.*" is used similarly.

The CU diskette includes a program, called the RC890 Editor, which may be used to edit and otherwise manipulate the CU files. This program is described in the section, Editing CU files, below.

Auxiliary files

For each customization parameter file read by the CU (cf. section D.2, Customization, Parameter Files) one or more auxiliary files ("help files") are distributed on the CU diskette (SW8900/SW8910). The auxiliary files are not read or otherwise accessed by the CU. They are only intended as an aid to the system administrator when customizing the CU.

All the auxiliary files for a given parameter file have the same file name extension which is derived from the name of the parameter file. The correspondence is shown in the following table:

Parameter file	Auxiliary files
MENUDL.CST	*.MDL
CONV1.CST, CONV2.CST	*.CNV
TEXTS.CST	*.TXT
COMM.CST	*.CMM

Three auxiliary files: DEFAULT.MDL, DEFAULT.TXT, and DEFAULT.CMM, contain parameter lines which show how the default parameter values may be specified. See the section,

Editing CU files, below, for advice on how to create customized *.CST files from the DEFAULT.* files.

The file DMENU.MDL contains a Danish language version of the default download menu. Similarly, the file DANSK.TXT contains standard Danish texts for status line messages and host link menus. If these two files are written over MENUDL.CST and TEXTS.CST, respectively, all messages pertaining to CU functions will be shown to the terminal operator in Danish.

Selecting character conversion

When performing 3270 emulation the CU converts between two encodings of characters: internal code and EBCDIC code. A general discussion of this topic is found in section D.2, Conversion tables.

The default conversion tables are appropriate only if the internal character set is US English (ASCII) and the desired EBCDIC code is US English. Often this will not be the case, and modifications will therefore be necessary.

Conversion table modifications suitable for a number of standard combinations of internal and EBCDIC encodings are found in the *.CNV files. When one of these standard combinations is applicable, customization of the character conversion is achieved simply by writing the proper *.CNV file over CONV1.CST (EBCDIC code 1) or CONV2.CST (EBCDIC code 2) (cf. the following subsection).

Code tables for all standard internal character sets and the corresponding standard EBCDIC encodings are included as appendices H.2 and H.3. The following table shows which *.CNV file to select for a given standard combination:

internal character set	EBCDIC encoding	file
US English	US English	default
UK English	UK English	ENGLISH.CNV
German	German	GERMAN.CNV
German	German, alternate	GERMANA.CNV

internal character set	EBCDIC encoding	file
Swedish	Swedish	SWEDISH.CNV
Swedish	Swedish, alternate	SWEDISHA.CNV
Standard Danish	Standard Danish	STDK.CNV
Standard Danish	Standard Danish, alternate	STDKA.CNV
Danish OS	Danish OS	DOS.CNV
Danish OS	Danish OS, alternate	DOSA.CNV

Editing CU files

By means of a program called the RC890 Editor (in the following referred to as the editor), the system administrator may manipulate the names and contents of the files on the CU diskette. The editor may be downloaded to and operated from a terminal.

The function to be performed by the editor is selected from a menu which is displayed when the editor has been loaded:

```
Select function:

1 Edit
2 Print
3 Read file
4 Write file
5 Rename file
6 Delete file
7 Read catalog
```

A function is selected by pressing the appropriate numeric key (1..7). After a function has been selected a return to the editor menu can be made by pressing the ESC key. At any time, the editor may be left and the terminal reloaded, typically by way of the download menu, by pressing the key combination CTRL+CLEAR.

Function 3, Read file, will request the name of a file which is then read into an editing area, called the buffer,

destroying any previous contents of the buffer. The contents of the buffer may subsequently be edited if function 1, Edit, is selected. The buffer contents may be written to a file by means of function 4, Write file, which also requests a file name. If no file name is given, i.e. the ↵ key is pressed immediately, the name of the last file read is assumed. The editor always asks for confirmation before writing a file, as writing destroys any previous contents of the named file.

When a file is read, edited, and written back with a different name, the original file is preserved. The recommended procedure for creating a customized *.CST file is to read the corresponding DEFAULT.* file, changing those parameters for which the default values are not appropriate, deleting the remaining (superfluous) parameter specification lines, and writing the file with the *.CST name which applies. Note that this overwrites the previous *.CST file. These files, as distributed on the CU diskette, are empty.

If only renaming with no editing is desired, function 5, Rename file, may be used. Note that renaming does not preserve the original file. Function 6 is used to delete a file from the CU diskette, and function 7 to display the names of all CU files.

Function 2, Print, is used to obtain a printed hardcopy of the contents of the buffer. The printer must be (physically) attached to the terminal on which the editor is executed. It is recommended that a printed copy be kept of all customization files that contain changes from default values.

The main function of the editor, of course, is 1, Edit. The editor is screen oriented. The screen is used as a window which allows the operator to see and manipulate 24 lines of the buffer contents at a time. When the Edit function is selected, the window is placed on the first 24 lines, and the cursor is set in the first position of the first line. The window is moved by moving the cursor. The cursor is moved by means of the following keys:

↑ The cursor is moved one line up, without changing its position within the line. If the cursor was in the first line of the window, the window is moved one line backward in the buffer (unless it was at the beginning of the buffer).

↓ The cursor is moved one line down, without changing its position within the line. If the cursor was in the last line of the window, the window is moved one line forward in the buffer (unless it was at the end of the buffer).

← The cursor is moved one position to the left. If it was already in the first position of a line, it is moved to the last position of the previous line. If the cursor was in the first position of the first line in the window, the window is moved one line backward in the buffer (unless it was at the beginning of the buffer).

→ The cursor is moved one position to the right. If it was already in the last position of a line, it is moved to the first position of the next line. If the cursor was in the last position of the last line in the window, the window is moved one line forkward in the buffer (unless it was at the end of the buffer).

↵ The cursor is moved to the first position of the next line. If it was in the last line of the window, the window is moved one line forward in the buffer (unless it was at the end of the buffer). In insert mode (see below), ↵ causes a new line to be entered in the buffer.

⇥ The window is moved 24 lines (or as much as possible) forward in the buffer. The cursor is not moved.

⇤ The window is moved 24 lines (or as much as possible) backward in the buffer. The cursor is not moved.

↖ The window is placed in its initial position, i.e. on the first 24 lines of the buffer, and the cursor is set in the first position of the first line.

The contents of the buffer are modified by keying in alphameric characters in update mode or in insert mode. In update mode existing data at the cursor position is overwritten. In insert mode existing data is "pushed ahead". Initially, the editor is in update mode. The mode is changed whenever the INS MODE key is pressed. Additional insertion and deletion functions are obtained by means of the following keys:

INS LINE — A line is inserted before the line in which the cursor is positioned. The cursor is moved to the first position of the new line.

DEL CHAR — The character at which the cursor is positioned is deleted. The rest of the line is moved one position to the left.

DEL LINE — The characters from the cursor position to the last position in the line are deleted. A whole line is deleted when the cursor is positioned at the first position of the line.

External cable connections

Normally the signal cables which connect the CU to other units are mounted when the CU hardware is installed. The present brief description is intended to enable the system administrator to ascertain by inspection that the connections are properly in place.

Figure E-1 shows the back panel of the RC890/RC891 cabinet where all connectors are located.

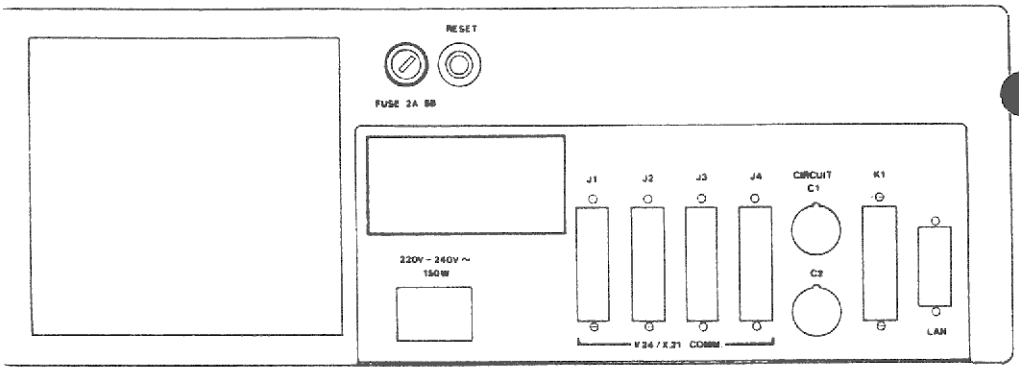

Figure E-1. RC890/RC891 connector panel.

Connector C1 is used for the RcCircuit signal cable, and the LAN connector for the transceiver cable used to attach an RC891 to an RcMicronet.

The connectors J1, J2, J3 and J4, marked V.24/X.21 COMM., are for the signal cables used to establish remote 3270 host links. The connectors are used as follows, depending on the configuration (cf. section D.1, remote host links):

configuration	connector(s) used
3270B	J1 - BSC link 1
3270BH	J3 - BSC link 1
3270BD	J1 - BSC link 1 J3 - BSC link 2
3270S	J2 - SNA/SDLC link 1
3270SH	J4 - SNA/SDLC link 1
3270SD	J2 - SNA/SDLC link 1 J4 - SNA/SDLC link 2
3270BS	J2 - SNA/SDLC link 1 J3 - BSC link 1

The connector used for a link is independent of whether the kind of the link is V.24 or X.21, but the signal cables used to connect the CU to a V.24 modem or to an X.21 DCE, respectively, are different (see Appendix H.4 for details). Both kinds of signal cable fit all four JX connectors.

Device number management (3270)

As discussed in section B.2, Emulated 3270 devices, device numbers are not customized in the parameter files of the CU, but in the various units which emulate the devices. It is the responsibility of the system administrator to assign the available device numbers to devices and to oversee that device numbers are properly configured in the various units, i.e. terminals and PCs. Only the device numbers for soft devices which reside within the CU are part of CU customization.

It is also the responsibility of the system administrator to coordinate the assignment of device numbers within an emulated 3270 cluster with the customization of the remote host computer(s). Often fairly rigid rules are applied to the selection of device numbers within the host computer system. It is therefore recommended that cooperation with

host computer operating staff be established before device numbers are assigned.

CU log file

The CU logs certain types of information in a log file. This happens when the configuration and customization files are read, during load of software modules, and when errors are detected while the CU is in operation. The CU log file is named ERRORLOG. Upon reset of the CU the previous log file is renamed as ERRORLOG.BAK before a new log is opened.

In general, the information in the system log is intended for RC software maintenance staff and not for the user. It may, however, be useful to read the log if the customization parameters prepared in the *.CST files by the system administrator do not have the intended effect.

When a parameter specification line in one of the files is not acceptable to the CU, either because of a syntax error, or because the parameter does not apply to the configuration as specified in the CONFIG.CST file, a line is written in the log file. This line will contain the name of the parameter file and the parameter name found at the beginning of the rejected line. All information about rejected parameter specification lines will appear in the first lines of the log. The system administrator may therefore read the beginning of the log as a report on the acceptability of the attempted customization.

Whether or not the system administrator considers it useful to read the log, it is recommended practice to print out the ERRORLOG file in case of a malfunction attributable to the CU. This can be done by means of the RC890 Editor (cf. the section, Editing CU files, above). Such a printout should be submitted with any error report concerning a CU function.

Lamps on the front panel

A row of eight small lamps is visible on the front panel of the RC890 cabinet; see Figure E-2.

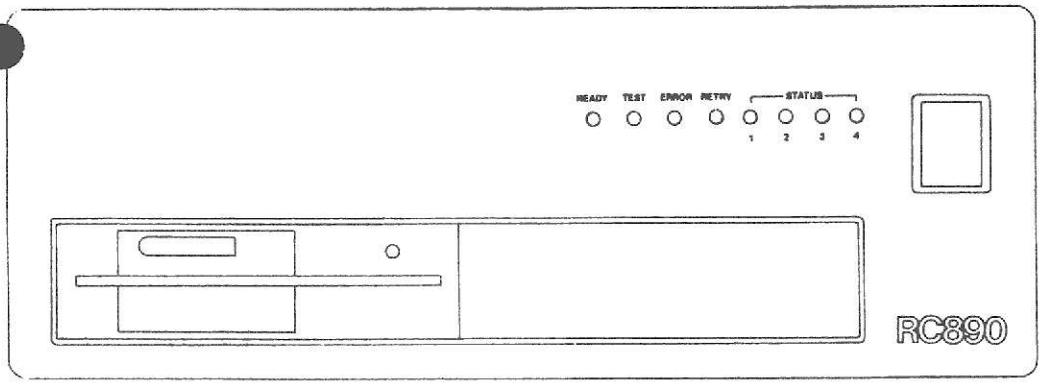

Figure E-2. RC890 front panel.

The lamps marked READY, TEST and ERROR have primary significance. TEST is only lit during the selftest performed by the microcomputers in the CU immediately after reset and the subsequent load of the CU. During normal operation, READY is the only one of these three lamps which is lit. READY lights after the selftest, and is lit together with TEST during the initial part of the CU load phase. If READY and TEST remain lit together, it is due to abnormal termination of the selftest.

ERROR lights on a detected error. If TEST is lit, too, the error occurred during the selftest or in the CU load phase. A simple reason for such an error may be that the CU diskette is missing.

If ERROR lights after TEST has been extinguished, i.e. during normal operation, the reason will be an unrecoverable error encountered by the programs executing in the CU.

In all cases when the ERROR lamp lights, the operator should note which other lamps are lit and which not, as this information may be of importance in an error report. Subsequently, the CU may be reset in order to restart. Except for the case where the error occurred during selftest, useful information on the error may also be obtained from the CU log file, i.e. ERRORLOG.BAK, after the CU has been restarted.

During normal CU operation, the significance of the RETRY and STATUS lamps is as follows:

STATUS 1: Activity on the remote host link which uses the J1 or J2 connector.

STATUS 2: Activity on the remote host link which uses the J3 or J4 connector.

STATUS 3: Activity on RcCircuit.

STATUS 4: Activity on RcMicronet (RC891 only).

RETRY: Retransmission on one of the (max.) four external connections, as indicated by the corresponding STATUS lamp.

Refer to section E, External cable connections, to see how host links are assigned to connectors for the various possible configurations.

F. Normal Use

During normal use, when terminals or PCs are used to emulate 3270 devices in cooperation with the CU, the CU will not be directly visible to the user. The functions of the CU will appear as functions of the terminal or PC. As long as all components in the system work correctly, the user need not be aware of the CU. In general, the information needed by users of the terminal emulator programs is found in the relevant user's guides and not in this guide.

The CU, however, also has a monitoring function: it discovers when errors or abnormal situations arise in the various types of communication it supports. In these instances operator messages issued by the CU will be shown on the relevant terminal or PC display.

The term error is used here not to indicate a fault on the part of the CU, but rather in the external part of the system or in the configuration and customization of the system as set up by the user (system administrator).

The situations which are indicated by operator messages are discussed in the following two subsections, one dealing with download of terminals, the other with 3270 emulation. All the messages discussed may be customized, i.e. modified according to user taste or preference, e.g. translated to a different language, cf. section D.2, Customization, Parameter Files.

In the following subsections the default versions of the messages are shown with an indication, given in parentheses, of the parameter name and text number to be used when customizing a replacement text.

Error messages during download

The error messages which occur in conjunction with download of terminals may be customized in the file MENUDL.CST.

CU: diskette error (ETEXT,1)

An error occurred when the CU tried to read a program file from its diskette. The reason could be that the diskette had been removed. It could also be a malfunctioning drive or an unreadable spot on the diskette. A couple of retries should be attempted before the error is reported.

CU: Program not found (ETEXT,4)

The CU accessed its diskette correctly, but only to find that the selected program file did not exist. The relationship between selection lines in the download menu and file names is explained in section D.2, Download menus.

The most obvious reason for a program file to be missing is that it has not been installed. Terminal programs are distributed in separate packages which must be installed before the programs can be loaded.

CU disconnected (ETEXT,2)

The connection between the CU and the terminal was broken. A couple of retries should be attempted before the error is reported, since the problem may be only temporary, e.g. when the CU is reset.

A program file is downloaded as a number of data messages (blocks). Each data message is protected during transmission on the RcCircuit by a cyclic redundancy check and retransmitted in case of error. An excessive number of retransmissions, which may occur if the cable is in very poor condition or poorly connected, causes the CU connection to be broken.

The connection is also broken, as observed from the terminal, if the CU ceases to operate (cf. section E, Lamps on the front panel).

Note that this message will not appear if the connection has not been established at all, e.g. if no physical connection (RcCircuit) exists.

Checksum error (ETEXT,3)
An error was detected when a checksum was computed on the complete program after all blocks had been transferred to the terminal. This message therefore does not indicate a transmission problem. The reason may be that a bad program file was read from the CU diskette, or a RAM error within the terminal. Some prelease program files may not be furnished with a checksum at all, in which case the message has no significance. In spite of the checksum error, the downloaded program will be started in the terminal.

3270 emulator status messages

The status messages which occur in conjunction with 3270 emulation may be customized in the file TEXTS.CST.

Device status messages

The status messages which concern an individual device within a cluster or the relationship between the CU and one or more devices without relating to host links are shown a little to the right of the center of the status line (positions 35 through 55). This is true for all terminals or PCs which emulate 3270 display devices.

The last five messages discussed in this subsection concern the use of a magnetic card reader. The card reader is not monitored by the CU, but the messages are mentioned here, because they appear in the same part of the status line and are customizable in the same fashion as the other device status messages.

Configuration error (DSTEXT,10)
A device was activated with an illegal device number. The device need not be a display device; it could also be a printer device.

A device number is illegal if it is larger than the maximum device number customized for the cluster, cf. section D.2, Cluster size.

A device number is also illegal if there is already an active device with the same number. The problem must be solved by appropriately assigning device numbers to physical equipment and configuring the terminals and PCs accordingly, cf. section E, Device number management.

CU disconnected (DSTEXT,11)
The connection between the 3270 CU emulator module and the terminal emulator program was broken. This may occur for several different reasons:

The CU may have been reset in which case the message will disappear when the CU has been reloaded.

An error may have occurred which caused the CU to cease to operate, cf. section E, Lamps on the front panel.

The condition of the cable or its connections may be so poor that an excessive number of retransmissions occurred, causing the CU to abandon the connection. In this case, the connection is likely to go on and off, since the CU and the terminal automatically attempt to reestablish communication.

Printer unavailable (DSTEXT,4)
Hard-copy printout was requested by the operator, but no printer was available to execute the request. The printer configured as hard-copy printer is either not active, i.e. the terminal or PC to which the printer is attached is not running the 3270 emulator program, or the display device does not belong to the source list of the printer (cf. section D.2, Printer authorization). If the hard-copy printer is specified as a printer class, the message indicates that none of the printers in the class are available.

In response to this message the operator should check the hard-copy printer configuration in the terminal or PC.

Printer busy (DSTEXT,5)
Hard-copy printout was requested by the operator, but the printer was busy. It may be that the printer is performing a

hard-copy printout for another display device, or it may be performing a host-initiated printout operation. If the hard-copy printer is specified as a printer class, the message indicates that all printers in the class are temporarily occupied.

When this message is shown, the printout request is queued within the CU until the printer becomes ready to execute it. While the request remains in the queue the keyboard will be locked. It can be reset in the usual way, whereby the printout request is dropped from the queue.

If the printer device is emulated on a PC (cf. section B.2, Emulated 3270 devices) and the actual printer is reserved by another PC application, e.g. a word processor, the printout request is dropped and not queued.

Print cancelled (DSTEXT,2)

A command was received in the 3270 data stream from the host computer while a hard-copy printout request was queued. This caused the request to be cancelled, because the received command is likely to cause the display image to change. If a hard-copy of the updated image is desired, the operator must press the PRINT key again.

Printer offline (DSTEXT,3)

A printout operation initiated by a hard-copy request went wrong and was given up. Part of the display image may have been printed.

The operation went wrong because the online signal from the printer to the terminal or PC to which it is attached went off. The reason for this may have been that the printer was selected locally, was powered off, or ran out of paper; or the printer may simply be poorly connected. This is the message which will normally occur in case of printer malfunction.

Printer not ready (DSTEXT,1)
A printout operation initiated by a hard-copy request went wrong and was given up. Part of the display image may have been printed.

The situation is similar to the one discussed above (Printer offline). It occurs when the online signal from the printer remains on, but a timeout occurs while the control logic of the terminal to which the printer is attached is waiting for the printer busy signal to go off, allowing the next character to be transmitted. This situation should occur very rarely and most likely indicates that the terminal emulator program is not well adjusted to the printer in question.

Protected field (DSTEXT,6)
An attempt was made to read data from the magnetic card reader into the display buffer while the cursor was positioned in a protected field. The cursor must be moved to an input field before the card can be read.

Card read error (DSTEXT,7)
An unsuccessful attempt was made to read a magnetic card. The card may have been incompletely inserted, or it may have been inserted at an uneven speed. The card should be re-inserted.

Card format error (DSTEXT,8)
A magnetic card was read, and the card was rejected because of invalid data. Most likely the card is invalid, and it will do no good to reinsert it.

Field size error (DSTEXT,9)
A magnetic card was read, but the input field into which the data were read was too small. The cursor must be moved to a larger field, or be backspaced so as to leave more input positions before end-of-field.

Illegal position (DSTEXT,12)
This message will only occur when the display device is in session with the SSCP (SNA). When the SSCP expects input, the input area is defined as starting from the cursor position - as left by the SSCP - and extending 256 character positions or to the end of the display. The message indicates that the cursor was moved before a magnetic card was read so that the card data, starting from the current cursor position, would not fit into the input area.

Communication status messages, remote host links
The status messages which concern the host link to which a display device is attached are shown in the rightmost part of the status line (positions 57 through 80). This is true for all terminals or PCs which emulate 3270 display devices.

The messages discussed in this subsection concern remote host links, i.e. they indicate an error or status pertaining to a V.24 modem, an X.21 DCE, or the remote host computer or RC3803 FE. The messages which may appear when a display device is attached to a local link (cf. section B.2, Local host links) are discussed in the following subsection.

Modem off (CSTEXT,1)
V.24 link: The Data Set Ready (DSR) signal from the modem is off. The reason may be that the modem is powered off or not present, or that the signal cable is not correctly connected.

X.21 link: The DCE fails to indicate the DCE ready state, i.e. call establishment cannot be initiated. The reason may be that the DCE is powered off or not present.

Line not ready (CSTEXT,2)
BSC link: No polling sequences issued by the host computer or FE can be detected.

SNA/SDLC link: Communication with the host computer cannot be established; one of the following codes - which refer to events in the SDLC protocol or X.21 call establishment - is shown to indicate the reason:

1: The host computer stopped polling (20 seconds timeout).

4: Disconnect Frame received.

5: The host committed a protocol error, FRMR (Frame Reject) was transmitted.

6: Transmitter malfunction.

8: Link disconnected by SNRM (Set Normal Response Mode) received from the host computer.

10: Initialization problem:

V.24: SNRM not received within 5 seconds after DSR. Likely reasons are:

- The link has not been started at the host.
- SDLC address or NRZI encoding not customized correctly, i.e. not in agreeement with the host.

X.21: The CU gave up trying to establish a call, in which case the "Call status CP" or "Call error" message (see below) will have been displayed previously, or the call was cleared by the network before SNRM was received.

System not available (CSTEXT,3)

Polling and/or selection sequences from the host computer or FE are detected, but not received by the CU, because the address they contain does not match the CU number. The most likely reasons are: improper customization of the CU number or improper generation of a multidropped line at the host site. Host computer operating staff should be consulted.

This message applies to BSC links only.

Cabling error (CSTEXT,4)
This message indicates that an X.21 signal cable has been connected to a connector for a link which has been customized as V.24, or vice versa. The correspondence between links and signal cable connectors is discussed in section E, External cable connections.

The message may also appear in conjunction with an X.21 link if the cable is not mounted. If the link is V.24 a missing cable will cause the "Modem off" message to be shown.

Device not supported (CSTEXT,5)
An attempt was made to attach a display device with a device number greater than 63 to a BSC link. The device was rejected.

Call status CP (CSTEXT,6)
An attempt by the CU to establish a call through the public data network to the host computer or FE failed. The network delivered a Call Progress (CP) signal with a code indicating the reason for the failure. The code is shown as a two-digit number adjacent to the text. Information on the meaning of specific CP codes should be obtained from the provider of the network service.

This message will not appear if the link is customized as V.24.

Call error (CSTEXT,7)
An attempt to establish a call through the public data network failed, but no CP code was received. One of the following codes is shown to indicate the reason (the meaning of these codes will be obscure to the user; they are for the use of RC technicians and should be included in the error report, should the problem persist):

01: Clear from DCE during call establishment
02: Receiver overrun

03: Receiver parity error
04: Unexpected interrupt
06: Time limit T1
07: Time limit T2
08: Time limit T3A/T3B
09: Time limit T4
10: Time limit T5/T6
11: Time limit T11

This message will not appear if the link is customized as V.24.

Waiting for menu (CSTEXT,8)
The display device is attached to a sublink of an X.21-BSC host link, i.e. a specific RC3803 FE has been selected, but the menu shown by this FE to indicate the hosts or applications available at the remote site has not yet been received by the CU. This message will only be shown for a brief time until the FE menu has been obtained. If the CU fails to communicate with the remote FE, the message will be replaced by another message (typically "Call status CP") indicating the reason for the failure.

This message can only appear if the link is customized as X.21-BSC.

Communication status messages, local host links
When an emulated 3270 terminal is attached to a local host link, i.e. communicates with an RC8000 host via an ADP, there is only one message which may appear in the communication status part of the status line (positions 57 through 80), viz:

Host timeout, data lost

This message indicates that the RC8000 has failed to receive input data from the ADP, most likely because the RC8000 has ceased to operate properly. The message cannot be customized.

H.1 References

(1) RCSL No.991 10275
Partner 3270 Terminal, Betjening

User's guide for the 3270 terminal emulator program for the RC 750 PC. Published in Danish.

(2) RCSL No.991 10048
RC45 IBM 3180 Emulator, Brugervejledning

User's guide for the 3270 terminal emulator program for the RC 45 terminal. Published in Danish.

(3) RCSL No.991 09859
RC855 IBM 3270 Emulator, Betjeningsvejledning

User's guide for the 3270 terminal emulator program for the RC 855 terminal. Published in Danish.

(4) (to be published)
RC750 Programmer's Toolkit for 3270 Communication

(5) RCSL No.991 10227
RC8000 Attached Device Processor, User's Guide

A description of the Attached Device Processor which is used to attach an RC8000 mainframe computer to a LAN.

H.2 Character Sets

This appendix contains charts showing the different national character sets that are available with RC terminal products. Each chart shows which characters belong to the character set in question and how they are encoded.

Bits 654	000	001	010	011	100	101	110	111
Bits 3210 Hex 1 / Hex 2	0	1	2	3	4	5	6	7
0000 0			SP	0	@	P	`	p
0001 1			!	1	A	Q	a	q
0010 2			"	2	B	R	b	r
0011 3			#	3	C	S	c	s
0100 4			$	4	D	T	d	t
0101 5			%	5	E	U	e	u
0110 6			&	6	F	V	f	v
0111 7			'	7	G	W	g	w
1000 8			(	8	H	X	h	x
1001 9			)	9	I	Y	i	y
1010 A			*	:	J	Z	j	z
1011 B			+	;	K	[	k	{
1100 C			,	<	L	\	l	|
1101 D			-	=	M	]	m	}
1110 E			.	>	N	^	n	~
1111 F			/	?	O	_	o	

Figure H.2-1. US English character set

Bits 3210 / Hex 2	Bits 654 / Hex 1	000	001	010	011	100	101	110	111
		0	1	2	3	4	5	6	7
0000	0			SP	0	@	P	`	p
0001	1			!	1	A	Q	a	q
0010	2			"	2	B	R	b	r
0011	3			£	3	C	S	c	s
0100	4			$	4	D	T	d	t
0101	5			%	5	E	U	e	u
0110	6			&	6	F	V	f	v
0111	7			'	7	G	W	g	w
1000	8			(	8	H	X	h	x
1001	9			)	9	I	Y	i	y
1010	A			*	:	J	Z	j	z
1011	B			+	;	K	[	k	{
1100	C			,	<	L	\	l	¦
1101	D			-	=	M	]	m	}
1110	E			.	>	N	↑	n	~
1111	F			/	?	O	_	o	

Figure H.2-2. UK English character set

Bits 654	000	001	010	011	100	101	110	111
Bits 3210 Hex 1 / Hex 2	0	1	2	3	4	5	6	7
0000	0			SP	0	§	P	`	p
0001	1			!	1	A	Q	a	q
0010	2			"	2	B	R	b	r
0011	3			#	3	C	S	c	s
0100	4			$	4	D	T	d	t
0101	5			%	5	E	U	e	u
0110	6			&	6	F	V	f	v
0111	7			'	7	G	W	g	w
1000	8			(	8	H	X	h	x
1001	9			)	9	I	Y	i	y
1010	A			*	:	J	Z	j	z
1011	B			+	;	K	Ä	k	ä
1100	C			,	<	L	Ö	l	ö
1101	D			-	=	M	Ü	m	ü
1110	E			.	>	N	^	n	
1111	F			/	?	O	_	o	

Figure H.2-3. German character set

Bits 654 / Bits 3210 / Hex 1 / Hex 2	000 / 0	001 / 1	010 / 2	011 / 3	100 / 4	101 / 5	110 / 6	111 / 7
0000	0			SP	0	E	P	é	p
0001	1			!	1	A	Q	a	q
0010	2			"	2	B	R	b	r
0011	3			#	3	C	S	c	s
0100	4			$	4	D	T	d	t
0101	5			%	5	E	U	e	u
0110	6			&	6	F	V	f	v
0111	7			'	7	G	W	g	w
1000	8			(	8	H	X	h	x
1001	9			)	9	I	Y	i	y
1010	A			*	:	J	Z	j	z
1011	B			+	;	K	Ä	k	ä
1100	C			,	<	L	Ö	l	ö
1101	D			-	=	M	Å	m	å
1110	E			.	>	N	Ü	n	ü
1111	F			/	?	O	_	o	

Figure H.2-4. Swedish character set

Bits 654	000	001	010	011	100	101	110	111
Bits 3210 / Hex 1 / Hex 2	0	1	2	3	4	5	6	7
0000	0			SP	0	ü	P	ä	p
0001	1			!	1	A	Q	a	q
0010	2			"	2	B	R	b	r
0011	3			#	3	C	S	c	s
0100	4			$	4	D	T	d	t
0101	5			%	5	E	U	e	u
0110	6			&	6	F	V	f	v
0111	7			'	7	G	W	g	w
1000	8			(	8	H	X	h	x
1001	9			)	9	I	Y	i	y
1010	A			*	:	J	Z	j	z
1011	B			+	;	K	Æ	k	æ
1100	C			,	<	L	Ø	l	ø
1101	D			-	=	M	Å	m	å
1110	E			.	>	N	↑	n	ö
1111	F			/	?	O	_	o	

Figure H.2-5. Standard Danish character set

The Standard Danish character set is only available on RC855 terminals.

Bits 654 / Bits 3210 / Hex 1 / Hex 2	000	001	010	011	100	101	110	111
	0	1	2	3	4	5	6	7
0000	0			SP	0	@	P	`	p
0001	1			!	1	A	Q	a	q
0010	2			"	2	B	R	b	r
0011	3			§	3	C	S	c	s
0100	4			$	4	D	T	d	t
0101	5			%	5	E	U	e	u
0110	6			&	6	F	V	f	v
0111	7			'	7	G	W	g	w
1000	8			(	8	H	X	h	x
1001	9			)	9	I	Y	i	y
1010	A			*	:	J	Z	j	z
1011	B			+	;	K	Æ	k	æ
1100	C			,	<	L	Ø	l	ø
1101	D			-	=	M	Å	m	å
1110	E			.	>	N	Ü	n	ü
1111	F			/	?	O	_	o	

Figure H.2-6. Danish OS (public sector) character set

The Danish OS character set as shown in Figure H.2-6 is known under the abbreviation DOS3. It is supported as shown on RC45 terminals and RC750 PCs. On RC855 terminals two versions of the Danish OS character set are available, both of which differ from DOS3 in the representation of the character with code 60_{Hex}, i.e. grave accent (`). In DOS1 the replacement character is o umlaut (ö), in DOS2 it is up arrow (↑).

H.3 EBCDIC Character Codes

This appendix contains charts showing the standard EBCDIC encodings of the various national character sets which are used for 3270 remote host communication. It is possible to customize the CU to support differing encodings. Those shown in this appendix are supported by the *.CNV auxiliary files distributed on the CU diskette (SW8900 or SW8910), cf. section E, Selecting character conversion.

	Bits 76	00				01				10				11			
	Bits 54	00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11
Bits 3210	Hex 1 / Hex 2	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0					SP	&	-						{	}	\	0
0001	1							/		a	j	~		A	J		1
0010	2									b	k	s		B	K	S	2
0011	3									c	l	t		C	L	T	3
0100	4									d	m	u		D	M	U	4
0101	5									e	n	v		E	N	V	5
0110	6									f	o	w		F	O	W	6
0111	7									g	p	x		G	P	X	7
1000	8									h	q	y		H	Q	Y	8
1001	9								`	i	r	z		I	R	Z	9
1010	A					]	:	¦	:								
1011	B					.	$	,	#								
1100	C					<	*	%	@								
1101	D					(	)	_	'								
1110	E					+	;	>	=								
1111	F					[	↑	?	"								

Figure H.3-1. US English EBCDIC codes.

US English EBCDIC code may be used if the character set of the terminal cluster is US English, cf. appendix H.2.

	Bits 76	00				01				10				11			
	Bits 54	00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11
Bits 3210	Hex 1 / Hex 2	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0					SP	&	-						{	}	\	0
0001	1							/		a	j	~		A	J		1
0010	2									b	k	s		B	K	S	2
0011	3									c	l	t		C	L	T	3
0100	4									d	m	u		D	M	U	4
0101	5									e	n	v		E	N	V	5
0110	6									f	o	w		F	O	W	6
0111	7									g	p	x		G	P	X	7
1000	8									h	q	y		H	Q	Y	8
1001	9								`	i	r	z		I	R	Z	9
1010	A					$	:	¦	:								
1011	B					.	£	,	]								
1100	C					<	*	§	#								
1101	D					(	)	_	'								
1110	E					+	;	>	=								
1111	F					[	↑	?	"								

Figure H.3-2. UK English EBCDIC codes.

UK English EBCDIC code may be used if the character set of the terminal cluster is UK English, cf. appendix H.2.

Bits 3210	Hex 1 / Hex 2	00 00	00 01	00 10	00 11	01 00	01 01	01 10	01 11	10 00	10 01	10 10	10 11	11 00	11 01	11 10	11 11
	Bits 76	00				01				10				11			
	Bits 54	00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11
	Hex 1	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0					SP	&	-						ä	ü	Ö	0
0001	1							/		a	j	ß		A	J		1
0010	2									b	k	s		B	K	S	2
0011	3									c	l	t		C	L	T	3
0100	4									d	m	u		D	M	U	4
0101	5									e	n	v		E	N	V	5
0110	6									f	o	w		F	O	W	6
0111	7									g	p	x		G	P	X	7
1000	8									h	q	y		H	Q	Y	8
1001	9								\	i	r	z		I	R	Z	9
1010	A					Ä	Ü	ö	:								
1011	B					.	$	,	#								
1100	C					<	*	%	§								
1101	D					(	)	_	'								
1110	E					+	;	>	=								
1111	F					!	↑	?	"								

Figure H.3-3. German EBCDIC codes.

German EBCDIC code may be used if the character set of the terminal cluster is German, cf. appendix H.2.

	Bits 76	00				01				10				11			
	Bits 54	00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11
Bits 3210	Hex 1 / Hex 2	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0					SP	&	-									0
0001	1							/		a	j			A	J		1
0010	2									b	k	s		B	K	S	2
0011	3									c	l	t		C	L	T	3
0100	4									d	m	u		D	M	U	4
0101	5									e	n	v		E	N	V	5
0110	6									f	o	w		F	O	W	6
0111	7									g	p	x		G	P	X	7
1000	8									h	q	y		H	Q	Y	8
1001	9									i	r	z		I	R	Z	9
1010	A					Ä	Ü		:								
1011	B					.	Ü	,	Ä								
1100	C					<	*	%	Ö								
1101	D					(	)	_	'								
1110	E					+	;	>	-								
1111	F					!	†	?	ß								

Figure H.3-4. German alternate EBCDIC codes.

German alternate EBCDIC code may be used if the character set of the terminal cluster is German, cf. appendix H.2.

The German character set includes five characters which do not appear in the chart above ($#`§"). The conversion table modifications distributed as file GERMANA.CNV cause these characters to be transmitted to a remote host as blanks (code 40_{Hex}).

Bits 3210	Bits 76	00				01				10				11			
	Bits 54	00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11
	Hex 1	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0					SP	&	-						ä	å	ß	0
0001	1							/		a	j	ü		A	J		1
0010	2									b	k	s		B	K	S	2
0011	3									c	l	t		C	L	T	3
0100	4									d	m	u		D	M	U	4
0101	5									e	n	v		E	N	V	5
0110	6									f	o	w		F	O	W	6
0111	7									g	p	x		G	P	X	7
1000	8									h	q	y		H	Q	Y	8
1001	9								é	i	r	z		I	R	Z	9
1010	A					#	$	ö	:								
1011	B					.	A	,	Ä								
1100	C					<	*	%	Ö								
1101	D					(	)	_	'								
1110	E					+	;	>	=								
1111	F					!	Ü	?	"								

Figure H.3-5. Swedish EBCDIC codes.

Swedish EBCDIC code may be used if the character set of the terminal cluster is Swedish, cf. appendix H.2.

Bits 7 6	00				01				10				11			
Bits 5 4	00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11
Bits 3 2 1 0 / Hex 1 / Hex 2	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0					SP	&	-								0
0001	1							/		a	j			A	J		1
0010	2									b	k	s		B	K	S	2
0011	3									c	l	t		C	L	T	3
0100	4									d	m	u		D	M	U	4
0101	5									e	n	v		E	N	V	5
0110	6									f	o	w		F	O	W	6
0111	7									g	p	x		G	P	X	7
1000	8					#	$	"	:	h	q	y		H	Q	Y	8
1001	9					É	É	ü	Ü	i	r	z		I	R	Z	9
1010	A					ö	Ä		;								
1011	B					.	Ä	,	Å								
1100	C					<	*	%	ö								
1101	D					(	)	_	'								
1110	E					+	;	>	=								
1111	F							?	ü								

Figure H.3-6. Swedish alternate EBCDIC codes.

Swedish (alternate) EBCDIC code may be used if the character set of the terminal cluster is Swedish, cf. appendix H.2.

Bits 76	00				01				10				11			
Bits 54	00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11
Bits 3210 / Hex 1 / Hex 2	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0				SP	&	-						æ	å	ä	0
0001	1						/		a	j	ü		A	J		1
0010	2								b	k	s		B	K	S	2
0011	3								c	l	t		C	L	T	3
0100	4								d	m	u		D	M	U	4
0101	5								e	n	v		E	N	V	5
0110	6								f	o	w		F	O	W	6
0111	7								g	p	x		G	P	X	7
1000	8								h	q	y		H	Q	Y	8
1001	9							ö	i	r	z		I	R	Z	9
1010	A				#	$	@	:								
1011	B				.	Å	,	Æ								
1100	C				<	*	%	Ø								
1101	D				(	)	_	'								
1110	E				+	;	>	=								
1111	F				!	↑	?	"								

Figure H.3-7. Standard Danish EBCDIC codes.

Standard Danish EBCDIC code may be used if the character set of the terminal cluster is Standard Danish, cf. appendix H.2.

	Bits 76	00				01				10				11			
	Bits 54	00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11
Bits 3210	Hex 1 / Hex 2	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0					SP	&	-									0
0001	1							/		a	j			A	J		1
0010	2									b	k	s		B	K	S	2
0011	3									c	l	t		C	L	T	3
0100	4									d	m	u		D	M	U	4
0101	5									e	n	v		E	N	V	5
0110	6									f	o	w		F	O	W	6
0111	7									g	p	x		G	P	X	7
1000	8							"	!	h	q	y		H	Q	Y	8
1001	9					Ø	¤	Ü		i	r	z		I	R	Z	9
1010	A					ø	ä		:								
1011	B					.	Å$	,	Æ#								
1100	C					<	*	%	@								
1101	D					(	)	_	'								
1110	E					+	;	>	=								
1111	F							?	æ								

Figure H.3-8. Standard Danish alternate EBCDIC codes.

Standard Danish alternate EBCDIC code may be used if the character set of the terminal cluster is Standard Danish, cf. appendix H.2.

The conversion table modifications distributed as file STDKA.CNV cause both Å and $ to be transmitted to a remote host as code $5B_{Hex}$. When this code is received from a remote host it is converted to the internal code for Å ($5D_{Hex}$). Similarly, Æ and # are both transmitted as code $7B_{Hex}$, and

when this code is received it is converted to the internal code for Æ ($5B_{Hex}$).

The Standard Danish character set is only available on RC855 terminals.

Bits 76	00				01				10				11			
Bits 54	00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11
Bits 3210 / Hex 1 / Hex 2	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0				SP	&	-						æ	å	Ø	0
0001	1						/		a	j	ü		A	J		1
0010	2								b	k	s		B	K	S	2
0011	3								c	l	t		C	L	T	3
0100	4								d	m	u		D	M	U	4
0101	5								e	n	v		E	N	V	5
0110	6								f	o	w		F	O	W	6
0111	7								g	p	x		G	P	X	7
1000	8								h	q	y		H	Q	Y	8
1001	9							@	i	r	z		I	R	Z	9
1010	A				§	$	ø	:								
1011	B				.	Å	,	Æ								
1100	C				<	*	¤	Ø								
1101	D				(	)	_	'								
1110	E				+	;	>	=								
1111	F				!	¬	?	"								

Figure H.3-9. Danish OS EBCDIC codes.

Danish OS EBCDIC code may be used if the character set of the terminal cluster is Danish OS, cf. appendix H.2.

	Bits 76	00				01				10				11			
	Bits 54	00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11
Bits 3210	Hex 1 / Hex 2	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0					SP	&	-									0
0001	1							/		a	j			A	J		1
0010	2									b	k	s		B	K	S	2
0011	3									c	l	t		C	L	T	3
0100	4									d	m	u		D	M	U	4
0101	5									e	n	v		E	N	V	5
0110	6									f	o	w		F	O	W	6
0111	7									g	p	x		G	P	X	7
1000	8							"	:	h	q	y		H	Q	Y	8
1001	9									i	r	z		I	R	Z	9
1010	A										§						
1011	B					.	$	,	Æ								
1100	C					<	*	%	Ø								
1101	D					(	)	_	'								
1110	E					+	;	>	=								
1111	F							?									

Figure H.3-10. Danish OS alternate EBCDIC codes.

Danish OS alternate EBCDIC code may be used if the character set of the terminal cluster is Danish OS, cf. appendix H.2.

The conversion table modifications distributed as file DOSA.CNV cause both Å and $ to be transmitted to a remote host as code $5B_{Hex}$. When this code is received from a remote host it is converted to the internal code for Å ($5D_{Hex}$).

H.4 V.24/X.21 Connectors

The connectors used to mount the signal cables for external communications according to the V.24 or X.21 interface standards are located on the back panel of the RC890/RC891 cabinet as described in section E, External cable connections. The present description applies to the connectors marked J1, J2, J3 and J4. Standard 25-pin D-connectors are used with pin assignments allowing the same connector to be used for either V.24 or X.21 connections by means of different cables.

The correspondence between connector pins and those V.24 interface circuits which are used complies with ISO standard 2110 as shown below:

pin no.	V.24 interface circuit
1	protective ground
2	transmitted data (103)
3	received data (104)
4	request to send (105)
5	ready for sending (106)
6	data set ready (107)
7	signal ground (102)
8	carrier (109)
15	transmit clock (114)
17	receive clock (115)
20	data terminal ready (108/2)

The X.21 interface circuits are assigned to the pins not used for V.24 signals as shown below:

pin no.	X.21 interface circuit
1	protective ground
7	signal ground (G)
9	transmit (T) A
10	indication (I) A
12	transmit (T) B
14	control (C) B
16	signal element timing (S) B
18	signal element timing (S) A
19	receive (R) B
21	receive (R) A
24	indication (I) B
25	control (C) A

Pin 11 is used to distinguish a cable intended for a V.24 interface from one intended for X.21. The signal should be ON for V.24, OFF for X.21.

H.5 Host Link Information Displays

Information about the current state of a remote host link may be displayed on an emulated display device, i.e. a terminal or PC running the appropriate emulator program, working in link information mode. Information is obtained about the link to which the device is attached. Only one device per link may be active in link information mode at a time. The key combination which is used to enter link information mode depends on the terminal (or PC) as follows:

terminal	key combination
RC45	ALT+TEST
RC855	SELECT T
RC750	CTRL+T

The same key combination is used to leave link information mode and return to normal emulation.

Note that the contents of the device buffer is abandoned when link information mode is entered. The display will therefore be cleared when the return is made to normal emulation.

The information displays which are available are different for BSC and SNA/SDLC. The two cases are dealt with in the two sections that follow.

BSC Link Information

Two functions are available: display BSC statistics and reset BSC statistics, i.e. counters. The choice is made from a menu which is shown when link information mode is entered and again whenever the CLEAR key is pressed.

The BSC statistics display is self-explanatory.

SNA/SDLC Link Information

Three displays are available: SNA statistics, SDLC statistics and X.21 statistics, the latter only for an SDLC-X.21 link. The choice is made from a menu which is shown when link information mode is entered and again whenever the CLEAR key is pressed.

The menu also provides a reset statistics function, which causes all the statistics (counters) pertaining to the link to be reset. Each of the statistics displays shows the time in minutes and seconds since the last time the statistics were reset (or the CU was loaded).

The three displays are discussed in detail below.

SNA statistics

This display contains information about the customizations of printer sharing and maximum device number and about the state of the Physical Unit (PU), the Logical Units (LU) and the LU-LU sessions. If the PU is inactive, the SNA statistics will appear as shown in Figure H.5.1. If the PU is active the display is extended with a line for each LU that has been activated by the host, see Figure H.5.2.

```
S N A   S T A T I S T I C S        1 MIN. 18 SEC.

PU INACTIVE
Max. number of devices =  64
Printer sharing is between brackets




Press CLEAR to return to statistics menu
```

Figure H.5-1. SNA statistics display for an inactive PU.

```
S N A   S T A T I S T I C S        1 MIN. 18 SEC.

PU ACTIVE
Max. number of devices =  64
Printer sharing is between brackets

LU  DEV   LU-LU SESSION                                          DIV INTERNAL

                    type hostname pacing  bracket chain ss dir

 2   0 C  ACTIVE-2    2  TESTIMS  0 0 0 0   BETB   BETC  C  N   XXX...XX
 3   1 D  INACTIVE
 4   2 D  INACTIVE
 5   3 D  INACTIVE



Press CLEAR to return to statistics menu
```

Figure H.5-2. SNA statistics display for an active PU.

Each LU line (cf. Figure H.5.2) should be interpreted as:

LU is the LU number as specified in the host (2-129)

DEV is the corresponding device number (0-127) and the state of the device

- C device is connected,
- D device is disconnected,
- R device is reserved (printer only).

LU-LU SESSION
gives the state of a session between the LU and an application in the host

- INACTIVE no session exists; the rest of the line will be empty.
- ACTIVE-1 session exists but data cannot be sent because no Start Data Traffic command has been sent by the host.
- ACTIVE-2 session exists and data can be sent. This is the normal active state of a session.
- ACTIVE-3 session exists and is closing down after Shutdown command is received from the host.
- CLEARING session is about to be removed.

type is the type of the session

1	SNA character stream printer
2	3270 display
3	3270 printer

hostname
is the name of the application in the host

pacing 4 numbers giving receive pacing count, transmit pacing count, current allowed receive count, current allowed transmit count. If zeroes are shown, pacing is not used for this session.

bracket is the bracket state

BETB	between brackets
INB	in bracket
PEND	pending begin bracket

chain is the chain state

BETC	between chains
INC	in chain

ss is the session state

C	contention
E	error
R	receive
S	send

dir is the direction

F	from host
N	neutral
T	to host

DIV INT.
14 characters with internal information about program states etc.

Each SNA statistics display has room for 10 lines of LU information. If there is more information than shown, this is indicated in the bottom part of the display, and PA1/PF1 can be used to retrieve subsequent lines.

SDLC statistics

This display contains information about the customization of the link (SDLC-address, terminal-ID, X.21/V.24, nrzi, COM board number, and host link identification; for V.24 also half/full duplex, point-to-point/multi-point and Data Terminal Ready handling) and the activity on the link (received/transmitted frames etc.).

The display for an SDLC-V.24 link is shown in Figure H.5.3 and the display for an SDLC-X.21 link in Figure H.5.4.

```
S D L C / L I N K   S T A T I S T I C S      0 MIN. 38 SEC.

  SDLC-addr =    C1
  NRZI      =   yes
  Term-id   = 01043

  V.24 / Full duplex / Point-to-point / Nonswitched
  COM board = 1 / SNA link 1

  Received I-frames              1752
  Transmitted I-frames           1587
  Received RNR                   0
  Transmitted RNR                0
  Received TEST                  0
  Transmitted TEST               0
  Receiver overrun               0
  Transmitter underrun           0
  Received CRC-errors            0
  Received aborts                0
  Retransmitted I-frames         0
  CD failures                    0
  CTS failures                   0

Press CLEAR to return to statistics menu
```

Figure H.5-3. SDLC statistics display for an SDLC-V.24 link

If the link uses a dial-up line, no attention should be paid to the CD failures counter.

```
S D L C / L I N K   S T A T I S T I C S        2 MIN 57 SEC

  SDLC-addr =     C1
  NRZI      =     no
  Term-id   = 23CBF

  X.21
  COM board = 1 / SNA link 1

  Received I-frames              12
  Transmitted I-frames           8
  Received RNR                   0
  Transmitted RNR                0
  Received TEST                  0
  Transmitted TEST               0
  Receiver overrun               0
  Transmitter underrun           0
  Received CRC-errors            0
  Received aborts                0
  Retransmitted I-frames         0


Press CLEAR to return to statistics menu
```

Figure H.5-4. SDLC statistics display for an SDLC-X.21 link

X.21 statistics

This display contains information about the activity at the X.21 interface level (outgoing calls, incoming calls, received call progress codes and error codes). The subscriber numbers of the CU and the host, and the state of the X.21 Short Hold Mode session are also shown (cf. Figure H.5.5).

```
X 2 1   S T A T I S T I C S        3 MIN. 44 SEC.

CU-DX = 125333       HOST-DX = 125334
Short Hold Mode Session =   active

Outgoing calls OK              4
Outgoing calls CP code         1
Outgoing calls Error           0
Incoming calls OK              2
Incoming calls Error           0

CP codes:
 45: 1
Error codes: none



Press CLEAR to return to statistics menu
```

Figure H.5-5. X.21 statistics display for an SDLC-X.21 link