

HOST LINKS



G3270 TM

***Emulating
IBM3270
Terminals***

<http://www.gar.no/hostlinks/>



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Host Links G3270

Installation

The G&R emulations and gateways are independent programs, but part of the *G&R Host Links* product set available on all major UNIX/Linux platforms. Many of the products are also available for Windows servers. For details on platforms supported, software delivery and installation refer to the *Host Links Installation and Configuration* manual.

Host Links Product Overview

Terminal environment

Host links products that run on UNIX or Linux servers with a terminal driven user interface include emulators and concentrators, as well as various utilities.

- **G3270** provides synchronous IBM3270 functionality. G3270 emulates IBM LU type 2, including base and extended colour together with extended highlighting.
- **Qsim** provides synchronous Questar terminal functionality. Qsim simulates all Questar models, including the DKU7007, DKU7107, DKU7105 and DKU7211 (Mono, four colour A/B and seven colour modes are supported). It also simulates the VIP7760 and the VIP7700.
- **V78sim** provides Bull VIP78xx (BDS) functionality. V78sim emulates all models of the VIP7800 family; the actual reference is the BDS7. All visual attributes including colour are supported.
- **Pthru** provides transparent VIP7800 visibility to Bull mainframes for users with asynchronous VIP7800 terminals or emulators. The terminals are used in text or forms mode.

Server environment

Host Links products that run on UNIX, Linux or Windows servers.

- **Ggate** is a transparent gateway to the Bull native network. It avoids all need for Front-ends (MainWay/Datanet) or other gateways. It can be used to connect G&R/Glink (for Windows or Java) emulators or any of the emulators, concentrators, network printer emulators and file transfer clients/servers in the Host Links product set. It also supports third party clients using the TNVIP, TN3270, TN3270E and standard asynchronous Telnet protocols.
- **Gweb** provides a web browser interface to any host application that is otherwise accessible using the *Host Links Qsim, V78sim, or G3270* emulations.
- **Gspool** is designed to run as an unattended process and accept transparent print output from any type of host application (GCOS8, GCOS7, GCOS6, IBM) that normally sends print data to network printers (ROPs), or to a remote spooling system (DPF8-DS). On the Gspool system the print may be directed to a physical printer or to the local spooling system. Gspool operates in different modes, Connect mode, Terminal Writer mode, DPF8 mode, SNM mode, IBM mode, TN3270 mode and TN3270E mode.
- **GUFT** is a G&R implementation of the Bull UFT file transfer protocols. It enables transfer of data files between Host Links and GCOS systems over a DSA network.
- **Gproxy** is a network management program used for supervision, management, load balancing and license sharing of G&R *Host Links* applications. **Gproxy** can be set up as a freestanding monitor program and/or report generator in a small network, or play a bigger role in a larger network.
- **Gsftp** is a transparent gateway between two different File Transfer protocols: FTP (RFC 959) and SFTP (the SSH File Transfer Protocol). The purpose is to present a seamless integration between the two protocols, with automatic conversion.

Scope of the product

Functionality

G&R/G3270 provides synchronous IBM3270 functionality to users with asynchronous terminals connected to a UNIX/Linux system. It transforms any UNIX/Linux platform into a 3270 cluster within SNA. G3270 is not available for Windows servers. G3270 emulates IBM LU type 2, including base and extended colour together with extended highlighting. Programmed symbols are not supported.

Network connections

G3270 can access IBM systems using Telnet 3270 (TN3270 or TN3270E) to connect to any TN3270↔SNA gateway or front-end. The TN3270 server on the Bull MainWay or UNIX systems, the IBM TN3270 front-end and the Microsoft TN3270 server for Windows are all qualified.

G3270 can also use DSA/ISO for connection via a Bull front-end (Datanet or MainWay) to Bull and IBM hosts. The OSF DSA↔SNA gateway (Janus) in the front-end provides SNA network access to the IBM host.

DSA connections can be made in the traditional way using OSI-transport, which is a requirement when connecting via old-style Datanets. The Bull systems can be accessed over an X.25 WAN or Ethernet LAN through a Datanet or MainWay front-end. Alternatively access can be direct to GCOS6 using a LAN adapter or direct to GCOS7 using ISL. Access can be by an FDDI LAN direct to GCOS7 using FCP7 or direct to GCOS8 using FCP8 (both support OSI-transport).

DSA connections can also be made over a TCP/IP network, using the Internet standard RFC1006 transport protocol to replace OSI-transport. MainWay front-ends with an ONP (Open Network Processor) have RFC1006 support in the standard product, allowing DSA sessions over TCP/IP into the MainWay. RFC1006 can also be installed in the FCP7 and FCP8 cards to support DSA connections direct to the mainframes without passing through the front-end. The GNSP of newer GCOS8 systems, and the Open System personality of GCOS7 Diane systems both support RFC1006 connections.

The *G&R/Ggate* product may be used to off-load the DSA session protocol into gateways. By running Ggate on the system(s) with the mainframe connections the emulator platforms need only the very small and efficient Ggate protocol layer to connect over TCP/IP to a Ggate gateway with full primary network functionality. Ggate can make the mainframe connection using OSI-transport or RFC1006. If you must use OSI-transport for the mainframe connection, using Ggate will limit the need for OSI-stacks to the Ggate platforms.

Asynchronous terminals

All asynchronous terminals supported by *Host Links* may be used to access G&R emulators, including Digital VTnnn, Bull VIP7801 and DKU7102 and PCs using *G&R/Glink* (but Glink users should normally use Glink's own emulation and connect directly, or via *G&R/Ggate*). The visual attributes shown are limited to the capability of the specific terminal. For VT340s and VT220 clones with colour support use our VT220 video driver with COLOURMODE in the profiles file.

Integration

G&R emulators allow execution of local commands, and the user may easily switch to other *Host Links* products while running the emulator. This includes the Interactive Help System that has all the information available in this manual. System administrators may easily customize the menus provided. The emulators utilize the *Host Links* screen interface. All functionality provided by this interface is therefore available for emulator users.

Run-time licenses

In order to run a G&R emulator, the following license keys must be present in your `/usr/gar/config/licenses` file:

basic	For the base G&R run-time system
emulator	One of <code>g3270</code> , <code>qsim</code> , <code>v78sim</code>

G3270

Connecting to host

You can connect to a host application by typing line feed followed by C (connect) LF C. G3270 will then make a connection request using the parameters set in the configuration file or given on the command line. You can instruct G3270 to connect at startup by giving the parameter `-CN ON`. You can also do your own connect by entering a connect command string when G3270 has started.

When connecting using DIWS/DSA:

Using a predefined CONAME from `dsa.cfg` to connect

```
$*$CN coname
```

Using G&R positional `$*$CN` format, the format for connections to IBM is:

```
$*$CN application,host_node<XMIT>
```

For TSO on an IBM host named IBM1, the connect command would be:

```
$*$CN TSO,IBM1<XMIT>
```

For TN3270 (Telnet 3270) connections only the IP address of the TN3270 gateway is used, either in numeric or symbolic format e.g.

```
$*$CN ibm1.gar.no<XMIT>
```

TN3270 servers are normally configured to use the standard Telnet port, and the TN3270 dialect is arrived at by Telnet negotiation. If the TN3270 server is configured on another port the connect command is:

```
$*$CN gateway:portnumber
```

Keyboard

G3270 Control keys

Control key table

Function	KEY	Function	KEY
alpha override	CTL/A	insert mode	INS
backspace	BACKSP	new line	RETURN
backtab	BACKTAB	PA1	SHIFT/F1 F1
clear	CLEAR	PA2	SHIFT/F2 F2
cursor select	CTL/C	PA3	SHIFT/F3 F3
delete	DEL	PF1..PF12	F1..F12
dup	CTL/D	PF13	SHIFT/F1 SHIFT/F1
enter	XMIT	PF14	SHIFT/F2 SHIFT/F2
erase field	EOF	PF15	SHIFT/F3 SHIFT/F3
erase input	EOP	PF16..PF24	SHIFT/F4..SHIFT/F12
field mark	CTL/B	reset	RESET
G3270 command	LF	tab	TAB
home	HOME		

Internal key and function numbering

This table lists all keys known to the *Host Links* emulators, their internal key number for use if quoting the key, and the assignments of functions to keys in G3270. All keys in the table may be redefined as macros, but the original function will still be available by quoting the key. Only control combinations (CTRL/X) marked unassigned are available for your own functions. Others are reserved for present or future use in the video handler.

Mnemonic	Hex	Decimal	G3270 function	Remark
CTL/A	\$101	257	alfa override	
CTL/B	\$102	258	field mark	
CTL/C	\$103	259	cursor select	
CTL/D	\$104	260	dup	
CTL/E	\$105	261	unassigned	
CTL/G	\$107	263	unassigned	
BS	\$108	264	back space	
HT	\$109	265	Forward tab	
LF	\$10A	266	command key	Also VT220 F16 (DO)
CTL/L	\$10C	268	unassigned	
CR	\$10D	269	new line	
CTL/R	\$112	274	unassigned	
F1	\$130	304	F-key 1	Also VT220 PF1
S1	\$131	305	S/F-key 1	
F2	\$132	306	F-key 2	Also VT220 PF2
S2	\$135	309	S/F-key 2	
F3	\$136	310	F-key 3	Also VT220 PF3
S3	\$137	311	S/F-key 3	
F4	\$138	312	F-key 4	Also VT220 PF4
S4	\$139	313	S/F-key 4	

G3270

Mnemonic	Hex	Decimal	G3270 function	Remark
F5	\$13A	314	F-key 5	Also VT220 PF5
S5	\$13B	315	S/F-key 5	
F6	\$13C	316	F-key 6	F6 to F12; also VT220
S6	\$13D	317	S/F-key 6	
F7	\$13E	318	F-key 7	
S7	\$13F	319	S/F-key 7	
CUP	\$141	321	cursor up	Also VT220 cursor keys
CUD	\$142	322	cursor down	
CUF	\$143	323	cursor forward	
CUB	\$144	324	cursor back	
CUH	\$148	328	Home	
EOP	\$14A	330	erase page	
EOL	\$14B	331	erase field	
F8	\$150	336	F-key 8	
S8	\$151	337	S/F-key 8	
F9	\$152	338	F-key 9	
S9	\$153	339	S/F-key 9	
F10	\$154	340	F-key 10	
S10	\$156	342	S/F-key 10	
F11	\$15C	348	F-key 11	
S11	\$15D	349	S/F-key 11	
F12	\$15E	350	F-key 12	
S12	\$15F	351	S/F-key 12	
CLR	\$160	352	Clear	
RIS	\$163	355	Reset	
RES	\$165	357	Reset	

Mnemonic	Hex	Decimal	G3270 function	Remark
IC	\$167	359	insert mode	
IMR	\$168	360	unassigned	
XMT	\$169	361	Enter	Send
IL	\$16A	362	unassigned	
DL	\$16F	367	unassigned	
TBS	\$170	368	unassigned	
TBI	\$175	373	unassigned	
DC	\$178	376	Del	Same as delete
CBT	\$17B	379	Back tab	
TBC	\$17C	380	unassigned	
DEL	\$17F	383	Delete	

Control keys and macros

Administration

Macros and redefined control keys are stored in sub-directories of the macro directory, `/usr/gar/<emu>_mac` where `<emu>` can be `3270`, `5250`, `qsim` or `v78`. This directory can be redefined with `-MP`, and would then be shared by all users with the same `-MP`.

Each sub-directory of the macro directory is a keyboard definition. By default, each user has a personal keyboard definition. The sub-directory name is the user's UNIX identification. This can be changed using `-MD`, and all users having the same `-MD` would share the keyboard definition. The first time a user presses a control key or executes a macro, the emulator checks the users sub-directory for a definition of the key. If the key is not defined in the user's sub-directory, it checks a shared sub-directory `default`. If a definition is found it is loaded for future use, otherwise the standard key definition is used.

By default, all users have permission to define macros and redefine control keys. This can be changed using the Host Links `profiles` directive `NOMACRO`. Users with `NOMACRO` in their profile can only read keyboard definitions made by the administrator. Note that when a group of users have the same `-MD` then they should not have permission to define macros, since they would all redefine the shared keyboard. Generally, only the administrator of such a group has permission to define macros. The administrator uses a personal keyboard definition and then copies it over to `-MD`. In the same way the administrator defines the default keyboard definition and copies it to sub-directory `default`.

```
v78sim -md group_a -li dsa.....
qsim -md group_a -li dsa.....
g3270 -md group_a -li dsa.....
g5250 -md group_a -li dsa.....
```

The command lines above would define the users as having their keyboard definitions at: `/usr/gar/` under directories `v78_mac`, `qsim_mac`, `G3270_mac`, `G5250_mac` respectively with subdirectory `group_a`.

Redefining your keyboard

G&R emulators provide 24 user definable macros that may be executed with the `LF F-KEY` sequence. Additionally any control key on the terminal can be redefined as a macro. Control keys visible to the emulators are all `DKU7102`, `VIP7800`, `VT220` or `Terminfo` function keys defined for the actual terminal. All macros are stored in the macro directory, `/usr/gar/<emu>_mac` (where `<emu>` can be `3270`, `5250`, `qsim` or `v78`), in a sub-directory corresponding to the user identification (unless redefined with `-MD`). The system administrator may define a default keyboard in directory `default` that will be used for all keys having no definition in the user's own macro directory.

A macro sequence may contain any key other than itself. This includes other macro keys. Macros may be nested to a depth of 8. When a nested macro is executed the current content of the macro is used. This makes it possible to redefine 'subroutine' macros. Macros may contain control characters (`LF X`). Macros may contain the transmit key, and if so the macro will be suspended until the mainframe replies.

Control keys may be included in a macro simply by pressing them. However, your terminal may not have the control key necessary to reach the emulator function you would like in the macro. To help you in this situation the emulators allow you to 'quote' any control key with the sequence `LF NNN "` that is interpreted as if you had pressed the key with the internal value of `nnn` (decimal).

If you use a control key in a macro and if you later redefine the control key (`LF K`) then your macro will use the new definition. If you want to execute an internal function e.g. Backspace, and also intend to redefine the `BACKSPACE` key to do something else then you must 'quote' the internal value for the Backspace function (decimal 264) in your macro, rather than use the key.

e.g. use `LF 264 "` at the point in the macro where you want a Backspace.

Redefining the command key

The command key, `LF` (`CTRL/J` and `F16`, `DO` on `VT200`), may be assigned to any visible control key by redefining the key and quoting the internal value of the command function. Thus some key 'funny' could be made into the command key as follows:

<code>LF K 'FUNNY' Y</code>	redefines 'funny' and confirms the redefinition
<code>LF 264 " LF N</code>	quotes the command function and terminates the macro

The key 'FUNNY' would thereafter act as the command key. Note that the quote of the command function will NOT act as a command key during the macro definition. This is an exception to the normal rule that all functions used in a macro are executed during macro definition. This means that if you want a special command key you should define it first, and thereafter use the special command key in all macros including a command sequence. If you have no `LF` key on the terminal you would use `CTRL/J` while defining a new command key as above.

A key used in `LF KEY` commands cannot be used as the command key. In addition to `F1-F12` and `SF1-SF12` (execute macro) the emulators have assigned `LF` command functions to `CR` (do nothing), `HOME` (clear), and `DEL` (reset), so these may not themselves be used as the command key.

Foreign terminals (VTnnn)

If you are using a 'stranger' terminal, particularly a VTnnn terminal, then you will find few of the standard control keys, but you may find up to 20 function keys, and other control keys. F1 to F12 may be needed in order to signal function key presses to your mainframe application, in which case 24 of the available control keys must be defined as internal functions F1 to F12 and shift/F1 to shift/F12. All of the other keys may be redefined as emulator functions or macros (`LF K`). Note that the VT200 function key 16 (Do) is used by default as the command key (`LF`), but this can be redefined. Also note that in general F1 to F5 of the VTnnn are local keys and cannot be used as F1 to F5 for mainframe sequences, unless programmable.

The VT100 video handler

This handler should be used with Digital VT100 terminals and clones and emulations of it. A TERM variable starting with 'vt1' selects this handler.

The real VT100 family has only PF1 to PF4 function keys. Since most main-frame applications expect keys F1 to F12 with shift, as well as some other VIP and DKU specific keys, these must be defined in some way on the terminal. The VT100 handler by default uses this mapping:

VT100 key	Result	Result after 0
KEYPAD 1	F1	SHIFT F1
KEYPAD 2	F2	SHIFT F2
KEYPAD 3	F3	SHIFT F3
KEYPAD 4	F4	SHIFT F4
KEYPAD 5	F5	SHIFT F5
KEYPAD 6	F6	SHIFT F6
KEYPAD 7	F7	SHIFT F7
KEYPAD 8	F8	SHIFT F8
KEYPAD 9	F9	SHIFT F9
KEYPAD ,	F10	SHIFT F10
KEYPAD -	F11	SHIFT F11
KEYPAD .	F12	SHIFT F12
KEYPAD ENTER	XMIT	
PF1	HOME	
PF2	ERASE TO END OF LINE	
PF3	ERASE TO END OF PAGE	
PF4	CLEAR	

The column 'Result after 0' shows what happens if the keypad 0 key is pressed first, then the key in the left column.

The interpretation of the numeric keypad can be toggled from the above to numeric using the `CTRL/N` key. In numeric mode the keypad may be used for keying numbers. The initial state of this interpretation can be set to numeric by using the `KPNUM` profile directive.

The VT200 video handler

This handler should be used on Digital VT200, VT300 and VT400 terminals and clones and emulations of it. A `TERM` variable starting with `'vt2'`, `'vt3'` or `'vt4'` selects this handler.

The real VT200 family has 20 function keys but F1 to F5 are allocated to internal functions, and there are no shifted F-keys. Since most mainframe applications expect keys F1 to F12 with shift, as well as some other VIP and DKU specific keys, these must be defined in some way on the terminal. The VT200 handler by default uses this mapping:

VT200 key	Result	Result after 0
KEYPAD 1	F1	SHIFT F1
KEYPAD 2	F2	SHIFT F2
KEYPAD 3	F3	SHIFT F3
KEYPAD 4	F4	SHIFT F4
KEYPAD 5	F5	SHIFT F5
KEYPAD 6	F6	SHIFT F6
KEYPAD 7	F7	SHIFT F7
KEYPAD 8	F8	SHIFT F8
KEYPAD 9	F9	SHIFT F9
KEYPAD ,	F10	SHIFT F10
KEYPAD -	F11	SHIFT F11
KEYPAD .	F12	SHIFT F12
KEYPAD ENTER	XMIT	
PF1	HOME	
PF2	ERASE TO END OF LINE	

VT200 key	Result	Result after 0
PF3	ERASE TO END OF PAGE	
PF4	CLEAR	
TAB	TAB	BACKTAB
FINISH	F4	SHIFT F4
INSERT	INSERT CHARACTER	INSERT LINE
REMOVE	DELETE CHARACTER	DELETE LINE
SELECT	SLC	
PREVIOUS SCREEN	PAGE UP	
NEXT SCREEN	PAGE DOWN	
F6	F6	
F7	F7	
F8	F8	
F9	F9	
F10	F10	
F11	F11	
F12	F12	
F13	LF	
F14	v14	
HELP	F1	
Do	LF	
F17	RESET INITIALIZE	RESET
F18	SET ATTRIBUTE	DELETE ATTRIBUTE
F19	SET TABSTOP	DELETE TABSTOP
F20	ESCAPE	

The column 'Result after 0' shows what happens if the keypad 0 key is pressed first, then the key in the left column.

The keyboard interpretation can be changed using profile directives `NOKPAM` and `KPNUM`. The `NOKPAM` directive turns off all interpretation. The `KPNUM` directive interprets the numeric keypad as numeric so that it can be used for keying numbers. There are thus four possible states for the keyboard:

`NOKPAM` set and `KPNUM` not set. This gives little initial functionality, it does no VT200 keyboard mapping at all. The function keys deliver native VT200 sequences, the numeric keyboard sends the sequences associated with application mode, and these too are delivered as native VT200 sequences.

`NOKPAM` is set and `KPNUM` is set. This is just as the above, except that the numeric keypad is interpreted as numeric and can be used to key numbers.

`NOKPAM` is not set, and `KPNUM` is not set. This is the default as shown in the table above. This gives maximum mapping of the keyboard into keys needed by Host Links products.

`NOKPAM` is not set and `KPNUM` is set. This gives the mapping in the table above, except that the numeric keypad is used to enter numbers.

The `CTRL/N` key can be used to toggle between the modes described above. For each press of `CTRL/N` the keyboard interpretation steps to the next mode. The mode is indicated with a status message.

The profiles option `COLOURMODE` allows the video handler to send ANSI colour sequences that are interpreted by VT340, and also many VT220 clones.

Keyboard mapping suggestions

If your VT200 clone has F1 to F5 programmable then you can program them to send numeric pad application mode sequences (`ESC O q -> ESC O u`) to give you F1 to F5 on the VT200 F-keys. Start with `KPNUM` in your profile, and you need never switch to application mode except for screen reset (`CTRL/N O PF4`, then step back to numeric with `CTRL/N`).

Otherwise if you suppress the mapping completely (NOKPAM) then all legal VT200 keys deliver native mode to the emulators. Extensions of the Single shift 3 sequence SS3 (`ESC O x`, x is A-Z a-z) and CSI (`ESC [n ~`, n is 0-39) can also be delivered if you have a programmable clone, and may be redefined as a function or macro. The numeric pad in application mode sends native sequences and these are recognized as native VTnnn sequences, and may be freely redefined as emulator functions or macros, independent of your solution for the F-keys.

In general, NOKPAM offers a greater freedom of choice of keys, but will mean more work defining a keyboard. VT220 clones with programmable shifted F-keys should certainly use this solution, and program the shifted f-keys 1-12 to send recognized SS3 or CSI extensions so that they can be assigned to emulator functions (`SF1-SF12`).

For a complete description of the video handlers and the `profiles` directives that allow you to customize them, see the *Installation and Configuration Guide*.

G3270 Function keys

The PF keys on the synchronous IBM3270 family are defined as transmitting the screen data to the host, preceded by a one byte flag (AID) to show which PF key was pressed. There are 24 PF keys. The PA keys are defined as sending a single byte to the host, but not the data from the screen. There are 3 PA keys. This means that many of the asynchronous terminals and PC-based emulations will not have enough function keys to allocate a unique key to each. The solution in G3270 is to allocate internal functions F1 to F12 as PF1 to PF12, and to make `SHIFT/F1` to `SHIFT/F3` lead to a selection. For example `SHIFT/F1` leads to a selection of F1 for PA1 or `SHIFT/F1` again for PF13. If you are defining a stranger keyboard you would put PA1 on a key by defining it as a macro (`LF K`) in which you quoted the internal function value of `SHIFT/F1 F1'`.

The type-ahead facility

Option `-TA ON` turns on type-ahead. Text typed while you don't have the 'turn' is stored until it is your turn, and then delivered to the emulator. The data will go into the variable fields if there is a form present. You can type several commands with `Xmit` after each. They will be delivered one at a time, whenever you get the turn. All `LF` commands clear the type-ahead buffer and are executed immediately. An `LF B` command will always send a break, and an `LF SPACE` or `LF CR` command will simply clear the type-ahead buffer.

Screen-scraping applications

In many cases the 'terminal' running a G&R emulator is not a terminal at all, but an application that simulates a `VTnnn` terminal in order to access the mainframe data that is painted on the `VTnnn` 'screen' by the G&R emulator. In this way the application can use a commodity terminal emulation (`VTnnn`) to access mainframe data otherwise available only to proprietary terminals (`VIP`, `DKU`, `3270`, `5250`). These applications are referred to as 'screen-scraping' applications. The `VTnnn` protocol has no 'turn' signal whereby the screen-scraping application can recognize that the output of a particular screen is finished. They therefore generally wait for a pause in output, and assume that the screen is complete. To make such an application work you will need to disable the normal dynamic update of the terminal screen with the `-DSU` parameter, so that the complete screen is updated in a single pass after the mainframe output is complete.

Printing

Hard copy

Host Links has a generic hard copy function in the video interface, CTL/P that may be used from any *Host Links* product to copy the screen to your screen.sav file. The LF P command enters a print menu of options for manipulating this file. However, if you always take hard copy in the same way and want it printed immediately via the print spooler, or direct to a device, then the LF W command may be used to write the screen content on to your <product>.sav. If you have configured a write command (-WC parameter), then this will be executed.

e.g. -WC 'lp -dpr1'

Options for the UNIX spooler lp may be used within the quotes, and the path name of the print will be supplied automatically to the command as a final argument.

You can also use your own shell script to process/print the file, and the path name of the print will be supplied automatically to the command as a final argument.

e.g. -WC myprintsript

Host print output

Gspool

As a print output station the *Host Links* mainframe print spooler *G&R/Gspool* is recommended. Gspool is designed to run as an unattended process and accept transparent print output from any type of mainframe application (GCOS8, GCOS7, GCOS6, IBM) that normally sends print data to network printers. On the Gspool system the print may be directed to a physical printer or to a file for spooling.

For all IBM print Gspool supports unformatted and formatted print (LU type 1 and 3) and SNA Character String (SCS) codes directed to an IBM3287 printer.

In IBM mode Gspool supports printers configured in a Bull front-end with the OSF SNA gateway (Janus). The front-end has the Gspool node and mailbox name configured as the location of the printer. Gspool waits for the connect request from the front-end.

In TN3270 mode Gspool supports printers via a TN3270/SNA gateway as specified in RFC1646. In TN3270E mode Gspool supports TN3270E print as specified in RFC1647 via a TN3270E/SNA gateway. It can be configured as a generic printer or associated printer through the use of TCP line handler parameters `-LU` and `-AP`. Microsoft's MS SNA Server (MS Windows), Bull's TN3270E server in MainWay and Bull's SNA/20 (AIX 4.1) are examples of SNA gateways that support RFC1647.

In SNM mode Gspool supports network printers configured in the SNM (GCOS6 Secondary network manager). When started with the 'no connect' option (`-CN o f f`), Gspool will wait for the connect request from SNM.

In GCOS8 or GCOS7 mode Gspool supports network printers configured in TP, TDS or Twriter. For Twriter Gspool waits for the connect from GCOS7.

In DPF8-DS mode (`-DPF8`) Gspool supports the 'DPF8-Distributed SYSOUT' ('DPF8-DS') product on GCOS8. In this mode Gspool starts two TCP/IP line handlers and waits for remote connect requests from DPF8-DS.

For more information about *Gspool* see the Gspool manual.

Commands

G&R emulators have an extensive range of commands that you can select with the sequence `LF X` where `LF` (`CTRL/J`) is the command key.

Command overview

The following keys may be typed in immediately after the command key.

1-99	set count for command	P	print menu
!	start UNIX shell	Q	quit (terminate emulator)
"	quote count as a key	R	sysreq key (5250)
#	change context (1-9)	S	set emulator/line parameter
\$	directory administrator	T	call editor with screen
+	Field + key (5250)	U	unlock keyboard
-	Field - key (5250)	W	write screen, and print
?	product information	X	include CTL in macro
B	send break to the host	Z	test key (5250)
C	connect to host	FN	execute macro F1-F12
D	disconnect from host	S/FN	execute macro SF1-SF12
E	execute UNIX command	HOME	clear screen
H	5250 Help key	DEL	reset screen
I	set insert mode	DOWN	roll up (5250)
K	start key definition	UP	roll down (5250)
M	start macro definition	XMIT	send page/all (DKU/V78)
N	end key/macro definition	EOL	erase user input (DKU)
O	set overlay mode		

G3270

The command key is F16 (Do) on a VT220, and the GRAY- key on a PC with *Glink*. The x is some other key denoting the desired command. You can type these commands or include them in macros assigned to various control keys on your keyboard. Some functions may be inhibited using *Host Links* profiles directives:

NODOLLAR, NOEXEC, NOEDIT, NOMACRO, NOSETUP

Set number for following command (LF n)

Many of the products in the *Host Links* range use the LF command key followed by a single character to select a function. If the function has several options then these may be selected by setting a number first, using the LF NUMBER command.

Examples are the context switch command, and the execute command:

LF #	Switch to context manager
LF 2 #	Switch to context 2
LF 6 #	Switch to context 6
LF E	Disconnect video, show/execute command, wait for CR
LF 1 E	Disconnect, cursor to 24/1, execute, no wait for CR
LF 2 E	No disconnect, execute command, refresh variables
LF 3 E	No disconnect, execute command, no refresh
LF 4 E	No disconnect, execute command, refresh whole screen

Start UNIX shell (LF !)

If you are working within the *Host Links* systems and are an advanced user, a UNIX specialist, or the system administrator you might find it convenient to start a command line shell in order to work with UNIX commands for a period without losing your *Host Links* context. Thus you can maintain several host connections or other activities while you temporarily work at command level.

LF ! Start a command line shell

This may be inhibited in your profiles file (NOEXEC).

Quote count as key (LF nnn ")

In several of the *Host Links* products there is a need to enter a key that is not on the keyboard. This can be achieved using the LF NNN " command. The count (NNN) represents the key value (in decimal), and is followed by " to quote the key. Combined with knowledge of the character set this allows entry of any valid display character. Combined with knowledge of the assignment of functions to control keys for a given product, it allows selection of functions otherwise unavailable from the keyboard. This is particularly important when defining keys or macros (e.g. in the macro facility).

LF 209	Set count 209 (hex D1)
"	Quote 209 as key Ñ (Upper case N with tilde)
LF 304	Set count 304 (hex 130)
"	Quote 304 as a key (F1) to select internal function F1

See section on macros for a table of internal functions.

Change context (LF #)

The *Host Links* multi-context feature is a set of utilities for allowing user friendly access to the UNIX multitasking capability such that a user may have several facilities in use at the same time, and jump between them as desired without terminating or restarting. For example, you may have several terminal emulators running, each of them logged on to a different host application and then switch between these applications as desired.

Each facility started by the *Host Links* multi-context feature is defined as an active context. If you have installed this software, then the LF # command allows you to jump directly to another active context.

A context number (1-n) is assigned to each active context. Use a repetition count to set the desired context number:

LF #	Jump to context manager
LF N #	Jump to context n

You should also note that *Host Links* supports UNIX shell level job control as supported in all UNIX shells except old versions of the Bourne shell.

Call the Host Links file manager (LF \$)

The *Host Links* file manager, *G&R/Gdir*, is a fully compatible interactive menu driven replacement for the standard file commands in UNIX. It provides facilities for navigating around the file and directory structure, and for creating and releasing files.

Additionally it has a facility for activating the alphanumeric keyboard with user-oriented functions that can then be executed with a single keystroke. These functions may contain any command, and the name of the file or directory being pointed to with the cursor in the file display is available as a parameter to the commands. The file manager is integrated with a configurable editor and print system, so the file pointed at may be read in to the editor or printed. For a detailed explanation, enter the manager and type LF H.

G&R/Gdir is included in the *G&R/Basic* package of utilities bundled with all *Host Links* products. Your *profiles* file may inhibit this function (NODOLLAR).

Field Plus (LF +)

Executes the 5250 Field Plus command.

Field Minus (LF -)

Executes the 5250 Field Minus command.

Get product information (LF ?)

Product name, version number and platform code is displayed in line 24.

Set FKC-addressing in macro (LF A n)

FKC-addressing is only really relevant for the DKU emulation (*Qsim*).

The DKU-family of terminals allows the FKC-sequence defined on an F-key to be addressed in three different ways. The sequence may be sent directly to the host (FKC-0), the sequence may be sent to the host and followed by transmission of whatever is transmittable on the screen (FKC-1), or the sequence may be

merely displayed on the screen (FKC-2). On the hardware DKU terminals FKC-0 is the default; the sequence is sent directly to the host.

You program the FKC-sequences by redefining the F-keys as macros using the LF K command. You can set a function code first using LF F before defining FKC addressing using LF A. The LF A sequence asks you to enter 0, 1 or 2 to define how the macro is to be addressed. FKC-0 and FKC-1 both transmit data to the host, and ASCII/CTL characters can be included in the macro, see LF X. In G&R emulations FKC-2 (display macro) is default, but a display macro may include a transmit, and send to the host.

In *G3270* this command is added for functional compatibility with other emulators in the family, and intended for specialists because use of macros that are transmitted directly to the host is complex in the 3270 environment. Macros are by default delivered through the emulator and cover the needs of ordinary users who need to define macros that automate dialog steps with the host.

The 3270 transmits a single byte direct to the host for PA-keys. It transmits a single byte (AID) followed by the cursor position, followed by transmission of whatever is transmittable on the screen for PF-keys.

In *G3270* PA-keys are simply defined using LF A to set FKC-0 addressing, and then entering the desired control byte. You enter this in ASCII. If you also define PF-keys that turn on the -FC parameter you should start the PA-key macro with LF S and set -FC off before the LF A to set FKC-0 addressing.

PF-keys are defined by first using LF S and setting parameter -FC ON, which adds the current cursor position after the first byte of an FKC-addressed macro. You use FKC-1 addressing. The LF A sequence will ask you to enter 0, 1 or 2 to define how the macro is to be addressed, and you select 1. You then enter the AID byte in ASCII and terminate the macro. The FKC-1 addressing causes transmission of the transmittable fields following your macro.

ASCII/CTL characters can be included in the macro, see LF X. It is therefore theoretically possible to use FKC-0 addressing and define the complete 3270-Xmit sequence of AID, cursor position, and then several variable fields, each with cursor position, control byte and content, but this is not really practical.

For GCOS8 applications using 3270 presentation the necessary 'Esc' is added automatically to the start of FKC-addressed macros.

Send a break command to the host application (LF B)

Several of the mainframe systems you may access have situations where they keep the initiative in a dialogue, and if you want to regain it you are required to transmit a break signal. Please do not confuse this function with the `BREAK` key on your asynchronous terminal.

Because the host has the initiative, your keyboard is locked for normal typing. However you may send a break to the host with `LF B`, which will normally cause the host to give you the initiative.

You may of course unlock the keyboard with `LF U`, and type normally. A break command may in this case be sent typing:

```
*$BRK <TRANSMIT>
```

Disconnect from host application (LF D)

To disconnect from a host application, enter the log-off sequence required by the host and transmit. The current session will then be closed by the host system and a 'Disconnected' message will appear on your screen.

If this log-off procedure for some reason fails, you may send a session disconnect request to the host by entering the command `LF D`. Normally you will then receive a disconnect confirmation message. Or you may type manually:

```
*$DIS <Xmit>
```


Execute command (LF E)

This command allows you to execute a UNIX command without exiting from *Host Links*. The following variations are available:

LF E COMMAND	Disconnect video, show/execute, wait for CR
LF E *COMMAND	Disconnect, cursor to 24/1, execute, no wait
LF E **COMMAND	No disconnect, execute, refresh variables
LF E ***COMMAND	No disconnect, execute, no refresh
LF E ****COMMAND	No disconnect, execute, refresh whole screen

In some products the variations can be produced using the LF N command to set a count prior to LF E. Normally the LF E command clears the screen, displays the command, executes the command, then waits for a CR before continuing. The display and wait may be avoided by preceding the command with an asterisk. Two asterisks should be used when executing commands from the file display that might change the directory. Three asterisks may be used when starting commands that do not update the screen at all. Four are used when starting another *Host Links* product, and cause the first to refresh the screen completely on return.

Your `profiles` file may inhibit this function (NOEXEC).

Call the Host Links help facility (LF H)

Typing LF H calls the *G&R/Gmenu* help facility. This is an independent system that executes outside of the products. The menu facility navigates through a series of menus and/or information pages, and most *Host Links* products have a set of help menus that can be consulted using the system. Other applications may also use it.

Menus and information pages may be added or changed by the user or system administrator. The kind of information you add can be information about different applications and a description of how to run them. Creating and maintaining the menus and information pages is described in the *G&R/Gmenu* facility manual.

Remember that you may take a hard copy of help pages with the hard copy control keys CTRL/P and CTRL/T, see the *Host Links* Screen handling section.

G&R/Gmenu is included in the *G&R/Basic* package of utilities bundled with all *Host Links* products.

Enter insert or overwrite mode (LF I, LF O)

Synchronous terminals normally operate in overlay mode, i.e. new characters, typed by you, overwrite the character at the cursor position on the screen.

In *Host Links* emulators you can choose to use insert mode instead, which will place a character at the cursor position and 'push' the character that was there one position to the right. This makes for easier editing in some circumstances.

Note that there are several other functions available using the control keys, all designed to be useful when working with a host editor that works in full-screen mode.

Start/End a key definition (LF K, LF N)

Any control key on the terminal that is visible to the emulator may be redefined as a macro, i.e. one or more other keystrokes. When you try to redefine the key you will be told its symbolic name, and asked to verify that you wish to redefine it, this means that you can safely use `LF K` to test if a key is visible, and find its name.

If you then continue and redefine the key as a macro the new definition is stored on disk as a file with the symbolic key name, and is available the next time you start the emulator. During macro definition each key is remembered as well as executed until you terminate with `LF N`.

Thereafter any time you press the control key the macro will be executed. System administrators please note that there are advanced functions available for use in macros; see `LF X` command.

Your `profiles` file may inhibit this function (NOMACRO).

Start/End a macro definition (LF M, LF N)

Up to twenty-four different user macros may be defined (as opposed to redefining control keys). `F-KEY` in the text below should be interpreted as one of the function keys `F1` to `F12`, or `SHIFT/F1` to `SHIFT/F12`.

LF M F-KEY sets the emulator in macro definition mode. This means that all user input is remembered, as well as being executed. LF N terminates the remembered key sequence. The sequence may then be executed at any time by entering LF F-KEY. The defined macro is saved in your macro directory with a name of type M1-M12 or N1-N12 and is therefore available the next time you start the emulator.

System administrators please note that there are advanced functions available for use in macros; see LF X command. Also any control key including F-KEYS may be redefined (LF K) to send a sequence when pressed (without a preceding LF). A macro may be defined and then renamed, and the new name given as the -MI parameter to cause it to be executed as an initialization macro when the emulator is started.

Your profiles file may inhibit this function (NOMACRO).

Call print menu (LF P)

Whenever you execute the LF P command, the emulator shows its print menu, which allows you to print screen dumps, print and remove screen dumps or simply remove the screen dumps.

Quit, leave the emulator (LF Q)

This command is used to terminate the emulator. The host log off sequence should be sent and a disconnect confirmation received before entering this command. However, if you leave with a session still active the network software will do an abnormal disconnect to close it. If the emulator is configured with the 'Disconnect Quit' (-DQ) parameter then it will always terminate if the host terminates the session or a connect fails. On unexpected disconnects and connection failures the emulator will generate a non-zero return code.

SYSREQ (LF R)

Executes the 5250 System Request command.

Set parameter (LF S)

Parameters are normally set when you start the emulator, either from the command line or preferably from the `<product>.cfg` file, but can be set afterwards by entering the LF S command. You will then be asked if the parameter is for the emulator or the line module. You answer E or L and then enter the parameter. More than one parameter may be entered. The following format should be used:

```
-XX parameter1 -YY parameter2
```

For an overview of the emulator and line module parameters available see the Startup/Configuration section.

Start your editor with screen image (LF T)

The LF T command starts the editor you have configured in your *Host Links* profile (DIRTED), the default is Gedit, but the experienced UNIX user may prefer vi. The editor workspace is loaded with the content of `screen.sav`, which has the screen image you had when you used the command, and any others saved previously with the video handler CTRL/P function. While in the editor you may manipulate the screen image as normal text, merge it with other text files, write it back to a file, print it out and then return to the *Host Links* product.

You may of course start any editor with the LF E option to get an empty workspace.

Unlock the keyboard (LF U)

Several of the host systems you access may have situations where they keep the initiative in a dialogue. Because the host has the initiative your keyboard is locked for normal typing, however you may send a break to the host with LF B, which will normally cause the host to give you the initiative.

You may unlock the keyboard with LF U, and type normally. A break command may in this case be sent typing:

```
.$* $BRK <TRANSMIT>
```

Write screen and execute print command (LF W)

As noted elsewhere, you may at any time within any *Host Links* product use the CTL/P command to take a hard copy of your screen image onto the file screen.sav on your home directory. You can access this via the LF P command, which puts you into the print menu.

However, if your hard copy printing is always done in exactly the same way, then you may use the LF W command, which first writes your screen image to the <product>.sav file, and then executes a pre-configured command (-WC parameter). The command may be any legal command, generally a spooling command to put the image into a queue for printing. Note that rename and delete parameters should be used, so that you may make successive requests, even though the printer is busy.

Include ASCII control character in macro (LF X)

Macro sequences to be sent directly to the host system (LF A) may need to include ASCII control characters. These special characters cannot be typed directly into the emulator, since it would interpret them as keyboard functions.

To include one in a macro, use the LF X command while in macro definition mode. You will be asked to press the desired control character, **BUT WITHOUT HOLDING DOWN THE CONTROL KEY.**

```
ASCII NUL SOH STX ETX EOT ENQ ACK BEL BS HT LF VT FF CR SO SI
KEY   @   A   B   C   D   E   F   G   H   I   J   K   L   M   N   O
```

```
ASCII DLE DC1 DC2 DC3 DC4 NAK SYN ETB CAN EM SUB ESC FS GS RS US
KEY   P   Q   R   S   T   U   V   W   X   Y   Z   [   \   ]   ^   _
```

Test (LF Z)

Executes the 5250 Test request command.

Execute a defined macro (LF F-key)

You can execute a predefined macro by entering LF FN, where FN is one of the function keys F1..F12, SHIFT/F1..SHIFT/F12. The emulator will check for a macro file with a name in the range M1 to M12 or N1 to N12 depending on the key. Macros are stored in the <product>_mac directory under /usr/gar (unless overridden with -MP) and the emulator looks first in the user's personal macro directory (unless overridden with -MD), and then in a directory with name default. If you have not defined the macro, an error message will be displayed.

Clear screen (LF Home)

The clear key is not available on some terminals, so LF HOME has been defined to duplicate the clear function. For Qsim/V78sim all variable fields are erased. In normal mode this is all data on the screen. For 3270/5250 all data on the screen is erased, and the host is notified.

Reset screen (LF Del)

The reset key is not available on some terminals, so LF DEL has been defined to duplicate the reset function. For Qsim/V78sim reset erases all fixed and variable data, cancels all field definitions, and resets tab positions. The emulator is set to normal mode. For 3270/5250 reset unlocks the keyboard and turns off insert mode.

Send page/all (LF Xmit)

The TRANSMIT key in Qsim/V78sim causes the emulator to transmit data to the host in a way depending on the mode of the emulator at the time. On a PC with G&R/Glink the XMIT key is GRAY +, and on VTnnn terminals it is probably configured as the ENTER key on the numeric keypad. In forms mode all variable data is sent from the fields in the form. In normal mode data is transmitted from the point on the screen at which the first character was entered, up to, but not including, the position of the cursor.

While a DKU is in normal mode it is possible to force transmission of all data on the screen, using the 'send page' function. On the DKU this is done using CTL/XMIT but in Qsim you use LF XMIT.

The VIP7800 terminals have a 'transmit all' function to force transmission of all data on the screen (including field definitions). This function is reached using LF XMIT. On the terminal this is done using ESC t, and this is supported as an alternative to LF XMIT.

Erase last user input (LF Eop)

In some situations where a user fills out some of the fields in a form it can be convenient to be able to erase the data from the last user input, without erasing other variable data filled out by the host or user previously. In Qsim LF EOL gives this function.

National character transliteration

IBM hosts use EBCDIC internally while UNIX systems use ASCII. This means that all data characters must be transliterated by G3270 when sent to or received from the host.

Note that Scandinavian users have traditionally 'fixed' the mapping of the three Scandinavian characters Æ Ø Å between their EBCDIC presentation of # @ \$ and their ASCII presentation of [\] in which case they will need the -SX option to duplicate this in G3270.

Internal character set

Using 8-bit terminals

Host Links supports 8-bit character sets if desired. If your *Host Links* profile indicates that your terminal is on an 8-bit line (EIGHTBIT), then the characters you type are stored as received. If your terminal is on a 7-bit line, but you have configured EXTENDED, then 8-bit character entry is done using some kind of SS2 (single shift 2) mechanism depending on the terminal type.

Using 7-bit terminals

If you have a 7-bit national keyboard you can specify LANGKEY (GE/FR/SF etc.), and the 8-bit internal character set is obtained by look up of the correct 8-bit character for your national keyboard's 7-bit equivalents. If you have a 7-bit national keyboard and do not choose a LANGKEY then the 7-bit national characters are stored as received, and the emulator can only be used with a 7-bit host using the same national character set.

Mainframe character set

National 7-bit character sets

The mainframe to which you connect may use a national 7-bit set. If you use 8-bit within the emulator you must specify the national character set used by the mainframe with the `-XL GE/FR` etc. parameter. The 8-bit characters within the emulator are then mapped to 7-bit national equivalents before transmission to the host, and vice versa. If you use a national 7-bit set within the emulator this is not necessary, both representations of national characters then use the same 7-bit equivalents (square and curly brackets etc.).

8-bit character sets

All of the GCOS mainframes (GCOS6, GCOS7, GCOS8) have 8-bit capability in the sense that characters can be stored as 8-bit bytes, but the communications software involved often undermines this capability. The front-end software or the mainframe terminal-handling package may not recognize the terminal as having an 8-bit capability, and may cut off the top bit.

The standard DKU terminal types avoid this problem by working in 7-bit mode over the communications line, and encoding 8-bit characters with an SS2 (Single Shift 2) mechanism. You enable this capability in Qsim with the `-EC` parameter instead of `-XL`. The SS2 mechanism is supported by GCOS7 for all mainframe 8-bit character sets, but Qsim only supports PLW (default) and Latin-2 (`-L2`). SS2 support is not standard on GCOS6 and GCOS8.

The standard VIP terminal types are defined as 7-bit. There is an encoding (SI/SO) for 8-bit, but this is not supported by the mainframes, so `-EC` is not useful. There is a VIP8800 terminal type that is defined as 8-bit, and this must be used when connecting to 8-bit mainframes. You enable this capability in V78sim with the `-E8` parameter.

G&R native 8-bit connections

The G&R DSA/DIWS interfaces, and G&R/Ggate provide an 8-bit connection to GCOS mainframes. In order to use this capability the emulators must be configured with the `-E8` parameter.

If your mainframe is a GCOS7 system it will not support 8-bit DKU connections for the standard DKU terminal types, and only supports 8-bit ASCII sessions for VIP8800. If your GCOS7 system is a Diane, then you can use the 8-bit terminal types and associated 8bit printer type specially defined for G&R to Diane communication. These were defined for GCOS 7 TS 9910 and need the following co-requisite patches:

Q1606.02, Q1607.03, Q1608.04, Q1609.02

Additionally the definition of the 3 new models must be appended in the H_TERM sub-file of the SYS.HSLLIB library as follows:

```
DEFLIKE EXTYPE=DKU9107,LIKE=DKU7107,DSAMODEL=20A2,CSETTYPE=9
DEFLIKE EXTYPE=VIP9800,LIKE=HDS7,DSAMODEL=20A3,CSETTYPE=9
DEFLIKE EXTYPE=PRT9220,LIKE=PRT1220,DSAMODEL=20A4,CSETTYPE=9
```


Host Links Screen handling

Control key functions

Besides standardizing screen handling, the various terminal specific drivers provide a selection of user-functions. The commands are as follows:

- | | |
|--------|---|
| CTRL/F | Toggle language key. The mapping to/from the extended character set will be stepped through the available ISO substitution sets. The chosen set is displayed in line 24 of the screen. US ASCII gives no mapping. |
| CTRL/I | Horizontal tab. For terminals with no TAB key. |
| CTRL/J | Line Feed. For terminals with no LF key. |
| CTRL/K | Copy field from screen. The characters between the cursor and the next attribute change on the screen (or the end of the line) are copied. |
| CTRL/L | Redisplay the entire screen. |
| CTRL/N | Select between different function and keypad modes in the VT100 and VT200 handlers. |
| CTRL/P | Hard copy of screen. The screen content is saved on your home directory with file name <code>screen.sav</code> in plain text format. |
| CTRL/U | Paste field. The field previously copied with CTRL/K is inserted as keyboard input at the cursor position. You should be at a place where it would be logical for you to type the content of the field you have copied. |
| CTRL/Z | Backtab. For terminals with no backtab key. |

Hard copy in video handler

While in any *Host Links* product hard copy of the screen is made with CTRL/P. The screen content is saved on your home directory with file name `screen.sav`.

The screen content is added to any existing data on the `screen.sav` file. That means that while running a remote application you may take a hard copy of each screen image in which you are interested, and thereafter print the `screen.sav` file.

To facilitate the manipulation of the `screen.sav` file, the LF P command brings you into a print menu.

Host Links field editing

The *Host Links* system will often require input of a field from the user, rather than a single key. The system uses a common method of editing this user input throughout the system using the following keys:

BACKSPACE	Delete the character to the left of the cursor
DELETE	Delete the character at the cursor position
CR	Finished with input: the whole field is used
ERASE EOF	Delete all characters from the cursor on
INSERT CHAR	Opens a space
CLEAR	Erase the whole field being input
CURSOR LEFT/RIGHT	Move cursor over typed text
TAB/BACK TAB	Move 10 positions (or to end)
CURSOR UP/DOWN	Go to start/end of typed data
LINE FEED	Call context sensitive help for the field

Host Links User profiles

Profiles file structure

User profiles are called profiles and maintained by the *Host Links* administrator.

```
/usr/gar/config/default/profiles
/usr/gar/config/$LOGNAME/profiles
/usr/gar/config/system/profiles
```

These files are read one by one in the sequence given above. Suggested commands should be given in `config/default/profiles`, user selected commands in `config/$LOGNAME/profiles` and finally the administrator may use the `config/system/profiles` to override all other settings.

All files are organized in sections, which may apply either to all terminals (Default), a specific user (User), a specific terminal (Terminal), a combination (Termuser), or a specific terminal type (Termttype). Each section is prefaced with a header line:

```
DEFAULT
USER      person.project.mode
TERMINAL  terminal_name
TERMUSER  terminal_name person.project.mode
TERMTYPE  terminal_type
```

Commands may be put into any section to specify the *Host Links* environment for a user or terminal. A full explanation of the facility is in the *Host Links Installation and Configuration* manual.

Startup/Configuration

```
g3270 -TA -LI DSA -HM IBM           (DSA)
g3270 -TA -LI DIWS -HM IBM         (DIWS)
g3270 -TA -li tcp -am tn3270 -tm ibm-3279-2-e   (TCP)
```

-TA indicates that the user wishes 'type ahead' turned on.

Parameters for the G&R emulators and gateways are divided into two categories, parameters for the product itself and parameters for the line handler. Parameters for the product must precede the -LI argument that signals that the rest of the parameters are for the line handler module.

The -USER and -HOST parameters may later be used to switch between product and line parameters. Parameters may be pre-configured on:

```
/usr/gar/config/$LOGNAME/<product>.cfg
```

The user (\$LOGNAME) directory may be replaced with default to give a configuration for users with no private directory.

Configuration file (<product>.cfg)

The configuration file is grouped into sections.

Default	Parameters apply to all users
User user(.acct.mode)	Parameters apply to this user only
Terminal terminal-name	Parameters apply to this terminal only
TermUser terminal user	Parameters apply to this combination only
ContextUser ctx user	Parameters apply to user in this context

G3270

The 'User' identifier may be in the standard star format, or the `.acct.mode` part can be omitted altogether. Comment lines are denoted by an asterisk or hash (`*`, `#`) in column 1, and may appear anywhere in the file. A section header must appear before the first parameter, but sections may be in any order. Both section headers and parameters can be indented for clarity. The file is processed sequentially and subsequent parameters will override any previous parameters of the same type.

Parameters for the product must be preceded by `-USER` if any line parameters have been delivered previously, e.g. in the `Default` section. Line parameters must always be preceded by `-LI XXX`.

In the following there are line parameters in the `Default` section, so the parameters in the user sections must be preceded with `-USER`, and the user's line parameters must be preceded with `-LI XXX` again.

e.g. `/usr/gar/config/default/g3270.cfg`

```
Default
-LI DSA -HM IBM -DN IBMA -DA CICS
ContextUser 1 Peter
-USER -TA -LI DSA -DA TSO -MN PETER1
ContextUser 2 Peter
-USER -MD OTHERMAC -LI DSA -MN PETER2
User Mary
-USER -MD MARYMAC -LI DSA -MN MARY
```

Using Ggate

-LI DSA or -LI DIWS

When using DSA or DIWS the line handler and the DSA-stack run on the same system. The G&R emulators and gateways also support the *G&R/Ggate* protocol and may access the Bull or IBM mainframe through a *G&R/Ggate* system. In this case there is no need for a DSA stack on the system running the emulator. The emulator can use the *Ggate* protocol on top of TCP/IP to communicate with *Ggate*, and *Ggate* will run the DSA or DIWS line handlers on top of the transport software on its own system. In this case the emulator startup commands would use:

```
-LI DSA:gars.gar.no (DSA)
-LI DIWS:192.150.211.4 (DIWS)
```

Note that both the symbolic and numeric IP-address formats are supported. See the *Ggate* manual for more information about *Ggate*.

G3270 parameters

Overview of operating parameters

Defaults are in upper case.

Parameter		Description
-An	rgbkilu	Overrides base colour decoding, see <i>colours and attributes</i> .
-CN	on/OFF	Connect automatically to host application (defined by line handler parameters) at startup.
-CRX	on/OFF	The CR key will act as transmit.
-DBG	on/OFF	Turns on an internal trace in G3270.

Parameter		Description
-DSU	On/OFF	Normally the screen is updated as data arrives from the line, provided the emulator gets time to do it. This parameter inhibits screen update until the host application indicates the end of the data. It may give a more pleasing impression by smoothing the screen update at the cost of waiting for all the data before starting. If the 'terminal' is actually a screen scraping application on another system then this parameter may be important to stop a premature reaction to a pause in the incoming screen image.
-DQ	on/OFF	Disconnect causes G3270 to quit, normal disconnect gives a return code of zero, abnormal disconnect gives a return code equal to the return code from the line. G3270 also quits on failing connection attempts with a non-zero return code.
-FC	on/OFF	Adds the current cursor position after the first byte of an FKC-addressed macro. This can be switched dynamically using LF S in the macro.
-II	on/OFF	Ignore the 3270 Field Attribute: "intensified display". When set to ON, G3270 will not highlight characters. The default is to highlight characters in a field with the "intensified display" set.
-LC	ON/off	Lower case is transmitted to the host. Can be turned off so that all data to the host is transmitted in upper case (although it is displayed in lower case on the screen).
-MD	name	Macro directory. The default is the user name in the directory 3270_mac in the /usr/gar directory.
-MI	name	The macro with this name is executed on G3270 startup.
-MP	path	Change the path to the main macro directory, the default is 3270_mac in the /usr/gar directories.
-MSG	ON/off	Wait... message after Xmit until reply from host.
-NUM	on/OFF	Check numeric attribute. Most 3270 keyboards disable numeric checking.
-QR	3278 3279	Response to host query. Default 3279 gives extended attributes and colour.

Parameter		Description
-SX	on/OFF	EBCDIC #@\$ transliterate to [] (Scandinavian transliteration).
-TA	on/OFF	Allow type ahead. User input is collected while the host has the turn.
-WC	'cmd'	The write command is executed after LF W to print the users' g3270.sav, with the path name as the last parameter in the command.
-XL	US	Translation from <i>Host Links</i> (ISO/Do11) 8-bit characters in G3270 to 7-bit equivalents to the host, and vice versa. The correct -XL (GB, GE, FR, SF, DE, NO, SP, IT, JA) must be specified if you choose an 8-bit profile in the profiles file and communicate with a 7-bit national host.
-XX	hxxh	Any incoming character from the host can be translated into any other for display purposes. Both are expressed in hex, and the first becomes the second. This is done after the EBCDIC => ASCII transliteration.

Colours and attributes

The 3270 terminal family has two modes of operation. In base colour mode the colours are generated locally using the attributes of the field on the screen. In extended colour mode the host application explicitly chooses the colours to be used.

Changing the base colour decoding

G3270 attributes

Attribute	Value	Attribute	Value
Blink	K	Turquoise	BG
Blue	B	Underline	U
Green	G	Violet	RB
Inverse video	I	White	RGB
Low intensity	L	Yellow	RG
Red	R		

The default field decoding for base colour mode:

Field Attribute	Colour	Parameter	Value
Unprotected, normal intensity	Green	-A1	GL
Unprotected, intensified	Red	-A2	R
Protected, normal intensity	Turquoise	-A3	GBL
Protected, intensified	White	-A4	RGB

To make unprotected, intensified fields violet and inverse video:

-A2 RBI

Some line handler parameters

All line handler parameters are described in the *Gline* manual.

DSA parameters

DSA can be used to connect to Bull GCOS systems that handle 3270 terminals, or to IBM systems that are available via the SNA gateway in Bull's front-end.

Parameter	Value	Explanation
-LI	DSA : GATEWAY	Use DSA (or DIWS if historical reasons). Optionally connect via Ggate on GATEWAY .
-HM	IBM/DPS7/ DPS8/CXI	Use IBM for access via the DSA/SNA gateway in the Bull front-end.
-LM	log mode	The log mode name is an eight-character string that corresponds to an entry in the log mode table in the Datanet associated with the LU. The default value is T32782.
-DA	Default application	Specifies the remote application mailbox for TSO, CICS, IMS, TDS, TP8
-DX	Default extension	Extension to the application mailbox. Used when connecting to Bull TP8.
-DN	default node	Session control name of the host.
-TM		Terminal mode. Not needed for DSA connections to the Datanet SNA gateway.
	IBM3270/ IBM3278/ IBM3279	Used when connecting to Bull GCOS7 applications that handle 3270 in EBCDIC mode.
	IBM3270A/ IBM3278A/ IBM3279A	Used when connecting to Bull GCOS8 applications that handle 3270 in ASCII mode.

Parameter	Value	Explanation
-MN	Mailbox name	You can specify a unique mailbox name for each active user; otherwise it is generated. If there is special mapping between DSA mailboxes and SNA LUs configured on the front-end the mailbox name must conform.

TCP parameters

Parameter	Value	Explanation
-LI	TCP	Use TCP/IP
-AM	TN3270 TN3270E	For TCP/IP connections it tells the TCP/IP line module to use the Telnet/3270 protocol.
-AP	on/OFF	Select the printer LU name associated with the LU name used by the screen (-LU)
-HO	hostname:port	Numeric/symbolic IP-address, optional port
-LU	LUname	The LUname is a symbolic name that can be appended to the terminal mode parameter when doing TN3270/TN3270E connections according to RFC-1646. The TN3270 gateway uses this LUname to map the connection to a specific LU or a pool of LUs.
-TM		Terminal mode
	IBM-3278-2 IBM-3278-3 IBM-3278-4 IBM-3278-5 IBM-3279-2 IBM-3279-3 IBM-3278-2-E IBM-3278-3-E IBM-3278-4-E IBM-3278-5-E IBM-3279-2-E IBM-3279-3-E	When connecting to IBM hosts over TCP/IP, the TN3270/TN3270E protocol negotiates the terminal type using assigned numbers as specified in RFC1340. They correspond to these values for terminal mode. You must choose one that is acceptable to the IBM TCP/IP front end.

Troubleshooting

If you experience any kind of problem when using an emulator or gateway to access your host application, the product trace file and/or the line handler trace file will provide useful documentation of the problem, for your own use, to the G&R distributor or to G&R if it turns out to be caused by an error in the product. See the appendix *Host Link Trace* for a full discussion of how to generate G&R/Host Links trace files.

Product trace files

UNIX/Linux	/usr/gar/debug/ XXX / YYY .dbg
------------	--

XXX = user name

YYY = product identifier *g32, g52, qsi, v78, pth*

This traces details from internal processing. Enable it by adding `-DBG` to the start-up command or the `<product>.cfg` configuration file:

```
-USER
      -DBG ON
```

Line handler trace files

UNIX/Linux	/usr/gar/debug/ XXX / YYY -gli.dbg
------------	--

XXX = user name

YYY = product identifier *g32, g52, qsi, v78, pth*

This traces details of line handler operation. Enable it by adding one or both of `-D_` and `-S_` to the start-up command or the `<product>.cfg` configuration file:

```
-LI ZZZ
      -S_ -D_
(ZZZ =line handler identification, i.e. DSA, DIWS, TCP or X25)
```

When connecting through Ggate

UNIX/Linux	/usr/gar/debug/ ZZZZ /gga NN-PPPP .dbg
Windows	C:\gar\debug\ ZZZZ \gga NN-PPPP .dbg

(ZZZZ = DSA node name, e.g. EN06 or PH13)

(NN = Instance number, starting at 01)

(PPPP = IP-address of the client system, running the emulator)

When any G&R or customer application based on GI-API connects through Ggate to the host application, the line handler trace will be generated on the Ggate system, with the name and location showed in the table above. In this case the product start-up command or <product>.cfg file would look like this:

```
-LI YYY:PPPP
    -S_ -D_
```

(YYY = line handler identification, i.e. DSA or DIWS)

(PPPP = IP-address of the system running Ggate)

Appendix: Host Links Manuals

Below you find a complete list of all available Host Links manuals:

Installation	
Host Links Servers	Installation and Configuration on UNIX/Linux
Host Links Emulators	Installation and Configuration on UNIX/Linux
Host Links	Installation and Configuration on Windows
Line handling	
Gline	Line Handler and DSA/OSI Configuration
Ggate	Transparent Gateway
Gproxy	Network Manager & SNMP Proxy Agent
G&R SSL	Using SSL for security in G&R products
GIAPI	Application Programming Interfaces
Gsftp	Gateway between FTP and SFTP
Emulations	
Gspool	Network Printer Emulation
GUFT	Unified File Transfer
G3270	Emulating IBM 3270 Terminals
G5250	Emulating IBM 5250 Terminals
Pthru	Gateway to the Bull Primary Network
Qsim	Emulating Questar DKU7107-7211 & VIP7700-7760
V78sim	Emulating VIP7801 & VIP7814
Gweb	Web Browser Front-end for DKU, VIP7700-7760, VIP7800, IBM3270 and IBM5250 Emulations

Appendix: Host Links DSA Utilities

The Gline package includes a set of Gline communication utilities. These are used when testing and debugging connection problems. The utilities are delivered as part of the Gline package and can be used without any additional configuration. The nodes to be tested must of course be configured in the `dsa.cfg` file.

Gconame

Lists the parameters generated from a given CONAME. The utility works for both CONAME and RESOURCE e.g.:

```
gconame tnviptm

Checking 'dsa.cfg' for coname 'tnviptm'
Coname: tnviptm, type TM, parameters:
-DA misfld
-S_
-D_
-CODE 0000
-CODE 1000
-CODE 1800
-TEXT Remote SCID?:
-CODE 4700
-TEXT Remote application?:
-CODE 1400
-CODE 1600
-TEXT Password?:
```

Gerror

Shows the text message associated with a DSA reason code. Only the most common codes are supported i.e. the ones related to network, transport and session communication layers. Errors generated by the OSI-stack on the Host Links platform are not covered by this utility; please refer to the documentation from the vendor of the stack e.g.:

```
gerror 0109
Reporting component: Session control (01) 0109, Dialog
protocol error or negotiation failed (wrong logical record).
```

For a detailed description of all reason codes, please consult the Bull manual *OSI/DSA Network System Messages and Return codes* (39A2 26DM).

Glnode

List and verify the communications parameters of the local node e.g.:

```
glnode
Local node name : GRDL
Local session control id : GRDL
DSA200 address (area:tsm): 54:60 (36:3C)
```

Gmacfix

When you connect to FCP cards on Bull mainframes via an Ethernet port on the LAN-Extender the mainframe address is given in Ethernet (LLC) format. If you connect to an FDDI adapter you must convert the MAC address to SMT. e.g.:

```
gmacfix 080038000fab
MAC address 080038000fab = 10001c00f0d5
```

Gping

Connects to a remote system using the Gline parameters set on the command line. If successful it returns 'connected to application', otherwise it shows the error code returned e.g.:

```
gping -li dsa -dn b7dl -da iof -du jim -pw mydogsname
Gping - $$DSA: Connected to application
```

Grnode

Return the parameters (in `dsa.cfg`) and the state of a remote node e.g.:

```
grnode b6dl
Checking 'dsa.cfg' for node 'b6dl'
Session control id : B6DL
DSA200 address (area:tsm) : 1:5 (1:5)
Inactivity interval : 0
Route 0
Load balance percentage : 0
TP class : 2
TP expedited : 0
TPDU size : 0
Network address : 130405
```

Gtrace

Same as `gping` but writes the DSA communication trace on the user's terminal (applicable to UNIX versions) e.g.:

```
gtrace -li dsa -dn ln40 -da snm151
D6:Application event @ 14:17:17.6003. tokenitem = 00
D6:Application event @ 14:17:17.6082. tokenitem = 00
D6:Connect request called, node = LN40
D6:OurBufferSizes. ApplMaxXmit = 511, ApplMaxRecv = 500
Rec:4000 0002 s:2
Rec:506B 0010 s:16
etc etc
Gtrace - line trace ending.
Gtrace - $$DSA: Connected to application.
```

Gtsupd

Update the state of a transport route. Transport routes can be set automatically in a disabled state if a backup route is configured. When such a state change occurs the route will be set back to the enabled state after a configurable timer has expired. The default is 15 minutes. You can reset the state of such a route with `gtsupd ts-name enbl/used/down/locked` e.g.:

```
gtsupd gars_rfc enbl
TS-entry 'gars_rfc', new state = enbl
```



Appendix: Host Links Trace

If you experience any kind of problem when using a Host Links application, the application trace file and/or the line handler trace file will provide useful documentation of the problem.

Trace activation

The Host Links products automatically create sub-directories in the debug directory when debug is activated: at product level using the `-dbg` parameter, or at line level using the `-d_` or `-s_` parameters to the line module.

Windows server	<code>gspool -id gsl -dbg -ps \\SERVER\LEXMARK -li dsa -da tptst -d_ on</code>
UNIX Linux	<code>gspool -id gsl -dbg-pc lp -li dsa -da tptst -d_ on</code>

Most G&R products include a facility for setting product or line parameters dynamically. It is therefore generally possible to turn on debug or trace without modifying the command line or configuration of a production system.

Trace types

All Host Links products accept a parameter `-dbg`, which starts an application level trace of internal events. This is useful when investigating malfunctions or looking closely at product behaviour.

All Gline line handlers accept a parameter `-d_` to turn on a data trace. It records data and enclosure level being exchanged with the line handler. It is useful when documenting product malfunction e.g. an emulation error, because it records exactly what the host sends and what the G&R application replies. It can be used to simulate a customer situation, reproduce a problem and to verify that a correction fixes the documented problem.

All Gline line handlers accept a parameter `-s_` to turn on a session trace. It records the raw data being exchanged between the line module and the underlying transport layer (e.g. OSI Transport, or TCP socket), as well as internal events and protocol states. It is useful when investigating protocol failures such as unsuccessful connect attempts or abnormal disconnections.

Structure

The Host Links file structure includes a debug directory to collect the trace and debug files in one location where the permissions can be adjusted as required for security. By default only the Host Links administrator can access the directory. The debug directory is created by the initialization procedure and located (by default) in:

Windows server	<code>\gar\debug</code>
UNIX Linux	<code>/usr/gar/debug</code>

If the application is a client type of application, a debug sub-directory with the same name as the user (UNIX username or PC login name) is created and all debug files are located there. This includes the line level trace except in the special case where the client application connects via Ggate and the line level trace is written on the Ggate system using the Ggate DSA node name as a debug sub-directory.

If the application is a server type of application, then a sub-directory will be created using the DSA node name on behalf of which the server application is executing. If the server does not use DSA the default local session control name is still used if there is a `dsa.cfg` file. If there is no `dsa.cfg` file then the system's UNIX or Windows communications node name is used. You can find this name using the command `uname -n` on UNIX systems, or the Network section of the control panel on Windows systems. This covers situations where several instances of a server are executing on the same system and accepting incoming calls to different DSA node names, or where several Host Links systems using the same server product share a file system.

Tracing Ggate

When Glink, a Host Links client or a customer application based on GI-API connects through Ggate to the application, the line handler trace is generated on the Ggate system, with the name and location shown in the table:

Windows server	<code>\gar\debug\NODE\ggaNN-PPPP.dbg</code>
UNIX Linux	<code>/usr/gar/debug/NODE/ggaNN-PPPP.dbg</code>

NODE is the local DSA node name used by the Ggate system.

The trace file name consists of the prefix `ggaNN-` followed by the IP-address of the client, suffixed by `.dbg` for a terminal session or `-dbg` for a printer session. The following is a trace file name for Ggate session sequence number 5 executing on Host Links system GRDL initiated from a Glink client on IP-address `jim.gar.no`:

```
gga05-jim.gar.no.dbg
```

This file, and possibly also a Glink debug file and a Glink communication trace file activated by the `/J` command line parameter will be needed by the support engineer investigating any problem.

To enable a line handler trace through Ggate the product's start-up command or configuration file would look like this:

```
-LI YYY:ZZZZ -S_ -D_
```

(*YYY =line handler identification, i.e. DSA or DIWS*)

(*ZZZZ =IP-address of the system running Ggate*)

Examples - G&R products

Examples of directory and file names in the debug structure are:

<code>/usr/gar/debug/jim</code>	Debug directory for user 'jim'	
<code>qsm.dbg</code>	Qsim emulator debug file	<code>-dbg</code>

qsm-gli.dbg	Qsim host line trace	-li dsa -s_
pth-glit.dbg	Pthru terminal line trace	-term -s_
pth-glih.dbg	Pthru -host line trace	-li dsa -s_
g32.dbg	G3270 emulator debug file	-dbg
g32-gli.dbg	G3270 host line trace	-s_
/usr/gar/debug/mike	Debug directory for user 'mike'	
v78.dbg	V78sim emulator debug file	-dbg
v78-gli.dbg	V78sim host line trace	-li dsa -s_
guf.dbg	GUFT client debug file	-dbg
guf-gli.dbg	GUFT client host line trace	-li dsa -s_
/usr/gar/debug/en01	Debug directory for node 'en01'	
guf.def	GUFT server debug file	-dbg
guf-gli.def	GUFT server host line trace	-li dsa -s_
gli-gli.dsa	DSA listener host line trace	-s_
gli-gli.diw	DIWS listener host line trace	-s_
gsp.def	Gspool (default -id) debug file	-dbg
gsp-gli.def	Gspool (default -id) host trace	-li dsa -s_
gga01-mike.gar.no.dbg	Ggate line trace, first Glink	-s_
gga02-mike.gar.no.dbg	Ggate line trace second Glink	-s_
/usr/gar/debug/en02	Debug directory for node 'en02'	
gsp.abc	Gspool (-id abc) debug file	-dbg
gsp-gli.abc	Gspool (-id abc) host trace	-li dsa -s_
gspc-gli.def	Gspool DPF8 command trace	-li tcp -s_
gspd-gli.def	Gspool DPS8 data trace	-li tcp -s_

<code>gsp._00</code>	Gspool started on demand debug	<code>-dbg</code>
<code>gsp-gli._00</code>	Gspool started on demand trace	<code>-li dsa -s_</code>

CPI-C and Gweb trace files

Gweb uses the CPI-C libraries so the Gweb debug structure is exactly the same as for CPI-C, except that Gweb inserts its own product identifier into the file name structure. CPI-C applications use the 'client' style of debug and create a debug directory with the UNIX username or PC login name used by the process that started them.

The application level debug (`-dbg`) and line trace (`-s_` and `-d_`) are set in the `cpic.cfg` file. The line trace goes to the debug directory, with the name built up as follows:

```
<product_id><session_id>-<process_id>.<debug_type>
```

product_id	<i>Value</i>	<i>Comment</i>
	<code>cp1</code>	CPI-C API
	<code>cp3</code>	CPI-C 3270
	<code>cp7</code>	CPI-C 7800
	<code>cpd</code>	CPI-C DKU
	<code>gw3</code>	Gweb3270
	<code>gw7</code>	Gweb7800
	<code>gwd</code>	Gwebdku
session_id	<code>(nn)</code>	If multi-session application, 1-63
process_id	<code>n (n n n...)</code>	Varies by platform
debug_type	<code>dgb</code>	Application level debug
	<code>gli</code>	Line trace

G3270

Example:

\gar\debug\system		debug directory for user "system"
cpi-16.dbg	CPI-C single session debug	-dbg
cpi-16.gli	CPI-C single session line trace	-li dsa -s_
cpi2-123.dbg	CPI-C session 2 application debug	-dbg
gw7-20172.gli	Gweb7800 host line trace	-li dsa -s_

Appendix: Error codes

OSI/DSA error codes

Below is a list of OSI/DSA error codes and the corresponding description. These are the same descriptions that the G&R/Errord utility will display when given the DSA code as a parameter.

code	Description
00xx	General Errors
0001	Open Failure in LC - Reject for unknown reason
0002	Open Failure in LC - Acceptor customer node inoperable
0003	Open Failure in LC - Acceptor customer node saturated.
0004	Open Failure in LC - Acceptor mailbox unknown.
0005	Open Failure in LC - Acceptor mailbox inoperable.
0006	Open Failure in LC - Acceptor mailbox saturated.
0007	Open Failure in LC - Acceptor application program saturated
0008	Connection refused. Transport protocol error or negotiation failed.
0009	Open Failure in LC - Dialog protocol error or negotiation failed
000A	Open Failure in LC - Presentation protocol error or negotiation failed
000B	Open Failure in LC / Connection refused lack of system resources
000C	Open Failure in LC / Connection refused from GCOS7 duplicate user
000D	Open Failure in LC, Duplicate implicit LID / Q class not started
000E	Open Failure in LC, Duplicate GRTS Id / lack of memory resources
000F	Open Failure in LC, No Logical line declared for DACQ / 7 connection refused
0010	Open Failure in LC, GCOS 8 GW Missing translation / Incorrect device length in ILCRL.
0011	Open Failure in LC, DAC connection not initialized / Too many jobs executing
0012	Open Failure in LC, No binary transfer / impossible to start the IOF job
0013	Open Failure in LC, connection is not negotiated in FD mode / impossible to start the IOF job

0014	Disconnection - Timeout resulting from absence of traffic.
0016	Option missing for an RBF mailbox.
0017	Connection refused - Incorrect access right for MB.
0018	Connection refused - Incorrect access rights for the application.
0019	Connection refused - Unknown pre-negotiated message path
001A	Connection refused - Security validation failed.
001B	Connection refused - Unknown acceptor mailbox extension.
001C	Connection refused - Inoperable acceptor mailbox extension.
001D	Connection refused - Invalid Message group number.
001F	Disconnection - no more memory space.
0020	Connection refused - Unknown node.
0021	Connection refused - inaccessible node or Host down.
0022	Connection refused - saturated site.
0023	Connection refused - inoperable mailbox.
0024	(X.25) Packet too long. Problem with packet size. / Connection block already used.
0030	Syntax Error - option not known (received on close VC).
0031	(X.25) No response to call request packet - timer expired.
0033	(X.25) Timer expired for reset or clear indication.
0039	Disconnection - transport protocol error (MUX).
003C	Presentation Control Protocol Error
003E	The application has not the turn
003F	Message group closed
0040	(X.25) Facility code not allowed. / Connection refused - unknown node
0041	Connection refused - path not available.
0042	Connection refused - Duplicate USER ID / Facility parameter not allowed
0044	(X.25) Invalid calling address.
0045	(X.25) Invalid facility length.
0047	(X.25) No logical channel available.
004F	DNSC: (X.25) Invalid call packet length.
0050	Normal disconnection (GCOS3/8)
0051	Error or Event on LC initiated by GW
0052	Error or Event on LC initiated by GW.
0053	Error or Event on LC initiated by GW. TCall
0054	Error or Event on LC initiated by GW. DIA in LOCK State
0055	Error or Event on LC initiated by GW. DIA error
0056	Error or Event on LC initiated by GW. GW has no known explanation.
0057	Error or Event on LC initiated by GW. Reject mailbox permanent

0058	Error or Event on LC initiated by GW. No more input lines in DACQ
0059	Time-out on GCOS 3/8 gateway.
005A	Error or Event on LC initiated by GW. Disconnect from terminal without reason
005B	Error or Event on LC initiated by GW. Wrong letter or wrong record
005C	Error or Event on LC initiated by GW. Forbidden letter received
005D	Error or Event on LC initiated by GW. Forbidden letter received
005E	Error or Event on LC initiated by GW. No buffer for secondary letter
005F	Error or Event on LC initiated by GW. No buffer for fragmented letter
0060	Error or Event on LC initiated by GW. Disconnect on end of phase record
0061	Error or event on LC initiated by GW. No buffer for control letter.
0062	Error or event on LC initiated by GW. Mailbox in closing phase
0064	Error or event on LC initiated by GW. Flow control error.
0065	Error or event on LC initiated by GW. CH locked by operator.
0066	Error or event on LC initiated by GW. Disconnect with a normal TMG F2 exchange.
0067	Error or event on LC initiated by GW. Teletel rerouting error from DACQ
0068	Error or event on LC initiated by GW. Teletel routing error from DACQ
0069	Error or event on LC initiated by GW. Teletel rerouting error from TM
006A	Error or event on LC initiated by GW. Teletel rerouting error from TM
006B	Syntax error - text too long.
006C	Syntax error - illegal object in a GA command.
006D	Syntax error - unknown node Id.
0078	Syntax error - illegal command for this object.
0079	Syntax error - illegal date.
007F	(X.25) No route available for X.25 switching.
0081	No more network routes available for switching.
0082	(X.25) Hop count reached for X.25 switching.
0083	(X.25) Flow control negotiation error.
0085	(X.25) Frame level disconnection.
0086	(X.25) Frame level connection.
0087	(X.25) Frame level reset.
0090	Frame level not set.
0092	(X.25) X.25 Echo service in use.
0093	(X.25) Incorrect password for PAD connection.

0094	(X.25) No more PAD connections allowed.
0096	(X.25) TS SX25 or NU X25 objects locked.
009C	(X.25) Invalid packet header. X.25 protocol error.
009D	(X.25) Incompatible header. X.25 protocol error.
009E	(X.25) Logical Channel Number too high.
009F	(X.25) Incorrect packet type.
00B2	Use of invalid password through PAD
00B6	Unknown mailbox selection for PAD connection using the PAD password.
00C0	(X.25) Normal disconnection.
00D7	(X.25) TS image (of type DSA or DIWS) in LOCK state.
00DE	(X.25) NS RMT or NR SW in LOCK state.
00E1	Connection refused. Mailbox is not in ENBL state.
00E6	QOS not available permanently.
01xx	Session Control
0100	Logical connection accepted or normal termination
0101	Rejection for unknown reason or abnormal termination
0102	Acceptor node inoperable.
0103	Acceptor node saturated. When a node has no available resources
0104	Acceptor mailbox unknown.
0105	Acceptor mailbox inoperable.
0106	DNS: Acceptor mailbox saturated.
0107	DNS: Acceptor application program saturated.
0108	Transport protocol error or negotiation failed (DSA 200 only).
0109	Dialog protocol error or negotiation failed. (Wrong logical record).
010A	Time-out on session initiation / unknown LID
010B	Acceptor mailbox extension unknown.
010C	Acceptor mailbox extension inoperable.
010D	Invalid Session Number.
010E	Unknown node.
010F	System error. System generation error or insufficient memory space
0110	Application abnormal termination. Subsequent to an abnormal occurrence in the dialogue
0111	Normal terminate rejected.
0112	Protocol not supported.
0113	Session control service purged by user.
0115	Disconnection Time-out on message group initiation.
0117	Incorrect Access Right for MB
0118	Incorrect Access Right for the Application
0119	Pre-negotiated Message Path Descriptor unknown
011A	Security validation failed
011E	Incorrect object status

011F	Not enough memory space available.
0120	Node unknown.
0121	The channel object (CH) is in LOCK state
0122	Saturation - no plug available
0123	Object status = LOCK
0124	Connection block (TSCNX) already used
0125	Disconnection already running
0126	The connection block (TSCNX) is disconnected (or not connected)
0127	Change Credit value < 0
0128	Ineffective Change Credit (delta = 0)
0129	No more deferred letters
012B	"Reinitialization" Request
012C	"Reinitialization" in progress
012D	"Reinitialization" in progress, letters are dropped
012E	Close virtual circuit. Either no mapping exists between PA/NR or CL and VC/NS
012F	Null connection object index.
0130	Undefined function at Sysgen time.
0131	Letter too large with respect to the negotiated size.
0132	The received letter is longer than the size which was
0133	Disconnection of the session control user
0134	Interface error on EOR (End-Of-Record) processing.
013C	Presentation control protocol error.
013E	You do not have the turn.
013F	Message group closed.
0140	Session is closed.
0151	Request refused, no system buffers available.
0152	Incorrect addressing record.
0153	No presentation record in the ILCAL or ILCRL
0154	Negotiation failed on session mode
0156	Negotiation failed on resynchronization.
0157	Negotiation failed on END to END ACK
0158	No presentation record in the connection letter
0159	Negotiation failed on session mode
015A	Negotiation failed on letter size (in the Logical Connection record).
015B	Negotiation failed on resynchronization (in the Logical Connection record).
015C	Negotiation failed on end-to-end ACK (Logical Connection record).
015D	No support of the "letter" interface because Multirecord is not negotiated.
0160	Incorrect TSPACNX table.
0161	Protocol error on letter reception.

0162	Negotiation failure.
0163	Record header length error.
0164	Protocol error.
0165	Protocol error reception of control letter.
0166	Type or length error on interrupt letter.
0167	Protocol error on reception of data letter.
0168	Dialog protocol error.
0169	Unknown event.
016A	Protocol error on data transfer.
016B	Invalid status for a disconnection request.
016C	Invalid status for a recover
016D	Invalid status for a suspend/resume request.
016E	Negotiation failure.
016F	Unknown command.
0170	Error in presentation protocol
0171	Letter header length error in
0172	ILCAL is not DSA 200 protocol.
0173	Error in session record.
0174	Normal disconnection, without complementary reason code.
0175	Letter is not in ASCII or EBCD.
0176	Connection protocol letter header
0177	Letter header protocol error.
0178	Record header protocol error.
0179	Record header length error.
017A	Mbx record header length error.
017B	Error on buffer transfer.
017C	DSA 200 record header protocol
017D	DSA 300 record header protocol
017E	Unsupported connection options.
017F	Character error in ASCII string.
0180	No segmented record size.
0181	Invalid mailbox object index.
0182	Mapping error for a remote connection.
0190	No more buffers.
0191	Byte count is greater than GP.
0192	Byte count is greater than GP.
0193	Byte count is greater than GP.
0194	Byte count is greater than GP.
0195	Byte count is greater than GP.
0196	Byte count is greater than GP.
0197	Byte count is greater than GP.
0198	No more buffers.

0199	Byte count is greater than GP.
019A	Byte count is greater than GP.
019B	Byte count is greater than GP.
019C	Byte count is greater than GP.
019D	Byte count is greater than GP.
019E	Byte count is greater than GP.
019F	Byte count is greater than GP.
01A0	Invalid transfer state.
01A1	Suspend protocol running.
01A2	Suspend protocol running.
01A3	Recover protocol running.
01A4	Forbidden function in write request. (\$WRITE)
01A5	Conflicting parameters for segmented record. (SWBREC)
01A6	Protocol conflict - suspend/recover.
01A7	Protocol not supported - letter/end-to-end ACK. (SWBLET)
01A8	Multi-record letter in progress.
01A9	Interrupt request forbidden.
01AA	Send control record request forbidden. (SCTROL)
01AB	Forbidden for TWA session - turn is here. (SREAD)
01AC	Termination forbidden - suspend or recover in progress. (STERM)
01C0	No space available for downstream connection request. (SMECNX)
01C1	No space available for upstream connection request. (SMUCNX)
01C2	No space available for upstream SCF connection. (SMRCNX)
01C3	No space available for session context. (\$SCTX)
01E0	Enclosure or data length error for a write request. (\$WRITE)
01E1	Enclosure or data length error for a write segment record request. (SWBREC)
01E2	Enclosure error for 'give turn' request. (SGVTRN)
01E3	Interrupt request is not demand turn, attention/data attention, or purge record.
01E4	Input status for a send control letter is not permitted.
01E8	Write request without turn.
01E9	Write segmented record request without turn.
01EA	Write segmented letter request without turn.
01EB	Send control letter request without turn.
01EC	Disconnection request without turn.
02xx	Presentation Control
0201	Protocol level not supported
0202	Application designation protocol error.
0203	Character encoding error. TM cannot support the proposed encoding.
0204	Character set error. TM cannot support the proposed character set.

0205	Character subset error. TM cannot support the proposed character subset.
0206	Incorrect record encoding.
0207	Incorrect parameter encoding.
0230	Data presentation control error. The presentation control proposed for this session cannot be used
0231	Device type is incompatible with the configuration.
0232	TM control protocol is incorrect.
0233	Device-sharing attributes are invalid.
0234	Initiator or acceptor configuration is not correct.
0235	Logical device index error.
0236	Number of logical devices is incompatible with the configuration.
0237	TM protocol record not supported.
03xx	Terminal Management
0300	Sysgen error WARNING. There is no mapped object; some objects will be spare.
0301	Operator requested session abort or logged.
0302	Idle time run out after secondary network failure.
0303	Idle time run out for no traffic.
0304	Form not found.
0305	Operator requested suspension.
0306	Destructive attention send on the session.
0307	Unknown TX addressed in this session. TM is unable to a the session.
030A	Protocol error. A record was received which did not comply with current standards
0310	Insufficient resources. The receiver cannot act on the request because of a temporary
031E	Incorrect value for Retry or Wait parameters on UP LL command.
0320	Function not supported.
0321	Parameter error. This can result
0322	Resource not available. The
0323	Intervention required (on principal device).
0324	Request not executable.
0325	EOI required.
0326	Presentation space altered, request executed.
0327	Presentation space altered, request not executed.
0328	Presentation space integrity lost.
0329	Device busy. The device is busy and cannot execute the request.
032A	Device disconnected.
032B	Resource not configured.
032C	Symbol set not loaded.

032D	Read partition state error.
032E	Page overflow.
0330	Subsidiary device temporarily not available.
0331	Intervention required at subsidiary device.
0332	Request not executable because of subsidiary device.
0340	TM cannot accept a new connection.
0341	Object status incorrect.
0342	The TM configuration is not correct.
0343	Unknown TX addressed on this session.
0344	Data presentation protocol error.
0345	Device type is incompatible with the configuration, or is not supported.
0346	TM control protocol incorrect.
0347	Device shareability attributes are invalid.
0348	Initiator or acceptor configuration is not correct.
0349	Logical device index error.
034A	Number of logical devices incompatible with the configuration.
0350	Disconnection of TM after reinitialization of the network.
0360	File not found. (Welcome and Broadcast Messages)
0361	Site not found. (Welcome and Broadcast Messages)
0362	NASF error. (Welcome and Broadcast Messages)
0370	No-session timeout. Device disconnected.
0371	No-input timeout. Device disconnected.
0372	No-output timeout. Device disconnected.
0373	Timeout due to no backup session being initiated.
0374	Timeout due to no backup session being established.
0375	Connection refused because of late activation of back up session.
0376	Disconnection of current session to switch to backup session.
0380	AUTOCN parameter not declared.
0381	Mixed ETB in data sent by VIP screen and cassette
0382	Data header sent by the terminal incorrect.
0383	Desynchronization in the exchange of data.
0384	KDS block count error.
038C	Remote terminal is not connected
0390	Unknown mailbox.
0391	No call packet to return.
0392	No "Possibility" command to return Protocol error
03C0	Slave device disconnection.
17xx	Network Layer
1701	PAD connection refused.
1702	Flow control error.

1706	Logical channel number not zero in restart packet.
1707	Illegal packet length or use of D-bit forbidden.
1708	Illegal header.
1709	Illegal Logical Channel Number.
1710	Invalid packet type for the automaton state. Protocol error
1711	Incorrect packet type.
1712	Inconsistent network parameters in the generation file.
1713	No more space.
1714	DSAC network layer object not usable.
1717	USED/ENBL transition. Transport station is locked.
1718	USED/ENBL transition. This is a back-up NR.
1719	USED/ENBL transition. Dynamic close due to load.
171A	USED/ENBL transition. Transfer time-out has elapsed.
171B	USED/ENBL transition. This is a back-up NR.
171C	USED/ENBL transition. Transport station is idle.
171E	USED/ENBL transition. NR object is locked.
171F	ENBL/LOCK transition. NR HDLC has no more memory space.
1721	Remote station is inaccessible via the configured network. Check
1723	Incorrect PAD password.
1724	Virtual circuit already in use. LCN (Logical Channel Number) too high.
1725	Invalid virtual circuit.
1726	Packet too short. Protocol error for the equipment directly connected to the Bull Datanet.
1727	Incompatibility between the generation parameters of two communicating systems on window or packet size.
1729	Packet size in communicating systems not the same.
1731	Timer runs out while waiting for call confirmation.
1732	Timer runs out while waiting for clear confirmation.
1733	Timer has run out while waiting a reset confirm.
1740	Call setup or call clearing problem.
1741	Open failure on virtual circuit. No flow control on this NS.
1742	Incorrect facility. Protocol error for the equipment directly connected to the Bull Datanet.
1744	Unknown subscriber.
1745	End of time-out on reset confirm. Invalid facility length. Protocol error for the equipment directly
1747	No logical channel available.
1749	End of time-out on call confirm.
174F	Incorrect packet length. Protocol error for the equipment directly connected to the Bull Datanet.
1755	Flow control, window, packet size or reset error.

1760	Frame disconnection.
1770	Frame connection.
1771	Frame reset.
1781	No more network routes available for X.25 switching.
1782	Maximum of 15 switches have been used,
1783	Flow control negotiation error.
1785	Frame level disconnection.
1786	Frame level connection.
1787	Frame level reset.
1790	Frame level not established.
1791	No more logical paths available for the PAD.
1792	Echo service busy.
1793	Incorrect PAD password.
1794	All the PAD virtual circuits are used
1795	X.25 initialization not possible.
179B	LCN not null in restart packet
179D	Incompatible header (receive error: all VC of concerned NS
179E	LCN greater than NBVC in NS directive
179F	Incorrect packet type
17A0	Invalid facility.
17B0	Normal disconnection.
17B1	X.25 Echo in use.
17B2	No more logical channels available.
17B3	No more PAD connections allowed.
17B4	TS SX25 or NU X25 object locked.
17B5	Buffer capacity overflow.
17B6	Normal disconnection.
17B8	Unknown calling SNPA (Sub-Network Point of Attachment).
17B9	Internet problem.
17CB	Call collision on VC
17CC	Incompatible generations (NR object without mapping).
17CE	Invalid status NR locked.
17CF	Lack of space.
17D0	Unknown subscriber.
17D4	TSCNX already used for another connection. SCF internal error.
17D7	Transport station locked.
17DD	Proper NS locked.
17DE	Invalid status NR locked.
17DF	Lack of space.
17E0	Forbidden parameter or invalid value.
17E1	Invalid transition.
17E2	Upward-mapped object (TS) not locked.

17E3	No object mapped above.
17E4	NR not locked (MP NR -ADD/-SUB) or virtual circuit already open.
17E5	NR is last in list and the TS is not locked.
17E6	No object mapped above (UP NR -PRIO). NR not mapped on TS.
17E7	Upward mapped object not locked
17E9	Mix of datagram and connection network
17EB	Class inconsistent with NR.
17EE	Incompatible generations. NR object without mapping.
17FF	Wrong parameter in administrative CALL
18xx	Transport Layer
1800	Normal disconnection initiated by the correspondent
1801	Local saturation at connection request time.
1802	Failed negotiation at connection time.
1803	Duplicate connection. Two or more requests have been issued for the same connection.
1804	Redundant request.
1805	Retransmission Time-out at transport level.
1806	Survey time-out at transport level.
1807	Transport protocol error.
1808	Session Control specified is not available (inaccessible).
1809	Requested Session Control Id unknown by remote transport.
180A	Termination because of disconnection by administration.
180B	Session Control/Transport interface error.
180C	Connection request on non-sharable VC in case of ISO Transport. ISO: header or parameter length is invalid.
1817	Station in shut-down state.
181F	No memory space at connection time.
1821	Session Control inaccessible by configured session routes. ISO: Session entity not attached to TSAP.
1824	Collision between Close NC and Open TC.
182E	Remote station not configured.
182F	Resource saturation.
1831	ISO: No route for the called NSAP.
1832	ISO: Received NSAP addresses are wrong.
1833	Segmentation violation.
1834	ISO:QOS priority not available temporarily, due to a local condition (for example, lack of resources).
1835	ISO:QOS priority permanently unavailable locally (for example, due to an error in the system generation).
183A	ISO: Remote reason not specified.
183C	ISO: Remote transport entity congestion at connect request time.
1840	Server in terminating state. TC has been re-assigned on another NC.

18A1	An additional NC has been assigned to a TC.
18B0	NC has been re-assigned on another VC.
18EF	Disconnection at Transport level caused by reception of RESTART DSA during the transfer phase.

Windows Sockets error Codes

Below is a list of Windows Sockets return codes and the corresponding description.

Hex code	Windows Sockets Access Error name	Description
2714	WSAEINTR	The (blocking) call was cancelled via WSACancelBlockingCall()
2719	WSAEBADF	The socket descriptor is not valid.
271E	WSAEFAULT	An invalid argument was supplied to the Windows Sockets API.
2726	WSAEINVAL	An invalid call was made to the Windows Sockets API.
2728	WSAEMFILE	No more file descriptors are available.
2733	WSAEWOULDBLOCK	The socket is marked as non-blocking and no connections are present to be accepted.
2734	WSAEINPROGRESS	A blocking Windows Sockets call is in progress.
2735	WSAEALREADY	The asynchronous routine being cancelled has already completed.
2736	WSAENOTSOCK	The descriptor is not a socket.
2737	WSAEDESTADDRREQ	A destination address is required.
2738	WSAEMSGSIZE	The datagram was too large to fit into the specified buffer and was truncated.
2739	WSAEPROTOTYPE	The specified protocol is the wrong type for this socket.
273A	WSAENOPROTOOPT	The option is unknown or unsupported.
273B	WSAEPROTONOSUPPORT	The specified protocol is not supported.

273C	WSAESOCKTNOSUPPORT	The specified socket type is not supported in this address family.
273D	WSAEOPNOTSUPP	The referenced socket is not a type that supports connection-oriented service.
273E	WSAEPFNOSUPPORT	
273F	WSAEAFNOSUPPORT	The specified address family is not supported by this protocol.
2740	WSAEADDRINUSE	The specified address is already in use.
2741	WSAEADDRNOTAVAIL	The specified address is not available from the local machine.
2742	WSAENETDOWN	The Windows Sockets implementation has detected that the network subsystem has failed.
2743	WSAENETUNREACH	The network address can't be reached from this host. There is probably a problem in the way you have set up TCP/IP routing for your PC (most likely you have not defined a default router).
2744	WSAENETRESET	The connection must be reset because the Windows Sockets implementation dropped it.
2745	WSAECONNABORTED	The connection has been closed.
2746	WSAECONNRESET	
2747	WSAENOBUFS	Not enough buffers available, or too many connections.
2748	WSAEISCONN	The socket is already connected.
2749	WSAENOTCONN	The socket is not connected.
274A	WSAESHUTDOWN	The socket has been shutdown.
274B	WSAETOOMANYREFS	
274C	WSAETIMEDOUT	Attempt to connect timed out without establishing a connection.
274D	WSAECONNREFUSED	The attempt to connect was forcefully rejected. The service on the other side is not available.
274E	WSAELOOP	Too many symbolic links were encountered in translating the path name.
274F	WSAENAMETOOLONG	
2750	WSAEHOSTDOWN	The host machine is out of service.
2751	WSAEHOSTUNREACH	The host machine is unreachable.

2752	WSAENOTEMPTY	
2753	WSAEPROCLIM	
2754	WSAEUSERS	
2755	WSAEDQUOT	
2756	WSAESTALE	
2757	WSAEREMOTE	
276B	WSASYSNOTREADY	Indicates that the underlying network subsystem is not ready for network communication.
276C	WSAVERNOTSUPPORTED	The version of Windows Sockets API support requested is not provided by this particular Windows Sockets implementation.
276D	WSANOTINITIALISED	A successful WSStartup() must occur before using this API.
2AF9	WSAHOST_NOT_FOUND	Authoritative answer host not found.
2AFA	WSATRY_AGAIN	Non-authoritative answer host not found, or SERVERFAIL.
2AFB	WSANO_RECOVERY	Non-recoverable errors, FORMERR, REFUSED, NOTIMP.
2AFC	WSANO_DATA	Valid name, no data record of requested type.