THE GALACTICOMM
SOFTWARE BREAKTHROUGH
LIBRARY REFERENCE GUIDE

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THE GALACTICOMM SOFTWARE BREAKTHROUGH

LIBRARY REFERENCE GUIDE

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1.0 INTRODUCTION

The Galacticomm Software Breakthrough Library manages a wide variety of communications hardware, supporting up to 256 users simultaneously on a fast IBM PC/AT/386/486 class of computer.

The GSBL is our communications interface for The Major BBS Bulletin Board System. One strategy of the GSBL is to isolate low-level communications considerations from the design of The Major BBS. Similarly, specific features and considerations of bulletin boards are isolated from the design of the GSBL.

This manual will describe the GSBL as a general purpose communications tool. Your practical interaction with the GSBL is as a library of C-language callable subroutines. So most of this manual is the detailed description of these routines.

To efficiently handle a very large number of channels on a personal computer, we've had to make some breakthroughs in the hardware as well the software. For example, the GalactiBox can hold sixteen inexpensive internal modems, all configured at the same COM port, without interrupt conflicts. Or a GalactiBoard can provide eight serial ports at the same COM port. And the original Galacticomm Breakthrough cards have many modems on one card but only use up two of the standard I/O addresses.

1.1 Galacticomm Hardware

Here are some examples if I/O hardware available from Galacticomm. Call sales at 1-800-328-1128 for the latest products and prices.

Part	Description
GalactiBox	16-slot COM expander
GalactiBoard	8-port serial card
Internal 2400	Internal 300-2400 bps modem
Internal 2400 MNP	Above with correction and compression
Internal 14400 MNP	Internal 300-14400 bps modem, etc.
External 2400	External 300-2400 bps modem
External 2400 MNP	Above with correction and compression
External 14400 MNP	External 300-14400 bps modem, etc.
PC XNet	X.25 interface subsystem
Model 2408	8-modem card, 300-2400 bps
Model 16	16-modem card, 300-1200 bps
Model 4	4-modem card, 300-1200 bps

The GalactiBox can expand the I/O capabilities of your PC bus with modems, serial ports or other devices. We can ship you the GalactiBox full of any of the above internal modems in any combination.

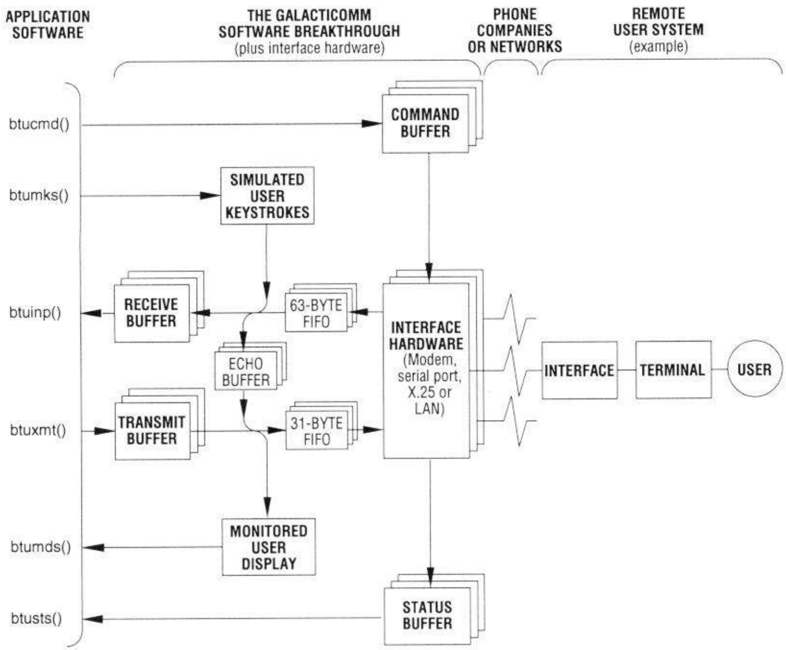
The GalactiBoard has eight RS-232-C serial channels with 16550-type UARTS for direct connection to devices like the above external modems, local terminals, printers, plotters, and so forth. 30" cabling is included.

The PC XNet card gives the GSBL the capability to support a service on a packet switching network like Sprintnet, CompuServe, or BT Tymnet.

With the Advanced LAN Option, you can also support communications across a Novell Local Area Network, based on the Netware IPX communications standard.

The Model 2408 modem card offers you the most compact 2400 bps multiple-modem solution. Each individual modem has its own microprocessor, and connects directly to your telephone company, using everyday "RJ-11" telephone jacks.

SECTION 1.0 INTRODUCTION



Galacticomm Software Breakthrough Block Diagram

2.0 ARCHITECTURE

The Galacticomm Software Breakthrough Library is a multi-user communications tool. This is different from multi-tasking. Our approach is to have a single DOS program take direct control of all communication ports -- not through DOS, not through BIOS (neither of these was developed with much regard for performance). The program must be expressly designed for multi-user purposes. With these principles, it is possible to serve a large number of users with an inexpensive computer such as the PC/XT/AT or compatible. This is what The Major BBS does. See page 196 and page 206 for examples of a very basic multi-user teleconferencing program that uses the GSBL routines.

To help you get a grasp of the architecture of the Galacticomm Software Breakthrough Library, figure 2-1 shows the structure and flow of data through these buffers:

Buffers Implemented for Each Channel

Buffer	Access via routine	Direction of access
Status	btusts()	input
Command	btucmd()	output
Receiver	btuinp() / btuict()	input
Transmitter	btuxmt() / btuxct()	output
Echo	(transparent)	---

The following buffers are only implemented for two channels -- the "monitored" channels -- as selected by btumon() (page 125) and btumon2() (page 127).

Buffers Implemented for only One Channel at a Time

Buffer	Access via routine	Direction of access
Monitored display	btumds()	input
Simulated keystrokes	btumks()	output
Monitored display #2	btumds2()	input
Sim. keystrokes #2	btumks2()	output

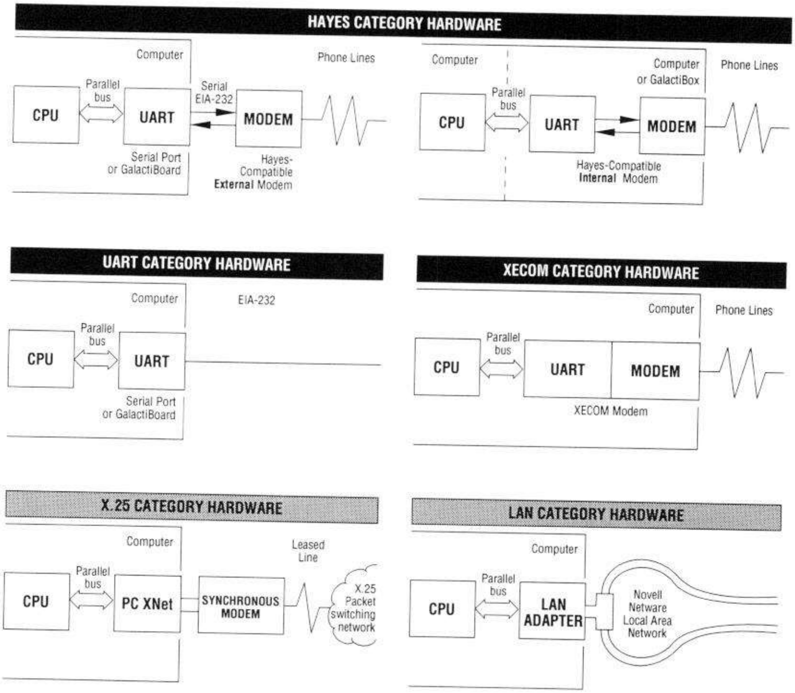


Figure 2-2: Hardware Architectures Supported

2.1 Hardware Categories

The Galacticomm Software Breakthrough Library supports multiple users on IBM PC/XT/AT and compatible computers using several different kinds of hardware, which fall into these three categories:

Hardware Category	Description	Examples
HAYES	"Hayes-protocol" modems	Galacticomm Model 2408, GalactiBox with internal modems installed, 8*Serial Card with external Hayes-compatible modems
XECOM	"Xecom-protocol" modems	Galacticomm Model 16, or Model 4
UART	RS-232 serial ports	8*Serial Card, IBM Asynchronous adapter

Other hardware and interfaces are supported as part of special option packages:

X.25	Packet switching networks	PC XNet Card
LAN	Direct & virtual circuits	Novell Local Area Networks

HAYES Category Hardware: Hayes-Protocol Modems

In this category of hardware, the computer is connected in series with three devices: an RS-232-C serial interface device (called a UART); a Hayes-compatible modem; and a telephone line. The two functions of controlling the modem, and communicating through it, are handled using the same signals. This is accomplished using two modes of operation: the modem is either in command mode or in online mode.

	XECOM Category Hardware	HAYES Category Hardware
Baud rates available	300, 1200	any rate from 75 to 38,400
Phone ringing (see btusts())	Status 1	Status 3 input string: "RING"
Carrier detect (results of btucmd(chan,"A"))	Status 2	Status 3 input string: "CONNECT" for 300 baud "CONNECT 1200" for 1200 baud "CONNECT 2400" for 2400 baud etc... Status 12
Lost carrier (see btusts())	Status 1	Status 11
Busy	Status 66 ('B')	Status 3 input string: "BUSY" or "NO CARRIER"
Timeout waiting for dial tone	Status 84 ('T')	Status 3 input string: "NO DIALTONE" or "NO CARRIER"
Timeout waiting for carrier	Status 84 ('T')	Status 3 input string: "NO ANSWER" or "NO CARRIER"
Command complete successfully (see btucmd())	Status 2	Status 12 Status 3 input string: "OK" (in most cases)
Successful Reset of modem (bturst() return code meaning OK)	0	1
Short pause btucmd("..p..") and Long pause btucmd("..P..") within a string of commands	Takes place AFTER the commands preceding it	Takes place BEFORE all other commands in the string
Commands not supported on Hayes hardware (see btucmd())	^M Frequency monitor ^O set 110 baud speed ^X Analog loopback, originate mode ^Y Analog loopback, answer mode H Hold I Identify version i Identify revision L Line analyze l ("ell") 1200 baud error statistics	(these commands will generate a status code 13 with Hayes hardware)
Commands supported only on Hayes hardware (see btucmd())	(this command will generate a status code 63 (?) on XECOM category hardware)	^F set speed to 2400 baud

Figure 2-3: Summary of the Differences Between Hayes and Xecom Hardware

Most modems in use today, in the IBM PC family of computers, support the command protocol originated by Hayes Microcomputer Products, Inc., Atlanta, Georgia, for their Smartmodem series. The Galacticomm Software Breakthrough Library will work with modems that are compatible with the Hayes Smartmodem series of modems.

When Hayes-compatible modems are in the command mode, you instruct them to perform tasks by transmitting to them a string of characters of the form:

AT<command><parameters><CR>

See your modem manual for a complete description of command and online modes, and the entire "AT" command set.

If you have a Hayes-compatible modem, and have connected it to your PC using a serial port that is equivalent to IBM's Asynchronous Communications Adapter (usually identified as "COM1:" or "COM2:" by the operating system), then you fit into the "HAYES" hardware category for the purposes of this manual. Many companies now make "internal" modems -- a single card, containing both a Hayes-compatible modem and a UART, that is plugged into the internal bus of the PC, and connected directly to the telephone lines. This architecture also fits into the "HAYES" category.

The Galacticomm Breakthrough Model 2408 is a special case of the "HAYES" category, in which 8 complete modems (plus an 8-channel UART) have been implemented on a single card that plugs into your IBM PC/XT/AT or compatible. The teleconferencing example program on page 196 was written for the Model 2408 card.

All other hardware in the "HAYES" category (besides the Model 2408) must include the 8250-type UART required by the "UART" category of hardware. More on that in the upcoming discussion of RS-232 serial ports.

XECOM Category Hardware: Xecom-Protocol Modems

The Galacticomm Breakthrough card Model 16 and Model 4 contain, respectively, 16 and 4 complete modems on a single card for the IBM PC/XT/AT or compatible. The computer talks to each of these modems over an 8-bit parallel bus. The functions of command and communication are not implemented over the same signals, but take four distinct paths: command, status, transmit and receive. This method was developed by Xecom Inc., Milpitas, California, for their compact MOSART 300/1200 baud modems.

Although the Xecom protocol may be a more efficient arrangement than the Hayes protocol, the Xecom technique is not in widespread use as is the protocol developed by Hayes. The syntax of commands on a Xecom-protocol modem is completely different from that on a Hayes-protocol modem.

The Galacticomm Software Breakthrough Library attempts to make those differences of as little concern as possible to the systems design, but some considerations must be made, particularly in the following areas:

<u>Areas of Difference between Hayes and Xecom Protocols</u>
Starting an outgoing call
Answering an incoming call
Sensing loss of carrier (user has hung up)
Certain test and measurement functions

Figure 2-3 (page 8) summarizes the differences between the Hayes and Xecom protocols. The teleconferencing example program on page 206 works on Xecom-compatible hardware.

<u>UART Category Hardware: RS-232 Serial Ports</u>

You could also use the Galacticomm Software Breakthrough Library to talk directly with any RS-232 compatible device, such as a terminal, printer, plotter, another computer, or many other types of devices.

In fact, Hayes-compatible modems are just one type of device that you may control using an RS-232 serial port, except that the Galacticomm Software Breakthrough Library provides extensive support for these particular devices (see the Hayes-protocol modem discussion, above).

You will need an interface card in your PC, equivalent to the IBM Asynchronous Communications Adapter. Most serial cards for the IBM PC family meet this requirement. They are designed to support what the operating system identifies as "COM1:" or "COM2:" (although the Software Breakthrough does not use DOS or BIOS to interface with these ports). One thing that the card must have is an integrated circuit called a UART of the 8250 family, which includes model numbers like 16450 and 16550. The 16550 model UART is highly desirable for its character buffering capability. The GalactiBoard 8-port serial card can supply you with a channel group of eight 16550 UARTs.

Novell Netware LAN Access

You can use the GSBL to interface to other programs across a Novell Local Area Network.

> WARNING: Direct communication with LAN channels may be dangerous. Some sockets are reserved for file servers or other system functions. Be sure that the software always uses appropriate socket numbers (page 212).

The standard GSBL comes with the capability to handle IPX Direct circuits. The Advanced LAN Option can also handle IPX Virtual and SPX circuits.

IPX Direct Circuits are relatively hard-wired connections between two machines on the network, or multi-network internet. Each party must know ahead of time what network address to connect to.

IPX Virtual Circuits are connections that can be easily made and remade between machines on a network or internet. Also when no connection is specified, a "raw packet mode" reports packets received from any other machine, and can be used to transmit packets to any other machine.

SPX Circuits are higher-level connections with automatic error correction. Also under SPX, "sessions" are established and terminated between parties, which among other things allows either party to detect the presence or absence of the other party.

The Advanced LAN Option also supports GTC (Galacticomm Terminal Configuration) for IPX Direct, IPX Virtual, and SPX channels. This allows, for example, a terminal program to preprocess input for a BBS, one line at a time. That way every single keystroke doesn't get transmitted over the LAN as a separate packet.

See page 212 for more on programming with the GSBL/X25 communications interface.

X.25 Packet Switching Network Access

"X.25" is a way for computers to talk to other computers over a packet switching network. A packet switching network is very much like a local or long-distance telephone network, but with a different emphasis. A telephone network is called a "circuit switching" network. During a phone call, one handset is theoretically in continuous electrical contact with another handset that could be anywhere else in the world.

On a packet switching network, calls are also begun and ended -- that's called switching. But during a call, the network does not need to maintain a connection during pauses in the data exchange. Neither is it a big problem if the network handles occasional peaks in traffic by slowing down all traffic just a little. However the packet switching network is exchanging digital data and must detect and correct all transmission errors. Because of these differences, a packet switching network can be more economical for data exchange than a circuit switching network.

CCITT recommendation X.25 is titled "Interface between Data Terminal Equipment (DTE) and Data Circuit Terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit". It was written by the International Telephone and Telegraph Consultative Committee (French abbreviation CCITT) in Geneva Switzerland in 1976 and is amended every four years (the 1988 assembly was in Melbourne, Australia). For more information, you may want to read:

> "Technical Aspects of Data Communication", by John E. McNamara, published 1988 by Digital Equipment Corporation, chapter 24: Packet Switching
>
> "X.25 Explained", by R.J. Deasington, published 1988 by Ellis Horwood Books

See page 226 for more on programming with the GSBL/X25 communications interface.

Throughout the detailed sections of this manual, you will see little annotations like:

HAYES

> Hayes-specific discussion . . .
> Concerning the Hayes-compatible modems, or the Galacticomm Breakthrough Model 2408.

to point out some information that is specific to Hayes compatible hardware, or:

XECOM

> Xecom-specific discussion . . .
> Concerning the Galacticomm Breakthrough Models 16 and 4.

to point out some information that applies only when using Xecom-compatible hardware, or:

UART

> Discussion specific to RS-232 serial ports, such as the IBM Asynchronous Communications Adapter, or most any serial card for the IBM PC family.

Frequently, information will apply to both the HAYES and to the UART categories, in which case you will see:

HAYES | **UART**

> Discussion which applies both to Hayes hardware, and to non-modem 8250 hardware . . .

These are seen together when discussing ports that use an "8250"-type UART.

Some discussions only apply when certain options or software licenses are obtained:

LAN

This discussion applies only to the Advanced LAN Option of the GSBL, "GSBL/LAN"

X.25

This discussion applies only to the GSBL with the X.25 Software Option, "GSBL/X25"

In some places in this manual, LAN access is discussed *outside* these marked-off regions. In this case, the discussion applies to the standard GSBL, without the Advanced LAN Option.

All variables and functions are available in all variations of the GSBL. For example, the btux29() function (page -2) is useful only with the X.25 Software Option. But even without that option, there is a btux29() function that you can call (it does nothing). This allows you to write C code that is compatible with all variations of the GSBL, and not get any undefined symbols when you go to link. See the variables btulan (page -2) and btux25 (page -2) for ways your software can determine what variation of the GSBL it is linked with.

	ASCII Input Mode	Binary Input Mode
How to select the input mode:	btutrg(chan,0)	btutrg(chan,NBYT)
Input unit:	One CR-terminated line	NBYT bytes
When is an input unit complete?	When a carriage return has been received	When NBYT bytes have been received
Status generated to indicate that the input unit has been received:	3	4
How to get the received input unit out of the receive buffer:	btuinp(chan,inbuff)	btuict(chan,inbuff)
Return code if no data is available:	-1	-2
Return code if some, but not enough, data is available:	-1	-2
Return code if a complete input unit is available (and has been moved to the "inbuff" buffer):	number of bytes received (less the CR)	NBYT
How many bytes were transferred into inbuff, in either of the above 2 cases?	strlen(inbuff)	global variable "ictact"
Format of data in the "inbuff" buffer:	One CR-terminated line, with the CR replaced by a 0-byte	NBYT bytes

Figure 2-4: Comparison of ASCII to Binary Input Modes

2.2 ASCII versus Binary Input Modes

There are two methods for receiving data using the Galacticomm Software Breakthrough Library. ASCII method means that you are expecting text from the user -- information which consists mainly of "printable characters" (letters, numbers and symbols). In this case, certain "control characters" are defined, and will be handled specially by the GSBL when they are received from the user. For example, <CR> (carriage return) terminates each input line from a user. Also, a user can use the backspace key to delete characters on his input line. You would use the ASCII method for menus, or question-and-answer sessions with a user.

Binary input mode means that there are no special characters or translations. You might use this mode to download or upload data files to/from a user, using a transparent binary protocol such as XMODEM.

In ASCII input mode, the following characters are treated specially when received:

ASCII Mode -- Special Input Characters

Hex	Dec	ASCII Symbol	Function	Assignment
00H	0	NUL	(ignored)	
08H	8	BS	backspace	btubse(), page 40
0DH	13	CR	carriage return	btutrm(), page 169
0FH	15	SI	output-abort	btutru(), page 171
11H	19	XON	output-resume	btuxnf(), page 192
13H	21	XOFF	output-pause	btuxnf(), page 192
7FH	127	DEL	backspace	btuxlt(), page 183

These GSBL routines may be used to assign the same functions to other characters. The default characters are shown here.

There are other functions that only apply to ASCII input mode:

ASCII Mode -- Special Functions

Function	Routine that controls the function
Input translation	btuxlt(), page 183
Custom handling	btuchi(), page 47
Input interception	btuchi(), page 47
Idle receiver handling	btuche(), page 45
Input line length limit	btumil(), page 121
Input word-wrap	btumil(), page 121
Automatic linefeed	btulfd(), page 114
Echo on/off	btuech(), page 86

See page 48 for the exact sequence of input processing in the ASCII mode.

ASCII input is achieved using the GSBL routine btuinp() (page 108). This routine will extract a string of characters from the receive buffer of a channel. The input string ends with a <CR>, but when read by btuinp(), the <CR> is replaced with a 0-byte terminator. A status 3 is generated (refer to btusts(), page 153) when a complete line has been received, and btuinp() is used to retrieve that line.

Binary method means that none of the input characters listed above are treated specially, nor does any kind of character translation take place. Binary input is achieved using the GSBL routines btutrg() (page 167) and btuict() (page 105). None of the special handling shown in the above two tables occurs when these routines are used to receive data.

btutrg() chooses between Binary and ASCII input modes. With a second parameter of zero, ASCII mode is chosen. When the second parameter is greater than zero, Binary mode is chosen, and that nonzero parameter is the number of bytes you want to receive at a time, in one block. A status 4 is generated (see btusts(), page 153) when a complete block has been received, and btuict() is used to retrieve that block. Figure 2-4 (page 16) illustrates the differences between the ASCII and Binary input methods.

2.3 ASCII versus Binary Output Modes

The ASCII output mode includes such features as:

- o Automatically appending linefeeds to carriage returns
- o Output word-wrap and paragraph reflow
- o Suspending output while input is in-progress
- o ANSI-graphics discrimination
- o Output "abort" character
- o Single-character prompts

This mode would be used during "conversational" interaction with a user -- asking questions, parsing replies, accepting commands, reporting results.

When the GSBL transmits in Binary output mode, no character is treated differently from any other. This mode would be used during a transparent computer-to- computer interchange, such as an XMODEM protocol upload or download.

The selection of ASCII versus Binary output modes is as follows:

Use **btuxmt()** for ASCII output (refer to page 189)
Use **btuxct()** for Binary output (refer to page 182)

NOTE: The actual transition from Binary to ASCII output modes occurs only when the output buffer empties completely. For example:

```
btuxct(chan,1,"\7");
btuxmt(chan,"WARNING\r");
```

This will probably transmit the "WARNING\r" message in the binary mode, since the buffer will probably not be empty when that message is stuffed into it. Either a status 5 (page 155) or a btuoba(chan) == outsiz-1 condition is necessary to be absolutely sure that a subsequent btuxmt() will transmit in the ASCII mode.

The following routines are associated with ASCII output and affect the operation of btuxmt():

btutsw()	Output word wrap
btuhcr()	Hard carriage-returns
btuscr()	Soft carriage-returns
btulfd()	Linefeeds appended to carriage returns
btutru()	Output abort character
btuxnf()	XON/XOFF handshaking
btupmt()	Prompt characters
btucmd()	Enable or disable ANSI graphics with the "[" and "]" commands

Most of the processing for these features is performed by btuxmt() -- and not by the interrupt-service routines, thereby increasing channel throughput. None of these features is in effect when you use btuxct().

3.0 GLOBAL VARIABLES

To use any of the following variables in a program, you should declare them in the manner shown under DECLARATION in the variable declaration section of your C-language program. The declaration must appear before any use of the variable. The header file BRKTHU.H includes all of these declarations.

variable **btudtr**

VARIABLE NAME

btudtr -- DTR level after channel reset

DECLARATION

```
extern int btudtr;     what to do after bturst():
                          0 = lower DTR for 2 seconds
                              and then raise
                          1 = leave DTR high always
```

DESCRIPTION

HAYES | UART

This command affects all channels that are based on the 8250-type UART. It specifies what happens after the channels are reset with bturst() (page 136). After reset, the DTR signal is set to this value for 2 seconds, then it is set high (active).

To vary your handling of individual ports, you could set btudtr just before every call to bturst().

VARIABLE NAME

btuhrt -- High-rate 65536 Hz counter

DECLARATION

extern unsigned long btuhrt;

DESCRIPTION

This 32-bit integer increments at approximately 65536 Hertz. You'll probably make the most use out of this by taking two samples and subtracting them -- the unsigned difference reflects the time between the samples. This is the same kind of thing that ticker does (page 33), only faster.

You can use the upper 16 bits of btuhrt as a 1 Hz counter.

Actually btuhrt only *simulates* this rate. It really changes at a rate controlled by btumxs() (page 128). btuhrt increments in spurts, in a manner calculated to keep btuhrt looking like a 65536 Hertz counter. The point is that you may not be able to use btuhrt to measure time too finely.

If btumxs(2400) is in effect, for example, then about 290 times a second, btuhrt increases by approximately 226 (226 x 290 = 65540, which is about 65536). A new btuhrt value will be available only 290 times a second, not 65536 times a second. So you couldn't measure 1-millisecond intervals.

CAUTIONS

When reading this variable, you should temporarily disable interrupts to avoid skew between the 16-bit halves of the value. For example, we use this code in The Major BBS:

```
unsigned long
hrtval(void)
{
     unsigned long hrtsmp;

     dsairp();
     hrtsmp=btuhrt;
     enairp();
     return(hrtsmp);
}
```

variable **btulan**

VARIABLE NAME

btulan -- LAN capability and status flags

DECLARATION

extern int btulan;

```
#define BTLIPXD  0x0001    /*  bit 0:  IPX Direct circuits supported    */
#define BTLIPXV  0x0002    /*  bit 1:  IPX Virtual circuits supported   */
#define BTLSPX   0x0004    /*  bit 2:  SPX circuits supported           */
#define BTLI7A   0x0100    /*  bit 8:  IPX driver is loaded             */
#define BTLSPXL  0x0200    /*  bit 9:  SPX is loaded                    */
```

DESCRIPTION

Your C program could use btulan to make a report on these conditions:

```
printf("Your GSBL supports:\n");
if (btulan&BTLIPXD) {
     printf("   IPX Direct Circuit channels\n");
}
if (btulan&BTLIPXV) {
     printf("   IPX Virtual Circuit channels\n");
}
if (btulan&BTLSPX) {
     printf("   SPX channels\n");
}
if ((btulan&(BTLIPXD+BTLIPXV+BTLSPX)) == 0) {
     printf("   no LAN access at all\n");
}
printf("The IPX driver %s been loaded at interrupt vector hex 7A\n",
       btulan&BTLI7A ? "has" : "has not");
printf("SPX %s installed on this node\n",
       btulan&BTLSPXL ? "is" : "is not");
```

IPX Direct Circuits are supported by all versions of the GSBL.

LAN

IPX Virtual and SPX Circuits are only supported by the Advanced LAN Option of the GSBL, "GSBL/LAN".

CAUTIONS

Note that the first three bits are always available when your program is running. The last two are available only after calling btuitz() and before calling btuend().

The above program must of course include the header file BRKTHU.H, and be run between calls to btuitz() and btuend().

VARIABLE NAME

bturno -- registration number

DECLARATION

```
extern char bturno[];          /* 8 digits plus a <NUL> */
```

DESCRIPTION

This character array contains the 8-character software registration number issued to you when you purchased the Galacticomm Software Breakthrough Library. It consists of 8 ASCII digits followed by an ASCII <NUL> (0-byte) terminator.

CAUTIONS

Don't let YOUR copy of the Galacticomm Software Breakthrough Library fall into unscrupulous hands!

Unauthorized copying of this software or documentation is a violation of federal law, specifically, Title 17, USC Section 506. Violators may be subject to a $25,000 fine, or imprisonment, or both.

variable **btusrs**

VARIABLE NAME

btusrs -- number of users licensed

DECLARATION

```
extern int btusrs;
```

DESCRIPTION

This variable is the number of users licensed for your copy of the GSBL.

In The Major BBS, this variable is used to display the version code suffix (e.g. "-32") in the "BBS UP" audit trail message.

Channels defined beyond this number will always be "non-hardware" channels (bturst() will always return -10, see page 136). Non-hardware channels may be useful in *simulating* a user channel. See about the monitor feature on page 125 (and page 127).

VARIABLE NAME

btuver -- GSBL version code

DECLARATION

```
extern char btuver[];
```

DESCRIPTION

This string is the software revision for the GSBL.

You could use it to display the version somewhere:

```
printf("Based on GSBL-%s for %d users",btuver,btusrs);
```

Or, you could use this variable to do different things based on the version code of the GSBL, for example:

```
if (strcmp(btuver,"J") == 0) {
     jspecific();
}
else if (strcmp(btuver,"K") == 0) {
     kspecific();
}
else {
     allelse();
}
```

variable **btux25**

VARIABLE NAME

btux25 -- Whether or not GSBL supports X.25

DECLARATION

```
extern int btux25;        0=GSBL does not support X.25
                          1=GSBL supports X.25
```

DESCRIPTION

This global variable can be used to take special action based on whether the GSBL supports X.25 or not. For example, you might code your program to generate an error message when it is configured to talk to X.25 channels but the GSBL does not support them. The return value of btusdf() for channel type 4 (page 144) may be used in the same way.

CAUTIONS

The value of btux25 is not defined until after you call btuitz().

VARIABLE NAME

ictact -- Actual number of bytes read by btuict()

DECLARATION

```
extern unsigned ictact;
```

DESCRIPTION

When you use btuict() (page 105) to retrieve data bytes from the input buffer, as many as are available are copied, up to the trigger count (the trigger count is set by btutrg(), page 167). When less than the trigger count of bytes are available, the bytes are transferred anyway, but they are not taken out of the input buffer. This is when btuict() returns -2 (indicating insufficient bytes are available). In this situation, the global variable ictact is the way you have of determining how many bytes were copied into your buffer.

variable **lanrev**

VARIABLE NAME

lanrev -- LAN SPX revision

DECLARATION

```
extern char lanrev[2];
```

DESCRIPTION

LAN

This array contains the SPX version numbers, minor version first:

```
printf("SPX version %d.%d\n",lanrev[1],lanrev[0]);
```

CAUTIONS

Without the Advanced LAN Option, the version is 0.0.

LAN

This array is only available after btuitz() has been called and only if SPX is available.

VARIABLE NAME

lansca -- LAN SPX connections available

DECLARATION

```
extern int lansca;
```

DESCRIPTION

LAN

This is the number of SPX sessions that your program can support. To increase this number, you might be able to increase the "SPX CONNECTIONS" parameter in your Netware SHELL.CFG file, as in:

```
SPX CONNECTIONS = 100
```

CAUTIONS

Without the Advanced LAN Option, lansca is always 0.

LAN

This value is only available after btuitz() has been called.

variable **lansop**

VARIABLE NAME

lansop -- LAN socket opened by btusdf()

DECLARATION

```
extern int lansop;
```

DESCRIPTION

If you use btusdf() to define a Netware LAN channel with a socket of 0, then IPX will assign an unopened socket for you. The socket it picks is then retrievable from this lansop variable.

The socket number is in convenient "lo-hi" byte order.

CAUTIONS

lansop is only defined for hardware channels (i.e. bturst() returns non-negative), and only after calling btusdf().

VARIABLE NAME

ticker -- second timer

DECLARATION

```
extern unsigned ticker;  /* 0 to 65535, and back again */
```

DESCRIPTION

Every second, the contents in this variable increments. After it reaches 65535, it goes back to 0 and starts over again. According to the properties of 16-bit unsigned arithmetic, you can sample the value of "ticker" at two different times, and the difference between the values will reflect the time between the samplings, as long as that time is less than 65535 seconds (about 18 hours).

If you need more resolution in your time measurement, use btuhrt (page 23).

CAUTIONS

This variable increments at a rate very close to 1 Hz (once a second), but -- don't set your watch by it.

variable **x25ign**

VARIABLE NAME

x25ign -- Count of ignored incoming packets

DECLARATION

```
extern int x25ign;
```

DESCRIPTION

An incoming packet will not be recognized if:

- the packet is not a DATA, CALL REQUEST, CALL CONFIRM, or CLEAR packet.
- an incoming data packet has a logical channel number (virtual circuit number) that does not agree with that of any channel defined (by btusdf()) for the GSBL.

You can set x25ign to 0 also. It will be incremented every time a packet is ignored.

VARIABLE NAME

x25udt -- User data reporting flag

DECLARATION

extern int x25udt;	set to 1 to capture the User Data Field of incoming packets

DESCRIPTION

If you set this flag to a 1, then the User Data field of an incoming call request packet is tacked onto the end of the "RING xxx CALLING xxx" string as a fifth word, as in:

"RING 81020551 CALLING 30448512 IGNEOUS-7"

CAUTIONS

The User Data field should be ASCII and have no imbedded control characters.

The input buffer for the channel must be large enough (as specified by btusiz(), btulsz(), or btubsz()) to hold the entire string.

4.0 THE SOFTWARE BREAKTHROUGH LIBRARY ROUTINES

This section, by far the largest in this manual, describes each of the GSBL routines in detail.

The prototypes for these routines, plus many of the constants and symbols you can use in programming with the GSBL, are in the header file BRKTHU.H.

btubrt

SUBROUTINE NAME

btubrt -- set channel's baud rate

SYNOPSIS

```
err=btubrt(chan,bdrate);
int err;           zero means OK, -3 means bad baud rate
int chan;          channel number
unsigned bdrate;   baud rate, in bits per second

                   For the Model 2408, bdrate must be one
                   of the values:  300 600 1200 or 2400

                   For 8250-interfaced serial devices,
                   bdrate must be between 75 and 38,400.
                   For the higher baud rates, the rate
                   should divide evenly into 115,200.

                   The default baud rate is 2400 baud,
                   after a channel is reset by bturst().
```

DESCRIPTION

HAYES | **UART**

Use this routine only on Hayes-compatible, or on RS-232 serial channels (page 7), not on Xecom-protocol modems.

This function specifies the bit rate (bits per second) for a specific communications channel. Only the UART is affected. If you are also using a modem, then the modem's baud rate must be set in some other way. To the blackboard for a moment: Computer talks to UART, which talks to Modem. The UART (Universal Asynchronous Receiver/Transmitter) translates characters from the computer into a single signal with a pulse for each bit. The modem (MOdulator / DEModulator) translates this into something that can be transmitted over phone lines (or other long distance media).

btubrt

HAYES

The two most common ways that a modem's baud rate changes are:

Case 1: incoming calls. When you send the command to answer an incoming call, the modem responds with "CONNECT" (for 300 baud) or with "CONNECT <baud rate>" for other baud rates (600, 1200, 2400,...,9600). After getting that message, the modem communicates from then on at the specified baud rate -- you should use btubrt() to change the UART to that baud rate.

Case 2: on demand. With the modem in command mode, simply change the UART baud rate using btubrt() (pronounced bi-TOO-burt) and issue the null Hayes modem command "AT" (followed by a carriage return). You should get an "OK" response from the modem (followed by carriage return and linefeed) at the new baud rate.

The baud rates for a Model 2408 Breakthrough card are: 300 600 1200 and 2400. These are the valid values for the "bdrate" parameter of btubrt(), when operating on a channel assigned to the Model 2408.

HAYES **UART**

Valid baud rates for 8250-interfaced serial devices (such as the IBM Asynchronous Communications Adapter) are between 75 and 38400. If the value you supply does not evenly divide into 115,200 then you will have some "truncation error", particularly with higher baud rates. For example if you supply 110 for the "bdrate" parameter, the actual baud rate will be 110.03 (plenty good enough). But if you supply 35000, then the actual baud rate will be 38,400 (way off for sure!).

HAYES | **UART**

TECHNICAL NOTE: If you really must know what the heck is going on here, the number [115200/bdrate] is programmed into the 8250 baud rate "divisor" to achieve the baud rate bdrate. That is, "the greatest integer less than or equal to 115200/bdrate". To compute the actual baud rate, use the formula:

actual baud rate = 115200 / [115200/bdrate]

remembering to replace [115200/bdrate] with the largest integer greater than or equal to this quotient.

NON-TECHNICAL NOTE: for those of you not interested in such truck, the following are perfectly good values for "bdrate" on 8250-interfaced channels:

75	110	150	300	600	1200	1800
2000	2400	4800	9600	19,200	38,400	

RETURNS

-3 baud rate is not valid for the hardware being used. See the above descriptions for the valid baud rates.

0 baud rate has been set correctly

CAUTIONS

You should not use a baud rate value greater than the value set by btumxs() (maximum data speed, see page 128). If you do, you will lose characters on input, and have slow output. This is because btumxs() actually sets the modem service rate -- the frequency at which all modems are polled for input and output -- with a 21% safety margin. But btubrt() sets the frequency of the communication clocks in the UART (universal asynchronous receiver transmitter) device, and therefore only affects the bit rate within each byte.

btubse

SUBROUTINE NAME

btubse -- set backspace-echo character

SYNOPSIS

```
err=btubse(chan,bschar);
int err;        zero means OK
int chan;       channel number
char bschar;    how to handle a user's backspace keystroke:
                   00 -- like any other character
                   08 -- delete last character (if any)
                         echo backspace - space - backspace
                         (default condition)
                   NN    delete last character (if any)
                         echo NN
```

DESCRIPTION

This function specifies how to handle the user backspace keystroke. It applies only to ASCII input mode, not to binary input mode (page 17). While in ASCII input mode, any input character that translates to a value of 8 will be taken as a logical backspace -- that is, it will delete the most recently accepted character on the current input line, if there is one. Note: the translate feature (see btuxlt(), page 183) can make the "DEL" character (7F hex) be treated just like the backspace character. In fact, this is the case in the default translate table (page 185).

The question that btubse() attempts to answer is: how will this character-delete operation be echoed back to the users terminal? On a CRT, you will probably want a "backspace - space - backspace" to do the work -- erasing the previous character and leaving the cursor in the position where that character used to be.

If, however, a user is using a hardcopy device, such as a teletype machine, it might be better to echo a backslash ("\"), or something, and let him figure out what he has typed and what he has deleted.

So, if the bschar parameter is 8, the backspace - space - backspace method will be used. This is the case by default, after you reset a channel (see bturst(), page 136). If bschar is some other nonzero value, then that is what's echoed upon each backspace that the user types (when it actually deletes a character on his input line, that is).

Now, if the bschar parameter is 0, then this idea of the user's backspace key deleting characters from his input line is thrown out altogether -- ASCII code 8's are simply passed into the input buffer just like any printable character.

RETURNS

-10 channel is not defined (see btudef(), page 82)
-11 channel number is out of range (seè btusiz() or btulsz(), pages 149, 116)
0 all is well

CAUTIONS

If you are using standard CRT terminals, or terminal emulators, there is no need to call this routine.

btubsz

SUBROUTINE NAME

btubsz -- respecify input and output buffer sizes

SYNOPSIS

```
err=btubsz(chan,isiz,osiz);
int err;              zero means OK, -5 means bad sizes
int chan;             channel number
int isiz;             new size of input data buffer
int osiz;             new size of output data buffer
```

DESCRIPTION

This command adjusts the size of the input and output data buffers for a particular channel. You might use this to temporarily increase the input or output buffer for special conditions. You must use integral powers of two, and their sum must not exceed that originally specified by btusiz() or by btulsz() (see cautions, below).

Typical application: YMODEM uploads. This protocol requires an unusually large input buffer. Since YMODEM data packets are 1024 bytes long plus overhead, you will require an "isiz" parameter of 2048, which allows 2047 bytes in the input buffer. Let's say that a much smaller value had been supplied for "isiz" in your original call to btusiz():

<u>Initial call to btusiz()</u>

btusiz(NCHAN,256,2048);

```
parameter "isiz" = 256
parameter "osiz" = 2048
```

These are reasonable values for a multi-user bulletin board system, such as The Major BBS by Galacticomm. The heaviest traffic on a BBS is usually in the direction toward the users. Output traffic may include an entire screenful of text: 80 X 24 = 1920 characters plus overhead. Input traffic, coming from each user's keyboard, is relatively light, requiring an input buffer big enough to hold an 80-character line of text.

Now when YMODEM upload is required, you can swap the capacities of the data I/O buffers for channel "chan":

<u>Subsequent call to btubsz()</u>

btubsz(chan,2048,256);

```
parameter "isiz" = 2048
parameter "osiz" = 256
```

Then after YMODEM upload has completed, you return the buffers to their original condition:

<u>Restoring call to btubsz()</u>

btubsz(chan,256,2048);

```
parameter "isiz" = 256
parameter "osiz" = 2048
```

btubsz

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
-5	buffer sizes are invalid: either one of them is not an integral power of two (128, 256, etc.), or their sum exceeds the total data buffering capacity of the channel, as set by the original call to btusiz() (see page 149)
0	all is well

CAUTIONS

The "isiz" and "osiz" parameters must each be an integral power of two (e.g. 128, 256, 512, 1024, 2048, 4096 etc.).

The sum of the "isiz" and "osiz" parameters must not exceed the space reserved for I/O buffers. That is the sum of the "isiz" and "osiz" parameters that you specified in your original call to btusiz() or to btulsz() (whichever you used -- refer to page 149 or 116).

The actual capacities of the I/O buffers are one less than the values specified in parameters "isiz" and "osiz".

If you mean to *temporarily* adjust input and output buffer sizes, be sure to use btubsz() to restore the original buffer sizes. Also, bturst() (page 136) restores the original buffer sizes.

btubsz() automatically clears the data input and output buffers.

btuche

SUBROUTINE NAME

btuche -- enable calling of btuchi() when echo buffer becomes empty

SYNOPSIS

```
err=btuche(chan,onoff);
int err;                    zero means OK
int chan;                   channel number
int onoff;                  1=enable calls; 0=disable
```

DESCRIPTION

Normally, the routine specified in btuchi() (see page 47) is only invoked when an input character is received, and your program has no way of telling when the channel's echo buffer is empty. This function allows you to turn on or off a feature whereby each time the channel's echo buffer becomes empty, the btuchi() "rouadr" function is invoked with the channel number and pseudo-key-code of -1 as parameters. For example:

```
            :
            btuchi(3,&idle);
            btuche(3,1);
            :

       idle(chan,c)
       int chan,c;
       {
            if (c == -1) {
                 chiout(chan,'~');
            }
            else {
                 chiout(chan,c);
                 return(0);
            }
       }
```

In this example, '~' is constantly output on channel 3 when no input is being received. When an input character is received, it echoes normally, then the '~' output continues. Note that this process will not begin until the first character is received.

btuche

RETURNS

-10 channel is not defined (see btudef(), page 82)
-11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0 all is well

CAUTIONS

When your btuchi() "rouadr" function is invoked with key-code equal to -1, no return value from the function is expected. Coding such as the example above may generate warnings by some compilers, since the function will sometimes return with an explicit return value, and at other times not. You can solve this, with only a small loss of efficiency, by coding the routine so that it always returns 0.

This function exists mainly to support certain advanced real-time protocols available for The Major BBS. Be sure that you fully understand the btuchi() function before attempting to use btuche().

SUBROUTINE NAME

btuchi -- set input character interceptor

SYNOPSIS

```
err=btuchi(chan,rouadr);
int err;                  zero means OK
int chan;                 channel number
char (*rouadr)();         address of character interceptor
                          routine (NULL to remove)

xc=(*rouadr)(chan,c);     the character interceptor routine
char xc;                  new input character (0=ignore)
int chan;                 channel number
int c;                    the un-translated character
                          received from the channel
                          (or -1, see btuche(), page 45)

chiinp(chan,c);           character input utility
int chan;                 channel number
char c;                   character to simulate input

chiout(chan,c);           character output (via echo buffer)
int chan;                 channel number
char c;                   character to output

chious(chan,str);         string output (via echo buffer)
int chan;                 channel number
char *str;                string to output

chiinj(chan,s);           status inject utility
int chan;                 channel number
int s;                    status to inject
```

DESCRIPTION

The btuchi() function provides a simple but powerful facility for customized handling of received characters. You can install your own C-language or assembly language routine so that it is invoked upon every byte received from a channel. This character interceptor of yours will only operate in the ASCII input mode. In the Binary input mode, it is suspended.

This is one of the most complex and potentially dangerous routines in the Software Breakthrough Library. You should not attempt to use it if concepts like interrupts and reentrant code are unfamiliar to you.

btuchi

We will describe the C-language method here. For the assembly language method, refer to your C compiler documentation sections on linking to assembly language routines.

To make your own input character interceptor, you must first code a C-language (or C-language compatible) function that accepts as parameters a channel number and a character. The function should return a single character value. See the synopsis of "rouadr" above. The syntax of that synopsis: "(*rouadr)(...)" simply means that the symbol rouadr represents a "pointer to a function" (which returns a value of type char, because xc is type char).

Next, you must call btuchi() and pass a channel number and the address of this custom handler routine of yours. If you want your custom handler to remain in effect constantly, you may call btuchi() right after the channel is defined (see btudef(), page 82).

Our character handler routine replaces the character translation function (refer to btuxlt() on page 183). However, the effects of all functions associated with ASCII input mode are still in effect. Again, your interceptor routine is not in effect when the channel is in Binary mode (page 17).

The input of a single character goes through the following sequence of steps during the ASCII input mode:

	Input Processing	Associated Library Routine
1.	Formatting, Overrun, Parity error checking	btuerp()
2.	Input lockout	btulok()
3.	ASCII mode or Binary mode?	btuict()
4.	XON/XOFF handling	btuxnf()
5.	Output abort character	btutru()
6.	Translate Table (or **btuchi()** routine)	btuxlt()/**btuchi()**
7.	Backspace	btubse()
8.	Line terminator	btutrm()
9.	Line length limit or input word wrap	btumil()
10.	Input buffer capacity	btusiz()/btulsz()
11.	Echo	btuech()

This table is provided for you to judge the interdependencies of the above library routines. For example, if your btuchi() routine returns a character code 8 (ASCII BS: backspace) then the backspace handler will swing into effect (it may echo a space-backspace-space sequence, unless you have tampered with btubse()).

To de-install your custom character interceptor routine, simply call btuchi() with a "rouadr" parameter value of NULL. bturst(), in resetting a channel, also de-installs any interceptor that may have been in effect.

EXAMPLE

Here is an example character handler that strips the high-order bit 7 off of each byte received:

```
char strip7(chan,c)
int chan;
char c;
{
     return(c&127);
}
```

Then the following call to btuchi() installs this routine on channel "chan":

```
btuchi(chan,&strip7);
```

The following routine de-installs it (restores default character handling) on channel "chan":

```
btuchi(chan,NULL);
```

ADVANCED USAGE

Four routines in the Galacticomm Software Breakthrough Library are provided only for use by your input character interceptor (btuchi()) or real-time interrupt (bturti(), page 140) routine(s). These are chiinp(), chiout(), chious(), and chiinj() (see synopses above). You may use these to cause all kinds of things to happen upon receipt of characters.

For example, in a "battleship" game, you may want the CTRL-E-D-X-S diamond on your user's keyboard to control his screen cursor using ANSI-standard cursor control codes. Your character handler would "echo" (using chiout() or chious()) the appropriate cursor control codes upon receipt of the cursor commands from the user's keyboard.

Also, keyboard macros could be implemented using chiinp(). You could translate special control codes from a user's keyboard into a whole stream of characters. For example, you may want a user to be able to type CTRL-G when he means "GO FORWARD"<Enter>.

Yet a third example would be inter-channel-chat. Let's say you make the following character interceptor routine:

```
uchat(chan,c)
int chan;
char c;
{
     chiout(chana,c);
     chiout(chanb,c);
     return(0);
}
```

Then you could install this routine as the input character interceptor for BOTH channels A and B:

```
btuchi(chana,&uchat);
btuchi(chanb,&uchat);
```

Now whatever character is typed by EITHER the user on channel A OR the user on channel B is immediately echoed to the screens of BOTH users.

RETURNS

-10 channel is not defined (see btudef(), page 82)
-11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0 all is well

CAUTIONS

Your character handler routine (the "rouadr" parameter passed to btuchi(), above) must be coded to execute very fast, in order not to hinder operation of the Software Breakthrough. The Software Breakthrough has been coded in assembly language and honed and polished into a lightning fast computing machine. That's why we can claim 256-user capability on the IBM PC/AT and compatibles. You have the opportunity to change all that by intercepting input characters with a slow clunky handler routine. In particular, your routine should only interact with variables and data structures in memory (you don't have enough time to even THINK about disk I/O!).

Since these routines may be called at the interrupt level, take care that any data structures used by both the "rouadr" character handler, and by any other of your routines, are not "skewed". This happens when your mainline (not interrupt generated) routine changes a data structure, and halfway through such a change, the interrupt generated handler tries to use or change the same data structure. Remember that your character handler can be invoked AT ANY TIME.

The routine identified as a character interceptor (by passing its address to btuchi()) should only be used for that purpose, and called under no other circumstances.

chiinp(), chiout(), chious(), and chiinj() must be called only by the routine(s) that are used as input character interceptors, or real-time interrupt handlers -- that is, whose address is passed as a parameter to btuchi() or bturti() (page 140).

The chiout() and chious() routines are limited by the size of the echo buffer: 255 bytes.

btuchi

X.25

Note to experts about interaction between echo modes and the btuchi() routine on X.25 channels:

Conditions:
1) X.25 channel
2) In echo-plex mode
3) You are using btuchi(chan,&custom) with a custom routine that returns values (intending them to be input AND echoed) and those values are NOT the same as the values *input* to the custom routine.

Action: call btuech(chan,2) when you install btuchi(chan,&custom), and recover btuech(chan, whatever) when you *uninstall* btuchi(chan, NULL). See page 86 on the values for the btuech() echo parameter.

Reasoning: when you install the custom routine, you want the user's PAD to stop blindly echoing everything the user types, and start having the GSBL decide what gets echoed (via return value from your custom routine). That means that you do NOT want echo-plex -- you want the GSBL to echo.

btuclc

SUBROUTINE NAME

btuclc -- clear command output buffer

SYNOPSIS

```
err=btuclc(chan);
int err;              zero means OK
int chan;             channel number
```

DESCRIPTION

btuclc() aborts any commands that may be in progress (refer to btucmd(), page 58), and clears the command buffer for the specified channel. A status 65 (refer to page 161) may be generated if a command was in progress.

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	all is well

btucli

SUBROUTINE NAME

btucli -- clear data input buffer

SYNOPSIS

```
err=btucli(chan);
int err;                zero means OK
int chan;               channel number
```

DESCRIPTION

Clears the data input buffer for the specified channel. Any queued input, even partial input strings or blocks, are completely cleared as though they were never received.

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	all is well

CAUTIONS

Calling this routine can cause inconsistencies between the status buffer contents and the input buffer contents. For example, if a CR-terminated string has been received but not yet processed at the time btucli() is called, the status of 3 (CR-TERMINATED INPUT DATA STRING AVAILABLE) will remain queued, but there will be no corresponding input data string available.

btuclo

SUBROUTINE NAME

btuclo -- clear data output buffer

SYNOPSIS

```
err=btuclo(chan);
int err;                zero means OK
int chan;               channel number
```

DESCRIPTION

btuclo() aborts any data output operation underway on the specified channel, clears its data output buffer, and eliminates the effects of XOFFs received, if any (see btuxnf(), page 192).

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	all is well

CAUTIONS

Any output data pending for the specified channel will be lost when this routine is called.

btucls

SUBROUTINE NAME

btucls -- clear status input buffer

SYNOPSIS

```
err=btucls(chan);
int err;                zero means OK
int chan;               channel number
```

DESCRIPTION

Provided only for completeness, this routine clears the highly sensitive status-input buffer, the key area upon which the sensing of modem condition depends. In other words, you should almost never need to use btucls().

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	all is well

CAUTIONS

Do not call this routine unless you totally confident that this is really what you want to do, since it is potentially dangerous to arbitrarily clear out what might be critical modem status information, such as "lost carrier".

btucmd

	Command	Description	Statuses Generated on HAYES hardware	Statuses Generated on XECOM hardware
Modem Dial Commands	R T	ROTARY (PULSE) DIAL MODE TOUCH-TONE DIAL MODE	12 12	2 2
	1 2 3 4 5 6 7 8 9 0	DIAL A DIGIT (TOUCH TONE OR ROTARY)	12	2
	a b c * # d	DIAL A SPECIAL DIGIT (TOUCH TONE ONLY)	12	2
Modem Mode Commands	W	WAIT FOR DIAL TONE	12 3	2 'B' 'M' 'I' 'R' 'T' 'V'
	A ^A	ANSWER-CARRIER WITH NO FRILLS ANSWER-CARRIER WITH DETECTIONS	12 3 12 3	2 'I' 'T' 'F' 2 'I' 'T' 'F' '1' 'V'
	O M	ORIGINATE-CARRIER WITH NO FRILLS ORIGINATE-CARRIER WITH DETECTIONS	12 3 12 3	2 'I' 'T' 'F' 2 'I' 'T' 'F' 'B' 'R' 'D' 'V'
	D H	DTMF RECEIVE MODE (TOUCH TONE INPUT) HOLD (OFF-HOOK, MODEM DISCONNECTED)	13 13	4 * 2
Baud Rate Commands	^T ^H ^F	SET SPEED TO 300 BPS SET SPEED TO 1200 BPS SET SPEED TO 2400 BPS	12 12 12	2 'I' 2 'I' '?'
Framing Commands	> < = ^S ^E ^N ^W	SET PARITY TO "EVEN" SET PARITY TO "ODD" SET PARITY TO "NONE" (NO PARITY BIT) SET CHARACTER LENGTH TO 7 BITS SET CHARACTER LENGTH TO 8 BITS SET STOP BITS TO ONE SET STOP BITS TO TWO	12 12 12 12 12 12 12	2 2 2 2 2 2 2
Pause Commands	P p t	PAUSE 5 SECONDS PAUSE 2 SECONDS PAUSE 1/10 SECOND	12 12 12	2 2 '?'
ANSI Commands	[ ]	ENABLE ANSI GRAPHICS (default) DISABLE ANSI GRAPHICS	12 12	2 2
Diagnostic Commands	I i ^M L l (ell) ^X ^Y	IDENTIFY MODEM VERSION IDENTIFY REVISION NUMBER CONTINUOUS MONITOR, RETURN LINE FREQ LINE ANALYZE RETURN 1200-BPS ERROR STATISTICS ANALOG LOOPBACK IN ORIGINATE MODE ANALOG LOOPBACK IN ANSWER MODE	13 13 13 13 13 13 13	4 * 4 * 4 * 4 * 4 * 'I'
Invalid Command	(Anything else)		13	'?'

* These commands return information in the receive buffer. We recommend that you use btutrg() (to select binary recieve mode) so that a status 4 is generated when these bytes are available.

Note 1:

A status code of 13 from HAYES category hardware, or '?' from XECOM category hardware, means that the command is not supported on this hardware.

Note 2:

On HAYES category hardware, commands which generate a status 3 return information in the receive buffer. The channel should be in the ASCII receive mode so that a status 3 indicates the availability of these bytes. This is the default mode, but if you should select binary receive mode using btutrg(), be sure to restore ASCII receive mode, also using btutrg(). In these cases, btusts() will return the status 3 AFTER it returns the status 12.

Note 3:

The baud rate, framing, pause, and ANSI commands are "soft" commands that are processed by the PC, rather than by the modem hardware. If you use btucmd() with a string of commands, all of the soft commands will be executed first, and then all of the "hard" commands.

These soft commands are the exact set of commands that may be issued on UART category hardware.

Figure 4-1: Summary of Hayes and Xecom Commands

SUBROUTINE NAME

btucmd -- command channel

SYNOPSIS

```
err=btucmd(chan,cmdstg);
int err;              zero means OK
int chan;             channel number
char *cmdstg;         command string (ASCIIZ)
```

DESCRIPTION

This routine controls functions of the UART and (if used) the modem on a channel. For example, you could dial up the Galacticomm Demo system with the following C-language statement:

```
btucmd(chan,"WT13055837808M");
```

If the call goes through as expected, btusts(chan) will eventually return a value of 12 (for HAYES hardware), or 2 (for XECOM hardware), meaning that command execution has completed successfully. (See page 7 for a discussion of hardware categories). Meanwhile your program can be off doing other things. Note that a status of 2 or 12 is created only when the end of the command string is reached, not on each command byte, and only when no other status from the modem is present after the last command byte in the string has been executed.

The syntax of the command string closely follows the modem command protocol developed by Xecom. However, many of these command codes can also be used on HAYES or UART category hardware. We have also added some command codes of our own, which are hardware independent. The services accessed by btucmd() fall into six categories, as shown in figure 4-1. This table shows which commands are supported on which hardware:

	HAYES	XECOM	UART
Modem dial commands	all	all	none
Modem mode commands	most	all	none
Baud rate commands	all	most	all
Framing commands	all	all	all
Pause commands	all	all	all
ANSI commands	all	all	all
Diagnostic commands	none	all	none

btucmd

Unsupported commands generate a status 13 on HAYES and UART category hardware, and a status 63 ('?') on XECOM category hardware (refer to btusts(), page 153).

HAYES

On Hayes-protocol hardware (including the Galacticomm Model 2408), all Modem dial commands, baud rate commands, framing commands, and pause commands are supported.

Most modem mode commands are supported. Some of these (^A and O) have reduced features over their Xecom-protocol counterparts. Others (D and H) are not supported on Hayes hardware.

None of the Diagnostic commands are supported on HAYES category hardware.

If you are exclusively using HAYES category hardware, you may want to use btuxmt() (the transmit routine, page 189) to handle the modem dial, and modem mode functions instead of btucmd(). Hayes-protocol modems have an "AT" command language for controlling the modem. See your modem manual for more details. The following table shows the modem mode commands that are translated into Hayes-protocol "AT" command codes by btucmd().

btucmd() command character	Hayes command character	Function
^A or A	A	Answer incoming call
W	D	Wait for dial-tone and dial a number
M or O	O	Go online (generate originate-carrier)

HAYES

The btucmd() modem dial commands are translated directly into parameters of the Hayes-protocol "D" command. For this reason, when any of the following btucmd() commands are used on HAYES category hardware, they must be placed immediately following the btucmd() "W" command (wait for dial-tone), which is translated into the Hayes-protocol "D" command (dial).

btucmd() command character	Hayes "D" command parameter	Function
R	P	Rotary (pulse) dial mode
T	T	Touch-tone dial mode
0-9	0-9	\
* #	* #	> Output DTMF tone
a b c d	a b c d	/

For example, the sample C-language statement mentioned above for dialing the Galacticomm Demo system was:

```
btucmd(chan,"WT13055837808M");
```

For HAYES category hardware, this statement has almost the identical effect as:

```
btuxmt(chan,"ATDT13055837808O");
```

The major difference being that when the btucmd() directive has completed, a status code of 12 is generated (page 155), assuming nothing goes wrong with the call. Minor differences include the generation of a status 5 after btuxmt() (if btuoes() has enabled it, see page 131), and that btucmd() on HAYES category hardware uses the echo buffer for output and is subject to its limitation of 255 characters at a time.

btucmd

HAYES | **UART**

On HAYES category hardware, some commands are handled by the Software Breakthrough, and others are passed directly to the modem hardware. We will call these "soft" and "hard" commands. The soft commands are the baud rate, framing, pause, and ANSI commands. The hard commands are modem mode and dial commands, and the diagnostic commands.

Soft commands are the only commands available on UART category hardware.

On HAYES category hardware, if you have a btucmd() string with mixed soft and hard commands, then all of the soft commands are executed first, followed by all of the hard commands. For example, the command string:

```
btucmd(chan,"Ap");
```

will pause for 2 seconds ("p" is the pause command -- a soft command), and *then* answer an incoming call ("A" is the answer command -- a hard command). However, if you use the following approach:

```
btucmd(chan,"A");
btucmd(chan,"p");
```

then the answer will precede the pause. See also page 191 for a description of the priority that transmitting takes over command execution.

Instead of the btucmd() baud rate commands, you may want to use btubrt() (page 37) to select the baud rate on HAYES and UART category hardware.

XECOM

All of the commands of btucmd() are supported on XECOM category hardware (Galacticomm Models 16 and 4), with the single exception of the ^F command (2400 baud).

The framing and pause commands provided by btucmd() apply to all categories of hardware. These functions can be obtained through no other Software Breakthrough library routine.

Be sure to review the CAUTIONS at the end of this section on btucmd() (page 80).

LAN

Here are the letter command codes that are valid for LAN channels:

		Page
'L'	Listen for connection (SPX only)	71
'W'	Prefix to "dialout" command	76
'0'-'9'	\ 24-digit network/node/socket addr	76
'A'-'F'	/ specified for "dialout" command	
'M'	Suffix to "dialout" command	76
'T'	Terminate an SPX connection	76
'G'	Greet another GSBL and offer to handle its input preprocessing	69
'P'	5-second pause (uppercase 'P')	73
'p'	2-second pause (lowercase 'p')	73
'V'	Disable auto PAD echo programming	75
'['	Enable ANSI-X3.64 output	79
']'	Disable ANSI-X3.64 output	80

X.25

The following command codes may be used on X.25 channels:

		Page
'A'	Answer an incoming call	68
'W'	Prefix to "dialout" command	78
'0'-'9'	Digits of address or user data field	78
'A'-'F'	Digits of user data field	78
','	Between caller and callee address	78
'M'	Suffix to an outgoing dial command	78
'/'	Prefix hexadecimal user data field	78
'P'	5-second pause (uppercase 'P')	73
'p'	2-second pause (lowercase 'p')	73
'['	enable ANSI-X3.64 output	79
']'	disable ANSI-X3.64 output	80

Astute readers will notice that 'A' appears twice in the above list. 'A' is a hexadecimal digit when, in a 'W' command, it appears after a '/' and before the 'M'. Otherwise, 'A' is an answer command.

Command codes 'T' and 'R' are ignored on X.25 channels. All other codes will produce a status 23 (page 156), and the remainder of the command string will not be processed.

^A (or CONTROL-A) = ANSWER-CARRIER WITH DETECTIONS (TT,VOICE)

HAYES

This command acts just like command "A" (ANSWER-CARRIER WITH NO FRILLS) on HAYES hardware. See page 68 for details.

XECOM

This command puts "answer carrier" on the line, and will generate a status of 2 if "originate carrier" is heard within 17 seconds. It acts just like the regular A command, but adds extra monitoring capability -- the answer sequence may be aborted by the caller in two ways. If the caller presses the DTMF "1" key, a status code of 49 (ASCII "1") is generated. If the caller speaks, a status code of 118 (ASCII "v") is generated. In either case the answer carrier tone is terminated.

^E (or CONTROL-E) = SET CHARACTER LENGTH TO 8 BITS

This mode can be used for binary data protocols such as XMODEM, etc. This command works on all hardware categories.

^F (or CONTROL-F) = SET SPEED TO 2400 BPS

HAYES **UART**

Sets the UART to 2400 baud. For HAYES category hardware, this command (or a call to btubrt()) must be issued after an answer command (command "A", page 68) results in a "CONNECT 2400" message.

^H (or CONTROL-H) = SET SPEED TO 1200 BPS

HAYES **UART**

Sets the UART to 1200 baud. For HAYES category hardware, this command (or a call to btubrt()) must be issued after an answer command (command "A", page 68) results in a "CONNECT 1200" message.

XECOM

For outgoing calls, sets the "preferred speed" of the modem to 1200 bits per second. For incoming calls, results in a status 'I' (for INAPPROPRIATE)

XECOM

when a 300 BAUD connection is already established.

^M (or CONTROL-M) = CONTINUOUS MONITOR, RETURN LINE FREQ

XECOM

This command causes the modem to turn into a sort of spectrum analyzer, reporting back the frequency it hears 20 times a second. The frequency is reported as a data byte ranging in value from 0 to 255:

0 .... Quiet, no frequency at all
1 to 254 .... Frequency in tens of Hz
255 .... Frequency greater than 2540 Hz

This function can only be terminated by a call to either bturst() (which resets the channel) or btuclc() (which clears the command buffer and aborts any command currently underway).

^N (or CONTROL-N) = ONE STOP BIT

UART

Set the UART in this channel to use 1 stop bit. This mode is the default condition after bturst().

^S (or CONTROL-S) = SET CHARACTER LENGTH TO 7 BITS

This mode is the default upon channel reset. This command works on all hardware categories.

^T (or CONTROL-T) = SET SPEED TO 300 BPS

HAYES **UART**

Sets the UART to 300 baud. For HAYES category hardware, this command (or a call to btubrt()) must be issued after an answer command (command "A", page 68) results in a "CONNECT" message.

XECOM

For outgoing calls, sets the "preferred speed" of the modem to 300 bits per second. For incoming calls, will result in a status code of I (INAPPROPRIATE) when a 1200 baud connection is already established. This is the default upon channel initialization or reset.

btucmd

^W (or CONTROL-W) = TWO STOP BITS

UART

Set the UART in this channel to use 2 stop bits.

^X (or CONTROL-X) = ANALOG LOOPBACK IN ORIGINATE MODE

XECOM

This command initiates a local loopback in the originate band. The filters for transmit and receive are set for the originate frequencies and are looped to each other. Transmitted data is routed through the full analog-digital path before being received back at the receiver port. May be used at any "preferred speed", to test all possible encode/decode components in a modem module. Once put in this mode, the channel must be reset (see bturst(), page 136) to get out of it.

^Y (or CONTROL-Y) = ANALOG LOOPBACK IN ANSWER MODE

XECOM

This command initiates a local loopback in the answer band. The filters for transmit and receive are set for the answer frequencies and are looped to each other. Transmitted data is routed through the full analog-digital path before being received back at the receiver port. May be used at any "preferred speed", to test all possible encode/decode components in a modem module. Once put in this mode, the channel must be reset (see bturst(), page 136) to get out of it.

0 to 9 = DIAL 0 to 9 (ROTARY PULSE OR TOUCH TONE)

HAYES **XECOM**

The corresponding digit will be rotary dialed or touch-tone dialed depending on the current mode (previous R or T command). On HAYES category hardware, these codes must only be used after the "W" command (page 75).

btucmd

<u>A = ANSWER-CARRIER WITH NO FRILLS</u>

HAYES

This command puts "answer carrier" on the line, and generates a status 3 if "originate carrier" is heard within 17 seconds. The status 3 indicates a received data string that you can get out of the receive buffer by using btuinp() (refer to page 108). Some examples of the string:

"CONNECT"	when 300 baud carrier has been detected
"CONNECT 2400"	when 2400 baud carrier has been detected
"CONNECT *<baud>*"	when other baud rates have been detected
"CONNECT *<baud><mode>*"	for special compression or correction modes

If no carrier is detected in 30 seconds, the following string usually appears in the receive buffer:

"NO CARRIER"	no originate carrier detected within 30 seconds.

XECOM

This command puts answer carrier on the line, and will generate a status of 2 if originate carrier is heard within 17 seconds. Otherwise a status code is generated indicating: 'T' (TIMEOUT), or 'I' (INAPPROPRIATE). This is the command you would normally use to pick up the phone when it rings (rather than the "^A" command).

X.25

The "A" command will answer an incoming call on an X.25 line if issued immediately after receiving a status 3 with "RING" message:

RING *<caller>* CALLING *<callee>*

Where *<caller>* is the decimal network address (if available) for the source of this call, and *<callee>* is your network address. The "A" command generates an immediate status 22.

If you set x25udt to 1, then btuinp() will return:

RING <*caller*> CALLING <*callee*> <*user data field*>

See page 35 for details on the limitations of this method.

D = DTMF RECEIVE MODE (ACCEPT TOUCH TONE INPUT)

XECOM

When placed in this mode, a modem will recognize incoming DTMF tone pairs as data input. The ASCII representations of 0-9, a-d, *, and # will be buffered as input data characters when they are detected. Note that DTMF information can be transmitted by issuing the normal digit dial commands. This mode is cancelled by a H, M, O, or A command.

G = GTC GREETING (LAN)

LAN

The Galacticomm Terminal Configuration protocol was designed for two computers that are connected via Advance LAN channels. GTC allows one computer to preprocess the input of the other computer. The presumption is that both computers are using the GSBL to communicate.

For example, GTC can be used in a terminal emulation program talking to The Major BBS Bulletin Board System. The 'G' command is executed in the terminal program once connection is established and says in effect: "Offer to preprocess the input of the BBS". This includes buffering an input line with or without echo, input word wrap, etc. Executing the 'G' command paves the way for status codes 40 - 44 to appear for the terminal program to handle (informing it of changing BBS input modes). For the BBS program all aspects of this exchange are handled by the GSBL and need no special handling by the BBS C program. The key point to remember here is that you only have to consider handling GTC if you execute the 'G' command.

See page 223 for more on the GTC protocol. GTC is only available in the Advanced LAN Option of the GSBL.

btucmd

H = HOLD (DISCONNECT MODEM, BUT REMAIN OFF-HOOK)

XECOM

Performs a "logical disconnect" of the modem from the phone line, but does not terminate the physical connection (i.e. the phone remains "off-hook"). This command can be used to quiet the line for voice or other use during a connection.

I = IDENTIFY MODEM VERSION

XECOM

Causes a single ASCII letter representing the version of the modem module to be generated as an input data character. Version codes are assigned consecutively, starting with "A" (65 decimal). Version number changes correspond to "significant unity upgrades", whereas revision numbers (see "i", immediately following) represent incremental enhancements.

i = IDENTIFY REVISION NUMBER

XECOM

Causes a single ASCII digit representing the revision code of the modem module to be generated as an input data character. This will usually be of no concern to you, since only "version numbers" (see "I", immediately above) correspond to "significant unity upgrades".

L = LINE ANALYZE

XECOM

This command acts the same as the M command but generates three special data input bytes if successful. The first byte represents the carrier frequency error, the second the S/N ratio, and the third the received carrier level. The calculations necessary for meaningful interpretation of this information are covered in Xecom data sheets.

L = LISTEN FOR SPX CONNECTION (LAN)

LAN

This command prepares the channel to accept a connection request from another party (presumably a terminal program like SPXTALK). The channel will remain in the listen-for-connection mode until a connection is established or until the channel is reset with bturst().

The listen command should only be issued on SPX channels that are in the idle state (see page 215). The 'L' command will have no effect on an IPX channel.

l (LOWERCASE L) = RETURN 1200-BPS ERROR STATISTICS

XECOM

This command may be used during a 1200 bps connection to check the phase demodulation statistics. An I (INAPPROPRIATE) status is generated if no 1200 bps connection exists. Otherwise two data bytes are queued: the first gives the average phase error of the signal, and the second gives the number of "phase hits" since the last request. The calculations necessary for extracting meaningful information from these values are covered in Xecom data sheets.

btucmd

M = MONITOR LINE AND ORIGINATE WITH DETECTIONS

HAYES

The modem goes to the Online mode, waiting for answer carrier. If answer carrier is detected within 30 seconds, the following string appears in the receive buffer (refer to btuinp(), page 108):

"CONNECT"	when 300 baud carrier has been detected
"CONNECT 1200"	when 1200 baud carrier has been detected
"CONNECT 2400"	when 2400 baud carrier has been detected

If no answer carrier is detected within 30 seconds, the following string appears in the receive buffer:

"NO CARRIER"	no answer carrier detected within 30 seconds.

XECOM

This command will generate a status of 2 if answer carrier is heard within 17 seconds. Otherwise a status code is generated indicating: B (BUSY), R (RINGING), I (INAPPROPRIATE), T (TIMEOUT), D (DIAL TONE), or V (VOICE). You should reissue the M command if you want to continue the attempt (e.g. for the first few rings).

LAN

See page 76 for using the 'M' command on LAN channels.

O = ORIGINATE-CARRIER WITH NO FRILLS

HAYES

This command acts identically to the "M" command on the HAYES category hardware.

The modem goes to the Online mode, waiting for answer carrier. If answer carrier is detected within 30 seconds, the following string appears in the receive buffer (refer to btuinp(), page 108):

"CONNECT"	when 300 baud carrier has been detected

"CONNECT 1200"	when 1200 baud carrier has been detected
"CONNECT 2400"	when 2400 baud carrier has been detected

If no answer carrier is detected within 30 seconds, the following string appears in the receive buffer:

"NO CARRIER"	no answer carrier detected within 30 seconds.

XECOM

This command will generate a status of 2 if answer carrier is heard within 17 seconds. Otherwise a status code is generated indicating: T (TIMEOUT), or I (INAPPROPRIATE). This command is primarily useful when the physical connection is already established, and your program decides to begin using it for data communications. When making a new connection, use the "M" command (page 72).

P = PAUSE 5 SECONDS

The "long pause". Works on all hardware categories.

p = PAUSE 2 SECONDS

The "short pause". Works on all hardware categories.

R = ROTARY (PULSE) DIAL SUBSEQUENT DIGITS

HAYES

This is the default condition, upon initialization or reset. This command must follow a "W" command.

btucmd

XECOM

Use this command to dial on a phone line which does not support touch-tone dialing.

T = TOUCH-TONE DIAL SUBSEQUENT DIGITS

HAYES

This command must follow a "W" command.

XECOM

This is the default, upon initialization or reset.

T = TERMINATE SPX CALL (LAN)

LAN

The terminate command will gracefully end an SPX session. A status 36 on the end that issued the 'T' command indicates that the session was terminated properly. A status 31 on the other end (in the GSBL of a program to which your program is connected) indicates the session was terminated. Here's a diagram of how an SPX session is terminated with the 'T' command:

```
Application 1 --> GSBL --/ /-- GSBL --> Application 2
                         \ \
          -- 'T' cmd --> / /
                         \ \  -- status 31 -->
       <-- status 36 --  / /
```

The terminate command should only be issued on SPX channels that are in the connected state (see page 215). At any other time, the terminate command will have no effect. The 'T' command will have no effect on an IPX channel.

t = WAIT 1/10 OF A SECOND (HAYES AND UART)

HAYES **UART**

Generates a status 12 after 0.1 seconds. Works only on 8250-type UARTs and modems or Model 2408 cards.

V = DISABLE AUTOMATIC PAD ECHO PROGRAMMING

X.25

Normally, turning echo on and off with btuech(), or switching between binary and ASCII input modes with btutrg() would automatically cause programming of paramter 2 of the remote PAD. This command disables that feature until the next bturst().

W = WAIT FOR DIAL TONE (TO PLACE AN OUTGOING CALL)

HAYES

This command is usually accompanied by digit dial commands, such as:

```
btucmd (chan,"WT13055837808M");
```

(which would dial the Galacticomm Demo system from your channel "chan").

In this case, if connection is established within 30 seconds, a status 12 is generated, along with the following string in the receive buffer (refer to btuinp(), page 108):

"CONNECT"	when 300 baud carrier has been detected
"CONNECT 1200"	when 1200 baud carrier has been detected
"CONNECT 2400"	when 2400 baud carrier has been detected

If no answer carrier is detected within 30 seconds, the following string appears in the receive buffer:

"NO CARRIER"	no answer carrier detected within 30 seconds.

XECOM

This command will generate a status of 2 if a dial tone is sensed within 5 seconds. Otherwise a status code is generated indicating: B (BUSY), M (MODEM CARRIER SENSED), I (INAPPROPRIATE), R (RINGING), T (TIMEOUT), or V (VOICE).

btucmd

LAN Dialout Command: *'W', digit, and 'M'*

LAN

This command is used to make an *outgoing call* on the network and establish connection with another address on the network.
For SPX channels, a dialout command means to establish a connection with a remote network/node/socket. You can have multiple SPX connections between the same pair of network/node/sockets.

For IPX, a dialout command specifies who we will talk to and who we will listen to. After an IPX dialout command on a particular channel, all transmissions on the channel will go to the specified network address. And all packets received from that address (and directed to the same local socket number) will be routed to the input buffer of the channel.

On IPX Virtual circuits, the dialout command may also be used to establish an *incoming call*. In the "raw-packet mode" an IPX Virtual Circuit reports the complete IPX packet to you. Then you can look at the source network/node/socket of this packet to determine who is attempting to communicate with you (page 219). You can format the results of this report into a dialout command to complete the "connection".
You can issue dialout commands on IPX channels whenever you want. When you do, all transmits and receives *since the most recent call to btuscn()* will correspond to the new network address. These transmits/receives will be processed/available after the next call to btuscn().

SPX channels are more complicated. The dialout command should only be issued on SPX channels that are in the idle state. See page 215 for details.

> If you use a dialout command to specify a network that is not connected, then the GSBL may appear to "hang" for several seconds, and then issue a status 39 (page 158).

Unique Network Addresses for IPX Dialouts

Among channels with the same local socket number, the network/node/socket of an IPX dialout command should be unique. That is, once you specify a certain network/node/socket for the dialout command on one channel, you should not specify the same network/node/socket for the dialout command on any other channel that shares the same local socket. For example,

This is not a good idea:

```
btusdf(0,2,6,0x4007,2);
btucmd(0,"W000000010000C0A61018M");
btucmd(1,"W000000010000C0A61018M");
```

(same local socket number, same destination n/n/s)

This is OK:

```
btusdf(0,2,6,0x4007,2);
btucmd(0,"W000000010000C0A61018M");
btucmd(1,"W000000010000C0CE0018M");
```

(different destination n/n/s)

This is also OK:

```
btusdf(0,1,6,0x4007,2);
btusdf(0,1,6,0x4008,2);
btucmd(0,"W000000010000C0A61018M");
btucmd(1,"W000000010000C0A61018M");
```

(different local socket number)

The result of IPX dialouts from two channels with the *same* local socket calling the *same* network address are: received packets may wind up in the input buffer of either channel, arbitrarily. Transmitted packets have no such ambiguity (although the other party may not be able to distinguish the originating channel).

Special Syntax of the Dialout Command

An outgoing call may be specified by multiple btucmd() calls, *as long as there are no other intervening calls to breakthrough routines.* For example:

```
btucmd(chan,"W");
btucmd(chan,"00000001");
btucmd(chan,"0000C0A81018");
btucmd(chan,"4007");
btucmd(chan,"M");
```

will have the same results as:

```
btucmd(chan,"W000004010000C0A810184007M");
```

btucmd

X.25 Dialout Command: 'W', digits, slash, hex digits, and 'M'

X.25

To place an outgoing call on an X.25 channel, issue any of the following command string formats, using btucmd():

W<*caller*>,<*callee*>/<*user data field*>M

W<*callee*>/<*user data field*>M

W<*caller*>,<*callee*>M

W<*callee*>M

You can use 'T's or 'R's in the above commands for compatibility with XECOM channels, where they mean T=touch tone or R=pulse dialing. For X.25 channels, they have no effect. For example:

```
btucmd(chan,"WT100657,399613M");
```

In this case, you are seeking network address "399613", while identifying yourself as network address "100657".
Note: an outgoing call may be specified in segments as long as there are no intervening calls to other GSBL routines. For example:

```
btucmd(chan,"W1234,");
btucmd(chan,"6789M");
```

will have the same results as:

```
btucmd(chan,"W1234,6789M");
```

The user data field of an outgoing call request packet is normally empty. To put data into the user data field, code it in hexadecimal after the '/' (slash) command, for example:

```
btucmd(chan,"W1234,6789/41423031M");
```

That example will put the 4-byte ASCII string "AB01" into the user data field. This data need not be ASCII. To code three zero bytes and a byte with value 01 hex:

```
btucmd(chan,"W1234,6789/00000001M");
```

Important note:

The outgoing call, if completed, may not actually be made over the same channel that you specify in btucmd(). The PC XNet card driver will decide the actual "virtual circuit" to use for the call. Specifying the channel for btucmd() with a dial-out command does serve the purpose of identifying the card and line to use. The PC XNet card usually puts the call on the *highest* unused channel that has been configured (unless the line is configured as "DCE", in which case outgoing calls go over the *lowest* available channel).

When an outgoing call has been confirmed, status code 77 (ASCII 'M') is generated on the channel on which the call has been established.

If an outgoing call fails, either: status code 66 (ASCII 'B') is generated if there is some local transmission error encountered when transmitting the call request packet (like transmit window full); or status code 21 ("lost carrier") is generated if the network refuses to connect your call, perhaps because the network address you specified is busy, or does not exist.

To terminate a call, bturst() disconnects the virtual circuit. When a call gets terminated, either by the network or by the remote user, status code 21 is generated on the channel.

[= ENABLE ANSI GRAPHICS (default)

This command affects the operation of btuxmt() when transmitting the following construct:

<ESC> [**<for-ANSI-users>** | <for-non-ANSI-users>]

If ANSI graphics have been enabled for a channel by this command, (or by default), then the string <for-ANSI-users> from the above construct will be transmitted and the string <for-non-ANSI-users> will NOT be transmitted.

ANSI graphics are automatically enabled by bturst(). See page 190 for more information on ANSI graphics directives.

btucmd

] = DISABLE ANSI GRAPHICS

This command affects the operation of btuxmt() when transmitting the following construct:

<ESC> [<for-ANSI-users> | **<for-non-ANSI-users>**]

If ANSI graphics have been disabled for a channel by this command, then the string <for-ANSI-users> from the above construct will NOT be transmitted and the string <for-non-ANSI-users> WILL be transmitted. Also, ANSI graphics directives embedded in the text passed to btuxmt() will not be transmitted to that channel. See page 190 for more information on these directives. ANSI graphics are automatically enabled by btursts().

RETURNS

-10 channel is not defined (see btudef(), page 82)
-11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0 all is well

CAUTIONS

If data input or output is in progress when this call is made, the data operation will be allowed to complete before the command string is executed. See page 191 on the priority of transmission over commands.

The framing commands must be reissued each time you reset a channel (by bturst(), page 136).

The command buffer can hold 62 characters at a time.

HAYES

To use btucmd() on HAYES category hardware, the modem must be in command mode.

SUBROUTINE NAME

btucpc -- set the clear pause-counter character
(puts off screen pauses when in output stream)

SYNOPSIS

```
err=btucpc(chan,cpchar);
int err;            zero means OK
int chan;           channel number
char cpchar;        clear pause-counter character
                    (or 0 to disable)
```

DESCRIPTION

When the cpchar character is discovered in the output stream (btuxmt() or btuxmn() -- see page 189 or page 187), the internal line counter is reset to 0. This line counter is used to determine when to display the pause message set by btuhpk() (page 99). The character itself is never actually output. Use cpchar=0 to disable this feature.

In The Major BBS this function is used to prevent screen pauses by inserting the Control-S character at strategic points in certain text blocks.

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	all is well

btudef

SUBROUTINE NAME

btudef -- define channels

SYNOPSIS

```
err=btudef(schan,sport,n);
int err;      zero means OK
int schan;    starting channel number
int sport;    starting port address
int n;        number of channels
```

DESCRIPTION

After you initialize the Software Breakthrough as a whole, using btusiz() (or btulsz()) and btuitz(), then you use btudef() to initialize individual channel groups. You will call btudef() once for each device that you have installed in your system. See also about btusdf() (page 144) for more alternative devices.

When you called btusiz() or btulsz(), you specified the total number of channels in the first parameter "nchan". btuitz() initialized the data structures for that many channels, numbered 0 to nchan-1. Now you will use btudef() to associate those channels with actual hardware. The following example (in C) illustrates a typical initialization sequence for one each of the Galacticomm Breakthrough Models 16, 4, and 2408 and a Hayes-compatible modem on COM1:

```
btuitz(malloc(btulsz(40,128,1024)));
btudef(0,0x2F0,16); /* Define Model   16 at 2F0 (hex) */
btudef(16,0x2F2,4); /* Define Model    4 at 2F2 (hex) */
btudef(20,0x2F4,8); /* Define Model 2408 at 2F4 (hex) */
btudef(28,0x2F8,1); /* Define 1 Hayes modem           */
                    /*     on a COM2 port at 2F8 (hex) */
btudef(29,0x3F8,8); /* Define 8 Hayes modems in a     */
                    /*    GalactiBox, each at the COM1 */
                    /*       port address of 3F8 (hex) */
```

For Galacticomm Breakthrough cards, the "sport" parameter identifies the I/O base address for the card, as set on the card's DIP switches. Refer to the Installation Manual for your particular model.

For hardware on the standard serial ports COM1 and COM2, you should use the following values for the "sport" parameter:

COM1	0x3F8	COM3	0x3E8
COM2	0x2F8	COM4	0x2E8

btudef() can discriminate between the three categories of hardware: HAYES, UART, and XECOM (see page 7). If it fails to find a Galacticomm Breakthrough Model 16 or 4 at the base address "sport", it will look for a Model 2408 card at the same address. Failing that, it will look for an 8250-type UART (which is used in both HAYES and UART category hardware).

HAYES **UART**

See the discussion of bturst() (page 136) for the proper sequence of initializing a HAYES or UART channel.

RETURNS

- -11 channel number(s) out of range: the specified range of channels (schan to schan+n-1) is not within the inclusive range 0 to nchan-1, where nchan has been defined in btusiz() (page 149) or btulsz() (page 116)
- 0 the specified channels were defined successfully.

CAUTIONS

The return value from btudef() only indicates whether the mechanics of the calling sequence are correct, not whether or not the modem or UART hardware is working.

If you are changing the maximum data rate using btumxs() (see page 128), you must do that before calling btudef().

XECOM

If there is no hardware at the specified address, the channels specified will all have statuses of -10 (see btusts(), page 153). If an underpopulated card is installed (for example, a Model 16 with 8 modems), then btudef()'s of the vacant modem slots will also generate a single status code -10 on those channels.

btudef

HAYES **UART**

If there is no hardware at the specified address, the channels specified will all have statuses of -10 (see btusts(), page 153). If an underpopulated card is installed (for example, a Model 2408 with 4 modems), then btudef()'s of the vacant modem positions will NOT generate statuses of -10 -- those channels will "appear" to the software to exist, but they will never be connected to anything. That's because the 2408 card has an 8-channel UART talking to up to 8 modems. Whether the modems are installed or not, the presence of the UART is all that is sought by the reset operation.

If you have purchased the N channel version of the Software Breakthrough, then you may only use channels 0 through N-1 to talk to real hardware. If you attempt to define channels N or higher, then these channels will each have a single status code of -10 -- as if there were no hardware on these channels. You may still use these channels for local emulation (described on page 125).

LAN **X.25**

Don't use btudef() on LAN or X.25 channels. Use btusdf() instead (page 144).

SUBROUTINE NAME

btueba -- echo buffer space available, in bytes

SYNOPSIS

```
nbytes=btueba(chan);
int chan;                channel number
int nbytes;              room in the echo buffer for bytes
                         to echo to the user's terminal
```

DESCRIPTION

This routine returns a value indicating the number of bytes that the echo buffer for this channel can handle before overflowing.

The echo buffer can hold up to 255 bytes. When the echo buffer overflows, a status 252 is generated (page 164).

RETURNS

```
    0   echo buffer is full
1-254   echo buffer is between full and empty
  255   echo buffer is empty
```

btuech

SUBROUTINE NAME

btuech -- set echo on/off

SYNOPSIS

```
err=btuech(chan,mode);
int err;        zero means OK
int chan;       channel number
int mode;       0 = disable echo
                1 = enable echo (echo-plex on X.25 channels)
                2 = enable echo (GSBL echo on X.25 channels)
```

DESCRIPTION

This routine allows input echo to be enabled or disabled while in the ASCII input mode (page 17). It defaults to the enabled state upon channel initialization or reset.

Here are two typical uses for this routine: The first is for hiding passwords: you can turn off the echo on a channel just as the user is prompted for his password -- then turn it back on again once the password has been entered. In this way, prying eyes in the user's vicinity will not see his password displayed on his screen.

A second use of btuech() is for half-duplex communications, in which the user's terminal already echoes each keystroke that he types (therefore your system should not echo). In this case, you would simply turn off the echo as soon as a connection is established, and leave it off for the duration (you will need to disable the echo after each reset of the channel with bturst(), page 136).

X.25

Echo-Plex and GSBL Echo on X.25 Channels

Echo-plex means that the PAD (packet assembler/ disassembler) on the user's end of the X.25 network does the echoing of characters. The GSBL programs the PAD to do this using the "Q" bit, per recommendations X.29 and X.3 (parameter 2).

GSBL echo means that the GSBL echos each input character, just as it does with modems and serial ports.

On a non-X.25 channel, btuech(chan,1) has the same effect as btuech(chan,2). On an X.25 channel, the call to btuech() controls both the echo of input from the GSBL and the echo of characters by the user's PAD:

Value of mode parameter in call to btuech()	Local echo from the GSBL?	X.3 pad parameter number 2 setting	Echo mode
0	OFF	0 (echo off)	Echo off
1	OFF	1 (echo on)	Echo-plex
2	ON	0 (echo off)	GSBL echo

Echo-plex can be more economical if your packet switching network charges for data traffic based upon the number of packets input and output. Echo-plex saves the extra packet per user keystroke that would result from the GSBL echoing each keystroke. However, there are a few minor drawbacks to echo-plex for X.25 channels:

- The input word-wrap feature enabled by btumil() will not work well on an X.25 channel in echo-plex mode. The GSBL will be splitting lines on word-boundaries, but not displaying the effects on the user's screen as it would in GSBL echo mode, or as it would on a non-X.25 channel.

- The maximum line length set by btumil() will not automatically disable echo when the limit is reached -- the user's PAD will continue to echo even after the GSBL stops accepting characters.

- The user backspace key erases input keystrokes fine, but does not stop when the beginning of the input line is reached, and may erase a preceding prompt.

- If a user types during output to his screen ("type-ahead"), then the echo is not suspended until the next prompt (as it is with GSBL echo mode or with non-X.25 channels), but is mixed in with the output.

The monitored channel, when in echo-plex mode, specially handles monitored input and output to most closely resemble the users screen, including the above mentioned drawbacks.

btuech

To achieve this:

- o Each monitored keystroke (btumks() or btumks2()) is immediately echoed to the monitor screen buffer (for access by btumds() or btumds2()) and to the users screen (via the GSBL's echo buffer).

- o Each received character is immediately echoed to the monitor screen buffer (for btumds() or btumds2()).

- o Carriage returns echoed to the monitor screen buffer are automatically appended with line feeds.

Note: Echo-plex is automatically suspended during binary input (when btutrg(chan,nonzero) is in effect) and re-enabled when ASCII input resumes (btutrg(chan,0)).

See also page 52 regarding echo considerations for your custom character interceptor routine, specified by btuchi().

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	all is well

CAUTIONS

Half-duplex communications modes are not recommended, for reasons of user-friendliness, flexibility, and standardization.

SUBROUTINE NAME

btuend -- shut down the Software Breakthrough

SYNOPSIS

```
btuend();
```

DESCRIPTION

Prepare the PC for return to DOS. This routine must be called as part of your exit cleanup procedure.

RETURNS

None.

CAUTIONS

If your program has called btuitz() (initialization, page 112), you must call btuend() before your program returns to DOS. The Software Breakthrough alters certain PC hardware settings for its own ends, and these must be restored, or else the operating system will become very confused.

Only call btuend() upon exiting your program altogether. The Software Breakthrough routines will no longer function once you have called btuend().

btuend() does not hang up your phone lines. You should call bturst() for every channel you have defined before calling btuend(). If you do not, your phone lines may remain off-hook with the carrier signal on, appearing to any users online at the time that your system has "locked-up". Better to let them think that you are rude than that your system is malfunctioning.

btuerp

SUBROUTINE NAME

btuerp -- pass/block input bytes with errors

SYNOPSIS

```
err=btuerp(chan,onoff);
int err;      zero means OK
int chan;     channel number
int onoff;    1 = accept characters with PE/FE/OE errors,
                  setting the high-order bit of each
                  (default)
              0 = ignore characters with PE/FE/OE errors
```

DESCRIPTION

The purpose of this feature is to give you control over the handling of input characters received with parity errors, framing errors, or overrun errors.

If error-passthru is enabled (onoff = 1), then any character received with one of these errors will have its high-order bit set (i.e. if not already in the range from 128 to 255 it will be brought there by adding 128 to it). Then this new value is used as an index into the global input-character translation table (see btuxlt(), page 183). If error-passthru is disabled (onoff = 0), then any character received with one of these errors will be ignored.

By default, this feature is enabled (onoff = 1). With the default input character translation table (page 185), this means that 7-bit ASCII characters with parity, framing, or overrun errors, are received as if they had nothing wrong with them: their high bits are set, but the translate table effectively strips them off.

RETURNS

```
-10  channel is not defined (see btudef(), page 82)
-11  channel number is out of range (see btusiz() or
     btulsz(), pages 149, 116)
  0  all is well
```

CAUTIONS

When running protocols requiring 8-bit data, such as XMODEM, you should probably disable error-passthru, because otherwise you will not be able to distinguish between valid received characters with their high-order bits set and invalidly received characters. Anyway, during XMODEM input, parity errors are not possible, framing errors are rare, and overrun errors are unlikely.

btuffo

SUBROUTINE NAME

btuffo -- enable receiver FIFO on 16550 UART

SYNOPSIS

```
err=btuffo(chan,onoff);
int err;              0 is ok
int chan;             channel number
int onoff;            1=enable 16-byte FIFO's
                      0=disable (for exact 16450 compatibility)
```

DESCRIPTION

HAYES | **UART**

This routine enables the 16-byte FIFO's in National Semiconductor's 16550 UART. This can be used to avoid losing received characters. There can be many diverse reasons why incoming characters could be lost. If any code, such as disk-caching software, keeps interrupts disabled for too long, for example, then the resulting jitter in sampling can cause characters to "fall between the cracks". If this happens, the btuerp() routine (page 90) can allow overrun errors to be reported as data bytes with the high bit set (and then possibly stripped by the translate table, page 183), resulting in double characters (for example "frog" would turn into "frrg").

The 16550 UART is a pin-compatible replacement for the 16450 UART (itself compatible with the original 8250 UART). UART stands for Universal Asynchronous Receiver Transmitter, and is the heart of almost all serial devices on the IBM PC and compatibles, and is also used in most modems, internal and external.

The 16550 UART however, has 16-byte deep first-in-first-out queues, one in the receiver circuit and one in the transmitter. That means that (1) the GSBL is almost certain not to miss any incoming characters and (2) the port can be polled less often (see page 128). To enable this FIFO feature, call btuffo with a 1 for the onoff parameter.

HAYES **UART**

btuffo() has no effect on 8250 or 16450 UARTs. It will return -18 to let you know they're not 16550's.

XECOM **LAN** **X.25**

btuffo() has no effect on XECOM, LAN, or X.25 category hardware (it always returns 0).

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
-18	channel has an 8250 or 16450 UART on it
0	either the channel does not have an 8250-type UART on it, or it has a 16550 type UART on it, and the FIFO mode has been set

CAUTIONS

Calling btuffo() on a channel with a 16550 UART can cause you to lose any characters that are in the FIFO transmitter or receiver circuitry at the moment that you call btuffo().

On a non-hardware channel that was defined using btudef() (or btusdf() with chtype=0), btuffo() will always return 0. On a non-hardware channel that was defined using btusdf() with chtype=3 (8250), the btuffo() return value is undefined. See page 144 for more about btusdf(), or page 82 for btudef().

btuhcr

SUBROUTINE NAME

btuhcr -- set the hard-CR character (for output wordwrap)

SYNOPSIS

```
err=btuhcr(chan,hardcr);
int err;                zero means OK
int chan;               channel number
char hardcr;            hard-CR, translated to 0DH
                        on output
```

DESCRIPTION

The "hard" carriage return is an output character that is unconditionally converted into an ASCII <CR> (carriage return). This occurs during ASCII output mode, when output word wrap is in effect. ASCII output mode, discussed on page 19, is performed using btuxmt() (page 189). Output wordwrap is controlled by btutsw() (page 172).

The hard carriage return defaults to ASCII <CR> (13 decimal) when a channel is initialized or reset, which is to say that <CR>'s are passed through unchanged.

By default, all <CR>'s are also appended with <LF>'s on output. This feature is controlled by btulfd() (page 114).

You can think of a hard CR as representing "end of paragraph" if you have output wordwrap enabled Usually the default value of 13 will be fine, but there may be cases in which you want to use some printable character, such as "@" or "<", to indicate paragraph boundaries.

RETURNS

-10 channel is not defined (see btudef(), page 82)
-11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0 all is well

btuhdr

SUBROUTINE NAME

btuhdr -- Capture information on X.25 or LAN channel

SYNOPSIS

```
err=btuhdr(chan,nbytes,buffer);
int err;             zero means OK
int chan;            channel number
int nbytes;          number of bytes to capture
char *buffer;        where to put them
```

DESCRIPTION

This routine can be used to capture the contents of special internal data structures for the channel. The routine is only available with the Advanced LAN Option or with the X.25 Software Option

The nbytes parameter should be even (if odd, btuhdr() will only copy nbytes-1 bytes).

LAN

Here are some useful values of nbytes for LAN channels with GSBL/LAN:

46	for most recent listen ECB
76	for most recent listen ECB + listen IPX header
88	for most recent listen ECB + listen SPX header
176	for most recent listen ECB + listen SPX header + send ECB + send SPX header

<u>ECB's used by the GSBL</u>
The ECBs (Event Control Blocks) used by the GSBL are 46 bytes long.* This includes the 42-byte structure defined by Novell for an ECB with one fragment descriptor, plus 4 bytes used internally by the GSBL.

btuhdr

The contents of this ECB can be found in the "ecbgsbl" structure in IPX.H:

```
struct ecbgsbl {          /* Event Control Block (for use with GSBL btuhdr()) */
     void *link;
     void (*esr)();                                    /* event service routine */
     char inuse;                      /* 0=not in use FE=listening FF=sending */
     char complt;               /* 0=good, nonzero=command-specific error code */
     int socket;                                       /* sending socket (hi-lo) */
     char ipxwsp[4];                                         /* IPX workspace */
     char drvwsp[12];                                     /* driver workspace */
     char immnod[6];                                   /* immediate node address */
     int frgcnt;                                       /* fragment count (lo-hi) */
     void *frgadr;                                  /* address of first fragment */
     int frgsiz;                               /* size of first fragment (lo-hi) */
     int prtseg;                 /* protected mode segment (GSBL-specific usage) */
     int chanx2;                     /* channel number * 2 (GSBL-specific usage) */
};
```

Local Network/Node Address

After calling btusdf() for a channel group, btuhdr() can be used to find the local network/node address of the machine on which the GSBL is running. It will reside in the dstnet and dstnod fields of the listen IPX header buffer. This occurs even before any packets are received, and offers your program the first opportunity to determine your local node address. (If your computer never logs into a file server, this information might not be available for the first minute or so of operation.)

Note that the IPX/SPX header part of this information is redundant in raw packet mode -- you always get the entire packet in the input buffer.

X.25

Here are some useful values for nbytes when calling btuhdr() on X.25 channels:

2 for cause and diagnostic of last clear packet (see about status 21 on page 156)

52 for cause and diagnostic, plus information about the last received X.29 string (see about status 24 on page 156)

Here is the full 52-byte structure for the data captured by btuhdr() on an X.25 channel:

```
struct x25hdr {          /* X.25 info from btuhdr()        */
     char cause;         /* clear packet cause             */
     char diag;          /* clear packet diagnostic        */
     char x29num;        /* number of parameters in x3list */
     char x29flg;        /* flags, see below               */
     struct x3list {     /* array of up to 24 X.3 pairs:   */
          char par;      /*      parameter number          */
          char val;      /*      value                     */
     } x3list[24];
};
                         /* Masks for x29flg flag bits:    */
#define X3SET  0x02      /* request to set X.3 values      */
#define X3READ 0x04      /* request to read X.3 values     */
#define X3NEW  0x80      /* new X.3 message has been rec'd */
#define X3OVF  0x40      /* more than 24 parameters rec'd  */
```

Each incoming clear packet generates a status 21 (page 156), and comes with a cause and a diagnostic field. As you can see above, you can obtain these values with btuhdr().

Calling btuhdr() clears the x29flg&X3NEW flag. Each received X.29 string sets X3NEW. So, if the X3NEW flag is set, then a new X.29 string has been received since you last called btuhdr(). Incoming X.29 strings are also heralded by a status 24 (page 156).

All other flag bits, the x29num field, and the x3list array are from the most recently received X.29 string. The X3OVF flag indicates that more than 24 parameter/value pairs were in the last incoming X.29 string.

An incoming X.29 string means that the other DTE on the X.25 network is trying to query (X3READ), set (X3SET), or both set and query (X3READ+X3SET) your X.3 parameters. Obviously this DTE thinks it is talking to a PAD. To respond to a query as if you were a PAD, you can call btux29() (page 179) with a message code of 0 (meaning query-reply).

RETURNS

- -10 channel is not defined (see btudef(), page 82)
- -11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
- 0 all is well

btuhit

SUBROUTINE NAME

btuhit -- Hook into a COM port interrupt and use it to invoke channel servicing

SYNOPSIS

```
err=btuhit(irqno);
int err;                zero means OK
int irqno;              2-7  IRQ number to intercept
```

DESCRIPTION

The GSBL is normally based on timed polling of all ports. This function can be used to make the GSBL instead take its cue from the UART interrupts of a very limited number of serial ports (typically 1 or 2, but possibly up to 6).

The most common practical values for irqno will be 3 and/or 4. You can call btuhit() on as many of the IRQ numbers 2-7 as you wish, but only once per IRQ number:

```
btuhit(3);
btuhit(4);
```

Normally you would use this feature in a multi-tasking environment such as Windows or OS/2.

CAUTIONS

btuhit() can only be used when the GSBL has been initialized with btuitm() (page 111), not with btuitz() (page 112).

Only one port per IRQ line can be serviced using this scheme.

RETURNS

-20	irqno is not 2/3/4/5/6/7, or btuitm() was not used to initialize (see page 111)
0	all is well

SUBROUTINE NAME

btuhpk -- Handle keystrokes during screen-pause mode

SYNOPSIS

```
err=btuhpk(chan,hpkrou);
int err;                  zero means OK
int chan;                 channel number
int (*hpkrou)();          pointer to function to be called

rc=(*hpkrou)(chan,c);     the character interceptor routine
                          during screen-pause mode
char rc;                  0=ignore
                          1=next page
                          2=continue nonstop
int chan;                 channel number
char c;                   character received
```

DESCRIPTION

First, a channel goes into screen-pause mode when:

1. More than N lines of text have been output (see the cnt parameter of the btuxnf(chan, xon,-xoff,cnt,stg) form of btuxnf() on page 192).

2. A special pause-character defined by btupbc() has been transmitted (page 133) and printable output has been transmitted to the user since the last time he hit Return.

3. A clear-screen code -- either an ASCII formfeed (Ctrl-L, 12 decimal) or an ANSI clear-screen sequence (Esc-[-2-J) -- can also trigger a pause because btuxmt() will insert the btupbc() pause character immediately before it.

After a channel goes into screen-pause mode, each character received triggers a call to the hpkrou routine, which may be coded in C. In other words: you will use btuhpk() to identify that the hpkrou routine will handle each character received on any channel during screen-pause mode.

There are several functions that can be implemented by the hpkrou routine, based on the keystroke(s) received during screen-pause mode. You can compose a very short (e.g. 40-character) menu of these functions in the stg message of the -xoff form of btuxnf(). Within the hpkrou routine:

1. To handle a "continue" key, just return 1.

2. To handle a "go nonstop" key, return 2.

3. To handle an "abort" key, you must inform your mainline program. For example inject a status 7 (this is what happens in The Major BBS, for example) and have the mainline program handle the status by clearing output using btuclo(), and changing states (to stop stuffing the output buffer).

The channel remains in screen-pause mode when you return 0. Otherwise, screen-pause mode ends and output resumes.

The character handed off to the hpkrou routine is not automatically echoed, but you could use chiout() to echo it if you wish.

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	all is well

CAUTIONS

See also page 51 for cautions relating to interrupt-called functions. Design of the "hpkrou" routine is fraught with pitfalls. Don't design lengthy complex code to run at interrupt level. Don't invoke DOS (because it is not reentrant). You may use the special chixxx() routines (page 47), but not any other Breakthrough Library routines. Beware of data "skewing", since a real-time interrupt may occur between any two machine-language instructions of your mainline code.

btuhwh

SUBROUTINE NAME

btuhwh -- enable hardware handshaking using RTS/CTS

SYNOPSIS

```
err=btuhwh(chan,inpcut);
int err;              zero means OK
int chan;             channel number
char inpcut;          input buffer byte count cutoff point
                         (or 0 to disable handshaking)
```

DESCRIPTION

By default, hardware handshaking is disabled, so that the cables you use to connect serial ports to modems or terminals can be as simple as possible (ground, receive, transmit, carrier-detect, and data-terminal-ready). However with today's high-speed modems, hardware flow may be necessary for your system. The btuhwh() function, when called with a nonzero "inpcut" parameter has two effects:

1. A high-to-low transition on the CTS (clear-to-send) input signal will inhibit transmission of output data until CTS goes high again.

2. The "RTS" (request-to-send) output signal will be asserted only when there are less than "inpcut" bytes waiting in the channel's input buffer. NOTE: this use of RTS is not compatible with RS232-C, but is in compliance with the current de facto standard of several hardware manufacturers. The function of this output signal is better described as "ready to receive".

These features allow effortless (non-software) throttling of data flow in both directions. Calling btuhwh() with inpcut equal to zero restores the default condition: CTS is ignored, and RTS is always active.

RETURNS

-10 channel is not defined (see btudef(), page 82)
-11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0 all is well

btuhwh

CAUTIONS

The sensing of the falling edge of CTS means that if CTS is always inactive, then there is no throttling of the outgoing data.

SUBROUTINE NAME

btuibw -- Input Bytes Waiting: report the number of bytes received and waiting in the input buffer

SYNOPSIS

```
inpbcw=btuibw(chan);
int inpbcw;            input bytes waiting, or error code
int chan;              channel number
```

DESCRIPTION

This routine simply returns the count of bytes currently present in the channel's input data buffer. This can be used to keep track of a block-oriented input process, or to detect user keystrokes without removing them from the input buffer.

The total capacity of the input buffer is:

Total capacity = isiz - 1

where isiz is the value of the "isiz" parameter passed to btusiz() (page 149) or btulsz() (page 116). Therefore the current capacity of the input buffer is:

Current capacity = isiz - 1 - btuibw(chan)

RETURNS

- -10 channel is not defined (see btudef(), page 82)
- -11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
- 0 the channel number is OK, but that channel's input buffer is empty
- N>0 this is the number of bytes waiting in the channel's input buffer

btuica

SUBROUTINE NAME

btuica -- input from a channel: reading in whatever bytes are available, up to a limit

SYNOPSIS

```
nbytes=btuica(chan,inbuff,siz);
int nbytes;              bytes transferred (negative if error)
int chan;                channel number
char *inbuff;            pointer to buffer for input bytes
int siz;                 maximum number of bytes to get
```

DESCRIPTION

This routine copies whatever bytes have been received so far into a location you specify with the inbuff and siz paramters. The siz parameter specifies the maximum number of bytes that btuica() will put at inbuff. If more are available, they'll be left in the input buffer.

The key difference between this routine and btuict() is that btuict() always takes a prearranged number of bytes from the input buffer (prearranged by btutrg(), page 167) or it will take none at all. btuica() always reads in as many as possible, up to the siz limit.

This is the preferred method for binary input. Your application should use it to processes incoming data as a stream of bytes.

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	the channel number is OK, but that channel's input buffer is empty
N>0	this is the number of bytes actually moved from the channel's input buffer to inbuff

SUBROUTINE NAME

btuict -- input from a channel: by the byte count prearranged with btutrg()

SYNOPSIS

```
nbytes=btuict(chan,inbuff);
int nbytes;       bytes transferred (negative if error)
int chan;         channel number
char *inbuff;     pointer to buffer for input bytes
```

DESCRIPTION

Only use btuict() when you have already prepared for the binary input method by calling btutrg() with nbyt > 0 (see pages 167 and 17). Use btuinp() instead (page 108) for the ASCII input method.

The routine discussed here, btuict(), checks to see if at least "nbyt" (the trigger number) bytes have been received in the input data buffer, and if so, transfers them to your buffer whose starting address you have supplied in the "inbuff" parameter. This data is flushed from the input buffer.

If not enough bytes have been received, btuict() transfers as many as it can, and does not flush any of them from the input buffer. In this case, the global variable "ictact" can be used to find out how many bytes were transferred (see page 29).

The key differences between this routine and btuinp() are:

1. btuict() reads in a predefined count of characters (prespecified by btutrg()), whereas btuinp() reads in a variable number of characters, ending in <CR>.

2. The characters returned by btuict() are arbitrary binary data, so they may include embedded zeros, or any other 8-bit value.

3. btuict() does not terminate the returned buffer contents with a zero byte, as btuinp() does.

4. btuict() performs no translation or special handling of the bytes it receives. See page 17 for more discussion on the ASCII versus binary input methods.

btuict

5. btuict() sets the global variable "ictact", indicating number of bytes transferred.

RETURNS

The return value of the function:

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
-2	insufficient bytes available in input buffer
N>0	length of returned input block (will be the same as the "nbyt" value passed to btutrg() when nbyt > 0, page 167)

The sequence of bytes at address inbuff:

the input block (the length of which you have already specified by calling btutrg()). This string is not 0-terminated (as is the output of btuinp()).

CAUTIONS

Normally, you should call this routine only after btusts() has returned a status of 4 (BYTE-COUNT-TRIGGERED INPUT DATA AVAILABLE, page 154) for the channel.

Do not call btuict() when in the ASCII input mode.

SUBROUTINE NAME

btuinj -- "inject" a status code into a channel

SYNOPSIS

```
err=btuinj(chan,status);
int err;             zero means OK
int chan;            channel number
char status;         status to be injected
```

DESCRIPTION

This routine simulates a status condition for a given channel. Each channel has a status "queue" that can accumulate multiple status codes if necessary. Those status codes are accessed by the main program one at a time using the btusts() routine (page 153). In some cases, it is handy to be able to put status codes directly into that queue. Then btusts() will return that code (after it returns any others that may be pending).

Status codes 200-249 are nominally reserved for you to define for special application-specific purposes and insert in the status stream using btuinj().

RETURNS

```
-10  channel is not defined (see btudef(), page 82)
-11  channel number is out of range (see btusiz() or
     btulsz(), pages 149, 116)
  0  all is well
```

btuinp

SUBROUTINE NAME

btuinp -- input from channel (ASCIIZ string)

SYNOPSIS

```
len=btuinp(chan,inbuff);
int len;         returned string length or error code
int chan;        channel number
char *inbuff;    pointer to buffer for input string (the
                 line terminator is replaced with a 0-byte
```

DESCRIPTION

btuinp() transfers a complete input data line into your buffer. This routine should normally be called only when btusts() returns a status of 3 (CR-TERMINATED INPUT DATA STRING AVAILABLE). When you call btuinp() after a status 3 has been detected, then the received line is copied into your buffer (inbuff) and removed from the channel's input buffer. The carriage return that terminated the input line is replaced with a single byte of 0 value in your buffer. In this case the "len" return of btuinp() will always be non-negative, giving the actual number of characters transferred (not counting the terminating zero byte).

If btuinp() is called when btusts() has NOT returned a status of 3 for this channel, then the "len" return code will probably equal -1, indicating that no CR-terminated data string exists in the buffer. If this happens, whatever characters were available are copied into your buffer anyway, and a zero is placed at the end of them. These characters are NOT flushed from the receive buffer in this case -- you will see them again once a complete line has been received.

You may use btutrm() (page 169) to change the line terminator character from ASCII <CR> to some other character.

RETURNS

The function's return value (the variable "len", above):

-10	channel was never defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
-1	a complete input line is not yet available (no <CR> yet)
N>=0	the length of the returned string (not including line terminator nor 0-terminator)

The character string (address "inbuff" in synopsis):

The input line entered by this user on this channel (not including the line terminator, but terminated instead by a 0-byte), is stored in the character array pointed to by the parameter "inbuff".

CAUTIONS

Unless you are doing something unusual, you should only call this routine after btusts() returns a status of 3.

Be sure that the memory area addressed by inbuff is big enough to contain the maximum size string anticipated (including the terminating zero). btumil() (page 121) will set a limit on the input length, but to be safe, you should probably expect up to the size of the input buffer ("isiz", as specified in btusiz() or btulsz()).

btuirp

SUBROUTINE NAME

btuirp -- define alternate GSBL timing source
using COM1/2/3/4

SYNOPSIS

```
err=btuirp(comno);
int err;                zero means OK
int comno;              0=use real-time interrupt (8253)
                        1=use COM1:  03F8, interrupt 4
                        2=use COM2:  02F8, interrupt 3
                        3=use COM3:  03E8, interrupt 4
                        4=use COM4:  02E8, interrupt 3
```

DESCRIPTION

The GSBL is based on timed polling of all ports. Normally the system timer interrupt is intercepted and then it's rate is multiplied by a factor sufficient to catch all characters at the highest baud rate.

The btuirp() routine specifies an MS-DOS asynchronous communication port, or COM port, to use as an alternate timing source. The port's baud rate and transmit interrupt are configured to provide a regular interrupt for polling all ports.

This may be helpful in operating systems or MS-DOS-like environments in which the 8253 timing device is not available.

RETURNS

-17	comno is not 0/1/2/3/4, or COM port specified is not available
0	all is well

CAUTIONS

You must only call btuirp() once, immediately following the call to btuitz(), and coming before any other calls to GSBL routines that also follow btuitz().

The COM port interrupts 3 and 4 are probably at a lower priority in your system than the interrupt 0 generated by the 8253 timer. This may mean that btuirp(1-4) will increase jitter and increase the possibility of missed incoming characters.

SUBROUTINE NAME

btuitm -- initialize the Software Breakthrough for use in a multi-tasking environment

SYNOPSIS

```
err=btuitm(region);
int err;              0 is OK
char *region;         ptr to memory region (size indicated
                      by btusiz() or btulsz())
```

DESCRIPTION

This alternative to btuitz() is used to initialize the GSBL in a multi-tasking environment, such as Windows or OS/2. The main differences between btuitm() and btuitz() are:

1. btuitz() will hook the GSBL into the timer interrupt IRQ0 (CPU interrupt 08). At each timed interrupt, all channels will be serviced.

2. btuitm() does not hook into the timer interrupt. Instead, it's left up to you to call btuhit() (page 98) to explicitly designate which of several interupts to hook into, IRQ2 to IRQ7 (CPU interrupts 0A through 0F hexadecimal).

RETURNS

0	all is well
-16	region pointer parameter is NULL (all zeros)
-15	memory allocation error
-19	protected mode memory tiling failed

CAUTIONS

See starting on page 112 for the descriptions and cautions associated with btuitz().

btuitz

SUBROUTINE NAME

btuitz -- initialize the Software Breakthrough

SYNOPSIS

```
err=btuitz(region);
int err;                0 is OK
char *region;           ptr to memory region (size indicated
                        by btusiz() or btulsz()) (if using
                        PBRKTHU.LIB, see caution below)
```

DESCRIPTION

This routine initializes the Software Breakthrough package. btuitz() must be called after either btusiz() or btulsz(), and before any other routine in the Software Breakthrough library. See line 7 of the example program on page 196 for an example of using btuitz(). The "region" parameter must be a pointer to a memory region set aside for Software Breakthrough's exclusive use. The size of this region, in bytes, must be equal to the value returned by either btusiz() or btulsz(), whichever was previously called. Use btusiz() if the size of memory you will need is less than 64K bytes. Use btulsz() if more, or if you are not sure.

If you are using the PBRKTHU.LIB version of the GSBL then btuitz() will attempt to "tile" the dynamic memory region into nchan+1 segments of equal length, with consecutive selectors. btuitz() will call the services for doing this. The pointer passed to btuitz() must point to a region capable of being tiled, namely it must have an offset of 0. Here is an example of how you could call btuitz() in the PBRKTHRU.LIB flavor of the GSBL:

```
long nbytes;
char *region;
union REGS regs;

nbytes=btulsz(64,256,4096);
regs.x.ax=0xE800;
regs.x.cx=nbytes>>16;
regs.x.dx=nbytes&0xFFFF;
int86(0x21,&regs,&regs);
region=(char *)(((long)regs.x.ax)<<16);
btuitz(region);
```

RETURNS

0	all is well
-16	region pointer parameter is NULL (all zeros)
-15	memory allocation error
-19	protected mode memory tiling failed

CAUTIONS

This routine assumes that no errors had been reported by btusiz() or btulsz() (whichever you used), -- in particular, that btusiz() or btulsz() (pages 149,116) had not returned an error code and that your dynamic memory allocator, if any, was able to allocate a block of the requested size.

This routine must be called exactly once at the beginning of execution. The routine btuend() must be called before btuitz() can be called again.

If using protected mode, the "region" pointer passed to btuitz() must have an offset portion of 0 and be based upon a selector capable of being "tiled" by the GSBL using operating system calls.

btulfd

SUBROUTINE NAME

btulfd -- set linefeed character (what follows every carriage return)

SYNOPSIS

```
err=btulfd(chan,lfchar);
int err;                 zero means OK
int chan;                channel number
char lfchar;        > 0  character to output after each
                         carriage return (defaults to 10,
                         the ASCII linefeed character)
                    = 0  disabled
```

DESCRIPTION

This routine enables automatic generation of linefeeds after carriage returns during the ASCII output mode (page 19).

There is a lack of standardization in communications today regarding whether a "carriage return" also implies advancing to the next line or not. On some terminals, displaying a CR (ASCII code 13) causes the cursor to merely return to column 1 of the current line, while on others, it also moves the cursor down the screen one line, or scrolls the screen, or advances the paper as the case may be.

The default upon channel initialization or reset is to assume the former: that is, that an explicit LF byte (ASCII code 10) is necessary following each CR in order to move on to the next line. However, this will cause lines to appear double-spaced under some conditions. You can eliminate the LF, or replace it with some other ASCII code, using the btulfd() routine.

The btulfd()-defined linefeed character also has a minor effect in ASCII input mode: after a carriage return (defined by btutrm()) is echoed, the linefeed character is also echoed.

RETURNS

```
-10  channel is not defined (see btudef(), page 82)
-11  channel number is out of range (see btusiz() or
     btulsz(), pages 149, 116)
  0  all is well
```

btulok

SUBROUTINE NAME

btulok -- set input lockout on/off

SYNOPSIS

```
err=btulok(chan,onoff);
int err;              zero means OK
int chan;             channel number
int onoff;            1 = lockout, 0 = remove lockout
```

DESCRIPTION

Allows a channel's input to be locked out. You might use this in a "deaf good-bye" scheme. This is a log-off sequence in which you do not want the user to be able to throttle output (via XOFF, ref btuxnf(), page 192), or to issue further commands, during the output of a final message.

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	all is well

btulsz

SUBROUTINE NAME

btulsz -- Size of dynamic memory needed (long version, used when more than 64K bytes are needed)

SYNOPSIS

```
lsiz=btulsz(nchan,isiz,osiz);
long lsiz;              total size needed, in bytes
int nchan;              number of channels to allow for
int isiz;               input data buffer size per channel
int osiz;               output data buffer size per channel
```

DESCRIPTION

Calculates the size of the memory region needed by the Software Breakthrough package. Either this routine or btusiz() must be called prior to calling btuitz() to initialize the system.

The input and output data buffer sizes specified must be integral powers of two (128, 256, 512, 1024, etc). The actual number of bytes that each buffer can hold will be 1 less than the size you specify. For example, if you specify an input data buffer size of 128, then blocks of up to 127 characters at a time may be input without overflowing.

This routine specifies the total number of channels you will support, and the sizes of the input and output buffers associated with each channel. This can be done in two ways:

1. If the language you are using supports dynamic memory allocation (this is usually called a "heap" or a "pool"), you can simply pass the return value of btusiz() or btulsz() to your allocator, specifying the number of bytes you want to allocate. This is the preferred method.

2. If you have no capability for dynamic memory allocation, and you must allocate all your data structures before your program runs, this is what you can do: write a separate little test program to call btusiz() or btulsz() with the appropriate parameters and simply print out the result. This is the number of bytes that the Software Breakthrough will need. Then create a fixed-length array of this size in the main program (the one that will be actually doing the communications). If you do this, you STILL must call btusiz() or btulsz() in your main program just before you call btuitz().

In either event, the address of a memory region this many bytes long must be passed to btuitz().

RETURNS

N >= 0L	This is the size, in bytes, of the memory region needed by the Software Breakthrough
-1L	Error: one of the buffer size parameters is not an integral power of two

CAUTIONS

Even when using method 2 above, either btusiz() or btulsz() must be called before calling btuitz(). There is no other way to inform the Software Breakthrough of the total number of channels and of their buffer sizes.

Method 1 is preferred over method 2. Under method 2, the size test procedure must be redone every time you receive an update to the Software Breakthrough, while relinking is all that is required under method 1. You will use Method 2 only when you require static memory (that is, when you cannot use dynamically allocated memory).

LAN

On LAN channels, input buffers and output buffers should usually be of sufficient size to accommodate full packet contents (546 bytes for IPX channels, 534 bytes for SPX channels). If either buffer is smaller than a full packet, then even SPX channels cannot necessarily be guaranteed against data loss (unless you are sure that the main program won't require it).

btulsz

Be sure to declare btulsz() as a function returning a long (32-bit) integer in one of the variable declaration sections of your C-language calling program, for example:

```
main()
{
     int i,j,k;
     char *farmalloc();
     long btulsz();

     btuitz(farmalloc(btulsz(64,1024,2048)));
     :
     :
     btuend();
}
```

Note: farmalloc() is a library routine of Borland's Turbo C compiler. You will need a memory allocation routine, like this one, that accepts a long-integer parameter.

SUBROUTINE NAME

btumds -- get next displayed character from the monitored channel (as specified by btumon(), see page 125)

SYNOPSIS

```
dspchr=btumds();
int dspchr;           character that was output or
                      echoed (0 if there aren't any)
```

DESCRIPTION

Returns the next buffered output character from the monitored channel, or returns 0 if the display monitor buffer is empty. Use btumon() (page 125) to select the monitored channel.

RETURNS

0	the monitor-output buffer is empty
dspchr > 0	the next character from the monitor-output buffer

CAUTIONS

When you are monitoring a channel, be sure to call this routine often enough that the monitor-output buffer will not overflow (it can hold up to 2047 characters). Also, when you do get around to calling this routine, we recommend that you call it repeatedly until it returns 0, to flush out its buffer.

btumds2

SUBROUTINE NAME

btumds2 -- get next displayed character from the monitored channel (as specified by btumon2(), see page 127)

This function is a clone of btumds(), for emulating a second channel.

SYNOPSIS

```
dspchr=btumds2();
int dspchr;              character that was output or
                         echoed (0 if there aren't any)
```

DESCRIPTION

Returns the next buffered output character from the monitored channel, or returns 0 if the display monitor buffer is empty. Use btumon2() (page 127) to select the monitored channel.

RETURNS

0	the monitor-output buffer is empty
N>0	the next character from the monitor-output buffer

CAUTIONS

When you are monitoring a channel, be sure to call this routine often enough that the monitor-output buffer will not overflow (it can hold up to 2047 characters). Also, when you do get around to calling this routine, we recommend that you call it repeatedly until it returns 0, to flush out its buffer.

btumil

SUBROUTINE NAME

btumil -- set maximum input line length
set input word wrap on/off

SYNOPSIS

```
err=btumil(chan,maxinl);
int err;          zero means OK
int chan;         channel number
int maxinl;
    if > 0  then input word wrap is disabled and "maxinl"
            is the maximum input line length
    if = 0  then input word wrap is disabled and there is
            no limit to the length of an input line (see
            status 251, page 164).
    if < 0  then input word wrap is enabled and
            abs(maxinl) is the maximum input line length.
```

DESCRIPTION

This routine may be used to restrict each line of input data to a specified field width. If a user should attempt to type more than the limit of characters on a single line, then characters after the limit will neither be stored in the input buffer, nor echoed back to the user (but status 251's will be generated).

In interactive applications, you often want to restrict the length of a user's input line -- maybe you only have 15 characters in which to store his name. Rather than accept data that is too lengthy, and truncate it after the user has hit RETURN, it is nicer for the user to "feel" the restriction while he is typing. Then he can backspace and retype some kind of abbreviation.

This routine also selects the input word wrap feature. To turn it on, make maxinl the negative of the screen width. For example, if maxinl is -79, then a user with an 80-column wide screen may type electronic mail without worrying about the right margin. Note: the last column should never actually be used, to prevent the display device from auto-scrolling. For example, if maxinl = -79, then word wrapping kicks in upon typing the 80th character of the line -- so that each line can be no longer than 79 characters.

btumil

RETURNS

```
-10  channel is not defined (see btudef(), page 82)
-11  channel number is out of range (see btusiz() or
     btulsz(), pages 149, 116)
  0  all is well
```

btumks

SUBROUTINE NAME

btumks -- simulate a keystroke on the monitored channel (as specified by btumon(), see page 125)

SYNOPSIS

```
btumks(kyschr);
char kyschr;          simulated-input character
```

DESCRIPTION

Simulates a keystroke on the user's terminal. The "kyschr" character is placed into the receive buffer just as if it had been received from the channel. This can be used to "parallel" the system operator's keyboard with that of the monitored user.

RETURNS

None.

CAUTIONS

Use of key macros or other means of rapidly issuing large blocks of keystrokes should be avoided with this routine, since the input-keystroke buffer can hold only 15 entries.

This routine has no effect if btumon() (page 125) has not been called, or if it was last called with a parameter of -1.

btumks2

SUBROUTINE NAME

btumks2 -- simulate a keystroke on the monitored channel (as specified by btumon2(), see page 127)

This function is a clone of btumks(), for emulating a second channel.

SYNOPSIS

```
btumks2(kyschr);
char kyschr;          simulated-input character
```

DESCRIPTION

Simulates a keystroke on the user's terminal. The "kyschr" character is placed into the receive buffer just as if it had been received from the channel. This can be used to "parallel" the system operator's keyboard with that of the monitored user.

RETURNS

None.

CAUTIONS

Use of key macros or other means of rapidly issuing large blocks of keystrokes should be avoided with this routine, since the input-keystroke buffer can hold only 15 entries.

This routine has no effect if btumon2() (page 127) has not been called, or if it was last called with a parameter of -1.

SUBROUTINE NAME

btumon -- start/stop monitoring a channel

SYNOPSIS

```
err=btumon(chan);
int err;             zero means OK
int chan;            channel number
                     (-1 to disable monitoring)
```

DESCRIPTION

btumon() sets up a specific channel for "monitoring", which means that each character transmitted to the channel can be obtained by calling btumds(), and you can simulate input from the channel by calling btumks(). The monitoring capability can be turned off by passing -1 to btumon().

The three routines btumon(), btumds(), and btumks() are designed for use in providing the ability to "tune in to" any desired online channel from some sort of "master console". When monitoring a given channel, the system operator can see everything the user of that channel is seeing: each keystroke echoed, and each block of output text. Also, the system operator's keyboard can be placed "in parallel" with that user's keyboard, in the sense that anything typed on the system operator's keyboard is processed exactly as though it had come from the monitored user's keyboard -- it even echoes to both displays.

There are two uses for the channel monitoring feature:

1. When a user is on the channel: to "look over a user's shoulder" and see what he is doing, maybe even help him along a little, by typing for him.

2. When no user is on the channel: for the system console operator to act as a user himself, as if he had dialed up the system with a modem and a terminal. This is called local emulation. This method can be used only on a channel with no actual modem hardware.

btumon

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	all is well

SUBROUTINE NAME

btumon2 -- start/stop monitoring a channel

This function is a clone of btumon(), for emulating a second channel.

SYNOPSIS

err=btumon2(chan);	
int err;	zero means OK
int chan;	channel number (must be a non-hardware channel), or -1 to disable monitoring

DESCRIPTION

btumon2() sets up a specific channel for "monitoring", which means that each character transmitted to the channel can be obtained by calling btumds2(), and you can simulate input from the channel by calling btumks2(). The monitoring capability can be turned off by passing -1 to btumon2().

The three routines btumon2(), btumds2(), and btumks2() are designed for use in providing the ability to "tune in to" a non-hardware channel from some sort of "master console".

The only use for channel monitoring with btumon2() is when the channel is a non-hardware channel, for the console operator to act as a user himself, as if he had dialed up the system with a modem and a terminal. This is called local emulation. This method can be used only on a channel with no actual modem hardware.

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	all is well

btumxs

SUBROUTINE NAME

btumxs -- Set maximum data speed

SYNOPSIS

```
err=btumxs(bdrate);
int err;               error return:  0=OK, -3=rate no good
unsigned bdrate;       baud rate (bits per second)
                       Default=2400  min=300  max=38400
```

DESCRIPTION

This routine specifies the maximum data rate (in bits per second) of all channels on your system.

This directly affects the rate at which all channels are serviced. The byte rate is derived from the baud rate (bdrate) that you specify with btumxs():

bytes per second = bdrate / 10

A 21% margin is added to this rate to get the channel service rate:

service rate = bytes per second X 1.21

For example, with the default "bdrate" of 2400 baud, data is expected for receiving and transmitting at 240 bytes per second. Therefore each channel is serviced about 290 times a second.

This parameter also affects the service rate of channels that are monitored using btumds() and btumds2() (pages 119 and 120), even if no hardware is connected to this channel (see use #2 on page 125). For example, using The Major BBS by Galacticomm, when you emulate a non-hardware channel (one that appears as "-------" in the user matrix on the console), the display rate is controlled by the bdrate parameter of btumxs(). For this reason, you may want to set the service rate higher than that required by your hardware -- so that your emulated screen is updated faster.

Using 16550 FIFOs

When you use 16550 UARTS, you may be able to set the btumxs() rate even slower than the maximum baud rate. That's because the 16550 UARTS have hardware

FIFOs in them and don't need to be polled as often. This can save your computer a lot of processing overhead, because it doesn't have to poll your channels as rapidly.

To take advantage of this, you need to distinguish ports with 16550 UARTs from those with standard 8250 UARTs. The btuffo() routine (see page 92) returns 0 for 16550 ports, and -18 for 8250 or 16450 ports. (It also returns 0 for XECOM or any other non-8250 based port.)

So, to figure the bdrate parameter for btumxs(), compute the maximum of all of the polling rates that are required for all the channel. The polling rate required for each channel is:

- o 16550 channel: the baud rate / 4
- o Non-16550 channel: the baud rate

Here are some examples:

```
 8250 port at 2400 bps   btuffo(chan,1) == 0
16550 port at 4800 bps   btuffo(chan,1) == 1
btumxs(2400)

 8250 port at 2400 bps   btuffo(chan,1) == 0
16550 port at 9600 bps   btuffo(chan,1) == 1
16550 port at 19200 bps  btuffo(chan,1) == 1
btumxs(4800)
```

RETURNS

- 0 the maximum data speed has been set
- -3 bad baud rate: the bdrate parameter was not a number between 300 and 38400

CAUTIONS

If you make the bdrate parameter smaller than the baud rate of the fastest channel on your system, you may lose received characters and you may be transmitting at less than capacity.

If you make the bdrate parameter larger than the baud rate of the fastest channel on your system, you will be wasting CPU time servicing channels more often than they require.

btuoba

SUBROUTINE NAME

btuoba -- Output Bytes Available: report the amount of space (number of bytes) available in the output buffer

SYNOPSIS

```
outbca=btuoba(chan);
int outbca;           output buffer size, or error code
int chan;             channel number
```

DESCRIPTION

This routine simply returns the size of the vacant portion of the output data buffer for the specified channel. It is intended for use in two ways (although you may find others):

1. You can find out whether or not an output message will fit in the space available, thereby avoiding a status of 253 (DATA OUTPUT CIRCULAR BUFFER OVERFLOW), and allowing your program to take remedial action (such as outputting a beep string to let the user know that an output block has been lost).

2. You can find out when the buffer is empty, if that makes a difference to you in some situation (such as for performance monitoring, in which you might want to get some feel for the fraction of online time spent outputting). The output buffer is empty when btuoba() returns a value of osiz-1, where "osiz" is the size of the output buffer specified in the original call to btusiz() (page 149) or btulsz() (page 116).

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	the channel number is OK but that channel's output buffer is full
N>0	the number of bytes available in the channel's output buffer

btuoes

SUBROUTINE NAME

btuoes -- enable/disable Output-Empty status codes

SYNOPSIS

```
err=btuoes(chan,onoff);
int err;              zero means OK
int chan;             channel number
int onoff;            1 = generate a single status 5 when
                          the output buffer becomes empty
                      0 = don't generate status 5's
```

DESCRIPTION

You may wish to be notified when the data output buffer goes empty on a channel, such as with certain block-oriented protocols like **XMODEM**. By default, no status 5 (see page 155) is generated. This routine turns the generation of this status on or off.

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	all is well

CAUTIONS

If the output buffer on the channel is already empty when this routine is called, no status 5 is generated. The test for generation of status 5 only occurs as the channel transitions from the not-empty state to the empty state.

btuolk

SUBROUTINE NAME

btuolk -- set output pausing on/off

SYNOPSIS

```
err=btuolk(chan,onoff);
int err;                zero means OK
int chan;               channel number
int onoff;              1 = pause, 0 = resume, pause off
```

DESCRIPTION

This routine pauses a channel's output until the pause is turned off by btuolk(). You might use this in some scheme to throttle output. For example, to implement a file transfer protocol that uses XON/XOFF in binary mode, your mainline program will need to process these characters and pause or resume output.

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	all is well

SUBROUTINE NAME

btupbc -- set screen-pause character
(pauses screen when in output stream)

SYNOPSIS

```
err=btupbc(chan,pausch);
int err;              zero means OK
int chan;             channel number
char pausch;          pause character (0 to disable)
```

DESCRIPTION

When the pausch character is transmitted to the user in ASCII output mode, output pauses and the channel goes into the screen-pause mode (page 99). Clear screen characters (ASCII formfeed and ANSI Esc-[-2-J) are automatically preceded by the pause character when btuxmt() stuffs them into the output buffer. The Major BBS uses Control-T for the pause character.

Characters received during the screen-pause mode are handled by a routine identified by btuhpk(). That routine specifies how to get out of screen-pause mode.

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	all is well

btupmt

SUBROUTINE NAME

btupmt -- set prompt character

SYNOPSIS

```
err=btupmt(chan,pmchar);
int err;            zero means OK
int chan;           channel number
char pmchar;        prompt character (0 to disable)
```

DESCRIPTION

This routine selects automatic prompting of the user with a single character. In this example, ">" is the prompt character, and the user's keystrokes are shown in **boldface**:

System ready
>**WHAT TIME IS IT?**
Oh, about half past eight
>**Download the marketing report.**
OK, the marketing report will be downloaded
when you log off. (Type "NOW" to do it now.)
>

Even when enabled, prompting is only active during the ASCII output mode (page 19) -- that is, when using btuxmt() to transmit (page 189).

The prompt character is automatically sent each time a transition is made from an outputting state to an inputting state. To disable this feature (the default condition), call btupmt() with a "pmchar" value of 0.

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	all is well

SUBROUTINE NAME

bturep -- report channel statistics

SYNOPSIS

```
value=bturep(chan,statid);
long value;           value of the statistic
int chan;             channel number
char statid;          0 - count of characters (LAN, X.25)
                      1 - count of packets (LAN, X.25)
                      2 - count of overruns (8250)
                      3 - count of parity errors (8250)
                      4 - count of framing errors (8250)
```

DESCRIPTION

These statistical values are set to zero by bturst() (page 136), or to any value by btuset() (page 147).

LAN **X.25**

The output of this function is only defined for X.25 and LAN channels when statid is 0 or 1.

A count of characters and packets that have been transferred in both direction since channel reset is reported.

UART

The output of this function is only defined for 8250-type UART channels when statid is 2-4. This function reports a running count of overrun, framing and parity errors in the UART of the channel.

Overrun errors in non-16550-FIFO mode can mean one or more characters lost per error. In 16550 mode (page 92), up to 16 characters or more can be lost per overrun error.

Framing errors usually mean baud-rate incompatibility or line noise. Technically they result from the lack of a high (mark) state when a stop bit was expected.

RETURNS

bturep() returns the current long integer value of the statistic.

bturst

SUBROUTINE NAME

bturst -- reset a channel

SYNOPSIS

```
err=bturst(chan);
int err;          0 = OK (XECOM hardware)
                  1 = OK (HAYES or UART hardware)
                  2 = OK (X.25 hardware)
                  3 = OK (LAN hardware)
                  less than zero means error (see page 139)
int chan;         channel number
```

DESCRIPTION

bturst() completely resets a channel, in both hardware and software, to its initial default conditions. This is also the recommended method for "hanging up", since the default condition of the switch hook is on-hook (disconnected).

Note: when btudef() (page 82) is used to define a channel or group of channels, the bturst() reset operation is automatically performed on these channels.

HAYES

We recommend that as part of resetting any channel with HAYES category hardware, including the Galacticomm Model 2408 card, you issue the following sequence of instructions, selecting certain non-default options on which our interface scheme depends:

```
bturst(chan);
btulok(chan,1);
btuoes(chan,1);
btuech(chan,0);
btubrt(chan,2400);
btuxmt(chan,"ATE0S0=1S2=1&C1&D2\r");
btucli(chan);
```

. . . *wait for status 5 from this channel* . . .

```
btulok(chan,0);
btuoes(chan,0);
```

This procedure is used in the TELCONH.C example program on page 196.

HAYES

This should also be done to every channel after it is defined (see btudef(), page 82). The rationale of each of these statements will now be explained:

bturst(chan);
Reset the channel.

btulok(chan,1);
Lock out input from the channel. This inhibits trash incoming characters from inhibiting transmission of the upcoming command string.

btuoes(chan,1);
This enables status code 5 generation when the transmit buffer goes empty. This will be used to detect when the command string completes transmission to the modem.

btuech(chan,0);
This turns off the echo in the Software Breakthrough (a different echo than that of the Hayes-compatible modem). For interactive applications, you will turn your echo on again after in incoming call has been answered.

btubrt(chan,2400);
This sets the baud rate of the UART that communicates with the modem. 2400 is the default baud rate, and if that's what you want, you can omit this statement. But if you want some other rate during communication with the modem in command mode, then set that rate here.

btuxmt(chan,"ATE0S0=1S2=1&C1&D2\r");
This command string selects various modes of the modem. "AT" is the standard prefix to all Hayes protocol commands.

- E0 Turns output echo off. Without this, the Hayes-compatible modem would echo back to us every character that we sent it. Certainly not what we want.
- S0=1 Enables auto-answer mode, so that incoming calls are automatically answered and presented with answer-carrier. You may wish to omit this setting if you have phone lines that you don't wish to answer.

bturst

HAYES

S2=1	Selects '\1' (ASCII 01, control-A) as the escape character. Per the Hayes modem control standard, transmitting the escape code three times (between 1 second pauses) results in switching from the online to the command mode. The default escape character is 43 ('+'). Since we do not want users to be able to issue the escape sequence, we make the escape character something that cannot be echoed back. Note that the default translate table (page 185) has ASCII 01's translated to 00 (ignored).
&C1	Makes the modem DCD output indicate the presence of data carrier.
&D2	Makes the modem DTR input reset the modem.
\r	This is the C-language notation for a carriage return.

The &C1 and &D2 commands may not be desirable or necessary on certain hardware. See your modem manual for details.

btucli(chan);

This instruction discards any trash input characters that may have been received up to this point.

. . . wait for status 5 from this channel . . .

To continue the reset procedure, we must wait for the status code 5 that indicates that the UART on this channel has completely transmitted the command sequence to the modem. In a multi-user program, remember that other channels may require servicing in this interval. You must structure your code such that all other channels will continue to be serviced, and when this status 5 does come in, the reset procedure will continue. The program on page 196 does this.

btulok(chan,0);

Remove input lockout.

btuoes(chan,0);

Turn off status code 5 generation

RETURNS

-10 channel is not defined (see btudef(), page 82), or no UART has been detected at the I/O address where it was defined. If you have purchased the N-channel version of the Software Breakthrough, then you may only use channels 0 through N-1 to talk to real hardware. If you attempt to reset channel N or higher, then you will get this error return code. You may still use these channels for local emulation (page 125), however.

-11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)

XECOM

0 means that a functional XECOM category modem has been detected on this channel

HAYES **UART**

1 means that functional HAYES or UART category hardware has been detected on this channel

X.25

2 means that functional X.25 driver and PC XNet hardware have been detected on this channel

LAN

3 means that a functional LAN interface has been detected on this channel

CAUTIONS

LAN

bturst() should always be called for each LAN channel just before you call btuend(). This ensures that SPX connections are completely aborted.

bturti

SUBROUTINE NAME

bturti -- define routine to be called in real-time

SYNOPSIS

```
err=bturti(hertz,rtirou);
int err;                 zero means OK
int hertz;               number of rti's per second
int (*rtirou)();         pointer to function to be called
```

DESCRIPTION

This routine arranges for one single specified subroutine to be called a specified number of times per second. The call takes place "at interrupt level", i.e. once your program arranges for this by calling bturti(), you do not need to perform any periodic maintenance, and the timing of the calls will not be affected by other system activity such as disk I/O or lengthy mainline computation loops.

RETURNS

-6 too many rti calls per second (hertz is too large)
 0 all is well

CAUTIONS

The "hertz" parameter may not exceed 0.12 times the maximum baud rate specified by the btumxs() routine (page 128), or 288 if btumxs() has not been called.

The time between rti's is quantized into discrete units equal to 0.12 times the btumxs()-specified maximum baud rate. So, as the specified rti rate approaches this maximum, the variation in intervals between calls to the "rtirou" routine can be as much as 100%. The *average* rate per second will be much more accurate, however (closer than 0.1%).

See also page 51 for cautions relating to interrupt-called functions. Design of the "rtirou" routine is fraught with pitfalls. Don't design lengthy complex code to run at interrupt level. Don't invoke DOS (because it is not reentrant). You may use the special chixxx() routines (page 47), but not any other Breakthrough Library routines. Beware of data "skewing", since a real-time interrupt may occur between any two machine-language instructions of your mainline code.

SUBROUTINE NAME

btuscn -- scan for channels in need of service (those with nonzero status)

SYNOPSIS

```
chan=btuscn();
int chan;          channel number (0 to nchan-1)
                   or -1, if no channels require service
```

DESCRIPTION

Scans all defined channels, searching for one with a nonzero status. If it finds one, the number of that channel is returned. This number will be between 0 and nchan-1, where "nchan" is the total number of channels allocated in btusiz() (page 149) or btulsz() (page 116). If no channels require service, -1 is returned, indicating that the status queues of all channels are empty.

Note: when btuscn() reports that a channel requires service, subsequent calls to btuscn() will resume scanning with the channel immediately following, so that all channels have the same priority.

This routine will most likely be the focal point of the main program. The main loop will repeatedly call btuscn() to find out "what to do next" -- that is, which channel needs servicing. You could do the same thing with repeated calls to btusts(), but btuscn() is far more time-efficient. Also, btuscn() gives equal priority to all channels.

LAN **X.25**

The btuscn() function has added purpose on LAN and X.25 channels, including:

- o Scan all channels for incoming packets, and process
- o Scan all channels with output data for the opportunity to transmit packets

The standard functions of btuscn() apply to all channels: to look for the next channel with a status code to report.

btuscn

CAUTIONS

LAN **X.25**

On LAN and X.25 channels, *must call btuscn() regularly*. If you do not, then you will not have any input or output on your LAN and X.25 channels.

RETURNS

-1	no channels require service: they all have a status of 0
N>=0	channel number of the next channel with a nonzero status

SUBROUTINE NAME

btuscr -- set the soft-CR character (for output wordwrap)

SYNOPSIS

```
err=btuscr(chan,softcr);
int err;              zero means OK
int chan;             channel number
char softcr;          soft-CR, becomes space once wrapped
                      (0 to disable soft-CR translation)
```

DESCRIPTION

The "soft" carriage return (see the discussion of "wordwrap" under btutsw(), page 172) is an output character that gets converted into a CR or CR/LF sequence (CR/LF if you have never called btulfd()) as long as no output word wrap has taken place yet. Otherwise, it is converted into a space (ASCII code 32). It defaults to the disabled condition (softcr=0) when a channel is initialized or reset. Soft carriage returns are processed by btuxmt() during transmission -- that is, they are only active during the ASCII output mode (page 19).

Background: when output word wrap is enabled, btuxmt() keeps track of whether or not a forced wrap has occurred within the current paragraph. After it has, appearances of the soft CR character are treated exactly like spaces. Before this point, appearances of the soft CR character are treated exactly like carriage returns. See the example on page 174, where the soft carriage return is set to 10 ('\n' in C-language notation).

RETURNS

-10 channel is not defined (see btudef(), page 82)
-11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0 all is well

btusdf

SUBROUTINE NAME

btusdf -- super-define channel groups

SYNOPSES

```
err=btusdf(schan,n,chtype,...);
int err;               zero means OK (see below)
int schan;             starting channel number
int n;                 number of channels
int chtype;            channel interface type:

     0 - wildcard (auto-determine whether type 1, 2 or 3)
         (this is the same as btudef())
     1 - XECOM 120x (as on Breakthrough Model 16 or 4)
     2 - XECOM 2400 (as on Breakthrough Model 2408)
     3 - 8250-type UART/modem
     4 - X.25 packet switching network channels
     5 - Novell Netware IPX Direct circuit channels
     6 - Novell Netware IPX Virtual circuit channels
     7 - Novell Netware SPX channels

...                    the remaining parameters depend
                       on the value of chtype:
```

Format of call to btusdf()	Purpose
err=btusdf(schan,n,0,ioaddr);	same as btudef()
err=btusdf(schan,n,1,ioaddr);	Model 16/4
err=btusdf(schan,n,2,ioaddr);	Model 2408
err=btusdf(schan,n,3,ioaddr);	8250-type UART
err=btusdf(schan,n,4,card,line,slcn);	X.25 network
err=btusdf(schan,n,5,socket,necbs);	LAN IPX Direct
err=btusdf(schan,n,6,socket,necbs);	LAN IPX Virtual
err=btusdf(schan,n,7,socket,necbs);	LAN SPX

```
int ioaddr;            starting port address for the
int card;              PC XNet card number (0-7)
int line;              PC XNet line (0=25-pin 1=15-pin)
int slcn               Starting logical channel number
int socket;            local socket number, or 0=define
int necbs;             number of listen ECB's to open
```

DESCRIPTION

You can use these symbols from BRKTHU.H for the chtype parameter:

```
#define SDFANY  0   /* GSBL btusdf() argument for XECOM/UART hdw */
#define SDFX25  4   /* GSBL btusdf() argument for X.25 hardware  */
#define SDFIPXD 5   /* GSBL btusdf() argument for IPX Direct hdw */
#define SDFIPXV 6   /* GSBL btusdf() argument for IPX Virtual hdw*/
#define SDFSPX  7   /* GSBL btusdf() argument for SPX hardware   */
```

Here is how the hardware categories compare with the chtype parameter for various types of hardware:

Communications hardware	Hardware category	chtype
Breakthrough Model 4	XECOM	1
Breakthrough Model 16	XECOM	1
Breakthrough Model 2408	HAYES	2
Hayes 2400B internal modem	HAYES	3
IBM Async adapter card	UART	3
OST PC XNet card	X.25	4
Novell LAN, IPX Direct	LAN	5
Novell LAN, IPX Virtual	LAN	6
Novell LAN, SPX	LAN	7

Calling btusdf(schan,n,0,ioaddr) is exactly the same as calling btudef(schan,ioaddr,n). The GSBL will automatically figure out the channel type among the Model 4/16, Model 2408, 8250 possibilities. See page 82.

Using btusdf() with the chtype parameter value of 1, 2 or 3 will force the GSBL to treat the channel as a Model 16/4, Model 2408, 8250 UART.

LAN

For LAN channel definition, the socket number is specified in the sensible easy-to-use "lo-hi" order (it gets byte-swapped into "hi-lo" order before being handed off to Netware). See page 212 for details on socket numbering.

The "necbs" parameter defines the number of ECB's per channel to allocate for receiving packets. This parameter should probably be a minimum of 2. Maximum possible value for "necbs" is 64. Memory overhead will be about 640 bytes per ECB per channel. Setting the necbs parameter to 0 will define a non-hardware LAN channel. Every channel should have at least 2 ECBs at its disposal. You may be able to set necb to 1 if you are defining more than one channel in a group -- since all ECBs for a given socket number are shared (among all the channels that use that socket number), then theoretically every channel will have at least 2 ECBs at its disposal.

btusdf

CAUTIONS

LAN **X.25**

There is no btuudf() (un-define) for LAN or X.25 channels. Defining a LAN or X.25 channel (calling btusdf() with chtype from 4 to 7) is "permanent" and can occur only once for a given channel over the run-time life of your program.

The only way to re-define LAN or X.25 channels is by calling btuend() to shut down the entire Software Breakthrough, and starting over again with btuitz(). And since you can only run btuitz() and btuend() once per program load, this means that LAN and X.25 channels can only be defined once for the run-time life of your program.

LAN

Defining a LAN channel group of one channel with one ECB per channel will have undefined results.

RETURNS

0	all is OK
-11	channel number is out of range
-12	sequence error - overlapping channel groups

X.25

-13	X.25 interface not available (only returned when chtype is 4 and you are using GSBL without the X.25 option)

LAN

-14	LAN interface not available (only returned when chtype is 6 or 7 and you are using the GSBL without the Advanced LAN Option)

-15	Out of memory

SUBROUTINE NAME

btuset -- set and report channel statistics

SYNOPSIS

```
value=btuset(chan,statid,newval);
long value;          value of the statistic
int chan;            channel number
char statid;         0 - count of characters (LAN, X.25)
                     1 - count of packets (LAN, X.25)
                     2 - count of overruns (8250)
                     3 - count of parity errors (8250)
                     4 - count of framing errors (8250)
long newval;         new value for the statistic
```

DESCRIPTION

These statistical values are set to zero by bturst() (page 136). The value returned by btuset() is the value of the statistic immediately *before* it gets set to the new value. A common practice is to call btuset() with newval=0L and use the result to keep a separate total.

LAN **X.25**

The operation of this function is only defined for X.25 and LAN channels when statid is 0 or 1.

A count of characters and packets that have been transferred in both direction since channel reset is reported. For example, you could keep track of packet traffic with code like this:

```
long pdelta;
static long ptotal=0L;
long btuset();

pdelta=btuset(chan,1,0L);
ptotal+=pdelta;
printf("%ld packets input/output, %ld total!\n",pdelta,ptotal);
```

UART

The operation of this function is only defined for 8250-type UART channels when statid is 2-4.

This function reports a running count of overrun, framing and parity errors in the UART of the channel.

btuset

Overrun errors in non-16550-FIFO mode can mean one or more characters lost per error. In 16550 mode (page 92), up to 16 characters or more can be lost per overrun error.

Framing errors usually mean baud-rate incompatibility or line noise. Technically they result from the lack of a high (mark) state when a stop bit was expected.

RETURNS

btuset() returns the value of the statistic immediately before it gets set to the new value.

SUBROUTINE NAME

btusiz -- Size of dynamic memory needed (only if < 64K)

SYNOPSIS

```
size=btusiz(nchan,isiz,osiz);
unsigned size;          total size needed, in bytes,
                        or 65535 if too much memory needed
                        (meaning you should use btulsz())
int nchan;              number of channels to allow for
int isiz;               input data buffer size per channel
int osiz;               output data buffer size per channel
```

DESCRIPTION

btusiz() calculates the total size of the memory region required by the Galacticomm Software Breakthrough Library to manage the communication channels. The address of a region this big must be passed to btuitz() (page 112) to initialize the Software Breakthrough.

If the parameters are such that more than 65535 bytes are needed, this routine returns 65535. In this case, you should use btulsz() (page 116) instead of btusiz(), because btulsz() returns a long integer (32-bit) quantity.

The input and output data buffer sizes specified must be powers of two (128, 256, 512, 1024, etc). The actual number of bytes that each buffer can hold will be 1 less than the size you specify. For example, if you specify an input data buffer size of 128, then blocks of up to 127 characters at a time (plus terminator) may be input without overflowing.

This routine specifies the total number of channels you will support, and the sizes of the input and output buffers associated with each channel. This can be done in two ways:

1. If the language you are using supports dynamic memory allocation (this is usually called a "heap" or a "pool"), you can simply pass the return value of btusiz() or btulsz() to your allocator, specifying the number of bytes you want to allocate. This is the preferred method.

2. If you have no capability for dynamic memory allocation, and you must allocate all your data structures before your program runs, this is what you can do: write a separate little test program to call btusiz() or btulsz() with the appropriate parameters and simply print out the result. This is the number of bytes that the Software Breakthrough will need. Then create a fixed-length array of this size in the main program (the one that will be actually doing the communications). If you do this, you STILL must call btusiz() or btulsz() in your main program just before you call btuitz().

In either event, the address of a memory region this many bytes long must be passed to btuitz().

RETURNS

0 < N <= 65534	This is the size, in bytes, of the memory region needed by the Software Breakthrough
65535	Error: more than 65534 bytes are needed, or either buffer size is not a power of two

CAUTIONS

Even when using method 2 above, either btusiz() or btulsz() must be called before calling btuitz(). There is no other way to inform the Software Breakthrough of the total number of channels and their buffer sizes.

Method 1 is preferred over method 2. Under method 2, the size test procedure must be redone every time you receive an update to the Software Breakthrough, while relinking is all that is required under method 1. You will use Method 2 only when you require static memory (that is, when you cannot dynamically allocate memory).

LAN

On LAN channels, input buffers and output buffers should usually be of sufficient size to accommodate full packet contents (546 bytes for IPX channels, 534 bytes for SPX channels). If either buffer is smaller than a full packet, then even SPX channels cannot necessarily be guaranteed against data loss (unless you are sure the main program won't require it).

Status Code	ASCII rep	Description
0		QUIET, NOTHING SPECIAL TO REPORT
1		RING-INDICATE OR LOST-CARRIER (XECOM)
2		COMMAND EXECUTION COMPLETED OK (XECOM)
3		CR-TERMINATED INPUT STRING AVAILABLE
4		BYTE-COUNT-TRIGGERED INPUT DATA AVAILABLE
5		OUTPUT BUFFER EMPTY
6		OUTPUT ABORTED BY USER
7		(RESERVED FOR SCREEN-PAUSE/QUIT COMMAND)
11		LOST CARRIER (HAYES)
12		COMMAND EXECUTION COMPLETED (HAYES, UART)
13		INVALID BTUCMD() COMMAND (HAYES)
21		X.25 INCOMING CLEAR PACKET (END OF SESSION)
22		X.25 COMMAND OR PAUSE COMPLETED
23		X.25 INVALID BTUCMD() COMMAND CODE
24		X.25 INCOMING X.29 STRING
31		LAN SPX CONNECTION TERMINATED BY OTHER SIDE
32		LAN PAUSE COMMAND COMPLETED
33		LAN INVALID BTUCMD() COMMAND
34		LAN SPX INCOMING CONNECTION ESTABLISHED
35		LAN SPX OUTGOING CONNECTION ESTABLISHED
36		LAN SPX TERMINATION COMPLETE BY THIS SIDE
37		LAN RECEIVER ERROR
38		LAN RECEIVED UNKNOWN OR UNEXPECTED PACKET
39		LAN CONNECTION ERROR
40		LAN GTC INPUT MODE: LOCKED OUT
41		LAN GTC INPUT MODE: BINARY
42		LAN GTC INPUT MODE: ASCII, NO ECHO
43		LAN GTC INPUT MODE: ASCII, WITH ECHO
44		LAN GTC INPUT MODE: ASCII, W/ECHO AND WRAP
49	1	XECOM DTMF 1 SENSED
63	?	XECOM INVALID COMMAND BYTE
65	A	XECOM ABORTED COMMAND PREMATURELY
66	B	XECOM BUSY SIGNAL SENSED (OR X.25 CALL FAILED)
68	D	XECOM DIAL TONE SENSED
70	F	XECOM FAILED FOR OTHER REASONS
73	I	XECOM INAPPROPRIATE COMMAND
77	M	XECOM MODEM CARRIER (OR X.25 CALL COMPLETED)
82	R	XECOM RINGING SENSED, BUT NO ANSWER
84	T	XECOM TIMEOUT (SILENCE SENSED)
86	V	XECOM VOICE SENSED
118	v	XECOM VOICE SENSED (BY ^A COMMAND)
200 - 249		\ RESERVED FOR YOUR > SPECIAL PURPOSES / USING btuinj() or chiinj()
250		TRANSMISSION ERROR (X.25)
251		DATA INPUT CIRCULAR-BUFFER OVERFLOW
252		ECHO OUTPUT CIRCULAR-BUFFER OVERFLOW
253		DATA OUTPUT CIRCULAR-BUFFER OVERFLOW
254		STATUS INPUT CIRCULAR-BUFFER OVERFLOW
255		COMMAND OUTPUT CIRCULAR-BUFFER OVERFLOW
-10		CHANNEL NOT DEFINED
-11		CHANNEL NUMBER OUT OF RANGE

Figure 4-2: Summary of Status codes

SUBROUTINE NAME

btusts -- status of a channel

SYNOPSIS

```
status=btusts(chan);
int status;          channel status code
int chan;            channel number
```

DESCRIPTION

Several events can occur on your communication channels that need your attention: an incoming call can "ring", a user can type in his name and hit his "enter" key. In other cases, a command that you issue (see btucmd(), page 58) can be completed. You will want to respond to these and other conditions, and that is what btusts() is all about.

This routine returns the next status code from the status buffer of the specified channel. The status buffer is a "first-in-first-out" structure, which simply means that btusts() gives you the status codes in the same order in which they are generated.

Some of the status codes returned by btusts() are reporting conditions sensed by software running in the PC. Other conditions are sensed directly by the individual modem. Some status codes indicate normal, expected conditions; others indicate errors. Each status code is discussed in detail below.

Be sure to review the CAUTIONS at the end of this section on btusts() (page 166).

RETURNS

0 = QUIET, NOTHING SPECIAL TO REPORT

If you use btuscn() to scan for channels that need service, you will never see this status code. btuscn() (page 141) identifies channels that have a status code of anything BUT zero, and when none do, it returns -1.

btusts

1 = RING-INDICATE OR LOST-CARRIER (BREAK)

XECOM

The Xecom modem module XE1201 uses the same bit to indicate both incoming ring and loss of carrier. Since incoming ring can only happen when the phone is on the hook, and loss of carrier can only happen when it is off the hook, it is simply matter of context to distinguish between the two. You can always reset the channel to be sure (bturst(), page 136).

2 = COMMAND EXECUTION COMPLETED OK (XECOM)

XECOM

If the modem has not generated any status codes by the time it finishes processing a command string (see btucmd(), page 58), then this status code is generated, indicating successful completion of the command string.

3 = CR-TERMINATED INPUT STRING AVAILABLE

Indicates that a complete line of input data has been received over a channel that is in ASCII input mode (page 17). Use btuinp() (page 108) to retrieve this string.

HAYES

In the command mode HAYES category hardware can indicate several conditions by way of status 3. A subsequent call to btuinp() will retrieve a description of the condition like "BUSY" or "NO ANSWER".

X.25

See page 227 about the "RING xxx CALLING xxx" status 3 message that represents an incoming call.

4 = BYTE-COUNT-TRIGGERED INPUT DATA AVAILABLE

Indicates that the trigger count specified for this channel (see btutrg(), page 167) has been reached, and that a logical block of transparent-mode data is ready for examination via btuict() (page 105).

5 = OUTPUT BUFFER EMPTY

This status code is generated when (1) the btuoes() routine has been called to enable it (see page 131), and (2) the output data buffer makes a transition from being not empty to being empty. This might be used when your program needs to know when a block of output has been completely transmitted, before the program can proceed to some other task.

6 = OUTPUT ABORTED BY USER

This status code may be generated when the user aborts output. The btutrs() routine enables/ disables status 6 generation. The user aborts ASCII output by typing the truncate character defined by btutru().

11 = LOST CARRIER (HAYES)

HAYES

The user (or equipment) on this channel has hung up. More precisely, the "carrier" signal (a tone or other quiescent sound, which is normally sounded continuously over the phone line) has been interrupted.

12 = COMMAND EXECUTION COMPLETED OK (HAYES, UART)

HAYES | **UART**

This status code is generated when btucmd() completes execution of the "soft" commands (and for HAYES hardware, before execution of the "hard" commands). See page 62 for a discussion of hard and soft commands.

13 = INVALID COMMAND BYTE (HAYES, UART)

HAYES | **UART**

This happens if you pass an invalid command byte to btucmd() for HAYES or UART category hardware. Look for 13's in the last column of figure 4-1 (page 58).

btusts

21 = X.25 INCOMING CLEAR PACKET (END OF SESSION)

X.25

This status indicates that an incoming clear packet was received on this X.25 channel. This could either be from the other party on the network, indicating that he ended the session, or from the network itself, indicating there was some error with the connection. See page 96 about how to obtain the cause and diagnostic fields of a clear packet.

22 = X.25 COMMAND OR PAUSE COMPLETED

X.25

This status indicates that a btucmd() command on this channel has completed successfully. Either a pause command ("P" or "p") or an answer command ("A") could eventually generate this code.

23 = X.25 INVALID BTUCMD() COMMAND CODE

X.25

This status indicates an illegal character in the btucmd() command string for this X.25 channel.

24 = X.25 INCOMING X.29 STRING

X.25

This status occurs when an X.29 string is recieved (a data packet with the "Q" bit set. You can use btuhdr() to retrieve the data (see page 95).

31 = LAN SPX CONNECTION TERMINATED BY OTHER SIDE

LAN

The other party in an SPX connection issued a 'T' command (page 74) to terminate the session.

Note on status codes 31 and 39. If an SPX session terminates immediately after it receives data, then your program may find out about both at the same time: after calling btuscn(), there will be new data in the buffer, and a status 31 (or 39) in the status buffer. For that reason, you may want to be sure all input data is processed before using a status 31 to reset your channel.

32 = LAN PAUSE COMMAND COMPLETED

LAN

A pause command ('P' or 'p', see page 73) on this LAN channel has just finished the 5 or 2 second delay.

33 = LAN INVALID BTUCMD() COMMAND

LAN

This means you issued an invalid btucmd() command code, or your outgoing call command (W...M) did not have exactly 24 hex digits, or the channel transmitter is busy right now. The latter may happen while transmitting, dialing out, listening, for a connection, or terminating a connection)

34 = LAN SPX INCOMING CONNECTION ESTABLISHED

LAN

An 'L' command (page 71) was issued on this channel to listen for an incoming SPX call. This status indicates that the call has been received and the connection is established.

35 = LAN SPX OUTGOING CONNECTION ESTABLISHED

LAN

A 'W' command (page 76) was issued on this channel to establish an outgoing SPX connection. This status indicates the connection is complete.

36 = LAN SPX TERMINATION COMPLETE BY THIS SIDE

LAN

You issued a 'T' command to terminate the SPX connection (page 74) on this channel. This status indicates that the termination of the connection is complete.

btusts

37 = LAN RECEIVER ERROR

LAN

This status indicates that the listen ECB completion code was not 00H or EDH. Some kind of low-level communications or interface error has occurred.

Error status 37 would show up on any channel arbitrarily in a group with the same socket number.

38 = LAN RECEIVED UNKNOWN OR UNEXPECTED PACKET

LAN

This channel received an unsolicited packet (IPX Direct channel), or all channels on this socket are full (IPX Virtual channel), or we received a packet with an unknown connection ID (SPX channel).

Error status 38 would show up on any channel arbitrarily in a group with the same socket number.

Status 38's are likely if you define multiple channel groups on the same local socket number but don't define them on *consecutive channels* (refer to page 213).

39 = LAN CONNECTION ERROR

LAN

There are many possible causes of this error status. For SPX channels, the connection may have terminated due to the watchdog, or to a transmitter error (e.g. remote abort), or some error was encountered trying to establish or terminate a connection (e.g. SPX connection table full, other partner disappeared, abort connection failed). See the note on page 156.

For IPX channels, the outdial command could not find the network path to the destination node (in this case, the status 39 may come after a perplexing pause of several seconds, during which the system seems to be "hung"), or some error occurred when transmitting (e.g. network failure).

40 = LAN GTC INPUT MODE: LOCKED OUT

LAN

The terminal should accept no input. This mode is the result of btulok(chan,1) by the other party.

Note on status codes 40-44. These status codes only occurs on LAN channels when you've issued the 'G' command (page 69). You would do that if you were using GSBL/LAN in a terminal emulation application. The 'G' command is a GTC (Galacticomm Terminal Control) Greeting. It means you volunteer to preprocess terminal input for the other party. See page 223 for more on GTC.

41 = LAN GTC INPUT MODE: BINARY

LAN

Transparent input mode -- the terminal should just forward characters verbatim on to the BBS. This mode is the result of btutrg(chan,nonzero), or of btuchi(chan,nonnull) by the other party.

See the note under status 40 about the 'G' command.

42 = LAN GTC INPUT MODE: ASCII, NO ECHO

LAN

Buffer a string of characters, terminate with a <CR>, and send the whole string to the BBS without echoing anything. This mode can be used to enter passwords. It is activated by btuech(chan,0) from the other party when he's in ASCII input mode.

If a control character other than ^H=backspace or ^M=return comes in, you may want to immediately send the character directly to the other party, bypassing the line input buffer. For example, with The Major BBS this would preserve some of the effects of ^O=abort and ^S=pause.

See the note under status 40 about the 'G' command.

43 = LAN GTC INPUT MODE: ASCII, WITH ECHO

LAN

Same as status 42 except echo every character. After echoing the <CR>, also echo a <LF>. The line length specifies the maximum number of pre-<CR> characters to accept. Extra characters should be ignored by the terminal. This is the most common, plain vanilla, input mode.

Note on status 43 and 44. Immediately after a status 43 (or a status 44) is another single status code that indicates the maximum length of the input line (when 1 to 255) or that line input is unlimited (when 0). This means that the routine that services a status 43 or 44 must call btusts() exactly once and treat it's result differently from all other values returned by btusts().

See the note under status 40 about the 'G' command.

44 = LAN GTC INPUT MODE: ASCII, W/ECHO AND WRAP

LAN

Same as 43 except that when the line length limit is reached, and another character is typed:

(Case 1) if the character is white-space (blank or <CR>), then just terminate the line with <CR> and move on;

(Case 2) if the character is printable and there are previous spaces on the line, then just forward the line up to and before the space (with a <CR> on it), erase the rest from the line on the terminal's display, then move this rest down to a new input line and resume as if it had just been typed;

(Case 3) if a complete line of non-white-space has been typed, then terminate and forward the line up to before the new character and make a new entry line with the character.

The line length "status code" (see above) should be used by the main program to wrap input words when the line would exceed this length. This mode is used for multi-line text entry.

See the note under status 40 about the 'G' command.

49 (ASCII 1) = DTMF 1 SENSED

XECOM

This code can only happen in response to a ^A ("controlled answer") command byte (see page 64). It indicates that the modem module has sensed the DTMF tones for "1" (the "1" on a touch-tone phone) while the modem was waiting for originate-carrier.

63 (ASCII ?) = INVALID COMMAND BYTE (XECOM)

XECOM

This happens if you pass an invalid command byte to btucmd() for XECOM category hardware. Look for ?'s in the next to the last column of figure 4-1 (page 58)

65 (ASCII A) = ABORTED COMMAND PREMATURELY

XECOM

Can only happen if a command is in progress, and your program calls btuclc() for that channel, which both clears the command output buffer and aborts the currently active command, if any.

66 (ASCII B) = BUSY SIGNAL SENSED

XECOM

This status can only happen in response to an L, M, or W command byte (see pages 70 to 75). It indicates that the modem module has sensed a busy signal on the phone line.

X.25

After an X.25 dialout command, this status indicates that the call failed for some internal reason, like transmit window full.

btusts

68 (ASCII D) = DIAL TONE SENSED

XECOM

Can only happen in response to an L or M command byte (see page 70). Indicates that the modem module has unexpectedly sensed dial tone on the line. This might happen if, for example, an attempt were made to place a touch-tone call on a pulse-dial phone line.

70 (ASCII F) = FAILED FOR OTHER REASONS

XECOM

Indicates that carrier was heard but that the originate/answer "handshake" failed for some reason (probably due to noise on the phone line, or an intermittent or very weak signal).

73 (ASCII I) = INAPPROPRIATE COMMAND

XECOM

This status can be returned anytime you issue a command byte that is "inappropriate" in the current context. For example, passing an "A" to btucmd() when there is already a modem-to-modem connection underway is inappropriate.

This status provides a way to distinguish between 300 and 1200 baud connections on XECOM category hardware. There is no other way to do this if the baud rate was automatically determined by a calling user's carrier signal (after you issue an "A" or "^A" command). Here is how you distinguish baud rates: if you issue a "^H" command (page 64) after a 300 baud connection has been established, you get this status code. If the connection is 1200 baud, you'll get the "OK" status code 2 (assuming the ^H command is by itself in the command string)

77 (ASCII M) = MODEM CARRIER SENSED

XECOM

This status condition can only happen in response to a W command byte (see btucmd(), page 58). It indicates that the modem module has sensed answer carrier on the phone line.

X.25

After an X.25 dialout command, this status indicates that the call succeeded and the connection has been established.

82 (ASCII R) = RINGING SENSED, BUT NO ANSWER

XECOM

This status condition can only happen in response to an L, M, or W command byte (see btucmd(), page 58). It indicates that the modem module has sensed a ringing sound on the phone line. This happens when you have placed a call, and you start to hear the telephone company's "ring-back" sound, but the other party has not yet picked it up.

84 (ASCII T) = TIMEOUT (SILENCE SENSED)

XECOM

This status can only happen in response to a ^A, ^X, ^Y, A, L, M, O, or W command (see pages 64 to 75). It indicates that the modem module has timed out after waiting 17 seconds for the carrier signal (except for the W command, which waits only 5 seconds for dial tone).

86 (ASCII V) = VOICE SENSED

XECOM

Can only happen in response to an L, M, or W command byte (see pages 70 to 75). Indicates that the modem module has sensed a rapidly varying spectrum of activity on the phone line. This code can also crop up if there is excessive noise on the line, or if the cable is not connected to the telephone company.

118 (ASCII v) = VOICE SENSED (BY ^A COMMAND)

XECOM

This status code can only occur in response to a ^A command (see btucmd() and page 64). Otherwise it is identical to status code 86.

250 = TRANSMISSION ERROR (X.25)

X.25

This status indicates an internal transmission error on this X.25 channel. Some data may have been lost.

251 = DATA INPUT CIRCULAR-BUFFER OVERFLOW

More data has been received than can fit in the input buffer for this channel. Either the capacity of the input buffer was reached before the termination condition was reached (the termination condition is: CR in ASCII mode, byte count in Binary mode), or the main program has not been servicing the channel often enough -- using btuinp() (for ASCII mode) or btuict() (for Binary mode). Exceeding the maxinl line length specified by btumil() will also generate status 251's.

In interactive applications, this status may merely mean that the user has typed an input line that is too long, and thus the condition can be safely ignored.

252 = ECHO OUTPUT CIRCULAR-BUFFER OVERFLOW

An attempt was made to buffer more data for echo than the echo buffer could hold. This status can usually be safely ignored, since it indicates merely that the user has not had all of his input echoed back to him. The echo buffer can hold up to 255 bytes, so this status can happen if both the input buffer size is specified larger than 128 (see btusiz() and btulsz(), pages 149, 116), and if the user manages to type more than 255 characters during an extended period in which echoes are locked out -- for example, during the transmission of a very long, continuous block of output data. The chiout() or chious() routines (page 47) of btuchi() or bturti() can also overflow the echo buffer.

253 = DATA OUTPUT CIRCULAR-BUFFER OVERFLOW

An attempt was made to buffer more data for transmission than the output buffer can hold. This can happen if your program tries to output more, or larger, blocks of data than it has allowed for in the output buffer size parameter "osiz" passed to btusiz() or btulsz() (pages 149, 116). This status can only occur as a result of a call to btuxmt() (page 189) or btuxct() (page 182). There is usually little your program can do but ignore this status if it arises, but you should consider increasing your data output buffer size if it arises very often. See also the caution on btuxmt() block terminator characters in the output buffer (page 191).

254 = STATUS INPUT CIRCULAR-BUFFER OVERFLOW

This is a serious error condition, and probably merits resetting the channel if it occurs. It indicates that status information has been lost, which means that you may have a false sense of the condition of the channel. For example, you may have missed a "lost-carrier" status (status 1 or 11). Fortunately, as the status buffer can contain up to 31 bytes, it is almost impossible for this status to crop up in peace-time conditions.

255 = COMMAND OUTPUT CIRCULAR-BUFFER OVERFLOW

This is a serious error condition, and probably merits resetting the channel (if not the entire machine) if it occurs. You can buffer up to 63 bytes of commands before getting this status, which is far more than most programs should need. The most likely cause of this status is a limited program "crash" of some sort: some unrelated piece of software went berserk and corrupted the channel data blocks.

-10 = CHANNEL NOT DEFINED

This status can only happen once after a call to btudef(). It indicates that the channel hardware did not respond properly to a reset attempt -- which means that it is either malfunctioning or absent altogether. Yet another possibility is that you have purchased an N-channel version of the Software

Breakthrough, and you have attempted to define channel N or higher. In this case, all channels except 0 through N-1 will always "appear" to have no hardware. These channels may still be used for local emulation however (refer to page 125).

-11 = CHANNEL NUMBER OUT OF RANGE

Indicates that the "chan" parameter passed to btusts() itself is outside the range of valid channel numbers, as defined in the original call to btusiz() or btulsz() (pages 149, 116).

CAUTIONS

Most probably, you will not have to deal with each and every one of these status codes whenever you call btusts(). In any given situation there are only a few that you should expect. See figure 4-1 (page 58) for a summary of what commands can be expected to directly generate which status codes. Other status codes are asynchronous, of course (ringing, lost carrier, input data received, etc). Any unexpected status codes should be handled by resetting the channel (bturst(), page 136).

Up to 31 bytes of status can be queued, per channel, before the status queue overflows.

See the note on status 43 and 44 (page 160) about how btusts() follows these status return codes with a status that could be anywhere between 0 and 255.

SUBROUTINE NAME

btutrg -- set the input byte trigger quantity (used in conjunction with btuict())

SYNOPSIS

```
err=btutrg(chan,nbyt);
int err;              zero means OK
int chan;             channel number
int nbyt;             input byte trigger quantity:
                      > 0  for Binary input mode,
                           indicating bytes per block
                           (use btuict() for input)
                      = 0  for ASCII input mode
                           (use btuinp() for input)
```

DESCRIPTION

If "nbyt" is nonzero, this routine causes input characters to be processed in transparent Binary mode. This means that no interpretation of the incoming characters takes place whatsoever: no translation through the global input-character translation table, no backspace handling, and no CR-triggered end-of-line status handling (as a convenience, echoing is also automatically disabled when in transparent mode). Instead, characters are simply accepted as they come in, and when the trigger count of "nbyt" has been reached, a status of 4 (BYTE-COUNT-TRIGGERED INPUT DATA AVAILABLE) is generated for the channel. Each group of "nbyt" input characters will generate this same status.

If "nbyt" is zero, then input is in ASCII mode (the default). See page 17 for more details on Binary versus ASCII input modes.

RETURNS

- -10 channel is not defined (see btudef(), page 82)
- -11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
- 0 all is well

CAUTIONS

This routine should only be used in special situations, such as for machine-to-machine communications (XMODEM, etc.), or to capture individual user keystrokes in real time (nbyt=1). For the latter case, you may also want to consider cases in which a custom character interceptor routine will do the trick. See the discussion of the btuchi() routine, starting on page 47.

SUBROUTINE NAME

btutrm -- set input line terminator character

SYNOPSIS

```
err=btutrm(chan,crchar);
int err;              zero means OK
int chan;             channel number
char crchar;          input line-terminator (0 to disable)
```

DESCRIPTION

The "input line-terminator" character is the character which, when typed at an interactive user's console, indicates that all editing of the input line is complete, and that it is time for your program to take the line as a whole and perform whatever processing it may require. The default line-terminator is a carriage return (ASCII code 13), but there may be occasions when you need to set it to something else. This routine gives you that option.

RETURNS

- -10 channel is not defined (see btudef(), page 82)
- -11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
- 0 all is well

CAUTIONS

You will only want to use this routine in exotic circumstances.

btutrs

SUBROUTINE NAME

btutrs -- generate status 6 when output aborted by user?

SYNOPSIS

```
err=btutrs(chan,onoff);
int err;                zero means OK
int chan;               channel number
int onoff;              1=generate 0=don't generate
                        (bturst() defaults to 0)
```

DESCRIPTION

In ASCII output mode (page 19), any data block in the process of being transmitted to a channel is aborted if the character specified in btutru() is received from the channel. To notify your mainline program, btutrs(chan,1) will trigger a status 6 whenever the user aborts output in this manner.

See page 171 for more on output abort.

RETURNS

```
-10  channel is not defined (see btudef(), page 82)
-11  channel number is out of range (see btusiz() or
     btulsz(), pages 149, 116)
  0  all is well
```

SUBROUTINE NAME

btutru -- set output-abort character
(truncates current output block)

SYNOPSIS

```
err=btutru(chan,trunch);
int err;            zero means OK
int chan;           channel number
char trunch;        truncate character (0 to disable)
```

DESCRIPTION

In ASCII output mode (page 19), any data block in the process of being transmitted to a channel is aborted if the character you specify here is received from the channel. On DEC systems, the character that users are accustomed to for this purpose is CTRL-O (control-oh). This is what we have used for The Major BBS. On other systems CTRL-X is preferred.

Only the block currently being transmitted is truncated, or aborted -- the rest of the output buffer is left alone. This way, it is less likely that users will inadvertently abort "asynchronous" messages such as Sysop alerts or messages from other users, or their next prompt. Each separate call of the btuxmt() routine (see page 189) generates a different output "block" which is individually clobbered by the abort character.

This feature is disabled by default, since its use is potentially harmful. Be sure to educate your users about the proper use of output block truncation if you enable it in your particular system.

RETURNS

- -10 channel is not defined (see btudef(), page 82)
- -11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
- 0 all is well

btutsw

SUBROUTINE NAME

btutsw -- set terminal screen width, and
select output word wrap.

SYNOPSIS

```
err=btutsw(chan,width);
int err;                zero means OK
int chan;               channel number
int width;         > 0  turn on output word wrap, where
                        "width" is the screen width
                   = 0  turn off output word wrap
                        (default condition)
```

DESCRIPTION

This routine turns on the output wordwrap feature, specifying the screen width to which text output should conform during ASCII output (page 19). Specifying a screen width of 0 turns off output word wrap.

First we will describe output word wrap and the effects of related Software Breakthrough routines. Then we will describe the default situation (what happens when you call none of these routines). Finally, we will present an example.

<u>How Output Word Wrap Works</u>
The output word wrap feature prevents words (strings of nonblank characters) from being split across line boundaries. This means, for example, that 80-column wide messages will be readable both to users with 80-column wide terminals, and to users with 40-column wide terminals. This is achieved by translating spaces into carriage returns in the output data string specified by btuxmt() (page 189). To prevent the user's terminal from doing its own line wrapping, each line is actually limited to width-1 characters.

btutsw() is the primary controller of output word wrap, but it operates in concert with other Software Breakthrough routines:

Routine	Involvement with output word wrap	Page
btuhcr()	specifies the "hard" carriage return character	94
btuscr()	specifies the "soft" carriage return character	143
btulfd()	specifies the "linefeed" character to append to every carriage return	114
btuxmt()	specifies the output string, and actually performs the output word wrap processing	189

The "hard" and "soft" carriage return characters are special characters in your output data string that affect the operation of output word wrap.

Hard carriage returns are always interpreted as the end of the line. They are translated into the ASCII <CR> character, which is appended with <LF> if btulfd() has so specified. Conceptually, hard carriage returns form paragraph boundaries.

Soft carriage returns may be interpreted as a single space, or as a carriage return, depending upon where they are positioned in the paragraph. The rule is this:

> When output word wrap has taken place in a paragraph, all subsequent soft carriage returns are converted into spaces.

Word wrap means that a line has been shortened to conform to the screen width by changing one of its spaces into a carriage return. Paragraphs are defined as strings of characters between hard carriage returns. Note that conversion of a soft carriage return into a space does not preclude its reconversion into a carriage return by the word wrap procedure. In this manner, wide paragraphs are completely "reflowed" to fit the available screen width. Note, however, that narrow paragraphs are not reflowed to fit wide screens.

btutsw

Default Conditions
After a channel is reset by bturst(): the output word wrap feature is turned off; the hard carriage return is 13 (ASCII <CR>); and there is no soft carriage return. The linefeed character is 10 (ASCII <LF>). In this situation, when transmitting messages, the line terminator should be the ASCII <CR> character:

```
btuxmt(chan,"This is one line of text.\r");
```

The "\r" is the C-language representation for ASCII <CR>. Since this is the hard carriage return character, it is translated into ASCII <CR> (that is, it is not changed). It is appended with ASCII <LF>.

Example of Output Word Wrap
The following conditions are similar to those in The Major BBS by Galacticomm (although screen width is user-selectable).

```
btutsw(chan,20);
btuhcr(chan,13);
btuscr(chan,10);
```

Now, hard carriage returns are ASCII <CR>'s and ASCII <LF> is the soft carriage return. The terminal screen width is limited to 20 characters for simplicity. Now let's suppose that the following statements were executed:

```
btuxmt(chan,"The blue form of the Engelmann Spruce\n");
btuxmt(chan,"is native to the mountains of western\n");
btuxmt(chan,"North America.\n");
btuxmt(chan,"\r");
btuxmt(chan,"Koyama's Spruce is native to central\n");
btuxmt(chan,"Japan (at altitudes of 1500 to 1800\n");
btuxmt(chan,"meters) and also to Korea.\n");
btuxmt(chan,"\r");
```

The result on the terminal of channel "chan" would be:

Results WITH output word wrap

```
The blue form of
the Engelmann
Spruce is native to
the mountains of
western North
America.

Koyama's Spruce is
native to central
Japan (at altitudes
of 1500 to 1800
meters) and also to
Korea.
```

If you had not turned on output wordwrap, this hypothetical 20-column wide screen would look something like:

Results WITHOUT output word wrap

```
The blue form of the
 Engelmann Spruce is
 native to the mount
ains of western Nort
h America.

Koyama's Spruce is n
ative to central Jap
an (at altitudes of
1500 to 1800 meters)
 and also to Korea.
```

RETURNS

- -10 channel is not defined (see btudef(), page 82)
- -11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
- 0 all is well

btuudf

SUBROUTINE NAME

btuudf -- "un-define" channels

SYNOPSIS

```
err=btuudf(schan,n);
int err;              zero means OK
int schan;            starting channel number
int n;                number of ports in this group
```

DESCRIPTION

This command undoes the effects of btudef() (page 82). This capability is provided in case you need to completely remove a channel, or group of channels, from service without affecting the operation of any other channels. In most cases, this will not be necessary, but it may come in handy if you are doing something exotic. Many of the other Software Breakthrough routines will return a code of -10 on a channel that has been un-defined.

CAUTIONS

LAN **X.25**

There is no btuudf() (un-define) for LAN or X.25 channels. Defining a LAN or X.25 channel (calling btusdf() with chtype from 4 to 7) is "permanent" and can occur only once for a given channel over the run-time life of your program.

RETURNS

-11 channel number(s) out of range: the specified range of channels (schan to schan+n-1) is not within the inclusive range 0 to nchan-1, where nchan has been defined in btusiz() (page 149) or btulsz() (page 116)

0 the specified channels were "un-defined" successfully.

SUBROUTINE NAME

btuusp -- special UART polling method

SYNOPSIS

```
err=btuusp(chan,onoff);
int err;            zero means OK
int chan;           channel number
int onoff;          1=special method (IIR bit 0)
                    0=standard method (LSR bit 0)
```

DESCRIPTION

UART

This function only has an effect on 8250-type UART channels. It would most likely be used on 16550 UARTs (see about btuffo() on page 92).

The standard method (onoff=0) for polling UARTs is to disable interrupts and poll the "Data Ready" bit (bit 0) of the Line Status Register (offset 5).

The special method (onoff=1) is to turn off OUT2 (MCR bit 3 is 0), enable received-data interrupts (IER bit 0 is 1), and to poll the "Interrupt Pending" bit (bit 0) of the Interrupt Identification Register (offset 2). No interrupts are actually received by the processor, because OUT2 is turned off, which by IBM PC convention is used to gate the UART interrupt onto the bus.

The special method is more reliable for some brands of UARTs, especially on fast computers, due to a sluggishness of the Data Ready bit to turn off after the last byte is read from the 16550's hardware FIFO. Compared with the Data Ready bit, the Interrupt Pending bit is the reverse sense: 0=interrupt pending=data available, 1=no interrupts=input FIFO empty.

CAUTIONS

UART

This special method may not work on some non-standard brands of UARTs, or non-standard serial interface hardware (although we haven't found any yet).

btuusp

HAYES | **XECOM** | **LAN** | **X.25**

Do not use this function on non-8250 ports. Such operation is not defined.

RETURNS

UART

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0	OK, special mode turned off
1	OK, special mode turned on

btux29

CCITT recommendation X.3 defines the numbering and meaning of PAD parameters. Many PAD manufacturers define their own extensions to X.3 to support specific features. Here is a sample of the parameters as used by OST's Europad III (unless otherwise mentioned, 0=off and 1=on):

1 Escape from data transfer (for user to enter X.28 commands) (0=disabled 1=enabled for control-P)
2 Echo (0=off 1=on)

3 Transmit when (0=full packet 2=after CR 126=after any control character)
4 Transmit when (0=full packet n=after n/20 seconds of no data from the user)
5 Enable PAD to XON/XOFF-throttle user transmissions (or CTS-throttle if on-standard "FWC" PAD option is set to Yes)
6 Display PAD service signals (indicating call progress)
7 Handling of Break-detect (0=off, otherwise see PAD manual)
8 Discard data output
9 Padding after CR (0=none, n=append n NUL bytes)
10 Line folding (0=none, n=automatic CR after n characters on line)
11 Line speed, in bits per second:

0 = 110 bps	10 = 50 bps
1 = 134 bps	11 = 75/1200 bps
2 = 300 bps	12 = 2400 bps
3 = 1200 bps	13 = 4800 bps
4 = 600 bps	14 = 9600 bps
5 = 75 bps	31 = 1200/75 bps
6 = 150 bps	32 = 3600 bps
7 = 1800 bps	33 = 7200 bps

12 Enable PAD to respond to XON/XOFF throttling by the user
13 Linefeed insertion (0=none, 4=echo LF after echoing CR)
14 Padding after LF (0=none, n=append n NUL bytes)
15 Local user editing of each transmitted line
16 Character-Delete character (0=none, or ASCII value, e.g. 8=backspace)
17 Line-Delete character (0=none, or ASCII value, e.g. 24=control-X)
18 Line-Display character (0=none, or ASCII value, e.g. 18=control-R)

RETURNS

-10	channel is not defined (see btudef(), page 82)
-11	channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
-13	X.25 interface not available (only returned when you are using GSBL without the X.25 Software Option)
0x500	(hexadecimal) transmit window full - try again later
0	channel number is good

all other return values indicate some error returned by the "DATASD" transmit function of the PC XNet driver. Refer to the documentation from OST, specifically, the PCXNET.H source file.

btuxct

SUBROUTINE NAME

btuxct -- transmit to channel (by byte count)

SYNOPSIS

```
err=btuxct(chan,nbyt,datstg);
int err;              zero means OK
int chan;             channel number
int nbyt;             number of bytes to send
char *datstg;         data block to be sent
```

DESCRIPTION

This routine transmits a data block to the specified channel in Binary output mode (see btuxmt(), page 189 for ASCII output mode). There are no restrictions on the length of the block, as long as there is room for it in the output data buffer. The block may contain any data, including zeros. Each byte will be transmitted when its turn comes.

The btuxct() routine does not have the "output suspended while inputting" feature of btuxmt() (page 189). In fact, if you need to use btuxmt(), but you want to disable this suspension feature, then after using btuxmt() you might code:

```
btuxct(chan,0,"");
```

RETURNS

-10 channel is not defined (see btudef(), page 82)
-11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0 all is well

CAUTIONS

If there is not enough room in the output buffer for the block, btuxct() will still return 0, but a status of 253 (DATA OUTPUT CIRCULAR-BUFFER OVERFLOW) will be queued for btusts(), and NONE of the data block will be output. If your program needs to know right away whether the data will fit, use btuoba() (page 130) and find out ahead of time how much space is available in the transmit buffer.

SUBROUTINE NAME

btuxlt -- set input translation table

SYNOPSIS

```
btuxlt(oldchr,newchr);
char oldchr;        character to be translated
char newchr;        character to xlate into (0 to ignore)
```

DESCRIPTION

The global input-character translation table applies to all channels in ASCII input mode (page 17), where you have not installed a custom character interceptor using btuchi() (page 47). As each character is received from the outside world, its ASCII value is used as an index into the translation table. If the resulting lookup value is zero, the character is ignored. Otherwise, the lookup value is used as though it had been received in place of the original (indexing) character.

This facility serves several purposes. Different people have different ideas as to what ASCII control characters they do or do not like. By default, only backspace (8) and carriage return (13) are accepted, and the translation table entries for all other characters in the range from 0 to 31 are zero. If you happened to like BEL (ASCII 7), you could write (in C):

```
btuxlt(7,7);
```

This would cause the bell character, when typed at a user's keyboard, to be echoed and passed along to your main program normally, just like any ordinary printable ASCII character.

btuxlt

Another purpose of the translation table is to permit you to translate upper case to lower case, or vice versa. This may improve the efficiency of the application software, in that you will not need to consider upper/lower case when comparing strings, storing them in a database, etc. For example, the following simple loop (in C) sets things up so that all channels in the ASCII mode will automatically treat upper case characters as though they were lower case:

```
for (i='A' ; i <= 'Z' ; i++) {
     btuxlt(i,i-'A'+'a');
}
```

The third use of the translation table is to to deal with parity, overrun, and framing errors. With "error-passthru" (ref btuerp(), page 90), enabled by default, bytes read in with these errors will be received and their high bits will be set. Thus they will form translation table indices in the range from 128 to 255, as opposed to proper ASCII characters, which will have values of 0 to 127. There are, then, four main ways you might elect to deal with input characters involving these errors, by setting the upper half of the global translate table.

1. Reject them: use btuxlt() to set all index values in the range 128-255 to zero, thereby causing erroneous input to be completely ignored.

2. Blot them out: use btuxlt() to translate all bytes in the range 128-255 to some nonzero "error" character, such as BEL (7), or X (88).

3. Tag them: use btuxlt() to cause values in the range 128-255 to be passed through unchanged. In this way, you defer the decision as to what to do about them to your main program. If it wants to accept or reject them in a context or user-dependent way, it may do so.

4. Accept them: the translation table defaults to this arrangement, whereby values in the range 128-255 effectively have 128 subtracted from them (in other words, their high bit is cleared). Accepting these characters means ignoring the error -- this is the default because many interactive applications do not want to insist that the caller have the right parity.

<u>Default Translate Table</u>
By default, all input control characters other than backspace and carriage return are ignored. No case conversions are active. Parity, framing, and overrun errors are ignored. A little kicker is that the RUBOUT character (ASCII 127) is translated to backspace, since many older terminals do not have a backspace key.

The following chart shows the 256 table values in hexadecimal. To use the chart, start with the raw input character to be translated, expressed as a hexadecimal number. Use the first hex digit to select a row of the chart, then use the second to select a column. The number found at the intersection of the row and the column is what your original raw input character will translate to.

2nd digit

1st digit	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	00	00	00	00	00	00	00	00	08	00	00	00	00	0D	00	00
1	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
2	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
3	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F
4	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
5	50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F
6	60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F
7	70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	08
8	00	00	00	00	00	00	00	00	08	00	00	00	00	0D	00	00
9	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
A	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
B	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F
C	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
D	50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F
E	60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F
F	70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	08

btuxlt

RETURNS

None.

CAUTIONS

Any changes made to the translation table apply instantly to the system as a whole. Unless you are doing something unusual, this means that your btuxlt() calls, if any, should all appear at the beginning of your program, just after your call to btuitz().

btuxmn

SUBROUTINE NAME

btuxmn -- transmit ASCII string that btuclo() will not be able to clear. (btubsz() will clear, however.)

SYNOPSIS

```
err=btuxmn(chan,outstg);
int err;              zero means OK
int chan;             channel number
char *outstg;         string to send (NUL-terminated)
```

DESCRIPTION

This routine transmits a character string to a channel in the ASCII output mode (page 19). There must be room for the string in the output buffer. The string may contain any number of line terminators (see below).

This routine is almost identical to btuxmt(). See page 189 for details on btuxmt(). btuxmn() however puts strings in the output buffer that btuclo() will not be able to clear. You might use btuxmn() to transmit an important message to a user that you do not want him to be able to skip or abort.

RETURNS

-10 channel is not defined (see btudef(), page 82)
-11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0 channel number is good

CAUTIONS

If there is not enough room in the output buffer for the string, btuxmn() will return 0, but a status of 253 (DATA OUTPUT CIRCULAR-BUFFER OVERFLOW) will be queued for btusts(), and the data string will not be output. If your program needs to know right away whether the data will fit, use btuoba() (page 130) to find out ahead of time how much space is available in the output data buffer.

Like btuxmt(), each call to btuxmn() puts a new "block" into the data output buffer, terminated by a hex 01 byte (Control-A), versus btuxmt()'s hex 00.

btuxmn

This routine will write a '\x01' byte over the terminating '\x00' NUL temporarily, and then restore the NUL, so *the outstg location must be writable.*

SUBROUTINE NAME

btuxmt -- transmit to channel (ASCIIZ string)

SYNOPSIS

```
err=btuxmt(chan,outstg);
int err;             zero means OK
int chan;            channel number
char *outstg;        string to send (NUL-terminated)
```

DESCRIPTION

This routine transmits a character string to a channel in the ASCII output mode (page 19). There must be room for the string in the output buffer. The string may contain any number of line terminators (see below). btuxmt() is the primary means of transmitting data to a user during an interactive session.

If the user is in the middle of constructing an input line when this routine is called, output will be postponed until he clears the line (either by pressing RETURN or by backspacing to the beginning of the line). Once output has begun, any data that the user enters while output is still in progress is not echoed until output of the current block completes. This supports asynchronous input and output and makes for a very readable user display, especially during functions such as teleconferencing. If this feature is undesirable, use btuxct() (page 182).

The following routines control operation of btuxmt() by selecting various ASCII output modes:

btutsw()	Output word wrap
btuhcr()	Hard carriage-returns
btuscr()	Soft carriage-returns
btulfd()	Linefeeds appended to carriage returns
btutru()	Output abort character
btuxnf()	XON/XOFF handshaking
btupmt()	Prompt characters

You will probably want to terminate each line in your data string with ASCII <CR> ('\r' in C notation), the "hard" carriage return. For transmitting a paragraph of text, you may want to use the "soft" carriage return, ASCII <LF> ('\n'). See page 174 for an example. For prompting, you might have no terminator character at the end of your data string.

btuxmt

If your users have ANSI graphics capabilities, then you may transmit the following directives to them using btuxmt() (there are no spaces in any of these directives):

<ESC> [<row> ; <column> H	Move cursor to <row>,<column>
<ESC> [<row> ; <column> f	Move cursor to <row>,<column>
<ESC> [<nrows> A	Move up <nrows> rows
<ESC> [<nrows> B	Move down <nrows> rows
<ESC> [<ncols> C	Move forward <ncols> columns
<ESC> [<ncols> D	Move backward <ncols> columns
<ESC> [s	Save cursor position
<ESC> [u	Restore cursor position
<ESC> [2 J	Erase display
<ESC> [K	Erase to end of current line

Display Attributes

<ESC> [0 m	Normal
<ESC> [1 m	Bold
<ESC> [4 m	Underscore
<ESC> [5 m	Blink
<ESC> [7 m	Reverse
<ESC> [8 m	Invisible

NOTE:
The "m" directives may be combined. For example, to select blinking black on blue, you could code:
btuxmt(chan,"\x1B[5;30;44m");

Set Foreground Color		Set Background Color	
<ESC> [3 0 m	Black	<ESC> [4 0 m	Black
<ESC> [3 1 m	Red	<ESC> [4 1 m	Red
<ESC> [3 2 m	Green	<ESC> [4 2 m	Green
<ESC> [3 3 m	Yellow	<ESC> [4 3 m	Yellow
<ESC> [3 4 m	Blue	<ESC> [4 4 m	Blue
<ESC> [3 5 m	Magenta	<ESC> [4 5 m	Magenta
<ESC> [3 6 m	Cyan	<ESC> [4 6 m	Cyan
<ESC> [3 7 m	White	<ESC> [4 7 m	White

The following special "IF-ANSI" construct interacts with the "[" and "]" commands of btucmd():

<ESC> [[<for-ANSI-users> | <for-non-ANSI-users>]

Only one of these strings will be transmitted, depending on which of the "[" or "]" btucmd() commands was last issued for the channel (see page 79). There is more to these commands: the "]" command disables ANSI graphics, and if in effect, btuxmt() will not transmit any of the above directives.

The tilde (~) character is used as an escape character by btuxmt(). The following character pairs may be used to avoid conflicts with the IF-ANSI construct:

~|	represents a single | (vertical bar)
~]	represents a single] (closed bracket)
~~	represents a single ~ (tilde)

RETURNS

-10 channel is not defined (see btudef(), page 82)
-11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
0 channel number is good

CAUTIONS

If there is not enough room in the output buffer for the string, btuxmt() will return 0, but a status of 253 (DATA OUTPUT CIRCULAR-BUFFER OVERFLOW) will be queued for btusts(), and the data string will not be output. If your program needs to know right away whether the data will fit, use btuoba() (page 130) to find out ahead of time how much space is available in the output data buffer.

Each call to btuxmt() puts a new "block" into the data output buffer. A block is the sequence of characters pointed to by the "datstg" parameter, and terminated by a 0-byte. btuxmt() stores the 0-byte in the output buffer to determine block boundaries. This may become critical with regard to output buffer capacity if you are doing numerous small transmissions with btuxmt(). The alternative is to use btuxct() (page 182), which does not put termination characters in the output buffer.

There is a razor's edge situation in which the priority of transmission over command execution must be considered:

```
btucmd(chan,"p")
btuxmt(chan,"Before or after pause?\r");
```

In this example, you cannot be sure that the command will be executed before the string is transmitted. This is because the interrupt-level code, when presented with commands and transmissions simultaneously, will choose transmissions. How can this be? The service rate (page 128) is low enough that, most probably, no service cycle will come between the above two instructions. If this occurs, the effects of these two statements will appear to the interrupt-level code simultaneously, and the data transmission will come before the pause.

btuxnf

SUBROUTINE NAME

btuxnf -- set XON/XOFF characters
select page mode

SYNOPSIS

```
err=btuxnf(chan,xon,xoff);                (for non-page mode)
            -or-
err=btuxnf(chan,xon,-xoff,cnt,stg);         (for page mode)

int err;        zero means OK
int chan;       channel number
int xon;        character taken as XON, or "resume"
                (0 to take anything)
int xoff;       character taken as XOFF, or "suspend"
                (0 to disable, negative for page mode)
int cnt;        Number of lines on screen (page mode only)
char *stg;      Page-break pause message (page mode only)
```

DESCRIPTION

A user can suspend text output to his terminal by sending the "xoff" character that you specify here. The "xon" character will cause the output to resume. Make the "xon" parameter zero if you want any character to resume output. Make the "xoff" parameter zero to disable XON/XOFF altogether. This feature is only in effect during the ASCII output mode (page 19).

The page mode feature (of the ASCII output mode) automatically pauses output between each screen of text. This gives the user a chance to review one screen before typing a key to move on to the next screen. The user resumes output the same way as after an XOFF pause: he types the "xon" character (if the "xon" parameter is nonzero), or he types any character (if "xon" is zero).

To select page mode, simply substitute for the "xoff" parameter its negative value (for example -19 instead of 19). In this case, you must also pass the "cnt" and "stg" parameters to btuxnf() (see the second line of the synopsis above). "cnt" is the total number of lines on the user's screen. "stg" is a pointer to the message to display between each screen (a 0-terminated character string).

The default values after initialization or reset operate just as if the following call had been made:

```
btuxnf(chan,0,19);
```

This means:

```
chan          This is the modem channel number
xon  =  0     Any character resumes after a pause
xoff = 19     Control-S pauses
```

Page mode is NOT selected.

Here is an example of how you would enable the page mode:

```
btuxnf(chan,0,-19,24,"Hit any key to continue...");
```

This means:

```
chan          This is the modem channel number
xon  =   0    Any character resumes after a pause
xoff = -19    Control-S pauses, page mode is selected
cnt  =  24    The user's screen has 24 lines
stg points to:  "Hit any key to continue..."
              This string is shown at the end of each
              block of 22 lines.
```

RETURNS

- -10 channel is not defined (see btudef(), page 82)
- -11 channel number is out of range (see btusiz() or btulsz(), pages 149, 116)
- 0 all is well

CAUTIONS

The Software Breakthrough cannot count wrap-arounds and line-breaks enforced by the user's terminal, so be sure that the width of the user's screen has been properly set by btutsw() (page 172).

5.0 HAYES AND XECOM PROGRAMMING EXAMPLES

The two programs in this section were written in the C language. They illustrate the use of the most important Software Breakthrough routines. One program runs on HAYES category hardware, like the Galacticomm Model 2408 Breakthrough card, and the other on XECOM category hardware, like the Galacticomm Models 16 and 4 Breakthrough cards. See page 7 for a description of hardware categories.

Each program is a complete multi-user teleconferencing system, albeit a simple one. Except for the hardware differences, the two programs function the same.

The HAYES program, page 196, with lines numbers 1 to 93, will be explained line-by-line in section 5.1. The lines of the XECOM program, page 206 are numbered 101 to 155, and are explained in section 5.2.

When a user calls up this teleconferencing system with a modem and a terminal, modem communication is established, and the user is asked to enter his name. Then he is placed online with the other users. While online, anything that one user types will appear on the displays of all others who are also online. All input and output is line-buffered, so that messages do not clobber one another.

For example, someone dialing up this teleconferencing system might see the following on their display (what the user types is shown in boldface):

```
To log on, please enter your name: FARKEL
Okay, you're online.
>HELLO OUT THERE
*** Message sent ***
>***
From Ferd: Hello, Farkel, how's the wife?
>WHY, FANNY'S FINE, FERD.
*** Message sent ***
>***
From Ferd: Ah, good, good, and the children?
>FLORA HAS THE FLU, BUT FLOYD AND FREDDIE ARE FEELING FINE
*** Message sent ***
>
```

SECTION 5.0 HAYES AND XECOM EXAMPLES

```
int chan,status,state[8],i;
char name[8][21],ibf[128],obf[163],*malloc();

main()
{
     printf("TELECONFERENCE DEMONSTRATION -- HIT ANY KEY TO STOP\n");
     btuitz(malloc(btusiz(8,128,1024)));
     btudef(0,0x3E8,8);                      /* define eight "COM3" modems */
     for (chan=0 ; chan < 8 ; chan++) {
          rstchn(chan);
     }
     while (!kbhit()) {
          if ((chan=btuscn()) >= 0) {
               status=btusts(chan);
               switch (state[chan]) {
               case 0:   /*--- CHANNEL STATE 0:  Initialized condition ------*/
                    if (status == 5) {
                         btulok(chan,0);
                         btuoes(chan,0);
                    }
                    else if (status == 3) {
                         btuinp(chan,ibf);
                         if (strcmp(ibf,"CONNECT") == 0) {
                              btubrt(chan,300);
                         }
                         else if (strcmp(ibf,"CONNECT 1200") == 0) {
                              btubrt(chan,1200);
                         }
                         else if (strcmp(ibf,"CONNECT 2400") == 0) {
                              btubrt(chan,2400);
                         }
                         else {
                              break;
                         }
                         btucmd(chan,"p");
                         state[chan]=1;
                    }
                    break;
               case 1:   /*--- CHANNEL STATE 1:  Waiting for 2 sec pause ----*/
                    if (status == 12) {
                         btuxmt(chan,"\rTo log on, please enter your name: ");
                         btucli(chan);
                         btuech(chan,1);
                         state[chan]=2;
                    }
                    else {
                         rstchn(chan);
                    }
                    break;
               case 2:   /*--- CHANNEL STATE 2:  Waiting for name -----------*/
                    if (status == 3) {
                         btuinp(chan,ibf);
                         sprintf(name[chan],"%1.20s",ibf);
                         btuxmt(chan,"Okay, you're online!\r>");
                         state[chan]=3;
                    }
                    else if (status != 251) {
                         rstchn(chan);
                    }
                    break;
               case 3:   /*--- CHANNEL STATE 3:  Online ---------------------*/
                    if (status == 3) {
                         btuinp(chan,ibf);
                         sprintf(obf,"***\rFrom %s: %s\r>",name[chan],ibf);
                         for (i=0 ; i < 8 ; i++) {
                              if (i != chan && state[i] == 3) {
                                   btuxmt(i,obf);
                              }
                         }
                         btuxmt(chan,"*** Message sent ***\r>");
                    }
                    else if (status != 251) {
                         rstchn(chan);
                    }
                    break;
               }
          }
     }
     printf("TELECONFERENCE DEMONSTRATION OVER, RETURNING TO DOS\n");
     for (chan=0 ; chan < 8 ; chan++) {
          bturst(chan);
     }
     btuend();
}

rstchn(chan)              /* Reset Channel */
int chan;
{
     bturst(chan);
     btulok(chan,1);
     btuoes(chan,1);
     btuech(chan,0);
     btuxmt(chan,"ATE0S0=1S2=1&C1&D2\r");
     btucli(chan);
     state[chan]=0;       /* Now we wait for a status 5 on this channel */
}
```

Figure 5-1: Teleconferencing Example, HAYES hardware

5.1 TELCONH.C Teleconference, HAYES Version

```
1   int chan,status,state[8],i;
     Declare the integer variables:
          chan       channel, or user number
          state[]    channel-specific state code:
                        0 - waiting for incoming call
                        1 - waiting for 2 seconds after
                            carrier is detected
                        2 - wait for user to type in
                            his name
                        3 - online
          i          scratch variable, used to count
                     through the other channels

2   char name[8][21],ibf[128],obf[163],*malloc();
     Declare several character variables:
          name[][]   array of names for each user
          ibf[]      input buffer (one user at a time)
          obf[]      output buffer (one user at a time)
          *malloc()  the standard memory allocation utility
                     (it returns a pointer to character)

3
4   main()
     Define the "main" function.

5   {
6    printf("TELECONFERENCE DEMONSTRATION . . .\n");
     Greeting for the system operator.

7    btuitz(malloc(btusiz(8,128,1024)));
          btusiz()   specifies the buffer sizes (input 128,
                     output 1024), and the total number of
                     channels (8).  It also computes the
                     total number of bytes required for
                     the Software Breakthrough.  Note that in
                     this example, the total memory required
                     will not be anywhere near 65535 bytes, so
                     that we do not use btulsz(), nor check
                     for an erroneous return value from
                     btusiz().
          malloc()   The standard dynamic memory allocation
                     utility.
          btuitz()   Initializes the Software Breakthrough and
                     "formats" its data structures in the
                     memory block allocated by malloc().
```

```
8    btudef(0,0x2F0,8);
```

Define 8 channels (numbered 0 to 7) with an I/O base address of 2F0 hex. This will work for a Galacticomm Breakthrough Model 2408 card. For a single Hayes-compatible modem on the COM1 serial port, you may wish to change this to "btudef(0,0x3F8,1)". Of course, you should also change the number of channels from 8 to 1, which is hard-coded throughout the program.

```
9    for (chan=0 ; chan < 8 ; chan++) {
10    rstchn(chan);
11   }
```

All channels must be reset and subjected to the initialization sequence. This sequence is performed by the function "rstchn()", coded on lines 86 to 96.

```
12   while (!kbhit()) {
```

The main loop of the program will continue until the system operator hits some key on the keyboard.

```
13    if ((chan=btuscn()) >= 0) {
```

If any channel requires service, its channel number will be put into the variable "chan".

```
14     status=btusts(chan);
```

The variable "status" now contains the status code of the channel that requires service.

```
15     switch (state[chan]) {
```

Now, lets treat each of the channel states separately. The state codes 0-3 are described above, with the explanation of line 1.

```
16     case 0:    /*--- CHANNEL STATE 0:  Initialized ---*/
```

The channel has been reset, at least most of the way. Two possible cases end up here: (1) we have a status 5, meaning that the Hayes-protocol command in the "rstchn()" function has been transmitted to the modem, and we need to complete the initialization sequence; or (2) we have a status 3, indicating that the modem has sent us a message, which may be: "RING", "OK", "NO CARRIER", "CONNECT", etc. We are only intereseted in the "CONNECT" messages, as you shall see.

```
17     if (status == 5) {
```
This is the status 5 that should eventually result from the btuxmt() call on line 93 in the "rstchn()" function, below. It means that the command string on that line has been completely transmitted to the modem.

Now we will complete the initialization procedure that was started by the "rstchn()" function. We are following the procedure described on page 136 for resetting HAYES category hardware.

```
18         btulok(chan,0);
```
Input lockout was turned on by the "rstchn()" function, on line 90. Now we can turn it on again.

```
19         btuoes(chan,0);
```
This turns off output empty status. The output empty status option was enabled by line 91. We needed this to find out when the Hayes initialization command completed. Turning this option on is what caused the status 5 that got us to this code in the first place. We will no longer take special heed of the transition-to-empty event of the output data buffer.

```
20     }
21     else if (status == 3) {
```
A string was received. What could it be?

```
22         btuinp(chan,ibf);
```
Let's get a hold of it and see . . .

```
23         if (strcmp(ibf,"CONNECT") == 0) {
```
Was it a message from the modem on this channel, indicating that a user has called up at 300 baud, and that we have made connection with him?

```
24             btubrt(chan,300);
```
Yes! Now we must set the baud rate of the UART to 300 baud, because all subsequent communications with the modem will take place at that 300 baud. We have just made the transition from command mode to online mode!

```
25         }
26         else if (strcmp(ibf,"CONNECT 1200") == 0) {
```
Wait a minute, was the message from the modem one that says that we have established connection with a 1200 baud user?

```
          btubrt(chan,1200);
```
Yes! Now we must set our UART's baud rate to 1200 baud. Isn't this fun!?!

```
         }
         else if (strcmp(ibf,"CONNECT 2400") == 0) {
```
Or could it be? A 2400 baud user has called us up?

```
          btubrt(chan,2400);
```
Yes, a speedster to be sure. Actually the way this program is currently written, this statement is unnecessary -- the UART's baud rate defaults to 2400 baud after you reset the channel. Even this "CONNECT 2400" message, like all of the "CONNECT" messages, has come to us at 2400 baud.

```
         }
         else {
          break;
         }
```
If some other string is received from the channel, just ignore it.

```
         btucmd(chan,"p");
```
If one of the above connect messages (for 300, 1200 or 2400 baud) has been received, we now must wait for the connection to settle. Our modem may have just changed baud rates, and so might the modem of the user that has just called up. To make sure we do not lose any characters, we will pause for 2 seconds before we send the greeting message.

```
         state[chan]=1;
```
Channel state 1 means we are waiting for this 2 second period to pass.

```
        }
        break;
```
End of the channel state 0 case.

```
      case 1:   /*--- CHANNEL STATE 1:  Wait for pause ---*/
```
We have been waiting for the 2 second pause to elapse . . .

```
        if (status == 12) {
```
Do we have a "command-done" status condition?

```
         btuxmt(chan,"\rTo log on, please enter your name: ");
```
Yes! Say hello to this new caller.

```
42      btucli(chan);
```
Ignore anything he has been saying up to his point, by clearing our data input buffer.

```
43      btuech(chan,1);
```
Now we will start echoing his keystrokes to his terminal.

```
44      state[chan]=2;
```
And he is online!

```
45     }
46     else {
```
If we have received any other status code from this channel while waiting for the 2 seconds to elapse, we will assume something bizarre is going on . . .

```
47      rstchn(chan);
```
. . . and we will reset the channel.

```
48     }
49     break;
```
End of the channel state 1 case.

```
50   case 2:   /*--- CHANNEL STATE 2:  Wait for name ---*/
```
We have been waiting for the user to type in his name . . .

```
51     if (status == 3) {
```
Have we received something from him?

```
52      btuinp(chan,ibf);
```
Yes, let's get a hold of it.

```
53      sprintf(name[chan],"%1.20s",ibf);
```
And store it in the name[][] array. This will be the guy's "handle" for the duration of his session. In case it is longer than 20 characters, we only store the first 20. This kind of precaution is necessary so that whatever a user does, he cannot crash the system. A good policy.

```
54      btuxmt(chan,"Okay, you're online!\r>");
```
Welcome him to the fray.

```
55      state[chan]=3;
```
Now he is online.

```
     }
     else if (status != 251) {
```

However, any other status (except input buffer overflow) . . .

```
      rstchn(chan);
```

. . . means that we will hang up on him.

```
     }
     break;
```

End of the channel state 2 case.

```
   case 3:   /*--- CHANNEL STATE 3:  Online ---*/
```

Now that he is online . . .

```
     if (status == 3) {
```

Does he have anything to say?

```
      btuinp(chan,ibf);
```

Let's hear it.

```
      sprintf(obf,"***\rFrom %s: %s\r>",name[chan],ibf);
```

And format a message for everybody else to hear. The message will include his "handle" that he typed when he logged on.

```
      for (i=0 ; i < 8 ; i++) {
```

For every channel . . .

```
       if (i != chan && state[i] == 3) {
```

. . . that is not this channel (the "chan" channel -- the one sending the message), and that is also online . . .

```
        btuxmt(i,obf);
```

. . . transmit the message.

```
       }
      }
      btuxmt(chan,"*** Message sent ***\r>");
```

And tell the sender that the message was sent to whomever happened to be listening.

```
     }
     else if (status != 251) {
```

Otherwise, any other condition (except that the guy typed in too long of a line) . . .

```
      rstchn(chan);
```
. . . means that we hang up on him.

```
      }
     break;
```
End of the channel state 3 case.

```
    }
```
End of all possible values of the channel state.

```
   }
```
End of check on btuscn() for channels needing service.

```
}
```
End of the main loop -- system operator has hit a key.

```
printf("TELECONFERENCE DEMONSTRATION OVER . . .\n");
```
Tell him goodbye.

```
for (chan=0 ; chan < 8 ; chan++) {
 bturst(chan);
}
```
Hang up all channels.

```
btuend();
```
Shut down the Software Breakthrough

```
}
```
And return to the operating system.

```

rstchn(chan)            /* Reset Channel */
int chan;
```
This function initiates the initialization sequence recommended on page 136.

```
{
 bturst(chan);
```
First the channel is reset: data structures are cleared, and the UART is initialized.

```
 btulok(chan,1);
```
Lock out input from this channel. This inhibits trash receive characters from inhibiting the upcoming transmission by btuxmt().

91 **btuoes(chan,1);**
Enable the generation of a status 5 when the transmit buffer goes from non-empty to empty. This will indicate that the Hayes-protocol command string has been fully transmitted to the modem.

92 **btuech(chan,0);**
Turn off the Software Breakthrough's echo of every character it receives.

93 **btuxmt(chan,"ATE0S0=1S2=1&C1&D2\r");**
Modem command:

E0	Modem echo off
S0=1	Auto answer mode on
S2=1	Escape character = control-A
&C1	modem DCD indicates carrier detect
&D2	modem DTR input resets the modem

For more detailed information on these commands, see your modem manual.

94 **btucli(chan);**
Clear any trash input from the channel

95 **state[chan]=0;   /* Now we wait for a status 5 on this channel */**
We have done as much resetting of this channel as we can right now. The only work that remains is to turn off the input lockout and to turn off status 5 generation. For that we must wait for the status 5 that will come when the above Hayes-protocol command string has been fully transmitted to the modem. This is detected and serviced in lines 17-20 of this program.

96 }
End of the "rstchn()" function.

```c
int chan,state[16],othchn;
char name[16][21],ibf[128],obf[163],*malloc();

main()
{
     printf("TELECONFERENCE DEMONSTRATION -- HIT ANY KEY TO STOP\n");
     btuitz(malloc(btusiz(16,128,1024)));
     btudef(0,0x2F0,16);
     while (!kbhit()) {
          if ((chan=btuscn()) >= 0) {
               switch (btusts(chan)) {
               case 1:   /*--- STATUS 1:  Phone ring or lost carrier ---*/
                    if (state[chan] == 0) {
                         btucmd(chan,"Ap");
                         state[chan]=1;
                    }
                    else {
                         bturst(chan);
                         state[chan]=0;
                    }
                    break;
               case 2:   /*--- STATUS 2:  Command complete ---*/
                    btuxmt(chan,"To log on, please enter your name: ");
                    break;
               case 3:   /*--- STATUS 3:  Input string available ---*/
                    if (btuinp(chan,ibf) > 0 && state[chan] == 1) {
                         sprintf(name[chan],"%1.20s",ibf);
                         btuxmt(chan,"Okay, you're online!\r>");
                         state[chan]=2;
                    }
                    else if (state[chan] == 2) {
                         sprintf(obf,"***\rFrom %s: %s\r>",name[chan],ibf);
                         for (othchn=0 ; othchn < 16 ; othchn++) {
                              if (othchn != chan && state[chan] == 2) {
                                   btuxmt(othchn,obf);
                              }
                         }
                         btuxmt(chan,"*** Message sent ***\r>");
                    }
                    break;
               case 251:   /*--- STATUS 251:  Input buffer overflow ---*/
                    break;
               default:    /*--- STATUS unknown ---*/
                    bturst(chan);
                    state[chan]=0;
                    break;
               }
          }
     }
     printf("TELECONFERENCE DEMONSTRATION OVER, RETURNING TO DOS\n");
     for (chan=0 ; chan < 16 ; chan++) {
          bturst(chan);
     }
     btuend();
}
```

Figure 5-2: Teleconferencing Example, XECOM hardware

5.2 TELCONX.C Teleconference, XECOM Version

101 **`int chan,state[16],othchn;`**

Declare integer variables:

```
chan        channel, or user number
state[]     user-specific state code:
               0 - waiting for ring
               1 - waiting for carrier,
                   or waiting for name
               2 - online
othchn      the other channel
```

102 **`char name[16][21],ibf[128],obf[163],*malloc();`**

Declare several character variables:

```
name[][]    array of names for each user
ibf[]       input buffer (one user at a time)
obf[]       output buffer (one user at a time)
*malloc()   the standard memory allocation utility
            (it returns a pointer to character)
```

103

104 **`main()`**

Define the "main" function.

105 **`{`**

106 **`printf("TELECONFERENCE DEMONSTRATION . . .\n");`**

Greeting for the system operator.

107 **`btuitz(malloc(btusiz(16,128,1024)));`**

```
btusiz()    specifies the buffer sizes (input 128,
            output 1024), and the total number of
            channels (16).  Computes the total number
            of bytes required for the Software
            Breakthrough
malloc()    The standard dynamic memory allocation
            utility.
btuitz()    Initializes the Software Breakthrough and
            "formats" its data structures in the
            memory block allocated by malloc()
```

108 **`btudef(0,0x2F0,16);`**

Define 16 channels (numbered 0 to 15) with an I/O base address of 2F0 hex. This would also work for the 4 channels of a Model 4.

```
109  while (!kbhit()) {
```
The main loop of the program will continue until the system operator hits any key.

```
110   if ((chan=btuscn()) >= 0) {
```
If any channel requires service, its channel number will be put in the variable "chan".

```
111    switch (btusts(chan)) {
```
Now let's treat each possible status condition differently.

```
112    case 1:    /*--- STATUS 1: Phone ring/lost carrier ---*/
```
A status code 1 can mean two very different things. If we are on-hook, it means the phone is ringing. In this case we will want to answer it. If we are off-hook, it means that we have lost the carrier signal. In that case we will want to hang up that channel (go on-hook).

```
113     if (state[chan] == 0) {
```
If this channel state is zero, then the status 1 means that we detect the ringing of an incoming call.

```
114      btucmd(chan,"Ap");
```
We will answer the incoming call ("A" answer command), and give the channel time to settle ("p" pause command). Answering a channel consists of going "off-hook" and beginning to sound the answer carrier signal.

```
115      state[chan]=1;
```
We now expect originate carrier to be detected.

```
116     }
117     else {
```
If the channel state is nonzero, then the status 1 means that we are no longer getting the quiescent carrier signal from this channel -- the user has probably hung up on us . . .

```
118      bturst(chan);
```
. . . so we hang up on him . . .

```
119      state[chan]=0;
```
. . . and wait for more calls on this channel.

```
120        }
121        break;
```

```
122      case 2:    /*--- STATUS 2:  Command complete ---*/
```

The status code of '2' means that the command string specified using btucmd() (in line 14) has completed successfully. This means we have detected originate carrier from this channel.

```
123        btuxmt(chan,"To log on, please enter your name: ");
```

Let's ask this caller to give us his name.

```
124        break;
```

```
125      case 3:    /*--- STATUS 3:  Input string available ---*/
```

This status code means that a carriage-return terminated string has been received from this channel. Either this is a new caller's name (in response to the question in line 23), or this is a message that he wants sent to other users.

```
126        if (btuinp(chan,ibf) > 0 && state[chan] == 1) {
```

We have gotten a string of at least one character, and we are expecting a new caller's name.

```
127          sprintf(name[chan],"%1.20s",ibf);
```

Let's remember his name, but limit its length to 20 characters maximum.

```
128          btuxmt(chan,"Okay, you're online!\r>");
```

Let him in the door. Note the ">" prompt for his first message.

```
129          state[chan]=2;
```

We will treat all further information from him as messages to other users.

```
130        }
131        else if (state[chan] == 2) {
```

Now, here is the case where an input string came in and we were expecting a message from him.

```
132          sprintf(obf,"***\rFrom %s: %s\r>",name[chan],ibf);
```

Here we format the complete message to be sent to the other users who are online.

```
133        for (othchn=0 ; othchn < 16 ; othchn++) {
```
Check every channel . . .

```
134          if (othchn != chan && state[chan] == 2) {
```
. . . every channel other than "chan", the one that is sending the message, that is. If there is a user on that channel, and he is online . . .

```
135            btuxmt(othchn,obf);
```
Transmit this guy's message to the other user.

```
136          }
137        }
138        btuxmt(chan,"*** Message sent ***\r>");
```
Let the sender of the message know that he is being heard.

```
139      }
140      break;
```

```
141    case 251: /*--- STATUS 251: Input buffer overflow ---*/
```
This status indicates that the input from the user on this channel has exceeded the size of the input buffer (128 bytes, as specified in btusiz, line 7). We will just ignore this condition. This will result in missing characters from the user's input string.

```
142      break;
```

```
143    default:     /*--- STATUS unknown ---*/
```
Several status codes indicate that the answer command (line 14) was not successful. These conditions are treated in the same way:

```
144      bturst(chan);
```
hang up the channel . . .

```
145      state[chan]=0;
```
. . . and wait for the next call on it.

```
146      break;
147    }
```
This is the end of the possible status codes.

```
   }
```
This is the end of the case where btuscn() indicates that some channel needed servicing.

```
  }
```
The system operator has hit a key . . .

```
 printf("TELECONFERENCE DEMONSTRATION OVER . . .");
```
Tell him goodbye . . .

```
 for (chan=0 ; chan < 16 ; chan++) {
  bturst(chan);
 }
```
And reset every channel, hanging up any calls that may have been in progress.

```
 btuend();
```
De-install the Software Breakthrough (a very important step).

```
}
```
And that's all, folks.

6.0 LAN PROGRAMMING

Socket Numbering

Socket Numbers from Novell

The eight socket numbers 80BB through 80C2 (hexadecimal) are registered with Novell by Galacticomm for use in The Major BBS software. Novell assigns "well-known" socket numbers for released software out of the range 8000 to FFFF. Alternatively, socket numbers 4000 through 7FFF are available for dynamic or experimental usage. Socket numbers 0000 through 3FFF are reserved by Novell, and may be used in accordance with Novell's instructions (e.g. such as for socket 0452, Service Advertising Protocol).

A value of zero for the socket parameter of btusdf() means pick an available dynamic socket number (4000 to 7FFF). In this case, the actual socket number assigned is available in the global integer variable "lansop" (see page 32).

Byte Order

You will encounter a socket number with reversed byte order when you are dealing with the IPX headers yourself on IPX Virtual channels in raw-packet mode (page 219). This only applies if you have the Advanced LAN Option.

> WARNING: The "length", "dstsoc" (destination socket), and "srcsoc" (source socket) fields of an IPX header contain values stored with the most-significant-byte in the lower address.

This is foreign to Intel processors, so you will need to remember to swap the bytes of these fields.

The following macro might be helpful for this (and is included in IPX.H):

```
#define hilo(i) (((unsigned)(i)>>8)|((unsigned char)(i)<<8))
```

This simply swaps the two bytes of a 16-bit "int" or "unsigned" variable.

Multiple Channels on the Same Local Socket

You can define several channels or several channel groups on the same local socket number if you follow a few rules.

> WARNING: Do not define IPX channels (Direct or Virtual) on the same local socket number as SPX channels.

> WARNING: If you define more than one channel group on the same local socket number, the groups must use *consecutive channels.*

You can define multiple channel groups on the same local socket number, as long as the groups are defined over consecutive channel numbers, and all groups defined on a given socket are either IPX, or all are SPX -- don't mix and match IPX and SPX on a single socket. (You can however, mix IPX Direct Circuits with IPX Virtual Circuits on the same local socket.)

> WARNING: Do not connect IPX channels with SPX channels.

When talking GSBL/LAN to GSBL/LAN over LAN channels, don't connect IPX with SPX (You can however connect an IPX Direct Circuit with an IPX Virtual Circuit.)

> Do not connect multiple IPX channels between two nodes (computers) using the same local socket number on both ends.

You can have several SPX connections on one network/node/socket talking one-to-one with several SPX connections on another network/node/socket. You can't do this with IPX however. The only way IPX has of distinguishing what channel an incoming IPX packet is for is (1) the local socket (of course) and (2) the network/node/socket that the packet originated from. SPX has connection ID's to distinguish who's talking to who, and there can be several on one socket. To have multiple IPX connections between two nodes using GSBL/LAN, either the local end, the remote end, or both, must use separate sockets.

6.1 LAN Channel State-Machines

IPX Direct Circuit Call

terminating:

```
     bturst(chan);  (direct circuit address is subsequently
                     undefined)
```

incoming or outgoing:

```
     btucmd(chan,"W000000010000C0A810184007M");
```

IPX direct channels are always in the "communicating" state.

IPX Virtual Circuit Call

terminating:

```
     bturst(chan);  (channel reverts to raw-packet mode)
```

incoming:

```
     btutrg(chan,30);   (prep for incoming 30-byte IPX header)
     btusts(chan) == 4
     btuict(...) returns a 30-byte IPX header (page 219),
          and inside it, the source network/node/socket
          contains the 12-byte node address in binary
     btucmd(chan,"W<24-digit node address in ASCII hex>M");
```

outgoing:

```
     btucmd(chan,"W000000010000C0A810184007M");
```

states:

```
     raw-packet mode
     communicating
```

SPX Call

```
terminating when in session:
     btucmd(chan,"T")
     wait for btusts(chan) == 36   (You should timeout this
                                   wait, in case a status 36
                                   never comes for some reason)
     bturst(chan) (optional)

terminating otherwise:
     bturst(chan)

incoming:
     btucmd(chan,"L");
     wait for btusts(chan) == 34

outgoing:
     btucmd(chan,"W000000010000C0A810184007M");
     wait for btusts(chan) == 35

states:
     idle
     waiting for incoming call
     waiting for outgoing call
     connection established
     terminating
```

6.2 The SPX Channel State-Machine

Each SPX channel is always in one of these five states:

Idle
Listening
Outdialing
Connected
Terminating

Here's a chronological diagram of how two applications based upon the GSBL/LAN might communicate over SPX channels:

Calling party	Listening Party
	btucmd(chan,"L");
btucmd(chan,"W000000010000C0A810184007M");	
status 35	status 34
:	:
:	:
:	:
btucmd(chan,"T");	
status 36	status 31

Note: once the link is established it is symmetrical; either channel can terminate it. In the above diagram this means, for example, that the *listening* party might decide to terminate the connection with btucmd(chan,"T"). It would soon get a status 36, and the *calling* party would get a status 31.

If either party abruptly aborts the connection with bturst(), the other party will eventually get a status 39. (The aborting party will get no special status code.)

Idle SPX Channel

All SPX channels become idle immediately after any of the following:

- o Definition by btusdf() (only allowed once per program load)
- o Reset by bturst() (may be done at any time)
- o Status 31: connection explicitly terminated by the remote party
- o Status 39: watchdog termination, meaning the other party has just disappeared, or some other transmit or connection error (see page 158)

When a channel is idle, and only when a channel is idle, you can issue dialout or listen commands.

Listening SPX Channel

After issuing the listen command (e.g. btucmd(chan,"L")), the channel is in the listening state, and ready to receive an incoming call from another network party (using SPX). Status 34 indicates when such a call has come in and been completed. In that case, the channel moves to the connected state.

The listening state has no timeout, and a channel may remain in the listening state indefinitely. To give up waiting for an incoming call, and return a channel to the idle state, call bturst().

Outdialing SPX Channel

After issuing the dialout command (e.g. btucmd(chan,"W...M")), the channel is in the outdialing state, and trying to make connection with the network address specified in the dialout command. Status 35 indicates when the call has gone through and the channel is in the connected state.

The dialout command may timeout, in which case a status 39 indicates that the call is aborted and the channel is reverting to the idle state. To give up waiting for an outgoing call to complete, and return a channel to the idle state, call bturst().

Connected SPX Channel

After an SPX channel has established a connection with another party on the network, you can transmit to the party (btuxmt(), btuxct()) and receive from it (btuinp(), btuict()). Now most of the hardware specifics vanish, and the channel acts much like any other channel on the GSBL.

SPX connections that have been completed (via status 34 or 35) can end in one of four ways:

- o Explicitly, by issuing the "T" command and then waiting for status 36
- o Remotely, by receiving a status 31 (other side terminated - see page 156)
- o Abortively, by resetting the channel (bturst())
- o Unexpectedly, by receiving a status 39 (watchdog abort)

Terminating SPX Channel

When you issue the terminate command (e.g. btucmd(chan,"T")), the channel moves to the terminating state. This is the polite way to end a connection, because the SPX system tries to make sure the other party knows the connection is ending. To end a connection quickly, with no muss and no fuss, just call bturst(), and the channel moves immediately to the idle state.

After issuing the terminate command on a channel that is in the connected state, the channel moves to the terminating state. Pretty soon, a status 36 indicates that the other party has acknowledged the termination and the connection has ended gracefully. The channel returns to the idle state.

On the other hand, a status 39 indicates that the termination notice was not acknowledged, and we can't be sure what the other party thinks. After a status 39, the channel ends up in the idle state.

6.3 IPX Virtual Circuits in Raw Packet Mode

30 to 576 bytes

30 bytes

0	chksum	(set by IPX)
2	length	Total number of bytes, incl header Range 30-576, WARNING: MSB FIRST!
4	trnspt	(set by IPX)
5	paktyp	Packet type, 4=IPX packets.
6	dstnet	Destination network, 4 binary bytes, right-justified, and zero-filled
10	dstnod	Destination node, 6 binary bytes, right-justified, and zero-filled
16	dstsoc	Destination socket, WARNING: MOST-SIGNIFICANT-BYTE FIRST!
18	srcnet	Source network, 4 binary bytes, right-justified, and zero-filled.
22	srcnod	Source node, 6 binary bytes, right-justified, and zero-filled.
28	srcsoc	Source socket, WARNING: MOST-SIGNIFICANT-BYTE FIRST!
30	datbuf	Data buffer, containing 0 to 546 bytes

Figure 6-1: IPX Virtual Raw Packet Format

Before transmitting a raw IPX packet, (that is, before transmitting a packet on an IPX Virtual channel in raw-packet mode), you must set the following fields of the packet:

length	Length of entire packet, including header, range 30 to 576 WARNING: most significant byte first
paktyp	Packet type (4 for IPX)
dstnet	Destination network
dstnod	Destination node
dstsoc	Destination socket WARNING: most significant byte first
datbuf	Data buffer, 0 to 546 bytes

The following fields are automatically set by IPX:

chksum	Checksum
trnspt	Transport control
srcnet	Source network
srcnod	Source node
srcsoc	Source socket

Incomplete Packets Under Raw-Packet Mode

> WARNING: You can only transmit complete packets in raw-packet mode. Fill the "length" field (in hi-lo byte order) with the total number of bytes in the packet, including the IPX header. The GSBL will use this field to determine packet boundaries. If you return to btuscn() in your main loop with a partial packet in the output buffer, the packet may be lost.
>
> Also, if you don't make sure that the length byte contains the actual packet length, or if you otherwise screw up packet alignment, then total trash could be transmitted via IPX, possibly clobbering your file server.

You could use this property (that partial raw packets will be lost) to detect when a packet transmitted in raw-packet mode has actually been totally and completely transmitted.

First, let's look at the problem: it is not enough just to poll at btuoba() (or to enable and then wait for status 5) to know when transmitting is done -- the GSBL may be done with a packet, but the low level Netware IPX interface may not have completed the associated "Send Event Control Block". So you could diligently make sure the output buffer was empty, and then innocently call bturst() thereby cancelling the data before it went out! You need to make sure IPX has finished transmitting the packet.

If after transmitting a raw packet, you "transmit" a single NUL (as in btuxct(chan,1,"\0")) and *then* wait for btuoba() to indicate an empty buffer (when it returns output buffer size minus 1), the raw packet preceding the NUL will have been completely transmitted, and the NUL will be discarded.

```
struct {
     struct ipx ipx;
     char data[NBYTES];
} ipxpkt;

/* Fill up ipxpkt somehow. */

btuxct(chan,sizeof(ipxpkt),&ipxpkt);
btuxct(chan,1,"\0");
while (btuoba(chan) < OSIZE-1) {
     btuscn();
}
bturst(chan);
```

This code is an excerpt only (btusiz(), btuitz(), btusdf(), btuend() calls are all essential but they are not shown above). And the while-loop should really have a timeout. And you would rarely call btuscn() only inside a loop like that. But this should give you an idea of what's involved in this little trick to detect total completion of raw packet transmission.

IPX Raw-Packet Transmit Example

For example, let's say you wanted to transmit the alphabet on an IPX Virtual channel in raw-packet mode to socket 4007 hex on node 2 of network 1. Assume you are using local socket 5008 hex. Here is code that would do this:

```
#define hilo(i) (((unsigned)(i)>>8)|((unsigned char)(i)<<8))

struct ipxhdr {                             /* an IPX header contains... */
     int chksum;                                            /* checksum */
     int length;      /* 30-576:  header PLUS rest of packet (hi-lo) */
     char trnspt;                                      /* IPX sets to 0 */
     char paktyp;                           /* 0=unknown 4=IPX 5=SPX */
     char *stnet[4];                               /* destination network */
     char dstnod[6];                                  /* destination node */
     int dstsoc;                       /* destination socket (hi-lo) */
     char srcnet[4];                                    /* source network */
     char srcnod[6];                                       /* source node */
     int srcsoc;                                /* source socket (hi-lo) */
};

#define IPXMAX 546           /* max length of data field of IPX packet */

struct ipxpak {                             /* an IPX packet contains... */
     struct ipxhdr hdr;                                     /* IPX header */
     char datbuf[IPXMAX];                          /* 0 to 546 data bytes */
}

struct ipxpak xmtpak;
char net[]={0,0,0,1};
char nod[]={0,0,0,0,0,2};
char alphabet[]="ABCDEFGHIJKLMNOPQRSTUVWXYZ";
int chan=0;
char *malloc();

main()
{
     btuitz(malloc(btusiz(1,256,2048)));
     btusdf(chan,1,6,0x5008,2);
     xmtpak.hdr.length=hilo(26);            /* xmtpak.hdr.length=0x1A00 */
     xmtpak.hdr.paktyp=4;
     movmem(net,xmtpak.hdr.dstnet,6);
     movmem(nod,xmtpak.hdr.dstnod,4);
     xmtpak.hdr.dstsoc=hilo(0x4007);      /* xmtpak.hdr.dstsoc=0x0740 */
     movmem(alphabet,xmtpak.datbuf,26);
     btuxct(chan,&xmtpak,sizeof(struct ipxhdr)+26);
     while(btuoba(chan) < 2047) {
          btuscn();
     }
     btuend();
}
```

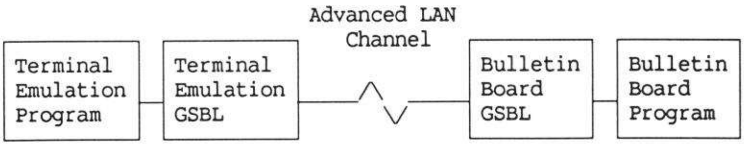
Note: this program is shown as a coding example and is almost useless otherwise, especially in its limited versatility and in its failure to check for erroneous return codes.

The calls to btusiz(), malloc(), and btuitz() prepare for one channel with a 2048-byte output buffer and a 256-byte input buffer.

The call to btusdf() defines one IPX Virtual channel using socket 5008 hex, with 2 ECB's. Note that the specification of the socket number here uses natural (Intel) byte order.

6.4 Galacticomm Terminal Configuration (GTC) Protocol

GTC enables one GSBL-based program to tell another that it is willing to preprocess the other's ASCII input.




```
"G" command --->
                      <- GTC Protocol ->
<--- status 40-44
```

For example, a terminal program based on the GSBL can tell a BBS program based on the GSBL that the terminal will buffer line input before sending it to the BBS.

> In this section we'll talk about the "terminal" and the "BBS" as the GSBL program volunteering to preprocess input and the GSBL program that relinquishes input preprocessing, respectively. Other applications could make use of this feature, but the terminal/BBS situation is why GTC was developed, and makes for a clear example.
>
> In this case, each of the programs (terminal and BBS) consists of a copy of the GSBL and an application program that uses it.

The usurpation of the BBS's input handling is detected and allowed by the BBS GSBL and is transparent to the BBS application program. GTC service starts with the terminal program sending a "greeting message" to the BBS GSBL. After that, the BBS GSBL will notify the terminal GSBL as to the current input mode. The terminal GSBL passes all such GTC information, in the form of status codes, to the terminal application program for processing.

For enhanced compatibility, a GTC-compatible BBS will not require a GTC-supporting terminal program. It is up to the terminal to request GTC before the BBS starts depending on it. At the same time, if a non-GTC BBS ignores the terminal's initial greeting message, the terminal GSBL will not generate GTC status codes.

If you don't want the main program to have to deal with GTC, then just don't ever send the "greeting message" (don't call btucmd(chan,"G")).

A new greeting must be issued after a channel reset from *either* the BBS or the terminal side.

Several varieties of input are supported, so that features like editor input word-wrap, teleconference chat, and password input operate transparently -- that is, just as they would calling over a non-LAN GSBL channel. The special case of suppressed output during line input (as is used so well in the teleconference) can be handled at the option of the terminal program: (1) suppress the output while entering a line; or (2) go ahead and display the output, but "move" the input line down to the new prompt.

The GTC protocol for IPX packets is based on:

IPX header with packet type 0 (unknown packet)

For SPX packets:

SPX header with data stream type F0 hex

Data fields:

Greeting message:
(empty data buffer)

The terminal sends this to the BBS (the G command) to volunteer to preprocess the BBS's ASCII input. The BBS GSBL takes note that it is communicating with a GTC-compatible program.

Input mode message:

"GTCI"	('I' means input configuration)	
1 byte	inmode	input mode (see below)
1 byte	maxinl	maximum input line length (0=unlimited)

These messages are transmitted from the BBS to the terminal to tell the terminal how to treat the BBS's input (that the terminal is gathering, for example, from an operator at the keyboard, or from a disk file).

Input modes (decimal)

40 Locked out
41 Binary
42 ASCII line mode without echo
43 ASCII line mode with echo (limit line length)
44 ASCII line mode with echo and word-wrap (limit line length)

These input modes are also the status codes that will eventually appear to the terminal application program when it calls btusts(). When the status code is 43 or 44, another status byte follows immediately, which is the input line length, where 0 is unlimited. See starting on page 159 for more details on these status codes.

Ctrl-S Pause with GTC

Also we recommend that a terminal program locally process the Ctrl-S pause of BBS output. This function cannot be handled by the BBS due to packetization: by the time the BBS would get a Ctrl-S, it may have already shipped out several huge packets.

7.0 X.25 PROGRAMMING

The features described in this section are available only with the X.25 Software Option for the GSBL. See page 12 for an overview of how X.25 works.

The GSBL handles low-level communications with X.25 and LAN channels differently than with modem or serial channels. While modems or serial ports must be timer-interrupt driven at the byte level, X.25 and LAN channels are handled without interrupts, at the packet level.

The btuxmt() output routine still puts data into a circular buffer. And the btuinp() routine still gets data out of another circular buffer -- these aspects of the GSBL have not changed. However, the interaction between these buffers and the X.25 or LAN hardware takes place transparently during your call to btuscn().

So remember that only *after* your call to btuscn():

- Will received data become available for:

  btuibw(), count of input bytes waiting
  btuinp(), ASCII input
  btuict(), binary input

- Does transmitted data, specified by:

  btuxmt(), ASCII output
  btuxct(), binary output

  actually get formed into packets and transmitted, and will:

  btuoba(), output bytes available

  indicate room in the output buffer

- Will monitored output become available:

  btumon(), start monitoring a channel
  btumds(), report latest output to that channel

  (similarly with btumon2() and btumds2())

Simulated keystrokes on the monitored channel (btumks() or btumks2()), however, immediately become available in the input buffer.

7.1 Handling an Incoming Call

When an incoming "call request" packing is received by the BBS on an X.25 virtual circuit:

btusts() returns status 3
btuinp() returns a string of the form:

```
"RING <caller> CALLING <callee>"
```

Where <caller> is the decimal network address (if available) for the source of this call, and <callee> is your network address. If you set x25udt to 1, then btuinp() will return:

```
"RING <caller> CALLING <callee> <user data field...>"
```

See page 35 for details on the limitations of this method.

To answer an incoming call:

btucmd("A"); (which will immediately generate a status 22, see also page 68)

7.2 Making an Outgoing Call

To place an outgoing call on an X.25 channel, issue any of the following command string formats using btucmd(chan,cmdstg) (page 58):

W*<caller>*,*<callee>*/*<user data field>*M

W*<callee>*/*<user data field>*M

W*<caller>*,*<callee>*M

W*<callee>*M

The *<caller>* and *<callee>* fields are decimal addresses, up to 16 digits each. The *<user data field>* is specified in hexadecimal. See page 78 for more details about making an outgoing call on an X.25 virtual circuit.

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