silent 700™

Model 742

Programmable Data Terminal

CHARACTERISTICS GUIDE

MODEL 742 FEATURES & GENERAL INFORMATION

The *Silent 700** Model 742 Programmable Data Terminal is designed for a wide variety of remote data capture, data manipulation, and data communications applications. The Model 742 utilizes the basic technology and many of the components and assemblies of the field-proven *Silent 700* line of data terminals, particularly the Model 733 ASR data terminal, with an added microprocessor and memory to provide programmability. The microprocessor provides the "intelligence" required for data manipulation, complex editing of data entries, and for control of communications. (An example of a typical data operation is shown in Figure 1.) Complete programmability of data operations is provided using the Texas Instruments Cassette Operating Language (TICOL). Dual magnetic tape cassettes provide 300k bytes of bulk storage for both current data entry control programs as well as data prepared under program control. The *Silent 700* thermal printer is the basic output device, producing printed copy at speeds up to 30 characters per second. The operator input device is a standard USASCII keyboard with a built-in numeric cluster.

Standard Features

- All terminal features contained in a compact, desktop unit
- Dual magnetic tape cassette operating system under local program control or central computer control, using control codes
- Quiet, nonimpact printing, using the field-proven *Silent 700* thermal printer . . . 30 characters per second printing
- Multipurpose USASCII keyboard with built-in numeric cluster
- Byte-oriented microprocessor (8 bits per byte) with 2K of random-access memory (RAM) for application programs and 8K of read-only memory for TICOL I
- Basic control programs resident in nonvolatile ROM . . . no preloading of control programs prior to loading application programs
- Automatic search feature under either program or manual control for locating application programs or for data editing
- Complete block and character editing capability
- Completely self-supporting . . . no extra peripherals or equipment required to generate, edit, translate, and execute application programs
- Switch-selectable transmission speeds of 110, 150, 300, or 1200 baud
- Choice of line communications . . . unattended DDD Network or multidrop leased line
- Switch-selectable line protocols . . . block transmission with error checking or conventional, continuous transmission with X–ON/X–OFF control.

Optional Features

Optional features available for the Model 742 include an extended communications feature, internal modem, auxiliary EIA interface and memory expansion feature.

- Extended communications capabilities comprehend answerback memory for positive terminal identification as well as 1200-baud reverse channel operation
- Built-in Bell 202-compatible modem
- Auxiliary EIA interface for driving a peripheral device such as an impact printer
- Memory expansion which includes an additional 2K of random-access memory (RAM) for the more complex application programs and an additional 2K of read-only memory (ROM) for the more powerful TICOL II.

Typical Applications

The Model 742 is ideally suited for a host of data entry, data capture, and data communication applications:

- Catalog order entry
- Insurance claims processing
- Remote batch processing
- Inventory data collection and reporting
- Virtually all kinds of branch office data preparation.

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Typical Operation

Aided by a tape cassette operating system contained in read-only-memory (ROM) and user programs written in the powerful TICOL language, operators with no previous data processing experience will find data entry an easy task on the Model 742. Day-to-day operation may be broken down into three basic steps:

1 – **Loading.** The user's application program, stored on magnetic tape cassette, is loaded into random-access-memory (RAM). No downloading is required from the central computer site. After the loading process, execution of the program is started automatically.

2 – **Execution.** During execution "fill-in-the-blank" data entry forms are generated; data entered by the operator is checked for size, type and range; arithmetic functions are performed; any prescribed table *look-ups* are executed; and data field relationships are checked. Errors are easily corrected by the operator before data is stored on magnetic tape cassette. Since loading and execution of a program is independent of the central computer, data capture continues even when the system's host computer is down. After all transactions requiring a particular form have been processed, the next form is located on the tape cassette (using the automatic search feature), the form is loaded, and data preparation continues.

3 – **Transmission.** Using the ability of the terminal to verify status of the various terminal functions under program control, the operator can be guided through the steps to correctly set up the terminal for unattended transmission and/or reception of data. Once the terminal is set up, data is transmitted at rates up to 1200 baud.

Configurations

The Model 742 may be configured for use in either dial-up systems over the Bell System DDD Network, with complete auto answer and manual originate capabilities, or in multidrop systems over dedicated lines.

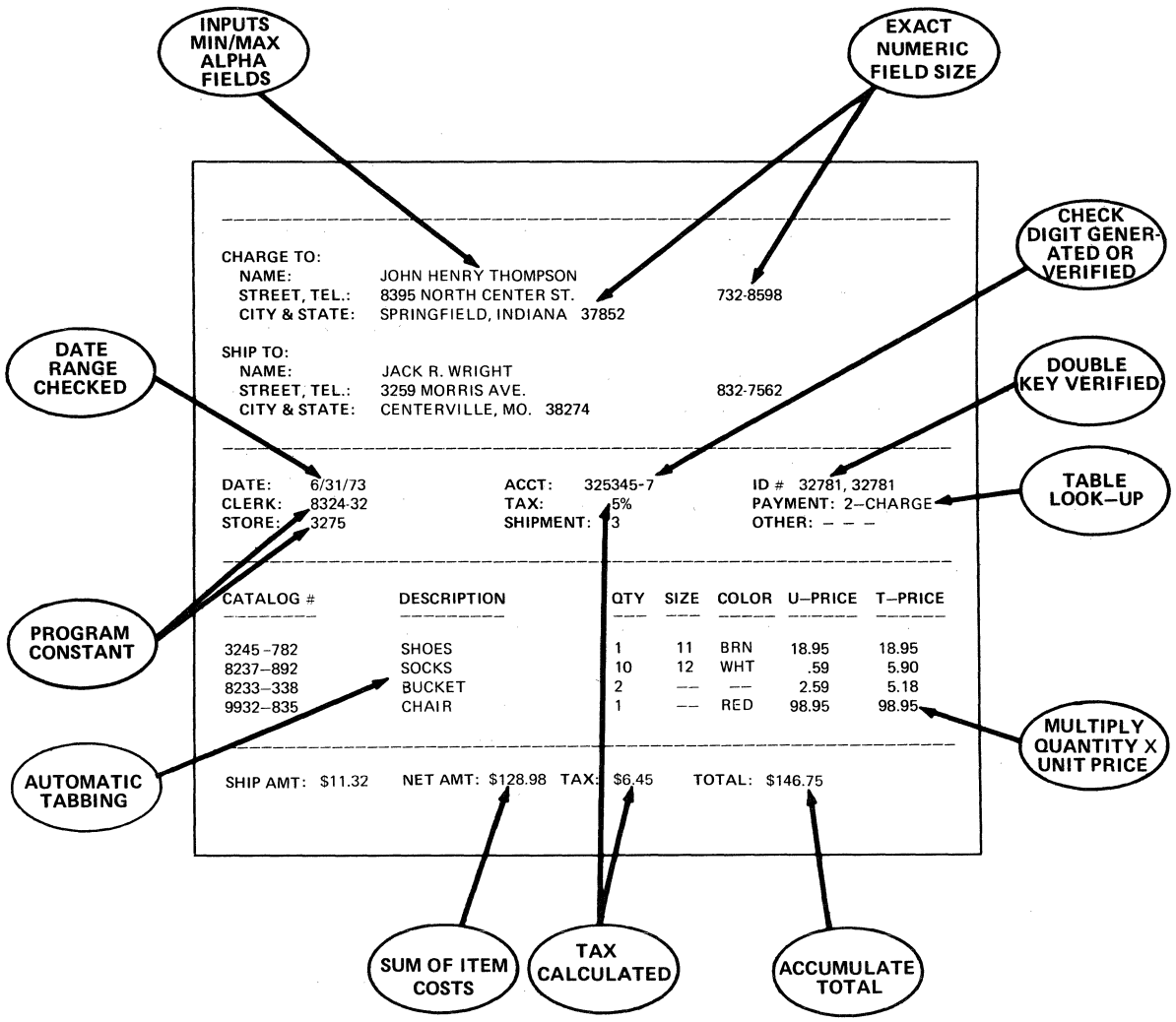


FIGURE 1 – The Model 742 can both generate and check typical *fill-in-the-blank* formatted data.

MODEL 742 PROGRAMMING FEATURES

General Features

The Model 742 microprocessor controls all terminal functions in both local and line operating modes. Operation in the line mode is controlled by programs stored in nonvolatile read-only-memory (ROM). Line operation, therefore, is assured in an unattended environment even when momentary power failure is experienced before transmission.

Local operation is supervised by control programs stored in ROM and the specific application program loaded into random-access memory (RAM). The control programs in ROM include basic control routines and various utility subroutines, which minimize the programming effort required for each application. An 86-character entry buffer, with various pointers, is used to store data prior to transferring the data to the recorder.

Other features include:

- Cassette operating system with two magnetic tape cassette transports
- Direct program linking, or program linking using a tape cassette search under program control
- Seven general purpose registers and one accumulator for arithmetic and storage operations
- Data in the entry buffer can be easily edited and manipulated before recording the data on tape
- Capability to reserve memory for temporary storage of alphanumeric data.
- Terminal and device status available under program control
- Machine level language to minimize memory and tape usage
- High level language for ease of programming.

Machine Level Language

The machine level language is designed to optimize memory and tape usage. Composed of USASCII characters . . . 95 printable characters and 7 noncommunication control characters . . . machine language instructions are stored in memory or recorded on tape continuously. A unique printable character is designated to represent each op code; one or more printable characters for operands; and one or more printable and control characters are used for each label (ID), when required. The seven control characters are used as delimiters for op codes, operands, and labels when instruction fields vary in length. Machine level programs may be transparently transmitted and recorded in any of the various communication modes.

Texas Instruments Cassette Operating Language (TICOL)

Available in two versions, TICOL is a language designed for the user to develop application programs. The language's instructions utilize three decimal numbers for labels (ID's) and field lengths, three-character mnemonics for op codes, and commas for operand delimiters. Comments can be added after the operand as long as the maximum instruction length of 60 characters is not exceeded. Each instruciton is terminated with a line feed/carriage return and is recorded as one block on tape, making editing and debugging under program control an easy, straightforward task. After generation of a program with TICOL, a translation process converts the TICOL program to machine level language. All programming operations (keying, editing, debugging, and listing) can be performed directly on the Model 742. No other peripherals or computer system equipment are required to program the Model 742.

Sample TICOL instructions are shown below:

LABEL (ID)	OP CODE	OPERAND	
012	NFD		Defines a new field with a label (ID) of 012
	PRN	"NAME?"	Defines the printing of an operator prompt: NAME?
	ITM	A,003,016	Defines an input from the keyboard to be alphabet characters only: 3 characters minimum, 16 characters maximum.
	SFG	100,003,6	Sets the 6th bit of the byte addressed by ID 100 plus 3, to a "1".

TICOL I

TICOL I, the standard version of the TICOL language, is powerful and easy-to-use. TICOL I is the starting point in learning to program the Model 742. A summary of the TICOL I instruction set is shown on page 5.

TICOL II

TICOL II, standard with the optional memory expansion feature, contains the tools for more conventional computer programming techniques and is designed for more complex applications. Relative addressing and jumping; faster table look-up; manipulation of characters, bytes and bits in memory; binary arithmetic in memory; faster search and easier data transfer are just some of the enhancements provided by TICOL II. All programs written in TICOL I will operate on a Model 742 with the memory expansion feature, since all the instructions contained in TICOL I are also contained in TICOL II. A summary of the additional instructions available in TICOL II is shown on page 5.

Programming Aids

To facilitate programming, standard utility programs are provided in the Model 742 Programmer's Starter Kit, each available in a TICOL I version or TICOL II version.

TICOL Generator
The TICOL Generator aids the programmer during the generation of TICOL programs on the Model 742. The generator program adds all delimiters where instruction fields are fixed, provides tabbing where appropriate, monitors the amount of memory the program being generated requires, and provides a printout of the memory required when generation is complete. The generator program also checks for syntax errors during program generation so that corrections can be made as errors are detected. This capability is provied within the Editor/Generator for TICOL II.

TICOL Lister
The TICOL Lister provides a specialized listing of TICOL programs. The Lister assigns and prints a line number for each instruction; prints special graphic symbols for the SPACE, CR, LF, BS, and BEL characters; and prints mnemonics for all other control characters where the characters can logically appear in a TICOL program. This capability is provided within the Translator/Lister for TICOL II.

TICOL Editor
The TICOL EDITOR permits the user to quickly edit a TICOL program. The user can search for a specific instruction (by line number), then modify or delete the instruction or add a new instruction. Syntax errors are again checked as changes are made to the program. This capability is provided within the Editor/Generator for TICOL II.

TICOL Translator
The TICOL Translator converts a TICOL program to the machine level language version of the program, on an instruction-for-instruction basis. The translator is both single pass and self running, requiring no operator action after execution is started. This capability is provided within the Translator/Lister for TICOL II.

Model 742 Programmer's Starter Kit

The Programmer's Starter Kit includes all necessary supplies and tools to rapidly gain programming knowledge and skills. Included are:

- A certified magnetic tape cassette containing TICOL generator, translator, lister, and editor (one side with TICOL I versions, the other with TICOL II versions)
- Two blank magnetic tape cassettes
- Model 742 Programmer's Manual
- Two Model 742 Programmer Reference Cards (one describing TICOL I, the other TICOL II)
- TICOL Coding Sheets.

TICOL I INSTRUCTION SET

INPUT

Specifies type input to be allowed from keyboard

ITM	input type min/max length
ITL	input type exact length(s)
ISC	input subfield and compare
DKY	double key verify

PRINT

Causes data in specified location to print

PRN	print from memory
PML	print multiple
PFD	print contents of field
PSF	print contents of subfield
PRG	print register

LOAD

Causes data in memory to be loaded into specified location

LSF	load subfield
LPS	load and print subfield
LRG	load register

BRANCH

Causes execution to continue at specified ID

JMP	jump
CAL	call subroutine – two level
RET	return

ARITHMETIC

Performs the specified operation

ADD	add
SUB	subtract
MPY	multiply
DIV	divide
INC	increment register by one
DEC	decrement register by one
BAD	binary add
BSB	binary subtract

COMPARE

Compares specified data to specified criteria and continues execution at specified ID

TRJ	test register and jump
CSJ	compare subfield and jump
CRJ	compare range and jump

DATA TRANSFER

Transfers specified data to specified location

DUP	duplicate data in entry buffer
RJS	right justify subfield
MOV R	register to register or subfield
MOV S	subfield to register
REC	entry buffer to record
RCJ	entry buffer to record and jump
SAV	save; subfield to memory
RTV	retrieve; memory to subfield

STATUS CONTROL

Sets status of specified device or program operation

PON	printer-ON
POF	printer-OFF
SKP	auto skip ON
SOF	auto skip OFF
FRE	free form
FIX	fixed form

PROGRAM DIRECTIVES

Sets specified condition or operation

NSF	new subfield
NFD	new field
NFJ	new field and jump
CLS	clear subfield
CLF	clear field
CLB	clear entry buffer
ERR	set error mode
END	return to normal mode
LEX	load and execute new protram
SRH	search

LOADER DIRECTIVES

Specifies operation during program loading

NAM	load program into min memory
EXT	load program into extended memory
RES	reserve memory for data storage

CASSETTE CONTROL

Causes the specified operation to be performed

CAS 2	rewind cassette 1
CAS J	rewind cassette 2
CAS 6	load cassette 1
CAS N	load cassette 2
CAS 5	record off & cassette 1 to record
CAS M	record off & cassette 2 to record
CAS1	block forward
CAS 9	block reverse
CAS 7	block skip
CAS 3	character forward

STATUS REQUEST

Jump if specified status is true

REQ B	cassette 1 on clear leader
REQ C	cassette 2 on clear leader
REQ L	playback is ready
REQ @	playback is not on-line
REQ M	record is ready
REQ D	record is not on-line
REQ E	printer is on-line
REQ R	terminal is not on-line
REQ G	RDC switch is ON
REQ A	playback error
REQ N	terminal is set for HI speed

ADDITIONAL INSTRUCTIONS IN TICOL II

INPUT

Specifies type input to be allowed from keyboard

IAB	Input and branch

LOAD

Causes data to be loaded into specified memory location

LMM	Load memory

BRANCH

Causes execution to continue specified number of instructions away

SKF	Skip forward
SKR	Skip reverse

CHARACTER MANIPULATION

Performs the specified operation on a character basis

ANM	Logical AND to character in memory
ANS	Logical AND to character in subfield
ORM	Logical OR to character in memory
ORS	Logical OR to character is subfield
TCM	Test character in memory with a mask
TCS	Text character in subfield with a mask
CCM	Compare character in memory
CCS	Compare character in subfield
ACM	Binary add to character in memory
ACS	Binary add to character in subfield
SCM	Binary subtract from character in memory
SCS	Binary subtract from character in subfield
ICM	Binary increment character in memory
ICS	Binary increment character in subfield
DCM	Binary decrement character in memory
DCS	Binary decrement character in subfield
CMN	Complement & AND to character in memory
CNS	Complement & AND to character in subfield
LCM	Less than test of character in memory
LCS	Less than test of character in subfield
GCM	Greater than test of character in memory
GCS	Greater than test of character in subfield
SFG	Set flag in memory
CFG	Clear flag in memory
TFG	Test flag in memory

COMPARE

Compares specified data to specified criteria and continues execution at specified ID

CSM	Compare subfield to memory
GLM	Greater/less than compare subfield

DATA TRANSFER

Transfers specified data to specified location

OMM	Output memory
MMS	Move memory to subfield
MSM	Move subfield to memory
MRM	Move register to memory
MMR	Move memory to register
MMM	Move memory to memory
SSR	Shift subfield right
SSF	Shift subfield left

PROGRAM DIRECTIVES

Set specified condition or operation

NFF	New field and skip forward
NRD	New record
NRF	New record and skip forward
DUR	Duplicate in reverse
DKC	Discard stored keyboard characters
PCR	Pointer count to register
FPC	Force pointer count

LOADER AND/OR TRANSLATOR DIRECTIVES

Specifies operation during program loading and/or translation

EJT	Page eject
LTM	Load table in memory

CASSETTE CONTROL

Causes the specified operation to be performed

CAS R1	Rewind cassette 1
CAS R2	Rewind cassette 2
CAS L1	Load cassette 1*
CAS L2	Load cassette 2*
CAS P1	Cassette 1 to playback*
CAS P2	Cassette 2 to playback*
CAS BF	Block forward*
CAS BR	Block reverse
CAS OB	Block skip*
CAS CF	Character forward*
CAS LB	Load block
CAS RN	Record on
CAS RF	Record off

*Also part of TICOL I instruction set; 1st subfield of operand is different, but operation is identical.

LINE COMMUNICATIONS

Controls data transfer to and from the line

TEB	Transmit entry buffer
RCV	Receive characters from the line

SEARCH

Causes a search

SBH	Search tape for block header
SSF	Search subfield

BASE 10/BINARY

Causes conversion of base 10 to binary during data manipulation

DBS	Base 10 to binary & store in subfield
DBM	Base 10 to binary & store in memory
BDS	Binary in subfield to base 10 & store in register
BDM	Binary in memory to base 10 & store in register

MODEL 742 HARDWARE FEATURES

General Description

The Model 742 Programmable Data Terminal is a complete, self-contained, intelligent communications terminal. As illustrated in Figure 2, the basic terminal consists of eight major devices: keyboard, printer, record, playback, line transmitter, line receiver, microprocessor, and memory.

The microprocessor provides the basic format and keyboard input storage, control of terminal functions, error checking on keyboard input, control of operating modes, and control of communications with a central computer. All input devices (playback, keyboard, and communications line receiver) send characters to the processor. The processor may store the characters, output them, or decode them and perform some control operation. Characters output by the processor may be sent to any or all of the output devices (recorder, printer, and communications line transmitter).

The terminal may be used to prepare or collect data under control of the local processor program and at a later time the communication line program may control communication with the central computer. The keyboard, printer, playback, and record functions may each be selected to be under control of the local or line programs by means of three-position switches on the upper unit control panel. The line program, and the communication line transmitter and receiver are enabled by setting the terminal ON–LINE switch to ON–LINE. All line and local control programs are in read-only-memory (ROM); therefore, all basic terminal functions are present when power is first applied to the terminal.

Keyboard

The Model 742 keyboard is the operator input device. Operative in four modes (unshifted, shifted, control, and numeric), the keyboard generates all USASCII codes except lowercase alphabet characters and the graphic symbols `{|}~. In the numeric mode, a cluster of twelve keys, similar to an 029 keypunch, may be used for rapid numeric data entry. In addition, ten special function keys are provided for use in manual tape editing and editing data under program control.

Printer

The primary display device for the Model 742 is the field proven, *Silent 700* thermal printer. Silent printing is achieved by a unique solid-state printhead which generates characters (5 x 7 dot matrix) on heat-sensitive paper. The printer operates incrementally-by-character at speeds up to 30 characters per second. All 95 printable USASCII characters are printed, and the action required by the four printer control characters (BEL, BS, LF, and CR) are performed when the printer receives the corresponding codes from the communication line, tape, or memory.

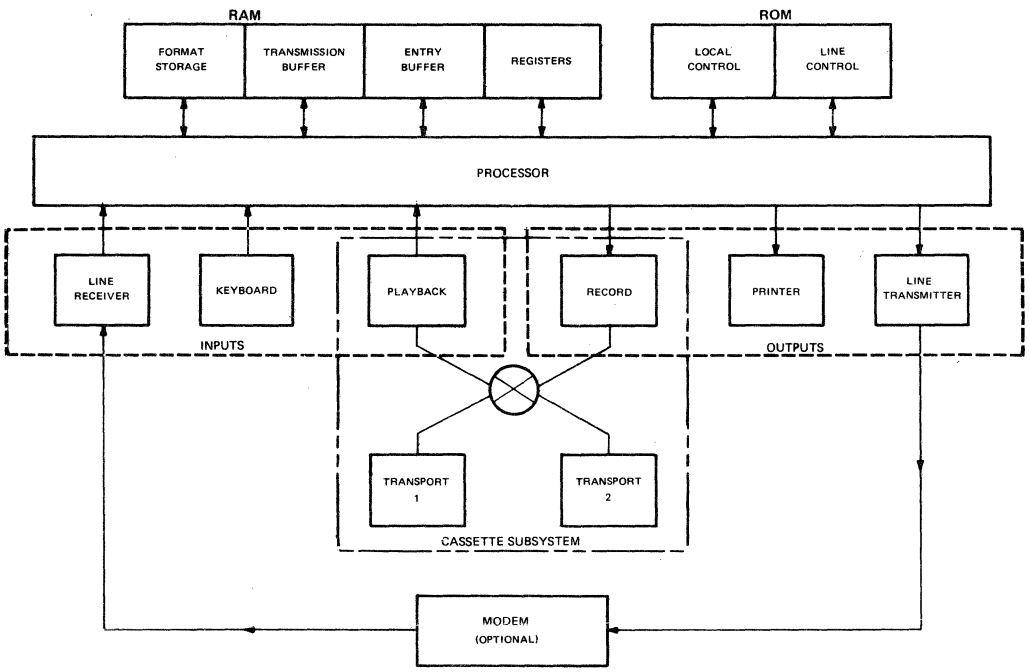


FIGURE 2 – Model 742 Programmable Data Terminal functional block diagram.

Cassette Subsystem

Bulk data storage for the Model 742 is provided by the dual magnetic tape cassette subsystem. The subsystem consists of a playback controller, a record controller, and two tape cassette transports. Either transport may be assigned to either controller, and the opposite transport is automatically assigned to the other controller . . . manually, by setting a switch on the upper unit control panel, automatically under program control, or remotely by a control computer:

- Either transport can be assigned to the appropriate controller
- The cassettes may be rewound to clear leader and loaded to the BOT marker (hole).

Tape Format

A block of data recorded on tape consists of a preamble, 86 data and/or control characters, two characters for future use, and a postamble. Two tape formats, line or continuous, are switch-selectable by the operator:

- In the LINE tape format, the USASCII carriage return (CR) character initiates recording of data on tape with unused positions of the 86 character block filled with *null* characters. Thus each block of data on tape normally corresponds to one printed line. This format is especially helpful when preparing and/or editing a tape.
- In the CONTinuous tape format, the 86th character entered or ETX initiates recording of data on tape. Thus, each block of data on tape may correspond to several printed lines. This format is especially useful when maximum tape storage is desired.

Tapes recorded in one format can be easily converted to the other format via tape duplication.

Record

The record device controls writing of local data (from the keyboard, playback cassette, or entry buffer), or remote data (from the communication line) on the tape cassette in the RECORD mode. Before recording on tape, data is entered into a record buffer where changes may be made manually. The buffer is a recirculation type, 128 characters in length, permitting a block of data to be received while the previous block is being recorded.

Playback

The playback device controls reading of data recorded on the cassette in the PLAYBACK mode for local or remote use. Data read from tape is stored (one block at a time) in a playback buffer and then is transmitted from the buffer to the printer, record cassette, processor, or communication line. The *nulls* following a CR character on a tape generated in line tape format are not transmitted. The playback device permits data to be read from the playback buffer either continuously, one block at a time, or one character at a time.

Processor

The heart of the Model 742 is the microprocessor: all input devices (keyboard, playback, and line receiver) transmit data to the processor. Data output by the processor may be transmitted to any or all of the output devices (printer, record, and line transmitter). The processor performs all error checks on input data, performs all arithmetic functions, and controls all terminal functions. Data flow in the terminal, whether line or local, is first inspected by the processor before being passed on to the intended output device. Processing, as specified by the application program or line control program, may range from simple retransmitting the data to performing a very complex arithmetic operation (e.g., a check digit calculation). An 86-character entry buffer is the focal point of all activity during execution of a RAM-resident application program. Data to be recorded is first entered in the entry buffer and programmed data operations are performed prior to transferring data to the record device. Error correction of a specific data field or the entire contents of the entry buffer can be performed while the data is in the entry buffer. Addionally TICOL II, offers more direct routes for data transfer e.g., transfer of data from one tape to the other without entering the entry buffer.

Memory

In the standard Model 742, the processor uses 10K bytes (8 bits per byte) of memory; 8K bytes are read-only-memory (ROM), and 2K bytes are random-access-memory (RAM). With the optional memory expansion feature, the processor uses 14K bytes of memory; 10K bytes are read-only memory (ROM) and 4K bytes are random-access memory (RAM).

ROM

All the local and line control programs are contained in 8K bytes of ROM in the standard configuration or 10K bytes of ROM with the memory expansion feature. Local operation during program execution is controlled by the control program in ROM and the application program in RAM. Line operation is strictly under ROM control and thus not programmable by the user. Since the ROM is nonvolatile, no system regeneration is necessary when power is applied to the terminal.

RAM

The RAM is used for application program storage and those processor functions requiring *read/write* type memory. The processor functions include seven general purpose registers, one accumulator, the entry buffer, and the transmission buffer. The remaining memory (1338 bytes, standard configuration or 3386 bytes with the optional memory expansion feature) may be used for applications program storage. When the terminal is off-line, the transmission buffer may be used for additional program storage, yielding a total of 1792 bytes (standard configuration) or 3840 bytes (with the optional memory expansion feature). Programs requiring more than the available memory may be divided into two or more separate applications routines and linked for execution.

Line Transmit/Receive

The line receiver transmitter converts synchronous data internal to the Model 742 to asynchronous data at the appropriate speed for the communication line. Data is transmitted to or received from the line at switch-selectable speeds of 110, 150, 300, and 1200 baud through a standard EIA RS232C interface. Although the Model 742 typically operates in half duplex mode, the Low Speed Communication Program (LSPCOM) enables full duplex operation (simultaneous transmission and reception at 10, 15 and 30 characters per second). Two switch-selectable communication protocols are provided.

COMMUNICATION FEATURES

Line Protocol

The Model 742 is equipped with two switch-selectable line protocols to enhance both flexibility and integrity of the user's communication systems. Dual protocol and speed flexibility enable the Model 742 to access or be accessed by a conventional low-speed communications network as well as a medium-speed network with sophisticated error checking. In either protocol, the cassettes and printer may be controlled by the central computer using ASCII control characters.

Nonblocked

Theteletypewriter-compatible nonblocked protocol enables standard asynchronous transmission and reception or serial data characters. No error checks are made, and acknowledgement procedures are not required. Transmission can be controlled with X–ON/X–OFF control characters. This protocol is conducive to communication networks and basic timesharing systems with varied terminal types.

Blocked

The blocked protocol enables transmission and reception of 425-character data blocks with longitudinal redundancy check (LRC) error detection. A positive (ACK)/negative (NAK) response from the terminal or central computer indicates whether a retransmission of the block is required. An ENQ character is used to request retransmission of the ACK/NAK character.

Line Discipline

One of two factory-preset line disciplines must be selected by the user: DDD/network or multidrop.

DDD Network

The DDD network line discipline permits unattended terminals to automatically answer or manually originate calls over the Bell System DDD Network. Additionally, this feature automatically triggers the answerback memory (if the extended communication option is also used) when a call is answered. Line disconnect features include EOT disconnect, no activity disconnect at 1200 baud, and loss of carrier disconnect at 300 baud.

Multidrop

The multidrop line discipline permits the Model 742 to operate in a polled, multidrop system over dedicated lines. The station's ID is a single character, switch-selectable during terminal installation. The controlling stations can receive status of the appropriate devices in the terminal after the terminal is polled. (For example, the playback function is on-line and ready, the record function is on-line and ready, and the printer function is on-line.) Connection to a terminal is terminated and the other terminals set up to check the polling character by receipt of the EOT character.

Line Interface

Standard EIA

The standard communication interface for the Model 742 is compatible with EIA Standard RS-232-C. A data set cable is provided for connection to Bell System 202C- or 202D-compatible data sets for transmission at 1200 baud or Bell System 103A- or 103F-compatible data sets for transmission at 300 baud or less.

Optional 1200-Baud Modem

An optional built-in 1200-baud modem provides Bell 202-series compatible frequency-shift-keying for presentation to a Bell System type CBS Data Access Arrangement (DAA). The Modem also provides the control necessary for automatically answering and manually originating calls over the Bell System DDD network via the DAA.

Extended Communications (Optional)

Answerback Memory

This option enables serial transmission of up to 21 USASCII characters as a station identification. The answerback memory is remotely triggered upon receipt of the ENQ character or automatically when a call is answered. Manual triggering from the keyboard is not possible. The specific answerback message desired must be chosen when the terminal is ordered. This option is compatible with either line discipline.

Reverse Channel

The reverse channel option is used to verify communication with a remote device. When in the receive mode, the Model 742 transmits a reverse channel to assure the transmitting device that the communication is still established. When in the transmit mode, the Model 742 recognizes the loss of reverse channel from the receiving device and disconnects the communication after an appropriate waiting period. This option is only compatible with the DDD network line discipline.

DATA INTERFACE SPECIFICATIONS

EIA RS-232-C Serial Data Interface

Standard EIA RS-232-C interface cable is 6 ft. long, terminated with a 25-pin male connector

Terminal Pins	Modem Pins	Function
A	1	Protective Ground
H	2	Transmitted Data
10	3	Received Data
F	4	Request to Send[1]
8	5	Clear to Send[2]
9	6	Data Set Ready[3]
7	7	Signal Ground
K	8	Data Carrier Detect[4]
5	11	Reverse Channel Transmit[5]
4	12	Reverse Channel Receive[6]
6	20	Data Terminal Ready[7]
J	22	Ring Indicator[8]

1 – Held to EIA ON (>+3V) when terminal is ready to transmit.
2 – Held to EIA ON by modem to allow transmission – required for transmission.
3 – Held to EIA ON by modem when modem is operative – required for operation.
4 – Held to EIA ON by modem during receipt of carrier – required for data reception.
5 – Held to EIA ON when terminal is in receive mode; to EIA OFF (<+3V) in transmit mode.
6 – Held to EIA ON by modem to indicate presence of reverse channel tone; EIA OFF if no tone.
7 – Held to EIA ON when terminal is on line; EIA OFF when terminal is off line or to terminate a call.
8 – Normally EIA OFF; signal goes high with ring of incoming call.

Data Access Arrangement (DAA)

A. Conforms to Bell Data Access Arrangement Type CBS.
B. Use with built-in 1200-baud modem.
C. A 6 ft. cable with 8 spade lugs is supplied.

Terminal Pins	Wire Color	Function
7	Black	Signal Ground (SG)
D	Red	Off Hook (OH)
J	Green	Ring Indicator (RI)
1	White	Coupler Cut Through (CCT)
B	Brown	Data Transmission (DA)
E	Orange	Data Tip (DT)
3	Yellow	Data Ring(DR)
2	Blue	Switch Hook (SH)

Auxiliary EIA RS-232C Serial Data Interface

A. Used to interface a peripheral device such as an impact printer.
B. Standard EIA RS-232-C interface cable is 6 ft. long, terminated with a 25-pin female connector.

Terminal Pins	Modem Pins	Function
11	3	Data Out
12	11	Control in
13	12	Control out
1	7	Signal Ground
	4	Request to Send[1]
	5	Clear to Send[1]
	6	Data Set Ready[2]
	8	Data Carrier Detect[2]
	20	Data Terminal Ready[2]

1 – Pins 4 and 5 are jumpered together.
2 – Pins 6, 8 and 20 are jumpered together.

MODEL 742 GENERAL SPECIFICATIONS

1 – PRINTER
- (a) Friction-feed platen
- (b) Line length: 8 inches (80 characters/line, 10 characters/inch).
- (c) Line spacing: switch-selectable 3 or 6 lines/inch.
- (d) Complete visibility of printed data, including the line being printed and the character just printed.
- (e) Enclosure contains space for printing paper: 8-1/2 in. wide x 300 ft. long x 3-5/8 in. diameter roll.
- (f) Character font: characters from 5 x 7, 35-dot matrix printhead, character size 0.105 in. x 0.080 in. Lowercase received data is printed from 5 x 5 matrix, character size 0.0715 in. x 0.080 in.
- (g) Carriage return/line feed (CR/LF) automatic at column 81, no code is transmitted. Maximum time for: (1) CR is 195 msec from any column, (2) LF (single space) is 33 msec, and (3) LF (double space) is 67 msec.

2 – PRINTING PAPER
TI thermographic printing paper, No. 213714 (white).

3 – PAPER–OUT INDICATION
Last 10 ft. of TI thermographic printing paper roll is color coded.

4 – KEYBOARD
"Two-key rollover" electronically prevents transmission when two keys are depressed simultaneously.

5 – CASSETTES
- (a) Recording method: phase-encoding at 800 bpi, 86 character blocks.
- (b) Bit error rate: 1 in 10^6 (maximum), 1 in 10^7 (typical).
- (c) Storage medium: ANSI-compatible (Phillips-type) cassettes containing 300 feet digital grade magnetic tape.
- (d) Storage: 144,000 data characters/track or 288,000 data characters/cassette (minimum).
- (e) Off-line playback or record at 30 characters/second; tape duplication without printing at up to 200 characters/second. On-line playback or record at 110, 150, 300, and 1200 baud.
- (f) Tape speed: read/write 8 in./sec.; rewind time, 60 seconds (maximum).
- (g) Sensors: EOT, BOT, cassette in place, write tab, cassette door closed.

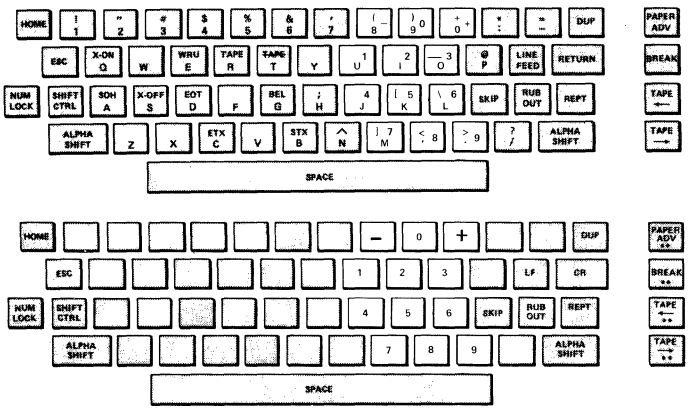
6 – PHYSICAL
- (a) Power requirements: 115/230 volts RMS, +10 percent -15 percent, 50/60-Hz, 400 VA maximum via a 6-foot 3-wire cable with type "U" grounded 3-prong connector.
- (b) Ambient temperature: Operating, 10°C to 35°C. Storage, -30°C to 70°C, not including paper or magnetic cassettes. Paper, -30°C to 40°C.
- (c) Shock: Operating 0g. Storage and handling, 10g for 11 msec (in shipping container).
- (d) Vibration: 10 to 60 cps, 0.5 g.
- (e) Humidity: Operating, equipment only, 20 percent to 80 percent. Storage, 10 percent to 95 percent (non-condensing).
- (f) Terminal is self-contained. Dimensions are 21.2" wide x 19.5" deep x 14.6" high.
- (g) Weight (excluding options): 60 lbs maximum.

MODEL 742 DETAILED SPECIFICATIONS

1 – KEYBOARD AND TRANSMISSION CODE

USASCII, seven-level, 11 bits/character, including parity, start, and 2 stop bits at 10 characters/second speed, 10 bits/character with 1 stop bit at higher speeds.

Standard ASCII keyboard has 68 printable characters, 33 control characters, and keypunch-type numeric cluster.



2 – DATA FORMAT

Half-duplex (without LSPCOM), Full-duplex (with LSPCOM), asynchronous serial-by-bit, serial-by-character; within the terminal 8 bits include a 7-bit ASCII character code plus an extra bit used as a block marker in the cassette (upper) unit.

3 – OPERATOR CONTROLS

(a) Terminal:

POWER: ON/OFF
SPEED: LO/MED/HI; SPEED: LO/HI
Transmission Mode: HALF/FULL DUPLEX (HALF without local copy)
Transmission Status: ON LINE/OFF
PARITY: ODD/EVEN/MARK
RDC: ON/OFF
PROTOCOL: BLOCKED/INTERACTIVE/TTY

(b) Printer

Print CONTRAST: light-Dark
LINE FEED: single/double
Status: LINE/OFF/LOCAL

(c) Cassette 1/Cassette 2
Operating Mode: RECORD/PLAYBACK
Tape: REWIND/STOP and LOAD, FAST FWD/STOP

(d) Record Control
Status: LINE/OFF/LOCAL and ON/OFF
Tape: ERASE/PRINT
Tape Format: LINE/CONTinuous

(e) Playback Control
Status: LINE/OFF/LOCAL
Tape: CONTinuous START/STOP, BLK FWD/REV and CHARacter FWD

(f) Keyboard:
REPEAT key
PAPER ADVance key
LINE FEED key
BREAK key
TAPE, TAPE keys
ALPHA SHIFT
NUMeric LOCK
SHIFT CONTROL
SKIP
HOME
DUPlicate
Status: LINE/OFF/LOCAL

4 – CONDITION INDICATORS

(a) Terminal:
Power-on lamp

(b) Cassette 1/Cassette 2:
READY lamp
END lamp
RECORD lamp
PLAYBACK lamp

(c) Record Control:
RECORD ON lamp
CHARACTER DISPLAY

(d) Playback Control:
PLAYBACK ON lamp
PLAYBACK ERROR lamp

(e) Terminal Status:
ERROR lamp
BUSY lamp
NORMAL MODE lamp
EXECUTE MODE lamp
RING INDICATOR lamp
TERMINAL READY lamp
RECEIVE MODE lamp
TRANSMIT MODE lamp

5 – CASSETTE SUBSYSTEM

(a) Record Format: Incremental by block; preamble (8 bits, ANSI std.) 86 data or control characters, two characters (16 bits) for future flexibility, and postamble (8 bits ANSI std.).

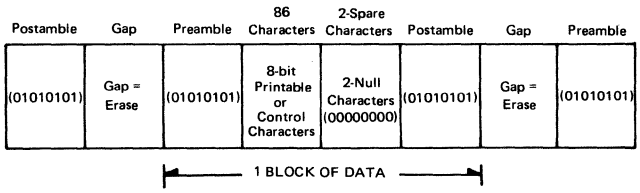
(b) Playback or Record: 10, 15, 30, and 120 characters/second. Tape duplication without printing at 200 characters/second.

(c) In LINE Format, block corresponds to a line of printout; in CONTinuous Format, block has 86 characters and may contain several printed lines. Line Format provides editing ease while Continuous Format achieves maximum packing density. Converting between formats achieved via tape duplication.

(d) Interchangeability: Any tape recorded on any Model 742 cassette operating within specifications may be read on any other Model 742 operating within specifications. Model 742 tape READ/WRITE capability is compatible with Model 733.

(e) Tape Format:

USASCII Character Set



6 – PROCESSOR

(a) Operating Modes: Normal and Execute

(b) Program Storage:
- Standard Configuration:
  Normal = 1338 words
  Extended = 1792 words
- Memory Expansion Feature
  Normal = 3386 words
  Extended = 3840 words

(c) Operating Features: Line Control, Local Control, Automatic Search, and Remote Terminal Control

(d) Instruction Set: Standard Configuration: 76 instructions; Memory Expansion Feature: 112 instructions

(e) Registers: seven general registers and one accumulator

(f) Register Size: 11 decimal digits plus sign (integer only)

(g) Entry Buffer Size: 86 locations

(h) Record Size: one or more fields, but not more than 86 characters

(i) Field Size: one or more subfields, but not more than 86 characters

(j) Subfield Size: one to 86 characters

(k) Memory:
- Standard Configuration:
  ROM = 8K bytes
  RAM = 2K bytes
- Memory Expansion Feature:
  ROM = 10K bytes
  RAM = 4K bytes

(l) Answerback Memory Size: one to 21 PROM locations

(m) Transmit Buffer Size: 425 characters

7 – CHARACTER SET

CHARACTERS WITHIN THE HEAVY LINE BOXES ARE NONPRINTABLE

USASCII Character Set

Bits b_7 b_6 b_5 / b_4 b_3 b_2	COLUMN / ROW	0_{00}	0_{01}	0_{10}	0_{11}	1_{00}	1_{01}	1_{10}	1_{11}
		0	1	2	3	4	5	6	7
0 0 0	0	NUL	DLE	SP	0	@	P	`	p
0 0 0	1	SOH	DC1	!	1	A	Q	a	q
0 0 1	0	STX	DC2	"	2	B	R	b	r
0 0 1	1	ETX	DC3	#	3	C	S	c	s
0 1 0	0	EOT	DC4	$	4	D	T	d	t
0 1 0	1	ENQ	NAK	%	5	E	U	e	u
0 1 1	0	ACK	SYN	&	6	F	V	f	v
0 1 1	1	BEL	ETB	'	7	G	W	g	w
1 0 0	0	BS	CAN	(	8	H	X	h	x
1 0 0	1	HT	EM	)	9	I	Y	i	y
1 0 1	0	LF	SUB	*	:	J	Z	j	z
1 0 1	1	VT	ESC	+	;	K	[	k	{
1 1 0	0	FF	FS	,	<	L	\	l	|
1 1 0	1	CR	GS	-	=	M	]	m	}
1 1 1	0	SO	RS	.	>	N	^	n	~
1 1 1	1	SI	US	/	?	O	_	o	DEL

MODEL 742 REMOTE DEVICE CONTROL CHARACTERS

The remote terminal control capability permits the computer to control and manipulate the playback and record cassettes, switch the printer on and off, and request the status of the terminal. This feature may be enabled or disabled by a switch (RDC/ON/OFF) under the terminal cover, accessible through the PC card cover. Four single-character commands and thirteen double-character commands are available. The terminal will normally decode the characters, issue the indicated command within one character time, and then await receipt of the next character. All seventeen commands can be received via communication lines; in addition, the four single-character commands can also be received via the keyboard or playback control.

No.	Command	Code
1	Playback ON	DC 1
2	Record ON	DC 2
3	Playback OFF	DC 3
4	Record OFF	DC 4
5	Rewind Cassette 1	DLE 1
6	Rewind Cassette 2	DLE 2
7	Load Cassette 1	DLE 3
8	Load Cassette 2	DLE 4
9	Cassette 1 in Record Mode	DLE 5

No.	Command	Code
10	Cassette 1 in Playback Mode	DLE 6
11	Block Forward	DLE 7
12	Block Reverse	DLE 8
13	Printer ON	DLE 9
14	Printer OFF	DLE 0
15	Auto Device Control ON (ADC ON)	DLE :
16	Auto Device Control OFF (ADC OFF)	DLE ;
17	Request Status	DLE <

MODEL 742 COMMUNICATIONS PROTOCOL

A basic flowchart to develop a handler for communicating with the Model 742 in Block Protocol is included in Figure 3.

Once the communication link has been established by the proper line discipline, the host decides if the terminal has data to send by requesting status. If data is present and the transmit tape is ready, reception begins by sending a DC1 (Playback On).

The host receives the sequence *STX data ETB LRC.* If the LRC does not compare, the block is negatively acknowledged with a NAK and the block is retransmitted.

If the LRC does compare, the block is positively acknowledged with an ACK and transmission continues. If the block ends with an ETX instead of an ETB, all data is assumed to have been transmitted.

The host then decides if there is data to send to the terminal. If data is present and the receive tape is ready, transmission begins by sending a DC2 (Record On).

The host transmits the sequence *STX data ETB LRC.* If an ACK is received, the next block is transmitted. If a NAK is received, the block is retransmitted. If an illegal response is detected, an ENQ will cause the terminal to retransmit the response. The last block is transmitted with an ETX instead of an ETB.

After all data has been transmitted and received, an EOT will disconnect the line.

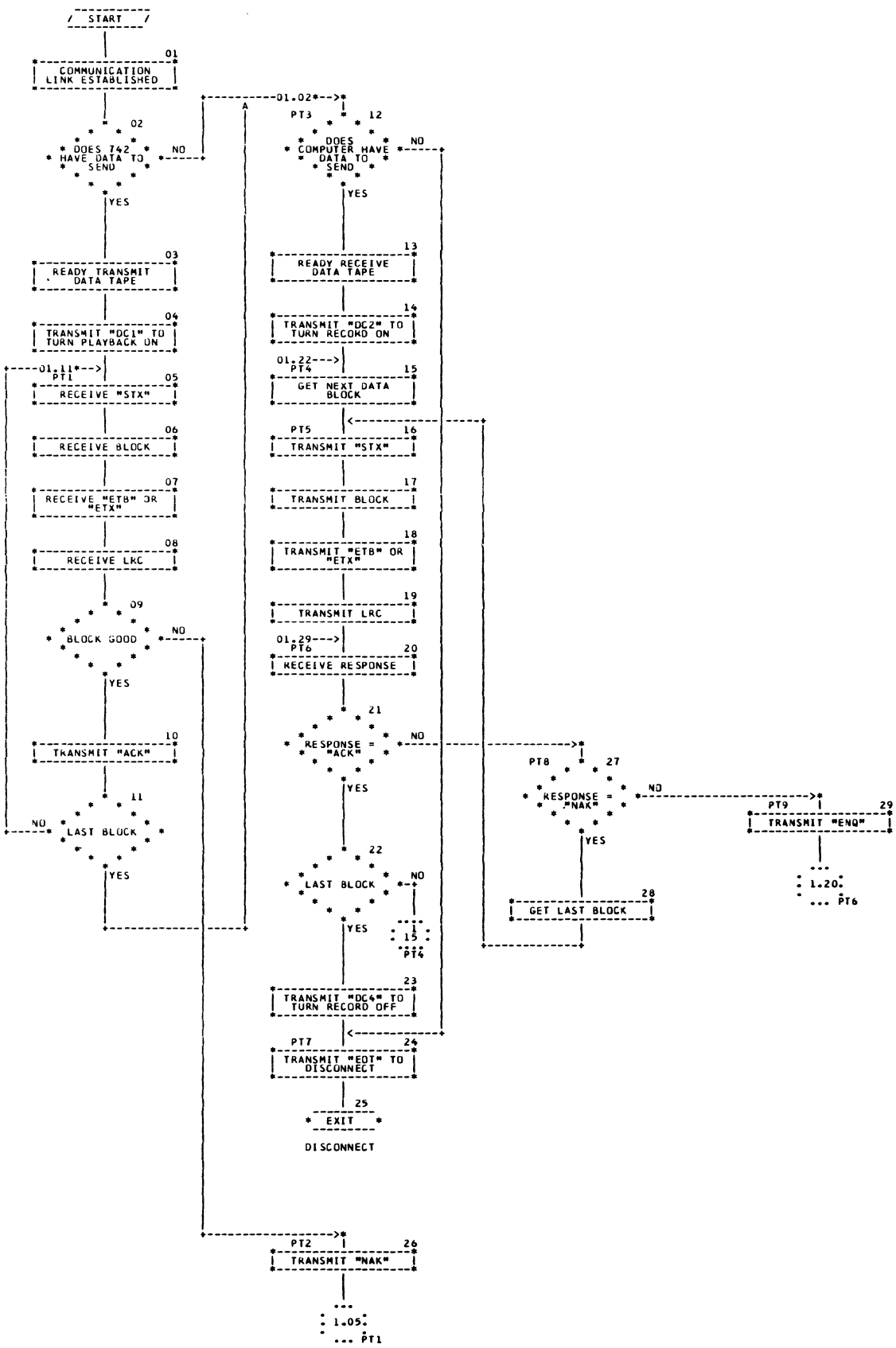


FIGURE 3 – Model 742 Communications Protocol Flowchart.

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